DRAFT ENVIRONMENTAL IMPACT ASSESSMENT

&

ENVIRONMENT MANAGEMENT PLAN

OF

Amkroh Limestone Mine

(Area- 1.25 Ha.)

FOR

Production of 60391 TPA Limestone Minerals

At

At-Amkroh, Elaka - Nongtalang, Jowai

District-West Jaintia Hills, State- Meghalaya

Proponent:

Shri Solomon Gassah

Village- Lamin

Dist. - West Jaintia Hills

State- Meghalaya

Prepared by :

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For EIA Studies as 'A' Category Consultant
(Sl. No. 91st, List of Accredited Consultant Organizations August, 2021)

September 2021

FOREWORD

Shri Solomon Gassah is proposing to operate a Limestone mine for the production of 60391 TPA Limestone Minerals over an area of 1.25 Ha. It is located at Amkroh, Elaka- Nongtalang, Jowai, District-West Jaintia Hills, and State- Meghalaya.

SEIAA, Meghalaya issued ToR Vide letter no. ML.SEIAA/MIN/WJH/P-152/2021 dated 2 August, 2021, which formed the basis of preparation of draft EIA report.

With a view to assess the potential environmental impacts due to proposed activities, Shri Solomon Gassah, Project Proponent has retained Indian Mine Planners & Consultants, Kolkata to undertake Environmental Impact Assessment studies for various environmental components, in order to identify the impacts and its mitigation measures. The report also envisages the prediction of the potential impacts due to the proposed activities.

The timely cooperation and assistance rendered Shri Solomon Gassah is gratefully acknowledged.

Authorised Signatory

Place: Kolkata **Indian Mine Planners & Consultants**

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CHAPTER-1- INTRODUCTION

1.0. INTRODUCTION

1.1. Purpose

Environmental Impact Assessment (EIA) is one of the proven management tools for integrating environmental concerns in development process and for improved decision making as there is need to harmonize the developmental activities with the environmental concerns into the larger interest of the society. The growing awareness, over the years, on environmental protection and sustainable development, has given further emphasis to the implementation of sound environmental management practices for mitigating adverse impacts from developmental activities. EIA study plays a vital role in sustainable development of a country. Recognizing its importance, the Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India has formulated policies and procedures governing the industrial and other developmental activities to prevent indiscriminate exploitation of natural resources and to promote integration of environmental concern in project development. Final Environmental Impact Assessment report has been prepared to comply with the proposed Terms of Reference (ToR), under EIA notification of the MoEF&CC dated 14th September, 2006 and amended thereof, for seeking environmental clearance for mining of limestone in the applied mining lease area.

1.2. Identification of Project & Project Proponent

Amkroh Limestone Mine project is for mining of limestone mineral by Semi mechanized opencast method with drilling and blasting. The applicant of the project is Shri Solomon Gassah; owner of Amkroh Limestone Mine is the authorized signatory. The Government of Meghalaya has issued Letter of Intent for mining lease of limestone (minor mineral) mining in favour of Shri Solomon Gassah on dated Jowai 20.07.2020 vide letter no. JH/S.G/M.L/L.S/2020-21/B/459 attached as **Annexure-2**. He has applied for an Environment Clearance after obtaining the necessary approval of the Mining Plan and Progressive Mine Closure Plan from the Directorate of Mineral Resources, Meghalaya vide letter no. DMO-J/40/MM/Mining Plan/2020-2021/125, dated Jowai, the 30 October 2020 attached as **Annexure-3**. The project area is of private land category. No forest area is involved. The mine will be in operation as per the Mining Plan approved by Director of Mineral Resources, Meghalaya. This EIA report is for production capacity up to 60391 TPA as per the Pre-feasibility Report. This is a new mining proposal. The owner of the mine carried out the mining

of Limestone for supplying to consumers in producing lime. The Limestone from the mines shall be utilised in the lime burning and construction activities.

The mine lease area is less than 50 ha, hence project comes under Schedule no. 1 (a) Category "B" as per EIA Notification 2006. Mining will commence after obtaining EC and other statutory clearance. As per DMO (Directorate of Mineral Resources) Jowai Report No. DMO-J/40/MM/Mining Plan/2020-2021/135, dated the 8th March 2021 lease area comes under cluster. DMO Report is attached as **Annexure-4**. The details of lease within a distance of 500 m from the periphery of applied lease area is as follows-

Table- 1.1

S.N.	Approved Mining Plan	Area (hectares)	Mineral	Distance from the approved mining site of Sri Solomon Gassah (meters)
1	Smt. Pri-io Buam	4.0	Limestone	3
2	Shri Baisor Lamin	4.5	Limestone	104
3	Shri Damanbait Lamare	4.9	Limestone	450

Shri Solomon Gassah, is the applicant of the project. Applicant is a Private Individual.

Correspondence & Registered Address:-
Shri Solomon Gassah
Village- Lamin
Dist. - West Jaintia Hills, State- Meghalaya.
Email- amkrohsolomon@gmail.com

1.2.1 Terms of Reference

The Terms of Reference is prescribed for Project seeking Environmental Clearance (EC) under the provision of the Environment Impact Assessment Notification, 2006 (except for project under item No. 8-a). The Terms of Reference issued after approval of the Ministry/SEIAA is based on the recommendation of the Expert Appraisal Committee (EAC) / State Expert Appraisal Committee (SEAC). In the present case the State Expert Appraisal Committee, Meghalaya (SEAC) in its ToR meeting followed by SEIAA' meeting issued TOR letter vide no. ML.SEIAA/MIN/WJH/P-152/2021 dated 2 August, 2021 for undertaking detailed EIA study for the purpose of obtaining environmental clearance in accordance with the provisions of the EIA Notification; 2006.The TOR issued and its compliance is attached as **Annexure-1** of the EIA report.

1.3. Brief Description of Project

The proposed project is for mining of Limestone mineral at the maximum rate of 60391 TPA in an area of 1.25 ha. The mining will be done by open cast semi mechanized method with drilling and blasting. Detail description is given in Chapter The proposed mine is located at Amkroh, Elaka Nongtalang, Jowai, District-West Jaintia Hills & State- Meghalaya.

1.4 Regulatory Compliances: Environmental Legislations Applicable In Development Sector

The environmental consideration in any development process has become a necessity for achieving sustainable development. To achieve these goals, the Ministry of Environment & Forests, Govt. of India, has enacted various acts, legislations, guidelines and standards from time to time. The principal environmental regulatory agency in India is the Ministry of Environment & Forests, New Delhi. MoEF&CC formulates environmental policies and accords environmental clearances for different projects. Organization's adherence to laws, regulations, guidelines and specifications relevant to its business is a part of regulatory compliance. Applicant will strictly follow all the law, regulations, guidelines and standards designed by MoEF&CC and concerned agencies. Applicant is well aware that violations of regulatory compliance regulations will result in legal punishment, including federal fines.

Table 1.2

Name	Scope and Objective	Key Areas	Operational Agencies/Key Player	Implications on our project
Water (Prevention and Control of Pollution) Act, 1974 and amendments	To provide for the prevention and control of water pollution and enhancing the quality of water	Control sewage and industrial effluent discharges	Central and State Pollution Control Boards	Yes, compliance of EC conditions will be done and PP will initiate monitoring of water quality at regular intervals
Air (Prevention and Control of Pollution) Act,1981 and amendments	To provide for the prevention and control of air pollution	Controls emission of air pollutants	Central and State Pollution Control Board	Yes, compliance of EMP and EC conditions will be done. Action onwards control of pollution and monitoring of Air quality will be taken up as per EMP given in the EIA report.
Noise Pollution	Noise	Control of	Central and	Yes, compliance of

(Regulation & Control) Rule2000 and amendments	pollution control	noise pollution in residential, commercial, industrial and silent zones	State Pollution Control Board	EMP and EC conditions will be done. Action towards control of Noise pollution and monitoring will be taken up as per EMP given in the EIA report.
Forest (Conservation) Act, 1988 and amendments	To consolidate acquisition of common property such as forest, halt India's rapid deforestation and resulting environmental degradation	Regulates access to natural resources, state has a monopoly right overland, categories forests, restriction on reservation and using forest for no forest purpose	State Government and Central Government	No, The lease is "non forest" land
Wildlife (Protection) Act, 1972 and amendments	To protect wildlife	Creates protected areas (national parks / sanctuaries) categories of wildlife which are protected	State Government and Central Government.	No
Ancient Monuments and Archaeological sites &Remains Act,1958 and amendments	To protect ancient monuments of national heritage / importance	Conservation of cultural and historical remains found in India	Archaeological Survey of India	NA, There is no ancient monument within the lease area.
Hazardous & other Wastes (Management & Trans boundary Movement) Rules, 2016	Health and safety	Assessment of hazardous materials and management	Central and State Pollution Control Board	Yes, compliance of EMP and EC conditions will be done. Action towards Management and disposal of Hazardous waste will be duly complied with.
Plastic Waste Management	Recyclable Waste	Assessment of Recyclable	Central and State	No

Rules, 2016		Plastic material.	Pollution Control Board	
Solid Waste Management Rules, 2016	Bio-degradable waste Management	Assessment of organic waste material and its management.	Central and State Pollution Control Board	Yes, compliance of EMP and EC conditions will be done. Action towards Management and disposal of Municipal waste will be duly complied with.
Biological Diversity Act, 2002 and amendments	Biodiversity conservation	Disclosure of species survey or collection activities to the National Biodiversity Authority	MoEF, New Delhi and State Forest Departments	Yes, compliance of EMP and EC conditions will be done.
Environment (Protection) Act, 1986 and amendments	To provide for the protection and improvement of environment	An umbrella legislation, supplements pollution laws	Central government nodal agency, MoEF can delegate to state departments of environment	Yes, EIA report has been prepared for the project. Yes, CTO from State Pollution Control Board will be obtained.
Right to Fair Compensation And Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 and amendments	The new legislation will guide all land acquisitions of central and state governments, bringing in stricter norms and increasing landowners' compensation significantly.	Fair compensation to the assets acquired and proper rehabilitation and resettlement of PAFs with improvement in post acquisition social and economic status	Central and State Government	NA, no habitation exists, therefore compensation on account of land ownership is not applicable.
EIA Notification 14th Sep 2006 and amendments	Environment Impact Assessment	Environmental Protection	Project Development, State and Central Government	Yes, EIA report has been prepared for the project. Once the EC is granted, compliance of EMP and EC conditions will be done.

CHAPTER 2: PROJECT DESCRIPTION

2.0 PROJECT DESCRIPTION

2.1 GENERAL

The proposed project is for mining of limestone mineral from lease area of 1.25 ha. The maximum production from the mine will be 60391 MT/annum. Mining of mineral will be done by opencast semi mechanized method. The applicant of the project is Shri Solomon Gassah, owner of Amkroh Limestone Mine is the authorized signatory. The Government of Meghalaya has issued Letter of Intent for mining lease of limestone (minor mineral) mining in favour of Shri Solomon Gassah on dated Jowai 20.07.2020 vide letter no. JH/S.G/M.L/L.S/2020-21/B/459. He has applied for an Environment Clearance after obtaining the necessary approval of the Mining Plan and Progressive Mine Closure Plan from the Directorate of Mineral Resources, Meghalaya vide letter no. DMO-J/40/MM/Mining Plan/2020-2021/125, dated Jowai, the 30 October 2020. The copy of approval letter of the mining plan is given at **Annexure no. 3** of the EIA report.

The project area is of private land category. No forest area is involved. The mine will be in operation as per the Mining Plan approved by Director of Mineral Resources, Meghalaya. This EIA report is for production capacity up to 60391 TPA as per the approved mining plan.

The latitude of the project area is N 25°14.713' TO N 25°14.780' and longitude is E 92°5.880' TO 92°5.962' E with maximum contour of 894 mRL and minimum contour of 887 mRL. The area falls in the Survey of India Topo-sheet no. 83C/3 (Restricted topo sheet). The lease area forms a part of the individual owned land. The proposed land is a Non forest Land according to Divisional Forest Officer, Jaintia Hills (T) Division, Jowai (Ref No. JH/S. Quarry/2009-10/476/B/2235, Dated 05.08.2019.

The proposed mine area is a Block (Polygon) shaped land and falls under "Non forest land".

The project comes under Schedule no. 1 (a) and category B as the mine area is less than 50 ha.

2.2 TYPE OF THE PROJECT

Present proposal pertains to open cast semi mechanized mining with drilling and blasting of limestone in district West Jaintia Hills, Meghalaya. The lease having an area of 1.25 Ha is located in Amkroh, Nongtalang area, District-West Jaintia Hills, State-Meghalaya and comes in Schedule S.No. 1(a), Category-B, for obtaining the environmental clearance.

2.2.1 Nature of the Project

This is a mining project covered under Schedule 1(a), Category 'B' according to Environment (Protection) Act 1986 as amended dated 14th September 2006, and subsequent amendments. The proposed project is for mining of limestone mineral at the rate of 60391 MT/annum. The extent of mining lease area is 1.25 Ha., which comprises of non forest land. The estimated project cost is about Rs 12.00 Lacs.

2.2.2 Demand of the Project

The limestone boulder have a great demand in the local open market as well as for supply to the neighbouring state as building and construction material for various construction purposes as well as for supply to limestone kilns. This contributes direct revenue accruals to the state as well as central exchequer in the form of royalty, GST and cess. The limestone mine will also provide several direct and indirect employments to the local people in the area.

2.2.3 Scope of Study

As per EIA Notification 2006 every entitled project has to undergo four stages of Environmental Clearance 1) Screening 2) Scoping 3) Public Consultation 4) Final Appraisal. After the initial process of determination of extent of project and its categorization comes the scoping part. During scoping the Expert Appraisal Committee determine detailed and comprehensive Terms of Reference (TOR) addressing all relevant Environmental concerns for the preparation of an Environment Impact Assessment (EIA) Report in respect of the project or activity for which prior environmental clearance is sought. The Committee has determined the Terms of Reference on the basis of the information furnished in the prescribed Form-1 and PFR. EIA Report has been prepared covering all the points directed in the issued Terms of Reference. The TOR from SEIAA, Meghalaya was granted vide letter no. ML.SEIAA/MIN/WJH/P-152/2021 dated 2 August, 2021. Tor letter for the mine and TOR compliance has been enclosed with EIA report. Baseline study was conducted earlier than Issuance of ToR during December- 2020 to February 2021.

Land Classification:

The elevation range within the lease area is 894 mRL highest contour to 887 mRL lowest contour. The mineral is exposed in the whole lease area. The area is hilly and stony and falls under "non forest land". The details of land classification of 1.25 Ha. of M.L. area is given below:

Table 2.1

Classification of Land within leasehold			
Private Land			
Forest Land	**Non- Forest Land (Barren Land)**	**Deemed Forest land**	**Agriculture land**
Nil	1.25 Ha	Nil	Nil

2.3 LOCATION OF THE PROJECT

The existing mining site is located at Amkroh, Nongtalang Elaka, West Jaintia Hills district of Meghalaya State. The location map is shown in figure 2.1. The Google Image of the project is shown in figure 2.2. The detailed Environmental Setting is shown in Table 2.2.

