

Final Environment Impact Assessment

Basupali Cluster Stone Quarry Cluster area: 9.67 Ha. Or 23.895 Acres (5 Nos individual Mines)

AT

Khata no. 14, Plot no. 101 & 79 Located at Village: Basupali, Tehsil:
Balangir, District: Balangir, Odisha

Proposed New Stone Quarry Cluster With Proposed Production Capacity of 112166 cum.

Category B1 with project activity type "1(a)" (Mining of Minerals)

April 2022

Baseline Period:
1st March 2021 31st May 2021

Conducted & Prepared By

GREEN CIRCLE, INC.

***Integrated HSEQR Consulting Engineers, Scientists & Trainers (MoEF
Recognized Environment Laboratory)***

***(An ISO: 9001, 14000, 45001, OHSAS: 18001 Certified Organization & GPCB approved
Environment Auditor – Schedule II)***

Corp. Office & Environmental Research Laboratory:

***Green Empire (Anupushpam), Above Axis Bank, Nr. Yash Complex, Gotri Road,
Vadodara-390 021(Gujarat) India***

www.greencircleinc.com

ACKNOWLEDGEMENT

WE EXPRESS OUR SINCERE THANKS TO MANAGEMET OF BASUPALI CLUSTER STONE QUARRY IS LOCATED AT VILLAGE BASUPALI, TEHSIL BALANGIR, DISTRICT BALANGIR, ODISHA FOR THEIR CO-OPERATION & UNSTINTED HELP WITHOUT WHICH THE EIA REPORT OF NEW STONE QUARRY MINE COULD NOT HAVE BEEN POSSIBLE. THE COURTESY EXTENDED TO OUR TEAM IS HIGHLY APPRECIATED.

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UNDERTAKING

I, PRADEEP JOSHI, PROPRIETOR OF M/S. GREEN CIRCLE INC. LOCATED AT GREEN EMPIRE (ANUPUSHPAM), ABOVE AXIS BANK, NEAR YASH COMPLEX, GOTRI MAIN ROAD, VADODARA- 390021, DO HEREBY UNDERTAKE, THAT WE HAVE PREPARED EIA REPORT FOR BASUPALI CLUSTER STONE QUARRY IS LOCATED AT VILLAGE BASUPALI, TEHSIL BALANGIR, DISTRICT BALANGIR, ODISHA, INDIA AS PER TERMS OF REFERENCE (TOR) PRESCRIBED SEIAA FOR FILE NUMBER FILE No. SIA/OR/MIN/64155/2021 on 26/07/2021. THE STATED TOR HAVE BEEN COMPLIED AND THE DATA MENTIONED IN THE EIA REPORT ARE FACTUALLY CORRECT.

THE ABOVE STATED FACT IS TRUE TO THE BEST OF MY KNOWLEDGE.



Date: 25.04.2022
Place:Vadodara

For. Green Circle, Inc

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STANDARD TOR			
1.	Year-wise production details since 1994 should be given, clearly stating the highest production achieved in any one year prior to 1994. 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 have been mentioned in the EIA.	Chapter 1 Section 1.1
2.	A copy of the document in support of the fact that the Proponent is the rightful lessee of the mine should be given.	Lease Would be granted after auction by the Tehsildar	-
3.	All documents 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.	All documents approved Mine plan, EIA, are compatible with one another in terms of the mine lease area, production levels, waste generation and its management, mining technology etc.	-
4.	All corner coordinates of the mine lease area, superimposed on a High Resolution Imagery/ toposheet, topographic sheet, geomorphology and geology of the area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).	All co-ordinates of the Mine lease with specific location and superimposed on google image.	Chapter 2 Section 2.3.
5.	Information should be provided in Survey of India Toposheet in 1:50,000 scale indicating geological map of the area, geomorphology of land forms of the area, existing minerals and mining history of the	Toposheet is Attached. Geology, Geomorphology and land-use pattern details of the study	Chapter 2, Section 2.3. Chapter 3 Section 3.3, 3.4 and 3.6

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	area, important water bodies, streams and rivers and soil characteristics.	area are attached	
6.	Details about the land proposed for mining activities should be given with information as to whether mining conforms to the land use policy of the State; land diversion for mining should have approval from State land use board or the concerned authority.	There is no land diversion for mining. Approved Mining plan for the same is attached.	Annexure 2
7.	It should be clearly stated whether the proponent Company has a well laid down Environment Policy approved by its Board of Directors? If so, it may be spelt out in the EIA Report with description of the prescribed operating process/procedures to bring into focus any infringement/deviation/ violation of the environmental or forest norms/ conditions? The hierarchical system or administrative order of the Company to deal with the environmental issues and for ensuring compliance with the EC conditions may also be given. The system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the Company and/or shareholders or stakeholders at large, may also be detailed in the EIA Report.	The company has well laid down Corporate Environmental Policy approved by the Project proponent. A well laid down Hierarchical system for reporting of non-compliances.	Chapter 10, Section 10.3.
8.	Issues relating to Mine Safety, including subsidence study in case of underground mining and slope study in case of open cast mining, blasting study etc. should be detailed. The proposed safeguard measures in each case should also be provided.	Details of Risks associated with Mining operations and their mitigation measures are mentioned in chapter 7	Chapter 7 Section 7.3
9.	The study area will comprise of 10 km zone around the mine lease from lease periphery and the data contained in the	Noted and complied	

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	EIA such as waste generation etc. should be for the life of the mine / lease period.		
10.	Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given.	Land use land cover details have been mentioned in detail.	Chapter 3, Section 3.6.
11.	Details of the land for any Over Burden Dumps outside the mine lease, such as extent of land area, distance from mine lease, its land use, R&R issues, if any, should be given.	Not Applicable as no overburden will be formed. Top Soil is not present in the lease area.	Chapter 2 Section 2.6.3
12.	A Certificate from the Competent Authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area. In the event of any contrary claim by the Project Proponent regarding the status of forests, the site may be inspected by the State Forest Department along with the Regional Office of the Ministry to ascertain the status of forests, based on which, the Certificate in this regard as mentioned above be issued. In all such cases, it would be desirable for representative of the State Forest Department to assist the Expert Appraisal Committees.	Not Applicable as no Forest Land is involved in the Project Area.	-
13.	Status of forestry clearance for the broken up area and virgin forestland involved in the Project including deposition of net	Not Applicable as no Forest Land is	-

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	present value (NPV) and compensatory afforestation (CA) should be indicated. A copy of the forestry clearance should also be furnished.	involved in the Project Area.	
14.	Implementation status of recognition of forest rights under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 should be indicated.	Not Applicable as Forest Land is not involved in the Project Area.	-
15.	The vegetation in the RF / PF areas in the study area, with necessary details, should be given	There is no any RF/PF in the study area.	-
16.	A study shall be got done to ascertain the impact of the Mining Project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the surrounding and any other protected area and accordingly, detailed mitigation measures required, should be worked out with cost implications and submitted.	Anticipated impacts because of the proposed mine and their mitigation measures are given.	Chapter 4 Section 4.5.6
17.	Location of National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/ Elephant Reserves/(existing as well as proposed), if any, within 10 km of the mine lease should be clearly indicated, supported by a location map duly authenticated by Chief Wildlife Warden. Necessary clearance, as may be applicable to such projects due to proximity of the ecologically sensitive areas as mentioned above, should be obtained from the Standing Committee of National Board of Wildlife and copy furnished.	Not Applicable as no National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/ Elephant Reserves are present in the study area.	-
18.	A detailed biological study of the study area [core zone and buffer zone (10 km	A detailed biological study of the study	

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	radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET Species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the Schedule of the fauna present. In case of any scheduled- I fauna found in the study area, the necessary plan along with budgetary provisions for their conservation should be prepared in consultation with State Forest and Wildlife Department and details furnished. Necessary allocation of funds for implementing the same should be made as part of the project cost.	area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] has been done. No Schedule I species were found.	Chapter 3, Section 3.16.
19.	Proximity to Areas declared as 'Critically Polluted' or the Project areas likely to come under the 'Aravali Range', (attracting court restrictions for mining operations), should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the SPCB or State Mining Department should be secured and furnished to the effect that the proposed mining activities could be considered	Not Applicable as the project area doesn't come under Critically Polluted area or Aravali Range	-
20.	Similarly, for coastal Projects, A CRZ map duly authenticated by one of the authorized agencies demarcating LTL. HTL, CRZ area, location of the mine lease w.r.t CRZ, coastal features such as mangroves, if any, should be furnished. (Note: The Mining Projects falling under CRZ would also need to obtain approval of the concerned Coastal Zone Management Authority).	Not Applicable as the project area doesn't come in CRZ.	-
21.	R&R Plan/compensation details for the Project Affected People (PAP) should be	Not Applicable. As there is no	

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	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.	habitation in the Project site.	-
22.	One season (non-monsoon) [i.e. March-May (Summer Season); October-December (post monsoon season) ; December-February (winter season)]primary baseline data on ambient air quality as per CPCB Notification of 2009, water quality, noise level, soil and flora and fauna shall be collected and the AAQ and other data so compiled presented date-wise in the EIA and EMP Report. Site-specific meteorological data should also be collected. The location of the monitoring stations should be such as to represent whole of the study area and justified keeping in view the pre-dominant downwind direction and location of sensitive receptors. There should be at least one monitoring station within 500 m of the mine lease in the pre-dominant downwind direction. The mineralogical composition	One Season: Pre Monsoon from March to May (01.03.2021 to 31.05.2021)	Chapter 3 Section 3.1

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	of PM10, particularly for free silica, should be given.		
23.	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 contours may be shown on a location map clearly indicating the location of the site, location of sensitive receptors, if any, and the habitation. The wind roses showing pre-dominant wind direction may also be indicated on the map.	Air Modelling has been carried out for prediction of impact due to the proposed project. All the emissions are within permissible limits.	Chapter 4
24.	The water requirement for the Project, its availability and source should be furnished. A detailed water balance should also be provided. Fresh water requirement for the Project should be indicated.	Total water requirement is 7 KLD. Details regarding consumption of water and waste generation are given.	Chapter 2,
25.	Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the Project should be provided.	Water requirement will be sourced from nearby available water resource/ tankers.	Chapter 2
26.	Description of water conservation measures proposed to be adopted in the Project should be given. Details of rainwater harvesting proposed in the Project, if any, should be provided.	Rain Water Harvesting is not proposed.	Chapter 4,
27.	Impact of the Project on the water quality, both surface and groundwater, should be assessed and necessary safeguard	Impacts due to the proposed project in Mine production	Chapter 4,

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	measures, if any required, should be provided.	capacity on the water quality has been assessed and its mitigation measures are suggested. Whereas there is no major surface water body nearby and the mining operations would not intersect the ground water table. So, there won't be any significant impact on the water quality due to the mining operations.	
28.	Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation in this regard may be provided. In case the working will intersect groundwater table, a detailed Hydro Geological Study should be undertaken and Report furnished. The Report inter-alia shall include details of the aquifers present and impact of mining activities on these aquifers. Necessary permission from Central Ground Water Authority for working below ground water and for pumping of ground water should also be obtained and copy furnished.	Not Applicable.	Chapter 4,
29.	Details of any stream, seasonal or otherwise, passing through the lease area and modification / diversion proposed, if any, and the impact of the same on the	Not Applicable. No any stream, seasonal or otherwise, passing	Chapter 4

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	hydrology should be brought out.	through the lease area.	
30.	Information on site elevation, working depth, groundwater table etc. Should be provided both in AMSL and BGL. A schematic diagram may also be provided for the same.	Cross section of the lease area has been given for the required details.	Chapter 2
31.	A time bound Progressive Greenbelt Development Plan shall be prepared in a tabular form (indicating the linear and quantitative coverage, plant species and time frame) and submitted, keeping in mind, the same will have to be executed up front on commencement of the Project. Phase-wise plan of plantation and compensatory afforestation should be charted clearly indicating the area to be covered under plantation and the species to be planted. The details of plantation already done should be given. The plant species selected for green belt should have greater ecological value and should be of good utility value to the local population with emphasis on local and native species and the species which are tolerant to pollution.	Detail plantation scheme has been prepared with year-wise development of the Greenbelt, Species which will be preferred for plantation are mentioned.	Chapter 10, Section 10.4.
32.	Impact on local transport infrastructure due to the Project should be indicated. Projected increase in truck traffic as a result of the Project in the present road network (including those outside the Project area) should be worked out, indicating whether it is capable of handling the incremental load. Arrangement for improving the infrastructure, if contemplated (including action to be taken by other agencies such as State	A detailed study regarding the increase in the existing traffic because of the proposed project has been done.	Chapter 3, Section 3.15

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	Government) should be covered. Project Proponent shall conduct Impact of Transportation study as per Indian Road Congress Guidelines.		
33.	Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.	Site shelter and facilities will be provided according to workforce.	-
34.	Conceptual post mining land use and Reclamation and Restoration of mined out areas (with plans and with adequate number of sections) should be given in the EIA report.	Conceptual post mining the mined out pit will be developed into a plantation.	Chapter 2, Section 2.10.
35.	Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be Occupational Hazard / Health & Safety Control Measures detailed.	Occupational health impacts of the project its preventive measures etc. have been mentioned.	Chapter 7, Section 7.7
36.	Public health implications of the Project and related activities for the population in the impact zone should be systematically evaluated and the proposed remedial measures should be detailed along with budgetary allocations.	Public health implication like respiratory disorder, noise induced problems are major issues which will be addressed properly. The impacts will confine to particular zone.	Chapter 7 Section 7.7

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37.	Measures of socio economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	Socio-economic benefits from the proposed project will influence the local community in a positive manner.	Chapter 8. Section 8.3
38.	Detailed environmental management plan (EMP) to mitigate the environmental impacts which, should inter-alia include the impacts of change of land use, loss of agricultural and grazing land, if any, occupational health impacts besides other impacts specific to the proposed Project.	Various impacts which are likely to be caused by the proposed project and their mitigation measures are mentioned.	Chapter 4
39.	Public Hearing points raised and commitment of the Project Proponent on the same along with time bound Action Plan with budgetary provisions to implement the same should be provided and also incorporated in the final EIA/EMP Report of the Project.	Public hearing details will be incorporated in final EIA.	-
40.	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 such legal cases are pending against the project.	
41.	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	Total project cost is Rs. ~2.0 Crore Capital Cost for EMP is Rs. 40,00,000. Recurring cost of EMP is Rs. 12,50,000 per annum. Details of EMP Budget are mentioned.	Chapter 2, Section 2.4. Chapter 10, Section 10.5.

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42.	A Disaster management Plan shall be prepared and included in the EIA/EMP Report.	Disaster management plan has been prepared and mentioned.	Chapter 7, Section 7.8.
43.	Benefits of the Project if the Project is implemented should be spelt out. The benefits of the Project shall clearly indicate environmental, social, economic, employment potential, etc.	Project benefits are detailed in EIA/EMP report.	Chapter 8
44.	Besides the above, the below mentioned general points are also to be followed:-		
A.	All documents to be properly referenced with index and continuous page numbering.	Noted	-
B.	Where data are presented in the Report especially in Tables, the period in which the data were collected and the sources should be indicated.	Noted	-
C.	Project Proponent shall enclose all the analysis/testing reports of water, air, soil, noise etc. using the MoEF&CC/NABL accredited laboratories. All the original analysis/testing reports should be available during appraisal of the Project.	Noted.	-
D.	Where the documents provided are in a language other than English, an English translation should be provided.	Noted.	-
E.	The Questionnaire for environmental appraisal of mining projects as devised earlier by the Ministry shall also be filled and submitted.	Noted.	-
F.	While preparing the EIA report, the instructions for the Proponents and instructions for the Consultants issued by MoEF&CC vide O.M. No. J-11013/41/2006-IA.II(I) dated 4 th August, 2009, which are available on the website of	Noted and complied.	-

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	this Ministry, should be followed.		
G.	Changes, if any made in the basic scope and project parameters (as submitted in Form-I and the PFR for securing the TOR) should be brought to the attention of MoEF&CC with reasons for such changes and permission should be sought, as the TOR may also have to be altered. Post Public Hearing changes in structure and content of the final EIA/EMP (other than modifications arising out of the P.H. process) will entail conducting the PH again with the revised documentation.	Noted	-
H.	As per the circular no. J-11011/618/2010-IA.II(I) dated 30.5.2012, certified report of the status of compliance of the conditions stipulated in the environment clearance for the existing operations of the project, should be obtained from the Regional Office of Ministry of Environment, Forest and Climate Change, as may be applicable.	Not Applicable. It is a newly proposed mine.	-
I.	The EIA report should also include (i) surface plan of the area indicating contours 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.	Noted and attached in EIA as well as in Approved mining plan.	Chapter 2.
Specific ToR:-			
1.	(i) Waste/ Dump management Generation use for construction and maintenance of haulage road and maximum inventory at any point of terms including dump area. height and slope etc.	Noted and attached in EIA as well as in Approved mining plan.	Chapter 2.
	(ii) Detail engineering estimate of use of	Noted and attached	Chapter 2.

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	waste in construction and maintenance of the haulage road.	in EIA as well as in Approved mining plan.	
2.	Distance of the nearest habitation I village (s) etc from the lease boundary duly certified by the concerned Tahasildar.		
3.	Will the village road be used for transportation of the mineral? If not the haulage road will be use the width and distance of it till it intersects with SH/ NH/ District road any public road and the later distance from the village road.	Details attached in EIA report.	Chapter 2.
4.	In case village / any habitation is very nearby, plan to ensure safety of human life and livestock from accidents by submitted.	Details attached in EIA report.	Chapter 2.
5.	Number and type of vehicles to be engaged per day and their frequency of plying	Details attached in EIA report.	Chapter 3.
6.	(i) Zero liquid discharge (ZLD) management w.r.t. garland drain details settling tank details during monsoon. If ZLD is not possible the SOP with details of discharge of water beyond lease boundary be submitted.	Details attached in EIA report.	Chapter 2.
	(ii) Whether the waste/ contaminated water will be discharged to barren land I agricultural land / nalla / river? Mechanism to ensure discharge of contaminated on free water and the periodic test/ analysis thereof before discharge.	Details attached in EIA report.	Chapter 2.
7.	Any high Transmission Electric line existing if yes, the distance of the same from the boundary of the lease.	Details attached in EIA report.	Annexure-3.
8.	Undertaking by project proponent for not disturbing the general flow of seasonal nala during mining activity	Details attached in EIA report.	Annexure-3
9.	Any water reservoir / dam / bridge /barrage exist nearby and if yes, the distance of the same with geo co-ordinates.	Details attached in EIA report.	Chapter 2.
10.	License for use and storage of explosive	Details attached in	Chapter 2.

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	used in the mining from the appropriate Authority to be submitted.	EIA report.	
11.	Certificate from the concerned DFO that there is no D LC land involved in lease area. Distance of the mines from the boundary of the Notified eco-sensitive Zone /Wildlife Sanctuary if any.	Details attached in EIA report.	Annexure-4
12.	Details of drainage plan proposed.	Details attached in EIA report.	Chapter 2.
13.	Details of silt management be submitted	Details attached in EIA report.	Chapter 2.
14.	Present use of land.	Details attached in EIA report.	Chapter 2.
15.	NOC of Panchayat for usage of haulage road/Panchayat Road	Details attached in EIA report.	Annexure-3



Final Environment Impact Assessment Report

New Proposed project of Basupali Cluster Stone Quarry Project with proposed total excavation of 112166 cum of stone, having an area of 9.67 ha, located at Village: Basupali, Khata No. 14, Plot No.101 & 79, Kisam Kudar, Tehsil: Balangir, District: Balangir, Odisha.

Executive Summary

Executive Summary

1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION OF PROJECT PROPONENT

Name of the project:	Basupali Cluster Stone quarry
Type of the project:	New
Proposed Production:	Proposed mine of Basupali Cluster Stone quarry with the excavation capacity of 112166 cum stone.
Area of Lease	9.67 ha
Location of the project:	Khasra No.-14, Village: Basupali, Tehsil: Balangir, District: Balangir (Odisha)
Identification of Proponent:	The mine lease is yet to be allotted. The EIA is being prepared under the name of the Tehsildar, Balangir (On behalf of Successful Bidder)

1.2 TYPE OF PROJECT

- Basupali Stone Quarry is an new stone quarry mine with an area of 9.67 ha and production capacity of 112166 cum stone. Now, the project proponent Tehsildar Balangir.
- As per the EIA Notification dated 1st July, 2016, a cluster shall be formed when the distance between the peripheries of one lease is less than 500 meters from the periphery of other lease in a homogeneous mineral area which shall be applicable to the mine leases or quarry licenses granted on and after 9th September, 2013. Therefore, as per the EIA Notification dated 15th January, 2016 and 1st July, 2016, the project comes under B1 Category with cluster situation which require prior Environmental Clearance (EC) from the State Environment Impact Assessment Authority (SEIAA).

1.3 NEED FOR THE PROJECT

The basic objective of the project is to meet the utilization of mineral demand in the country and /or region. The urbanization and industrialization has enhanced the demand of building material. Now a days, the production of the stones mostly used in the building & road metal, and it also used in walls, foundation etc. 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.

PROJECT PROPONENT	ENVIRONMENT CONSULTANT	Page 1
BASUPALI CLUSTER STONE QUARRY PROJECT	M/S GREEN CIRCLE INC. NABET/EIA/2124/RA 0219	



Final Environment Impact Assessment Report

New Proposed project of Basupali Cluster Stone Quarry Project with proposed total excavation of 112166 cum of stone, having an area of 9.67 ha, located at Village: Basupali, Khata No. 14, Plot No.101 & 79, Kisam Kudar, Tehsil: Balangir, District: Balangir, Odisha.

Executive Summary

1.4 BRIEF DESCRIPTION OF THE PROJECT

Table – 1 Brief Description of the Project

S. No.	Particulars	Details
A.	Nature of project	Basupali Stone Quarry Project
B.	Size of project	
1.	ML Area	9.67 Ha
2.	Proposal	Proposed mine of Basupali Cluster Stone quarry with the excavation capacity of 112166 cum stone.
C	Project Location	
1.	Villages	Basupali
2.	Tehsil	Balangir
3.	District	Balangir
4.	State	Odisha
5.	Khata No.	Khata No.-14
6.	Toposheet No.	64P/6
D	Environmental Setting Details (with approx. aerial distance & direction from the mining lease boundary)	
1.	Nearest village	Jalia Village 1.2 Km, W
2.	Nearest Town/City	Balangir about 8.2 km, NE
3.	Nearest Railway Station	Deogan Road Railway Station-8 Km, S
4.	Nearest Airport	Biju Patnaik International Airport, Bhubaneswar about 249.5 km, E
5.	Nearest Highway	NH- 201 is 1.7 Km W away from lease area(Bolangir to Bhawanipatna road) / SH-42 is about 9.5 Km E from lease area (Bolangir to Bangomunda road)
6.	Nearest Water Body	Padampur Nallah 2.6 Km, N
7.	Ecology Sensitive Zone	No national parks and sanctuary within 10 km radius
8.	Topography	Topographically area is a part of hilly terrain
9.	Sismic Zone	Zone – II as per IS: 1893 (Part-I): 2002
D	Cost Details	
1.	Project Cost	~2.0 Crore
2.	Cost of EMP	Capital Cost- 40,00,000 Recurring Cost- 12,50,000

Source: Site Visit & Pre-feasibility Report

PROJECT PROPONENT	ENVIRONMENT CONSULTANT	Page 2
BASUPALI CLUSTER STONE QUARRY PROJECT	M/S GREEN CIRCLE INC. NABET/EIA/2124/RA 0219	

1.5 LOCATION MAP

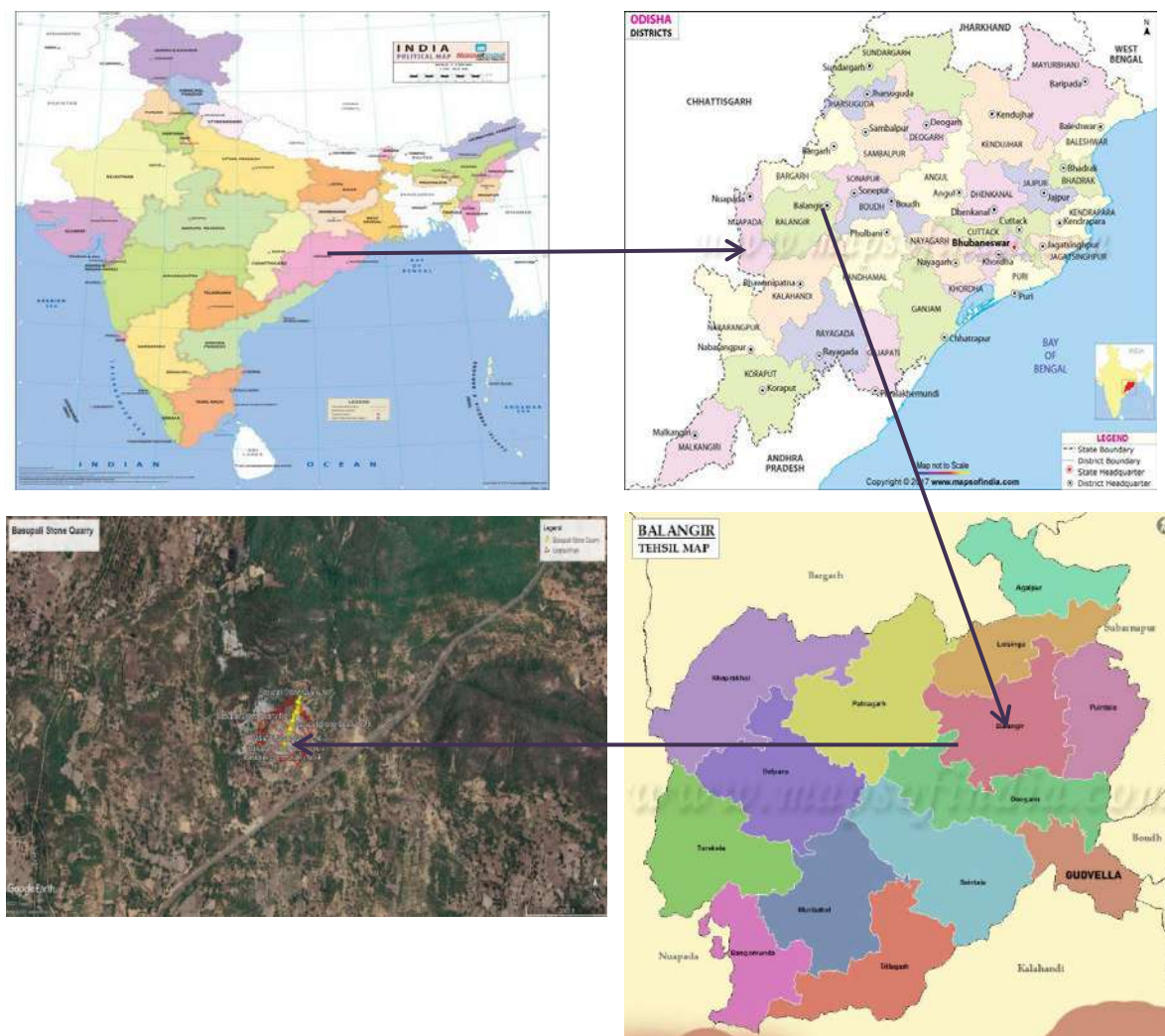


Figure-1: Location map (Showing general as well as specific location of the ML area)

1.6 MINE DESCRIPTION

1.6.1 MINING LEASE STATUS

Basupali Cluster Stone Quarry is a new stone mine cluster with the excavation capacity of 112166 cum stone located at Village: Basupali, Khata No. 14, Plot No.101 & 79, Kisam Kudar, Tehsil: Balangir, District: Balangir, Odisha. The proposal is made for the new project with capacity of 112166 cum stone.

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1.6.2 MINING DETAILS

Table – 2 Mining Details

Particulars	Details
Method of Mining	Semi- Mechanized Open Cast mining
Available Movable Reserve-Stone	7,83,593.1 cum
Life of Mines	Approx. 5 years
Bench Height	3 to 6 m
Bench Width	6 m
Water Table	15-20 m
Water Requirement	7.0 KLD
Manpower Requirement	55 Nos.
No. of Working Days	300 days/Year
Climatic Conditions	Annual Maximum Temperature: 46°C Annual Minimum Temperature: 8 °C
Present land use at the proposed site	The area is a Non-Forest, undeveloped Govt. land

Source: Approved Mining Plan & Progressive Mine Closure Plan

1.6.3 METHOD OF MINING

Mining operations will be carried out by Semi-mechanized opencast mining method. The topsoil will be used for greenbelt development and mine waste will be stacked separately, will be used as road building material. To facilitate further mining development of benches is suggested having 6 m height and 45° face slope.

The Jack hammer drills of 32 mm diameter rods will be deployed to drill blast holes and these will be charged with explosive cartridges.

Wet drilling will be carried out & Blasting will be there on contract basis.

Quarrying activities will be done following all the security majors. Rules and regulations of DGMS and IBM will be observed during the Quarrying operations to avoid unwanted circumstances.

Muffled blasting will be carried to reduce the ground vibration, fly rock etc. due to blasting.

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Mined out material will be loaded into the dumpers with the help of JCB and will be sent to the nearby established crusher outside the lease area and finally the material of commercial use as per the demand of the market will be transported by Covered trucks / dumpers to its final destination.

2.0 DESCRIPTION OF THE ENVIRONMENT

2.1 PRESENTATION OF RESULTS (AIR, NOISE, WATER & SOIL)

Baseline study of the study area was conducted during pre-monsoon season from 1st March 2021 to 31st May 2021.

The concentrations of PM₁₀ and PM_{2.5} for all the 8 AAQM stations were found between 60.1 to 72.4 µg/m³ and 18.6 to 27.5 µg/m³ respectively. The concentrations of SO₂ and NO_x were found to be in range of range of 6.7 to 9.1µg/m³ and 10 to 13.6 µg/m³ respectively.

The noise levels varied in the study area during day time from 51.2 dB (A) Leq at Pandel to 63.6 Leq dB (A) at Project site. The night time noise level in the study area is in the range of 39.8 dB (A) Leq at Ratanpur to 59.2 Leq dB (A) at Project Site. The day time as well as night time noise was also within stipulated standards of CPCB.

The ground water analysis for all the 7 sampling stations shows that the samples meet the desirable standards pH ranges from 7.26 to 7.54. TDS in samples ranges from 416 mg/L to 554 mg/L. All the samples meet the permissible limit of 2000 mg/L. Total Hardness in the water ranges from 326 mg/L to 485 mg/L. All the samples meet the permissible limit of 600 mg/L. Calcium content in the water ranges from 84.8 mg/L to 147.2 mg/L, all the samples meet the permissible limit of 200 mg/L. Magnesium content in the water ranges from 26.7 mg/L to 35.9 mg/L. All the samples meet the permissible limit of 100 mg/L.

The surface water analysis for all the 6 sampling stations shows that pH ranges from 7.0 to 7.4. TDS in samples ranges from 282 mg/L to 353 mg/L. Total hardness in the water ranges from 204 mg/L to 253 mg/L. Calcium content in the water ranges from 24.6 mg/L to 30.9 mg/L. Magnesium content in the water ranges from 44.28 mg/L to 55.52 mg/L.

Samples collected from identified soil locations indicate pH in the range from 6.64.-7.56. Conductivity of the samples were in the range from 354µS/cm- 543 µS/cm. Moisture were in the range from 6.9% to 10.5%. Organic Carbon ranges from 0.4% -0.7 %. Organic Matter ranges from 0.68 mg/kg-1.2 mg/kg. Phosphorus in the samples ranges from 19.7 mg/kg- 25.7 mg/L. Total Nitrogen in the samples ranges from 236 mg/kg -484 mg/kg. Potassium in the samples

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ranges from 189.5 mg/kg -690.6 mg/kg. Calcium in the samples ranges from 236 mg/kg -602 mg/kg. Magnesium ranges from 212 mg/kg – 433 mg/kg. Chloride ranges from 48 mg/kg- 75 mg/kg. Copper, zinc, lead, cadmium and nickel all lies well in the Soil.

2.2 BIOLOGICAL ENVIRONMENT

Flora: Shisham, Sagwan, Gulmohar, Neem, Safeda, Amaltash, Karanj, Ashok, Babool, and fruit plants like Mango, Lemon, and Aamla, Rose, Kaner, Bottle brush, Pot marigold, Gudhal.

Fauna: The various animal species in the study area are reported in below table. Richness of plant species of the region is the prime cause for animal richness: Bank myna, Black drongo, Cattle egret, Five stripped palm Squirrel, Common House rat, Indian Gerbil, Black Rat.

2.3 SOCIO-ECONOMIC ENVIRONMENT

The total & total population as per 2011 Census records is 206410 (for 10 km radius buffer zone). In the study area the sex ratio is 964. As per the Census 2011 the male population is 50% while female population is 50% of the total population.

3.0 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

➤ Impact on Air Environment

Due to Mining

The key air emissions from the mining activities (drilling, blasting, crushing, loading, haulage and transportation) are Particulate Matter, Oxides of Nitrogen (NO_x) and Sulphur dioxide (SO₂). Gaseous emissions will be generated from HEMM & movement of vehicles. Use of proper mitigation measures will be taken like water sprinkling on haul roads & development of green area to control fugitive emissions. Better maintenance of equipments also helps to reduce such emissions.

➤ Impact on Water Environment –

Surface Water

As per surface water monitoring, there will be no impact predicted on surface water.

Ground Water

As per groundwater monitoring, water level is 15-20 m bgl. At conceptual stage, ultimate working depth of the mining operation will not intersect the water table.

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Mitigation Measures

- Garland drains, settling tank followed by storage tank will be constructed to prevent run off from mine site.
- Green belt area will be developed at the boundary.
- Mining of Stone does not have any significant impact on the water quality and parameters as the mining does not intersect with the ground water level.

➤ Impact of Noise & Vibration –

Due to Mining Activities

Major noise generating sources of the mining activity are drilling, blasting & HEMM movement. The plantation and the green belt around the mining lease boundary will help in reducing noise level and proper mitigation measures will be carried out.

Total Mining Lease area is 9.67 ha. Blasting and thick plantation will be done to mitigate the impacts of the blasting. However, All DGMS guidelines will be followed to reduce the impact of blasting. Controlled blasting techniques through proper blast design and explosive selection will be used to reduce the vibrations to a greater extent and it is on contract basis will be done by blasting experts. Vibration will be under threshold value and will be limited upto mining area which can more be dampened by the use of Muffled blasting techniques.

➤ Impact on Land Environment –

The land use of the lease area will be altered from barren land to mining area including pits, temporary dumps, greenbelt, plantation zone, water reservoir etc but will not have any significant effect on the surface features of the surrounding areas.


At conceptual and rest 1.0901ha will be converted into Quarry. Greenbelt will be developed in the mine lease covering an area of 0.55 ha.

4.0 POST PROJECT ENVIRONMENTAL MONITORING PROGRAMME

Table 4 Post Project Monitoring

S. No.	DESCRIPTION	FREQUENCY OF MONITORING
1.	Ambient Air Quality monitoring	Half Yearly or as per consent
2.	Water Quality & Level monitoring	Half Yearly or as per consent
3.	Noise Level Monitoring	Half Yearly or as per consent

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	<p align="center">Final Environment Impact Assessment Report</p> <p>New Proposed project of Basupali Cluster Stone Quarry Project with proposed total excavation of 112166 cum of stone, having an area of 9.67 ha, located at Village: Basupali, Khata No. 14, Plot No.101 & 79, Kizam Kudar, Tehsil: Balangir, District: Balangir, Odisha.</p>
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4.	Soil Analysis	Half Yearly or as per consent
5.	Medical Checkup of employees	Half Yearly or as per consent

5.0 ADDITIONAL STUDIES

Additional Studies i.e. Risk Assessment & Disaster Management Plan, Land use and land cover study, Ecology and Biodiversity are covered with this EIA/EMP Report.

6.0 PROJECT BENEFITS

The proposed project will help the local economy directly as well as indirectly as there is going to be capital expenditure for this proposed unit and it will generate substantial employment in the region. With the proposed development in and around the area, there will be supporting facilities/infrastructure eventually leading to the development of the area. The project will boost the overall growth of the region and in the state, the local economy will flourish due to income expenditure in the local market. Therefore, project is having great importance to the district and state economy.

Along with the contribution in employment generation and economic growth of the country project will also be helpful in the development of basic needs of the local area like education, Health & family welfare, women empowerment, water conservation, infrastructure development etc. With the CER activities grazing land for the lives stocks will also be developed.

7.0 ENVIRONMENT MANAGEMENT PLAN

7.1 AIR QUALITY MANAGEMENT

Drilling

- Drilling machines will be provided with wet drilling arrangements to prevent dust from being air borne.

Blasting

- Controlled and Muffled blasting will be adopted by the contractor.
- Rock breaker will be deployed in place of secondary blasting.
- Water spray on blasted muck pile before dozing/loading to control dust generation.

Loading & Transportation

- All the mine roads from loading to destination place will be maintained properly with motor grader and watered regularly during the shift operation to prevent generation of dust due to the movement of dumper etc.

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- Development of green belt/plantation around mine boundary, roads and other places will be carried out to control the air pollution.
- Proper maintenance of the HEMMs & transportation vehicles will be done.
- Vehicular emissions will be kept under norms.
- Personal Protective Equipment like dust masks will be provided to all employees.
- Periodic air quality monitoring will be carried out.

7.2 NOISE QUALITY MANAGEMENT

Drilling

- Drilling will be done with sharp drill bits to achieve optimum drilling performance and to reduce noise generation at source.
- Personal protective equipments i.e. earplug at drilling, crushing & at other high noise areas will be ensured.
- Periodic noise quality will be monitored regularly.

Blasting & Vibration

- Explosives charge per hole and per delay will be maintained as per DGMS guidelines.
- Muffled Blasting techniques like making of trenches, use of flexible heavy rubber curtains, drilling of Dummy holes, Placing of Sand bags etc. will be implemented to dampen the vibrations upto maximum extent.

Transportation

- Adequate silencers in HEMM will be provided to reduce generation of noise.
- Proper maintenance, oiling and greasing of machines at regular intervals will be done to reduce generation of noise.
- The workers employed at HEMM will be provided with protective equipment, earmuffs and earplugs as a protective measure from the high noise level generated at the mine site and wherever required.
- Development of green belt & plantation around lease boundary, roads and other places will be carried out.
- Periodical monitoring of noise level will be carried out regularly.

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7.3 WASTE WATER MANAGEMENT

Waste Water

- Domestic wastewater generated from mines office will be disposed off in soak pit via septic tank.
- No waste water will be generated from the mining operations.

Surface Run-off

- Garland drains will be constructed at toe of temporary dump (if in case it is to be made).
- The rainwater falling directly into the mine pits will be stored and used for plantation & dust suppression.
- Periodical monitoring of ground water quality will be carried out.

9.4 TOP SOIL AND SOLID WASTE GENERATION & MANAGEMENT

Top Soil Generation & Management

- Top soil will be used for development of Green Belt around the lease area.
- Generated waste/Reject will be used for the repairing and maintenance of road on regular basis in every few months and rest will be stacked separately in dumping area.

7.5 LAND USE PATTERN

- At conceptual stage total excavated area will be 1.0901ha.
- Greenbelt will be developed along the lease periphery on 0.55 ha.

7.6 GREENBELT DEVELOPMENT AND PLANTATION PROGRAM

- Greenbelt will be developed along the lease periphery covering 0.55 ha area.
- Native species will be planted like Amla, Neem, Pipal, Sissoo, Bargad, Mango, Karanj and Guava.



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Chapter 1 Introduction

1.1 Purpose of the Report

Basupali Cluster Stone quarry is a newly proposed Mine located at village: Basupali, Tehsil: Balangir, District: Balangir (Odisha). The cluster is spread over an area of 9.67 ha. The Mining plan was authorized by the Joint Directorate of Geology, Balangir, Odisha. It is a new proposed stone mine cluster project with the excavation capacity of 112166 cum stone. Terms of Reference was granted by SEIAA for file number File No. SIA/OR/MIN/64155/2021 on 26/07/2021.

The Environmental Impact assessment study was carried out to have an idea about the existing environmental condition related to physical environment, biological environment and social environment. Environmental Management Plan has been prepared to assess the current environmental scenario of the area and then based on the activities of mining proposed, to carry out Environmental Impact Assessment. The plan will identify and address the impacts, where these are adverse in nature, and thereafter design mitigation measures to manage such impacts in a manner as to conserve environment and ecology of the area. The EMP has been prepared with a view to ultimately ensure that the adverse impacts are minimized if these cannot be prevented altogether.

The main purpose of this report is to provide a coherent statement after analyzing all significant impact of the proposed mining project and measures that should be taken to eliminate and mitigate them. It contains essential information for:

- The proponent to implement the proposal in an environmentally and socially responsible way;
- The responsible authority to make an informed decision on the proposal, including the terms and conditions that must be attached to an approval or authorization; and
- The public to understand the proposal and its likely impacts on people and the environment.

1.2 Identification of the Project & Project Proponent

1.2.1 Identification of the Project

A. Proposed project

Basupali Cluster Stone Quarry is a new stone mine cluster with the excavation capacity of 112166 cum stone located at Village: Basupali, Khata No. 14, Plot No.101 & 79, Kisam Kudar, Tehsil: Balangir, District: Balangir, Odisha. The proposal is made for the new project with capacity of 112166 cum stone.

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B. Screening Category

As per the EIA Notification dated 1st July, 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 which shall be applicable to the mine leases or quarry licenses granted on and after 9th September, 2013. (Ref: Clause (B) (i), Page No-4 in EIA Notification dated 1st July, 2016).

Therefore, as per the EIA Notification dated 15th January, 2016 and 1st July, 2016 and notification of MOEFCC vide S.O. No. 3977(E), Appendix- XI dated 14th August 2018, the project comes under B1 Category with **project activity type “1(a)”** (Mining of Minerals) with cluster situation.

Cluster of active mines area in the immediate surrounding exceeding 5 hectares, therefore EIA and EMP required for seeking Environmental Clearance from SEIAA as per the O.M F. No. L-11011/175/2018/-IA-II (M) dated 12/12/2018.

C. Mining Lease Status

Quarry lease has not yet been auctioned for awarding by Tehsildar of Balangir. The period of lease would be 5 years, as mentioned in approved mining plan.

D. Mining Plan Status

Mining Plan with Progressive Mine Closure Plan has been approved by Joint Directorate of geology, Zonal Survey, Balangir, Odisha vide Memo no. 444 as a copy to RQP Sri Sai Datta Das dated 16/04/2021

E. Environment Clearance status for proposed project.

It is a new proposed project. The chronology of the project activities undertaken so far with respect to the process of getting Environment clearance are as given in the table below-

Table 1-1 Status of proposal for Environmental clearance

S. No.	Project Activity	Date/Duration
1.	Approval of Mining Plan	Joint Directorate of geology, Zonal Survey, Balangir, Odisha vide Memo no. 444 as a copy to RQP Sri Sai Datta Das dated 16/04/2021
2.	Quarry Lease	Yet to be awarded.
3.	ToR Letter issued by SEIAA, Orissa	Terms of Reference was granted by SEIAA for file number File No. SIA/OR/MIN/64155/2021 on 26/07/2021.



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4.	Baseline monitoring & data collection	March 2021 to May 2021
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1.2.2 Introduction of the Project Proponent

Basupali Cluster Stone Quarry is a new stone mine cluster with the excavation capacity of 112166 cum stone located at Village: Basupali, Khata No. 14, Plot No.101 & 79, Kisam Kudar, Tehsil: Balangir, District: Balangir, Odisha. The proposal is made for the new project with capacity of 112166 cum stone.