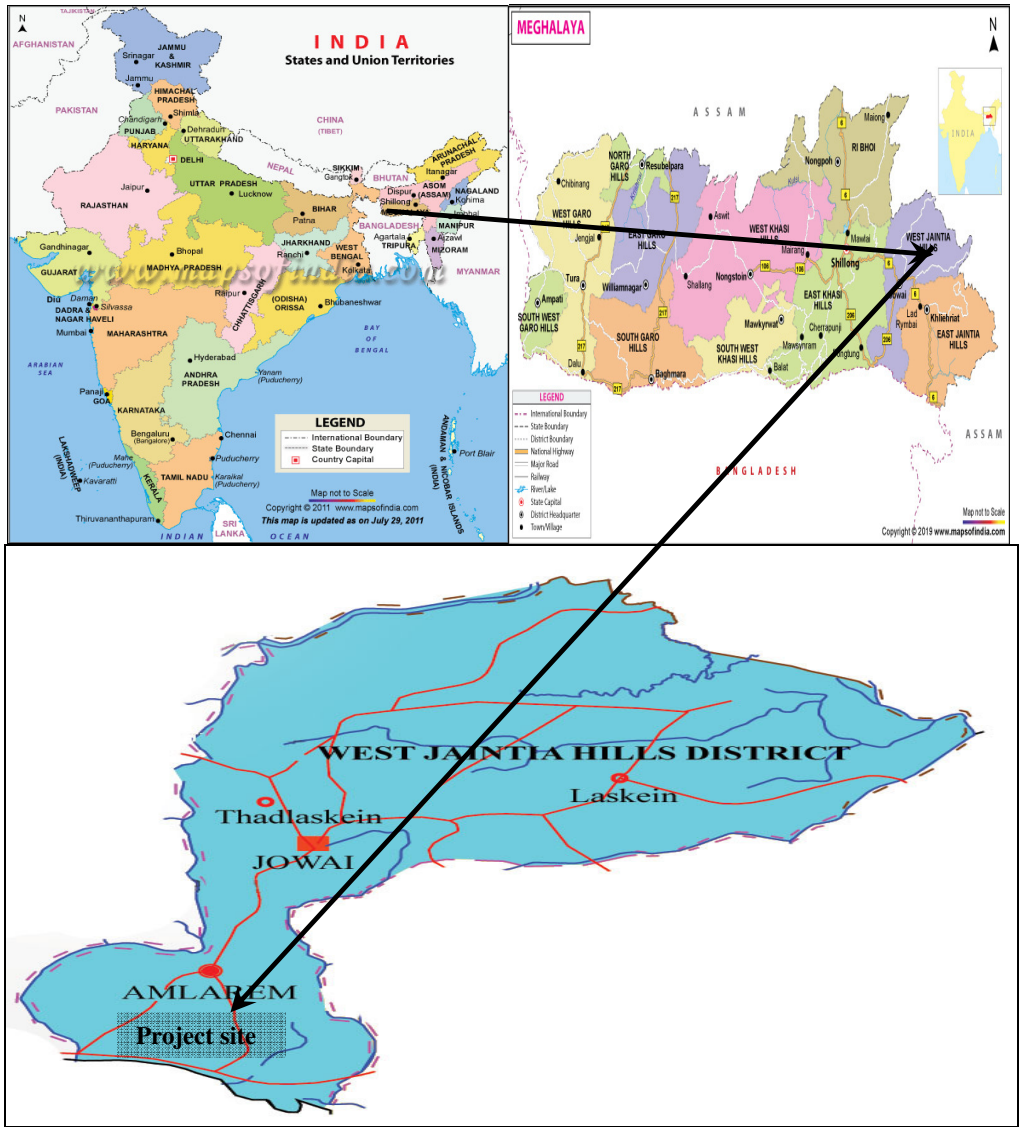


Figure 2.1: Location Map

Figure 2.2 : Google Image

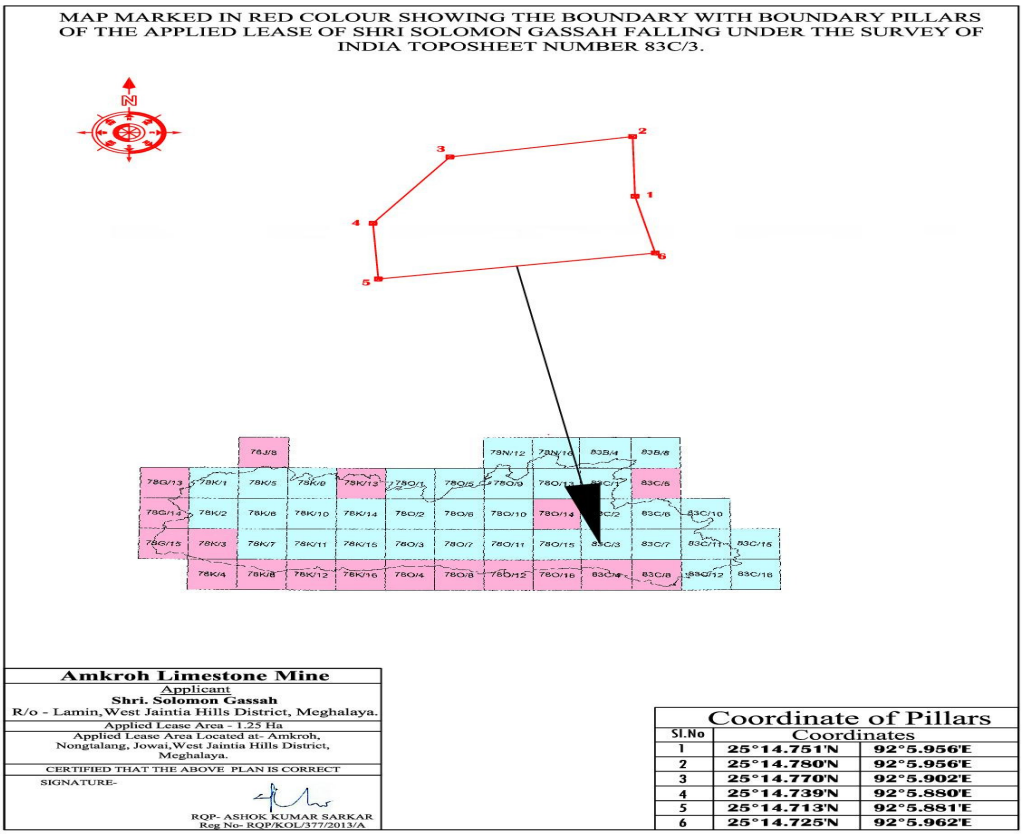


Figure 2.3: Lay Out Plan & Toposheet details

Table 2.2 Environmental Setting

Sr. No.	Particulars	Details
1	Location	At-Amkroh, Nongtalang Elaka, Jowai District- West Jaintia Hills State- Meghalaya.
2	Khasra No.	-
4	Total area	1.25 Hectares
5	Village	Amkroh
6	District	West Jaintia Hills
7	State	Meghalaya
8	Site elevation above MSL	Minimum Elevation- 887 m Maximum Elevation- 894 m
9	Geographical location in toposheets	83 C/3
10	Nearest representative IMD station	Cherrapunji, Meghalaya (35 km W)
11	Site topography	The area represents a domain of gentle rolling topography. The elevation range within the lease area is 894 mRL highest contour to 884 mRL.
12	Nearest highway	NH-40- (210 m W)
13	Nearest railway station	Guwahati Railway Station (200 Km N)
14	Nearest airport	Umroi Airport (102 Km N)
15	Nearest river/ Nalla	Wah Umngot River (10.5 Km NW)
17	Nearest port	No within 10 km radius
18	Nearest town	Nongtalang (3.5 km NE)
20	District headquarters	Jowai (24 km SW)
21	Nearest state/national boundaries	Bangladesh International Boundary (7.8 km S)
22	Nearest major city with 2,00,000 population	Jowai (24 km SW)
23	Nearest village	Nongtalang
24	Villages within 1 km radius	None
25	Distance from sea coast	Beyond 10 km radius
26	Hills/valleys	Lease area is Hill only
27	Nearest tourist place	Cherrapunji (35 km W)
28	Archaeologically important places	None within 10 km radius
29	Protected areas as per wildlife protection act 1972 (tiger reverses, elephant reserve, biospheres, national	Nil in 10 km radius

	parks wildlife sanctuaries, community reserves & conservation reserves)	
30	Reserved/protected forests	None
31	Seismicity	Seismically this area is categorized under zone-V.
32	Defence Installations	None

2.4 SIZE OF THE PROJECT

The proposal is to mine limestone mineral from the lease area 1.25 Ha the rate of 60391 TPA/201 TPD by open cast semi mechanized method with drilling and blasting.

2.5 LEASEHOLD AREA

Topography

The elevation range within the lease area is 900 m mRL highest contour to 700 mRL lowest contour. The mineral is exposed in the whole lease area.

Drainage

Drainage in the lease area is easterly. General drainage outside the area is almost easterly. The area is hilly and stony. Area is broken by nalahas/Nadi in the five kilometres periphery is illustrated on plate-2.

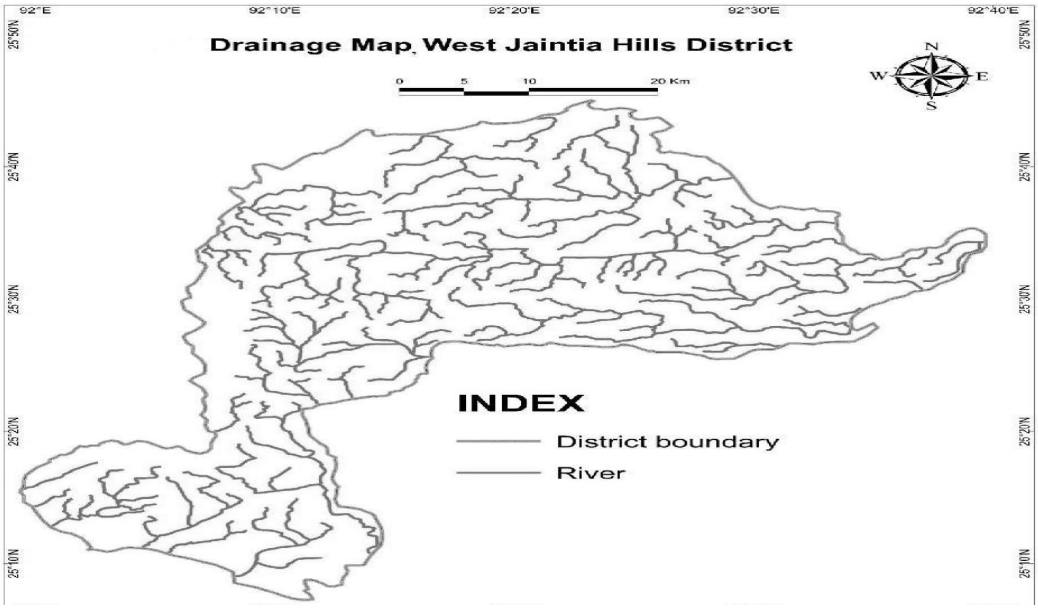


Figure 2.4 : Drainage map of West Jaintia Hills District (Source:CGWB Report of West Jaintia Hills District, Page No.11)

Existing Land Use of the Core Zone

It is a non forest land, involving 1.25 Ha.

Table 2.3, Existing Land use of the Mine lease area

Category	Area (Hectares)
Quarry	0.00
Road	0.01
Total area in use	**0.01**
Balance Un-used area	1.24
Total	**1.25**

2.6 GEOLOGY

Regional Geology

In a regional scale the area forms a part of the Meghalaya Plateau exposing geological milieu representing Precambrian to Tertiary sequence in this part of West Jaintia Hills District of Meghalaya.

Table: Summarized Regional Geological set-up

Geological Age	Group Name	Formation Name	Rock Type
Palaeocene-Eocene	Jaintia	Kopili Shella Langpar	Argillaceous sediments Dominantly limestone with Sandstone Calc siltstone with sandy I St.
Up cretaceous	Ultrabasic		
Cretaceous Jurassic	Khasi Group Sylhet trap	Mahadek	Thick units of conglomerate with impersistent interbands of sandstone Volcanic trap with vesicles
Pre-Cambrian	Khasi Greenstone Shillong Group		Epidiorite, meta dolerite, diorites Dykes Thick pile of quartzite
Proterozoic & Archaean	Assam Meghalaya Gneissic Complex		Para and ortho-gneiss, migmatite, mica schist

Local Geology

The proposed mining area is small and exposes only the limestone of the Sylhet limestone formation. Table provides a glimpse of the Geology that is seen in the area.

Table-: Local Geological set-up in the block

Geological Age	Group Name	Formation Name	Summarized Rock Type
Recent	Newer Alluvium	Unclassified	Unconsolidated soil, scree material
Eocene	Jaintia Group	Sylhet (=Shella)	Top part with grey/white limestone Bottom part with dark /steel grey limestone

Soil type:

The West Jaintia Hills district shows different types of soils as the provenance differs widely. The loamy soil is the most prevalent one. They vary from sandy to clayey-loam in Jowai and Nongbah. Reddish lateritic soil is observed in the hill slope in Sonapur and alluvial soil occurs in the southern periphery of the district eg Dawki, Muktapur, Lakroh etc. The soil is acidic in nature, with low percentage of phosphorous and high organic carbons.

Exploration carried out & Future Exploration

None.

2.6.1 Geological Reserves

The reserves are computed for proved and probable categories.

Table 2.4

Category of Resource	Mineable Reserves in Tonnes
Proved Mineral Reserves	569552
Probable Mineral Reserves	33893
Total Mineable Reserves	**603445**

2.6.2 Mineable Reserve

As per approved mining plan mineable reserves are 603445 Tonnes.

2.6.2 Life of Mine

The mineable reserve of the mine area is 603445 tonnes. Taking the maximum production target of 60391 tonnes and taking 300 as the average no. of working days per annum, the life of mine is estimated to be about 10 years.

2.7 PROPOSED SCHEDULE FOR APPROVAL AND IMPLEMENTATION

Mining as proposed will be undertaken after getting the Environmental Clearance and other statutory clearances. Thereafter the project will be implemented as per the directions/guidelines issued by SEIAA, Meghalaya while granting the EC.

2.8 TECHNOLOGY AND PROCESS DESCRIPTION

The process of limestone mining will be opencast semi mechanized mining. Drilling and blasting will be done to break hard limestone.

2.8.1 Mining Method

Semi Mechanized open cast mining will be undertaken with drilling and blasting.

❖ The width of each bench shall always be maintained to be not less than the height which is 6 m.

❖Since the deposit in this area is massive and compact in nature, it is proposed to carry out only opencast semi-mechanized mining during this plan period, i.e. five years.

❖**Drilling and Blasting** Jack hammer drill machine will be deployed for drilling of shot holes ranging from 39 to 34 mm diameter and breaking of limestone at the required size will also be done manually.

BLASTING:

Blasting is one of the most critical activities of any mining operation. For forming the working benches, drilling and blasting is done in the limestone deposit over the specified floor level. The depth of drilling and the quantity of explosive to be charged are determined so that after the blasting is carried out, the breakage of limestone will be upto the proposed floor levels.

Drilling will be done by jack hammer drill having diameter from 39mm to 34mm and blasting will be carried out by using gel explosives (such as Powergel 901). After sufficient numbers of holes have been drilled, the mining site is cleared of all persons except the blasting crew who will do their work of charging the holes with explosives and adequate charge in each hole.

After the blasting operation is over, an all clear signal is given to let people come and resume normal work in the mine. However, it is necessary that the blasting personnel

first check the blasted site in case there is a misfire. In such an event the all clear signal is not given and the blasting crew have to make the area around the misfire safe before the all clear signal is given.

The blasted boulders are carried by dumpers to the desired destination and the blasted face is dressed properly to prepare the area for another round of drilling and blasting.

Safety precautions in blasting

- The blasting personnel, including the helpers, shall use hard hats (safety helmets) as well as mining boots while on duty.
- Drilling and Charging of holes shall not be carried out in the same area simultaneously
- A detailed record of the hole positions, type of explosives, quality of explosives, hole depth, charge column and stemming would be maintained in a Register for locating/finding out the depth of the charge in case of a chance misfire.
- The mine shall be evacuated of all workers except the blasting crew, before blasting work is taken up.
- The blasting personnel should always use the blasting shelter for taking protection during blasting operation.
- A warning signal by siren or whistle shall be sounded before the charge is blasted.
- After blasting is over, all the shot holes shall be examined if there is any misfire taking place. The place shall be made safe before the all clear signal is sounded.
- Blasting time will be fixed in consultation with the neighbouring mines.

2.8.2 Past Production

It is a new mine for which Government of Meghalaya has issued Letter of Intent for mining lease of limestone (minor mineral) mining in favour of Shri Solomon Gassah dated Jowai 20.07.2020 vide letter no. JH/S.G/M.L/L.S/2020-21/B/459 for grant of Mining Lease over an area of 1.25 Ha. at-Amkroh, Elaka Nongtalang, Jowai, District- West Jaintia Hills, State- Meghalaya for mineral Limestone. There is no past production of mineral from this mine.

2.8.3 Proposed Production

It is proposed to produce a maximum of 60391 TPA of Limestone per year.

Table 2.5

Year	Proposed Production in Tonnes
1st year	60021
2nd year	60167
3rd year	60045
4th year	60197
5th year	60391
Total	**300821**

Maximum Production target for remaining life of the mine will be 60391 tonnes/year.

2.8.4 Details of mining activities with respect to block wise, Calendar Wise, Zonal wise

Mining will be opencast semi mechanized with drilling and blasting with maximum production of 60391 tonnes per year. The proposed production for the planned five years are given as under-

STONE PRODUCTION 1ST YEAR						
Bench RL(m)	**Section**	**Sectional Area(m^2)**	**Length of Influence(m)**	**Volume(m^3)**	**T.F.**	**Limestone (Tonnes)**
893-887	A-A′	342	65	22230	2.7	60021
Total						**60021**
STONE PRODUCTION 2nd YEAR						
Bench RL(m)	**Section**	**Sectional Area(m^2)**	**Length of Influence(m)**	**Volume(m^3)**	**T.F.**	**Limestone (Tonnes)**
893-887	B-B′	256	54	13824	2.7	37325
887-881	A-A′	188	45	8460	2.7	22842
Total						**60167**
STONE PRODUCTION 3rd YEAR						
Bench RL(m)	**Section**	**Sectional Area(m^2)**	**Length of Influence(m)**	**Volume(m^3)**	**T.F.**	**Limestone (Tonnes)**
887-881	B-B′	231	24	5544	2.7	14969
887-881	A-A′	265	63	16695	2.7	45077
Total						**60045**
STONE PRODUCTION 4th YEAR						
Bench RL(m)	**Section**	**Sectional Area(m^2)**	**Length of Influence(m)**	**Volume(m^3)**	**T.F.**	**Limestone (Tonnes)**
887-881	A-A′	185	67	12395	2.7	33467

881-875	A-A′	220	45	9900	2.7	26730
Total						**60197**
STONE PRODUCTION 5th YEAR						
Bench RL(m)	**Section**	**Sectional Area(m^2)**	**Length of Influence(m)**	**Volume(m^3)**	**T.F.**	**Limestone (Tonnes)**
881-875	A-A′	172	50	8600	2.7	23220
881-875	B-B′	353	39	13767	2.7	37171
Total						**60391**

2.8.5 List of Equipment

The list of machines as existing and additional to be used is as follows:

Table – 2.6

List of Machinery to be used

Sl. No.	Type of Machine	No.	Dia of hole in mm	Size/Capacity	Motive Power	H.P
1	Excavators	2	-----	0.6 Cu.m	Diesel	115
2	Compressor	2	-----	300 cfm	Diesel operated	1
3	Jack Hammer Drill	3	-----	------	----	---
4	Tippers	2	-----	10 MT	Diesel	98.5
5	Rock breaker	1	-----	-------	-----	---
6	Water tanker	1	-----	-------	-----	---

2.9 WASTE MANAGEMENT

The waste generation from the proposed project is given in the table below:

2.9.1 Waste Generation:

There is no Waste generation from the proposed project

Table 2.7; Total waste generation during the plan period

Year	Production of Stone in Tonnes	Production of waste in Tonnes
1st	60021	NIL
2nd	60167	NIL
3rd	60045	NIL
4th	60197	NIL
5th	60391	NIL
Total	**300821**	NIL

2.9.2 Waste Management

There is no gritty soil over the project area and therefore, no dumping will be done. After conceptual period exhausted quarry area will be reclaimed to the extent possible.

2.10 RECLAMATION & RESETTLEMENT MEASURES

Green Belt development

Plantation will be done in the 7.50 m barrier zone along the periphery of the mining lease area and on the backfilled area after final closure of the mines. Locally thriving plants will be used for the purpose.

Table 2.8

Sl. No.	Year of Plantation	Target of Plantation	Spacing	Area of Plantation	Remarks
1	First	51	2.5 m	Safety/Barrier Zone	Planting in Zig Zag pattern
2	Second	51	2.5 m	Safety/Barrier Zone	
3	Third	51	2.5 m	Safety/Barrier Zone	
4	Fourth	51	2.5 m	Safety/Barrier Zone	
5	Fifth	51	2.5 m	Safety/Barrier Zone	
TOTAL		**255**			

Resettlement

As there is no habitation and the entire area is under non forest land. Hence no resettlement will be done.

Water Conservation

It is a mining project and the water will be only used for drinking purpose, for dust suppression and for plantation. The main ore body is limestone which is impervious in nature; hence water accumulated in the quarry during rainy season will help in recharging the ground water.

2.11 GENERAL FEATURES:

The raw inputs which will be mainly consumed in this mining project are diesel, water and explosives whose quantity and source of supply are discussed under following headings:

2.11.1 Power, Water Requirement

Power Requirement

No electrical energy will be required. However 100 liters of HSD will be required for daily operation of the machines such as jack hammer, rock breakers etc.

Water Requirement

Total water requirement is about 4.00 KLD (1.0 KLD Domestic Uses) + 2.0 KLD (Dust Suppression) & 1.0 KLD (Green Belt) from nearby water sources. Water for drinking purpose will be met from nearby villages. For sprinkling & plantation water will be taken from Private tanker.

Table 2.9; Requirements of Raw Materials

Inputs	Approx Quantity required per day
High Speed Diesel Requirement	
Diesel	100 Liters (at peak production)
Water Requirement	
Water for Drinking	1.0 KLD
Water for Sprinkling	2.0 KLD
Water for green belt development	1.0 KLD

2.11.2 Use of Mineral

India possesses a wide spectrum of dimensional stones that include granite, marble, sandstone, limestone, slate, and quartzite, spread out all over the country. The limestone boulder have a great demand in the local open market as well as for supply to the neighbouring state as building and construction material, for various construction purposes, lime making, Cement Industry as well as for supply to limestone kilns.

2.11.3 Proposed Transportation and Infrastructure

Transportation

There is existing approach roads which goes up to the quarry. Total 2 tippers of 10 T capacities will be deployed to transport the minerals from quarry to stockyard.

Infrastructure: The details of Existing and proposed infrastructure is given below:

Existing Infrastructure: The details area given below:

Physical Infrastructure: There is existing road NH-40 is 210m W from the mine site. No physical infrastructure exists at the mine site.

Social Infrastructure: The Medical facility such as PHC is located in Dawki & CHC facility is available in Nongtalang only. Primary and Secondary Schools are located in Nongtalang village at a distance of about 3.5 kms and higher studies like colleges are

available only in Jowai the district Sub divisional Headquarters at a distance of about 24 kms.

Proposed Infrastructure: The details area given below:

Physical Infrastructure: Site services such as temporary rest-shed, blasting shed etc. will be developed during mining.

Social Infrastructure: Proposed mining in the area will facilitate development of other small ancillary industries like Workshop, administrative building, machine shops, auto repair garages etc. Local shops are available in all villages.

2.12 HUMAN RESOURSE:

This project would provide employment to around 36 persons who include Mining Engineers, Executives, Skilled, Semi-Skilled and Unskilled laborers and indirect employment, in contractual works & transport to the local population.

2.13 PROJECT COST:

The project cost is about Rs. 12.0 lakhs. The breakup of the project cost is given below:

Table – 2.10; Project Cost

Sl. No.	HEAD	CAPITAL (In Rs)
1	Land	1,30,000/-
2	Road & Temporary Structures	1,00,000/-
3	Tools & Machinery	7,00,000/-
4	Miscellaneous	2,70,000/-
TOTAL		**12,00,000/-**

CHAPTER 3: DESCRIPTION OF THE ENVIRONMENT

3.1INTRODUCTION

EIA report contains a detailed description of existing environment that would be or might be affected directly or indirectly by the proposed project. Environmental baseline monitoring is a very important stage of EIA. Environmental baseline monitoring, during the operational phase, helps in judging the success of mitigation measures in protecting the environment.

The intention of environmental baseline monitoring is not just to describe all baseline conditions but to emphasis on the collection and description of baseline data on those environmental parameters that are important and are likely to be affected by the proposed project activities and is included in impact assessments. The baseline values/characteristics of the environmental parameters are discussed in this chapter -3.

3.2 METHODOLOGY

It would be apt to reiterate here that the environmental indicators mostly seen for Core and Buffer Zone separately. The area, which is going to produce impact that is mining lease, is considered as core zone, whereas the surrounding area, which is going to absorb the impact is considered as Buffer Zone. As per ToR, the buffer zone is 10 km all around of mining lease area in this case.

For the present study, all the sampling locations are marked with the help of topographical maps. The land use/ land cover map has been generated on 1:50,000 scale using Satellite imagery, topographical maps, Survey of India and ground truth information. The baseline environmental quality has been assessed during **Winter Season (December 2020 to February 2021).** Meteorological data of IMD station at Cherrapunji, Meghalaya has been used for the study. Samples of air, water and soil from the site and nearby areas has been collected and analyzed for the study of existing condition. Primary and secondary data collection has been done by the Ecology and Biodiversity team for the study of flora and fauna in the core and Buffer Zone.

The baseline data is generated through field study within the impact zone (Core Zone and Buffer Zone) for various components of the environment viz. Air, Noise, Water, Land, Ecology and Socioeconomic. The baseline environmental quality has been assessed in a study area of 10 Km radius distance from the project site. While generating the baseline status of physical and biological environment of the study area, the concept of impact zone has been considered. The impact zone selection is based on preliminary screening and

modeling studies. The methodology for evaluation of various environmental facets has been discussed under the same parameter for convenience.

It would be in fitness of things to start this chapter with Meteorology as the data collected from IMD is used for selection of sampling station.

3.3 METEOROLOGY

A) Long Term Meteorological Data

The meteorological data recorded during the monitoring period is very useful for proper interpretation of the baseline information as well as input for air quality prediction. Historical data on meteorological parameters also plays an important role in identifying the general meteorological regime of the region.

The year may broadly be divided into four seasons:

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

Methodology

On-site monitoring was undertaken for various meteorological parameters as per BIS and IMD guidelines to generate the site-specific data. The generated data was then compared with the meteorological data obtained from Cherrapunji, Meghalaya.

Sources of Information

Secondary information for the last thirty year's (1971-2000) meteorological conditions was collected from the nearest IMD station at Cherrapunji. Pressure, temperature, relative humidity, rainfall, wind speed and direction data's are incorporated in the report. The meteorological data, rainfall data, climatological data and solar energy and surface meteorology for the study area collected from IMD Cherrapunji is presented in **Table-3.1, Table-3.2, Table-3.3 and Table-3.4** respectively.

Analysis of IMD Data Cherrapunji

The Indian Meteorological Department records the data at two times a day viz. 08:30 hr and 17:30 hr, while the site-specific data was recorded at an hourly interval. Comparison of the site-specific data generated during the study period vis-à-vis the data monitored by IMD shows that by and large these are comparable.

Temperature & Relative Humidity

The winter seasons sets in towards end of November and continues till mid of February. The last week of December to first week of January is the coolest period of the year, with lowest minimum temperature falling as low as -1.0^{0}C (20th Jan 1993). Temperature gradually rises after February. March to June is the summer season. This is also referred to as Pre-monsoon season. During this time the highest maximum temperature may rise to 30.2^{0}C (26th May 1962). From the post monsoon of October, the mean temperature falls gradually marking the onset of the winter season. The average humidity, during the monsoon season is about 78% – 96%. The humidity in Pre-monsoon (March-May) is about 64-84%. Generally the weather during the other seasons is more or less dry and in the comfortable zone.

TABLE 3.1 METEOROLOGICAL DATA FROM IMD, CHERRAPUNJI (1971-2000)

Month	Mean Station Level Pressure in hPa	Mean Relative Humidity in %	Mean High Cloud Amount in oktas	Mean Highest temp in ^{0}C	Mean Lowest temp in ^{0}C	Extreme Highest temp in ^{0}C	Extreme Lowest temp in ^{0}C
January	871.5	60	1.9	19.0	3.7	26.7	-1.0
February	870.7	61	2.3	20.8	4.8	28.9	0.3
March	870.0	64	2.9	24.1	8.0	30.6	0.6
April	868.9	78	4.9	24.8	10.5	28.3	3.9
May	866.9	84	5.9	25.8	12.2	30.2	3.3
June	864.0	93	7.0	26.1	15.1	29.2	9.2
July	863.8	96	7.4	26.0	16.5	28.6	10.0
August	865.0	92	6.9	27.0	16.5	29.5	6.0
September	868.0	89	6.3	26.6	15.5	31.1	12.4
October	870.9	73	3.8	26.0	12.2	29.9	7.8
November	872.4	62	2.4	24.3	8.8	26.9	3.7
December	872.6	61	1.8	20.6	5.4	24.0	1.7

(Source: Climatological data 1971-2000, Indian Meteorological Department)

Rainfall

Annual rainfall over the basin varies between 817 and 2992 mm with an average of 968 mm, of which 84% occurs during the monsoon season. The monsoon starts in end of May and continues till September. The maximum amount of rainfall and maximum rainy days occur in July (Table 3.2).