Table 1-2 General Information about Project Proponent

Name of the project proponent:	The mine lease is yet to be allotted. The EIA is being prepared under the name of the Tehsildar, Balangir (On behalf of Successful Bidder)
Address:	At/Po/Ps- Balangir Dist-Balangir, Odisha, Pin- 767001 Contac No- 06652-232547 E-Mail Id- tah.bolangir-od@nic.in

1.3 Brief description of Nature, Size, location of the Project and its importance to the country and region.

1.3.1 Brief Description of Nature, Size, and location of the project

The brief description of the nature, size and location of the project is given in below table:

Table 1-3 Brief Description of the project

Project Proponent	Tahasildar, Blangir At/Po/Ps- Balangir Dist-Balangir, Odisha, Pin- 767001 Contac No- 06652-232547 E-Mail Id- tah.bolangir-od@nic.in
Project Name	Basupali Cluster Stone Quarry
New/ existing / R enewal mine/ Lease Period	New
Lease Period	5 years
Total Geologic Reserve	1,607,944.5cum
Available Minalable Reserve	7,83,593.1 cum
Water Requirement	7 KLD

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Manpower Requirement	55 Nos.
Climatic Conditions	Annual Maximum Temperature: 46°C Annual Minimum Temperature: 8 °C
Present land use at the proposed site	Non Forest Government Land
Nearest village	Jalia Village 1.2 Km,W
Nearest Town/City	Balangir about 8.2 km, NE
Nearest Railway Station	Deogan Road Railway Station-8 Km, S
Nearest Airport	Biju Patnaik International Airport, Bhubaneswar about 249.5 km, E
Nearest Highway	NH- 201 is 1.7 Km W away from lease area(Bolangir to Bhawanipatna road) / SH-42 is about 9.5 Km E from lease area (Bolangir to Bangomunda road)
Nearest Water Body	Padampur River 2.6 Km, N
Nearest Bridge	Bijakhaman Bridge –5 km, N
Nearest River Embankment	Padampur River Embankment-2.6 Km, N
Nearest Archeological Site	Vaishno Devi Temple -2 km, N
Nearest Sensitive Man-made Land use	Government Ayurvedic Collage & Hospital- 8.3Km,NW High School, Sinkhaman- 2.6 Km, N Vaishno Devi Temple -2 km,N A3 World Amusement Park-1.5 Km, SW
Ecology Sensitive Zone	No national parks and sanctuary within 10 km radius
Reserve Forest	Matkhai Reserve Forest- 1 Km, W
Topography	Hilly terrain
Sesmic Zone	Zone – II as per IS: 1893 (Part-I): 2002
Survey of India Topo-Sheet no.	64P/6

1.3.2 Project importance to the Country and Region

The basic objective of the project is to meet the utilization of mineral demand in the country and /or region. The urbanization and industrialization has enhanced the demand of building material. Now a days, the production of the stones mostly used in the building & road metal,

Chapter 1

and it also used in walls, foundation etc. 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.

1.4 Scope and Methodology of the Study

The scope of the EIA study is based on the generic structure of environmental impact assessment document as stated in the Appendix III of the EIA Notification 2006 (S.O. 1533), Ministry of Environment and Forests, Government of India.

The scope of the study includes a detailed characteristic of environment in the study area associated with the proposed development on various environmental components. For the purpose of environmental assessment of areas within 10 km radius of the project the following methodology will be adopted:

- Generation and collection of baseline data for valued environmental components as per the EIA guidelines.
- Identification and quantification of significant environmental impacts due to the project and associated activities.
- Evaluation of impacts due to proposed activities and preparation of an environmental impact statement.
- Preparation of appropriate Environmental Management Plan (EMP) encompassing strategies for minimizing identified adverse impacts along with budgetary provisions to be made by the project authorities for implementation of mitigation measures.
- Delineation of post Environmental Quality Monitoring Programme (EQMP) along with organizational setup required for monitoring the effectiveness of mitigation measures.

The project proposal was submitted to State Expert Appraisal Committee-SEAC for its appraisal. ToR was submitted on date **24 June 2021**. Based on the data provided, the state Expert Appraisal Committee, SEIAA has issued the Terms of Reference to Proposal No SIA/OR/MIN/64155/2021 on **26/07/2021**. The ToR Letter is attached as **Annexure 1**.

Table 1-4 Structure of the report

Executive Summary:	This chapter gives the summary of the EIA report.
Chapter 1 (Introduction):	This chapter describes objectives and methodology for EIA.
Chapter 2 (Project Description):	This chapter gives a brief description of the location, approachability, manufacturing processes, and details of raw materials, amenities, layout and utilities of the proposed project.
Chapter 3 (Description of	This chapter presents details of the baseline environmental status for microclimate, air quality, noise, traffic, water



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the Environment):	quality, soil quality, flora, fauna and socio-economic status etc.
Chapter 4 (Anticipated Environmental Impact and Mitigation Measures):	This chapter discusses the possible sources of pollution and environmental impacts due to the project during construction and operation phases and suggests the mitigation measures.
Chapter 5 (Analysis of Alternatives):	This chapter covers analysis of technology alternatives and site alternatives.
Chapter 6 (Environmental Monitoring Programme):	This chapter discusses the details about the environmental monitoring program during construction and operation phases.
Chapter 7 (Additional Studies):	This chapter covers information about Risk Assessment Studies for the construction and operation phase, the safety precautions that are taken during construction phase and Disaster Management Plan and Emergency Preparedness Plan onsite and offsite.
Chapter 8 (Project Benefits):	This chapter presents the benefits from this project.
Chapter 9 (Environmental Cost Benefit Analysis)	If recommended by EAC at the scoping stage, this chapter shall include the Environmental Cost benefit Analysis of the project.
Chapter 10 (Environmental Management Plan):	This chapter deals with the Environmental Management Plan (EMP) for the proposed Project and indicates measures proposed to minimize the likely impacts on the environment during construction and operation phases and budgetary allocation for the same.
Chapter 11 (Conclusion):	This chapter presents the conclusion made by the project proponent and developer.
Chapter 12 (Disclosure of Consultants engaged):	This chapter presents the details of the consultant.



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2.1 Type of the Project

Basupali Cluster Stone Quarry is a new stone mine cluster with the excavation capacity of 112166 cum stone located at Village: Basupali, Khata No. 14, Plot No.101 & 79, K isam Kudar, Tehsil: Balangir, District: Balangir, Odisha. The proposal is made for the new project with capacity of 112166 cum stone.

2.2 Need for the Project

Although stone is not a rock of economic importance, it is quite suitable as road metal and concrete in RCC works and other various Infrastructure development as well as Road construction projects. So, to meet the increasing demand of the market the project is proposed.

Presently, Government emphasizes on rapid improvement of basic infrastructure like roads, railways, dams and other social infrastructures both in rural and urban areas, there is a constant demand for ensuring regular supply of stone.

Apart from this the project will also serve the following:

- Generate various employment opportunities especially to the local people.
- Economic development of the state by contributing to state exchequer.

2.3 Location

Basupali Cluster Stone Quarry is a new stone mine cluster with the excavation capacity of 112166 cum stone located at Village: Basupali, Khata No. 14, Plot No.101 & 79, K isam Kudar, Tehsil: Balangir, District: Balangir, Odisha. The proposal is made for the new project with capacity of 112166 cum stone. . Co-ordinates of project site are given in below:

Site Co-ordinates

Table 2-1 Project Site Co-ordinates- Basupali Cluster Stone Quarry

Id	Latitude	Longitude
1	N20° 37' 35.0"	E83° 26' 56.1"
2	N20° 37' 35.5"	E83° 26' 57.4"
3	N20° 37' 34.9"	E83° 26' 58.4"
4	N20° 37' 33.6"	E83° 26' 59.9"
5	N20° 37' 33.2"	E83° 27' 00.0"
6	N20° 37' 33.0"	E83° 27' 01.1"
7	N20° 37' 32.6"	E83° 27' 01.0"
8	N20° 37' 31.6"	E83° 27' 02.5"
9	N20° 37' 30.5"	E83° 27' 03.4"



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10	N20° 37' 30.3"	E83° 27' 03.2"
11	N20° 37' 29.8"	E83° 27' 02.8"
12	N20° 37' 29.1"	E83° 27' 02.8"
13	N20° 37' 29.1"	E83° 27' 02.4"
14	N20° 37' 28.5"	E83° 27' 01.8"
15	N20° 37' 27.5"	E83° 27' 01.1"
16	N20° 37' 25.2"	E83° 27' 01.2"
17	N20° 37' 24.7"	E83° 27' 00.1"
18	N20° 37' 24.3"	E83° 26' 59.6"
19	N20° 37' 23.5"	E83° 26' 58.9"
20	N20° 37' 24.1"	E83° 26' 58.7"
21	N20° 37' 24.3"	E83° 26' 58.0"
22	N20° 37' 24.5"	E83° 26' 55.4"
23	N20° 37' 24.2"	E83° 26' 54.5"
24	N20° 37' 25.0"	E83° 26' 54.6"
25	N20° 37' 25.3"	E83° 26' 53.5"
26	N20° 37' 26.6"	E83° 26' 51.1"
27	N20° 37' 26.1"	E83° 26' 50.6"
28	N20° 37' 26.2"	E83° 26' 50.0"
29	N20° 37' 27.3"	E83° 26' 50.3"
30	N20° 37' 27.6"	E83° 26' 48.8"
31	N20° 37' 27.4"	E83° 26' 48.4"
32	N20° 37' 28.2"	E83° 26' 48.3"
33	N20° 37' 29.3"	E83° 26' 48.7"
34	N20° 37' 29.5"	E83° 26' 49.0"
35	N20° 37' 30.3"	E83° 26' 49.0"
36	N20° 37' 31.3"	E83° 26' 49.1"
37	N20° 37' 31.2"	E83° 26' 49.5"
38	N20° 37' 31.8"	E83° 26' 49.8"

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39	N20° 37' 32.0"	E83° 26' 50.1"
40	N20° 37' 32.8"	E83° 26' 50.7"
41	N20° 37' 32.8"	E83° 26' 51.7"
42	N20° 37' 33.0"	E83° 26' 52.2"
43	N20° 37' 33.0"	E83° 26' 53.2"
44	N20° 37' 33.2"	E83° 26' 54.4"
45	N20° 37' 33.3"	E83° 26' 54.7"
46	N20° 37' 33.5"	E83° 26' 54.5"
47	N20° 37' 34.3"	E83° 26' 55.2"



Figure 2-1 Project Site

2.3.1 Location Map (General & Specific)

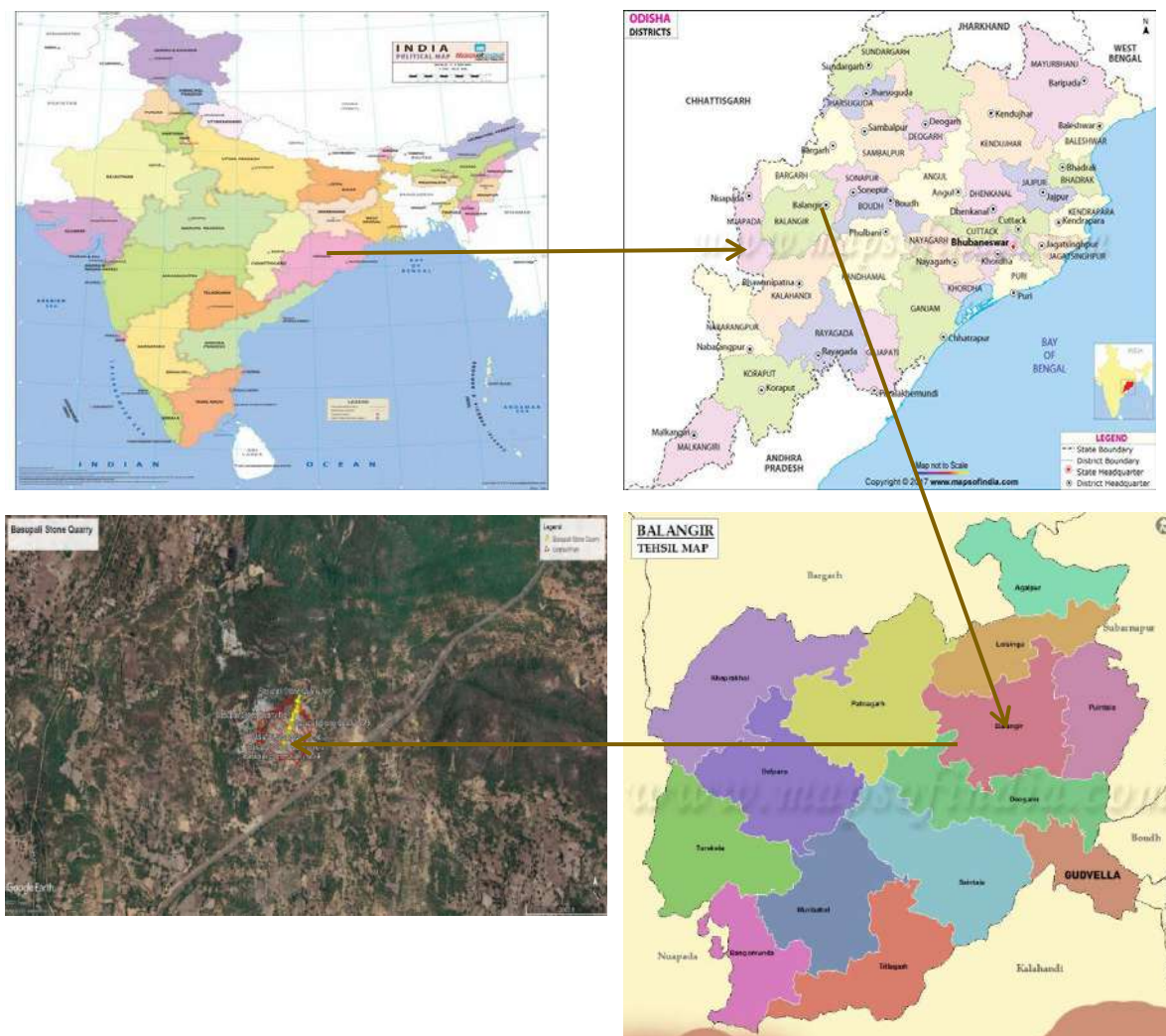


Figure 2-2 Location Map (General and Specific)

2.3.2 Project Site Layout

• Land Details

Quarry lease will be granted for 5 years which is spread over an area of 9.67 ha. Topographically, the area is hilly terrain.

Total cluster area is 9.67 ha located at Village: Basupali, Khata No. 14, Plot No.79 & 101, Kism Kudar, Tehsil: Balangir, District: Balangir, Odisha.

Table 2-2 Details of Land

Sl. No.	Name of Source	Khata No.	Plot No.	Area in Ac.	Kism
1	Basupali Stone Quarry No.1	14	79	4.4	Kudar
2	Basupali Stone Quarry No.2	14	79	5.00	Kudar
3	Basupali Stone Quarry No.3	14	79	5.00	Kudar
4	Basupali Stone Quarry No.4	14	79	5.00	Kudar
5	Basupali Stone Quarry No.5	14	79 & 101	4.5	Kudar
Total Area				23.9 Ac	

Existing features of the lease area:

- The area is approachable from cluster by fair weather road. The applied area is about 249.5 km away from Bhubaneswar Airport. The nearest railway station is at Deogan Road Railway Station 8 Km from the site.

Table 2-3 Environmental Settings near the project Site

Sr. No.	Particulars	Details
1.	Nearest village	Jalia Village 1.2 Km, W
2.	Nearest Town/City	Balangir about 8.2 km, NE
3.	Nearest Railway Station	Deogan Road Railway Station-8 Km, S
4.	Nearest Airport	Biju Patnaik International Airport, Bhubaneswar about 249.5 km, E
5.	Nearest Highway	NH- 201 is 1.7 Km W away from lease area



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6.	Nearest Water Body	Padampur Nallah 2.6 Km, N
7.	Reserve Forest	Matkhai Reserve Forest- 1 Km, W

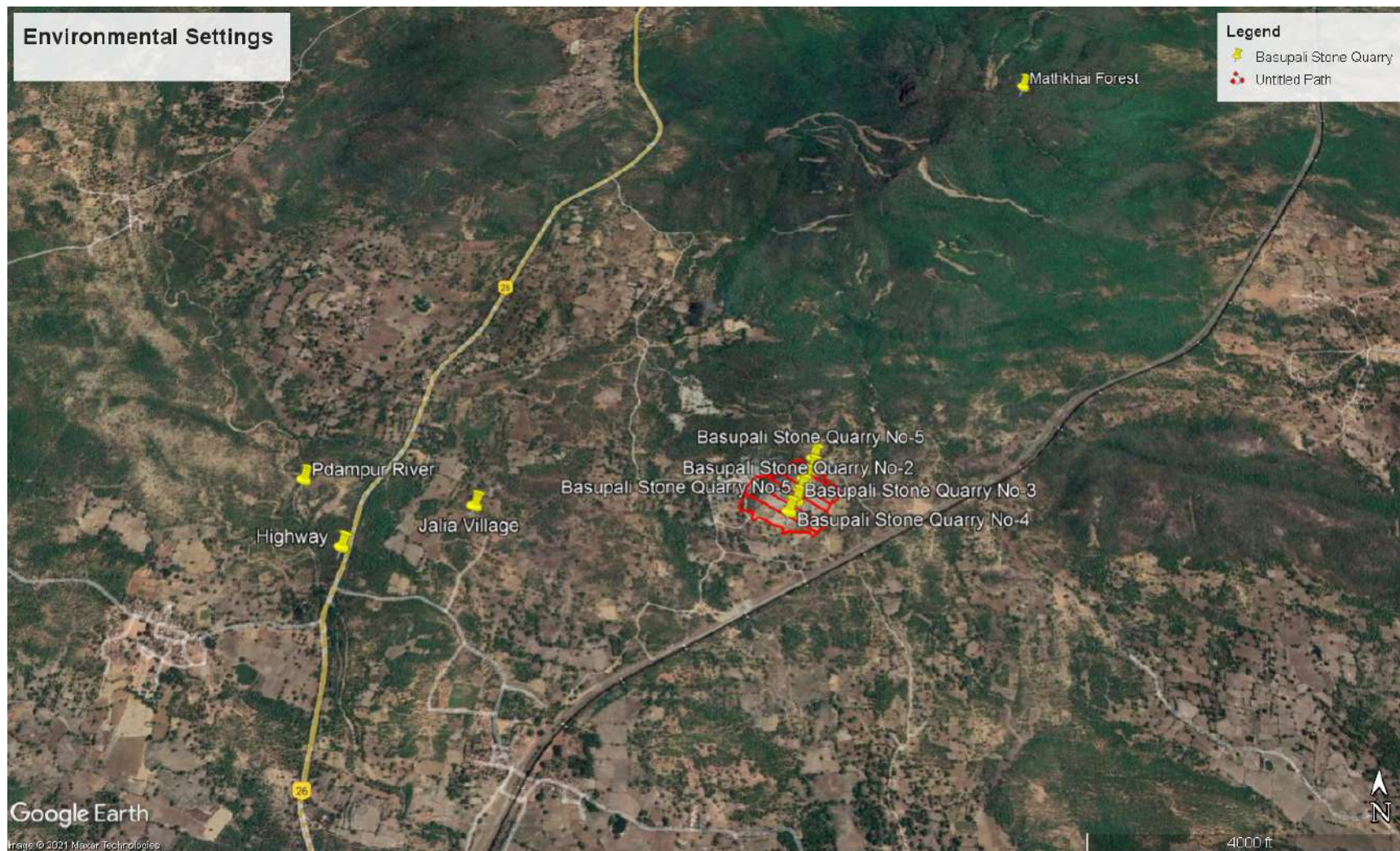


Figure 2-3 Environmental Settings near the Project Site

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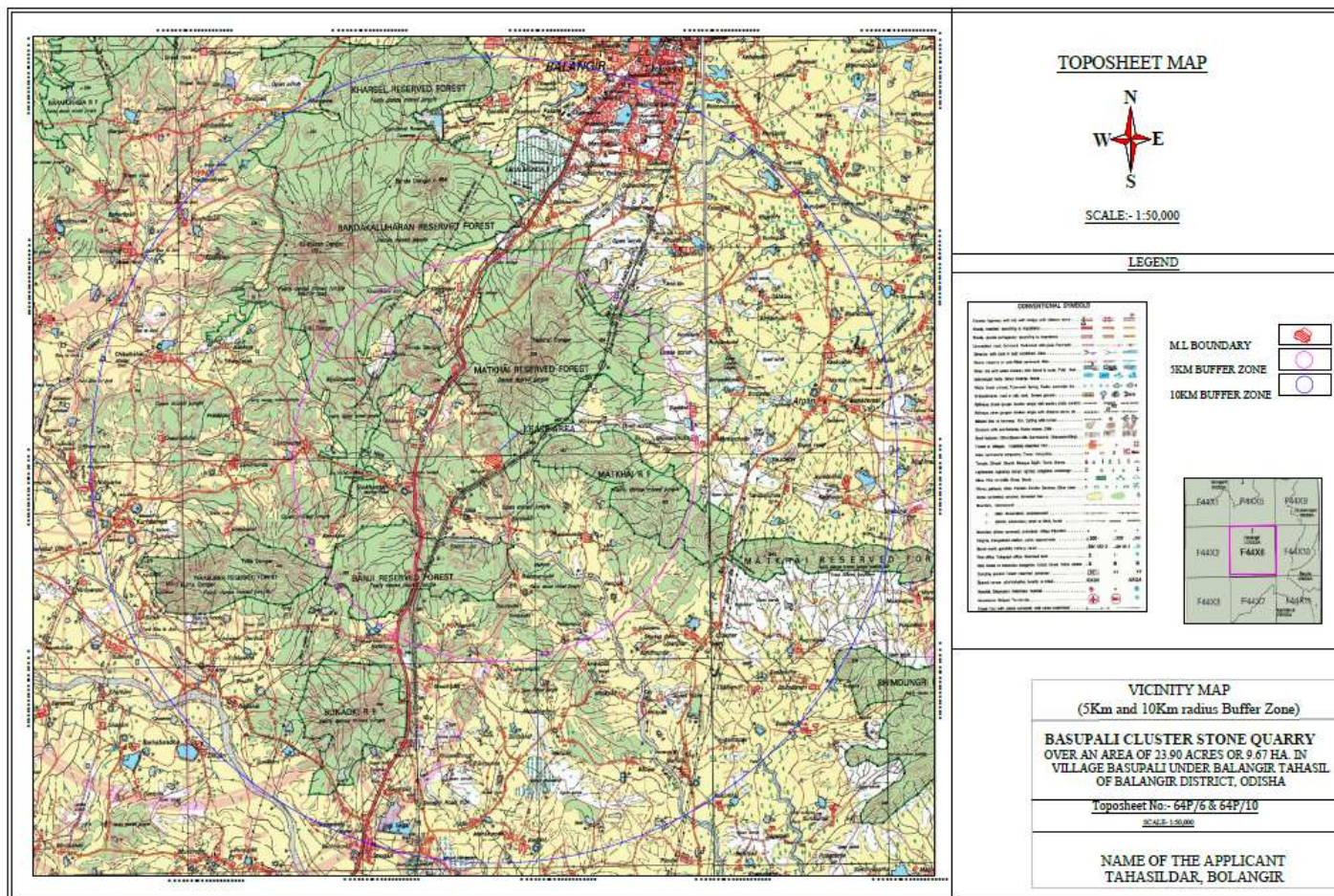


Figure 2-4 Key Map of the Study Area

2.4 Size or Magnitude of the Operation

It is newly proposed stone quarry mine having lease area of 9.67 ha with proposed production capacity of 112166 cum stone. The total lease area is non-forest Govt. land. The lease has been granted for 5 years. 55 people would be employed in the project.

Table 2-4 Cost of the Project

Sr.No.	Particulars	Cost of each	Capital cost
1.	Cost of dumper (Quantity -2 nos) remaining 06 dumpers on hire basis	~20,00,000/-	~40,00,000 /-
2.	J.C.B (Quantity -2nos on hire basis)	30,00,000/-	60,00,000/-
3.	Water Tanker(Quantity -2nos) remaining on hire basis	~5,00,000/-	~10,00,000/-
3.	EMP	~40,00,000/-	~40,00,000/-
4.	Lease/ Land Cost	-	-
5.	Other cost	-	~50,00,000/-
TOTAL COST			~2.0Crores

2.4.1 Associated Activities/Facilities

A make shift quarry office shall be established at the ramp of the quarry site. Other statutory constructions like rest shelter, offices shall not be required as the laborers involved in the quarry operation will be from adjoining villages.

2.5 Status of Statutory Clearances, Permissions, No Objection Certificates & Implementation

The mining project will be implemented after getting all the Statutory Clearances, Permissions, No Objection Certificates, and Consents etc. which is required/necessary for this project under various Acts, Rules and Regulations as given in table below:

Table 2-5 Status of Statutory clearances

Sr.No.	Particulars	Status
A. Statutory Clearances		
1.	Letter of Intent (LOI) for grant of mining lease	Tehsildar, Bolangir
2.	Approved Mining Plan along with Progressive Mine Closure Plan	Joint Directorate of geology, Zonal Survey, Balangir, Odisha vide Memo no. 444 a s a copy to RQP Sri Sai Datta Das dated 16/04/2021
3.	Mining Lease Status	New Mine

2.5.1 Implementation

Implementation of the proposed mining project will be done in accordance with the existing Acts and Rules applicable on mining operations as well as in accordance with any Act/Rule/Guidelines issued by Central or State Government from time to time. Implementation of the mining project will be done as per Approved Mining Plan and

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Progressive Mine Closure Plan approved by Joint Directorate of geology, Zonal Survey, Balangir, Odisha including the following activities:

- Exploration
- Mine Development & Production

2.6 Technology & Description

2.6.1 Basic requirements for the Project

The project requirements such as water, Power, Man Power, and Machinery are described in the sections below:

2.6.1.1 Water Requirement

The total water requirement for the project estimated to be 7.0 KLD for mining, spraying, greenbelt development and domestic uses and will be sourced from the nearby available water source and drinking water will be sourced from tanker water.

Table 2-6 Breakup of required water

Sl. No.	Activity	Requirement of water (KLD)	Source
1.	Domestic Purpose	2	Water will be sourced from nearest available source.
2.	Plantation purpose	2.5	
3.	Fugitive dust suppression	2.5	
Total		7	

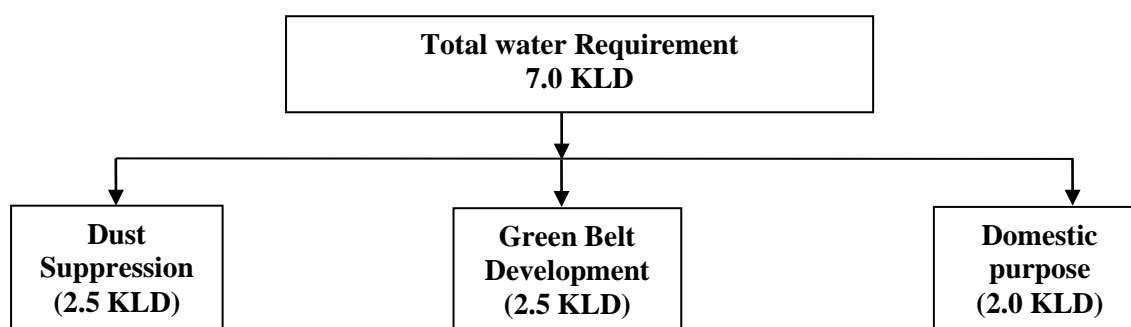


Figure 2-5 Water Balance Chart

2.6.1.2 Power Supply

No electrical power shall be required for mining operations.

2.6.1.3 Man power Requirement

Mine workers will be engaged from the nearby villages. Thus, there is no constraint regarding manpower.

Total man power of 55 people will be required for the proposed project.

Table 2-7 Man-power Details

Designation	Basupali Cluster
Supervisory Personnel/ Statutory Personnel	5
Skilled laborers (Operator and Helper)	10
Semi-skilled Laborer	15
Unskilled Laborer	25
Total	55

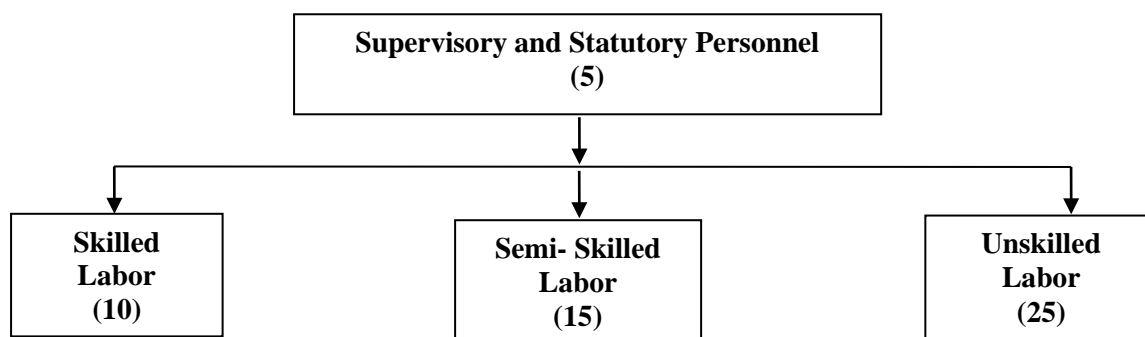


Figure 2-6 Manpower Requirement

Table 2-8 Responsibilities details

S. No.	Designation	Role/Responsibilities
1.	Supervisory Personnel and Statutory Personnel	<ul style="list-style-type: none"> ➤ Create awareness on potential environmental aspects & occupational hazards & risk. ➤ Ensure judicious use of all natural resources including energy, minerals, water etc. ➤ Ensure environment friendly operations with a view to keep the emissions/effluents within the prescribed norms. ➤ To Identify and comply with the applicable Statutory & Regulatory requirements. ➤ To identify, control and reduce the EHS hazards and risks. ➤ Training Need Assessment of Employees for effective implementation of the EMP ➤ Incident controller in case of any emergency. ➤ To plan for new equipment, minor modification etc. for betterment of Mine Working (i.e. Quality improvement,

		<p>reduction of environmental impact & OHS Risk etc.).</p> <ul style="list-style-type: none"> ➤ Overall environmental performance of the Mines. ➤ Ensure the EMP is implemented and is effective. Assist the HSE Engineer with regulatory authorities and/or community consultation (i.e. complaints). ➤ Ensure that all the applicable environmental parameters are regularly monitored and measured as per defined interval and reports submitted to the concerned regulatory authorities ➤ Implement appropriate management programs to achieve the management objectives and goals. ➤ Assist operational staff with respect to clarifying or improving existing practices / procedures or adding more stringent requirements / controls) ➤ Ensure that any change in any of the activities/ equipment/ processes are duly evaluated in order to ensure No increase in or introduction of new environmental risks or impacts. ➤ Undertake routine environment monitoring as per schedule ➤ Ensure that regular water sprinkling is done on the haul roads for effective control of fugitive emissions ➤ Supervising the overall progress of environmental management programs put in place and ensuring they adhere to all applicable regulations. ➤ Developing greenbelt in line with stipulated guidelines
2.	Skilled Workers	<ul style="list-style-type: none"> ➤ Daily inspection of mining machineries. ➤ Regular maintenance of equipment as per OEM recommendations. ➤ Keeping maintenance logs. ➤ Ensure that the mining machineries conform to the applicable environmental norms. ➤ Ensure that the emission/noise levels from the mining machineries do not exceed the permissible levels
3.	Unskilled Workers	<ul style="list-style-type: none"> ➤ Responsible for carrying out general housekeeping of the area ➤ Regular disposal of office and other municipal waste ➤ Plantation of saplings ➤ Watering and maintenance of saplings ➤ Gardening and horticultural activities ➤ Assist personnel in carrying monitoring equipment at site
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		<ul style="list-style-type: none"> ➤ Water spray on haul roads through tankers ➤ Mining operations ➤ Operating Machineries with care etc. 	
--	--	--	--

2.6.2 Level of Mechanization

Mining method to be adopted in the sanctioned lease area will be of semi-mechanized open cast manner. In which;

- ✓ The mining operation as proposed will be done by Semi- mechanized opencast method with the help of Hydraulic Excavator, dumpers, etc.
- ✓ The cover of Soil/over-burden will be removed manually or by semi mechanized manner and will be stacked separately as dumps at predefined area (Simultaneously will be used as per Solid waste management) to facilitate further mining development of benches is suggested having 6.0 m height and 45° face slopes.
- ✓ Quarrying activities will be done following all the security majors. Rules and regulations of DGMS and IBM will be observed during the Quarrying operations to avoid unwanted circumstances.
- ✓ Mined out material of commercial use will be transported by trucks / dumpers to Crushers. Haul road of suitable width is proposed for proper and smooth quarry operations.
- ✓ Quarrying / excavation will be done according to the proposed manner of manual and Semi-mechanized means, for mechanized way following machineries will be required to deploy on hire basis for loading and transport purpose.
- ✓ After crushing the stone, the aggregate is temporally stacked at the crushing unit. It is supply to the consumers by truck/tippers dumpers as per requirement.

All the requisite NOC and permission regarding depth shall be obtained by the lease holder from the competent authorities.

Table 2-9 Required Machineries

Sl. No	Machine	Capacity	No. of Units
1	Excavator with breaker	0.9 cu.m.	3no.
2	JCB		4no.
3	IR HP 450 compressor (450 CFM) & Jack Hammer	32 mm	3 no. each
4	Tipper	10 T	4no.

Some will be on hire basis

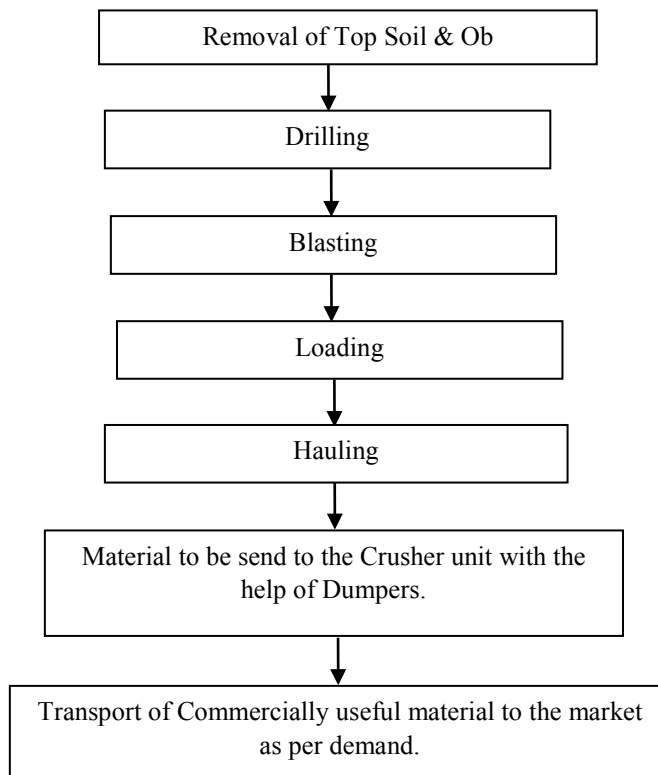
16.1.1 Process Description

16.1.1.1 Proposed Method of Mining

- Mining operations will be carried out by Semi-mechanized opencast mining method.

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- There topsoil will be used for greenbelt development and mine waste approx. 5% of the total production will be stacked separately, will be used as road building material. To facilitate further mining development of benches is suggested having 6 m height and 45⁰ face slope.
- The Jack hammer drills of 32 mm diameter rods will be deployed to drill blast holes and these will be charged with explosive cartridges.
- Wet drilling will be carried out & Blasting will be there on contract basis.
- Quarrying activities will be done following all the security majors. Rules and regulations of DGMS and IBM will be observed during the Quarrying operations to avoid unwanted circumstances.
- Muffled blasting will be carried to reduce the ground vibration, fly rock etc. due to blasting.
- Mined out material will be loaded into the dumpers with the help of JCB and will be send to the nearby established crusher outside the lease area and finally the material of commercial use as per the demand of the market will be transported by Covered trucks / dumpers to its final destination.



A. Top Soil Removal

The mine working will involve removal of topsoil. The top soil cover is soft in nature and will be removed by scraper then stacked separately in non-mineralized zone. This stacked top soil will be simultaneously used for plantation.

B. Drilling

Since the stone is hard and compact, drilling is required to break the rock. Drilling will be carried out.

C. Blasting

The exploitation of the hard rocks needs drilling and blasting to generate ROM. The drilling and blasting is attended by the register contractors i.e. on contractual basis as per the MOU signed by Lessee and blasting agency. The general blasting practice/drilling is given below:

Blasting Parameters

Depth of the hole drilled by 34-106 mm diameter Jack Hammer Drills	3 to 6 m depth
Sequence of firing	Double row blasting
Storage of explosives	No explosives will be stored onsite and will be utilized on daily basis and will be taken back by the certified contractor after its use at the end of day's work
Diameter of the hole	32 mm

**Considering 15 blasts per month*

D. Loading

Hydraulic excavator or JCB will be used for the purpose of loading of the material to the dumpers.

E. Transportation

The transportation of the material will be done with the help of dumpers. For transportation of materials suitable width of haul road will be provided and regular water sprinkling will be done to prevent the fugitive emission which can be caused due to the movement of the Vehicles.

F. Crushing of material

Nearby installed crushers unit will be preferred and the mined out material will transferred to the crusher units and from there as per demand of the market the material will be crushed and will be send to the market.

16.2 Reserve Estimation

The reserve is estimated based on local parameters. Predominantly, the reserve is estimated on the basis of field geological mapping and observations of existing quarries over the cluster-1 area. Hillock area boundary has been deciphered/ considered following the mineralized area boundary of the respective hillocks. In this cluster 5 separate quarries are present. Accordingly, separate reserves have been estimated to arrive at the total reserve for

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the 5 quarries under this cluster-1. Separate section lines for each patch has been taken for estimation of the geological as well as mineable reserves in different categories of the respective patch over the cluster-1 area.

However, the reserves of the cluster-1 have been estimated by considering the following parameters.

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

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

iii) Excavated quarries exist up to various depths over the cluster-1 area under reference. From the field study and observations of existing quarries. Existing quarries over the area are worked out up to various depths and the rock mass is exposed up to a lowest extent of 205mRL in Cluster-1 (Basupali).

Based on the above field observations, geological reserve is estimated considering the lowest extent of exposed rock mass in existing quarries as Proved i.e.205mRL. Another 5m of the rock mass is expected below the Proved limit up to 200mRL in Cluster-1 (Basupali), over the area, which has been considered as Probable limit. Possible Limit has been taken 5m below the probable limit that is 195mRL.

iv) In the Cluster-1 area, Thirteen cross sections i.e., A-A' to M-M' been drawn across the trend of the rock mass covering a hill patches, i.e., Cluster-1 (Basupali).

v) The length of influence for geological and mineable reserve calculation has been given in respective reserve calculation tables for each hillock/patch of the Cluster-1 area.

vi) 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 90%. Rest 10% has been considered as waste material over the area.

Based on the above parameters, the geological reserve (Probable & Possible) for building stone/road metal has been estimated as 1,607,944.5cum over the cluster-1 (Basupali), (Ref. Table-3). Hence, the total geological reserve over Cluster-1 mineralised area has been estimated as 1,607,944.5cum (Ref. Table-3).

The mineable reserve has been estimated in similar manner as geological reserve leaving 7.5m safety zone barrier all along the respective hillock area boundary of the cluster-1 and maintaining the safety distance of 200 meters from existing revenue habitations, and the mineral blocked under benches to maintain safe quarry slope. Thus, the mineable reserve for building stone/road metal worked out to be 7,83,593.1cum .Hence, the total mineable reserve over Cluster-1A mineralised area has been estimated as 7,83,593.1 cum.

Safety zone barrier of 7.5 m from the respective hillock area boundary and 200 meters from existing revenue habitations has been taken into account all along the mineralized area

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boundary of separate hillock patches of the cluster-1. So the mineable reserve has been estimated excluding the reserve coming within the safety zones 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 mineable 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-1 (Basupali hillocks) is given as follows.