TABLE: 3.2 RAINFALL DATA FOR FROM IMD, CHERRAPUNJI (1971-2000)

Month	Total Rainfall in the month in mm	Heaviest 24 hrs rainfall in mm	No. of Rainy days in the month (days with rainfall > 2.4 mm)
January	16.3	97	1.4
February	52.9	376.9	3.0
March	327.0	587.4	7.9
April	817.2	644.2	16.1
May	1313.8	812.0	20.2
June	2511.7	1563.0	24.1
July	2992.3	838.2	28.2
August	1914.4	853.4	24.6
September	1034.8	985.5	19.1
October	539.4	594.0	8.4
November	74.0	332.2	2.1
December	25.6	189.7	1.0

(Source: Climatological data 1971-2000, Indian Meteorological Department)

Wind Speed / Direction

Overall Wind Rose data for study area (IMD, Cherrapunji data) is shown in Table-3.1. Wind is normally light to moderate in the area as observed from the winter season. During January, the predominant winds are Easterlies and north-Easterlies in major part of the area. In February, winds are in different directions in different parts of the area. However, the predominant directions are SW and E. The wind data collected at the site for the study period (Dec-2020 to Feb-2021) is presented in the form of Wind rose diagram in Figure 3.2.

TABLE 3.3 CLIMATOLOGICAL DATA FROM IMD, CHERRAPUNJI (1971-2000)

Month	No. of days in wind directions								Average wind speed in kmph
	N	NE	E	SE	S	SW	W	NW	
January	1	22	28	11	4	13	9	2	4.0
February	1	13	20	8	4	28	17	1	5.9
March	1	9	10	7	6	39	19	3	7.4
April	1	10	8	9	7	42	13	4	7.5
May	2	13	12	10	5	32	13	2	6.1
June	2	11	16	12	8	29	7	2	6.5
July	1	9	12	14	11	37	5	1	7.4
August	1	14	20	16	8	23	4	1	5.9
September	1	14	21	12	5	22	8	2	4.7
October	2	23	31	11	3	13	6	0	3.9
November	1	24	41	10	2	9	5	1	3.8
December	1	24	40	13	2	8	3	1	3.7

(Source: Climatological data 1971-2000, Indian Meteorological Department)

B) Micro-Meteorological Data

The meteorological data for wind speed and direction were collected in and around the core zone during the study period simultaneously AAQ monitoring. The predominant wind direction is from S, SW & SSW. The brief data are represented in Table below:

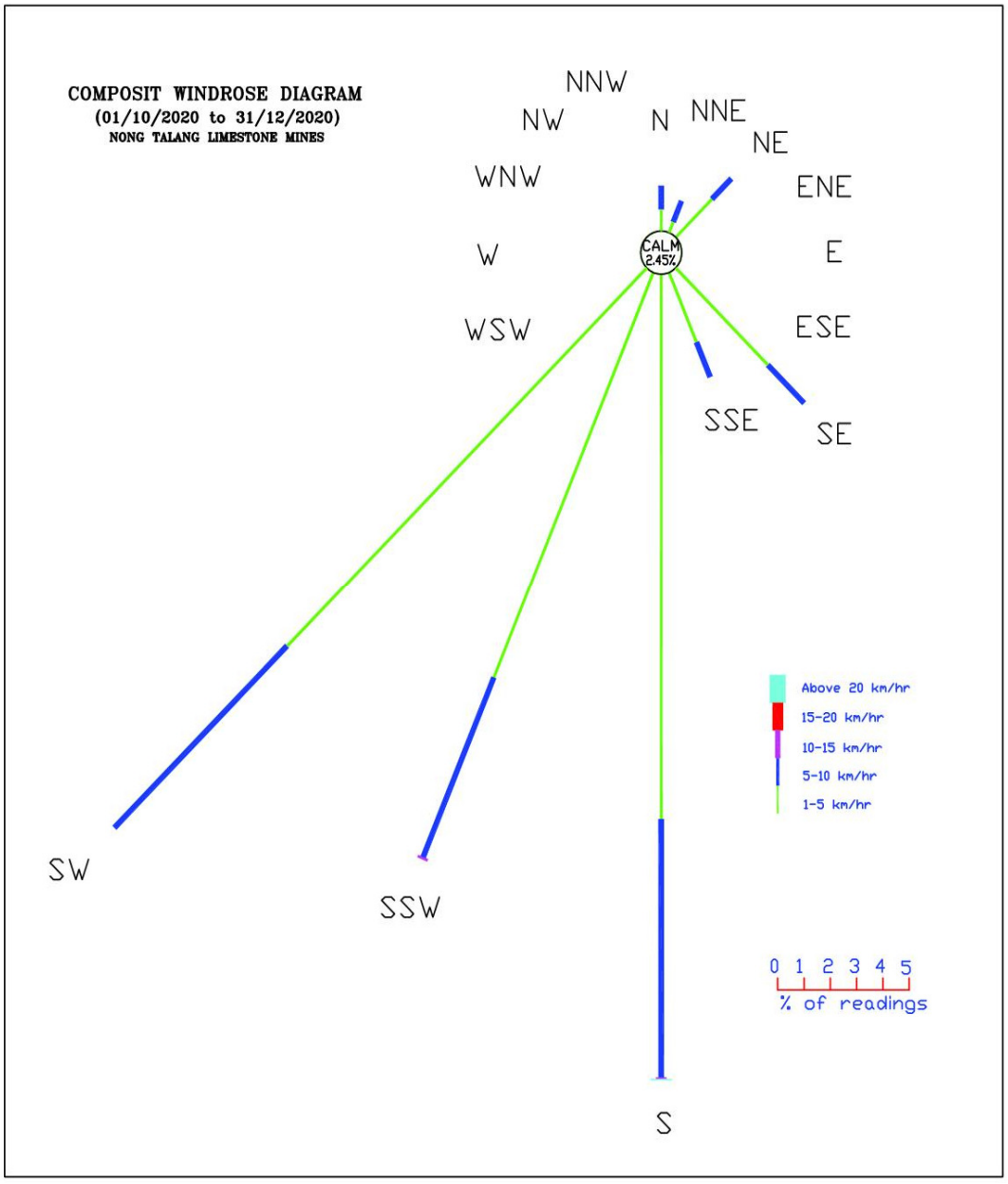
Table 3.4; Micro Meteorological Data

Month	Temperature(°C)			Humidity (%)			Wind speed (km/hr)		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
1st -31st Dec 2020	19	36	28.3	60	98	80.3	0	11	4.91
1st -31st Jan 2021	2	33	19.3	37	93	70.2	0	9	3.86
1st -28th Dec 2021	4	29	17.5	25	96	67.2	1	54	5.13

i. **Temperature:** Temperature of the area varied from 2.0^{0}C to 36.0^{0}C.

ii. **Relative Humidity:** Humidity of the area varied from 25.0 % to 98.0%.

iii. **Wind Speed:** Wind speed was in the range of 0.0 Km/hr to 54.0Km/hr.



Seasonal Wind rose Diagram:Oct 2020–Dec 2020

3.4 AMBIENT AIR QUALITY

The ambient air quality monitoring was carried out at 8 stations for the month of December 2020 to February 2021. The guidelines for selections of ambient air monitoring stations given in IS – 5182 part 14, 2000 were followed. These guidelines state that, "when the objective of air sampling is to identify the contribution from specific sources of pollution, the sampling locations should be located in upwind and the downwind direction of such sources".

As per the guidelines, the location of air quality monitoring stations should satisfy the following conditions:

1. The site should be representative of the area selected;
2. The stations should be selected in a way so as to yield data that can be compared with another;
3. Certain physical requirements should be satisfied at the site.

3.4.1 Sampling Stations

To select the air sampling locations, meteorological data with respect to temperature, relative humidity, wind speed and direction plays a vital role. Predominant wind direction plays an important role in determining location of monitoring stations. The monitoring stations were located in areas that were downwind from the source. Location of Air sampling stations are shown below —

Table 3.5; Sampling locations for Ambient Air Quality

Location	Name of the Location	Distance & Direction w.r.t Proposed Mine	Classification
AAQ I	Core Zone	0.0 KM-C	Project Area
AAQ 2	Pre-dominant DW Near Jowai-Dawki (NH-40)	0.2 K M – W	Commercial
AAQ 3	Pre-dominant DW Near Khonglah Village	8.7 K M - W	Residential
AAQ 4	Predominant UW near Pamtbuh Village	2.0 K M – E	Residential
AAQ 5	2nd Pre-dominant DW near Pdenkarong Village	1.2 K M – SW	Residential
AAQ 6	Pre-dominant UW near Pamtbuh Village	4.5 K M – NE	Residential
AAQ 7	3rd Pre-dominant DW near Pamtadong Village	3.0 K M – NW	Residential
AAQ 8	Pre-dominant UW near Pdengkseh Village	4.0 K M- SE	Residential

However, the predominant wind direction is S, SW & SSW and to study the maximum impact of the project on nearest localities, the sampling location was selected in the North, NE, South & SSW direction. As from the field visit it is found that the maximum habitat is located in the South & South-West directions. To study the present ambient air scenario eight ambient air locations were selected.

3.4.2 Ambient Air Sampling Locations

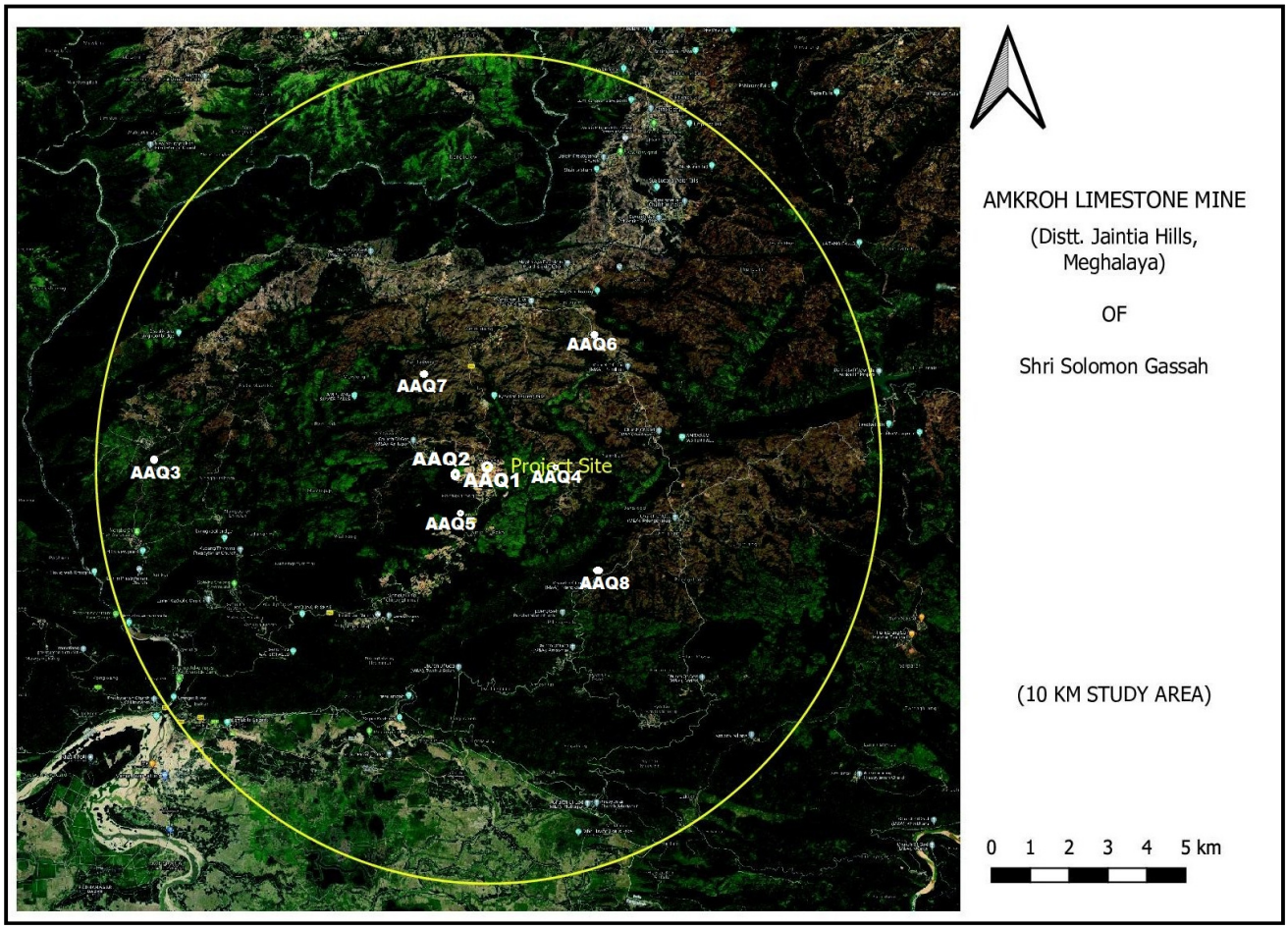


Figure 3.1; Ambient Air sampling locations on 10 Km Google satellite imagery

3.4.3 Sampling Procedure

Time averaged in-situ sampling was adopted by passing a known volume of air through a trap, and a collecting medium (filter paper). Respirable Dust Sampler & Fine Particulate Sampler was used for the purpose.

This procedure was adopted because there are no short-term variations and low concentration of gaseous pollutants was expected.

3.4.4 Analytical methods followed for ambient air quality monitoring:

I. **Particulate Matter ($PM_{2.5}$): (USEPA Quality Assurance Hand Book (Vol.II) Part II, Quality Assurance Guideline Document, 2.12):** Particulate Matter ($PM_{2.5}$) was analyzed by Gravimetric Method. Particulate matter was collected on the 46.2 mm dia glass micro fiber Filter Paper. $PM_{2.5}$ value is determined from the values of volume of air passes through Fine Particulate Sampler.

II. **Particulate Matter (PM_{10}) (IS: 5182 Part 23:2006):** Particulate Matter (PM_{10}) was carried out by Respirable Dust sampler as per IS: 5182(Part 23):2006. Particulate matter was collected on the GF/A Filter Paper. Particles with aerodynamics diameter less than the cut-point of the inlet are collected by the filter. The mass of these particles is determined by the difference in filter weight prior to and after sampling.

III. **Sulphur dioxide (SO_2) (IS: 5182; Part – II – 2001):** Sulphur dioxide is absorbed by aspirating a measured air sample through a solution of Potassium or sodium tetrachloro-mercurate, TCM. This procedure results in the formation of a dichlorosulphite mercurate complex. The Sulphite Ion produced during sampling is reacted with sulphamic acid, formaldehyde and pararosaniline to form an azo dye and then determined calorimetrically.

IV. **Nitrogen Oxides (IS: 5182; Part – VI – 2006):** Nitrogen dioxide is collected by bubbling air through a sodium hydroxide- sodium arsenite solution to form a stable solution of sodium Nitrite. The Nitrite Ion Produced during sampling is reacted with hydrogen peroxide, Sulphanilamide and NEDA to form an azo dye and then determined calorimetrically.

3.4.5 Ambient Air Quality Results

At each station of ambient air quality was monitored twice a week of 3 months **(Dec 2021 to Feb 2021)** 24 hourly at uniform intervals.

Table 3.6; Ambient Air quality results of $PM_{2.5}$ & PM_{10}

Location	Min.	Max.	98 Percentile	Mean	Min.	Max.	98 Percentile	Mean
	$PM_{2.5}$ (Standard – 60 µg/m³)				PM_{10}(Standard – 100 µg/m³)			
A1	31.0	38.0	38.0	34.2	67.0	81.0	81.0	74.1
A2	33.0	44.0	44.0	38.3	68.0	89.0	87.6	77.8
A3	32.0	41.0	41.0	35.8	64.0	85.0	85.0	74.7
A4	30.0	37.0	37.0	33.4	65.0	82.0	82.0	72.8
A5	29.0	35.0	35.0	31.9	59.0	78.0	78.0	68.5
A6	31.0	31.0	39.0	34.6	71.0	71.0	83.0	76.2
A7	30.0	36.0	36.0	33.1	60.0	73.0	73.0	67.1
A8	32.0	40.0	40.0	35.5	70.0	83.0	83.0	77.3

Table-3.7; Ambient Air quality results of SO_2 & NO_x

Location	Min.	Max.	98 Percentile	Mean	Min.	Max.	98 Percentile	Mean
	SO_2(Standard – 80 µg/m³)				NOx(Standard – 80 µg/m³)			
A1	12.1	15.5	14.6	13.5	17.6	20.6	20.4	18.9
A2	13.0	15.1	14.9	14.1	16.3	21.7	20.8	18.4
A3	12.4	14.9	14.4	13.6	15.8	23.2	22.4	18.9
A4	12.4	14.3	14.0	13.4	16.3	26.1	24.7	20.7
A5	10.2	12.9	12.0	11.4	16.4	24.8	23.3	19.8
A6	11.2	11.2	13.1	12.3	18.3	18.3	26.0	21.8
A7	9.4	12.9	12.3	11.1	17.9	25.4	24.5	21.1
A8	11.2	17.6	13.7	12.5	16.4	26.5	25.9	20.8

(Source of Standards: G.S.R 826(E) dated 16th November 2009 of MoEF, Laboratory engaged: Envirocheck, Kolkata (NABL Accredited).

3.4.6 Data Interpretation

Results of Core & Buffer Zone are shown in above tables & further are explained below.

PM_{10}:

The results of PM_{10} of all locations are showing variations from 73.0 μg/m³ in the 3rd Pre-dominant DW near Pamtadong Village to 87.6 μg/m³ in the Pre-dominant DW Near Jowai-Dawki (NH-40). The results are within the limits of National ambient air quality standards. The variation of PM_{10} concentration has shown in Table-3.6

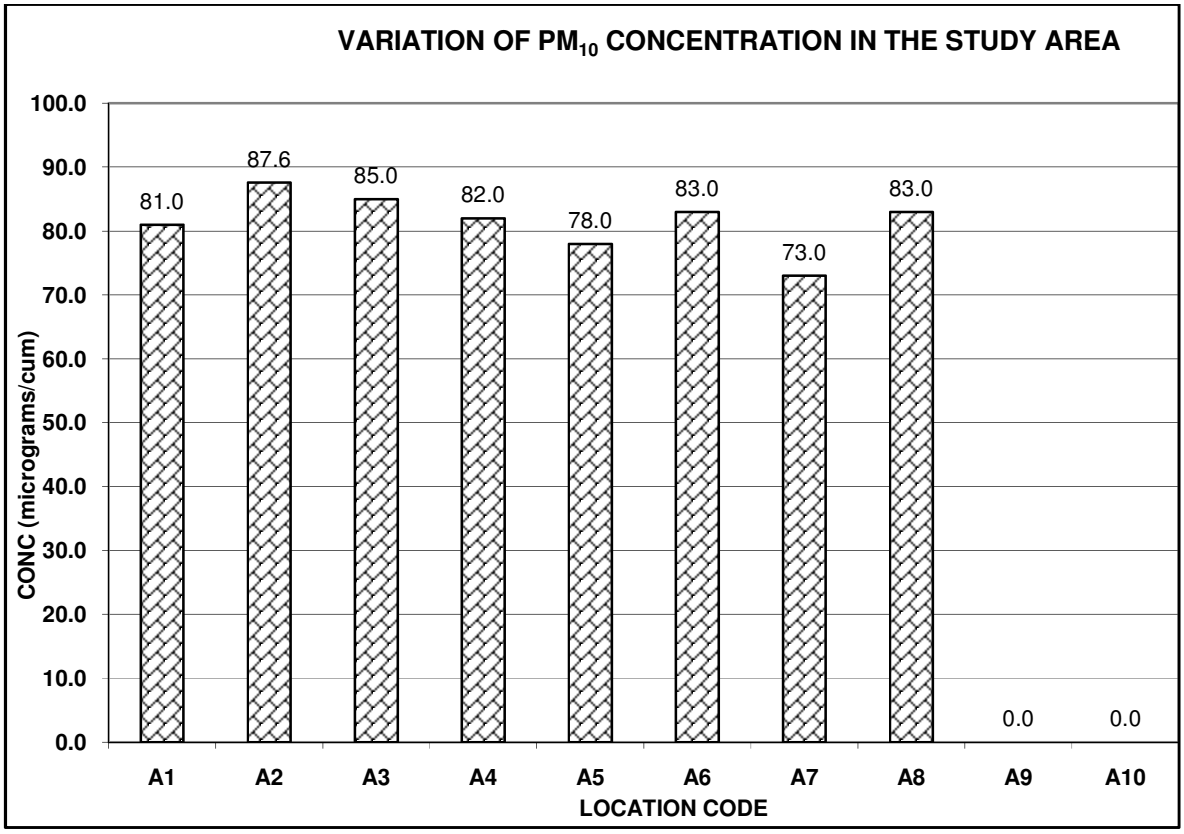


Figure 3.2; Variation of PM_{10} Concentration in the Study area

PM2.5:

The results of $PM_{2.5}$ of all locations are showing variations from 36.0 μg/m^3 in the 3rd Pre-dominant DW near Pamtadong Village to 38.0 μg/m3 in the Pre-dominant DW Near Jowai-Dawki (NH-40). However, the results are within the limits of National ambient air quality standards. The variation of $PM_{2.5}$ concentration has shown in Table-3.6

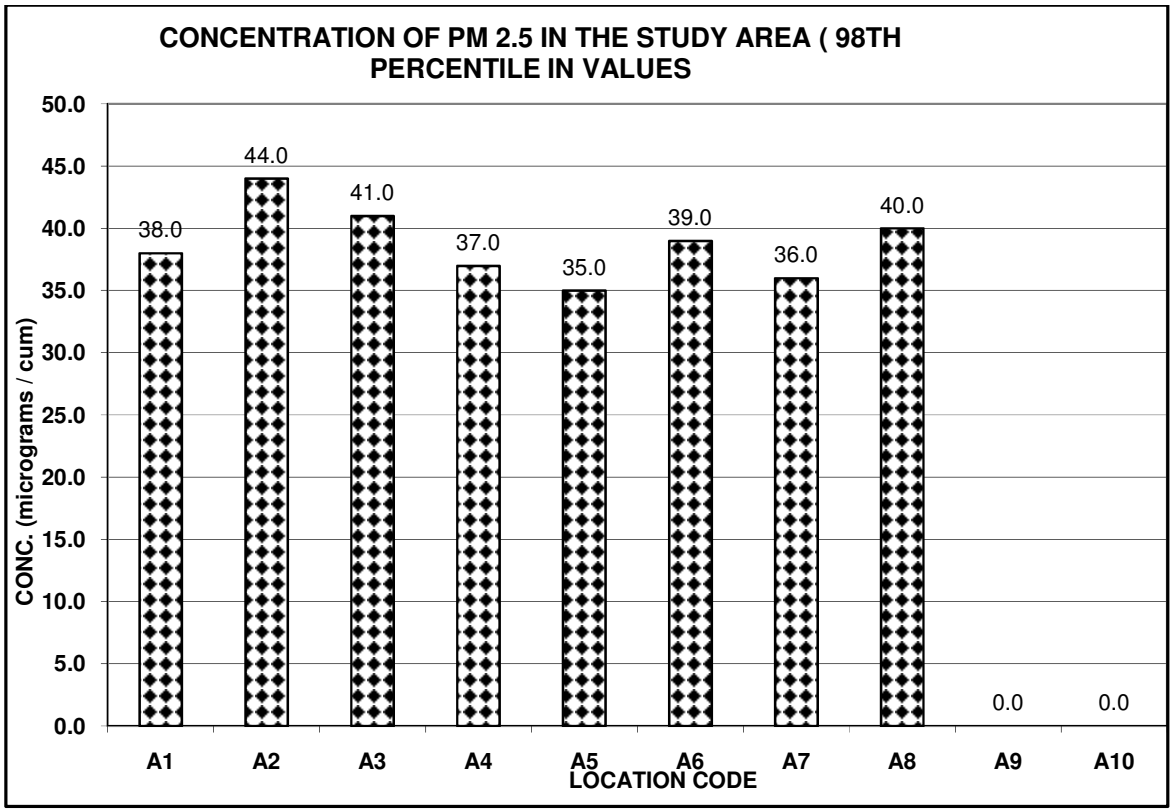


Figure 3.3; Variation of $PM_{2.5}$ Concentration in the Study area

SO2:

The results of SO_2 of all locations are showing variations from 12.0 μg/m^3 in the 2nd Pre-dominant DW near Pdenkarong Village to 14.9 μg/m3 in the Pre-dominant DW near Jowai-Dawki (NH-40). However the results are within the limits of National ambient air quality standards. The variation of SO_2 concentration has shown in Table-3.7.

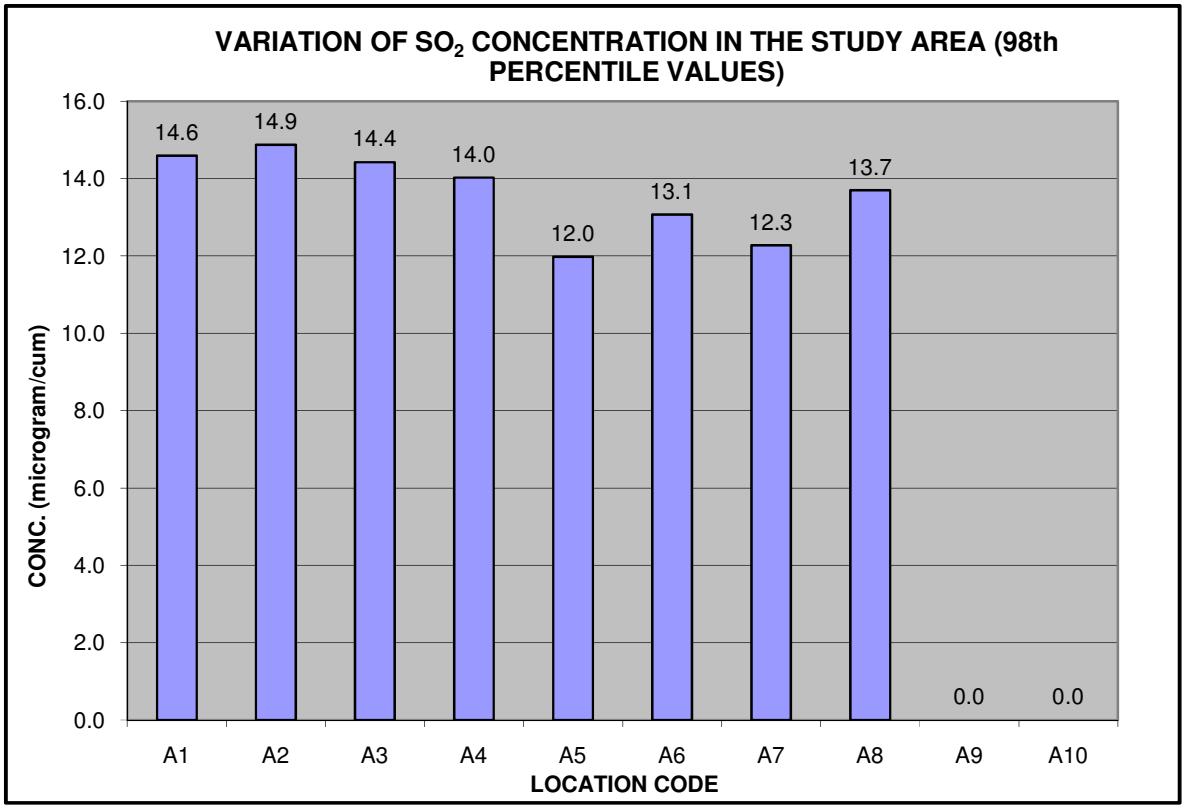


Figure 3.4; Variation of SO_2 Concentration in the Study area

NO2:

The results of NO_2 of all locations are showing variations from 20.4 µg/m³ in the Core Zone to 11.8 µg/m³ in the Pre-dominant UW near Pamtbuh Village. However, the results are within the limits of National ambient air quality standards. The variation of NO_2 concentration has shown in Table-3.7

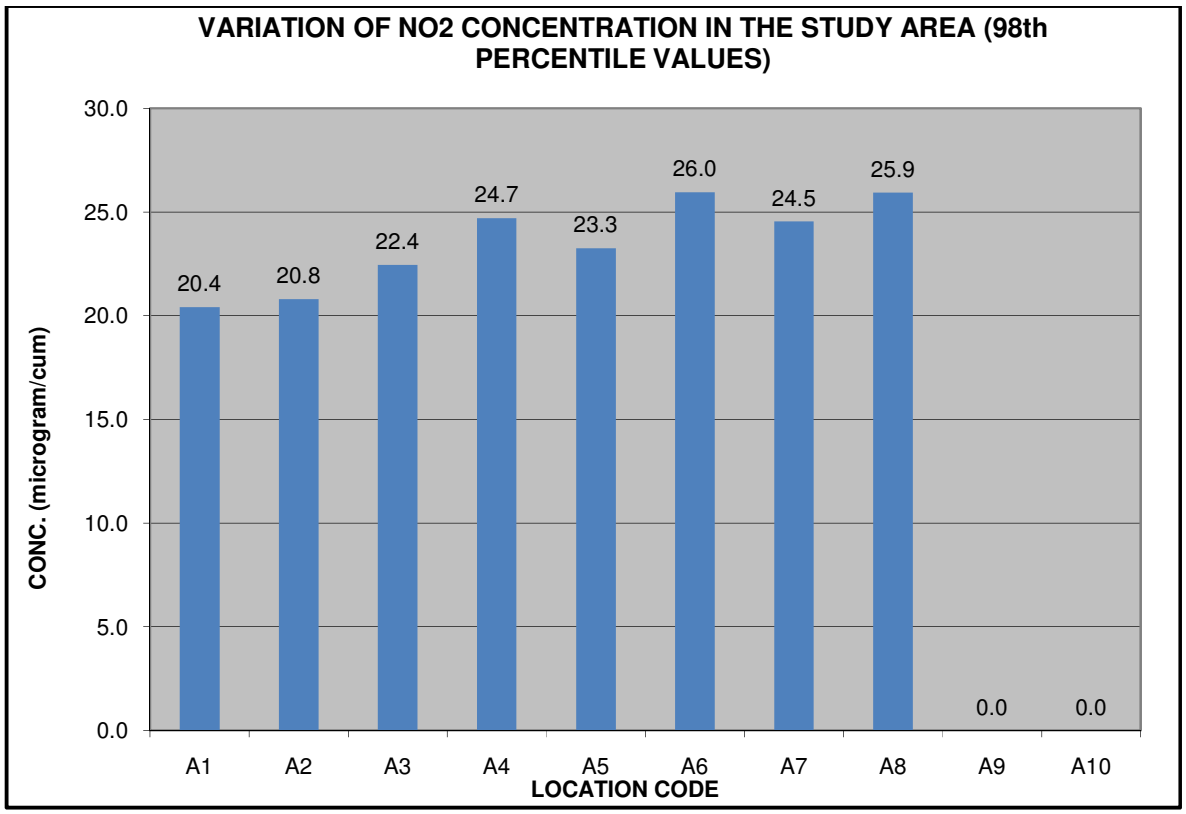


Figure 3.5; Variation of NO_2 Concentration in Study area

3.5 NOISE QUALITY

Noise Measurement Locations: Noise levels were measured in residential areas and other settlements located within 10 km radius around the site. The baseline noise levels have been monitored at 8 locations, one in core zone and seven within the study zone during winter period, using a sound level meter and noise level measurement locations were identified for assessment of existing noise level status, keeping in view the land use pattern, industrial area, Silence Zone, residential areas in villages etc., if available within 10 km radius of the study area. Location of Noise sampling stations are described below and location are given below.