Table 2-1 Geological Reserve of Black Stone : Cluster-1 (Basupali-1)

Category	Section Line	Sectional Area	Length of Influence	Volume (Cum)	Recoverable Volume of Rock mass @90% (Cum)	Vol. of waste mass@10 % (cum)
		(m ²)	(m)			
A	b	c	D	e= c x d	f = e x 90%	G=e x 10%
Proved	G-G'	910	50	45500	40950	4550
	H-H'	1124	50	56200	50580	5620
	I-I'	616	50	30800	27720	3080
	J-J'	622	50	31100	27990	3110
	K-K'	995	60	59700	53730	5970
Sub- Total				223300	200970	22330
Probable	G-G'	336	50	16800	15120	1680
	H-H'	339	50	16950	15255	1695
	I-I'	342	50	17100	15390	1710
	J-J'	346	50	17300	15570	1730
	K-K'	348	60	20880	18792	2088
Sub- Total				89030	80127	8903
Possible	G-G'	336	50	16800	15120	1680
	H-H'	339	50	16950	15255	1695



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	I-I'	342	50	17100	15390	1710
	J-J'	346	50	17300	15570	1730
	K-K'	348	60	20880	18792	2088
Sub- Total				89030	80127	8903
Total				401360	361224	40136

Table 2-2 Geological Reserve of Black Stone : Cluster-1 (Basupali-2)

Category	Section Line	Sectional Area	Length of Influence	Volume (Cum)	Recoverable Volume of Rock mass @ 90% (Cum)	Vol. of waste mass@ 10% (cum)
		(m ²)	(m)			
A	b	c	D	e= c x d	f = e x 90%	G=e x 10%
Proved	A-A'	1685	60	101100	90990	10110
Probable	A-A'	1801	60	108060	97254	10806
Possible	A-A'	1801	60	108060	97254	10806
Total				317220	285498	31722

Table 2-3 Geological Reserve of Black Stone : Cluster-1 (Basupali-3)

Category	Section Line	Sectional Area	Length of Influence	Volume (Cum)	Recoverable Volume of Rock mass @ 90% (Cum)	Vol. of waste mass@ 10% (cum)
		(m ²)	(m)			
A	b	c	D	e= c x d	f = e x 90%	G=e x 10%
Proved	B-B'	2116	55	116380	104742	11638
Probable	B-B'	1836	55	100980	90882	10098

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Possible	B-B'	1836	55	100980	90882	10098
Total				318340	286506	31834

Table 2-4 Geological Reserve of Black Stone : Cluster-1 (Basupali-4)

Category	Section Line	Sectional Area	Length of Influence	Volume (Cum)	Recoverable Volume of Rock mass @90% (Cum)	Vol. of waste mass@10% (cum)
		(m ²)	(m)			
A	b	c	D	e= c x d	f = e x 90%	G=e x 10%
Proved	C-C'	2337	55	128535	115681.5	12853.5
Probable	C-C'	1745	55	95975	86377.5	9597.5
Possible	C-C'	1745	55	95975	86377.5	9597.5
Total				320485	288436.5	32048.5

Table 2-5 Geological Reserve of Black Stone : Cluster-1 (Basupali-5)

Category	Section Line	Sectional Area	Length of Influence	Volume (Cum)	Recoverable Volume of Rock mass @90% (Cum)	Vol. of waste mass@10% (cum)
		(m ²)	(m)			
A	b	c	D	e= c x d	f = e x 90%	G=e x 10%
Proved	D-D'	880	95	83600	75240	8360
	E-E'	459	100	45900	41310	4590
	F-F'	590	75	44250	39825	4425
	L-L'	414	110	45540	40986	4554
	M-M'	240	125	30000	27000	3000
Sub- Total				249290	224361	24929
Probable	D-D'	233	95	22135	19921.5	2213.5
	E-E'	215	100	21500	19350	2150



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	F-F'	197	75	14775	13297.5	1477.5
	L-L'	172	110	18920	17028	1892
	M-M'	101	125	12625	11362.5	1262.5
Sub- Total				89955	80959.5	8995.5
Possible	D-D'	233	95	22135	19921.5	2213.5
	E-E'	215	100	21500	19350	2150
	F-F'	197	75	14775	13297.5	1477.5
	L-L'	172	110	18920	17028	1892
	M-M'	101	125	12625	11362.5	1262.5
Sub- Total				89955	80959.5	8995.5
Total				429200	386280	42920

Table 2-6 Mineable Reserve of black Stone : Cluster-1 (Basupali-1)

Category	Section Line	Sectional Area	Length of Influence	Volume (Cum)	Recoverable Volume of Rock mass @ 90% (Cum)	Vol. of waste mass@ 10% (cum)
		(m²)	(m)			
A	b	c	D	e= c x d	f = e x 90%	G=e x 10%
Proved	G-G’	546	42	22932	20638.8	2293.2
	H-H’	739	50	36950	33255	3695
	I-I’	427	50	21350	19215	2135
	J-J’	433	50	21650	19485	2165
	K-K’	624	52	32448	29203.2	3244.8
Sub- Total				135330	121797	13533
Probable	G-G’	113	42	4746	4271.4	474.6
	H-H’	108	50	5400	4860	540
	I-I’	165	50	8250	7425	825
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	J-J'	168	50	8400	7560	840
	K-K'	123	52	6396	5756.4	639.6
Sub- Total				33192	29872.8	3319.2
Total				168522	151669.8	16852.2

Table 2-7 Mineable Reserve of black Stone : Cluster-1 (Basupali-2)

Category	Section Line	Sectional Area	Length of Influence	Volume (Cum)	Recoverable Volume of Rock mass @ 90% (Cum)	Vol. of waste mass@ 10% (cum)
		(m ²)	(m)			
A	b	c	D	e= c x d	f = e x 90%	G=e x 10%
Proved	A-A'	1452	45	65340	58806	6534
Probable	A-A'	1588	45	71460	64314	7146
Total				136800	123120	13680

Table 2-8 Mineable Reserve of black Stone: Cluster-1 (Basupali-3)

Category	Section Line	Sectional Area	Length of Influence	Volume (Cum)	Recoverable Volume of Rock mass @ 90% (Cum)	Vol. of waste mass@ 10% (cum)
		(m ²)	(m)			
A	b	c	D	e= c x d	f = e x 90%	G=e x 10%
Proved	B-B'	1913	40	76520	68868	7652
Probable	B-B'	1641	40	65640	59076	6564
Total				142160	127944	14216

Table 2-9 Mineable Reserve of black Stone : Cluster-1 (Basupali-4)

Category	Section	Sectional Area	Length of	Volume	Recoverable Volume of	Vol. of waste
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	Line	l Area (m ²)	Influenc e (m)	(Cum)	Rock mass @90% (Cum)	mass@ 10% (cum)
A	b	c	D	e= c x d	f = e x 90%	G=e x 10%
Proved	C-C'	1848	40	73920	66528	7392
Probable	C-C'	1386	40	55440	49896	5544
Total				129360	116424	12936

Table 2-10 Mineable Reserve of black Stone : Cluster-1 (Basupali-5)

Category	Section Line	Sectional Area (m ²)	Length of Influence (m)	Volume (Cum)	Recoverable Volume of Rock mass @90% (Cum)	Vol. of waste mass@10% (cum)
A	b	c	D	e= c x d	f = e x 90%	G=e x 10%
Proved	D-D'	425	87	36975	33277.5	3697.5
	E-E'	425	100	42500	38250	4250
	F-F'	254	67	17018	15316	1701.8
	L-L'	148	102	15096	13586	1509.6
	M-M'	15	117	1755	1579.5	175.5
Sub- Total				113344	102009	11334.4
Probable	D-D'	44	87	3828	3445.2	382.8
Sub- Total				3828	3445.2	382.8
Total				117172	105454.2	11717.2

The summary of total geological (Proved, probable & possible) and mineable (probable) reserves of building stone/road metal over the Cluster-1(Basupali) area are as follows.

Table 2-11: SUMMARY OF GEOLOGICAL & MINEABLE RESERVES OF CLUSTER-1

Type of Reserve	Category of Reserve	Cluster-1 (Basupali-1) in cum	Cluster-1 (Basupali-2) in cum	Cluster-1 (Basupali-3) in cum	Cluster-1 (Basupali-4) in cum	Cluster-1 (Basupali-5) in cum	Total Reserve cum
Geological	Proved	200970	90990	104742	115681.5	224361	736744.5
	Probable	80127	97254	90802	86377.5	80959.5	435520
	Possible	361224	97254	90802	86377.5	80959.5	716617
Total		642321	285498	286346	288436.5	386280	1888882
Mineable	Proved	121797	58806	68868	66528	102009	418008
	Probable	29872.8	64314	59076	49896	3445.2	206604
Total		151669.8	123120	127944	116424	105454.2	624612

16.3 Mining Details

16.3.1 Mining Method

16.3.2 Blasting and benching Details

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 6 meter. Assuming 26348m³(max) productions per annum of Cluster-1, the monthly production target will be around 2635 m³. To produce 2635of rock mass, tentatively 263kg/month of explosive will be required assuming power factor 2m³/ kg.

Conventional method of mining will be adopted in the Cluster-1 area. In the present plan period it is proposed to shape the quarry with bench height of 3m to 3m (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 for easy movement of workers and vehicles.

16.3.3 Face Lay Out

As discussed, no particular pit layout is feasible to be proposed over the Cluster-1 area as it comprises of small individual quarries. The development for the ensuring plan period would be proposed in the respective approved mining plan of the particular quarry in the cluster-1 area. However, the quarries in cluster 1 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.

16.4 Conceptual Mine Development Plan

16.4.1 Annual Production

Total available cluster mineable reserve over the area has been estimated considering the probable zone of occurrence of river sand bed within the proposed area which will be extracted year wise during the plan period. Based on the total extractable cluster mineable

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reserve, the MGQ has been fixed by the competent authority and this much quantity of sand has been planned to be extracted each year from the source as mentioned below:

Table 2-12 Annual Production of Stone

Year	Cluster-1 (Basupali-1) in cum	Cluster-1 (Basupali-2) in cum	Cluster-1 (Basupali-3) in cum	Cluster-1 (Basupali-4) in cum	Cluster-1 (Basupali-5) in cum	Total (cum)
First	4050	5000	4032	5000	4349	22431
Second	4095	5000	4000	5000	4377	22472
Third	4050	5000	4063	5000	4349	22462
Fourth	4005	5000	4000	5000	4320	22325
Fifth	4095	5000	4032	5000	4349	22476
Sub- Total	20295	25000	20127	25000	21844	112166

16.4.2 Over Burden and Waste generation

The Cluster-1 area is partly covered with soil mixed rock boulders/pebbles followed by Granite Gneiss/Charnockite 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-1. Moreover, as envisaged, waste to the tune of about 10% 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 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.

16.5 Mine Closure Plan

16.5.1 Mined Out Land

During the plan period of five (5) years the mined out land will be 1.0901 Ha in Cluster-1 area. Since, the individual quarries of cluster-1 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

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with the peripheral safety zone of 7.5m will be brought under plantation. The individual lessees of the cluster-1 area would obtain permission of DGMS to quarry out the safety zone located in between adjoining leaseholds.

Land use at present, at the end of plan period

Description	At present (Ha)	At the end of plan period of 5 yrs (Ha)
Quarry	4.175	1.0901
Road		Nil
Waste Dump Yard		Nil
Soil stack yard		Nil
Saleable stone stack-yard		Nil
Safety zone	Nil	0.1113
Plantation	Nil	0.5582
Rest shelter	0.01	Nil
Total	4.185	1.7596

16.5.2 Post Mining Reclamation

(a) Describe the process/activities to be Undertaken for reclamation and Rehabilitation in respect of the following:

As discussed, hillock wise boundaries are delineated following the mineralized area boundaries of the respective hillock/patch of Cluster-1 area. Safety zone of 7.5m all along the peripheral hillock/ patch boundary has been proposed/ considered for the respective hillock/patch of the Cluster-1 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.

(i) Waste/ Reject dump:

As the cluster-1 area is for building stone, suitability of the rocks not dependent on chemical parameters. The cluster-1 area is partly covered with soil mix rock boulders/pebbles followed by granite Gneiss/Charnockite deposit. The soil to be generated will be stacked in 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-1. Moreover, as envisaged, waste to the tune of about 10% 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

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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.

(ii) Topsoil stack and its utilization:

Whatever topsoil generated from the lease area will be utilized in maintenance of road. Hence there is no proposal for Top soil stack & its utilization during the plan period.

b) Financial assurance: (To be furnished as a bank guarantee).

The tentative area to be put to use at the end of plan as well as conceptual period will be 1.0901 Ha over the Cluster-1. However, as this plan is for the cluster, no financial assurance is required to be deposited by the project proponent. The Financial Assurance and fee towards Environment Management Fund as calculated in the approved mining plan for individual small quarries of the cluster would be deposited by respective auction holders/lessees.

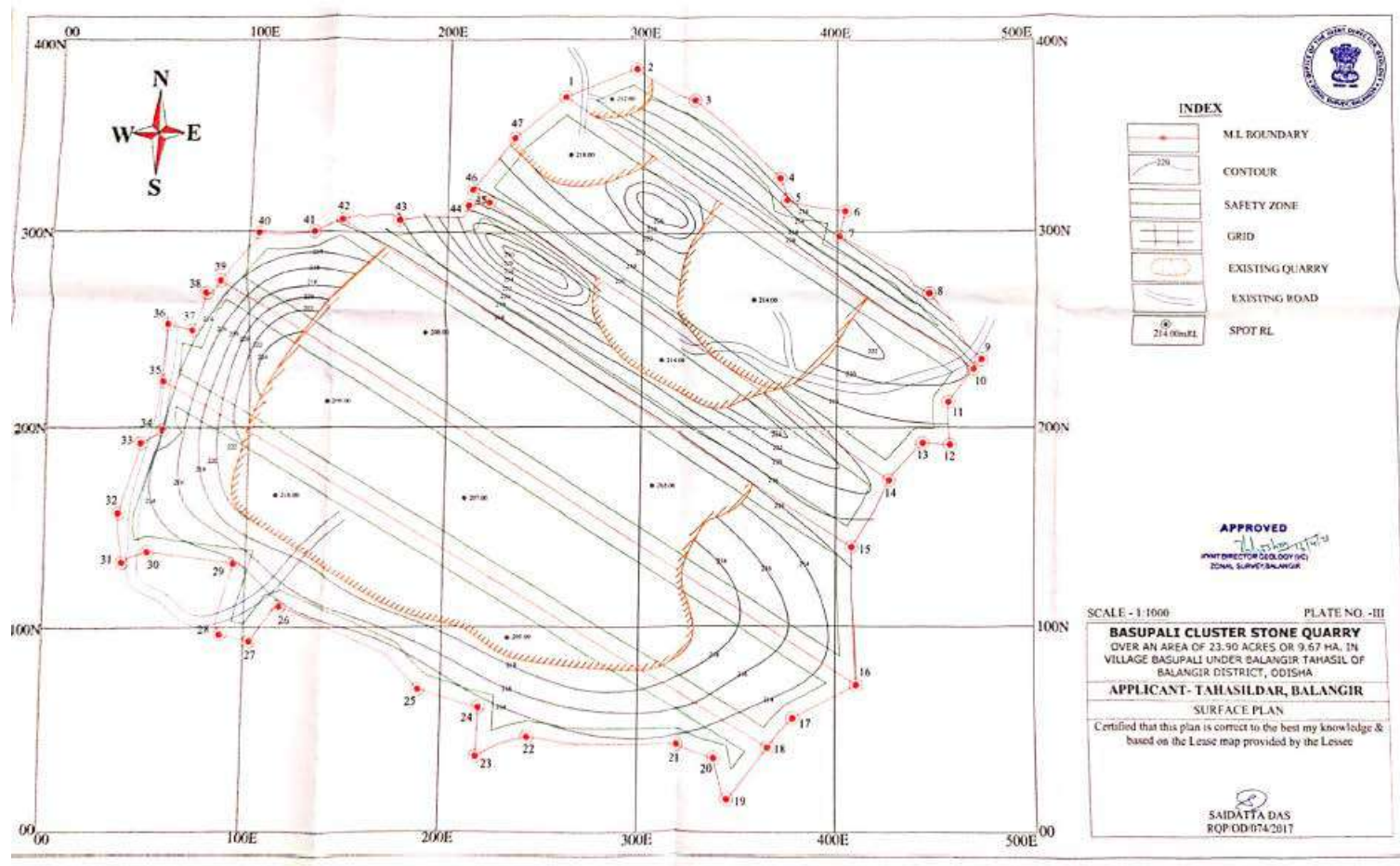


Figure 16-1 Surface Plan

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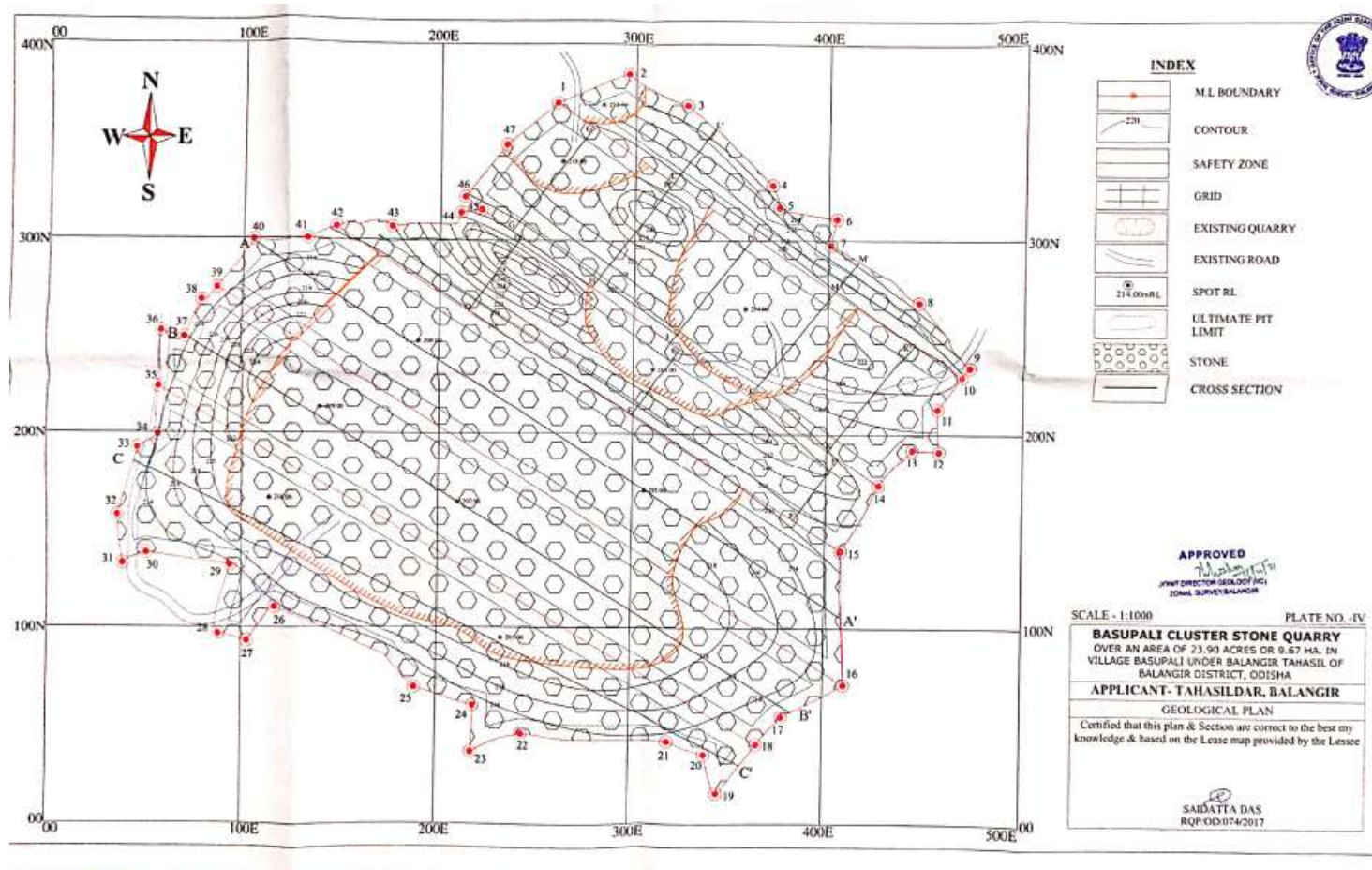


Figure 16-2 Geological plan

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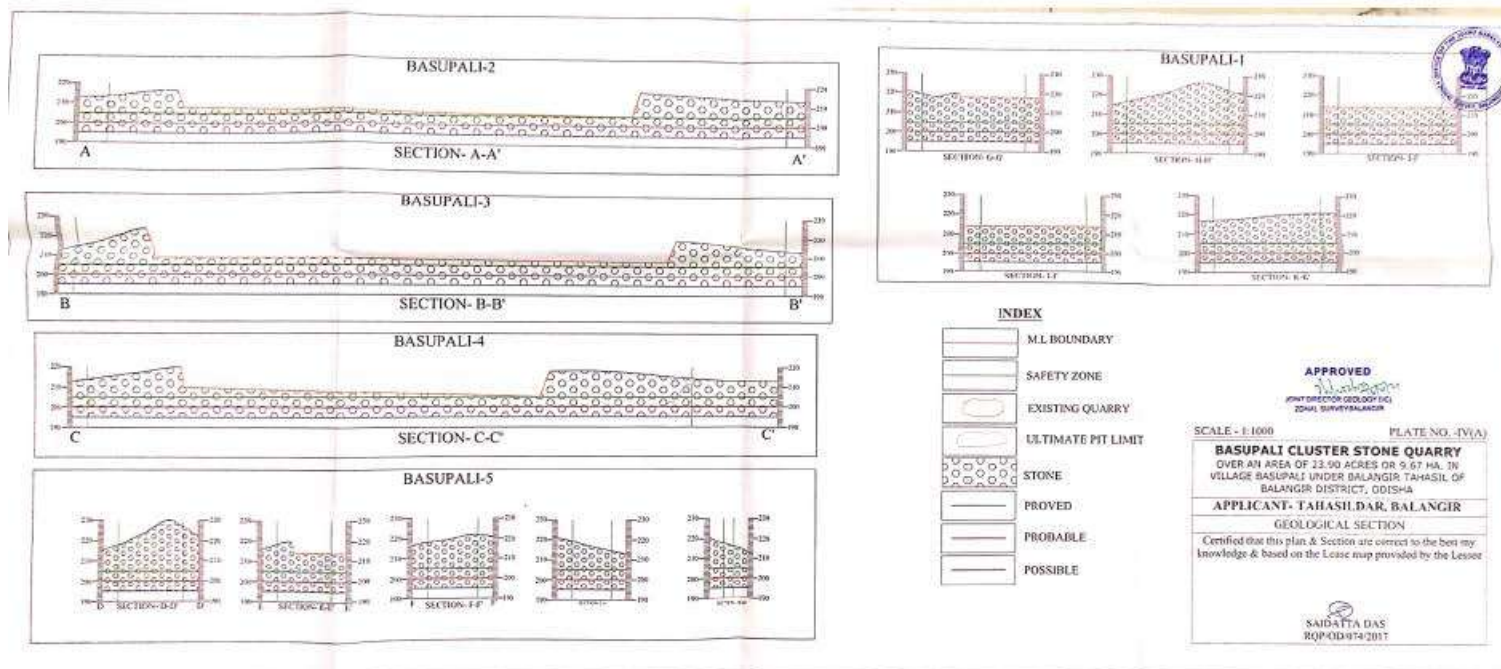


Figure 16-3 Geological Section Plan

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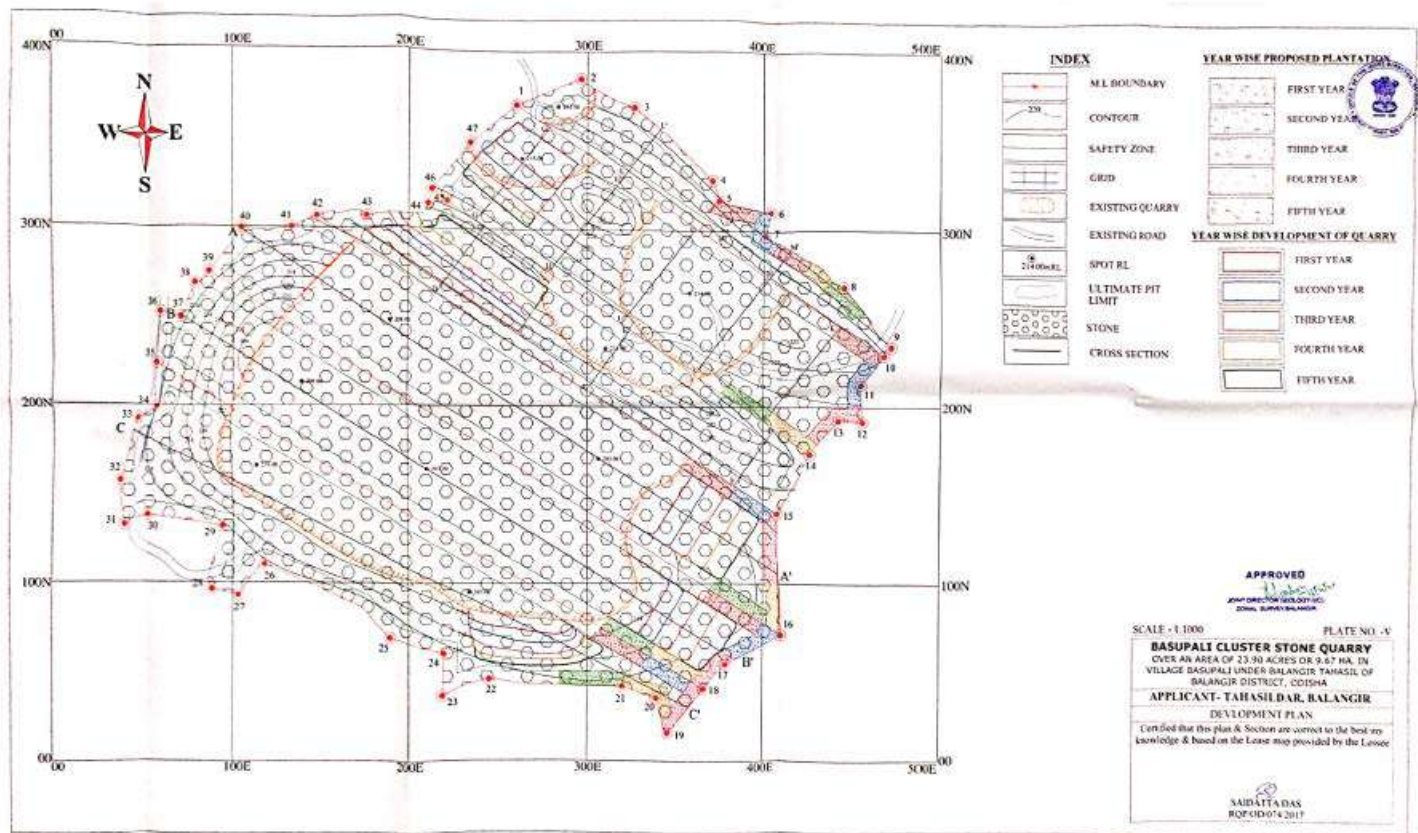


Figure 16-4 Development Plan

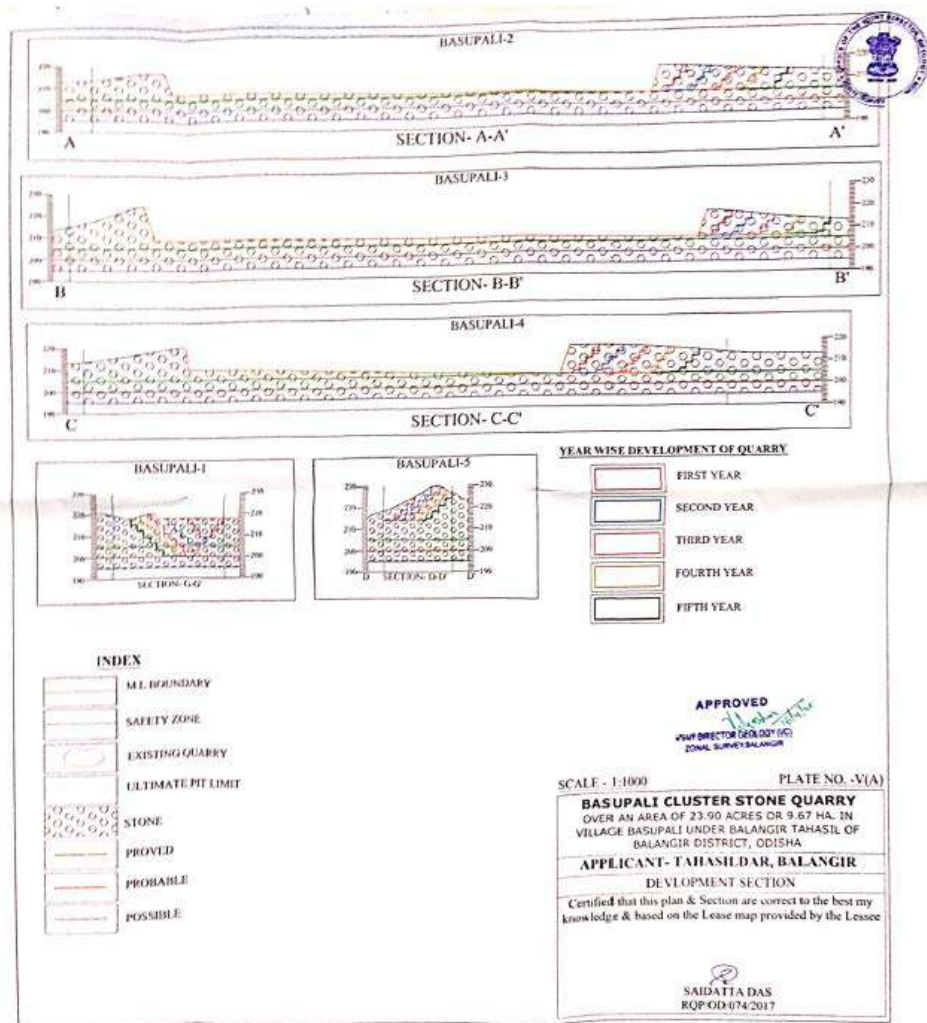


Figure 16-5 Development Section Plan

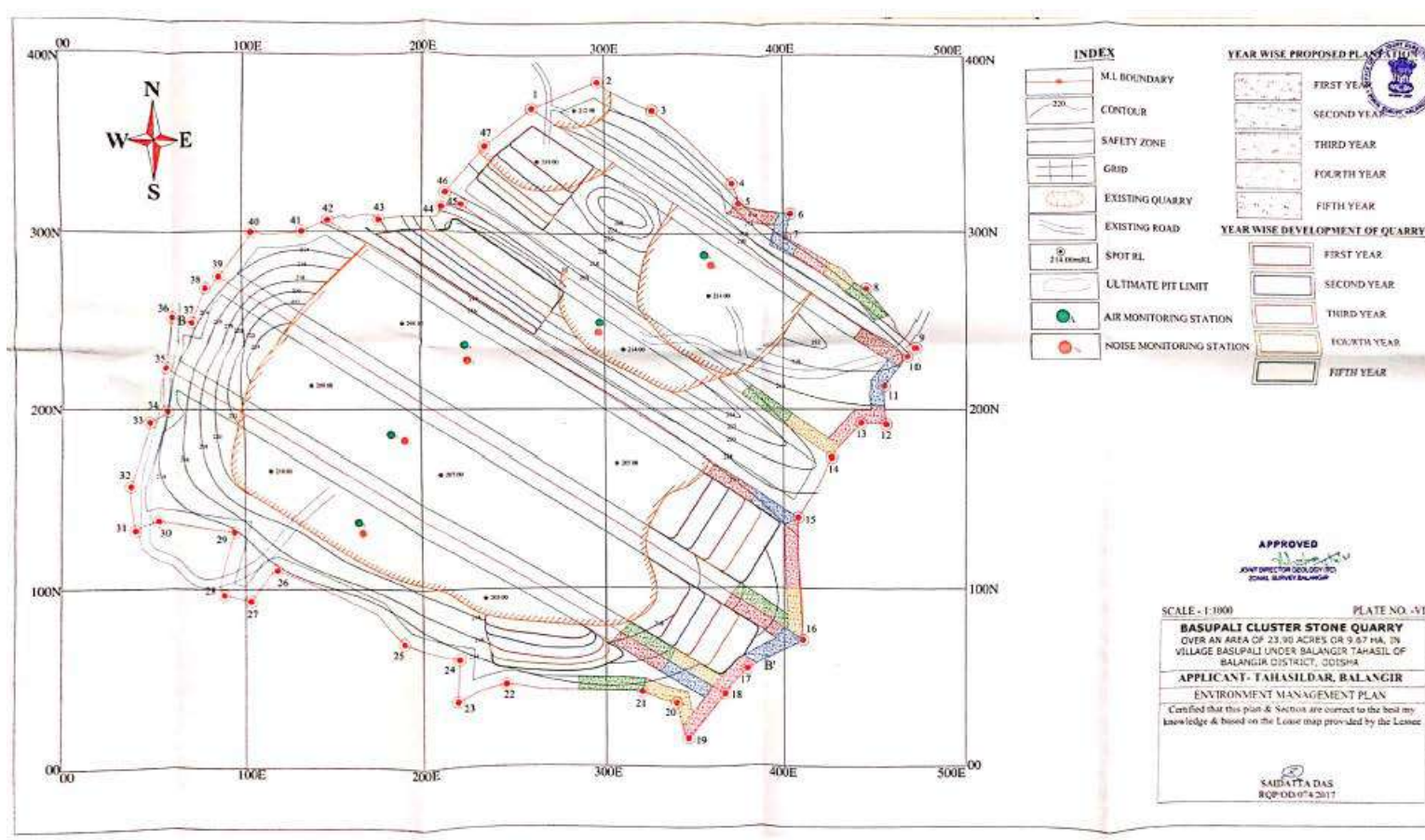


Figure 16-6 Environment Management Plan

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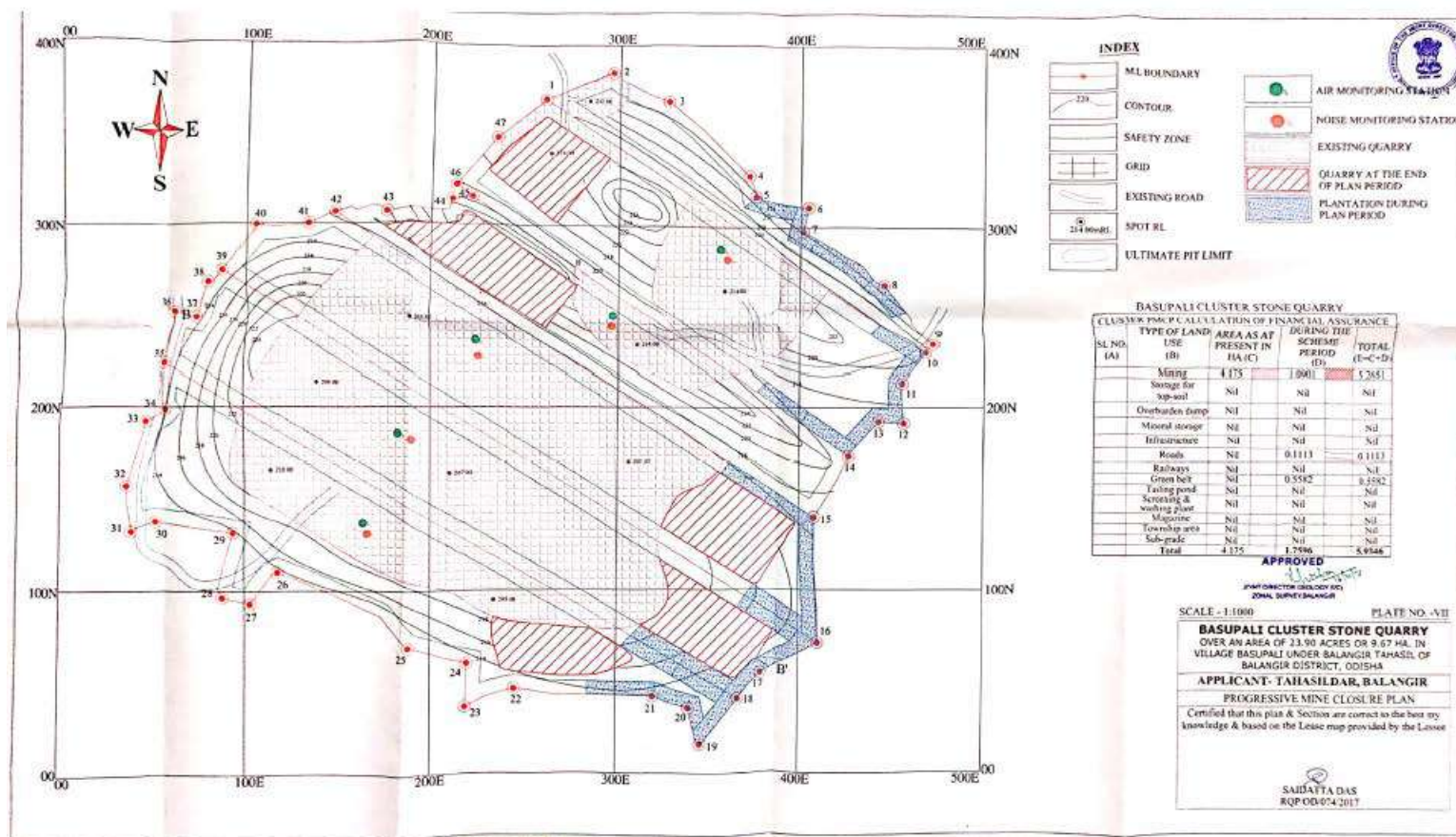


Figure 16-7 Progressive Mine Closure Plan

16.6 Description of Mitigation Measures

The mitigation measures given in this section are for management of the emissions (particulate or gaseous), waste water & surface run-off and Noise pollution generated from the mining operations to meet the environmental standards and environmental operating conditions.

16.6.1 Air Quality Management

Loading & Transportation –

- All the mine roads from loading to hauling road will be maintained properly and watered regularly during the shift operation to prevent generation of dust due to the movement of dumper etc.
- Development of green belt/plantation along roads and other places will be carried out to control the air pollution.
- Proper maintenance of the HEMMs & transportation vehicles will be done.
- Vehicular emissions will be kept under norms.
- Personal Protective Equipment like dust masks will be provided to employees.
- Periodic air quality monitoring will be carried out.

16.6.2 Noise Quality Management

Loading and Transportation –

- Adequate silencers in HEMM will be provided to reduce generation of noise.
- Proper maintenance, oiling and greasing of machines at regular intervals will be done to reduce generation of noise.
- The workers employed at HEMM will be provided with protective equipment, earmuffs and earplugs as a protective measure from the high noise level generated at the mine site and wherever required.
- Development of green belt & plantation around lease boundary, roads and other places will be carried out.
- Periodical monitoring of noise will be carried out regularly.

16.6.3 Waste Water Management –

Waste Water-

- Domestic wastewater so generated will be disposed-off in soak pit via septic tank.

16.6.4 Greenbelt/ Plantation

- Greenbelt will be developed along haul road.
- Plantation will be done along haul road and in villages nearby. Native Species will be preferred for the plantation.

16.1 Assessment of New and Tested Technology for the Risk of Technological Failure

From the nature and extent of the deposit, the reserves and the quality have been proved with adequate degree of reliability. Considering the type of mineralization, manual method is the most feasible method for mining in the proposed mining lease area. It is also a matter of fact that the mining machineries are rapidly changing and therefore the Project Proponent would act fast to adopt more advanced equipment and automation for safe and environment friendly mining technology in the years to come.



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3.1 Study Area & Period

The baseline environmental qualities of various environmental components like air, noise, water, land, flora and fauna and socio-economic form an important and integral part of an EIA study. The baseline data forms the basis for predicting/assessing the environmental impacts of the proposed project. The baseline environmental quality is assessed through field surveys within the impact zone as well as the secondary data for various components of the environment, viz., air, noise, water, land and socio-economic.

Basupali Cluster Stone quarry is a newly proposed Mine located at village: Basupali, Tehsil: Balangir, District: Balangir (Odisha). The proposed project is at the intersection of N20° 37' 35.0", latitude and E83° 26' 56.1" longitude.

For The Baseline survey, data collected during the sampling period of three months during pre-monsoon season from 1st March 2021 to 31st May 2021, various environmental components were monitored and samples were analysed.

The baseline quality of various components of the environment viz., air, noise, water, land, biology, meteorological and socio- economic was assessed within the impact zone of about 10 km around the proposed site. Secondary data has also been incorporated from authentic sources viz., Government/Non-Governmental Agencies, Universities, Indian Meteorological Department (IMD), Ground Water Board etc. Various environmental components were monitored and samples were analysed.

3.2 Methodology

The methodology for conducting the baseline environmental survey has been obtained from the guidelines provided in the EIA Guidance Manual issued by the Ministry of Environment Forest and Climate Change (MoEF&CC). Environmental attributes and frequency of monitoring is given below in table:

Table 3-1 Location Details, Period and Methodology of Baseline Data Generation

Sr. No.	Attribute	Parameters	No. of Sampling Locations	Frequency of Monitoring / Data Collection
1	Meteorology	Wind speed & direction, temperature, relative humidity, rainfall.	Project Site	Data collected from IMD
2	Ambient air quality	PM10, PM2.5, SO ₂ , NO _x , CO, NH ₃ , HC, Pb, Ozone, Benzene, Benzopyrene, Arsenic, Nickel.	08	24 hourly samples twice a week. CO and O ₃ 8 hourly samples twice a week.
3	Noise levels	Noise levels in dB(A) Leq	08	At least one day in a season for day time and night time on a working & nonworking day.



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Sr. No.	Attribute	Parameters	No. of Sampling Locations	Frequency of Monitoring / Data Collection
4	Surface water quality	Physical, chemical and bacteriological parameters including pH, temperature, turbidity, magnesium hardness, total alkalinity, chloride, sulphates, fluoride, salinity, DO, BOD, COD, Heavy metals, Total coliforms, fecal coliforms,	06	Once in a Monitoring Period.
5	Groundwater quality	Physical, chemical and bacteriological parameters including pH, temperature, turbidity, magnesium hardness, total alkalinity, chloride, sulphates, fluoride, salinity, DO, Heavy metals, Total coliforms, Fecal coliforms,	07	Once in a Monitoring Period.
6	Biological Environment	Existing flora and fauna.	Study Area	Through field visits and substantiated through secondary data sources.
7	Soil characteristics	Physical, chemical and biological parameters to assess agricultural and afforestation potential including pH, Permeability, Electrical conductivity, Nitrites, Phosphates, TPH, Fluorides, Heavy metals, SAR, Total hydrocarbons and cat-ion exchange capacity.	08	Once in a Monitoring Period.
8	Land use / Land Cover	Land use for different land use Classifications.	Study Area	Land use / Land Cover Analysis using satellite imaging and GIS Technique
9	Socio-economic Environment	Socio-economic characteristics, labour force characteristics, population statistics existing amenities in the study area and quality of life.	Study Area	Based on field survey and data collected from Census of India

3.3 Geology

3.3.1 Introduction

Bolangir is one of the economically backward district of western Orissa with a geographical area of 6569 Sq.Km and is an integral part of Western Orissa Development Council constituted by Govt. of Orissa very often reels under severe drought condition. About 89 percent of the population of the district live in rural areas and agriculture is the main stay of the people. The agriculture is mostly rainfed and due to lack of adequate irrigation facilities and recurring severe drought conditions in the district, the agricultural production is very often curtailed. In the year 1996 the district witnessed an unprecedented drought situation. Bolangir district lies between North latitudes 21°4' and 20°9' and East longitudes 82°41' and 83°32', falling in Survey of India toposheet nos. 64O, 64P & 64L. It is bounded on the North by Bargarh district, in the East by Suvarnapur district and in the South and West by Kalahandi and Nawapara district respectively. The district is well connected by rail and roads. Two National Highways are passing through the district. The Titilagarh railway station is a junction connecting Raipur – Vizianagaram and Titilagarh – Jharsuguda broad gauge railway tracts. All the block headquarters are connected by metalled roads. The district comprises three subdivisions namely Bolangir, Patnagarh and Titilagarh and 14 community Development blocks with the district headquarters at Bolangir (Plate-I). According to 2011 census data, the total population of the district is 1648574 constituting nearly 4 percent of the total population of Orissa. The rural and urban populations are 1182871 and 154323 respectively. The rural population constitutes 88.46 % of the total population. The density of population is 251 against the state figure of 236 persons per sq. km.

The rivers Tel and its tributaries like Suktel, Lant, Indra etc. constitute the main drainage system in the district. The river Tel and its tributaries flow from West to East. The river Ong which is a tributary of Mahanadi is flowing in the northern part of the district following an easterly course. The rivers are generally perennial in nature with a very nominal flow during summer months. Drainage pattern is dendritic. Studies on satellite imageries and hydrogeological surveys have revealed that the drainage pattern in the district is controlled by the fracture system which is developed due to tectonic activity in the area.

The district has limited irrigation facilities as per available data. The net irrigated area from different sources is 27705 ha. The Ong dam is a Medium Irrigation Project, which caters to flow irrigation. In addition to Ong medium irrigation project the other ongoing major irrigation projects in the district are lower Lant (CCA 21444 Ha) , upper Lant (4700 Ha) upper Suktel (1350 Ha) and lower Tel (46598 Ha). Besides that other two ongoing Medium Irrigation Projects are Titilagarh and Harihar with designed ayacut of 2000 and 9950ha respectively. Block-wise and source-wise irrigation details of the district is presented in the following table. The sourcewise Irrigation potential created in the district from various sources has been tabulated in Table-1.1. The irrigation potential created from ground water resources is 23983 and 6549 Ha in Kharif and Rabi respectively.

3.4 Geomorphology

The district can be divided into two broad physiographic units:

- (i) undulating plains (Pediments) dotted with residual hills and
- (ii) Scattered hills and areas with high relief.

The undulating plains occupy the central and eastern parts of the district the average elevation being 200m to 300m above mean sea level with a general slope towards east. The areas with high relief and high hills are situated in the north western, western and south eastern parts of the district (Plate-V). The hill ranges belong to the Eastern Ghats having a general trend of Northeast – Southwest. The highest peak is Gandhamardan situated 983 m above mean sea level. The distribution of different soil types in the district depends much on its physiographic and lithologic variations. Based on the physical and chemical characteristics, mode of origin and occurrence, soils of the district may be classified into three groups namely Alfisols, Ultisols and Vertisols. Alfisols : It includes red sandy soils and red loamy soils. The red loamy and sandy soils are occurring in major parts of the district. The characteristic features of red soils are (1) light texture, porous and friable structure, (2) absence of lime Kankar and free carbonates and (3) soluble salts in a small quantity usually not exceeding 0.05%. These are usually deficient in nitrogen, phosphate, organic matter and lime. These soils are suitable for cultivation of paddy and other crops. Ultisols : These are lateritic soils occurring in northwestern part of the district in Khaprakhol block in a limited area. These are characterized by compact to vesicular mass in the subsoil horizons composed essentially of a mixture of the hydrated oxides of aluminum and iron. Due to peculiar granular nature, these soils can be cultivated immediately after heavy rains. Vertisols : These are medium black soils found in the blocks of Loisinga, Bolangir and Puintala especially in the areas mostly underlain by anorthosite. The soils are highly argillaceous and contain high amount of iron, calcium and magnesium. These are poor in organic matter, nitrogen and phosphorous but rich in potash and lime. The pH varies from neutral to alkaline and texture varies from loam to clayey loam. These are quite fertile soils and the crops grown are generally cotton, wheat, tobacco and chilly.

3.5 Drainage Pattern of the Site

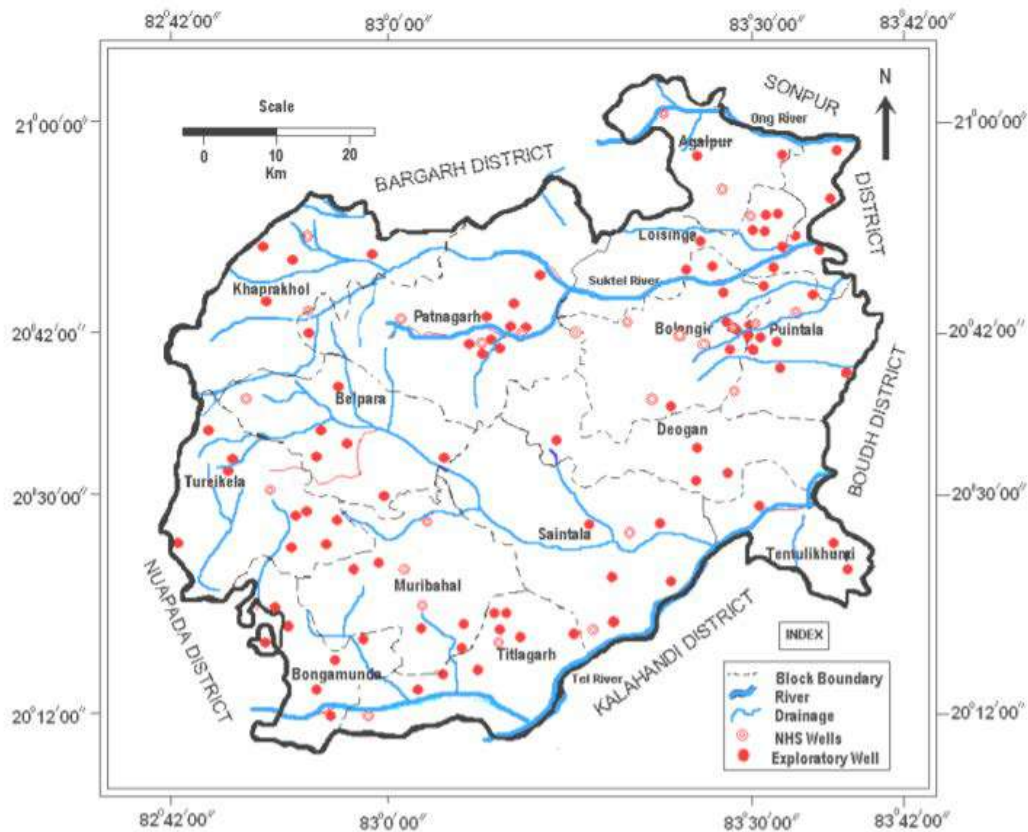


Figure 3-1 Drainage Pattern of the Study Area

No stream is passing through the lease. The mine drainage will be controlled by construction of garland drains along the lease periphery and settling tanks. OB dump location has been selected up gradient side of the lease so that drainage would not pass through the dumping area. There is small seasonal nallah passing near the mining area. Proper mitigation measures have been mentioned in Chapter 4.

3.6 Land use

Proposed Land use pattern of Mine Lease area: The proposed mine area falls under Survey of India Topo-sheet No 64P/6

Table 3-2 Land Use Pattern in the Lease Area

Description	At present (Ha)	At the end of plan period of 5 yrs (Ha)

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Quarry	4.175	1.0901
Road	Nil	
Waste Dump Yard	Nil	
Soil stack yard	Nil	
Saleable stone stack-yard	Nil	
Safety zone	Nil	0.1113
Plantation	Nil	0.5582
Rest shelter	0.01	Nil
Total	4.185	1.7596

3.7 Hydrogeology Study

The hydrogeological framework of the district is mainly controlled by the geological set up, rainfall distribution and the degree of secondary and primary porosities in the geological formations for storage and movement of ground water. Since major parts of the district are underlain by hard rocks of diverse lithological composition and structure, the water bearing properties of the formations also vary to a great extent. The area has undergone several phases of intense tectonic deformations which has been responsible for the development of deep seated intersecting fracture system. Hydrogeological surveys in the district reveals the lithological characteristics and the role of tectonic deformation on the occurrence and distribution of ground water reservoirs and their water bearing and water yielding properties. Lineaments formed due to tensile deformation were picked up from remote sensing studies. The structural elements mainly control the occurrence and movement of groundwater in the typical fractured crystalline basement terrain. The major hydrogeologic units in the district can be subdivided into three broad groups. (i) Areas underlain by fractured, fissured and consolidated basement rock formations. (ii) Areas underlain by the semi consolidated (Gondwana) formation. (iii) Areas underlain by recent unconsolidated alluvial formations. Water bearing properties of the Consolidated formations : The crystalline rocks like Khondalites, granite gneisses, charnockites, quartzites and anorthosites, which are devoid of primary porosity, occupy about 95% of the area of the district. The weathered residuum and jointed & fractured portion of these consolidated rocks constitute principal water bearing horizons. The thickness of the weathered zone is generally more in the topographic lows and undulating plains than in the high land areas. Ground water occurs under phreatic condition in the weathered zone and in semi-confined to confined condition in deeper fractured zones. The water yielding capacity of fractured rocks largely depends on the extent of fracturing openness and size of fracture and nature of their inter connections. Usually two to four water bearing fractures occur down to a depth of 100m below ground level. Potential fracture zone is encountered even at depth of 178 m at Kanut (BlockBelpara). Granites and Granite Gneisses Including Bonai granite : These are the most predominant rock types occurring in the undulating plains and topographic lows. Depending upon the topographic set up, the depth of weathering ranges from 5.5m to 17.50m and occasionally extends up to 35.5m depth. The weathered residuum and fracture zones form

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principal aquifers. In deeper fracture zones ground water occurs under confined to semi-confined conditions. In general the deep bore wells in these rocks can sustain yield of 2 to 25 LPS depending upon topographic setting, proximity to the major lineaments, thickness of weathered residuum and number of saturated and interconnected fractures encountered. The granites and granite gneiss can be developed through open wells and borewells. High yielding wells are recorded in the western parts of the district where the discharge ranges from 10 to 25 LPS. Specific capacity of the dug wells tapping the weathered zone ranges from 6 to 286 LPM/M drawdown. Khondalites : These rocks generally form steep linear ridges hence don't form potential aquifers. Well foliated nature of these rocks allows deep weathering. In the pediment areas, the thickness of weathering is varying from 5 to 32m. Ground water occurs under water table condition in the weathered zone and circulates through deeper fractures. The yield of bore wells range from 1 to 5 LPS. The specific capacity of the dug wells ranges from 2.3 to 13.3 LPM/m draw down. Charnockite : These formations are of very much restricted occurrences in the district. Due to paucity of joints and fractures the thickness of weathering in these formations is limited up to 10m. Due to the compact nature and less weathering, ground water prospects in charnockites are not good. Gabbro – anorthosites : The rheologic property of these rocks resembles with charnockite, Barring few locations dismal weathering and lack of fracturing renders these formation as a bad water yielder. The Sp. Capacity of dug wells in anorthosite vary from 16 to 102 LPM/M drawdown. Quartzites : This unit also less fractured and weathered hence do not form good aquifers. However fractured quartzites along lineaments yield good amount of water. Pegmatite and quartz vein : These are coarse grained intrusives and form good aquifers when fractured. Semiconsolidated Formation : These are represented by rocks of lower Gondwana formations. These formations have faulted contact with the Precambrians. The friable and loosely connected sandstones form the aquifers. Ground water occurs under water table condition in the weathered zone and under semiconfined to confined condition in deeper fractured and friable sand stone beds.

Depth to Water Level (Pre-monsoon and Post-monsoon, 2011)

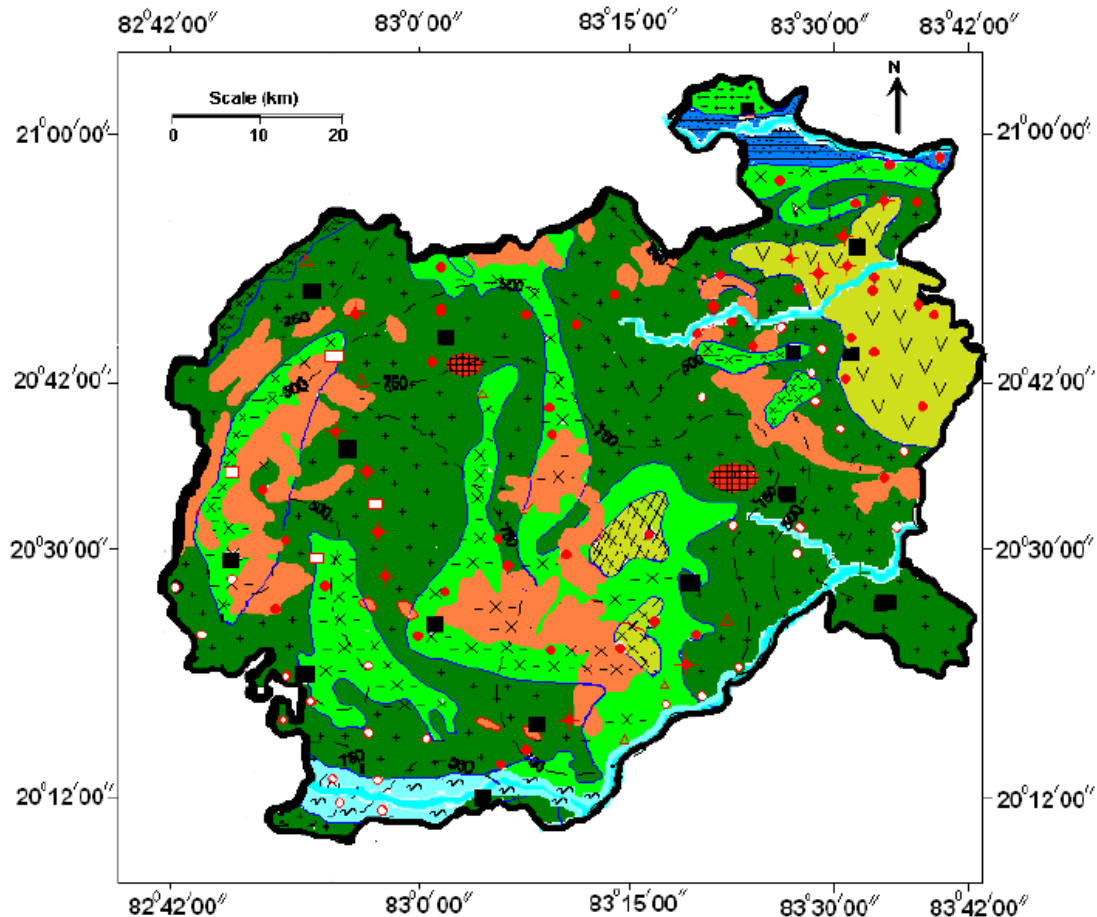
The depth to water level is measured from the National Hydrograph Stations situated in different blocks of the Bolangir District. The Pre monsoon, 2011 water level data varies from 1.33 mbgl to 8.85 mbgl. The shallow water level was measured from Harisankar and the deepest water level was measured at Muribahahl. The depth to water level map of pre -monsoon, 2011 is displayed in Plate II. The depth to water level data of Post-monsoon, 2011 represents 0.78 mbgl to 6.85 mbgl. The Dumerbahal shows deepest water level and Suka shows shallowest one. Plate III represents depth to water level map of post –monsoon,2011.

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HYDROGEOLOGICAL MAP OF BOLANGIR DISTRICT, ORISSA



LEGEND
















Age Group	Lithology	Index	Hydrogeological Conditions	
Recent to Sub Recent	Alluvium		Flood plain, Unconfined aquifer, Yield 5 lps	
Lower Gondwana	Sandstone, Shale Conglomerate		Moderately Thick, Discontinuous Confined to semi confined aquifer, Yield less than 5 lps	
Pre-cambrian	Anorthosite/ Gabbro		Ground water is restricted to weathered residuum and fracture zones, low to moderate yield within 3 lps	
	Charnockite			
	Bonai Granite / Quartzite		Ground water is restricted to weathered and fractured horizon. Yield upto 10 lps	
	Khondalite & Calc silicate		Most pervasive crystalline aquifer ground water occurs in weathered and fractured horizon. Yield upto 25 lps.	
	Granite & Granite Gneiss			
Discharge range of Bore holes				Hilly Areas without Productive Aquifer except in pockets. Yield less than 1 lps
	<1 lps		Fluoride Contaminated Area	
	1-3 lps			
	3-5 lps		EC Contour	
	5-10 lps			
	>10 lps			

Figure 3-2 Hydrogeology of the district Bolangir

3.8 Seismicity of the Study Area

Although much of Odisha is in zone II, Mahanadi graben is in zone III and encompasses cities Such as Talchir, Angul, Bhubaneswar, Cuttack, Sambalpur, Dhenkanal, and the Balasore district. The Bonaigarh Talchir area was struck by two moderate events (Mw 5 and 4.8) during May and June in 1995, respectively. Two more events also happened of 5.2 Mw in 1958 and 1962 within Rengali province. In January 1986, events of Mw 4.4, 4.1, and 4.3 were reported due to the active north Odisha boundary fault (NOBF), respectively. The Geological Survey of India established four stations for micro earthquake measurement in the Bonaigarh–Talchir area.

District Coming Under Moderate Risk Zones (Zone-III)

Sundargarh, Jharsuguda, Bargarh, Sambalpur, Deogarh, Anugul, Dhenkanal, Jajpur, Cuttack, Khurda, Puri, Jagatsinghpur, Kendrapada, Bhadrak, Mayurbhanj, Balasore.

Districts Coming Under Low damage Risk Zones (Zone-II)

Malkangiri, Korapur, Rayagada, Gajapati, Ganjam, Kandhamala, Nawrangpur, Kalahandi, Nuapada, Bolangir, Sonapur, Boud, Nayagarh, Keonjhar,

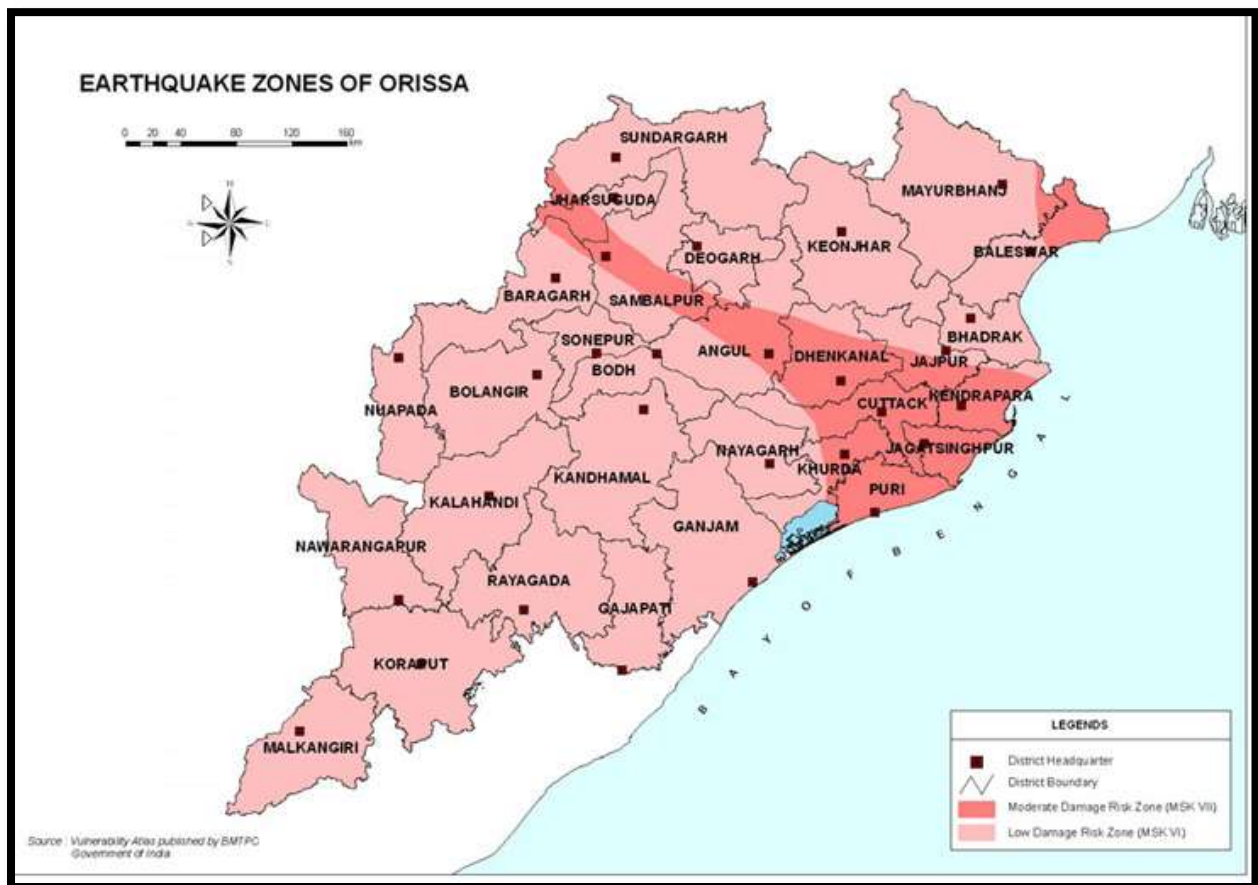


Figure 3-3 Earthquake Vulnerability

3.9 Meteorology

Micro meteorological data within the study area, during air quality survey period. Meteorological data recorded during the monitoring period is very useful for proper interpretation of the baseline information as well as for the input to the predictive air pollutants dispersion models. Historical data on meteorological parameters will also play an important role in identifying the general meteorological status of the region. Site specific data can be compared with the historical data in order to identify changes, which may have taken place due to the rapid industrialization in the area.

The micro-meteorological parameters regulate the transport and diffusion of pollutants released into the atmosphere. The principle variables which affect the micrometeorology are horizontal connective transport (average wind speed and direction), vertical connective transport (atmospheric stability and inversion conditions) and topography of the area.

The year may broadly be divided into four seasons.

Winter season	:	December to February
Pre-monsoon season	:	March to May
Monsoon season	:	June to September
Post Monsoon season	:	October to November

Table 3-3 Meteorological Data (2020)

Month	Maximum temperature (Deg. C)	Minimum temperature (Deg. C)	Average Humidity (%)	Wind Speed (Kmph)	Rainfall (mm)
January	26	17	50	5.5	0.0
February	30	19	42	6.5	0.0
March	36	25	39	7.8	0.0
April	40	27	30	12.1	0.0
May	43	28	33	13.4	7.9
June	37	28	56	13.2	152.5
July	34	27	68	11.5	238
August	30	25	81	14	685.8
September	32	25	76	7.5	214.3
October	30	23	75	6.5	169.6
November	28	20	59	5.5	0.0
December	28	17	47	3.8	0.0

3.9.1 Met Data Generated at Site

Site specific climatic condition refers to average weather comprising of temperature, relative humidity, wind speed, rainfall, cloud cover etc. This determines the baseline conditions and probable impacts on environmental parameters with respect to the Project.

Ambient Temperature:

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-	Temperature (°C)		
	March, 2021	April, 2021	May, 2021
Maximum	39	42	40
Minimum	23	27	28
Average	34	37	36

Precipitation:

Month	Total Precipitation (mm)
March, 2021	9.1
April, 2021	9.8
May, 2021	29.7

Humidity:

Month	Humidity (%)
	Average
March, 2021	87
April, 2021	95
May, 2021	97

Wind Speed:

Month	Wind Speed (km/hr)		
	Maximum	Minimum	Average
March, 2021	13.4	Calm	8.5
April, 2021	17.6	Calm	10.7
May, 2021	21.3	Calm	13.5

3.9.2 Climate & Rainfall

The south-west monsoon is the principal source of rainfall in the district. Average annual rainfall of the district is 1229.47mm. About 80% of the total rainfall is received during the period from June-September. Droughts are quite common in the district. The rainfall is scanty in the west and west-central parts of the district i.e. in the Patnagarh subdivision, which increases in east and southern directions. Block wise average annual rainfall varies from 946.0 mm to 1492.10-mm. The climate of the district is tropical with hot and dry summer and pleasant winter. The summer season extends from March to middle of June followed by the rainy season from June to September. The winter season extends from November till the end of February. Humidity is high during middle of June and it's less in post monsoon period. The relative humidity in the district varies from 26% to 84% throughout the year. The mean monthly potential evapotranspiration value ranges from 45mm in December to 470 mm in May. Wind is generally light to moderate. During summer and southwest monsoon months wind velocity increases. The mean annual wind speed is 3.3 Km/hr.

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3.9.3 Wind Rose

Wind blowing from ENE to WSW direction (1st March 2021 to 31st May 2021)

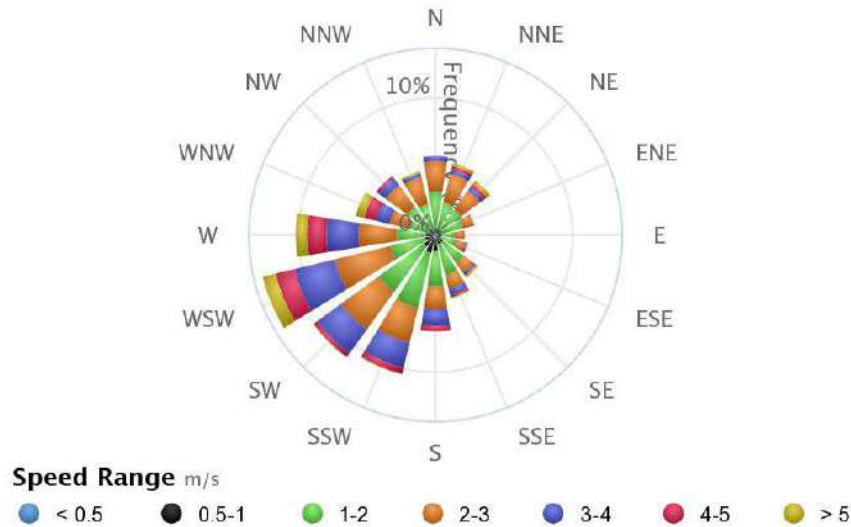


Figure 3-4 Wind Rose (1st March 2021 to 31st May 2021)

3.10 Ambient Air Quality:

Reconnaissance: The quality of ambient air depends upon the background concentrations of specific contaminants, the emission sources and meteorological conditions. The study on baseline ambient air quality status in the project area is an essential and primary requirement for assessing the impacts on air environment due to any proposed developmental activity.

The baseline studies on air environment include identification of specific air pollution parameters expected to have significant impacts and assessing their existing levels in ambient air within the impact zone. To assess the baseline status of ambient air quality in the study area monitoring is undertaken to ascertain the baseline pollutant concentrations in ambient air.

Methodology for air Monitoring: AAQM was carried out and AAQM locations were monitored on 24 hourly average bases twice in a week as per guidelines of CPCB and NAAQS. The conventional and project specific parameters such as particulate matter PM₁₀ (size less than 10 µm), particulate matter PM_{2.5} (size less than 2.5µm), Sulphur Dioxide (SO₂) & Oxides of Nitrogen (NO_x) were monitored.

Selection of Stations for Sampling: Depending upon the purpose of the study IS: 5184 (part XIV) lays down various criteria for selection of sampling stations. For EIA/ EMP, the purpose is to ascertain the baseline pollutant concentrations in ambient air. Accordingly, the criterion has been selected to ascertain quality of air on human settlements or environmentally sensitive areas if any located in the 10 km radius study area.

Air Monitoring Stations

The locations for AAQM study were selected within the 10 km radius of the proposed plant installation. Ambient air quality was monitored on 8 locations to generate representative ambient air quality data. The sampling locations are shown in Figure and listed in Table

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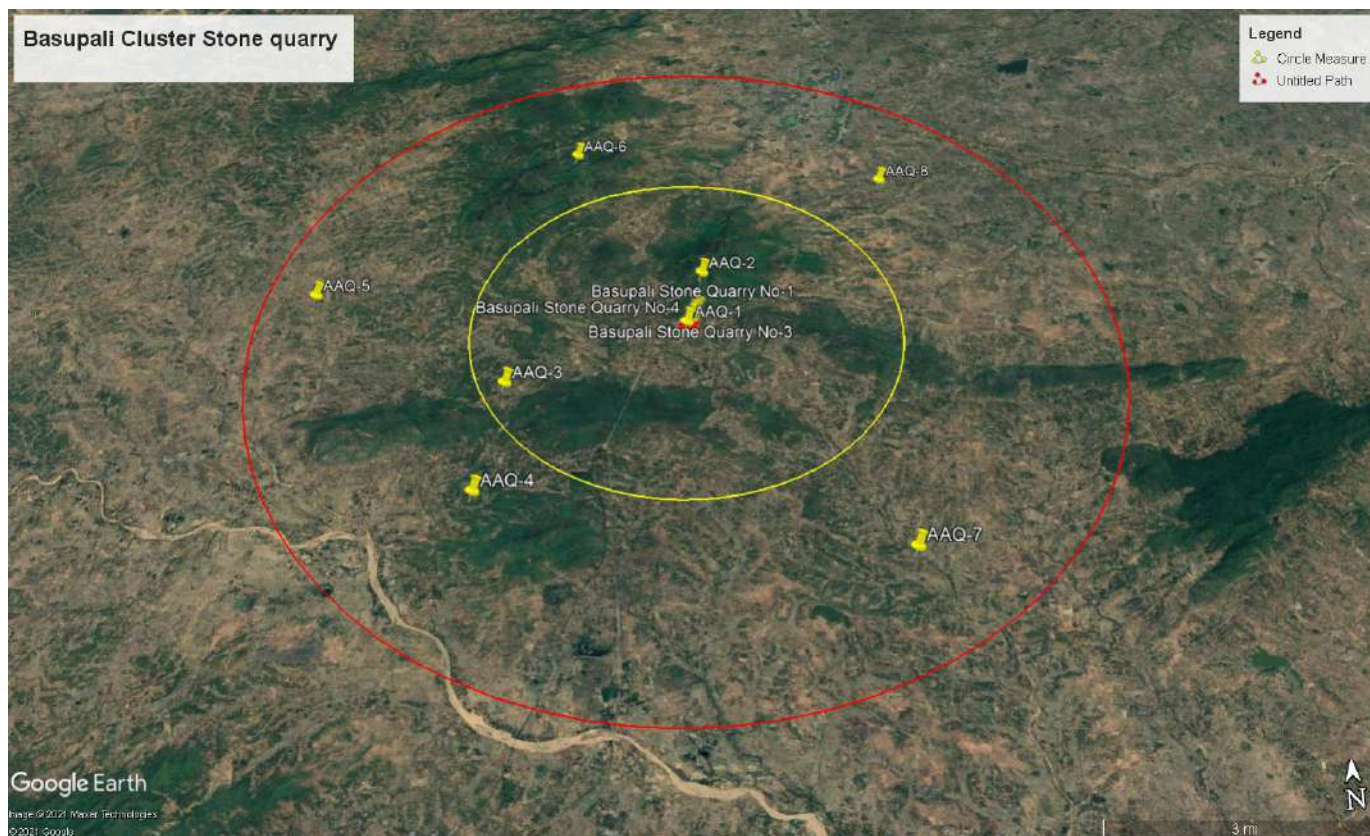


Figure 3-5 Ambient Air Quality Monitoring Locations on Google Map

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Table 3-4 Ambient Air Quality Monitoring Locations

Sr. No.	Location	Justification	Distance (KM)	Directions	Coordinates	
AAQ1	Project Site	-	-	-	20° 37' 35.0" N	83° 26' 56.1"E
AAQ2	Basupali	Down wind	1.56	NE	20°38'14.59"N	83°27'25.64"E
AAQ3	Ratanpur	Up Wind	4.26	SW	20°36'26.39"N	83°24'40.01"E
AAQ4	Jurlakani	Up Wind	6.65	SSW	20°34'56.86"N	83°24'6.13"E
AAQ5	Nuapada	Up Wind	9.01	WNW	20°38'13.11"N	83°21'52.98"E
AAQ6	Balangir Range	Cross Wind	6.08	NNW	20°40'46.11"N	83°25'29.05"E
AAQ7	Pandel	Cross Wind	7.98	SSE	20°33'48.79"N	83°29'11.34"E
AAQ8	Pandrapita	Down wind	7.01	NE	20°39'54.31"N	83°29'56.07"E

(Source: Analysis during study period, GCI)



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Table 3-5 Ambient Air Quality Monitoring Results (24-hour average)

Locations		PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO _x (µg/m ³)	CO (mg/m ³)	NH ₃ (µg/m ³)	Pb (µg/m ³)	O ₃ (µg/m ³)	As (ng/m ³)	Ni (ng/m ³)	Benzo (a) Pyrene (ng/m ³)
AAQ1	Maximum	71.2	21.4	8.6	12.8	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	Minimum	62.0	18.6	7.4	11.2	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	Average	65.7	19.9	8.0	11.9	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	98percentile	70.5	21.2	8.4	12.7	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
AAQ2	Maximum	68.5	21.9	8.4	12.6	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	Minimum	60.8	19.5	7.5	11.2	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	Average	64.2	20.5	7.9	11.8	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	98percentile	67.8	21.7	8.3	12.5	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
AAQ3	Maximum	72.4	27.2	9.1	13.6	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	Minimum	62.4	20.0	6.7	10.0	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	Average	68.4	22.6	7.6	11.4	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	98percentile	71.7	26.9	8.9	13.5	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
AAQ4	Maximum	68.4	21.9	8.1	12.2	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	Minimum	60.1	19.2	6.9	10.4	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	Average	62.2	19.9	7.4	11.0	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	98percentile	67.7	21.7	7.9	12.0	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
AAQ5	Maximum	69.8	22.3	7.8	11.7	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	Minimum	60.4	19.3	6.7	10.1	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	Average	63.3	20.2	7.1	10.6	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	98percentile	69.1	22.1	7.6	11.6	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
AAQ6	Maximum	67.9	21.7	8.4	12.5	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	Minimum	62.3	19.9	7.7	10.6	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	Average	64.8	20.7	8.0	11.9	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	98percentile	67.2	21.5	8.2	12.4	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
AAQ7	Maximum	66.4	21.2	8.2	12.3	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	Minimum	62.0	19.9	7.6	11.5	<0.5	<20	<0.01	<20	<5	<1.0	<0.01



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Locations		PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO _x (µg/m ³)	CO (mg/m ³)	NH ₃ (µg/m ³)	Pb (µg/m ³)	O ₃ (µg/m ³)	As (ng/m ³)	Ni (ng/m ³)	Benzo (a) Pyrene (ng/m ³)
AAQ8	Average	63.8	20.4	7.9	11.8	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	98percentile	65.7	21.0	8.0	12.1	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	Maximum	67.5	21.6	8.3	12.5	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	Minimum	61.5	19.7	7.6	11.4	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	Average	64.3	20.6	7.9	11.9	<0.5	<20	<0.01	<20	<5	<1.0	<0.01
	98percentile	66.8	21.4	8.1	12.3	<0.5	<20	<0.01	<20	<5	<1.0	<0.01

(Source: Primary Data Collection and analysis during study period by Laboratory)

Table 3-6 National Ambient Air Quality Standards and Methods of Measurement

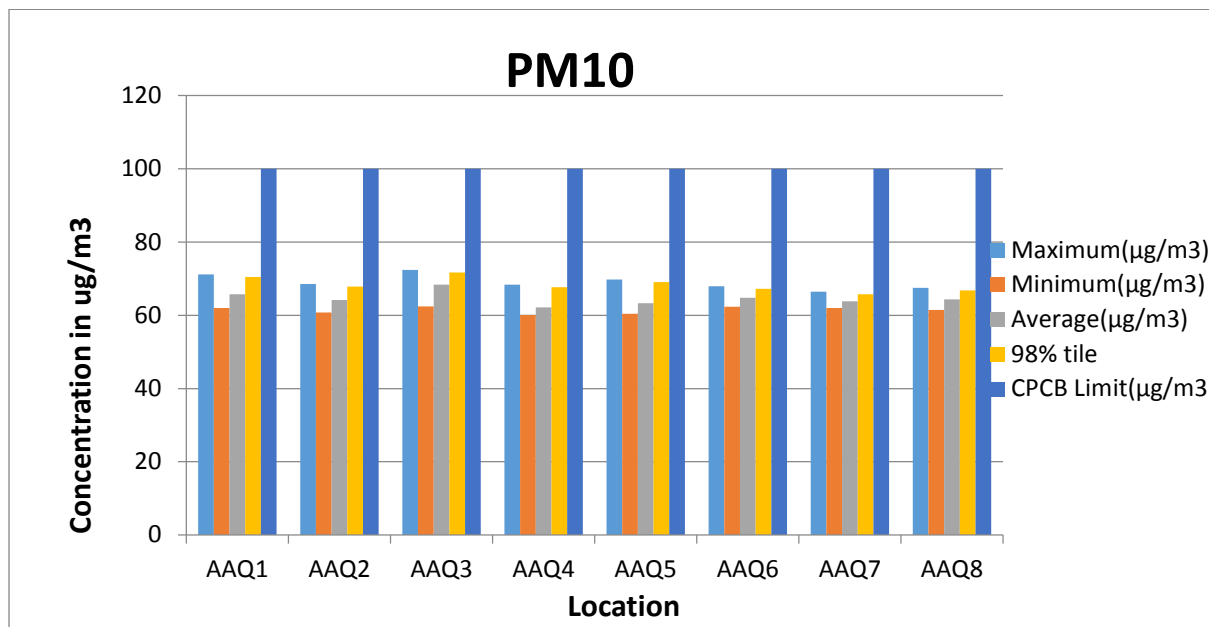
S. No.	Pollutants	Time Weighted Average	National Ambient Air Quality Standards (NAAQS)		
			Industrial, Residential, Rural and other area	Ecologically Sensitive Area	Methods of measurement
1	SO ₂ (µg/m ³)	24 hours	80	80	Improved West and Gaeke method.
2	NO _x (µg/m ³)	24 hours	80	80	Modified Jacob & Hochheiser (Sodium Arsenite).
3	PM ₁₀ (µg/m ³)	24 hours	100	100	Gravimetric Method
4	PM _{2.5} (µg/m ³)	24 hours	60	60	Gravimetric Method
5	CO (mg/m ³)	8 hours	2	2	Non Dispersive Infra-Red Spectroscopy
6	Ammonia (µg/m ³)	24 hours	400	400	Indophenol Blue Method
7	Ozone (µg/m ³)	8 hours	100	100	UV Photometric Chemical Method
8	Lead (µg/m ³)	24 hours	1.0	1.0	AAS
9	Arsenic (ng/m ³)	Annual	6.0	6.0	AAS
10	Nickel (ng/m ³)	Annual	20.0	20.0	AAS
11	Benzene (µg/m ³)	Annual	5.0	5.0	Gas Chromatography
12	Benzopyrene (ng/m ³)	Annual	1.0	1.0	Gas Chromatography

(Source: http://cpcb.nic.in/National_Ambient_Air_Quality_Standards.php)

3.10.1 Observations on Ambient Air Quality:

3.10.1.1 Particulate Matter (PM₁₀):

PM₁₀ levels were ranging from 60.1 to 72.4 µg/m³. The highest PM₁₀ level was found at Ratanpur as wind is blowing from ENE to WSW and this location is located in SW. PM₁₀ concentration was within the NAAQS level (i.e.100 µg/m³) at all locations.

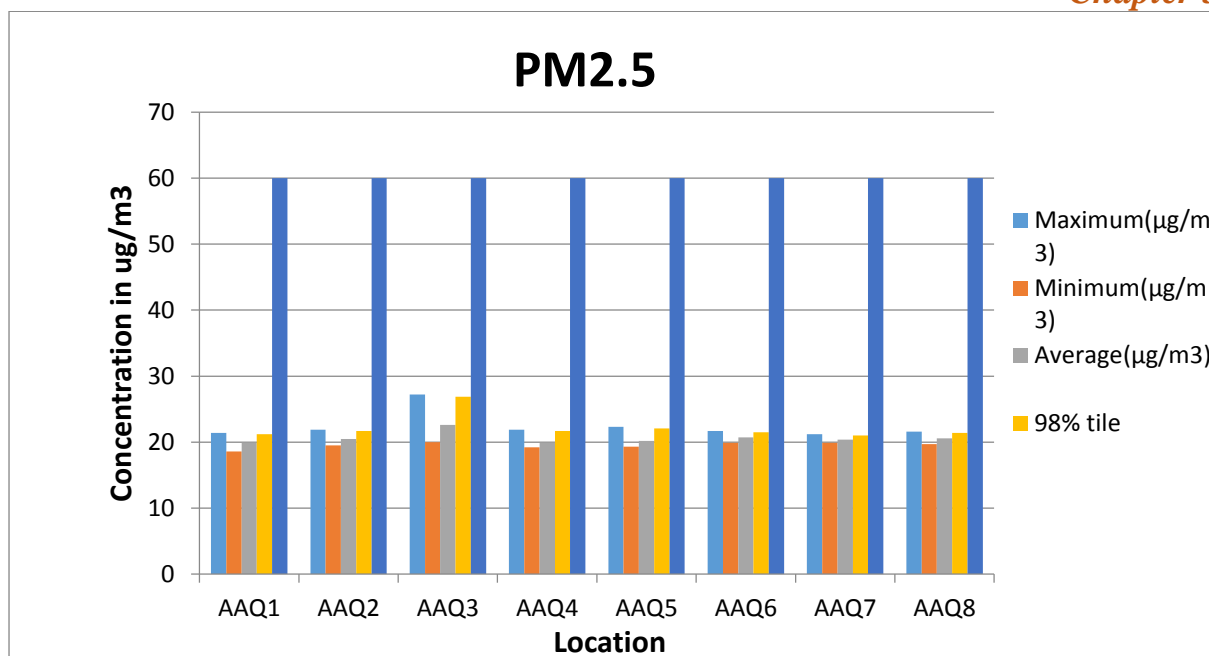


(Source: Analysis GCI)

Figure 3-6 Graphical representation of PM₁₀ concentration at different locations

3.10.1.2 Particulate Matter (PM_{2.5}):

PM_{2.5} levels were ranging from 18.6 to 27.5 µg/m³. The highest PM_{2.5} level was found at Ratanpur as wind is blowing from ENE to WSW and this location is located in SW. PM_{2.5} concentration was found within the NAAQS level (i.e.60 µg/m³) at all the locations.

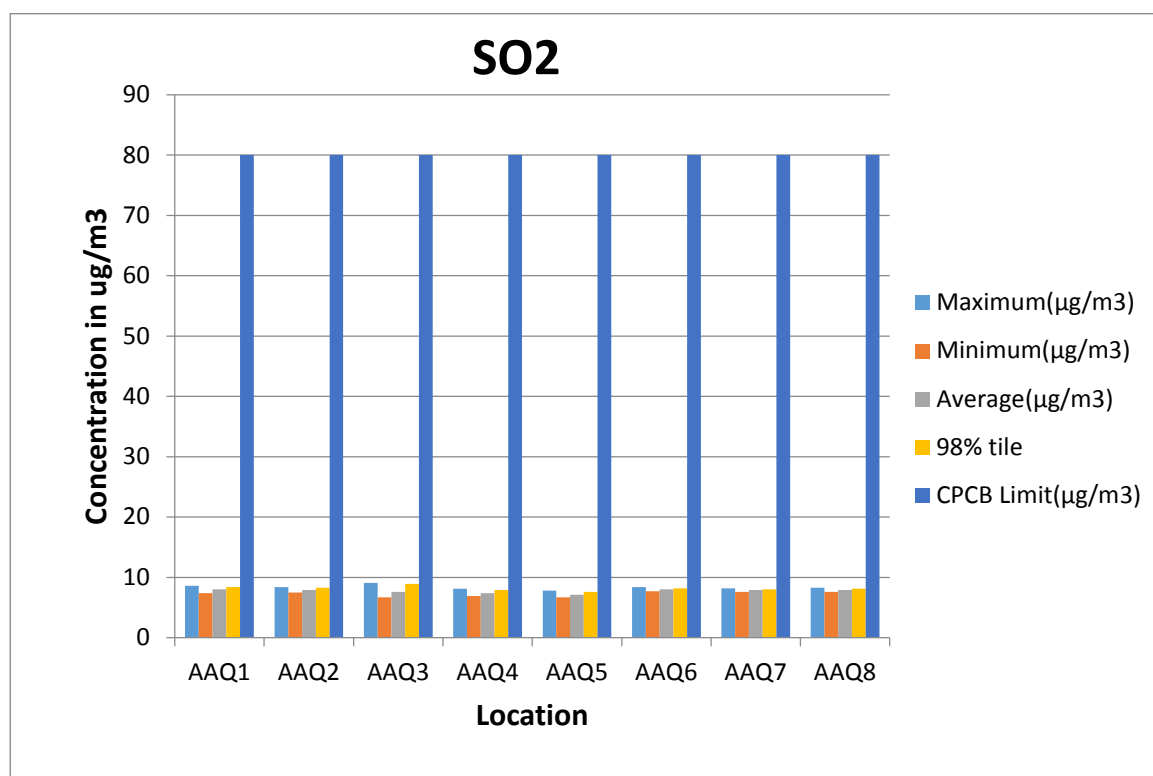


(Source: Analysis GCI)

Figure 3-7 Graphical representation of PM2.5 concentration at different location

3.10.1.3 Sulphur Dioxide (SO₂):

SO₂ levels were ranging from 6.7 to 9.1 µg/m³. The highest SO₂ level was found at Ratanpur as wind is blowing from ENE to WSW and this location is located in SW. The SO₂ level in all the monitoring locations is within permissible limit i.e. NAAQS level 80 µg/m³.