LOCATIONS OF NOISE SAMPLING STATION

Table 3.8; Sampling Location for Noise Quality

Location Code	Name of the Location	Distance & Direction w.r.t Proposed Mine	Classification
ANL I	Core Zone	0.0 KM-C	Project Area
ANL 2	Near Jowai-Dawki (NH-40)	0.2 K M – W	Commercial
ANL3	Khonglah Village	8.7 K M - W	Residential
ANL 4	Pamtbuh Village-I	2.0 K M – E	Residential
ANL 5	Pdenkarong Village	1.2 K M – SW	Residential
ANL 6	Pamtbuh Village-II	4.5 K M – NE	Residential
ANL 7	Pamtadong Village	3.0 K M – NW	Residential
ANL8	Pdengkseh Village	4.0 K M- SE	Residential

To study the present ambient air scenario 8 ambient Noise locations were selected.

3.5.1 Locations of Noise Sampling Stations

The location of Noise sampling is shown below in the 10km radius map.

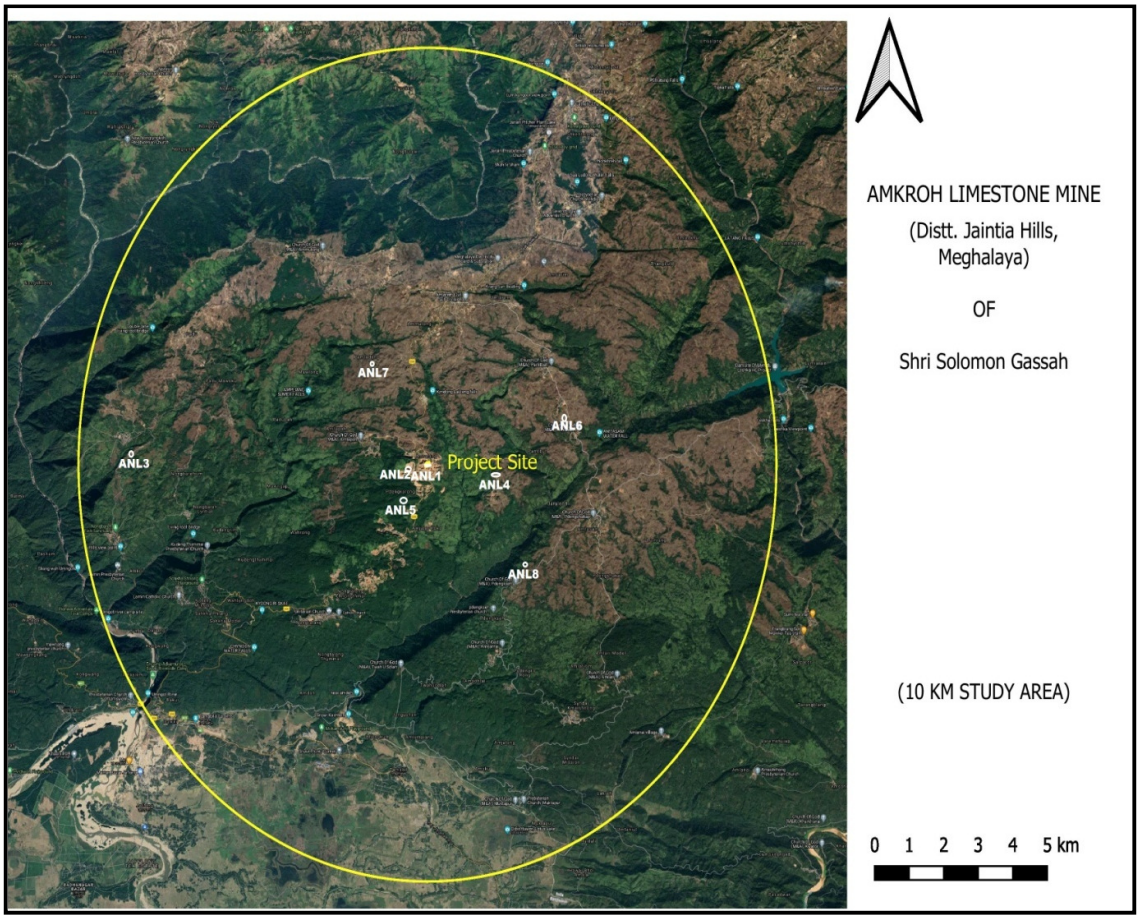


Figure 3.6; Noise sampling Locations on 10 Km Google satellite imagery

3.5.2 Methodology

At each station noise level was monitored for 24-hours simultaneously. For each measurement, dB (A) readings was taken for every 15 minutes for 24 hrs ones in a season to get Leq values.

Table 3.9; Noise quality results

S.No.	Locations	L_{eq} noise level dB(A)	Maximum noise level dB(A)	Day time (6.00 A.M to 10.00P.M)	Night time (10.00 P.M to 6.00A.M)
				Standard (L_{eq} in dB(A)	Standard (L_{eq} in dB(A)
ANL1	Core Zone	53.7	60.0	54.9	39.6
ANL2	Near Jowai-Dawki (NH-40)	54.7	61.6	55.9	40.8
ANL3	Khonglah Village	53.7	58.8	54.8	40.4
ANL4	Pamtbuh Village-I	53.9	59.8	54.6	41.7
ANL5	Pdenkarong Village	53.8	59.4	54.6	41.4
ANL6	Pamtbuh Village-II	53.5	59.0	54.4	40.6
ANL7	Pamtadong Village	52.1	58.1	53.1	40.5
ANL8	Pdengkseh Village	53.6	59.4	54.6	40.6

(Source of Standards: CPCB standards for Noise Pollution (Regulation & control) Rules, Laboratory: Envirocheck, Kolkata (NABL Accredited)

3.5.3 Data Interpretation:

The Ambient Noise Quality results are summarized above**.** The results are discussed below:

Core Zone: The details are given below:

Core Zone: ANL1: The ambient noise level during day time at the proposed project site was 54.9 dB (A) which are within the standard limit of Industrial area~75 dB (A). During night the noise level at the project site is 39.6dB (A) which is within the night-time noise standard limit of 70dB (A).

No mining activity was observed at the site.

Buffer Zone: The details are given below:

ANL2: The noise level at **Near Jowai-Dawki (NH-40)** is 55.9 dB (A) which is less than the day time noise standard limit of commercial area are ~ 65 dB (A). During night the noise level was recorded 40.8 dB (A) which is less than the night time noise standard limit of commercial area are ~ 55 dB (A).

ANL3: The noise level at **Khonglah Village** is 54.8 dB (A) which is less than the standard limit of residential area ~ 55 dB (A). During night the noise level was recorded 40.4 dB (A) which is less than the night-time noise standard limit of ~ 45.0 dB (A).

ANL4: The noise level at **Pamtbuh Village-I** is 54.6 dB (A) which is less than the standard limit of residential area ~ 55 dB (A). During night the noise level was recorded 41.7 dB (A) which is less than the night-time noise standard limit of ~ 45.0 dB (A).

ANL5: The noise level at **Pdenkarong Village** is 54.6 dB (A) which are within the standard limit of residential area area~55 dB (A). During night the noise level at the project site ranges from 41.4 dB (A) which is within the night-time noise standard limit of 45 dB (A).

ANL6: The noise level of **Pamtbuh Village-II** is 54.4 dB (A) which is less than the day time noise standard limit of residential area are ~ 55 dB (A). During night the noise level is 40.6 dB (A) which is less the night time noise standard limit of residential area are ~ 45 dB (A).

ANL7: The noise level of **Pamtadong Village** is 53.1 dB (A) which is less than the day time noise standard limit of residential area are ~ 55 dB (A). During night the noise level is 40.5 dB (A) which is less the night time noise standard limit of residential area are ~ 45 dB (A).

ANL8: The noise level of **Pdengkseh Village** is 54.6 dB (A) which is lower than the standard limit of residential areas of ~ 55 dB (A). During night the noise level is 40.6 dB (A) which is within the standard limits of commercial area ~ 45 dB (A).

3.6 Ground Water

The occurrence of ground water is directly related to the geological setup and structure. It would be in fitness of things to assess the geology before going to the hydrology of the area. Further ground water is controlled by the various factors influencing it regionally; therefore, it would be wise not to divide the study in core and buffer zone.

3.6.1 Geology:

Regional Geology

In a regional scale the area forms a part of the Meghalaya Plateau exposing geological milieu representing Precambrian to Tertiary sequence in this part of West Jaintia Hills District of Meghalaya.

Table: Summarized Regional Geological set-up

Geological Age	Group Name	Formation Name	Rock Type
Palaeocene-Eocene	Jaintia	Kopili Shella Langpar	Argillaceous sediments Dominantly limestone with Sandstone Calc siltstone with sandy I St.
Up cretaceous	Ultrabasic		
Cretaceous Jurassic	Khasi Group Sylhet trap	Mahadek	Thick units of conglomerate with impersistent interbands of sandstone Volcanic trap with vesicles
Pre-Cambrian	Khasi Greenstone Shillong Group		Epidiorite, meta dolerite, diorites Dykes Thick pile of quartzite
Proterozoic & Archaean	Assam Meghalaya Gneissic Complex		Para and ortho-gneiss, migmatite, mica schist

Local Geology

The proposed mining area is small and exposes only the limestone of the Sylhet limestone formation. Table provides a glimpse of the Geology that is seen in the area.

Table-: Local Geological set-up in the block

Geological Age	Group Name	Formation Name	Summarized Rock Type
Recent	Newer Alluvium	Unclassified	Unconsolidated soil, scree material
Eocene	Jaintia Group	Sylhet (=Shella)	Top part with grey/white limestone Bottom part with dark /steel grey limestone

3.6.2 Hydrology

The hydrogeological formation of the study area comprised of Granite Gneiss and intrusive of Archean Proterozoic, Quartzite of Paleo-Meso-Proterozoic of Shillong group, Granite of Neo Proterozoic- early Proterozoic, Sandstone and Limestone of Paleocene-Eocene age. The presence of weak planes like fractures and joints in these hard rock formation forms the principal aquifer in the area. The ground water in the district occurs under unconfined, semi confined to confined conditions. Study of dug wells and exploration data reveals the presence of phreatic/shallow and deep fractured aquifers in the district.

(**Source:** Central Ground Water Board, India)

3.6.3 Ground water Development

Ground water exploration has been carried out in different parts of the district to delineate the potential aquifers and their geometry and to determine the hydrogeological parameters of the aquifer systems. Before NAQUIM programme started in the district, 5 EW and 1 OW were constructed and as a part of data gap generation 5 EW were constructed during the course of study. Details of the exploratory wells are presented below. The summarized details of Ground Water Exploration carried out in the district are given below-

Table 3.10: Summarized Details of Ground Water Exploration

Sl. No.	Location	Block	District	Latitude	Longitude	RL (m)	Type	Lithology
1	Raliang	Laskein	West Jaintia Hills	25°30′05.4″	92°23′56.2″	1276	Depression	Granite Gneiss
2	Madanrwan	Laskein	West Jaintia Hills	25°32′23.1″	92°28′08.8″	1041	Depression	Granite Gneiss
3	Niawkmai	Laskein	West Jaintia Hills	25°32′58.2″	92°29′59.8″	981	Depression	Granite Gneiss
4	Banmuhur	Laskein	West Jaintia Hills	25°31′46.1″	92°32′33.7″	906	Depression	Sandstone
5	Nongringkoh	Laskein	West Jaintia Hills	25°29′11.0″	92°30′54.2″	1082	Depression	Granite Gneiss
6	Shangpung	Laskein	West Jaintia Hills	25°28′49.6″	92°21′11.3″	1260	Depression	Sandstone
7	Thadlaskien	Thadlaskein	West Jaintia Hills	25°29′42.6″	92°10′13.4″	1368	Depression	Quartzite
8	Tyrsang	Thadlaskein	West Jaintia Hills	25°32′04.7″	92°08′52.3″	1328	Fracture	Quartzite
9	Lad Mukhla	Thadlaskein	West Jaintia Hills	25°30′37.0″	92°09′52.6″	1344	Depression	Quartzite
10	Mukhla	Thadlaskein	West Jaintia Hills	25°30′20.5″	92°10′17.9″	1362	Depression	Quartzite
11	Nartiang	Thadlaskein	West Jaintia Hills	25°34′09.7″	92°12′23.5″	1204	Depression	Quartzite
12	Moobakhon	Thadlaskein	West Jaintia Hills	25°38'37.4″	92°17′12.6″	1045	Depression	Quartzite
13	Namdong	Thadlaskein	West Jaintia Hills	25°39'33.0″	92°19′36.4″	990	Depression	Quartzite
14	Khonsaro	Thadlaskein	West Jaintia Hills	25°41'09.2"	92°20′49.4″	963	Depression	Quartzite
15	Saitsama	Thadlaskein	West Jaintia Hills	25°43'15.2"	92°23′01.9″	891	Depression	Quartzite
16	Khanduli	Thadlaskein	West Jaintia Hills	25°43'11.5"	92°24′55.0″	859	Depression	Quartzite
17	UmsyneirSaitsama	Thadlaskein	West Jaintia Hills	25°43'21.1"	92°23′46.7″	878	Depression	Quartzite
18	Mukoh	Thadlaskein	West Jaintia Hills	25°40'25.5"	92°21′01.1″	960	Depression	Quartzite
19	Nongbah	Thadlaskein	West Jaintia Hills	25°31'22.0"	92°14′56.7″	1313	Fracture	Granite Gneiss
20	Jowai	Thadlaskein	West Jaintia Hills	25°26'30.37"	92°11′20.47″	1263	Depression	Quartzite
21	Mostam	Amlarem	West Jaintia Hills	25°24'42.5"	92°10′14.0″	1318	Depression	Sandstone
22	Shkendyrsit	Amlarem	West Jaintia Hills	25°21'49.2"	92°08′51.5″	1304	Fracture	Sandstone
23	Umjarang	Amlarem	West Jaintia Hills	25°18'52.38"	92°07′49.51″	1142	Fracture	Sandstone
24	Dawki	Amlarem	West Jaintia Hills	25°11'11.8"	92°01′08.6″	28	Fracture	Sandstone
25	Amlari	Amlarem	West Jaintia Hills	25°11'00.68"	92°08′59.83″	418	Fracture	Limestone

It may be clearly observed that the ground water development in the region, in which lease area falls in safe category.