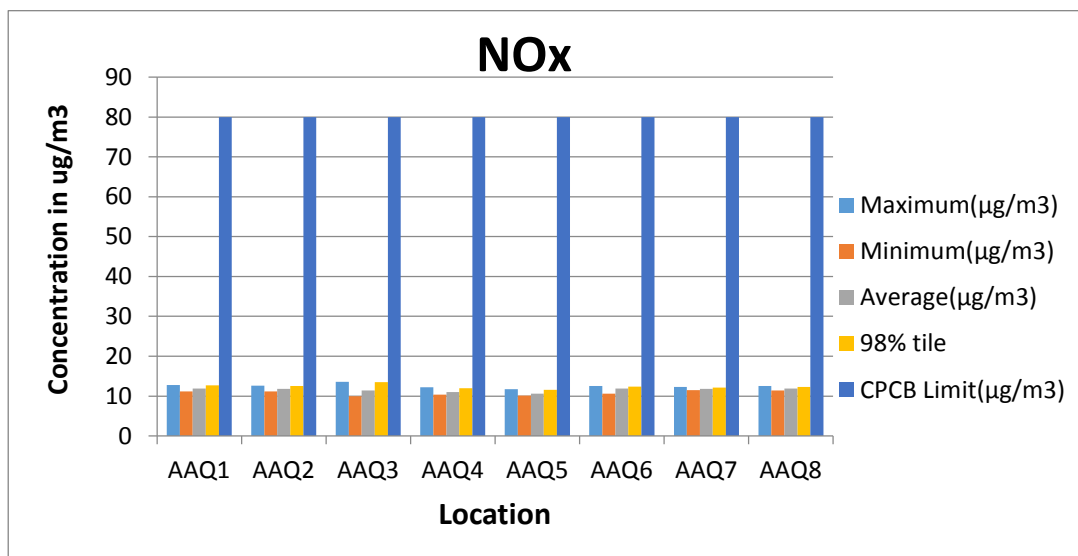


(Source: Analysis GCI)

Figure 3-8 Graphical representation of SO2 concentration at different locations

3.10.1.4 Oxides of Nitrogen (NO_x):

NO_x levels were found ranging from 10 to 13.6 µg/m³. The highest NO_x level were found at Ratanpur as wind is blowing from ENE to WSW and this location is located in SW. The NO_x level in all monitoring locations was under permissible limit i.e. NAAQS level 80 µg/m³.



(Source: Analysis GCI)

Figure 3-9 Graphical representation of NO_x concentration at different locations

3.11 Noise Environment

Noise can be defined as an unwanted sound. It interferes with speech and hearing. The definition of noise as unwanted sound implies that it has an adverse effect on human beings and their environment. Noise can also disturb natural wildlife and ecological system.

The objective of the noise pollution survey in the study area is to identify existing noise sources and to measure background noise levels.

Reconnaissance

In order to measure the existing noise sources and to identify the background noise levels, the noise pollution survey around the proposed site was carried out. The collection of baseline noise environment data included Identification of noise sources and to measure background noise levels and Measurement of noise levels due to transportation and other local activity.

Methodology for Noise Monitoring

Noise standards have been designated as per the Noise Pollution (Regulation & Control) Rules, 2000 Notified by Ministry of Environment and Forests, New Delhi, February 14, 2000. The ambient noise standards are presented in Equivalent noise levels (Leq.) have been measured twice a week during study period. The measurements were carried out at each monitoring location during day time and night time.

Noise Monitoring Locations

A total of 08 locations were identified for ambient noise monitoring in the study area.

Table 3-7 Ambient Noise Quality in the Study Area

S. No.	Location name	Zone	Units	Day Time		Night Time	
				Result	CPCB Permissible Limit	Result	CPCB Permissible Limit
N-1	Project Site	Industrial	dB(A) Leq	63.6	75	59.2	70
N-2	Basupali	Residential	dB(A) Leq	54.6	55	43.3	45
N-3	Ratanpur	Residential	dB(A) Leq	48.5	55	39.8	45
N-4	Jurlakani	Residential	dB(A) Leq	52.5	55	42.3	45
N-5	Nuapada	Residential	dB(A) Leq	51.4	55	40.7	45
N-6	Balangir Range	Residential	dB(A) Leq	53.4	55	40.1	45
N-7	Pandel	Residential	dB(A) Leq	51.2	55	42.2	45
N-8	Pandrapita	Residential	dB(A) Leq	51.4	55	40.2	45

(Source: Monitoring during Study period by GCI)

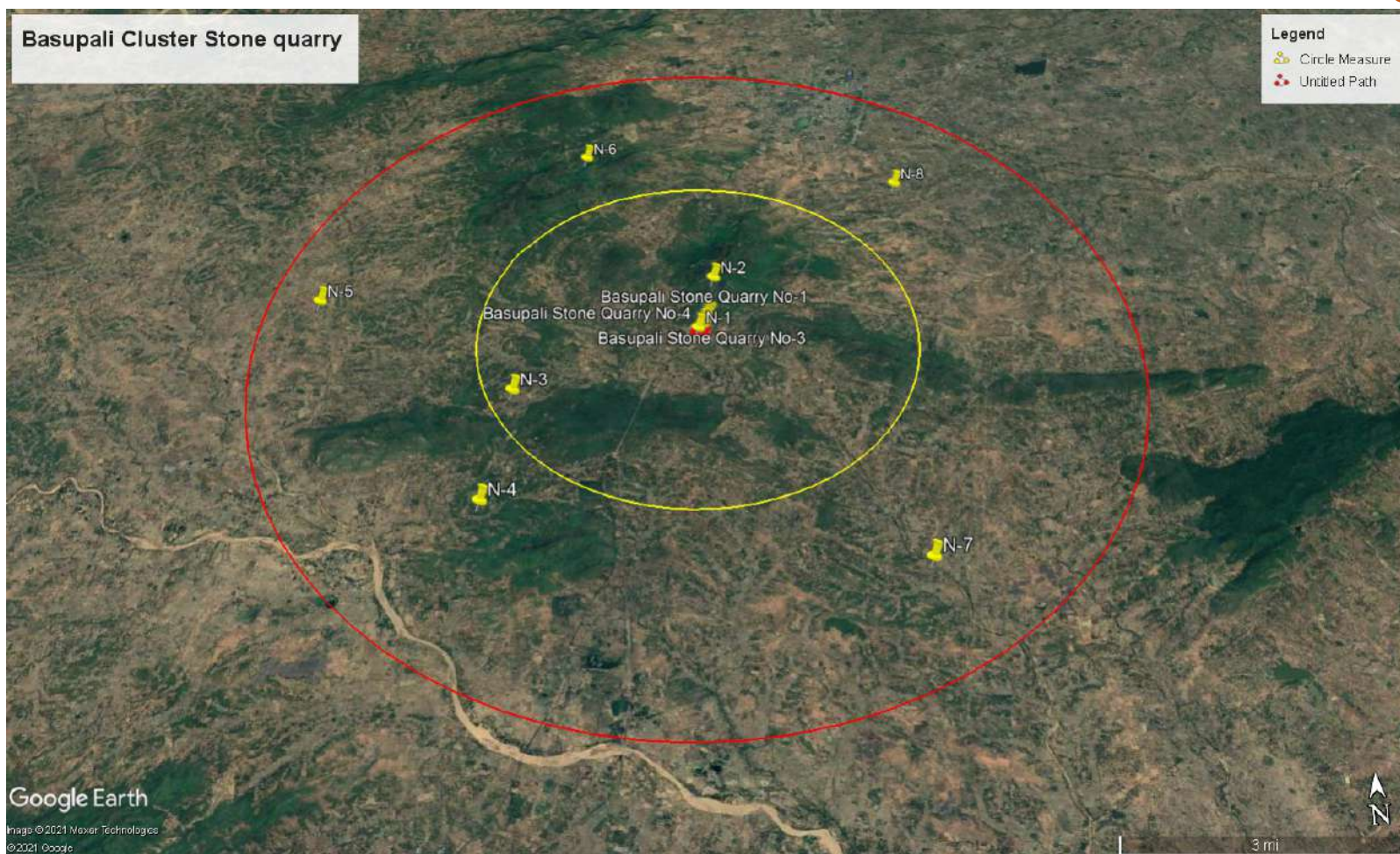


Figure 3-10 Google Earth map showing Ambient Noise Monitoring Locations

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3.11.1 Observation on Ambient Noise Quality:

3.11.1.1 Day Time:

The noise levels varied in the study area during day time from 51.2 dB (A) Leq at Pandel to 63.6 Leq dB (A) at Project site, as this site have Mining activity and traffic load which increase Noise level.

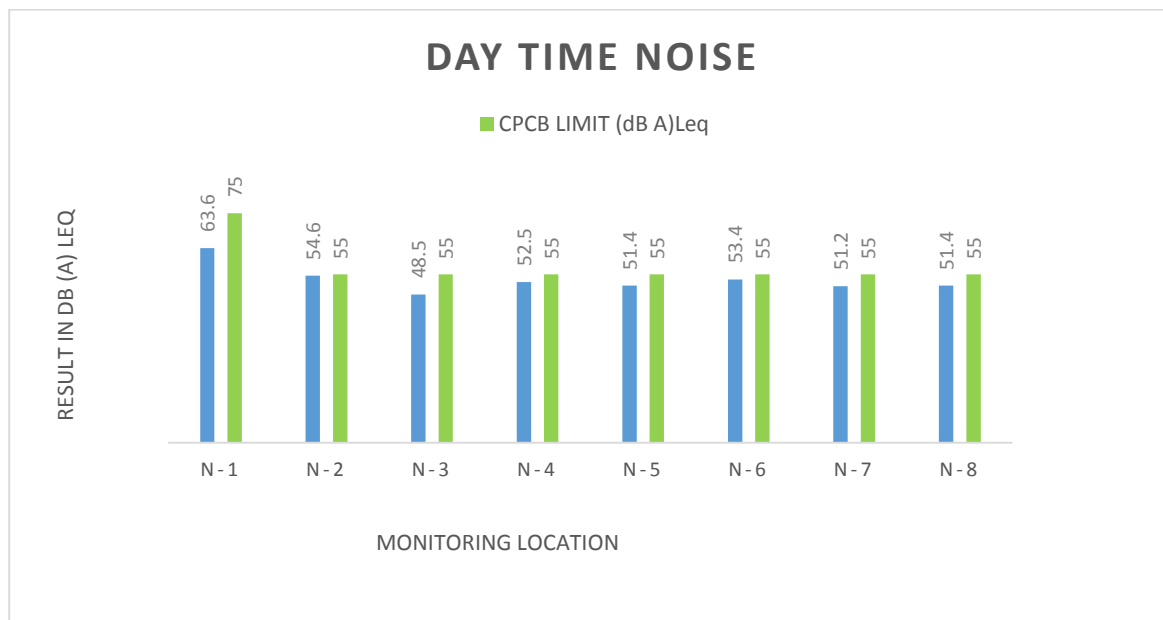
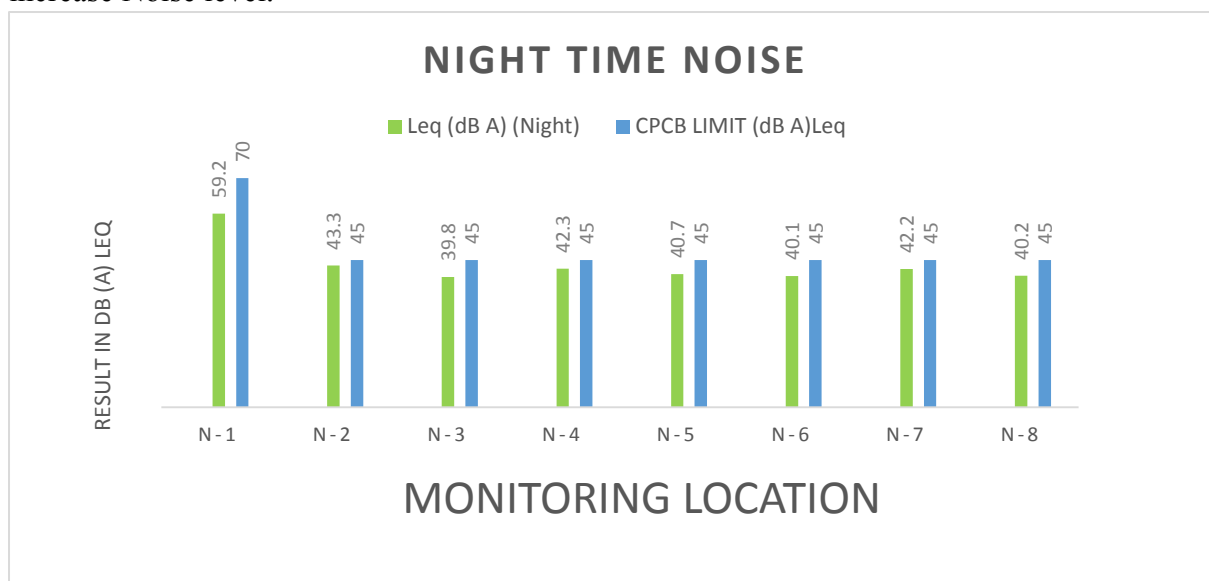


Figure 3-11 Graphical Representation of Day time Noise Level in the study area

3.11.1.2 Night Time:

The night time noise level in the study area is in the range of 39.8 dB (A) Leq at Ratanpur to 59.2 Leq dB (A) at Project Site as this site have Mining activity and traffic load which increase Noise level.



(Source: Analysis GCI)

Figure 3-12 Graphical Representation of Night time Noise Level in the study area

Table 3-8 Applicable Noise Standards

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

(Source: Noise Pollution Rules, 2000)

Note:

- ✓ Day time is reckoned in between 6 am and 10 pm.
- ✓ Night time reckoned in between 10 pm and 6 am.
- ✓ Silence zone is defined as areas up to 100 meters around such premises as hospitals, education, institutions and courts. The silence zones are to be declared by the Component Authority.
- ✓ Mixed categories of areas should be declared as one of the four above-mentioned categories by the Component Authority and the corresponding standard shall apply.

3.12 Water Quality

Reconnaissance Survey

Reconnaissance survey has been done for water quality monitoring in the Study Area. The baseline water quality of ground water / surface water in the region is obtained by collecting sample from villages in the area considering the 10 km radius for the baseline study.

Methodology of Monitoring

In order to establish the baseline water quality, ground water and surface water sampling locations were selected based on a availability, following standard norms and requirement. Ground water samples were collected from the identified hand pumps and bore wells for the characterization of water quality. Selection of surface water sampling locations has been considered as per the utilization pattern of the villagers for domestic / drinking purposes.

The samples collected were preserved, stored and analysed as per standards methods of Analysis of Water and Waste Water (APHA, 2017).

3.12.1 Ground Water Quality:

Ground water samples were collected from 07 locations during the study period and analysed for a number of physico-chemical parameters.

Table 3-9 Ground Water Sampling Locations

Sr.No.	Village Name	Source	Distance	Direction	Co-Ordinate	
GW-1	Basupali	Hand pump	1.56	NE	20°38'14.59"N	83°27'25.64"E
GW-2	Ratanpur	Hand pump	4.26	SW	20°36'26.39"N	83°24'40.01"E
GW-3	Jurlakani	Hand pump	6.65	SSW	20°34'56.86"N	83°24'6.13"E
GW-4	Nuapada	Hand pump	9.01	WNW	20°38'13.11"N	83°21'52.98"E
GW-5	Balangir Range	Hand pump	6.08	NNW	20°40'46.11"N	83°25'29.05"E
GW-6	Pandel	Hand pump	7.98	SSE	20°33'48.79"N	83°29'11.34"E
GW-7	Pandrapita	Hand pump	7.01	NE	20°39'54.31"N	83°29'56.07"E

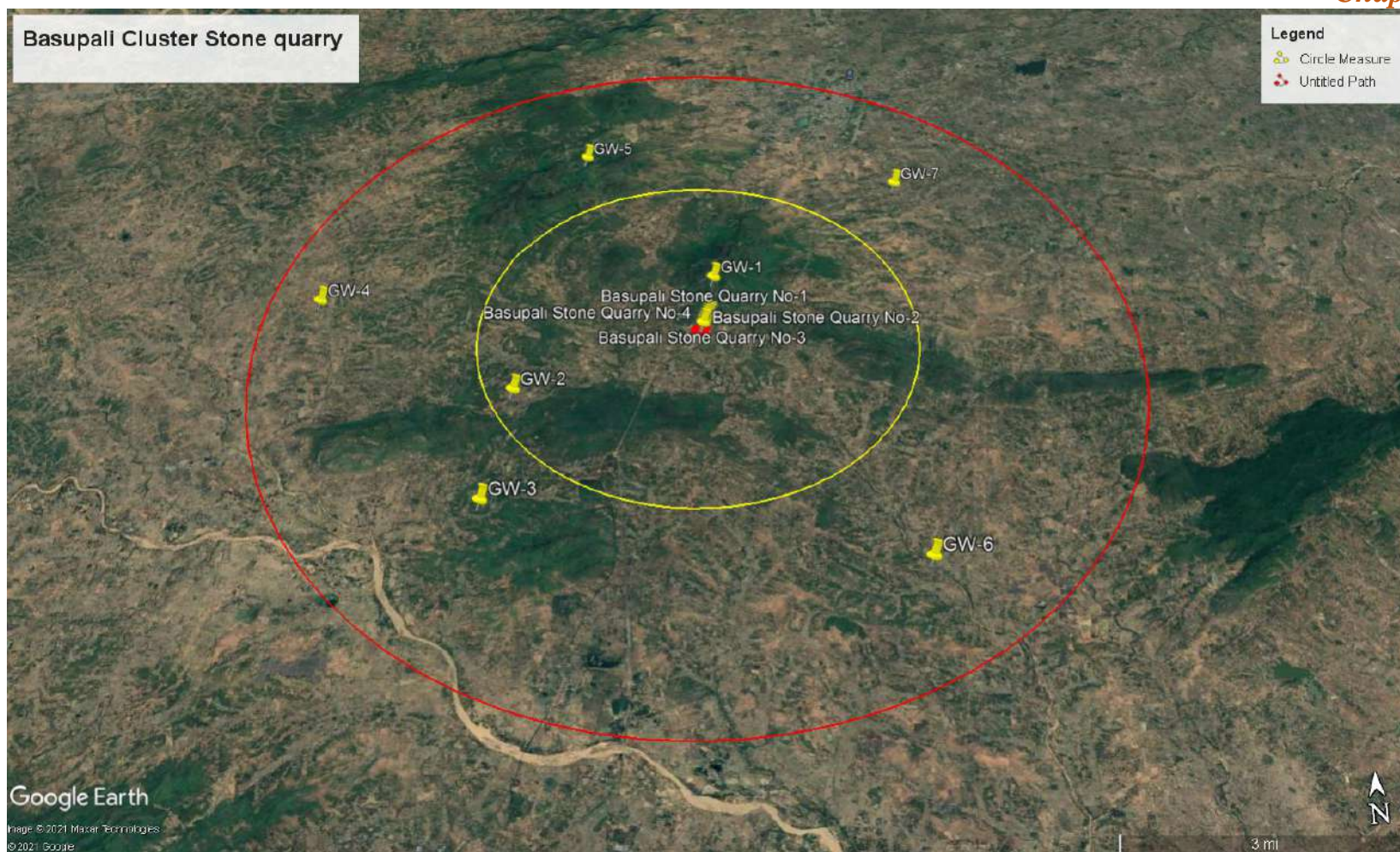


Figure 3-13 Google Earth Map showing Ground Water Quality Monitoring Locations

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Table 3-10 Ground Water Quality in the Study Area

No.	Parameter	Units	Result							Permissible Limit as Per IS 10500:2012	Reference Method
Sample Identification			GW1	GW2	GW3	GW4	GW5	GW6	GW7		
1.	pH	---	7.54	7.28	7.70	7.26	7.46	7.34	7.43	6.5-8.5	APHA 4500 H+
2.	Conductivity	µs/cm	644	743	632	767	762	743	637	-	APHA 2510
3.	Turbidity	NTU	<1	<1	<1	<1	<1	<1	<1	5	APHA 2130
4.	Colour	Hazen	<5	<5	<5	<5	<5	<5	<5	15	APHA 2120
5.	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	APHA 2150
6.	Total Dissolved Solid	mg/L	416	482	423	554	466	478	442	2000	APHA 2540 C
7.	Total Suspended Solid	mg/L	<2	<2	<2	<2	<2	<2	<2	-	APHA 2540 B
8.	Sulphate	mg/L	26.8	34.2	24.8	23.5	21.8	32.4	21.6	400	APHA 4500-SO42-
9.	Chloride	mg/L	39.5	42.1	32.5	42.9	34.1	45.8	38.4	1000	APHA 4500 – Cl-
10.	Total Hardness	mg/L	355	412	326	485	406	396	342	600	APHA 2340
11.	Calcium as Ca	mg/L	96.8	120.8	84.8	147.2	103.2	104.8	84.8	200	APHA -3500 Ca
12.	Magnesium Mg	mg/L	27.5	26.7	27.7	28.4	35.9	32.56	31.5	100	APHA 3500-Mg
13.	Alkalinity	mg/L	186	172	186	175	198	193	174	600	APHA 2320
14.	Copper	mg/L	0.14	0.1	0.12	0.17	0.18	0.13	0.19	1.5	APHA 3500-Cu
15.	Zinc	mg/L	0.14	0.1	0.12	0.16	0.12	0.13	0.15	15	APHA 3500-Zn
16.	Iron	mg/L	0.14	0.1	0.15	0.12	0.13	0.15	0.18	0.3	APHA 3500-Fe
17.	Lead	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	APHA 3500-Pb
18.	Nickel	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	APHA 3500-Ni
19.	Cadmium	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.003	APHA 3500-C
20.	Calcium Hardness as	mg/L	247	312	224	346	252	245	242	-	APHA 3500-Ca

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No.	Parameter	Units	Result							Permissible Limit as Per IS 10500:2012	Reference Method
Sample Identification			GW1	GW2	GW3	GW4	GW5	GW6	GW7		
	CaCO ₃										
21.	Magnesium Hardness as CaCO ₃	mg/L	112	115	116	117	148	134	130	-	APHA 3500-Mg
22.	Phenolic compound	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	APHA 5530
23.	Fluoride	mg/L	0.65	0.49	0.52	0.38	0.43	0.48	0.52	1.5	APHA 4500-F-

(Source: Water Analysis during study period)

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3.12.1.1 Observation of ground water monitoring results:

All the samples were colourless meeting desirable norms (<5 Hazen). All the samples meet the desirable standards pH ranges from 7.26 to 7.54. TDS in samples ranges from 416 mg/L to 554 mg/L. All the samples meet the permissible limit of 2000 mg/L. Total Hardness in the water ranges from 326 mg/L to 485 mg/L. All the samples meet the permissible limit of 600 mg/L. Calcium content in the water ranges from 84.8 mg/L to 147.2 mg/L, all the samples meet the permissible limit of 200 mg/L. Magnesium content in the water ranges from 26.7 mg/L to 35.9 mg/L. All the samples meet the permissible limit of 100 mg/L.

Total alkalinity in the water samples ranges from 172 mg/L to 198 mg/L. All the samples are within the permissible limit of drinking water (600 mg/L). Chlorides range from 32.5 mg/L to 45.8 mg/L, which are below permissible limits (1000 mg/L). Heavy metals like Copper, Nickel, Cadmium and Zinc are well below the limit in all samples.

Hence, it can be observed that ground water qualities in terms of various essential and desirable characteristics are found within the limits specified by IS 10500:2012.

3.12.2 Surface Water Quality:

Surface water samples were collected from 6 locations during the study period and analysed for a number of physico-chemical parameters.

Table 3-11 Surface Water Sampling Locations

Sr.No.	Village Name	Distance (KM)	Direction	Co-Ordinate	
SW-1	Balangir (Sagar)	9.06	NNE	20°41'33.12"N	83°28'52.47"E
SW-2	Jiramaya Sagar	7.66	N	20°41'30.02"N	83°26'14.29"E
SW-3	Dhauradadar	8.44	W	20°38'48.93"N	83°22'17.55"E
SW-4	Songad River	9.27	SSW	20°33'40.51"N	83°23'17.89"E
SW-5	Sarsbal River	1.90	SW	20°36'46.87"N	83°26'4.35"E
SW-6	Pond	3.10	ESE	20°36'30.74"N	83°28'22.86"E

(Source: Analysis during study period, GCI)

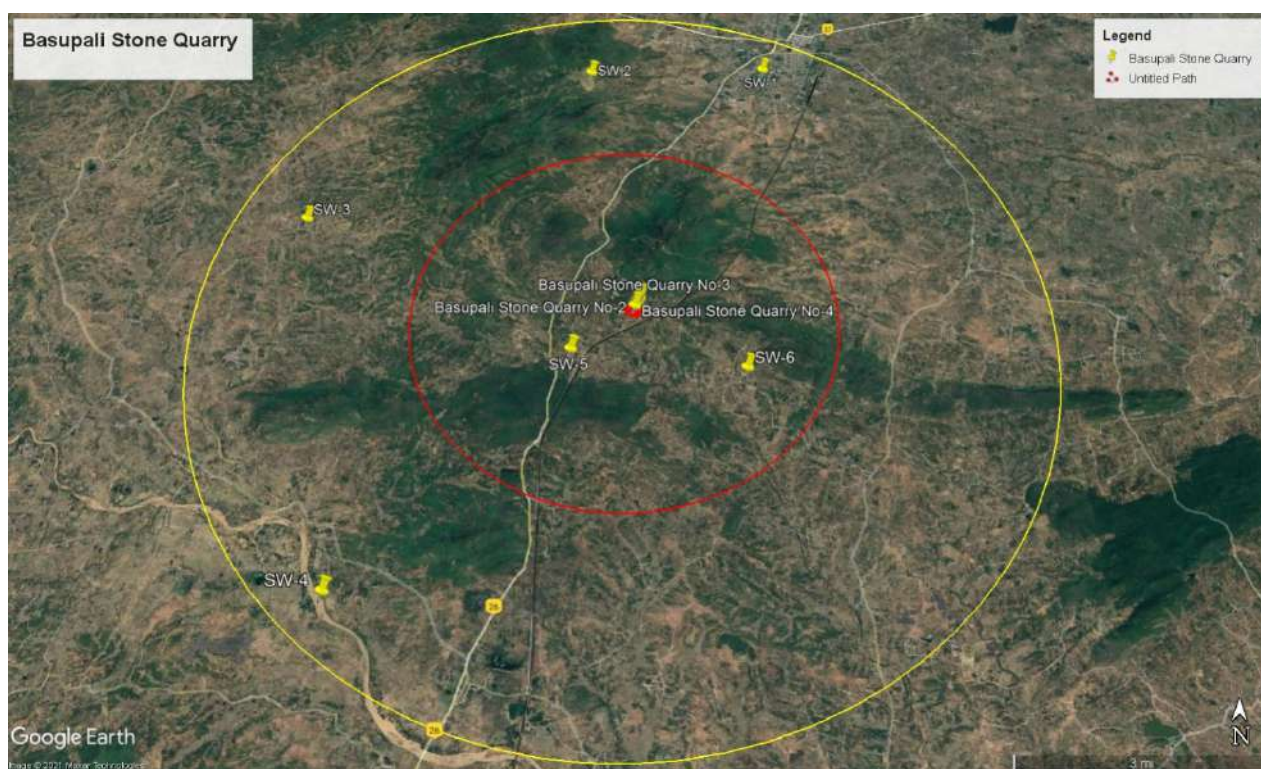


Figure 3-14 Surface Water Sampling Locations



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Table 3-12 Surface Water Quality in the Study Area

Sr.No	Parameter	Units	Result						Reference Method
			SW1	SW2	SW3	SW4	SW5	SW6	
1.	pH	---	7.1	7.3	7.4	7.0	7.36	7.12	APHA 4500 H+
2.	Conductivity	μS/cm	435	455	434	495	543	513	APHA 2510
3.	Turbidity	NTU	<2	<2	<2	<2	<2	<2	APHA 2130
4.	Colour	Hazen	<5	<5	<5	<5	<5	<5	APHA 2120
5.	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	APHA 2150
6.	Total Dissolved Solid	mg/L	283	296	282	322	353	334	APHA 2540 C
7.	Total Suspended Solid	mg/L	16	20	24	20	17	22	APHA 2540 B
8.	Sulphate	mg/L	32.4	45.9	32.6	49.2	45.2	41.5	APHA 4500- SO42-
9.	Chloride	mg/L	36.4	29.6	28.8	32.9	27.9	27.3	APHA 4500 – Cl-
10.	Total Hardness	mg/L	216	222	204	236	253	245	APHA 2340
11.	Calcium as Ca	mg/L	26.4	24.6	28.8	30.9	25.9	26.3	APHA -3500 Ca
12.	Magnesium Mg	mg/L	47.52	44.28	51.84	55.62	46.62	47.34	APHA 3500-Mg
13.	Alkalinity	mg/L	158	168	194	152	162	145	APHA 2320
14.	Copper	mg/L	0.1	0.08	0.06	0.12	0.1	0.13	APHA 3500-Cu
15.	Zinc	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	APHA 3500-Zn
16.	Iron	mg/L	0.14	0.17	0.18	0.22	0.12	0.15	APHA 3500-Fe



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Sr.No	Parameter	Units	Result						Reference Method
Sample Identification			SW1	SW2	SW3	SW4	SW5	SW6	
17.	Lead	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	APHA 3500-Pb
18.	Nickel	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	APHA 3500-Ni
19.	Cadmium	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	APHA 3500-C
20.	Total Coliform	MPN/100 ml	106	122	116	120	220	210	APHA 9221 B
21.	Faecal Coliform	MPN/100 ml	20	24	26	28	40	30	APHA 9221 E
22.	E. Coli	MPN/100 ml	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	APHA 9221 F
23.	Calcium Hardness as CaCO3	mg/L	185	156	156	142	156	132	APHA 3500-Ca
24.	Magnesium Hardness as CaCO3	mg/L	31	66	48	94	97	113	APHA 3500-Mg
25.	Phenol	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	APHA 5530
26.	Fluoride	mg/L	0.42	0.44	0.46	0.4	0.42	0.48	APHA 4500-F-
27.	Salinity	mg/L	65.52	53.28	51.84	59.22	50.22	49.14	APHA 2520 B
28.	Pesticides	P/A	Absent	Absent	Absent	Absent	Absent	Absent	Gas Chromatography
29.	Chemical Oxygen Demand	mg/L	18	16	22	20	18	16	APHA 5220
30.	Biochemical Oxygen	mg/L	6	6	8	8	4	6	APHA 5210
31.	Dissolved Oxygen	mg/L	5.8	6.5	5.9	6.1	4.1	3.9	APHA 4500-O-C

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3.12.2.1 Observation of Surface water monitoring results:

All samples were colourless meeting. All samples meet the desirable standards pH ranges from 7.0 to 7.4. TDS in samples ranges from 282 mg/L to 353 mg/L. Total hardness in the water ranges from 204 mg/L to 253 mg/L. Calcium content in the water ranges from 24.6 mg/L to 30.9 mg/L. Magnesium content in the water ranges from 44.28 mg/L to 55.52 mg/L.

Total alkalinity in the water samples ranges from 145 mg/L to 194 mg/L. Chloride ranges from 27.3 mg/L to 36.4 mg/L. Heavy metals like copper, nickel, cadmium and zinc are well below the limit in all samples.

Hence it can be observed that surface water qualities in terms of various essential and desirable characteristics are found within the limits.

Table 3-13 Standard Water Quality Criteria

Class of Water	Designated best use	Criteria
A	Drinking without treatment disinfection Water Source conventional but after	Total Coliforms Organism MPN/100ml shall be 50 or less pH between 6.5 and 8.5 Dissolved Oxygen 6mg/L or more Biochemical Oxygen Demand 5 days 20°C 2mg/L or less
B	Outdoor (Organized) bathing	Total Coliforms Organism MPN/100ml shall be 500 or less pH between 6.5 and 8.5 Dissolved Oxygen 5mg/L or more Biochemical Oxygen Demand 5 days 20°C 3mg/L or less
C	Drinking water source after conventional treatment and disinfection	Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4mg/L or more Biochemical Oxygen Demand 5 days 20°C 3mg/L or less
D	Propagation of Wild life and Fisheries	pH between 6.5 to 8.5 Dissolved Oxygen 4mg/L or more Free Ammonia (as N) 1.2 mg/L or less
E	Irrigation, Industrial Cooling, Controlled Waste disposal	pH between 6.0 to 8.5 Electrical Conductivity at 25°C micro mhos/cm Max. 2250 Sodium absorption Ratio Max. 26 Boron Max. 2mg/L

(Source: http://epcb.nic.in/Water_Quality_Criteria.php)

3.13 Soil

Soil is our most important natural resource and a natural resource is anything that comes from the earth and is used by us. We depend on the soil for food, clothing, shelter, minerals, clay & water. Soil is the seat of many macro and micro flora like algae, fungi, earthworms, bacteria etc. These are very beneficial in promoting soil reactions and decomposing the organic matter by which essential nutrients for plants are liberated. Most of the soil is made-up of two main parts:

Tiny bits of mineral particles which come from larger rocks, and humus, which is dark brown in colour and consists of decaying remains of plants and animals.

Soil also contains water, air and living organisms, such as fungi, bacteria, earthworms, roundworms, insects, etc. Actually more living organisms live in the soil than above it.

Methodology

The soil samples were collected from 8 selected locations during post-monsoon season. The samples collected were homogeneous representative of each sampling location. At random sub-locations were identified at each location and soil samples were collected from 5 to 15 cm below the surface. It was uniformly mixed before homogenizing the soil samples. The samples about 500-gms were packed in polythene bags labelled in the field with location, number and sent to the laboratory for the analysis of physicochemical parameters.

Soil Sampling Locations

Soil sampling was conducted once during the study period of Post-monsoon season. 8 soil samples were collected from selected locations in the vicinity of the proposed project. For studying soil quality environment in the study area, sampling locations were selected to assess the existing soil conditions in and around the existing plant area representing various land use conditions. The homogenized samples were analysed for physicochemical characteristics.

Table 3-14 Soil Sampling Locations

Sr. No.	Location	Justification	Distance	Directions	Coordinates	
SOIL1	Project Site	Barren	-	-	20° 37' 35.0" N	83° 26' 56.1"E
SOIL2	Basupali	Agriculture	1.56	NE	20°38'14.59"N	83°27'25.64"E
SOIL3	Ratanpur	Agriculture	4.26	SW	20°36'26.39"N	83°24'40.01"E
SOIL4	Jurlakani	Agriculture	6.65	SSW	20°34'56.86"N	83°24'6.13"E
SOIL5	Nuapada	Agriculture	9.01	WNW	20°38'13.11"N	83°21'52.98"E
SOIL6	Balangir Range	Agriculture	6.08	NNW	20°40'46.11"N	83°25'29.05"E
SOIL7	Pandel	Agriculture	7.98	SSE	20°33'48.79"N	83°29'11.34"E
SOIL8	Pandrapita	Agriculture	7.01	NE	20°39'54.31"N	83°29'56.07"E

(Source: Analysis during study period, GCI)

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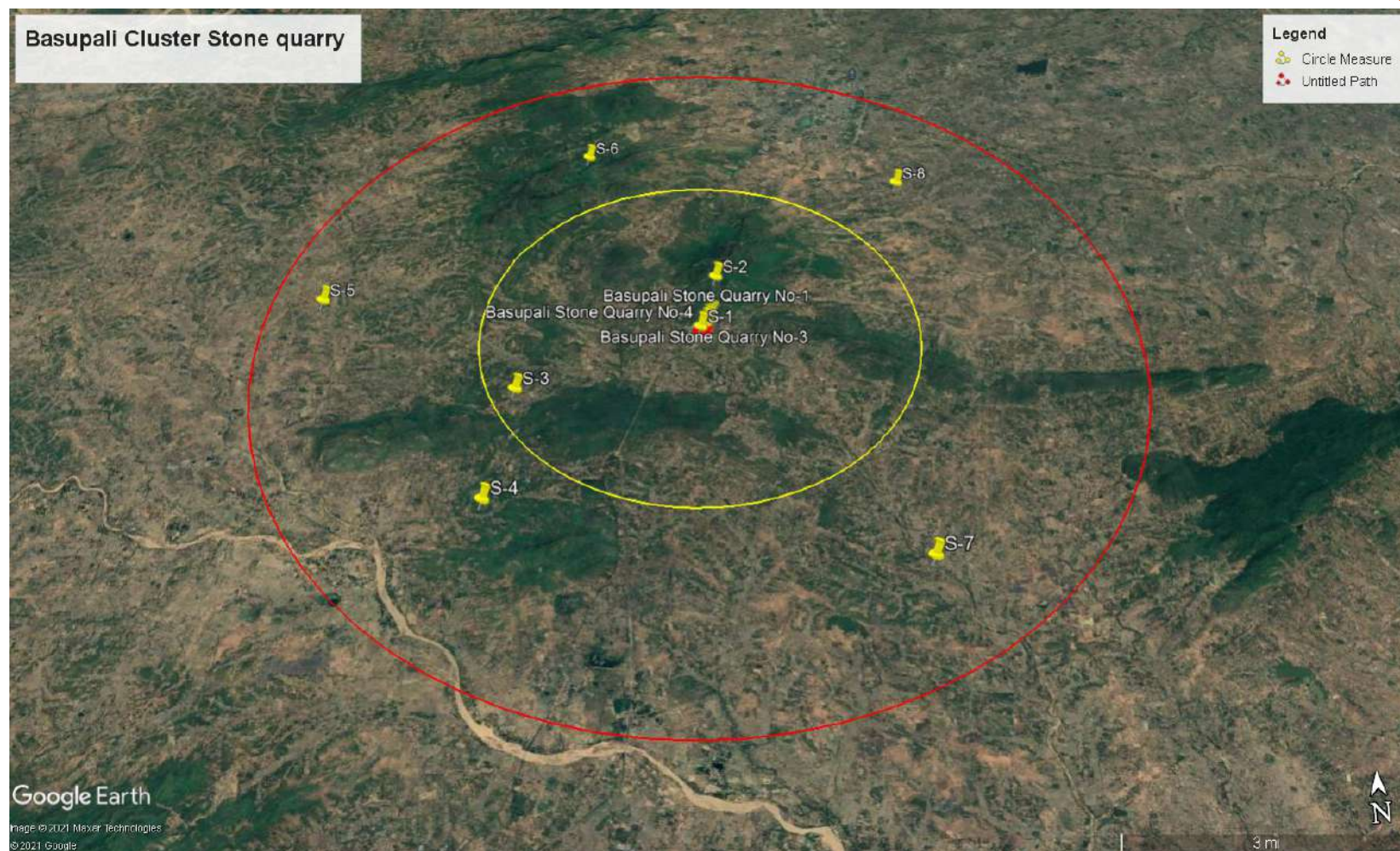


Figure 3-15 Google Earth map showing Soil Monitoring Locations

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Analysis of Soil Samples

The soil samples were examined for various physicochemical parameters, to determine the existing soil characteristics of the study area. Physicochemical characteristics of soil are presented as follows:

Table 3-15 Physiochemical Characteristics of Soil

Sr. No.	Parameters	Unit	Results								Reference Method
			S1	S2	S3	S4	S5	S6	S7	S8	
1.	pH	-	7.54	6.79	7.53	7.64	6.86	7.23	7.56	7.43	IS 2720 : Part 26 : 1987
2.	Electrical Conductivity	µmhos /cm	464	532	354	543	432	512	432	521	IS 14767: 2000
3.	Soil Moisture Content	%	6.9	7.9	10.5	7.3	10.2	7.5	9.9	9.2	IS 2720 – Part – 2
4.	Organic Carbon	%	0.40	0.57	0.60	0.65	0.57	0.64	0.70	0.53	IS 2720 : Part 22 : 1972
5.	Organic Matter	%	0.68	0.98	1.03	1.12	0.98	1.10	1.20	0.91	IS 2720 : Part 22 : 1972
6.	Phosphorus	mg/kg	23.6	24.5	21.5	20.6	23.4	19.7	23.4	25.7	APHA 4500 – P
7.	Total Nitrogen	mg/kg	236	448	484	472	464	409	480	440	APHA 4500-N _{ORG}
8.	Potassium as K	mg/kg	185.9	452.5	455.7	603.3	638.5	680.6	690.6	608.7	APHA 3500 – K - B
9.	Calcium	mg/kg	236	548	506	514	602	566	528	486	APHA 3500 –Ca– B
10.	Magnesium	mg/kg	212	234	239	433	304	352	314	312	APHA 3500 –Mg
11.	Chloride	mg/kg	63	75	63	56	58	53	48	55	IS 6925: 1973
12.	Copper as Cu	mg/kg	112	156	132	158	142	127	138	147	APHA 3111 B
13.	Zinc as Zn	mg/kg	63.7	80.8	73.8	85.7	66.5	72.5	82.7	67.4	APHA 3111 B
14.	Iron as Fe	mg/kg	112.7	130.6	127.2	126.5	132.8	137.9	129.5	119.5	APHA 3111 B
15.	Lead as Pb	mg/kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	APHA 3500-Pb
16.	Nickel as Ni	mg/kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	APHA 3500-Ni
17.	Pesticides	P/A	Absent	Absent	Present	Present	Present	Present	Present	Present	GC

(Source: Analysis Report)

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3.13.1.1 Observation of Soil monitoring results:

All the samples showed pH in the range from 6.64.-7.56. Conductivity of the samples were in the range from 354 μ S/cm- 543 μ S/cm. Moisture were in the range from 6.9% to 10.5%. Organic Carbone ranges from 0.4% -0.7 %. Organic Matter ranges from 0.68 mg/kg-1.2 mg/kg. Phosphorus in the samples ranges from 19.7 m g/kg- 25.7 mg/L. Total Nitrogen in the samples ranges from 236 m g/kg -484 mg/kg. Potassium in the samples ranges from 189.5 mg/kg -690.6 mg/kg. Calcium in the samples ranges from 236 mg/kg -602 mg/kg. Magnesium ranges from 212 m g/kg – 433 mg/kg. Chloride ranges from 48 mg/kg- 75 mg/kg. Copper, zinc, lead, cadmium and nickel all lies well in the Soil.