3.6.4 Water Conservation -

During rains the water will be collected in the pit and same shall be re-use for various activities during non- rainy days. The plantation is also proposed along the lease boundary.

3.7 WATER QUALITY

The various indicators of water quality form one of the most important tools for impact assessment in future, therefore it is imperative to assess the existing water quality of both ground and surface water occurring in the core and buffer zone. In order to assess the existing water quality, the Ground water samples were collected from 5 different locations and Surface Water quality from 2 locations within the study area and analysed it as per the procedure specified in standard methods for examination of water and wastewater published by American Public Health Association and Bureau of Indian Standards (APHA/BIS). The details of the study of water quality are given below:

3.7.1 Sampling station

To assess the water quality of the proposed area, following 7 stations (5 ground water & 2 surface water) were selected. Location of Water sampling stations is described below and location below:

Table 3.11; Sampling locations for water quality

Station No.	Location	Classification	Distance & Direction from Project site	Environmental Significance
GW1	Core Zone	Tube Well	0.0 KM-C	Existing Ground Water quality at Core zone
GW2	Khonglah Village	Tube Well	8.7 KM - W	Existing Ground water quality at Buffer zone
GW3	Pamtbuh Village-I	Tube Well	2.0 KM – E	
GW4	Pamtbuh Village-II	Tube Well	4.5 KM – NE	
GW5	Pdengkseh Village	Tube Well	4.0 KM- SE	
SW1	Wah Umngot River (US) near Burma	Surface Water	10.0 KM-W	Existing Surface water quality at Buffer zone
SW2	Wah Umngot River (DS) near Dawki	Surface Water	9.5 KM-SW	

Surface Water: To assess the surface water quality of the proposed area, stations were selected. All the stations were taken in the buffer zone as core zone did not have any surface water body. Location of surface water sampling stations is shown in the map—

3.7.2 Criteria of Selection of sampling Locations:

Water sampling locations were selected on the basis of following criteria: source of water, flow of water, geological structure (hydrogeology), use of water, depth of water table etc.

Ground water samples were collected from 5 locations. Core zone (Tube Well), Khonglah Village (Tube Well), Pamtbuh Village-I (Tube Well), Pamtbuh Village-II (Tube Well) & Pdengkseh Village (Tube Well).

Surface water was collected from Upstream & downstream to study the chemical parameters. During surface water sampling flow of water pays an important role. In present study, source of surface water is Umngot River.

3.7.3 SURFACE WATER

The core zone does not have any surface water body. However, following water bodies were observed across the buffer zone in the vicinity of the mining lease.

Wah Umngot River

The Wah Umngot River is about 10.5 km from lease area towards North West.

3.7.4 Sampling Locations:

The sampling locations have been shown on 10km radius Map.

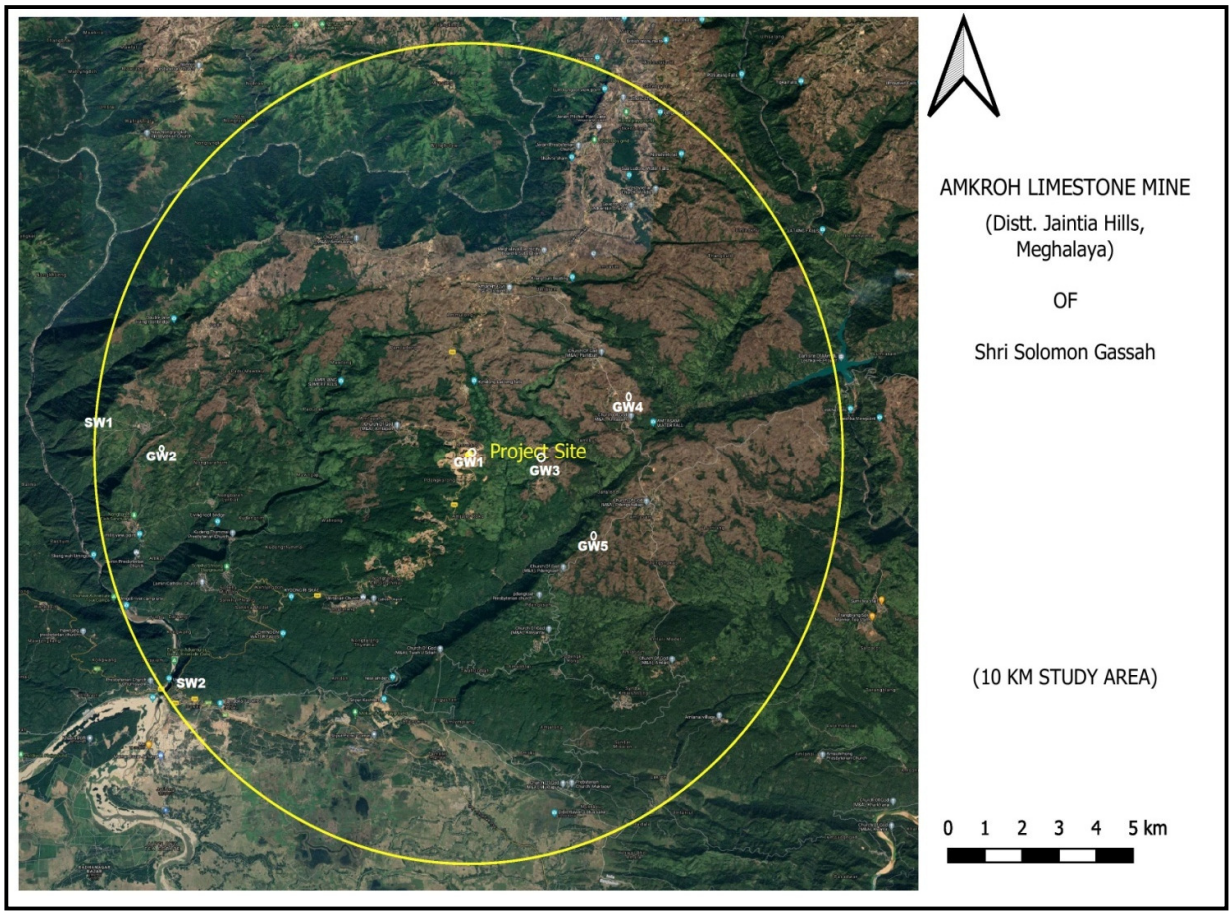


Figure 3.7; Water sampling Locations on 10 Km Google satellite imagery

3.7.5 Sampling Frequency and Sampling Techniques:

As per the standard practice grab sampling was done for 5 locations, and integrated Sampling for River. Water samples were taken as per the Standard Methods (IS & APHA, 23nd Edition 2012). Necessary precautions were taken for preservation of samples.

The physical parameters viz. pH, temperature and conductivity were measured at site using portable water analyzer.

As evident from the sampling locations for water quality assessment represented surface and groundwater. The results of water quality assessment are presented below:

3.7.6 Groundwater Quality Results

The water quality assessment was done based on the IS-10500, the analysed parameters were compared with IS-10500 to assess portability of the water available in the area. The detailed results are given in the **Annexure-6.** The results of water quality assessment for the parameters, which were found close to the limiting values as per IS-10500 are presented and discussed here. The results of the 5 sample of ground water in core and buffer zone are given as ahead —

3.7.7 Ground Water Quality results of Core and Buffer Zone

Table 3.12; Core and Buffer Zone Water quality results

SN	Parameter	Unit	IS:10500-93 Drinking Water Standards	Core Zone of Solomon (GW1)	Khonglah Village (GW2)	Pamtbuh Village-I (GW3)	Pamtbuh Village-II (GW4)	Pdengkseh Village (GW5)
1.	pH Value	-	6.5 to 8.5	6.68	6.87	6.72	6.82	6.78
2.	Turbidity NTU	NTU	5 (10)	0.6	0.5	0.7	0.7	0.6
3.	Electrical Conductivity at 25^0C	µS/cm	-	622.10	612.30	623.40	628.00	610.50
4.	Apparent Colour	Hazen	5	<1	<1	<1	<1	<1
5.	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
6.	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
7.	Total Dissolved Solids (TDS)	mg/l	500 (2000)	427.28	462.52	471.70	483.62	452.82
8.	Total Hardness (CaCO3)	mg/l	300 (600)	259.12	274.24	269.68	276.42	268.20
9.	Iron (as Fe)	mg/l	0.3 (1.0)	0.04	0.06	0.07	0.07	0.06
10.	Chlorides (as Cl)	mg/l	250 (1000)	32.7	41.9	38.3	37.4	33.1
11.	Calcium (as Ca)	mg/l	75 (200)	37.6	40.1	48.3	51.3	45.8
12.	Magnesium (as Mg)	mg / l	30 (100)	22.8	21.3	23.9	24.2	20.7
13.	Sulphate (as SO4)	mg / l	200 (400)	22.2	20.3	21.7	22.1	20.8
14.	Nitrates (as NO3)	mg / l	45	4.25	3.88	3.82	3.94	3.68
15.	Fluoride (as F)	mg / l	1.0 (1.5)	0.44	0.47	0.56	0.51	0.43
16.	Total Alkalinity (CaCO3)	mg /l	200 (600)	152	161	159	162	152
17.	Free Residual Chlorine	mg /l	Min 0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
18.	Copper as(Cu)	mg /l	0.05 (1.5)	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
19.	Manganese as (Mn)	mg /l	0.1 (0.3)	0.05	0.04	0.06	0.07	0.04
20.	Mercury as (Hg)	mg / l	0.001	< 0.0005	< 0.0003	< 0.0004	< 0.0005	< 0.0005
21.	Cadmium as (Cd)	mg / l	0.01	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
22.	Selenium as (Se)	mg / l	0.01	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
23.	Arsenic as (As)	mg / l	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
24.	Lead as (Pb)	mg / l	0.05	< 0.005	< 0.004	< 0.005	< 0.005	< 0.005
25.	Zinc as (Zn)	mg / l	5 (15)	< 0.1	< 0.2	< 0.3	< 0.3	< 0.3
26.	Chromium as (Cr)	mg / l	0.05	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
27.	Aluminium as (Al)	mg / l	0.03 (0.2)	0.007	0.008	0.006	0.006	0.007
28.	Boron as (B)	mg / l	1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

29.	Cyanide as (CN)	mg / l	0.05	< 0.003	< 0.003	< 0.004	< 0.005	< 0.005
30.	Total Coliform	MPN/ 100 ml	Nil	Absent	Absent	Absent	Absent	Absent
31.	Phenolic Compounds	mg / l	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
32.	Anionic Detergents	mg / l	0.2(1.0)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
33.	Polynuclear aromatic Comp (as PAH)	µg / l	-	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
34.	Mineral Oil	mg / l	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

3.7.8 Data Interpretation of Ground water quality (Core & Buffer zone):

The Ground water quality results clearly explain that:

Core & Buffer zone ground water results: is taken as the area within 10 km radius from the proposed project site. Collected samples are from ground water sources.

1. The Ground water quality at location **GW1 (Core Zone of Solomon Gassah, Tube Well Water)** shows that parameters like Total Hardness (259.12 mg/l); Total dissolved solids (427.28 mg/l), Magnesium (22.8 mg/l), & Alkalinity (152 mg/l) is well within drinking water standards (IS: 10500).
2. The Ground Water results in the location **GW2 (Khonglah Village, Tube Well Water)** shows all parameters within the permissible range.
3. The Ground Water results in the location **GW3 (Pamtbuh Village-I, Tube Well water)** shows all parameters within the permissible range.
4. The Ground Water results in the location **GW4 (Pamtbuh Village-II, Tube Well Water)** shows all parameters within the permissible range.
5. The Ground water quality at location **GW5 (Pdengkseh Village, Tube Well Water)** shows all parameters within the permissible range.

The detailed tables are given at Annexure no.8.