3.14 Traffic Study

LOCATION OF SURVEY POINT: To and fro traffic count is done at a Junction point on Main Road connected to mines (Latitude & Longitude: 20°37'17.06"N, 83°26'57.53"E)

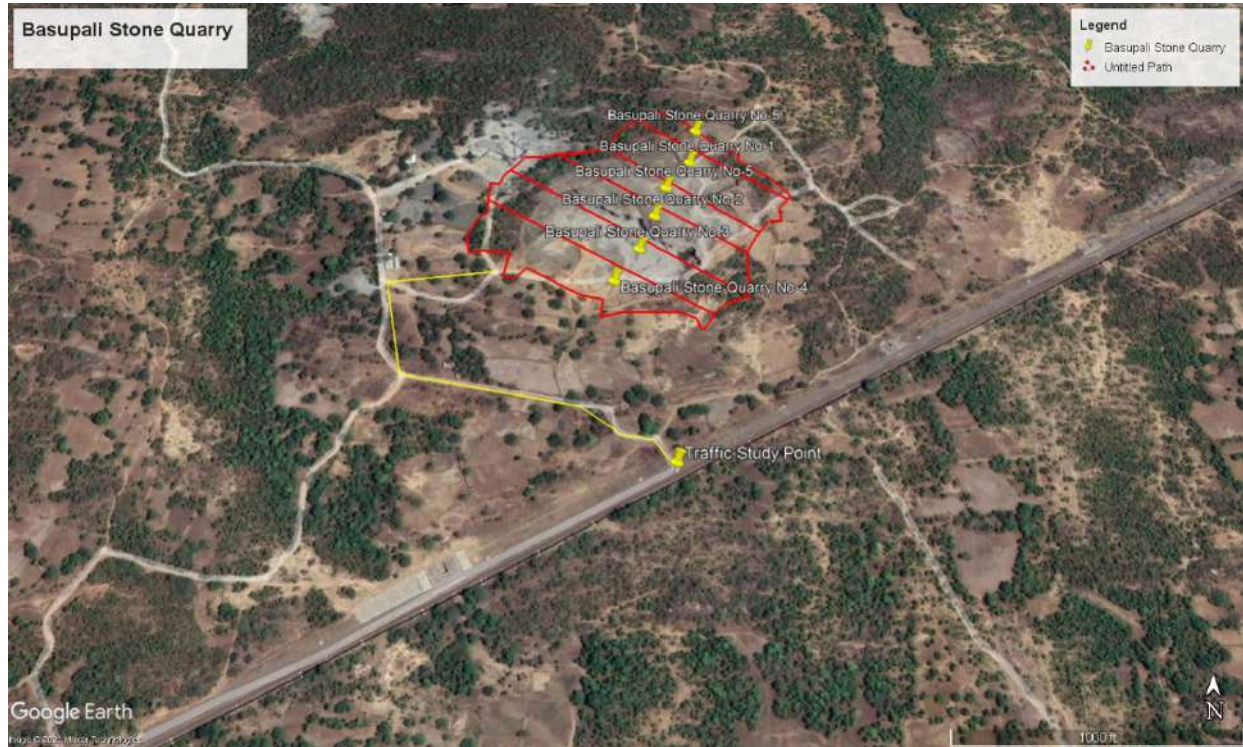


Figure 3-16 Traffic Survey Point

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Table 3-16 Details of Traffic Study before production

SR.NO	VEHICLE	NO.OF VEHICLES
1	Cycle	127
2	2 Wheeler	135
3	3 Wheeler	68
4	Passenger car, pickup van	109
5	Agricultural Tractor/LCV	176
6	Bus	136
7	Truck	248
8	Tractor with trailer (includes water tanker)	154
9	Multi Axle	50
Average vehicle/day		1201
Type of area		Rural
Recommended Design Service for Single lane roads(PCU/day)		2000

Table 3-17 Level of Service of Service road- With proposed expansion of project at Main Road

Route	Total PCU/day	C(PCU/day)	V/C ratio	LOS
Route-1	2639	2000	0.07	A

CONCLUSION

Level of Service is “A” i.e. Excellent Main road connecting with the proposed project of Basupali Stone Quarry.

Table 3-18 Details after proposed expansion Project of Basupali Stone Quarry

1.	Total Annual, Tones	22476 m ³ /year (max)
2.	Days	300
3.	Daily Production (Assuming 300 working days)	75 m ³ /day(max)
4.	Trucks/Trippers/dumper Capacity	15 m ³
5.	Total number of one-way trips (75/15 = 44)	5
6.	Total number of trips required (to and fro)	10
10.	No. of Routes	1

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Table 3-19 Details of Traffic Study

SR.NO	VEHICLE	NO.OF VEHICLES
1	Cycle	220
2	2 Wheeler	265
3	3 Wheeler	194
4	Passenger car, pickup van	234
5	Agricultural Tractor/LCV	223
6	Bus	247
7	Truck	469
8	Tractor with trailer (includes water tanker)	326
9	Multi Axle	107
Average vehicle/day		2285
Type of area		Rural
Recommended Design Service for Single lane roads(PCU/day)		2000

Table 3-20 Vehicle type Equivalency according to IRC 064

Vehicle type Equivalency		
Fast vehicle		
1	2-Wheeler	0.5
2	Passenger car, pickup van	1.0
3	Auto rickshaw	1.0
4	LCV	1.4
5	Truck/bus	3.0
6	Agricultural tractor trailer	4.5
Slow vehicle		
7	Cycle	0.5
8	Cycle Rickshaw	2.0
9	Horse drawn vehicle	4.0

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Vehicle type Equivalency		
Fast vehicle		
10	Hand cart	3.0

Table 3-21 Level of Service of Service road- With proposed expansion of project at Main Road

Route	Total PCU/day	C(PCU/day)	V/C ratio	LOS
Route-1	5104	2000	0.11	A

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

CONCLUSION

The existing road network is adequate to handle the increased traffic load. The traffic density on the surrounding roads of the mine site is average and capable of handling of increased traffic.

Level of Service is “A” i.e. Excellent Main road connecting with the proposed project of Basupali Stone Quarry. The Management of Basupali Stone Quarry is committed to contribute in maintaining road so that quality of road remains Excellent. Thus, due to mining operations the Level of service is acceptable.

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3.14.1 Evacuation Route for vehicular movement

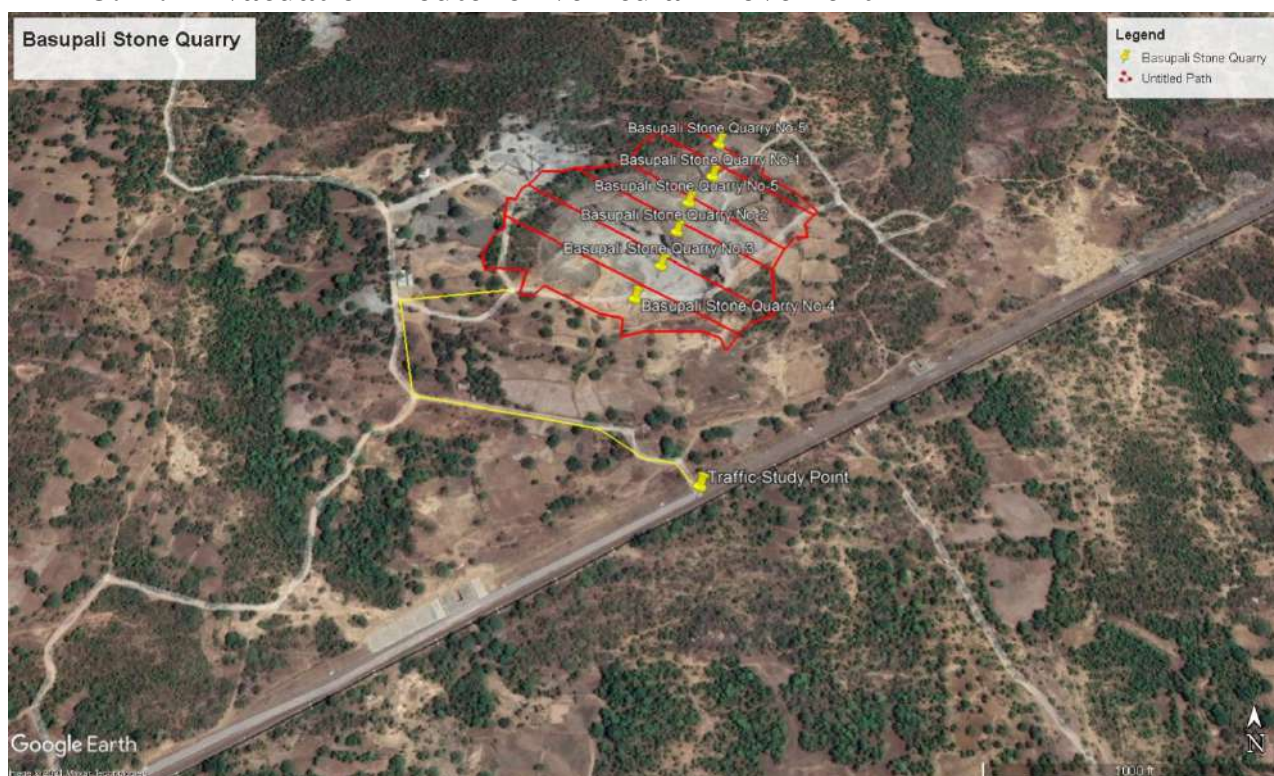


Figure 3-17 Evacuation Path

- ✓ Approximately 0.66 Km long approach road in east connects mine to Highway
- ✓ There is no school/market or hospital coming in evacuation route. Transportation through densely populated areas or through habitation would be avoided over all.
- ✓ Lessee will contribute in order to maintaining and repairing the approach road during development.
- ✓ In order to repairing and maintaining the village Road the required materials must be of standard quality as per P.W.D. Norms.
- ✓ Plantation is also recommended on both sides of the approach road with tree guards. Particular emphasis will be given to the area facing village.

3.15 Biological Environment

Biological resources of the area are an indicator of quality/health of the environment of the area. Therefore, the study of the same is an important aspect to minimize the distribution due to the intervention of the proposed project to accept in a sustainable approach. To achieve the goal, EIA study was conducted during 1st March 2021 to 31st May 2021 to cover all the biological parameters.

Nature supports a great variety of living beings under a structural and functional unit called ecosystem. In any natural ecosystem, there are several components which exist in harmony and survive only by interdependence. These components may be either biotic or abiotic. Developmental

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activities often have great impacts on the biodiversity both ecosystems as well as species level. Present study has been carried out to inventories the biodiversity exist in the study area of present project, to evaluate the possible impacts on biodiversity due to project activities and suggest effective mitigation measures against the negative impacts.

The ecological study was undertaken to understand the present status of ecosystem of the area, to predict changes as a result of proposed activities and to suggest measures for maintaining the conditions. This carried through primary survey and secondary data collected from various Government agencies like Forest Department, Agriculture Department, Scientific literatures etc.

The animal and plant communities co-exist in a well-organized manner. Their natural settings can get disturbed by any externally induced anthropological activities or by naturally occurring calamities or disaster. So, once this setting is disturbed, it sometimes is either practically impossible or may take a longer time to come back to its original state. Hence changes in the status of flora and fauna are an elementary requirement of Environmental Impact Assessment studies, in view of the need for conservation of environmental quality and biodiversity. Information on flora and fauna was collected within the study area.

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Table 3-22 List of Flora Plants recorded in the core zone

Sr. No	Species Name	Common name	Family
1.	<i>Acacia catechu</i>	Khaira	Fabaceae
2.	<i>Aegle marmelos</i>	Bela	Rutaceae
3.	<i>Ailanthus excels</i>	Mahala	Simaroubaceae
4.	<i>Alstoniascholaris</i>	Chatiana	Apocynaceae
5.	<i>Albizia lebbek</i>	Sirsa	Mimosaceae
6.	<i>Anogeissus latifolia</i>	Dhau	Combretaceae
7.	<i>Anogeissus acuminata</i>	Phasi	Combretaceae
8.	<i>Artocarpus heterophyllus</i>	Panas	Moraceae
9.	<i>Averrhoa carambola</i>	Karamanga	Oxalidaceae
10.	<i>Azadirachta indica</i>	Nimba	Meliaceae
11.	<i>Bauhinia variegata</i>	Kanchana	Fabaceae
12.	<i>Barringtonia acutangula</i>	Hinjal	Lecythidaceae
13.	<i>Bedelia Retusa</i>	Kasi	Cycadaceae
14.	<i>Bombax ceiba</i>	Simuli	Malvaceae
15.	<i>Boswellia serrate</i>	Salai	Burseraceae
16.	<i>Bridellia retusa</i>	Kasi	Phyllanthaceae
17.	<i>Buchanania lanzan</i>	Chara	Anacardiaceae
18.	<i>Butea monosperma</i>	Palasa	Fabaceae
19.	<i>Butea parviflora</i>	Handiphuta	Fabaceae
20.	<i>Carica papeya</i>	Amrutabhand	Caricaceae
21.	<i>Careya arboria</i>	Kumbhi	Lecythidaceae
22.	<i>Cassia fistula</i>	Sunari	Fabaceae
23.	<i>Cassia siamea</i>	Chakunda	Fabaceae
24.	<i>Cleistanthus collinus</i>	Karada	Phyllanthaceae
25.	<i>Couropita guianensis</i>	Nageswar	Lecythidaceae
26.	<i>Datura metel</i>	Dudura	Solanaceae
27.	<i>Diospyros melanoxylon</i>	Kendu	Ebenaceae
28.	<i>Diospyros embryopteris</i>	Mankada Kendu	Ebenaceae
29.	<i>Dalbergia latifolia</i>	Pahadi Sisoo	Fabaceae
30.	<i>Erythrina variegata</i>	Paladhua	Fabaceae
31.	<i>Ficus carica</i>	Dimiri	Moraceae
32.	<i>Holarrhena pubescens</i>	Kurua	Apocynaceae
33.	<i>Morinda tinctoria</i>	Achhu	Rubiaceae
34.	<i>Messua ferrea</i>	Nageswar	Calophyllaceae
35.	<i>Madhuca indica</i>	Mahula	Sapotacea
36.	<i>Oroxylon indicum</i>	Phanphana	Bignoniaceae
37.	<i>Pterocarpus marsupium</i>	Piasal/ Bijasal	Fabaceae
38.	<i>Streblus asper</i>	Sahada	Moraceae
39.	<i>Saraca indica</i>	Ashoka	Fabaceae
40.	<i>Strychnos patatorum</i>	Nirmala	Strychnaceae



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Sr. No	Species Name	Common name	Family
41.	<i>Terminalia arjuna</i>	Arjuna	Combretaceae
42.	<i>Tectona grandis</i>	Teak / Saguan	Lamiaceae

Table 3-23 Trees found during Site Visit

Trees found during site visit			
Sr. No.	Common Name	Species Name	Family
1	Ashoka	<i>Polyalthia longifolia</i>	Annonaceae
2	Neem	<i>Azadirachta indica</i>	Meliaceae
3	Aam	<i>Mangifera indica</i>	Anacardiaceae
Shrubs			
1	Kaner	<i>Nerium oleander</i>	Apocynaceae
2	Peeli kaner	<i>Thevetia peruviana</i>	Apocynaceae
3	Chameli	<i>Jasminum sp.</i>	Oleaceae
Grass			
1	Doob ghas	<i>Cynodon dactylon</i>	Poaceae
2	Sheda Grass	<i>Dichanthium annulatum</i>	Poaceae
3	Makra	<i>Dactyloctenium aegyptium</i>	Poaceae

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Status of Fauna

The various animal species in the study area are reported in below table. Richness of plant species of the region is the prime cause for animal richness.

Core zone: Avifauna

Overall 9 species belonging to 8 families were observed in the core zone (Existing Plant site) of the study area during the field survey. The dominant species were Red-wattled lapwing, and Cattleegret.

Table 3-24 List of Avifauna species recorded in the Core Zone

S.No	Common Name	Scientific name	Family	Status (IWPA 1972)
1	Bank myna	<i>Acridotheres ginginianus</i>	Sturnidae	Schedule IV
2	Black drongo	<i>Dicrurus macrocercus</i>	Dicruridae	Schedule IV
3	Cattle egret	<i>Bubulcus ibis</i>	Ardeidae	Schedule IV
4	Collared dove	<i>Streptopelia decaocto</i>	Columbidae	Schedule IV
5	Green bee-eater	<i>Merops orientalis</i>	Meropidae	No mention
6	House crow	<i>Corvus splendens</i>	Corvidae	Schedule V
7	Red-vented bulbul	<i>Pycnonotus cafer</i>	Pycnonotidae	Schedule IV
8	Red-wattled lapwing	<i>Vanellus indicus</i>	Charadriidae	No mention
9	Rock Pigeon	<i>Columba livia</i>	Columbidae	Schedule IV

Mammals

A total of 04 species were observed in the core zone (Existing Plant site) during the field survey. i.e. five striped palm squirrel (*Funambulus pennantii*) and common house rat (*Rattus rattus*). These species are very common in the study area and usually uses wide variety of the habitats.



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Table 3-25 Mammalian species recorded in Core Zone

S. No.	Vernacular Name	Scientific Name	Family	Category	
				Schedule (IWPA 1972)	IUCN Ver. 3.1
1	Five stripped palm Squirrel	<i>Funambulus pennantii</i>	Sciuridae	IV	LR-lc
2	Common House rat	<i>Rattusrattus</i>	Muridae	V	LC
3	Indian Gerbil	<i>Tateraindica</i>	Muridae	V	LRlc
4	Black Rat	<i>Rattusrattus</i>	Muridae	V	LRlc

Amphibian

No species of amphibian fauna was reported during the field survey in the core zone (Existing Plantsite) of the study area.

Reptiles

Two species was observed in the core zone (Existing Plant site) during the field survey. i.e Oriental Garden Lizard.(*Calotesversicolor*) and Common garden Skink (*Eutropismacularia*).

Amphibian

No species of amphibian fauna was reported during the field survey in the core zone (Existing Plantsite) of the study area.

Reptiles

Two species was observed in the core zone (Existing Plant site) during the field survey. i.e Oriental Garden Lizard.(*Calotes versicolor*) and Common garden Skink (*Eutropis macularia*).

Table 3-26 Reptiles recorded in core zone

S.No.	Vernacular Name	Scientific Name	Family	Category	
				Status(IWPA)	IUCN
1	Oriental Garden Lizard	<i>Calotes versicolor</i>	Agamidae	-	LC
2	Common garden skink	<i>Lampropholis guichenoti</i>	Scincidae	-	LRnt

Mammals:

The dominant species were *Funambulus pennantii* (Five stripped palm squirrel) and *Boselaphus tragocamelus*.

Table 3-27 List of mammalian species recorded in Buffer Zone

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S.No.	Vernacular Name	Scientific Name	Family	Status (IWPA-1972)
1.	Five stripped palm squirrel	<i>Funambulus pennantii</i>	Sciuridae	IV
2.	Common House rat	<i>Rattus rattus</i>	Muridae	V
3.	Grey Musk Shrew	<i>Suncus murinus</i>	Soricidae	--
4.	Indian Hare	<i>Lepus nigricollis</i>	Leporidae	IV
5.	Indian field mouse	<i>Mus booduga</i>	Muridae	V
6.	Nilgai	<i>Boselaphus tragocamelus</i>	Bovidae	III
7.	Wild pig	<i>Sus scrofa</i>	Suidae	III
8.	Mongoose	<i>Herpestes edwardsii</i>	Herpestidae	II

Table 3-28 Amphibian recorded in buffer zone

S. No. & Family	Vernacular Name	Common English Name	Conservation Status		
			IUCN	CITES	IWPA
1. Bufonidae					
1.	<i>Bufo melanostictus</i>	Common Indian Toad	VU	--	--
2. Ranidae					
2.	<i>Hoplobatrachus tigerinus</i>	Indian Bull Frog	VU	App. II	chedule-IV

Reptiles

The dominant species was Oriental Garden Lizard (*Calotes versicolor*).

Table 3-29 List of reptiles recorded in Buffer Zone

S.No.	Vernacular Name	Scientific Name	Family	Status (IWPA)
1	Common House Gecko	<i>Hemidactylus frenatus</i>	Gekkonidae	No mention
2	Oriental Garden Lizard	<i>Calotes versicolor</i>	Agamidae	No mention
3	Indian sand boa	<i>Eryx johnii</i>	Boidae	Schedule IV
4	Common Rat Snake	<i>Ptyas mucosus</i>	Colubridae	Schedule II

Butterflies:

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Table 3-30 Butterflies Recorded in the Study Area

S. No.	Species	Scientific Name	Family
1	Crimson Rose	<i>Pachliopta hector</i>	Papilionidae
2	Lime Butterfly	<i>Papilio polymnestor</i>	Papilionidae
3	Yellow Pansy	<i>Junonia hierta</i>	Nymphalidae
4	Blue Pansy	<i>Junonia orithya</i>	Nymphalidae
5	Plain Tiger	<i>Danaus chrysippus</i>	Nymphalidae
6	Common Grass Yellow	<i>Eurema hecabe</i>	Pieridae

3.16 Socio Economic Assessment

Socio-economic environment is an essential part of environmental study which incorporates various facts related to socio-economic conditions in the area and deals with the total environment.

Socio - economic study includes demographic structure of the area, provision of basic amenities viz. housing, education, health and medical services, occupation, water supply, sanitation, communication, transportation, prevailing diseases pattern as well as feature of aesthetic significance such as temples, historical monuments etc. at the baseline level. This would help in visualizing and predicting the possible impact depending upon the nature and magnitude of the project. Socio-economic study of an area provides a good opportunity to assess the socio-economic conditions of an area.

This study will possibly estimate the change in living and social standards of the particular area benefitted due to the project. The gross economic production of the area will be increased substantially due to the existence of this project. It can undoubtedly be said that this project will provide direct and indirect employment and improve the infrastructural facilities and living standards of the area.

3.16.1 Socio Economic Assessment

The objective of the study is to know the current socio-economic situation in the region, to recommend practical strategic interventions in the sector and to help in providing better living standards

Scope of work is to study the Socio-economic Environment of area, prediction of project impact and suggesting mitigation measures.

Collection of Data:

Data for this project were collected via primary sources (field survey) and secondary sources (i.e. Government department, maps, literature research etc) in the study area.

Presentation of Data and Analysis:

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The data collected were presented in a suitable, concise form for further analysis. The collected data were presented in the form of tabular or diagrammatic or graphic form. These tabulated data were interpreted and analyzed with the help of various qualitative techniques and ideographic approaches.

- A mixture of both quantitative and qualitative approach has been adopted in the current socio-economic study.
- The study has been conducted based on primary and secondary data. While primary data has been collected through a sample survey of selected households, the secondary data has been collected from the administrative records Census 2011, district hand books etc.
- The details regarding population composition, number of literates, workers etc. have been collected from secondary sources and analyzed. Also village/city/town wise details regarding amenities available in the study area have been collected from secondary sources and analyzed.
- Two stage sampling design has been adopted to select the sampling units. The first stage units are census villages in the rural areas and towns/cities in urban areas. The ultimate stage units are households in the selected villages and towns/cities. Simple Random Sampling without Replacement (SRSWOR) has been adopted to select the sampling units.
- Estimation of various parameters has been made based on sample data and bottom top approach has been adopted.
- On the basis of a preliminary reconnaissance survey, two questionnaires were developed to make it suitable to fulfil the objectives of the study. The questionnaires contained both open ended and close ended questions
- The data collected during the above survey was analyzed to evaluate the prevailing socio-economic profile of the area.
- Based on the above data, impacts due to operation on the community have been assessed and recommendations for improvement have been made.

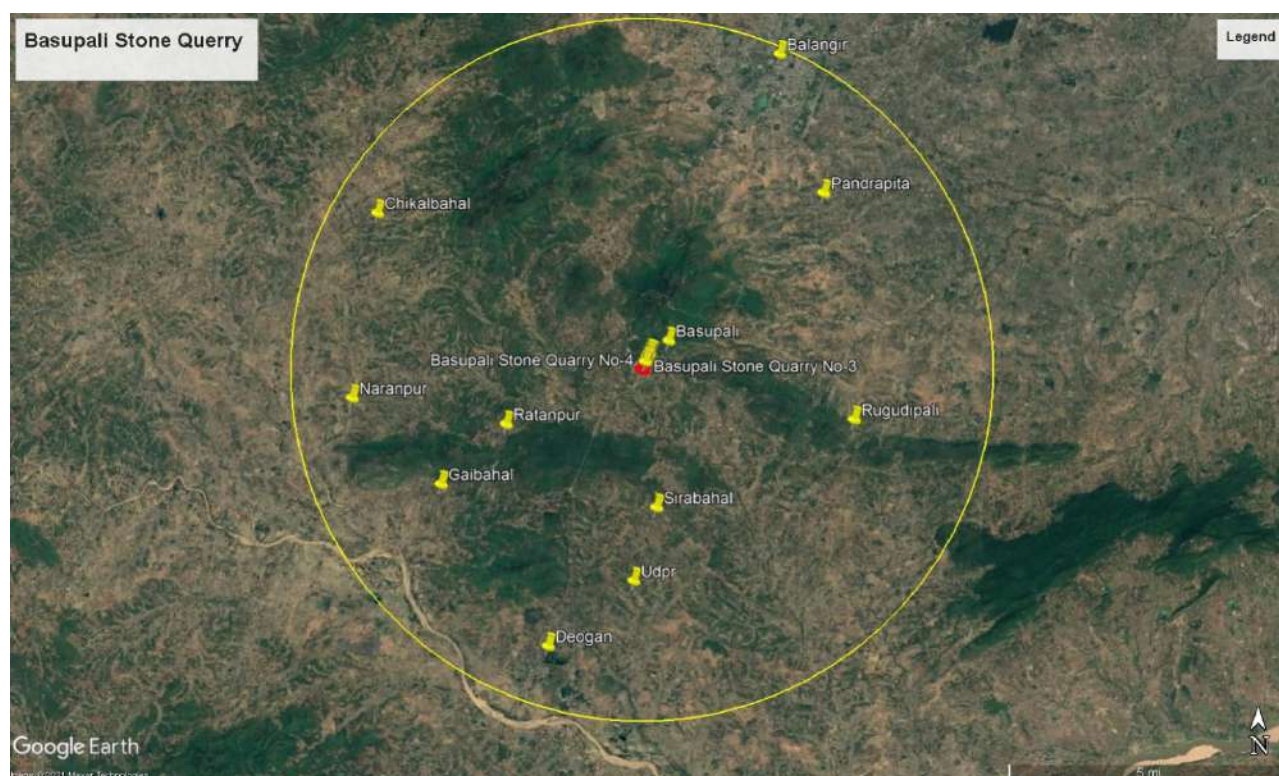
3.16.2 Background of the Study area

Balangir also known as Bolangir, is a city and municipality, the headquarters of Balangir district in the state of Odisha, India. Balangir has a rich cultural heritage. It is also known as the cultural hub of Odisha. Balangir municipality is divided into twenty-one wards. It is spread over an area of 12,200 acres (4,900 ha).

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3.16.3 Demographics

There are 11 villages in the study area. The demographic pattern of all the settlements as per 2011 census is given in below table. A study has been undertaken with respect to demography, occupational pattern, literacy rate and other important socio-economic indicators of these Villages to reveal the socioeconomic structure of the entire project area.



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Table 3-31 List of villages present in the study area

Sr. No.	Name of Village	Distance from the Project Site	Direction from the Project Site
1.	Basupali	1.48	NE
2.	Pandrapita	7.06	NE
3.	Chikalbahal	8.62	NW
4.	Balangir	9.24	N
5.	Naranpur	8.63	W
6.	Ratanpur	4.27	SW
7.	Rugudipali	6.36	SE
8.	Gaibahal	6.72	SW
9.	Sirabahal	4.27	S
10.	Udpr	6.05	S
11.	Deogaon	8.5	S

3.16.4 Population

There are 3481 households in the study area consisting of total population of 51688. A group of persons who normally live together and take their meals from a common kitchen are called a household. Persons living in a household may be related or unrelated or a mix of both. However, if a group of related or unrelated people live in a house but do not take their meals from the common kitchen, then they are not part of a common household. Each such person is treated as a separate household. There may be one member households, two member households or multimember households. Average number of people in one household is 4.7 in the study area. Village wise details of the population are given in table below.

Table 3-32 Village-wise details of Population

S. No	Village	No of Households	Total Population	Male	Female	Sex Ratio (females/males)*1000
1.	Basupali	12	40	21	19	904
2.	Pandrapita	197	755	369	386	1046
3.	Chikalbahal	437	1800	899	901	1002
4.	Balangir	25476	102952	52076	50876	976
5.	Naranpur	54	228	121	107	884

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6.	Ratanpur	127	580	295	285	966
7.	Rugudipali	247	927	456	471	1032
8.	Gaibahal	187	729	358	371	1036
9.	Sirabahal	107	429	230	199	865
10.	Udpr	75	325	170	155	911
11.	Deogaon	24769	97645	49005	48640	992
Total		51688	206410	104000	102410	Average:964

3.16.5 Sex Ratio

Sex ratio is number of females per 1000 males. As per the census 2011, the number of females per 1000 males is around 904. This is a good sex ratio. In some villages, sex ratio is threateningly low, reaching to a minimum of 884 in Naranpur. The maximum sex ratio reaches to 1046 in Pandrapita, which is a healthy sex ratio.

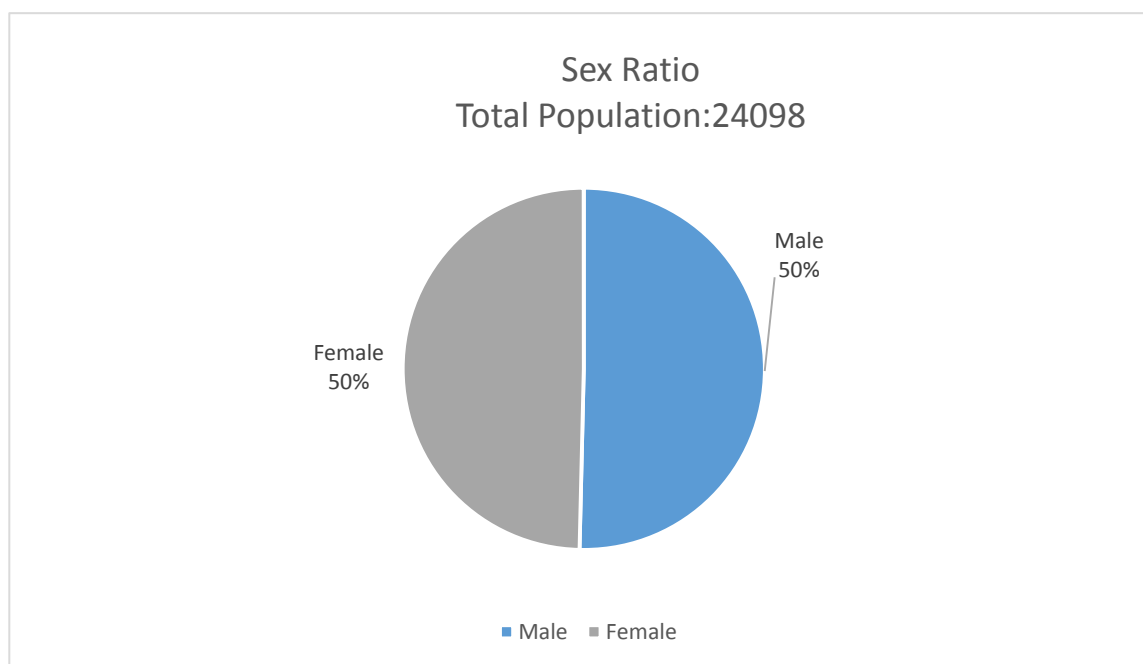


Figure 3-18 Population of the study area

The occupational profile has been classified based on the available 2011 census classification. A person is treated as main worker if the person has worked for a major part of the year (180 days or more). A marginal worker is a person who has worked for some time during a year but adding upto 180 days in a year. Those who have not worked throughout the year are treated as non-workers.

Total Worker:

Work is defined as economically productive activity with or without compensation or wages. Such participation may be physical or mental or physical in nature, also, it includes both working and

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supervising and directing the work. It even includes part time help or unpaid work on farm, family enterprise or its economic activity. Number of total workers in the area is 8124 which is 50% of the total population. Out of the total working population, 60.9% is male working population whereas 39.1% is female working population. The total working population is further divided into main and marginal working population.

Main Working Population:

The term is used for people who have worked for a major part of the year, such as 6 months for reference. Out of total working population, main working population is 5488 which is 67.55%.

Marginal Working Population:

Marginal workers constitute of people who have been involved in work but not for a major part of the year (less than six months). The number of marginal workers in the study area is 2636 which is 32.45% of the total working population.

Cultivator:

A person is called cultivator if he or she is engaged in cultivation of land own or from government or held from private persons or institutions for payment in money, kind or share. Cultivation work includes effective supervision or direction in cultivation. A person who has given out her/his land to another person or institution(s) for cultivation for money, kind or share of crop and who does not even supervise or direct cultivation process is not treated as cultivator. Similarly, a person working on another person's land for wages in cash or kind or combination of both is not treated as cultivator. Total cultivators in study area are 3534 which is approx. 43.5% of the total workers.

Agricultural Labourers:

Persons working on the land of others for wages or share in the yield have been treated as agricultural labourers. The total workers of this category are about 1327 which is approx. 16.33% of the total workers and 8.2% of total population.

Household Workers:

Household industry is defined as an industry conducted by one or more members of the household at home or near area and only within the precincts of the house where the household lives in urban areas. The larger proportion of the household industry consists of the members of the household. The industry is not run on the scale of a register company or qualifies or has to be registered under the Indian Factories Act. Household industry relates to production, processing, servicing, repairing or making and selling but not includes professions such as a pleader, Doctor, Musician, Dancer, Waterman, Astrologer, Dhobi, Barber, even if such professions, trade or services are run at home by members of the household. The total workers of this category are about 94 which is 1.2% of the total working population.

Other Workers:

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All workers, i.e., those who have been engaged in some economic activity during the last one year are other workers. The type of workers that come under this category is government servants, municipal employees, teachers, factory workers, plantation workers, those engaged in trading, transport, banking, mining, construction, political or social work, priests, entertainment artist, etc. In effect, all workers except cultivators or agricultural labourers or household industry workers are other workers. The total workers of this category are about 533 which is 6.56% of total workers.

Non-workers:

The non-workers include those engaged in unpaid household duties, students, retired persons, dependants, beggars etc. The total number of non-workers population is 8139 which 50% of the total population. Out of which 44.5% is male and 55.6% is female.

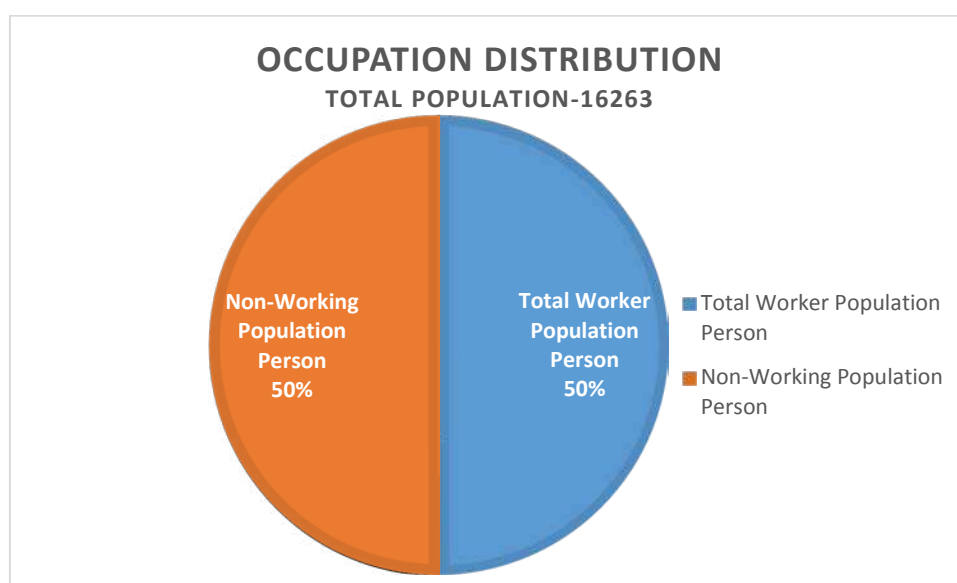


Figure 3-19 Occupational Pattern of the study area

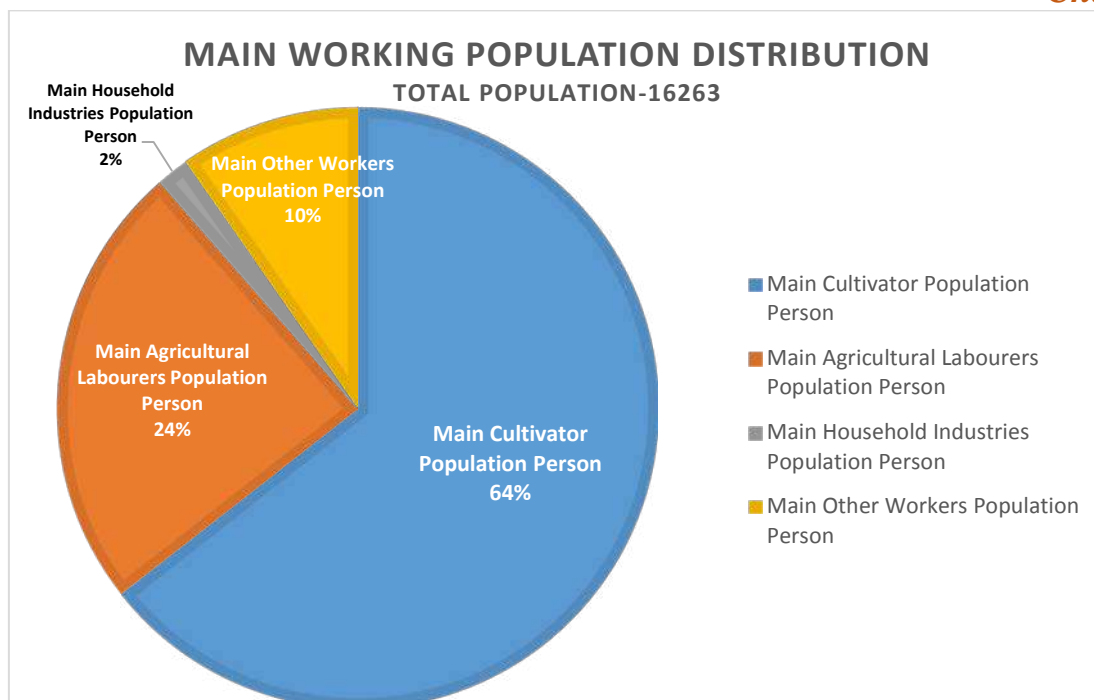


Figure 3-20 Occupational Pattern in Main Working Population in the Study Area





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Chapter 4 Anticipated Impacts and Mitigation Measures

4.1 Introduction

The environmental parameters likely to be affected by mining are related to many factors, i.e. physical, social, economic, agriculture and aesthetic value. The proposed mining activity involves Excavation, loading and transport of minerals. The operations may disturb the environment of the area in various ways, such as removal of mass, change of landscape, flora and fauna of the area, surface drainage, and change in air, water and soil quality. While for the purpose of development and economic upliftment of people, there is need for establishment of mining industries, but these should be environment friendly. Therefore, it is essential to assess the impacts of mining on different environmental parameters, before starting the mining operations, so that abatement measures could be planned in advance for eco - friendly mining in the area. Identification of all potential environmental impacts due to any proposed project is an essential step of Environmental Impact Assessment. Open cast mines, which are more, preferred now for rapid increase in mineral production and safety reasons, cause significant impacts on land use, drainage, air quality, ecology, noise etc., if adequate control measures are not taken to prevent/mitigate the adverse environmental impacts. On the other hand, there is continuous urge of new industries establishment and mining for economic upliftment and development, therefore, it is essential to assess the impacts of every project on different environmental parameters, before starting the operations. It facilitates in advance planning of pollution abatement measures for eco- friendly development in the area.

4.2 Methodology of Impact Assessment

The impact assessment has been undertaken following a systematic process that identifies, predicts and evaluates the impacts, the project could have in aspect of the physical, biological, social/ socio-economic and cultural environment, and identifies measures that the project will take to avoid, minimize/reduce, mitigate, offset or compensate for adverse impacts; and to enhance positive impacts where practicable. The stages of the impact assessment process comprise of the following:

- **Impact identification:** To identify the potential impact of the project on the various environmental parameters.
- **Impact prediction:** To determine what could potentially happen to resources/receptors as a consequence of the project and its associated activities.
- **Impact evaluation:** To evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resources/ receptors.
- **Impact mitigation:** To identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.

4.3 Basics of Impact Assessment

The impact of the proposed project will be assessed on the basis of their characteristics i.e. nature, type, extent, duration, intensity & frequency and its significance.

Characteristics of Impacts

The impact is described in terms of its characteristics such as nature, type etc. Impact characteristics are given in Table - 4.1.

Table 4-1 Impact Characteristics

Characteristic	Classification	Description
Nature	Positive impact	When impact is considered to represent improvement to baseline or introduce a new positive factor/change.
	Negative impact	When impact is considered to represent adverse change from the baseline or introduce a new undesirable factor/change.
	Neutral	When there is no impact to represent any change from the baseline and not introducing any new factor/change.
Type	Direct impact	Resulting from a direct interaction between a project activity and the receiving environment / receptors.
	Indirect impact	Resulting from other activities that happened as a consequence of the project.
	Cumulative impact	Impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the Project.
Extent	Project Area	When impact due to the project related activities is restricted within the premises of project area i.e. core zone.
	Local	When impact due to the project related activities is restricted within the immediate surroundings i.e. up to 3 km radius.
	Zonal	When impact due to the project related activities is restricted within the study area i.e. up to 10 km radius.

Characteristic	Classification	Description
	Regional	When an impact due to the project activity extends within as well as beyond 10 km radius.
Duration	Short – term	When the impact is usually temporary or last for a short time or will have an effect soon rather than in the distant future.
	Long- term	When impact would occur during the development of the project and either takes a long time or lasts a long time or cause a permanent change in the affected receptor/resource.
Intensity	Low	When resulting in slight changes of prevailing baseline conditions and quality of existing physical environment is good. Ecological environments as well as human receptors are not likely to be affected due to the proposed project activity.
	Medium	When resulting in changes of prevailing baseline conditions which are within the benchmark norms and quality of existing physical environment shows some signs of stress. Ecological environment as well as human receptors could be sensitive to change in quality of prevailing baseline condition, but human receptors retain an ability to adapt to change.
	High	When resulting in changes of prevailing baseline conditions which are exceeding the benchmark norms and quality of existing physical environment is already under stress. Ecological environment as well as human receptors would be impacted to the larger extent and the ability of human receptors to adapt to changes would be undermined.
Frequency	Remote (R)	When resulting in remote or one-off chance of an event due to an activity on a receptor/ resource.
	Occasional	When an impact due to an activity is occurring

Characteristic	Classification	Description
	(O)	intermittently from time to time on a receptor/resource.
	Periodic (P)	When an impact due to an activity is resulting on periodic basis for a week or a month on a resource/receptor.
	Continuous (C)	When an impact due to an activity is continuously resulting on a resource/receptor.

Significance of Impacts

Impacts are described in terms of 'significance'. Significance is a function of the magnitude & sensitivity / importance of the impact.

Classification of impact significance is given in Table - 4.2.

Table 4-2 Significance of Impact

Significance	Description
Insignificant	Negligible impact or where a resource or receptor (including people) will not be affected in any way by a particular activity, or the predicted effect is deemed to be 'negligible' or 'imperceptible' or is indistinguishable from natural background variations.
Minor	Where an effect will be experienced, but the impact is well within accepted standards/guidelines with or without mitigation.
Moderate	Where an effect will be experienced and the impact is within accepted standards/guidelines with mitigation.
Major	Impact where an accepted limit or standard may be exceeded or the impact occur to the highly valued/sensitive resource/receptors.

Irreversible and Irretrievable commitments of environmental components

Determining the irreversible and irretrievable commitments of the resources is one of the major stages of impact evaluation, which gives an understanding about the potential impacts that are likely to affect future generations of the area and facilitates for adoption of proper mitigation measures regarding the same.

Table 4-3 Irreversible and Irretrievable commitments of environmental Components

Commitment of resources	Description
Irreversible	Irreversible commitments of resources refer to the impact or loss of the resources that cannot be recovered or reversed. Irreversible is a term that describes the loss of future options. It applies primarily to the impacts of use of nonrenewable resources or to those factors that are renewable only over long periods of time.
Irretrievable	Irretrievable is a term that applies to the loss of production, harvest, or use of natural resources. Irretrievable commitment of resources may be considered as the loss of resources as a result of change (both reversible & irreversible) due to any project activity that cannot be regained or recovered.

4.4 Interaction Matrix

The interaction matrix enables a methodical identification of the potential interactions each project activity may have on the range of resources/receptors within the Area of Influence for the Project.

The interaction matrix for the project activities and likely impacted resources/receptors is presented in Table - 4.4 which covers potential interactions, regardless of probability of occurrence. The matrix consists of a list of resources/ receptors that could be affected against a list of project activities.

Entries in the matrix cells are tick marked to indicate whether:

- An interaction is not reasonably expected (blank);
- The interaction is reasonably possible and may lead to potential impact (tick marked).

Table 4-4 Interaction Matrix

S. No.	Project Activity Likely Impacted Resources / Receptors	Mine development & Process		Reclamation and Greenbelt/plantation		Miscellaneous
		Mining Operation (excavation with Drilling, blasting)	Loading and unloading of mined out material	Dump formation (terracing, construction of garland drains & retaining walls)	Greenbelt Development and along roads. Plantation at conceptual stage	Meeting points of workers/ employees i.e. Rest shelter, canteen
A.	Physical					
1.	Air	√	√	√		
2.	Noise & / Vibration	√	√		√	√
3.	Land Use			√	√	
4.	Topography	√		√		
5.	Geology			√		
6.	Drainage Pattern					
7.	Surface Water					√
8.	Ground Water					
9.	Soil		√	√	√	√
B.	Biological					
1.	Flora	√	√	√	√	
2.	Fauna	√		√	√	
3.	NP/WLS/BR/reserves/Forests etc.					
C.	Social / Socio-Economic					
1.	Demography					
2.	Physical Displacement					
3.	Land Use (w.r.t. Population influx)					
4.	Habitation					
5.	Economy & Livelihood	√				
6.	Social & Cultural Structure					
7.	Infrastructure & Public Services	√				
8.	Public Health		√		√	

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9.	Agriculture	√	√			
10.	Transport Infrastructure			√		
D. Occupational Health						
1.	Injury		√			
2.	Health					
3.	Non - routine risk		√			
	Legends	() - Show no interactions is reasonably		(√) - Show interactions reasonably possible with one of the outcomes may lead to potential impact		

According to the interactions identified between project activities and resource/receptors as described in the above Table, it is evident that the following aspects are likely to have impact due to the mining project (Table - 4.5) and therefore, to be considered for Impact Assessment:

Table 4-5 Likely Impacted Resources/ Receptors

S. No.	Likely Impacted Resources / Receptors	
A.	Physical	Air Quality
		Noise Level, ground vibrations
		Water environment (Surface & Ground water)
		Soil Environment
		Land Use
		Geology & Topography
B.	Biological environment	Flora
		Fauna
C.	Socio economic environment	Habitation & Demography
		Physical Displacement
		Land use (w.r.t. population influx)
		Economy & Livelihood
		Social & Cultural Structure

		Infrastructure & Public Services
		Public Health
		Agriculture
		Transport Infrastructure
D.	Occupation Health & Safety	Injury
		Health
		Non Routine Risk

4.5 Environmental Impact Assessment and Mitigation Measures

The proposed mining activities may disturb environment in various ways such as degradation of land, dust generation, deterioration of water and soil quality, affecting the biological and socio-economic environment of the area. The impacts of mining on various environmental parameters were assessed and are given below:

4.5.1 Air Pollution

i) Gaseous Pollution

Gaseous pollutants (SO_2 and NO_x) are anticipated from HEMMs like drills excavator, loaders, dumpers, and other vehicles.

ii) Particulate Matter

The generation of dust is anticipated from various mining activities like drilling, blasting, excavation, loading, unloading and transportation, and other mining related activities. The ambient air quality monitored during Winter Season from 1st December 2020 to 28th February 2021, Table-3.6 shows that the PM concentration in the surrounding villages are within the prescribed limits, which indicates negligible or no impact from proposed mining activities on ambient air quality.

4.5.1.1 Ambient Air Quality Impact Prediction Modelling

Impact Prediction is an important part of Environmental Impact Assessment Study. There are various techniques available to predict the impacts. Mathematical modeling is an established and accepted technique for the same.

The ambient air quality depends upon emission sources, meteorological conditions and the topographical features of the study area. The impact of any future emission activities can be accessed through air quality modelling. Air quality modeling is a mathematical replication of how air pollutants disperse and transport to the receptor considering the effect of meteorology and site terrain. An air quality models reflects a mathematical description of hypothesis

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conveying the behavior of some physical process or other and not exact replica but contain some of nature's essential elements. Air quality managers use models to identify source contributions to air quality problems and assist in the design of effective strategies to reduce harmful air pollutants.

This report gives the cumulative peak incremental concentration of Particulate Matter to a distance of 10 km, due to the mining & allied activity. The concentrations have been predicted in all directions covering study period. Spatial distributions of all the pollutants are also presented in the form of Isopleths.

4.5.1.1.1 Air Quality Dispersion Modelling

Due to complexity in the mining activities, high source roughness and different types of sources, USEPA regulatory model i.e. AERMOD is one of the suitable models which can take care all the sources and predict the pollutant concentration more satisfactorily. Prediction of incremental ground level concentrations (GLC's) due to Stone Quarry has been made by AERMODCLOUDE as per CPCB guidelines.

It is US-EPA approved model for prediction of the air quality. The model uses rural dispersion and regulatory default options as per guidelines on air quality models (PROBES/70/1997-1998). USEPA has replaced the ISCST3 model with AERMOD as regulatory model.

4.5.1.1.2 Meteorological Data/Input Parameters

Data at the weather monitoring station on wind speed, direction, and temperature at one-hour interval for the monitoring period has been used as meteorological input.

4.5.1.1.3 Ambient Air Quality Standards

Ambient air quality standards promulgated by National Ambient Air Quality Standards for different areas are as follows:

Table 4-6 Ambient Air Quality Standards

Area	Time Weighted Average	Concentration ($\mu\text{g}/\text{m}^3$)			
		PM ₁₀	PM _{2.5}	SO ₂	NO _x
Industrial Area, Residential Rural and Other Areas	Annual Average *	60	40	50	40
	24 hours **	100	60	80	80
Ecologically Sensitive Area (Notified by Central Govt.)	Annual Average *	60	40	20	30
	24 hours **	100	60	80	80

4.5.1.1.4 Presentation of Results

In the present case, model simulations have been carried out for mining project to obtain an optimum description of variations in concentration over the site in 10 km radius covering 12 directions.

The incremental concentrations have been estimated based on mathematical emission data-based modeling. For each time scale, i.e. for 24 hrs, the model computes the maximum GLC observed during the period over all the measurement points. Existing value has been covered in the Background Ambient Air Quality Monitoring. Details are given as under:

For volume Source

The maximum incremental GLCs due to the mining project operation for PM, is superimposed on the maximum baseline PM, concentration recorded at the monitoring locations during the field monitoring period.

Mainly fugitive emission will be generated from mining operation which will be restricted nearby the lease boundary by using proper dust suppression measures.

Dust emissions generated due to area source will be controlled by various measures viz wet drilling, controlled blasting, Preventive maintenance of HEMMs, and regular water sprinkling on blasted muck pile etc other than this, use of PPEs for workers working in high dust zone and development of green belt will be adopted.

For Line Source:

Dust emissions due to transportation of material will be generated and pollution control measures like water sprinkling on haul roads, development of green belt will be adopted.

Gaseous emission i.e. SO₂ & NO_x will be generated due to combustion of fuel in transportation and pollution control measures will be adopted like, proper maintenance of vehicles. Also, emission levels will be maintained as per EuroVI standards.

4.5.1.2 Meteorological Data

Meteorological file comprising wind direction, wind speed, ambient temperature, has been prepared for modelling purpose. Details of the same are given in chapter 3.

1. Particulate Matter (PM₁₀):

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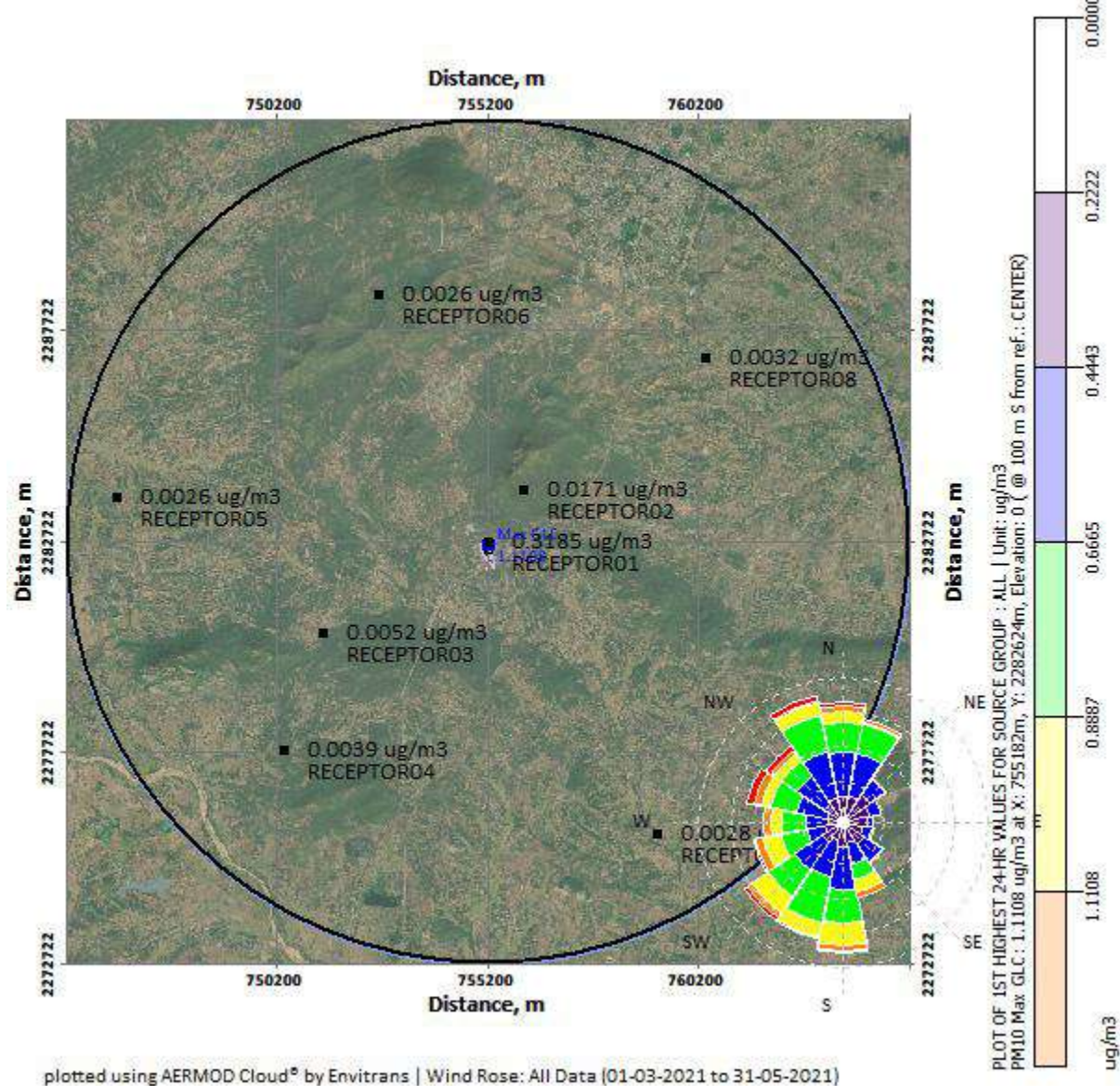


Figure 4-1 Isopleth for PM_{10}

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2. NO_x:

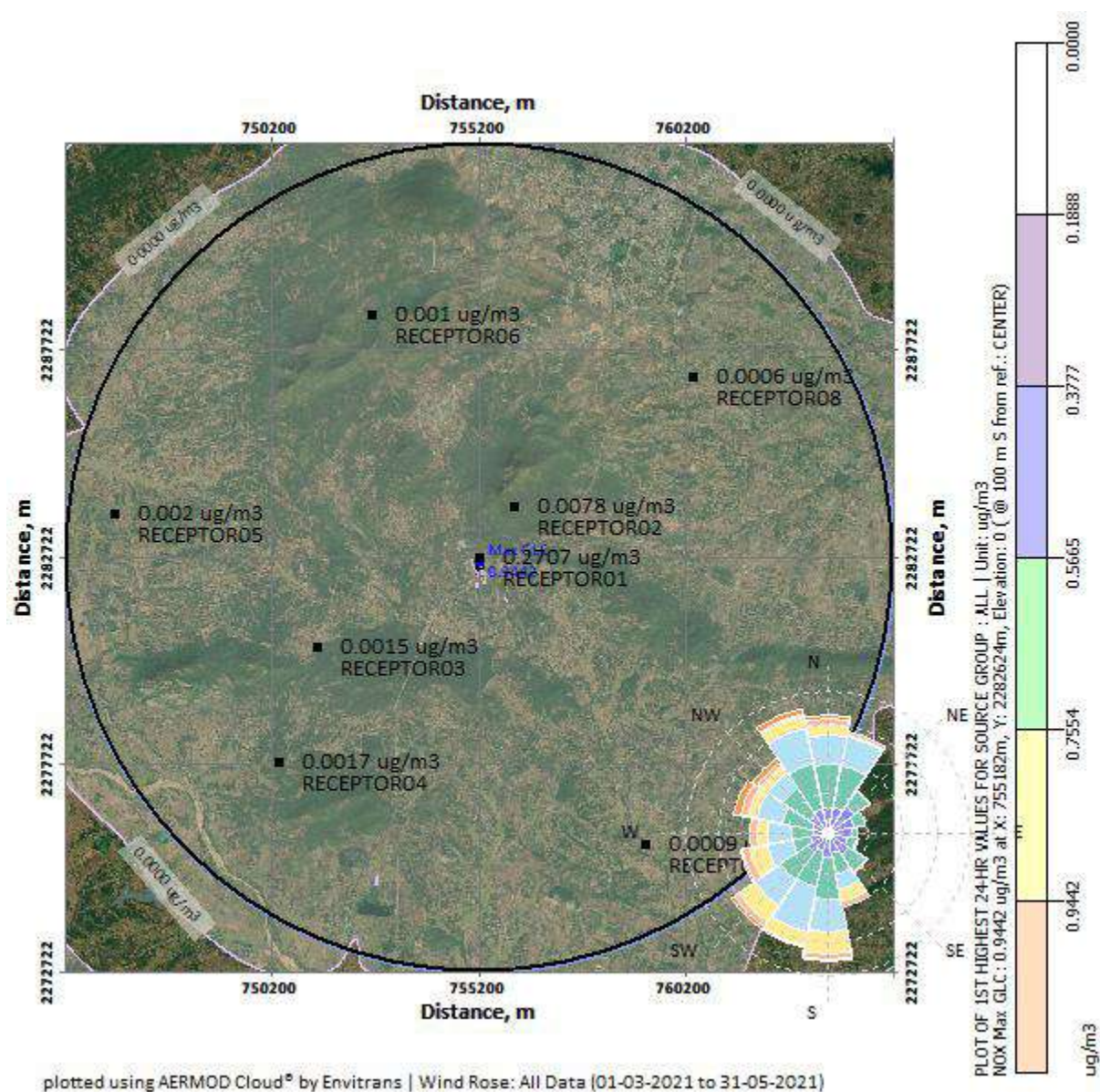


Figure 4-2 Isopleth for NOx

New Proposed project of Basupali Cluster Stone Quarry Project with proposed total excavation of 112166 cum of stone, having an area of 9.67 ha, located at Village: Basupali, Khata No. 14, Plot No.101 & 79, Kisam Kudar, Tehsil: Balangir, District: Balangir, Odisha.

3. SO₂:

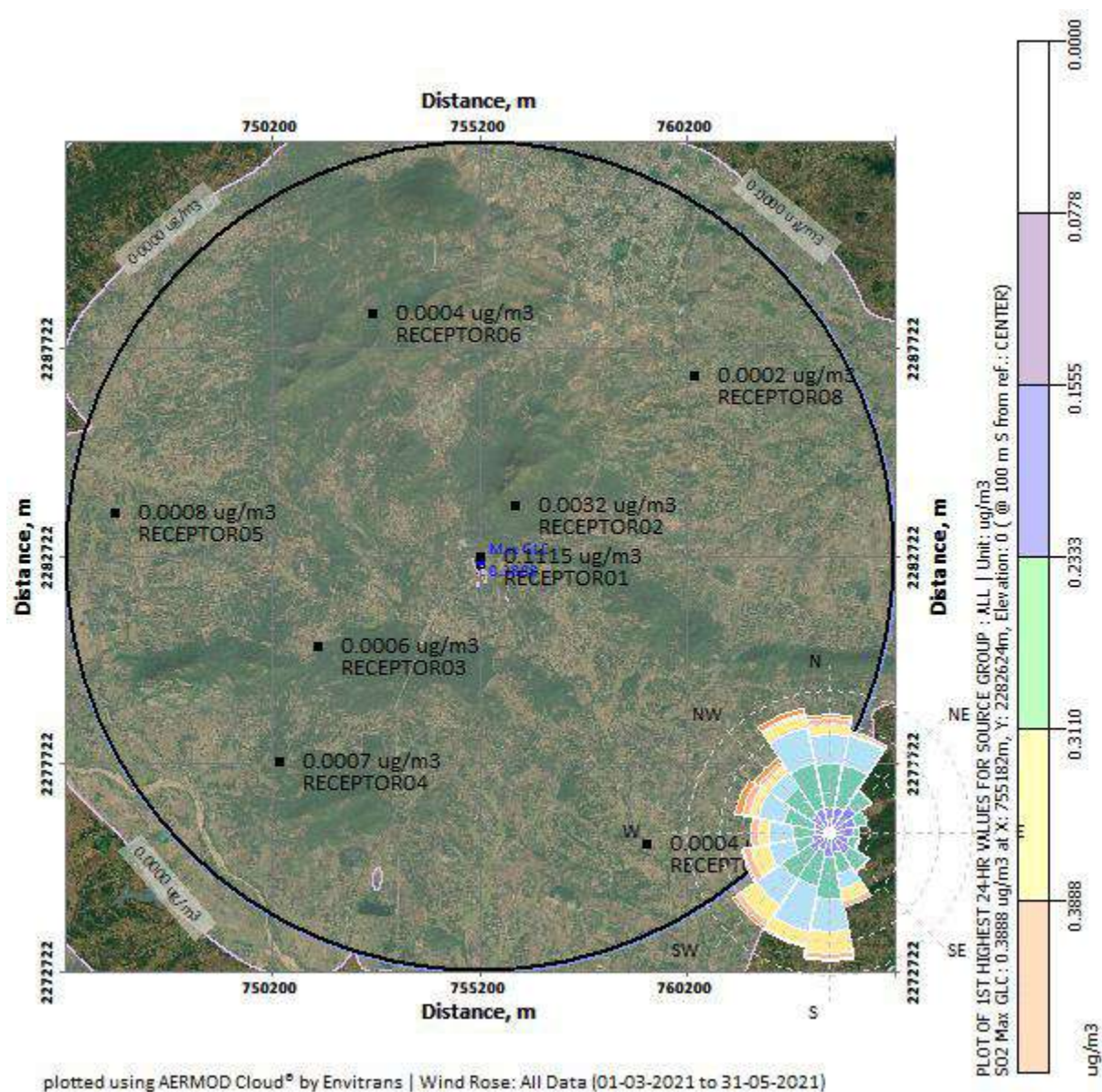


Figure 4-3 Isopleth for SO₂

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Table 4-7 Impact Prediction due to Mining Activity

S.no.	Pollutants	Concentration ($\mu\text{g}/\text{m}^3$)			CPCB NAAQS Standards
		Baseline Value	Incremental Value	Resultant	
1.	PM ₁₀	72.40	1.11	73.51	100
2.	NO _x	13.0	0.94	13.94	80
3.	SO ₂	9.1	0.38	9.48	80

4.5.1.3 Safeguard/Mitigation Measures

Table 4-8 Anticipated Impacts and Management Plan for Air Pollution

S.No.	Expected Impact	Impact Zones	Management Plan
1.	Airborne dust due to drilling machines and blasting	Local	Drilling machines will be equipped with wet drilling arrangements and controlled and muffled blasting will be adopted
2.	Excessive dust particles in atmosphere due to repetitive blasting	Local	Rock breaker is proposed to be used in place of secondary blasting for breaking over size boulders.
3.	Dust and fugitive emissions due to transport of vehicles	Local	Regular Water sprinkling will be done on haulage roads to arrest dust from becoming air borne. Proper maintenance (preventive as well as scheduled maintenance), oiling and greasing of HEMMs will be done to minimize gaseous pollutants.
4.	Increased Pollution load due to transportation through unpaved roads and unnecessary speeding.	Local	Planning transportation routes of mined material so as to reach the nearest paved roads by shortest route. (Minimize transportation over unpaved road). Speed limit will be enforced to reduce airborne fugitive dust from vehicular traffic. Covering of material while transportation. So, that the fugitive emissions can be controlled. Transportation from densely populated areas will be avoided.
5.	Effect on health of workers	Project Area	Development of green belt/plantation

	due to dust and air pollution		around lease boundary, roads and other places will be carried out to control the air pollution. Personal protective equipment i.e. Dust mask will be provided to all employees & workers.
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4.5.1.4 Impact Evaluation

Ambient Air Quality monitoring results are given in Table 3.6, Chapter 3 of this EIA/EMP Report. From this it is evident that AAQ results are well within the prescribed norms. Impact evaluation is given in table below.

Table 4-9 Impact Evaluation for Ambient Air Quality

Impact Element	Evaluation	Change of Air Quality Due to the Proposed expansion of Stone Quarry Mining Project			
Potential Concern	Effect/	Impact on health of humans and nearby biological/ecological receptors due to line and point sources of air emissions including fugitive dust emissions during Dolerite Stone mining activities from the proposed Project.			
Characteristics of Impacts					
Nature	Positive		Negative	Neutral	
			✓		
Type	Direct	Indirect	Cumulative		
	✓				
Extent	Project Area	Local	Zonal	Regional	
		✓			
Duration	Short – term		Long- term		
			✓		
Intensity	Low		Medium	High	
			✓		
Frequency	Remote (R)	Occasional (O)	Periodic (P)	Continuous (C)	
				✓	

Significance of Impact

Significance	Insignificant	Minor	<i>Moderate</i>	Major
			√	

4.5.2 Noise Environment

With the mining operations for mine development, excavation and transportation of Dolerite Stone, it is imperative that noise levels would increase. However, pronounced effect of above noise levels is felt only near the active working area

1. Noise Generated due to Drilling, Excavation & Transportation:

The drilling operations in the Stone Quarry Mine will be carried out by jack hammer Drill machine. The noise levels in the working environment will be maintained within the standards prescribed by Occupational Safety and Health Administration (OSHA). The permissible limits, as laid down by CPCB, are presented in following table.

**Table 4-10 Permissible Exposure in Cases of
Continuous Noise (CPCB, Govt. of India)**

S. No.	Sound Level (dB A)	Continuous Duration (Hours)
1.	85	8
2.	88	4
3.	91	2
4.	94	1
5.	97	0.5
6.	100	0.25

Source: CPCB (Govt of India)

2. Noise Generated due to Blasting:

Noise generated from blasting is for a short duration and instantaneous. Noise of blast is site specific and depends on type, quantity of explosives, dimensions of drill holes, degree of compaction of explosive in the blast holes.

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The noise levels tend to decrease with distance. The impact of noise will be restricted to mining activity area only, as plantation/ green belt will be developed around the mine which restricts the propagation of noise.

3. Noise Impact Analysis on Community

High noise levels will be confined to work zone areas only. It can be seen that noise levels get diffused rapidly with distance. Noise level in the study area varies from 51.2 dB (A) Leq to 63.6 Leq dB (A) during day time and from 39.8 dB (A) Leq to 59.2 Leq dB (A) during night time. The predicted noise levels indicate that there will be no significant increment in the ambient noise levels.

Maximum noise levels during day time as well as during night time were observed at Cluster area. Cluster area shows higher noise level due to operational activities result in high noise levels.

4.5.2.1 Mitigation Measures

The following control measures will be adopted to keep the ambient noise levels well below the limits.

Table 4-11 Anticipated Impacts and Mitigation Measure for Noise Pollution

S.No.	Expected Impact	Impact Zones	Management Plan
1.	Noise Generated due to Drilling, Excavation	Project Area	Drilling will be carried out with the help of sharp drill bits which will help in reducing noise. Blasting and drilling will be done during day time only.
2.	Noise Generated due to Blasting	Project Area	Secondary blasting will be totally avoided and Hydraulic rock breaker will be used for breaking boulders. Controlled blasting will be adopted. Blasting and drilling will be done during day time only. Muffled blasting will be adopted. No blasting zone has been left our near habitation.
3.	Noise Generated due to Transportation	Local	Proper maintenance (preventive as well as scheduled maintenance), oiling and greasing of HEMMs will be done to minimize generation of noise. Green Belt and Plantation will be developed around the mining activity area and along haul roads. The plantation checks propagation of noise.



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4.	Other	Local	The workers employed at HEMM will be provided with protective equipment, earmuffs and earplugs as a protective measure from the high noise level generated at the mine site and wherever required. Periodical monitoring of noise will be carried out.
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4.5.2.2 Impact Evaluation of Noise

Ambient Noise Level monitoring results are given in Table 3-8 Chapter 3 of this EIA/EMP report. From this it is evident that results are well within the prescribed norms. Impact evaluation is given in table below:

Table 4-12 Impact Evaluation for Noise

Impact Element	Evaluation	Change of Noise Level due to the Proposed expansion of Stone Quarry Mining Project			
Potential Concern	Effect/	Impact on health of humans and biological factors/receptors due to noise generated due to mining activities during day and night time and also on occupational health of the workers exposed to noise.			
Characteristics of Impacts					
Nature	Positive		Negative	Neutral	
			✓		
Type	Direct	Indirect	Cumulative		
	✓				
Extent	Project Area	Local	Zonal	Regional	
	✓				
Duration	Short – term		Long- term		
	✓				
Intensity	Low		Medium	High	
			✓		
Frequency	Remote (R)	Occasional (O)	Periodic (P)	Continuous (C)	
				✓	

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Significance of Impact

Significance	Insignificant	Minor	Moderate	Major
		√		

4.5.2.3 Impact of Vibration due to Blasting

Ground vibration, fly rock, noise, dust and fumes are the deleterious effects of blasting operation on environment. The explosive energy sets up a seismic wave in the ground, which can cause significant damage to structures and disturbance to human occupants.

When an explosive charge is fired inside the blast hole, it is converted into hot gases, which exert intense pressure on the blast-hole walls. High intensity shock waves propagate radially in all directions and cause the rock particles to oscillate. This oscillation is felt as ground vibration. Blasting, in addition to easing the hard strata, generates ground vibrations and instantaneous noise. Ground vibration from mine blasting is expressed by amplitude, frequency and duration of blast. The variables, which influence ground vibrations, are controllable and non-controllable. The non-controllable variables include general surface terrain, type and depth of overburden. Similarly, the controllable variables include type of explosives, charge per delay, delay interval, direction of blast progression, burden, spacing, specific charge and coupling ratio.

The oscillation of rock particles is called Particle Velocity and its value is called Peak Particle velocity (PPV), which is measured in millimeters per second.

As the distance increases the PPV value is likely to reduce. Following mitigation measures will be adopted to combat the ground vibrations due to blasting:

- There is human settlement <200 m in the NE side, the area demarcated in the map will be left as no blasting zone, only rock breaker will be used in this area. Blasting will be done within the standards prescribed by DGMS for controlled blasting.
- Explosives charge per hole and per delay will be maintained as per DGMS guidelines.
- Blasting will be carried out only during day time.
- Muffled Blasting techniques will be implemented to control the Fly rocks, dust fumes etc.
- In the whole cluster Staggered Blasting can be implemented to reduce the cumulative effect of noise and vibrations

4.5.2.4 Impact Significance of Ground Vibrations

Table 4-13 Impact Evaluation for Ground Vibrations

Impact Element	Evaluation	Ground Vibrations due to the proposed expansion of Stone Quarry Mining Project			
Potential Concern	Effect/	Impact on buildings and other structures and on the workers involved in the blasting process.			
Characteristics of Impacts					
Nature		Positive		Negative	Neutral
				✓	
Type		Direct	Indirect	Cumulative	
		✓			
Extent		Project Area	Local	Zonal	Regional
		✓			
Duration		Short – term		Long- term	
		✓			
Intensity		Low		Medium	High
				✓	
Frequency		Remote (R)	Occasional (O)	Periodic (P)	Continuous (C)
				✓	
Significance of Impact					
Significance		Insignificant	Minor	Moderate	Major
			✓		

4.5.3 Water Environment

There is no major surface water body i.e. nalla or streams within the lease area. So, there will be no significant impact on the Surface water and in reference to Ground water the Water table is at 40- 45 m while the ultimate depth proposed for mining activities is 30 m. So, there will be no ground water intersection and hence the mining activities will not have any impact on the ground water.

4.5.3.1 Mitigation Measures

- Garland drains, settling tank followed by storage tank will be constructed to prevent run off from mine site.
- Green belt area will be developed at the boundary.
- Mining of Gitti, Patthar & boulder does not have any significant impact on the water quality and parameters as the mining does not intersect with the ground water level.

4.5.3.2 Waste water management

No waste water will be generated due to the proposed mining activities. Only domestic waste water will be generated which will be treated with septic tank followed by soak pits.

4.5.3.3 Impact Evaluation

Impact evaluation is given in table below:

Table 4-14 Impact Evaluation for Water Environment

Impact Evaluation Element	Change in the water environment (quantity as well as quality of Surface and Ground water) due to proposed expansion of Stone Quarry Mining project.		
Potential Effect/ Concern	Increase in water availability in the area due to development of water reservoir.		
Characteristics of Impacts			
Nature	Positive	Negative	Neutral
	√		

4.5.3.4 Mitigation Measures

Table 4-15 Anticipated Impacts and Mitigation measures for Water Environment Pollution

S.No.	Expected Impact	Impact Zones	Management Plan
1.	Ground Water Contamination due to mining	Local	Ground water the Water table is at 15- 20 m. So, there will be no ground water intersection and hence the mining activities will not have any impact on the ground water.
2.	Surface Water Contamination due to mining	-	There is no major surface water body i.e. nalla or streams within the lease area. So, there will be no significant impact on the Surface water
3.	Other	Project Area	Garland drains, settling tank followed by storage tank will be constructed to prevent run

			<p>off from mine site.</p> <p>Green belt area will be developed at the boundary.</p> <p>Mining of Gitti, Patthar & boulder does not have any significant impact on the water quality and parameters as the mining does not intersect any water body.</p> <p>Rain Water harvesting through garland drains and settling tanks would be practiced.</p>
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4.5.4 Land Environment

The top soil cover is soft in nature will be collected carefully and loaded in dumpers by loaders and will be used for plantation along the greenbelt periphery. Greenbelt will be developed in such a manner that dense plantation is placed towards village.

By adopting efficient dust suppression measures, the contamination of dust with soil will be avoided. Following measures will be taken to reduce the impact of mining on adjacent land with reference to run off, soil erosion and loss of top soil:

Run Off

- Garland drains will be made around the mine and dumps to prevent water flow towards mine for prevention of land slide/side fall etc.

Soil Erosion

- The increased green cover will substantially prevent soil erosion.
- Garland drain will be maintained around the peripheral dump area to arrest plausible soil erosion.

4.5.4.1 Land Use Pattern

Table 4-16 Land use pattern of the Project Site

Description	At present (Ha)	At the end of plan period of 5 yrs (Ha)
Quarry	4.175	1.0901
Road		Nil
Waste Dump Yard		Nil
Soil stack yard		Nil
Saleable stone stack-yard		Nil

Safety zone	Nil	0.1113
Plantation	Nil	0.5582
Rest shelter	0.01	Nil
Total	4.185	1.7596

Source: Approved Mining plan & Progressive Mine Closure Plan

4.5.4.2 Solid Waste Management

Top Soil: Top soil will be used for the development of green belt within the Mine lease area and along the road side outside the premises.

OB waste: OB which will generate due to exploration of dolerite stone will be used for the development and maintenance of roads within the lease area and with that it will be used for maintenance of haul roads which will be used for transportation of mined out material. This practice will be done regularly. If in case any over burden is left then it will be stacked at Dump site with maintaining proper degree of slope and its height and it will be stabilized with the greenbelt plantation preferring the local plant species.

4.5.4.3 Reclamation Plan for Land

At conceptual Stage total excavated area will be 1.0901 ha. Backfilling of the mined out pit will not be possible. So, the mined out pit will be used for plantation.

4.5.4.3.1 Impact Significance

Impact significance is given in table below:

4.5.4.4 Mitigation Measures

Table 4-17 Anticipated Impact and Mitigation Measures for Land Environment

S.No.	Expected Impact	Impact Zones	Management Plan
1.	Disturbance of top soil cover due to run off	Local	The top soil cover is soft in nature will be collected carefully and loaded in dumpers by loaders and will be used for plantation along the greenbelt periphery. The top soil cover is soft in nature will be collected carefully and loaded in dumpers by loaders and will be used for plantation along the greenbelt periphery.
2.	Soil Erosion Caused as secondary impact of mining	Project Area	The increased green cover will substantially prevent soil erosion. Garland drain will be maintained around the peripheral dump area to arrest plausible soil erosion.
3.	Mishandling of excavated top soil and OB	Project Area	Top soil will be used for the development of green belt within the Mine lease area and

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			along the road side outside the premises. OB which will generate due to exploration of dolerite stone will be used for the development and maintenance of roads within the lease area and with that it will be used for maintenance of haul roads which will be used for transportation of mined out material.
4.	Degradation of Land due to mining while mine closure	Project Site	Backfilling of the mined out pit will not be possible. So, the mined out pit will be developed into a Water reservoir which will help in rain water harvesting which can be used in irrigation and other purposes by local inhabitants and it will also act as a recharge system for the local aquifer.

Table 4-18 Impact Evaluation to determine the significance (Land use- During operation Phase)

Impact Evaluation Element	Change in the land use due to mine development & operation			
Potential Effect/ Concern	Change in the land use of core zone due to mining activities (during operation) due to proposed Stone quarry Mine development & operation activities			
Characteristics of Impacts				
Nature	Positive		Negative	Neutral
			✓	
Type	Direct	Indirect	Cumulative	
	✓			
Extent	Project Area	Local	Zonal	Regional
	✓			
Duration	Short – term		Long- term	
			✓	
Intensity	Low		Medium	High



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			✓	
Frequency	Remote (R)	Occasional (O)	Periodic (P)	Continuous (C)
				✓
Significance of Impact				
Significance	Insignificant	Minor	Moderate	Major
			✓	

**Change in land use due to the mining activity at the conceptual stage will be positive as the land use of the lease area will be converted to water reservoir.*

4.5.5 Socio-economic Environment

The potential impact on socio-economic environment due to this mining project is given in following heads.

4.5.5.1 Positive Impacts

Employment

Direct and indirect employment opportunities will be generated during mining operation.

Community Skills Development

Community Skill Development courses can be provide under the CER Activities which will be conducted by the project proponent. Many CER activities would help the local inhabitants to improve their skills and it can also help in women empowerment, better education facility, health facility etc.

Improved Standard of Living

Employment opportunities created by the project and skill development activities carried out under CER, will increase income of local community and therefore improve the overall standard of living in the area.

Economic Exposure and Development

Implementation of the project will make opportunities for sustainable livelihood, better infrastructure facilities and services available to the people. This will expose and introduce the local population to factors of economic development including the banking system, financial services and credit and investment schemes.

The illumination and sound at night at project site will be kept in check in order not to disturb human and animal population in the nearby habitations. Mining would be done during day time only so that the biological clock of human and livestock is not disturbed and problems such as sleep disorders and stress do not arise. Also, special attention would be given to keeing noise levels in check.

4.5.6 Other Impacts on Biological Environment

4.5.6.1 Impact on Biodiversity

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Habitat loss, degradation, and fragmentation are important causes of known species-population extinctions. The main cause of degradation and depletion of forests and wildlife are the human activity (anthropogenic pressure). Population explosion, over exploitation of forest resources, urbanization, unscientific management, encroachment of forest land, illicit felling, lack of regeneration of forests and outdated laws are major factors responsible for the degradation and depletion of forests.

There are no endangered species, wildlife sanctuary, wildlife corridors, faunal migratory routes or eco sensitive area near the whole study area.

Impact on Flora

No adverse impact is envisaged on the existing flora, as there will be no deforestation by mining operation. Plantation will be developed in the lease area as per plantation program. These activities help to improve the floral cover of the area.

***A grazing land will also be developed for the cattle and livestock.**

Impact on Fauna

There is no National Park, Wildlife Sanctuary, and Biosphere Reserve, Wildlife Corridors, Tiger/Elephant Reserves, Protected Forest etc. within 10 km radius of the Mine site.

So, there would be not any significant effect on Bio-diversity of flora and fauna.

Impact on Agriculture

Agricultural activities may be impacted because of dust generation due to activities such as;

1. Transportation of over burden from ML area.
2. Mining operations.

These effects can be minimized by adopting the proper mitigation measures as mentioned earlier. The cluster owners shall ensure that the productivity of agricultural crops is not affected due to mining operations

4.5.7 Occupation Health & Safety

Occupational health and safety (OHS) is multidisciplinary field concerned with the safety, health and welfare of people at work. The goal of occupational safety and health programs includes fostering a safe and healthy work environment. OHS may also protect co-workers, family members, employers, customers, and many others who might be affected by the workplace environment.

This mining project does not contain any toxic elements. Further this being a manual/semi mechanized mine, stone production is by manual/mechanized means and waste material handling partly by manual and partly by mechanized way, there shall be marginal impact on air and noise qualities. Therefore; the possibilities of any health hazards are minimal.

Impacts

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New Proposed project of Basupali Cluster Stone Quarry Project with proposed total excavation of 112166 cum of stone, having an area of 9.67 ha, located at Village: Basupali, Khata No. 14, Plot No.101 & 79, Kism Kudar, Tehsil: Balangir, District: Balangir, Odisha.

Chapter 4

The most significant occupation healthy treats are Noise Induced Hearing Loss (NIHL) and Occupational Lung Disease (OLD) due to inhalation of dust.

Mitigation measures

1. Employees will be adequately trained and educated for involvement and commitment into the implementation of health and safety guidelines.
2. Monitoring the effects of mining activities on safety and health and conducting regular performance reviews through periodical health check-up.
3. First Aid facility and training to workers.
4. PPEs will be provided to the workers likely hand gloves, safety shoes etc.
5. Working of mine will be done as per approved mining plan.



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Chapter 5 Analysis of Alternatives

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Chapter 5 Analysis of Alternatives

5.1 Introduction

A comparison of alternatives like proposed project site & proposed technology etc will facilitate in selection of best available option for project development, this leads to minimum environmental impacts and adoption of most environment friendly and cost-effective options. Every mine needs to be planned in a way that project's objective gets achieved with maximum resource utilization and without causing any environmental damages upto the maximum extent possible. Mineral deposits are site specific, and it is an existing mine. So, therefore no alternate site has been selected.

5.2 Alternative of Site

Basupali Cluster Stone quarry is a newly proposed mine cluster and as Mining is site specific and guided by deposit geology; hence alternative site is not applicable. The selected site has the following advantages.

1. Analysis of Technology: Mineral processing will not be carried out. No other alternative technologies can be used because of the nature and occurrence of the deposit, cost of operation, capacity of the mine and specification laid by the consumer industry. The mining activity has been planned for maximum mineral utilization, safety of the mine and scientific mining.
2. Outcome of geological mapping: Fresh patches of unexploited river sand occurrences are also observed within the area.
3. Short distance to main Approach road from Mine site.
4. No endangered species around the mine site.
5. Availability of labor from nearby villages.

5.3 Conclusion

No change in use of mineral is envisaged. With implementation of various environmental protection measures this site is found to be most suitable as per Cost Benefit ratio and environment is concerned.



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Chapter 6 Environmental Monitoring Program

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Chapter 6 Environmental Monitoring Program

6.1 Introduction

Post Project Monitoring is an essential part to check the impact of project related activity. Hence monitoring of various environmental parameters will be carried out on a regular basis to ascertain the following:

- Status of Pollution at the mine site and in its vicinity.
- To generate data for predictive or corrective purpose in respect of pollution.
- To examine the efficiency of pollution control system adopted at the site.
- To assess environmental impacts.
- Monitoring will be carried out at the site as per the norms of CPCB.

6.2 Environment Monitoring Cell

A centralized Environmental Monitoring Cell will be established for setting up monitoring programme for important and crucial environmental parameters which are of immense importance to assess the status of environment during mine operation. With the knowledge of initial parameters, deviations in environmental conditions due to operation of the mine will be assessed and suitable mitigation steps will be taken to safeguard the environment. The routine monitoring program will be implemented under the project monitoring as per CPCB and MoEF&CC guidelines.

The responsibilities of the Environmental Monitoring Cell will be: -

To develop and implement Environmental Monitoring Programme for core and buffer Zone.

To verify that all or selected parameters measured by Environmental Monitoring Program are in compliance with regulatory requirements, internal policies and standards, and established environmental quality performance limits.

- To assess effectiveness of the environmental management system, practices and procedures.
- To develop greenbelt.
- To coordinate the environment related activities to the top management within as well as with outside concerned agencies.

6.2.1 Environmental Monitoring Program

Post project monitoring will be carried out as per conditions stipulated in Environmental Clearance Letter, issued by SEIAA; Consent to operate of SPCB as well as according to CPCB guidelines. The post project environmental monitoring for the proposed mining operations shall be conducted for following parameters:

- Air quality
- Water quality
- Noise levels
- Soil quality and
- Medical Check-up of the employees

Chapter 6

The location of the monitoring stations will be selected on the basis of prevailing micro-meteorological conditions of the area. AAQM stations will be selected (including minimum 1 location in core zone, upwind side, more sites in downwind side/impact zone) to assess ambient air quality of the area and at site.

Noise level monitoring will be carried out on lease boundary & at high noise generating area within the lease. Water & soil monitoring locations will be decided on the basis of general slope of the area & drainage.

Table 6-1 Post Project Monitoring Program

S. No.	Attributes	Parameters	Frequency	Locations
1	Air Quality & Meteorological			
1.1	Ambient Air Quality at mine site	PM _{2.5} , PM ₁₀ , SO ₂ , NO _x and CO	Half yearly/As per consent	Locations in the project impact area (Minimum 1 Locations in upwind side, more sites in downwind side / impact zone)
2	Water and Ground Quality Monitoring			
2.1	Ground Water Quality	Drinking Water Parameters, As per IS-10500:2012	Half yearly/As per consent	Set of grab samples during pre and post monsoon for ground and surface water in nearby villages
2.2	Surface Water Quality	Class will be assessed as per the CPCB Guidelines	Half yearly/As per consent	
3	Soil Quality			
3.1	Soil Quality	Colour, textural class, grain size, distribution, pH, Electrical Conductivity, Bulk Density, Porosity, Infiltration rate, Moisture retention capacity, Wilting Co-efficient, Organic matter Na, K, PO ₄ , SO ₄ , SAR, Base Exchange Capacity, Pb, Cu, Zn, Cd, Fe.	Half yearly/As per consent	Mining Site and in buffer zone
4.	Noise Level Monitoring			

S. No.	Attributes	Parameters	Frequency	Locations
4.	Noise Level Monitoring	Noise level in dB(A) Quarterly/half yearly	Half yearly/As per consent	Mine Boundary, High noise generating areas within the Mine boundary and Study area.
5.	Medical Check-up of the Employees			
5.	Medical Check-up of Employee	-	Medical examination: Age of workers < 45 years: After every 5 years Age of workers > 45 years: After every 3 years	

6.2.2 Instruments to be used

The post project environmental monitoring work will be carried out by recognized laboratory registered with MoEF&CC the following instruments shall come into use for data collection work in the monitoring schedule:

- Respirable Dust Sampler (RDS)
- Fine Particulate Sampler (FPS)
- Sound Level Meter (Type-A)

6.2.3 Methodology Adopted

Any reputed organization with MoEF&CC recognition under EP act shall be engaged for carrying out the post project environmental monitoring (PPM) and timely compliance report submission to various regulatory authorities. Standard methods for sampling and analysis shall be followed. All environmental monitoring and relevant operational data shall be stored in the database.

6.2.4 Reporting Schedule

Environmental Monitoring Program (EMP) will be designed considering conditions stipulated in the Environmental Clearance issued by the SEIAA, Bhubaneswar & consent to establish and operate by SEIAA, Bhubaneswar. Six monthly compliance reports will be submitted to the concerned regulatory authorities.

6.2.5 Corrective and Preventive Action for Non- Compliance/Non-Compliance

The company would detail the process for identification of non- Conformances and address these through mid – course corrective action plan. The measures include-

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- To identify non – compliance/ non- conformances.
- To record non-compliance/Non conformances.
- To evaluate the non-Compliance/ Non conformation, to determine specific corrective and preventive action.
- To address the Non-compliance / Non-conformances.
- To review the corrective actions by the senior Management for effective implementation.
- Reporting of any statutory non-compliance if any, to board at regular interval as per Corporate Environment Policy.

6.2.6 Budget details for Environmental Monitoring Program

The monitoring of the environment parameters will be outsourced and carried out by the lab having accreditation of MoEF & CC & NABL.

The total budget for Environment Monitoring Program for the proposed project is Rs. 50,000 per year.

**This is estimated cost; the actual expenditure may vary at the time of execution and implementation.*



Chapter 7 Additional Studies

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Chapter 7 Additional Studies

7.1 Public Hearing

Proceedings of public hearing held on 04.03.2022 at Basupali School, Balangir district in reference to the proposed Basupali Cluster Stone Quarry is a newly proposed Mine at village: Basupali, Tehsil: Balangir, District: Balangir (Odisha) having an area of 9.67 ha with proposed production capacity of 112166 cum.

As per the provisions contained in S.O. 1533 dated 14.09.2006 of Environment impact assessment Notification of MoEF&CC, the conduct of public hearing at Basupali School, Basupali, Tehsil – Balangir, District – Balangir dated 04.03.2022 at 11:00 AM was decided by the Add. District Magistrate (Revenue), Balangir for the proposed Basupali Cluster Stone Quarry is a newly proposed Mine at village: Basupali, Tehsil: Balangir, District: Balangir (Odisha) having an area of 9.67 ha with proposed production capacity 112166 cum. Information of the same was circulated by the means of the National and regional newspapers. The public hearing was conducted on dated 04.03.2022 as decided by the chairmanship of ADM, Collector Office.

EIA report and the Executive summary (Oriya and English language) regarding public hearing of this project by the office was sent for public viewing to Collector Office, District- Balangir, The executive summary was also made available in the website of State pollution Control Board, Bhubaneswar (www.ospcboard.org). Regarding Public Hearing Publicity by the office has been also done through announcements in nearby villages.

Public hearing was organized under the chairmanship of Sh. Mahendra Mahapatra, OAS(S), Additional District Magistrate, Balangir at 11.00 AM on 04.03.2022 at Basupali School, Basupali, Tehsil – Balangir, District – Balangir as decided by the office, in which Er. Ramesh Kumar Ekka, Regional Officer, State Pollution Control Board, Odisha, Balangir were present. Public hearing process was conducted in the presence of Project Proponent. Villagers from nearby villages took part in the public hearing. Attendance report of the citizens along with the Officers present in the public hearing is attached with MoM which is enclosed as enclosed as Annexure.

First, in the process of Public hearing, the Regional Officer of the Board has informed the General public and officials about the provisions of the Environment Impact Assessment

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Notification of MoEF&CC. As per the provisions of the notification, the information regarding the publication of Information etc. was given by the Regional Officer to the general Public.

Afterwards, with the permission of Additional District Magistrate, detail information regarding the project and about the proposal for improvement of Environment and on other subjects was given to the general public by the technical expert of the project.

During Public Hearing 9 suggestions/opinions were received during the public hearing by local citizens. About 40-50 local people participated in public hearing out of which 24 persons signed the attendance sheet. Opinions/Objection/Suggestions received during public hearing are as under:

Sr. No.	Name	Presented Suggestions	Reply by proponent
Oral Suggestions/Opinions/Objections			
1.	Mr. Suresh Sethi, Basupali	He supported the proposed project.	Local people will employ for the mining operations.
2.	Mr. Sekhar Patel, Basupali	He welcomed for the operation of the stone quarry.	As above
3.	Mr. Sushant Gibela, Basupali	He welcomed for the operation of the stone quarry.	As above
4.	Mr. Girish Bhue, Basupali	He supported the proposed project. He stated that water sprinkling arrangement should be provided by the mining authority on the roads to suppress fugitive emission.	Periodically, Water sprinkling will be done at intervals as necessary. Water will be sprinkled on roads to wet the surface. Estimated Budget: Rs. ~5,00,000/-
5.	Mr. Ganesh Pradhan, Basupali	He supported the proposed project.	-
6.	Mr. Parameshwar Majhi, Asurdungri	No comments.	-
7.	Mr. Saroj Bariha, Basupali	He supported the proposed project. He stated that water sprinkling arrangement should be	Periodically, Water sprinkling will be done at intervals as necessary. Water



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		provided by the mining authority on the roads to suppress fugitive emission.	will be sprinkled on roads to wet the surface. Estimated Budget: Rs. ~5,00,000/-
8.	Mr. Ramesh Majhi, Asurdungri	He welcomed for the operation of the stone quarry.	As above
9.	Mr. Dinesh Karan, Basupali	He welcomed for the operation of the stone quarry.	As above

Figure 7-1- Public Hearing Photographs

7.2 Risk Assessment & Disaster Management Plan

Introduction

Human health and Environmental risk from developmental activities is mainly due to occurrence of some accident consisting of an event or sequence of events like explosion, fire and toxic hazards. Risk analysis provides a numerical measure of the risk that a particular facility poses to the public. It begins with the identification of probable hazardous events at an operational area and categorization as per the predetermined criteria. The consequences of major events or accidents are calculated for different combinations of weather conditions to stimulate worst possible scenario.

All types of mining face certain types of hazards which can disrupt normal activities abruptly and to disaster like fires, inundation, failure of machinery, explosion, to name a few. Similarly Mining of minor mineral also have impending dangers or risk which need be addressed for which a disaster management plan has been formulated with an aim of taking precautionary steps to avert disasters and also to take such action after the disaster which limits the damage to the minimum.

As per proposal made under the mining plan, during proposed working the area will be developed by means of manual opencast mining method. Exploitation and transportation of minerals are to be carried out by manual means. Water table will not be touched during processed working. No high-risk accidents like landslides, subsidence flood etc. have been apprehended.

No explosives will be stored at site as Blasting will be conducted on contract basis by an expertise person from certified blasting agency.

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But possibility of accidental disaster is also not ruled out. Therefore, all the statutory precautions should be taken for quick evacuation as per the Mines Act 1952, the Mines Rules 1955 MMR-1961 and MCDR-1988.

7.2.1 Risk Assessment & Disaster Management Plan

Mining and allied activities are associated with several potential hazards to both, the employees and the public at large. A worker in a mine should be able to work under condition, which are adequately safe and healthy. At the same time the environment should be such as not to impair his working efficiency. This is possible only when there is adequate safety in mines. Safety of the mine and the employees is taken care of by the mining rules & regulations, which are well defined with laid down procedure for safety, which when scrupulously followed safety is ensured not only to manpower but also to machines & working environment.

A major emergency in a mine is one that may cause injury or loss to the workers engaged in the mining and allied operations. Therefore, the first action under the disaster management is the identification of risks involved and their priorities. From this risk assessment the identified risks are as below:

- a) Use of explosives and the blasting operations, inducing vibrations due to blasting.
- b) Fly rocks & vibrations from Blasting.
- c) Slope Failures in open pit.
- d) Solid waste generation, their disposal and rehabilitation.
- e) Improper use of equipment and machinery.
- f) Dust exposure.

Each parameter is discussed below:

7.2.2 Use of Explosive and the Blasting Operation:

Blasting will be done on the contract basis and it will be conducted by Blasting expert. No Magazine will be there as no explosives will be stored at the Mine premise. The explosives will be bought by contractor for blasting and after the completion of work it will be taken back by himself.

7.2.3 Mitigation measures to avoid impacts due to Blasting

1. Muffled Blasting with controlled Blasting will be employed to arrest the Flying rocks.
2. Prior Information and investigation of area will be done before blasting at Site.
3. Timings will be fixed for Blasting and it will be conveyed to all the workers and Employees engaged in Mining operation.
4. Dummy Holes, Trenches etc. would be implemented to dampen the vibrations.
5. Regular Health check-up of the workers will be carried out.

7.2.4 Slope Failures

The mining is proposed from top level and gradually advance towards lower levels. Height of benches will be kept 6.0 m and Slope will be kept at 45° or as per the guidelines. In that case, chances of slope failure will be negligible.

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7.2.5 Solid Waste Generation, Their Disposal and Rehabilitation

Soil shall be generated during course of mining will be used for greenbelt development. Overburden will be used for road maintenance.

7.2.6 Proper Training on the Use of Equipment

Machineries will be employed in the mine. Vocational training program will be organized to train the workers about mine workings & operating the machines.

7.2.7 Exposure to dust emissions

1. Proper PPE's i.e. Helmet, Nose mask, Safety Shoes, Ear Plugs, Safety goggles etc. will be provided to workers engaged in working at Mining operations.
2. Water Spraying on haul roads.
3. The green belt development program will be implemented which will help in prevention of dust (leaves acting as a sink) and screening noise. It will also proves to be helpful in maintaining ecological balance.

7.3 Disaster & its Management

Mining will be done by Open Cast Semi-mechanized method to produce stone. There are various factors, which can create unsafe working conditions/ hazards in mining of minerals. The following types of hazards are identified during the proposed mining operations: -

- Mining Machinery and Loading operation.
- Vehicular movement and Transportation of Mineral
- Fall of workers from high benches

7.3.1 Mitigation Measures

- Unorganized Vehicular movement in the ML area will also contribute in accident occurrence. Following practice will be adopted:
- To avoid danger while reversing the trackless vehicles especially at the embankment and tipping points, all areas for reversing of Lorries should be made man free as far as possible.
- The vehicles must be maintained, repaired and checked thoroughly at least once in a week.
- Overloading should not be permitted, and the maximum permissible speed limit should be ensured.
- The dumper/Tractor drivers should have proper driving license.
- A statutory provision of the fences, constant education, training etc. will go a long way in reducing the incidents of such accidents.
- The top of every opencast working shall be kept securely fenced.
- The opencast mine has been planned for working with shovel dumper system which requires proper benching not only for slope stability but also for movement of dumpers and other heavy machinery.

7.4 Emergency Management Plan for Proposed Mines On-Site and Off-Site Emergency Preparedness Plan

The emergency plan delineates the Organizational procedures for dealing with accidents or unexpected events and natural calamities arising from operation of the company. An experience of any accidents that have occurred in other manufacturing/mining projects is considered to prepare this plan. This Emergency plan should be periodically reviewed and modified. It should also be changed based on the observations of emergency mock drills and experience of handling actual emergencies. Major objectives of this onsite – offsite emergency plan is:

- To take necessary proactive and preventive actions to avoid the emergency. The main aim of any emergency plan should be to prevent emergency situations.
- To train the manpower to handle the emergencies of the following nature:
 - Onsite (Within ML boundary)
 - Offsite (Outside ML boundary)

7.4.1 Onsite & offsite Emergency Plan

- Fire
- Explosion
- Major accidents involving man-made collapse of the mining edges.

7.4.2 Disaster Due to Natural Calamities Like

- Flood/ heavy rains which can involve natural landslides.
- Earthquake
- Cyclone
- Lightening

General Guidelines:

- The mining operations should be immediately stopped in case of any emergency. A siren can be sounded if available.
- An emergency assembly point should be created, and all Employees should guide visitors or contractors to approach assembly point.
- The site office can serve as emergency control room (Centre) in case of emergency.
- Emergency vehicle should be available near security main gate and rush to the emergency control center at the blowing of emergency siren. The driver of emergency vehicle will follow the instructions of Incident Controller / Site Main Controller.
- People should be trained for the precautions to be taken during natural disasters like heavy rain, floods, earthquake and cyclone.

7.4.3 Emergency Control

- Shut down of mining operations: Raising the alarm or siren followed by immediate safe shut down of the power supply, and isolation of affected areas.
- Treatment of injured: First aid and hospitalization of injured persons

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- Protection of environment and property: During mitigation, efforts should be made to prevent impacts on environment and property to the extent possible.
- Preserving all evidences and records: This should be done to enable a thorough investigation of the true causes of the emergency.
- Ensuring safety of personnel prior to restarting of operations: Efforts required to be made to ensure that work environment is safe prior to restarting the work.

7.5 Emergency Evacuation of Employees

7.5.1 Emergency Training

One day of the week-long pre-production start-up program will be devoted to fresher training in emergency procedures, fire-fighting and related programs. An emergency evacuation drill will be held at least once during the production season.

7.5.2 Training for Evacuation

In the event of an emergency requiring employee evacuation:

1. Notify the plant office.
2. The office will sound the alarm and notify all employees to evacuate.
3. All employees will come to the plant office by company vehicle obeying posted speed limits.
4. Park in the parking lot and assemble in front of the office or inside if the weather is bad.

7.5.3 Training for Incident and Injury

1. First aid kits should be located at the Site office and in each company vehicle.
2. For minor injuries (scrapes, shallow cuts, etc.) all employees are authorized to use materials in any first aid kit but must make a note of the injury and materials used in the kit's logbook.
3. For any injury more serious than the above, call the office for assistance. Current-trained first aiders. They will determine whether an injury can be treated on site, treated in hospital or requires an ambulance.
4. It is company policy that no employee shall walk on, climb or otherwise become personally involved with stockpiled material so runs of material should not be a safety issue.

7.5.4 Training for Security Procedures

1. Only the main gate near the weigh scale will be opened for vehicle access. All other gates at entries to the property will be closed and locked at all times. Report any damage to gates or perimeter fences
2. Incoming customer trucks for pickup must stop at the office. Drivers should not allowed to leave the cabs of their vehicles at any time while on property.
3. All other visitors are required to park near the office for check-in and check-out when leaving.

4. No explosives are stored on the company property. Blasting contractors bring only the required quantity of explosives for the job at hand and are responsible for explosives security.

7.6 Occupational Hazard / Health & Safety Control Measures

This mining project does not contain any toxic elements. Further this being a manual/semi mechanized mine, stone production is by manual/mechanised means and waste material handling partly by manual and partly by mechanized way, there shall be marginal impact on air and noise qualities. Therefore; the possibilities of any health hazards are minimal. The most significant occupation healthy treats are Noise Induced Hearing Loss (NIHL) and Occupational Lung Disease (OLD) due to inhalation of dust. However, the management of the Basupali Stone Quarry has been taking enough care in minimizing the impacts due to these activities.

- Employees are adequately trained and educated for involvement and commitment into the implementation of health and safety guidelines.
- Monitoring the effects of mining activities on safety and health and conducting regular performance reviews through periodical health check-up.
- Provision of all necessary resources for safety and health of employees and contractors engaged in mining.
- Setting of safety and health objectives based on comprehensive strategic plans and measure performance against these plans.
- Implementing safety and health management system and assessing the effectiveness through periodic audits.

Occupational safety and health are very closely related to productivity and good employer-employee relationship. The factors of occupational health in Proposed Mining project are mainly dust and land degradation. Safety of employees during operation and maintenance etc. shall be as per Mines rules and regulations.

Table 7-1 Anticipated Occupational Hazards & Safety

Anticipated Occupational Health and Safety Impacts	Proposed Mitigation Measures
Lung disease and respiratory disorder due to dust exposure	<p>There will be regular health checkups for all the workers. Lung function tests, chest X-rays etc. shall be carried out and any health disorders will be evaluated.</p> <p>Dust mask will be provided to the workers.</p> <p>Precautions will be adopted to prevent dust generation at site and dispersing in the environment.</p> <p>Air emission control system such as water sprinkling, green belt development.</p> <p>Budget of pollution control i.e. dust suppression by water sprinkling, Green belt development etc. is proposed in EMP.</p>



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Anticipated Occupational Health and Safety Impacts	Proposed Mitigation Measures
Noise	Earmuff will be provided Good Maintenance of vehicles. PUC certified vehicles will be engaged for transportation and other Mining activities.
Accident at site	PPEs will be provided to the workers likely hand gloves, safety shoes etc.
Others	Awareness program/training program will be organized for workers for occupational safety. Smoking and tobacco will be banned at site. Provisions of rest shelter for mine workers with facility of drinking water. First Aid facility and training to workers.



Chapter 8 Projects Benefits

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Chapter 8 Projects Benefits

8.1 Purpose of the Report

The execution of the project brings overall improvement in the locality, neighborhood and the State by bringing industry, roads, employment and hence improving living standard and economic growth. All the baseline data is collected, and all the measures have been proposed for sustainable mining. In this chapter benefits of the proposed project will be discussed. Benefits will include the social, environmental and economic aspect of the project.

8.2 Physical Benefits, Employment Potential and Economic Upliftment

The opening of the proposed project will enhance the physical infrastructure facilities in the adjoining areas. This land is not being used for any purpose and through this land no economic or environmental benefit is proposed if the land remains as such. The area surrounding the Mining site is economically backward. The project will give direct employment to 55 people. Local people will be preferred for providing job opportunity. The mine management will recruit skilled, semi-skilled & unskilled workers. The overall effect will improve the buying power of employees up to some extent and thus a higher standard of living viz. better education, improved health and sanitation facilities, housing and acquisition of consumer durables.

Royalty will be paid to the government against the mineral so it will increase the exchequer of the government leading to improvement in economic condition of the area including the transport structure, medical infrastructure, educational infrastructure and improvement of other civic amenities and will get a gradual boost in future. This is envisaged as a major positive benefit.

8.3 Social Benefits

8.3.1 Market

By improving the economic status of local habitants through employments will attract market to develop their facilities and services near to the project site it's a part of indirect employment which will be developed due to the proposed project. Infrastructure: Proposed project will provide the raw material for the infrastructure development like road, building etc.

8.3.2 Local Employment:

This project will enhance the opportunities of employment for the local villagers due to which their economic status will become better. Around 55 direct employment will be generated and several other indirect employments will be developed.

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8.4 Environmental Benefits

As mentioned above, currently ML area is completely waste land no vegetation or agricultural activities can be proposed here as such. After mining of mineral from the area, the whole area will be planted with trees or will be converted to water reservoir. Plantation and water conservation are the need of this hour. It has been proposed that out of 9.67 ha area, 8.21ha will have the green belt development.

Afforestation program is of paramount importance of Eco-friendly development. The proposed plantation program benefits the environment through supplementing oxygen to the atmosphere and combat air pollution effectively. It's not only improves the aesthetic beauty and land scape resulting in harmonizing and amalgamating the physical structures of the mines with surrounding environment, but also acts as pollution sink. It also checks soil erosion, make the ecosystem more complex and functionally stable and make the climate more conducive.

All measures will be adopted at each project development phase for environment management and have been described in previous chapters. Therefore, it is safe to say that the project is not likely to cause any significant impact on the ecology of the area, as adequate preventive measures will be adopted to contain the various pollutants within permissible limits.

8.5 Corporate Environment Responsibility (CER)

The CER activities by the management of proposed mine can be considerably beneficial for the people. These along with the economic benefits of the proposed project will result in further benefits in terms of the literacy level and on health facilities.

Table 8-1 Proposed CER activities with Budget.

Village	Cost	Duration	Particular
Basupali	Rs. 1,00,000	1 st year	Activities for CER would be finalised based on outcome of Public Hearing. Suggested Activities: <ul style="list-style-type: none"> Distribution of masks(500nos) and sanitizers (250nos) to villagers of Basupali for 1st year only Conducting health awareness program

8.6 Conclusion

The management will recruit the semi-skilled & unskilled workers from the nearby villagers. The project activity and the management will support the local panchayat and provide other form of assistance for the development of public amenities in this region. The Mine management will contribute to the local schools, dispensaries for the welfare of the villagers through the contribution given to the village Panchayat. Green belt development / Plantation will be taken up along the approach roads, etc.



Chapter 9 Environmental Cost Benefit Analysis

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Chapter 9 Environmental Cost Benefit Analysis

9.1 Environmental Cost Benefit Analysis

As per EIA Notification dated September 14th 2006, the Chapter on the 'Environmental Cost Benefit Analysis' is applicable only if, the same is recommended at the Scoping stage.

As per the ToR points issued by SEIAA, Bhubaneswar dated March 26/07/2021, for File No. SIA/OR/MIN/64155/2021, for the mining project activity, the 'Environmental Cost Benefit Analysis' is not required.



Chapter 10 Environmental Management Plan

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Chapter 10 Environmental Management Plan

10.1 Introduction

The environmental management plan (EMP) is required to minimize adverse environmental impacts by implementing suggested mitigation measures with timelines and responsibilities during the project life cycle.

EMP consists of a set of mitigation, management and institutional measures to be taken up during implementation and operation of a project to eliminate adverse environmental impacts or reduce them to an acceptable level. Chapter IV dealt with environmental impacts of this project and proposed mitigation measures to minimize adverse impacts as well as to improve the existing environment quality. This chapter mainly discusses the administrative aspects of ensuring that mitigation measures are implemented and their effectiveness is monitored after approval of EMP. It comprises of Corporate Environment Policy (CEP) of company, establishment of an Environment Management Cell (EMC) and developing mechanism of reporting of non-compliances, if any to company board, conduct root cause analysis of non-compliances and propose appropriate mitigation measures to ensure avoidance of adverse Penal action arising out of environment and other statutory regulation.

Good practices of EMP will be ensured to keep all the environmental parameters of the project w.r.t. Air, Water quality, soil, biological diversity of the area Socio economic improvement, standards, biological diversity of the area within statutory limits and sustainable manner.

10.2 Elements of EMP

EMP includes four major elements: -

1. **Planning:** This includes identification of environmental impacts, legal requirement, commitments and policies, setting environmental objectives and environment, health, safety and social compliance requirements;
2. **Implementation:** This comprises of resources available for the project, accountability of employees, contractors and documentation of measures to be taken;
3. **Checking:** Measurement & Evaluation: This includes regular inspection, audits, monitoring corrective actions and record keeping; and
4. **Management Review:** Actions are taken to continually improve the environment, health, safety, and social performance of the organization.

The following Policy & programs have been developed to ensure proper implementation of EMP for the proposed mining project:

- Formulating Corporate Environment Policy (CEP)
- Formation of Environment Management Cell (EMC)
- Greenbelt Development/plantation programme
- Occupational Health and Safety
- Budgeting of Environmental mitigation measures

10.3 Corporate Environment Policy

Corporate Environment Policy (CEP) has been formulated and adopted by the Project Proponent to provide a framework to become an environmental sustainable company. The hierarchical system or administrative order of the company to deal with the environmental issues and for ensuring compliance with the EC conditions etc. has been given in the Corporate Environmental Policy of the company.

Corporate Environmental Policies of the Company:

1. Consider ways of demonstrating commitments to comply with the environmental legislations where practical.
2. To mount pollution control equipment and carrying out performance evaluation on regular basis.
3. Encourage and enhance biodiversity and ecology.
4. To coordinate the environment related activities to the top management within as well as with outside concerned agencies.
5. Ensure that key employees are aware of this policy and trained in their environmental responsibilities.
6. Regular review environmental performance and set targets to achieve continuous improvement.

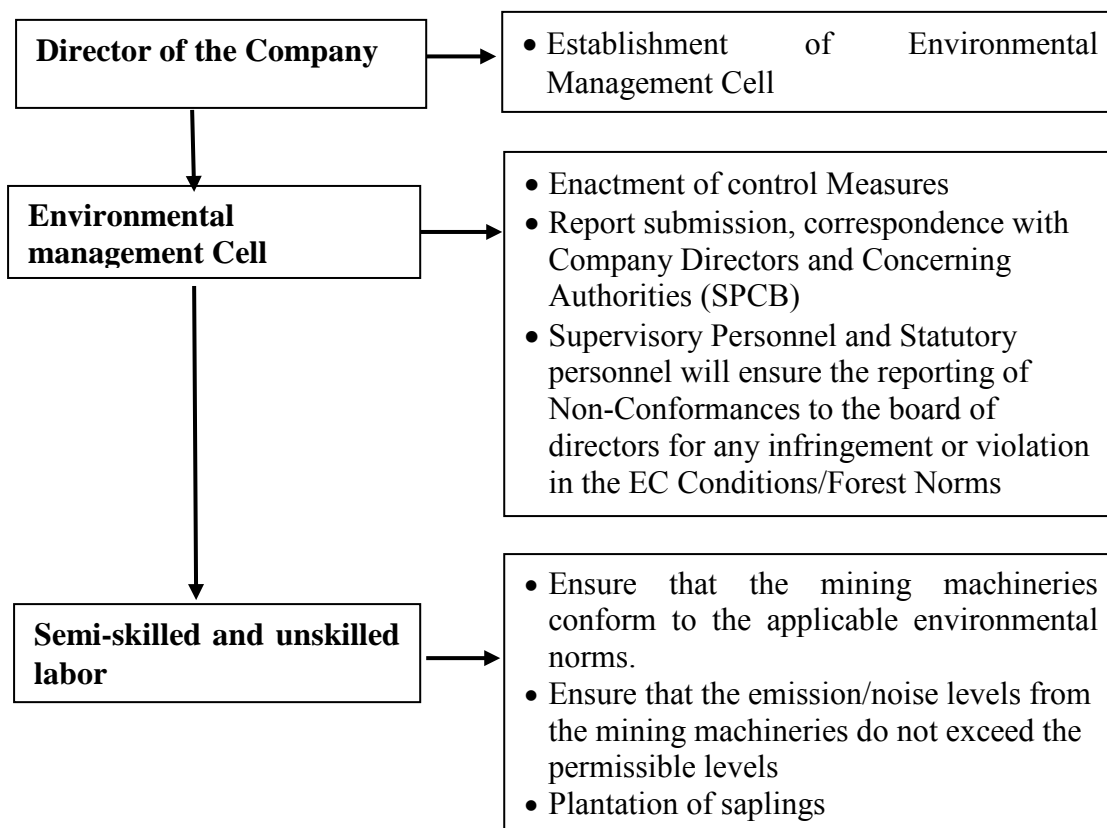


Figure 10-1 Corporate Environmental Policy

10.4 Proposed Plantation Scheme

About 264 trees will be planted each year as indicated below. Optimum sizes of green belt will be chosen to alter pollutants from fugitive sources. The prime factors to be taken into consideration for green belt plantation scheme shall be the nature of pollutants, emission levels and the maximum impacted zones. As plantation is not possible in the safety zone because soil is not suitable for plantation therefore plantation will be done along the haul road and in nearby villages, outside the lease area. Following species are recommended and given in table;

Table 10-1 List of tree Species for Green Belt Development

S. No	Scientific Name	Standard Name	Time When Flowering/ Fruiting occurs
1.	Ailanthus excelsa	Maharuk	January-March
2.	Albizia lebbeck	Sirish	January-March
3.	Albizia procera	Safed Sirish	January-March
4.	Azadirachta indica	Neem	June-July
5.	Bauhinia variegata	Kanchan	May-June
6.	Butea monosperma	Palash	February-April
7.	Cassia fistula	Amaltas	March-June
8.	Emblica officinalis	Amla	January
9.	Terminalia bellerica	Bahad	April-July
10.	Cassia siamea	Chakunda	May – June
11.	Leucaena leucocephala	Subabul	February-May
12.	Mangifera indica	Aam	April-July
15.	Syzygium cumini	Jamun	June-July
16.	Terminalia arjuna	Arjun	April-July
17.	Ficus benghalensis	Bargad	May – August
19.	Cassia fistula	Sonnari/ amaltas	May – June
20.	Zizyphus spp	Barkoli	April – June

Table 10-2 Year wise Plantation Program

Period	Location	Area in Ha	No of saplings
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1st year of Plan Period	Peripheral Safety Zone of Cluster-1	0.292	264
2nd year of Plan Period	Peripheral Safety Zone of Cluster-1	0.292	264
3rd year of Plan Period	Peripheral Safety Zone of Cluster-1	0.292	264
4th year of Plan Period	Peripheral Safety Zone of Cluster-1	0.292	264
5th year of Plan Period	Peripheral Safety Zone of Cluster-1	0.292	264
Total		1.46	1320
At the end of Conceptual (Life of mine) period	Quarried out area of Cluster- 1	8.21	3000
Total		9.67	4320

10.5 Detailed Budget for EMP

It is necessary to include the environmental cost as a part of the budgetary cost component. The project authorities propose to undertake the following environmental works to achieve the environmental quality as desired.

Table 10-3 Budget for EMP for Proposed Project

S.no	Particulars	Capital Cost	Annual Recurring cost
1	Pollution Control	10,00,000	2,50,000
2	Pollution Monitoring	10,00,000	2,50,000
3	Afforestation along Approach road	5,00,000	2,50,000
4	Occupational health and safety	15,00,000	5,00,000
Total		40,00,000	12,50,000



Chapter 11 Summary & Conclusion

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Chapter 11 Summary & Conclusion

11.1 Introduction

Basupali Cluster Stone quarry is a newly proposed Mine located at village: Basupali, Tehsil: Balangir, District: Balangir (Odisha). The cluster is spread over an area of 9.67 ha. The Mining plan was authorized by the Joint Directorate of Geology, Balangir, Odisha. It is a new proposed stone mine cluster project with the excavation capacity of 112166 cum stone.

Cluster of active mines area in the immediate surrounding exceeding 5 hectares, therefore EIA and EMP required for seeking Environmental Clearance from SEIAA as per the O.M F. No. L-11011/175/2018/-IA-II (M) dated 12/12/2018.

11.2 Project Details

Table 11-1 Project Details

A. Project Proponent	
Project Proponent	The mine lease is yet to be allotted. The EIA is being prepared under the name of the Tehsildar, Balangir (On behalf of Successful Bidder)
A. Nature of Project	Proposed mine of Basupali Cluster Stone quarry with the excavation capacity of 112166 cum stone.
B. Size of the Project	
Project Name	Basupali Cluster Stone quarry
New/ existing / R enewal mine/ Lease Period	New
Area	9.67 ha
C. Project Location	
Khata No.	14
Location	Village: Basupali, Tehsil: Balangir, District: Balangir (Odisha).
Survey of India Topo Sheet no.	64P/6
Life of Mines	Approx. 5 years
Available Mineable Reserve-Stone	7,83,593.1



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Chapter 11

Water Requirement	7.0 KLD
Manpower Requirement	55 Nos.
Climatic Conditions	Annual Maximum Temperature: 46°C Annual Minimum Temperature: 8 °C
Present land use at the proposed site	The area is a Non-Forest, undeveloped Govt. land
D. Environmental Settings Details	
Nearest village	Jalia Village 1.2 Km,W
Nearest Town/City	Balangir about 8.2 km, NE
Nearest Railway Station	Deogan Road Railway Station-8 Km, S
Nearest Airport	Biju Patnaik International Airport, Bhubaneswar about 249.5 km, E
Nearest Highway	NH- 201 is 1.7 Km W away from lease area(Bolangir to Bhawanipatna road) / SH-42 is about 9.5 Km E from lease area (Bolangir to Bangomunda road)
Nearest Water Body	Padampur Nallah 2.6 Km, N
Ecology Sensitive Zone	No national parks and sanctuary within 10 k m radius
Topography	Topographically area is a part of hilly terrain
Sesmic Zone	Zone – II as per IS: 1893 (Part-I): 2002
E. Cost Details	
Project Cost	~2.0 Crore
Cost of EMP	Capital Cost- 40,00,000 Recurring Cost- 12,50,000

11.3 Mining Details

Table 11-2 Mining Details

Particulars	Details	
Method of Mining	Semi- Mechanized Open Cast mining	
Available Minal Reserve-Stone	7,83,593.1 cum	
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Life of Mines	Approx. 5 years
Bench Height	3 to 6 m
Bench Width	6 m
Water Table	15-20 m
Water Requirement	7.0 KLD
Manpower Requirement	55 Nos.
No. of Working Days	300 days/Year
Climatic Conditions	Annual Maximum Temperature: 46°C Annual Minimum Temperature: 8 °C
Present land use at the proposed site	The area is a Non-Forest, undeveloped Govt. land

Source: Mining Plan & Progressive Mine Closure Plan

11.4 Mitigation Measures

11.4.1 Air Pollution Control Measures

Drilling:

Drilling machines will be equipped with wet drilling arrangements

Blasting:

- Controlled blasting with Muffled blasting techniques will be adopted.
- Rock breaker will be deployed in place of secondary blasting.
- Water spray on blasted muck pile.

Loading & Transportation

- Regular water sprinkling on the Haul roads with the help of water tanker.
- Development of green belt/plantation around mine boundary, roads and other places will be carried out to control the air pollution.
- Regular maintenance of HEMMs & transportation vehicles.
- Vehicular emissions will be kept under norms.
- Personal Protective Equipment like dust masks will be provided to all employees.
- Periodic air quality monitoring will be carried out.
- Transportation using the route in habitations would be avoided.

11.4.2 Noise Pollution Control Measures

Drilling

- Drilling will be done with sharp drill bits to achieve optimum drilling performance and to reduce noise generation at source.
- Personal protective equipment i.e. earplug in drilling & high noise area will be ensured.

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Blasting & Vibration

- Ground vibrations will not affect the structures in the vicinity of ML area as blasting will be done in accordance with standards prescribed by DGMS for controlled blasting.
- Muffled Blasting techniques such as using of flexible & heavy rubber sheets over blasting holes, Dummy holes, trench making etc. which will help in reducing the ground vibration.
- Explosives charge per hole and per delay will be maintained as per DGMS guidelines.
- Zone would be left out towards the nearest habitation and blasting would not be done in this area, only rock breaker would be employed in this area.

Transportation

- Adequate silencers in HEMM will be provided to reduce generation of noise.
- Proper maintenance, oiling and greasing of machines at regular intervals will be done to reduce generation of noise.
- The workers employed at HEMM will be provided with protective equipment, earmuffs and earplugs as a protective measure from the high noise level generated at the mine site and wherever required.
- Development of green belt & plantation around lease boundary, roads and other places will be carried out.
- Periodical monitoring of noise will be carried out regularly.
- Transportation using the route in habitations would be avoided.

11.4.3 Waste water management

Waste Water

- Domestic wastewater generated from mines office will be disposed off in soak pit via septic tank.
- Other than Domestic waste water no other waste water will be generated from the Mining Operations.

Surface Run-off

- Garland drains will be constructed to check the soil erosion & surface run-off.
- The rainwater falling directly into the mine pits will be stored and used for plantation & dust suppression.
- Periodical monitoring of ground water quality will be carried out.

11.4.4 Reclamation plan for Land use

- The mining activity will affect the present landscape of the ML area. However, at conceptual stage, the area will be developed into water reservoir.

11.4.5 Green Belt development & Plantation

- Total area which will be covered under planation till the end of the life of mine will be 0.292 ha.

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- 264 plants per year will be planted as per the plantation program.
- Local plant species will be selected for the green belt development.

11.5 Additional Studies

Additional Studies i.e. Risk Assessment & Disaster Management Plan, Land use and land cover study, Ecology and Biodiversity are covered with this EMP Report as per the Terms of Reference was granted by SEIAA for file number File No. SIA/OR/MIN/64155/2021 on 26/07/2021.

11.6 Project Benefits

The proposed project will help the local economy directly as well as indirectly as there is going to be capital expenditure for this unit and it will generate substantial employment in the region. The project will also contribute to the District as well as to State exchequer by way of various taxes and duties. With the proposed development in and around the area, there will be supporting facilities/infrastructure eventually leading to the development of the area. The project will boost the overall growth of the region and in the state, the local economy will flourish due to income expenditure in the local market. Therefore, project is having great importance to the state and national economy.

Along with the contribution in employment generation and economic growth of the country project will also be helpful in the development of basic needs of the local area like education, Health & family welfare, women empowerment, Natural resource management, water conservation, infrastructure development etc.

11.7 Conclusion

The Stone Quarry Mine project will prove beneficial to the local people as direct and indirect employment opportunity will be generated. There will be increase in revenue generation to the government by way of government taxes etc. Further improvement in infrastructure will take place like education, roads, availability of drinking water, medical facilities in adjacent villages.

There will be no significant pollution of air, water, soil and noise. Regular monitoring of all the components of environment will be done and according to that the proposed mitigation measures will be adopted. Increased social welfare measures taken by the proponent will bring development in the near-by villages.



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Chapter 12 Disclosure of Consultants

12.1 Company Details & Organization of Company

Name : *Green Circle, Inc.*
Corp. Office & R&D Address : *Green Empire (Anupusham), Above Axis bank, near Yash Complex, Gotri Road, Vadodara, 390021 Gujarat.*

Telephone : [0265 237 1269](tel:02652371269), [091 9998036028](tel:0919998036028)

Email : info@greencircleinc.com

12.2 Company Profile

Green Circle, Inc. is a leading IMS (ISO 9001, 14000,45001) & Integrated HSEQR Consulting, Engineering, Scientists and training organization in the field of Environmental, Safety, Health & Hygiene, Risk Engineering & Quality Systems.

GCI offers One Stop Solution for all industrial & commercial requirements in the field of Environment, risk and safety, having Business Operations in India and Abroad.

GCI is committed to deliver the best practical solution to all sectors of business with an aim to have Pollution Free & Healthy Environment along with Sustainable development.

12.3 Service Provided

M/s. Green Circle, Inc. offers following specialized services in 8 verticals as:

- ✓ *Risk Management Services (with Fire & Safety)*
- ✓ *Electrical Safety Services*
- ✓ *Industrial Hygiene Services*
- ✓ *Business Management Services*
- ✓ *EIA & Environmental Consulting*
- ✓ *Environmental Laboratory Services*
- ✓ *Training & Seminars*
- ✓ *Engineering Services*

12.4 Vision Statement

Our Mission

Our mission is to provide outstanding HSE consulting service with an integrated strategic and technical approach that delivers excellent, long lasting and sustainable impact for our clients."

Our Vision

"To become the leading total sustainable EHS solution provider in the country."

12.5 EIA Team Members

The EIA team engaged in the preparation of EIA report consists of professionals with multidisciplinary skills and experience required for undertaking this project.

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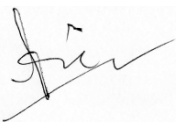
The EIA involved in various stages of planning to final report preparation is given below in table:

“I, hereby, certify that I was a part of the EIA team in the following capacity that developed this Report”.

The EIA team engaged in the preparation of EIA report consists of professionals with multidisciplinary skills and experience required for undertaking this project. The EIA involved in various stages of planning to final report preparation is given below in table:

Project Name: Basupali Stone Quarry Cluster Project		
Name and address of the consultant	Green Circle Inc. Green Empire Anupushpam, Above Axis Bank, Near Yash Complex, Gotri Main Road	QCI-NABET Accredited NABET/EIA/2124/RA0219 (Valid till-26.04.2024)
EIA Coordinator and Team Leader	Mr. Arun Kumar Shrivastava	

12.6 EIA coordinator

Name	Mr. Arun Kumar Shrivastava
Signature & Date	
Involvement	<ul style="list-style-type: none"> Obtaining information like the PFR that provides the essential project related information for EIA purpose Ensuring the quality of baseline data through FAEs Explaining the client the local environmental issues Developing the environmental management plan including its implementation the monitoring plan Finalization of EIA/EMP report







12.7 Functional area experts

Functional Areas	Name of the Expert	Involvement (Period & Task**)	Signature & Date
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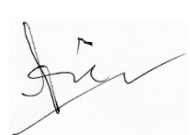




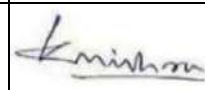
Meteorology, air quality modelling, and prediction (AQ)	Mr. Pradeep Joshi	Site visit, finalization of monitoring locations, checking air quality data, evaluation of results of Ambient Air Quality Monitoring (AAQM), supervision of air quality modeling and prediction, identification of impacts, suggestion and finalization of mitigation measures with client, and contribution to EIA documentation.	
Air pollution monitoring, prevention and control (AP)	Mr. Ram Raghav	Site visit, finalization of monitoring locations, checking air quality data, evaluation of results of Ambient Air and identification of impacts, suggestion and finalization of mitigation measures with client, and contribution to EIA documentation.	
Water Pollution(WP)	Miss. Sheetal Parmar	Site visit and finalization of sampling locations for water sampling, water balance for the project, evaluation of water pollution control management, identification of impacts, suggestion and finalization of mitigation measures, contribution to EIA documentation.	
Water Pollution(WP)	Mr. Sumant Kuvar	Finalization of sampling locations for water sampling, water balance for the project, evaluation of water pollution control management, identification of impacts, suggestion and finalization of mitigation measures, contribution to EIA documentation.	
Water Pollution(WP)	Mr. Nanjunda Swamy Raman	Finalization of sampling locations for water sampling, water balance for the project, evaluation of water pollution control management, identification of impacts, suggestion and finalization of mitigation measures, contribution to EIA documentation.	
Solid and Hazardous waste Management (SHW)	Mr. Pradeep Joshi	Identification of the waste generated from the mining activity, studying its management and mitigation.	



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Socio-Economic (SE)	Mr. Gunesh Deosthali	Secondary data collection, site visit, evaluation of Socio-Economic status of the study area, assessment of the possible changes to socio-economic issues arising out of the proposed activity, contribution to the EIA documentation.	
Noise and Vibration (NV)	Mr. Pradeep Joshi	Supervision of noise sampling programme, analysis of data, identification of impacts and mitigation measures, contribution to EIA documentation.	
Noise and Vibration (NV)	Mr. Arun Kumar Shrivastav	Supervision of noise sampling programme, analysis of data, identification of impacts and mitigation measures, contribution to EIA documentation.	
Noise and Vibration (NV)	Mr. Ram Raghav	Supervision of noise sampling programme, analysis of data, identification of impacts and mitigation measures, contribution to EIA documentation.	
Risk & hazard (RH)	Mr. Pradeep Joshi	Identification, finalization of DMP, contribution to RA / DMP documentation.	
Ecology and biodiversity (EB)	Mrs. Pooja Sharma	Ecosystem analysis and evaluation, landscape ecology, assessment of impacts on ecological and biodiversity impact assessment on ecology/ biodiversity	
Hydrology, ground water and water conservation (HG)	Mr. Pravaranjan Mishra	Supervision in undertaking study related to Hydro-Geology and preparation of drainage pattern. Analysis of surface hydrological data pertaining to flow fluctuation, , designing of ground water table measurement and monitoring network, computation of ground water recharge, flow rate and direction	
Geology (Geo)	Mr. Pravaranjan Mishra	Supervision in undertaking Geology and Geo morphological analysis, studying Stratigraphy/Lithology, Vibration analysis in relation to mining operations, Developing geological maps.	



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Soil Conservation (SC)	Mr. Shirish Vishwasrao Bhoite	Supervision in sampling, analysis and characterization of soil, assessment of fertility/productivity of soil, nutrient availability, assessment and minimizing of impact of gaseous, liquid and solid pollutants on soil.	
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12.8 Team members

Sr. No	Name	Signature
1	Mr. Somnath Kahandal	
2	Mr. Rajesh Shelke	
3	Miss. Hariyali Shah	
4	Mr. Sushant Kumbhar	