3.7.9 Surface Water Quality Results:

The surface water quality assessment was done based on the IS-10500 as well as on CPCB Surface Water Criteria; the analyzed parameters were compared with IS-10500 to assess portability of the water available in the area also against the norms of CPCB for surface water. The detailed results are given in the **Annexure -8.** The results of water quality assessment for the parameters, which were found close to the limiting values as per IS-10500, are presented discussed here —

Table 3.13: Surface water Quality results of Wah Umngot River

S. No.	Parameters	Unit	As Per IS:2296: 1992 Category - C	SW1 (Upstream near Burma)	SW2 (Downstream near Dawki)
1.	Colour	Hazen units	300	<1	<1
2.	Odour	-	Un - Objectionable	Agreeable	Agreeable
3.	Turbidity NTU	NTU	-	<1	<1
4.	pH Value	-	6.5 to 8.5	7.28	7.48
5.	Dissolved Oxygen	mg / l	≥ 4	7.1	7.3
6.	BOD (3d, 250C)	mg / l	3	2.5	2.8
7.	COD	mg / l	-	7.1	7.7
8.	Total Hardness (CaCO3)	mg / l	-	91.2	94.7
9.	Oil and Grease	mg / l	0.1	<1	<1
10.	Iron (as Fe)	mg / l	59.2	63.7	0.14
11.	Chlorides (as Cl)	mg / l	600	58.2	61.4
12.	Electrical Conductivity at 25^0C	µs/cm	-	465.50	470.10
13.	Total Dissolved Solids (TDS)	mg / l	1500	293.28	299.12
14.	Calcium (as Ca)	mg / l	-	22.8	27.4
15.	Magnesium (as Mg)	mg / l	-	7.7	7.6
16.	Sulphate (as SO4)	mg / l	400	22.80	25.2
17.	Free residual chlorine	mg / l	-	< 0.1	< 0.1
18.	Nitrates (as NO3)	mg / l	50	2.62	2.72
19.	Fluoride (as F)	mg / l	1.5	0.27	0.30
20.	Free Ammonia (as NH3)	mg / l	-	<1.0	<1.0
21.	Copper as(Cu)	mg / l	1.5	< 0.02	< 0.02
22.	Manganese as (Mn)	mg / l	-	0.09	0.10
23.	Cadmium as (Cd)	mg / l	0.01	< 0.001	< 0.001
24.	Selenium (as Se)	mg / l	0.05	< 0.001	< 0.001
25.	Arsenic as (As)	mg / l	0.2	< 0.01	< 0.01
26.	Mercury as (Hg)	mg / l	-	< 0.0003	< 0.0003
27.	Lead as (Pb)	mg / l	0.1	< 0.005	< 0.005
28.	Zinc as (Zn)	mg / l	15	< 0.3	< 0.3
29.	Boron as (B)	mg / l	-	< 0.1	< 0.1
30.	Chromium as (Cr +6)	mg / l	0.05	< 0.03	< 0.03
31.	Cyanide as (CN)	mg / l	0.05	< 0.005	< 0.005
32.	Phenolic Compounds	mg / l	0.005	< 0.001	< 0.001
33.	Anionic Detergents as MBAS	mg / l	1	< 0.001	< 0.001
34.	Total Coliform	MPN/100 ml	Nil	< 0.001	< 0.001
35.	Faecal Coliform	MPN/100 ml	Nil	Absent	Absent
36.	Polynuclear aromatic Comp (as PAH)	ppb	-	Absent	Absent

Source: Laboratory: Envirocheck, Kolkata (NABL Accredited)

All the parameters marked with *** are also compared with the surface water quality criteria of CPCB, this is for all classes 'A' to 'E" is shown as below:

S.No.	Parameters	Unit	CPCB Surface water quality criteria				
			Class 'A'	Class 'B'	Class 'C'	Class 'D'	Class 'E'
1	pH Value	-	6.5-6.8	6.5-8.5	6.5 – 9.0	6.5-8.5	6-8.5
2	BOD	mg/l	≤2	≤3	≤3	-	-
3	DO	mg/l	≥6	≥5	≥4	-	-

3.7.10 Data Interpretation of surface water quality (Buffer zone):

The Surface water quality of the **Wah Umngot river** shows that all the parameters are within the CPCB Water Quality Criteria Class of water 'A', 'B', 'C', 'D' & 'E'. BOD of Upstream and Downstream water (2.50 mg/l & 2.80 mg/l) of the river, which is less than CPCB Water Quality Criteria Class of water 'C'; DO of upstream & downstream water (7.1 mg/l & 7.3 mg/l) is acceptable as per CPCB Water Quality Criteria Class of water 'A'.

3.8 Topography:

The elevation range within the lease area is 900 m mRL highest contour to 700 mRL lowest contour. The mineral is exposed in the whole lease area.

Drainage

Drainage in the lease area is easterly. General drainage outside the area is almost easterly. The area is hilly and stony.

3.9 SOIL QUALITY

For studying the soil types and soil characteristics, 5 sampling locations were selected to assess the existing soil conditions representing various land use conditions and geological features. To assess the soil quality of the proposed area, following stations were selected. Soil profile and quality was studied at 5 different locations.

3.9.1 Sampling location:

Location of Soil sampling stations is described below.

Table 3.14; Sampling location for soil quality

Station No.	Location	Distance & Direction from Project area	Project area / Study area	Environmental Significance
S1	Core Zone	0.0 KM-C	-	Existing Soil quality at core zone
S2	Near Jowai-Dawki (NH-40)	0.2 K M – W	Agricultural Land	Existing Soil quality at Buffer zone
S3	Khonglah Village	8.7 K M - W	Agricultural Land	
S4	Pamtbuh Village	4.5 K M – NE	Agricultural Land	
S5	Pdengkseh Village	4.0 K M- SE	Agricultural Land	

3.9.2 Locations of soil sampling stations:

Location of Soil sampling stations are shown in the map below and described ahead —

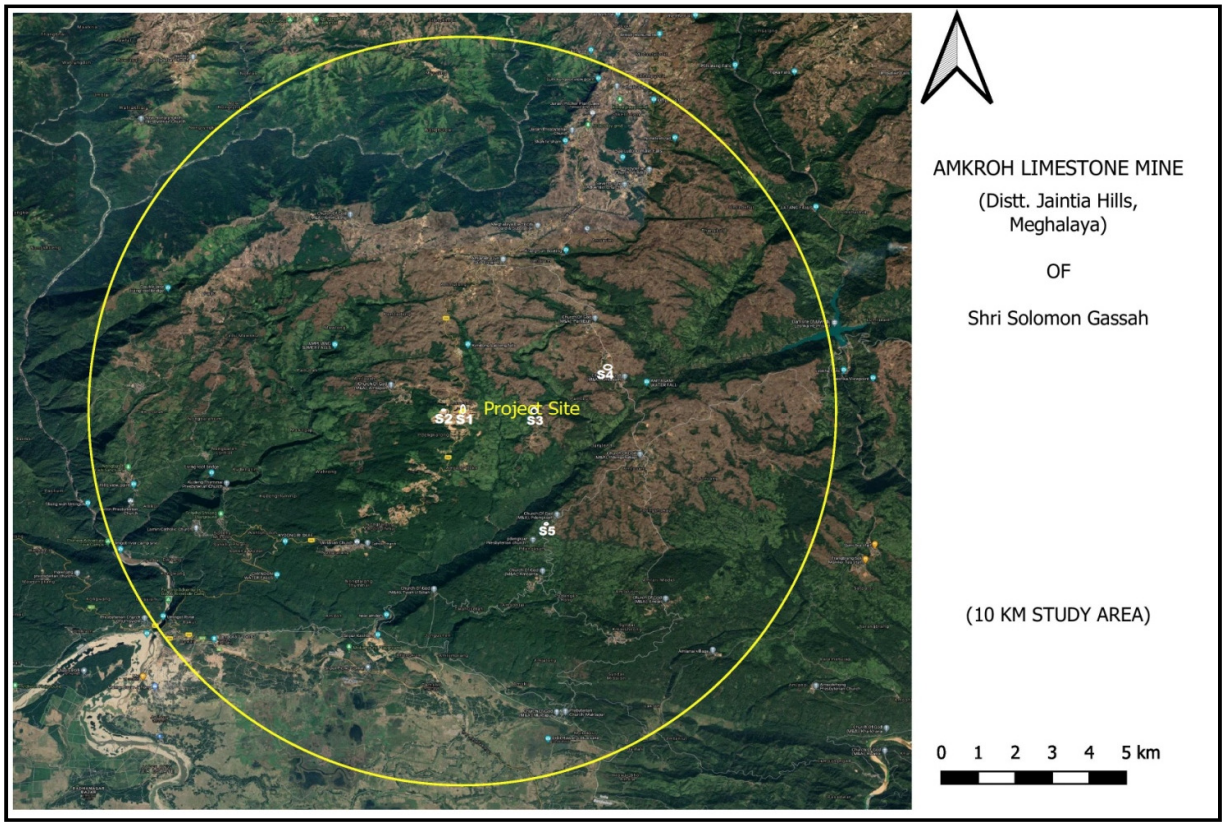


Figure 3.8; Soil sampling locations on 10 Km Google Satellite image

3.9.3 Sampling procedure & Analysis:

Augur method (Homogenized sampling method) was used and samples were collected at 15 cm depth after removing the upper crust. Sample from each spot were well mixed with hand on a clean polythene sheet. About 1 kg of soil was retained after process of quartering. This sample was kept for some time for air-drying at room temperature, stored in polythene bag with label at the top. Samples were analyzed for bulk density, pH, nitrogen, phosphorus, calcium, magnesium and organic contents etc.

The soil quality assessment has been carried out at 5 locations were identified for collection of soil samples from the study area. The sampling locations are shown in Figure-3.8. and their distances and bearings from the project site are listed in Table 3.14

Physical Characteristics of soil

Physical characteristics of soil are delineated through specific parameters viz. bulk density, moisture, Infiltration rates and texture are presented in Table 3.15.

Regular cultivation practices increase the bulk density of soils thus inducing compaction. This results in reduction in water percolation rate and penetration of roots through soils. The soils with low bulk density have favourable physical conditions where as those with high bulk density exhibit poor physical conditions for agriculture crops. The bulk density of the soil in the study area ranged between 1.43 to 1.52 gm/cm^3 which indicates favourable physical condition for plant growth.

TABLE 3.15
PHYSICAL CHARACTERISTICS OF SOIL

S. No.	Location	Bulk Density gm/cm^3	Moisture %	Infiltration Rates cm/hr	Texture
1	Core Zone	1.52	6.3	44.00	Loamy Sand
2	Near Jowai-Dawki (NH-40)	1.47	7.4	38.00	Clay Loam
3	Khonglah Village	1.43	6.8	41.00	Loamy Sand
4	Pamtbuh Village	1.44	6.9	46.00	Loamy Sand
5	Pdengkseh Village	1.47	7.0	40.00	Loamy Sand

Chemical Characteristics of soil

Data collected for chemical characteristics of soils through selected parameters viz. pH, EC, Total Organic, cations and anions are presented in Table 3.16 & 3.17.

pH is an important parameter indicative of alkaline or acidic nature of soil. It greatly affects the microbial population as well as solubility of metal ions and regulates nutrient

availability. Variation in the pH of the soil in the study area is presented in Table 3.16 and it is found to be slightly acidic (6.43 to 6.76).

Electrical conductivity, a measure of soluble salts in the soil is in the range of 348.0 μs/sec to 374.0 μs/sec as seen in Table 3.16. The important cations in the soil are calcium and magnesium whose concentrations range from 1.70 to 2.44 meq/100g and 3.5 to 4.1 meq/100g respectively.

Organic matter present in soil influences its physical and chemical properties and is responsible for stability of soil aggregates. Total Organic Carbon and nitrogen are found in the range of 1.44 – 1.56 % and 25.20– 29.20 mg/100g. This shows that soil is moderately good in organic and nutrient contents. Plant requires some of the heavy metals at microgram level for their metabolic activities. These heavy metals are termed as micronutrients. Their deficiency becomes a limiting factor in plant growth, but at the same time their higher concentration in soil leads to toxicity.

TABLE 3.16
CHEMICAL CHARACTERISTICS OF SOIL IN STUDY AREA

S. No.	Location	pH	EC (μs/sec)	Org. C	Cl	SO4	Ca	Mg
				%			meq/100g	
1	Core Zone	6.58	349.0	1.47	0.069	0.030	1.70	3.7
2	Near Jowai-Dawki (NH-40)	6.76	359.0	1.44	0.077	0.033	2.30	3.5
3	Khonglah Village	6.43	374.0	1.49	0.081	0.039	2.40	4.1
4	Pamtbuh Village	6.62	366.0	1.56	0.084	0.036	2.38	4.1
5	Pdengkseh Village	6.71	348.0	1.49	0.069	0.040	2.44	3.8

TABLE 3.17 FERTILITY STATUS

S. No.	Location	Organic Carbon (%)	Nitrogen (mg/100g)	Phosphorus (mg/100g)	Potassium (mg/100g)
1.	Core Zone	1.47	27.40	0.83	0.52
2.	Near Jowai-Dawki (NH-40)	1.44	29.20	0.69	0.59
3.	Khonglah Village	1.49	27.40	0.77	0.64
4.	Pamtbuh Village	1.56	26.10	0.83	0.63
5.	Pdengkseh Village	1.49	25.20	0.79	0.67

The soil quality of the core & Buffer one is discussed below:

Soil Quality Results: Core Zone: The result shows that pH is 6.58.The availability of many plant nutrients in the soil changes as a result of reactions in the soil, which are largely controlled by soil pH. Amount of primary nutrients like Organic Carbon 1.47 %, the available nitrogen 27.40 mg/100g is lower in range, the available Potassium 0.52 mg/100g is moderate in range while available Phosphorous 0.83 mg/100g is higher in range, Primary nutrient profile shows that soil is low in fertility due to the availability of low amount of nitrogen.

Buffer Zone: The result shows that texture of soil has clay loam texture. pH ranges from 6.43 to 6.76. Amount of primary nutrients like Organic carbon 1.44% to 1.56%, the available nitrogen 25.20 to 29.20 mg/100g, the available phosphorus 0.69- 0.83 mg/100g is higher in range while Available Potassium 0.59 to 0.67 meq/100g is lower in range, Primary nutrient profile shows that soil is low in fertility due to the availability of low amount of nitrogen, available potassium.

3.10 LAND USE

Core Zone Land Use: The core zone consists of total 1.25 Ha. The classification of the land is Private, Barren & Non- Forestland.

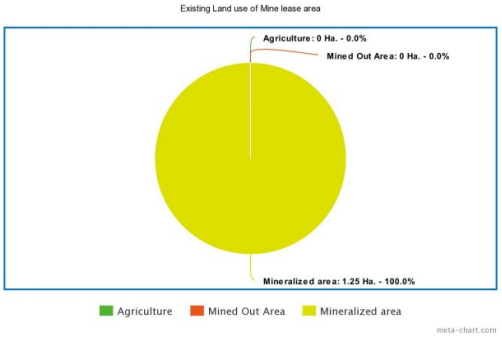
Classification of Land within leasehold			
Government Land		Private Land	
Forest Land	Non- Forest Land (Barren Land)	Barren land	Agriculture land
Nil	Nil	1.25 Ha.	Nil

The land use of the core zone is given below:

Land Use of the Core Zone

It is a non forest land**,** involving 1.25 ha. The surface map is attached as **Plate 4.**

Existing Land use of the Mine lease area (in %)



Land Use	Area in Ha. (existing)
Agricultural	Nil
Mined Out Area	Nil
Mineralized area (Barren)	1.25
Total	**1.25**

Figure 3.9; Existing Land Use of Core Zone

Land use of Buffer Zone:

Information on land use/ land cover is the basic prerequisite for land resource evaluation, environmental assessment, utilization and management. As a precursor, it is necessary to understand the 'cause and effect' of the transformations through scientific studies. The scope of the present study is limited to mapping the current land use / land cover pattern, their assessment, spatial distribution and extent using remote sensing and GIS techniques. The land environment will mainly deal with the land use, land cover within core and buffer zone.

3.10.1 Methodology

Image processing software and GIS Software were used for the project. Image Processing Software was used for digital processing of the spatial data. Digital image processing techniques were applied for the mapping of the land use/land cover classes of the provided area from the satellite data. The methodology applied comes under following steps:

- Satellite imageries for the Area of Interest were created through image processing software.
- Geometric correction includes correction for geometric distortions due to sensor, earth geometry variations and conversion of the data to real world coordinates.
- Image enhancement is one of the important image processing functions primarily done to improve the appearance of the imagery to assist in visual interpretation and analysis.
- Google image is used as a reference map for base layer preparation.
- Visual interpretation technique has been used for digitization of geographical feature for different land use and vegetation cover classes based on spatial pattern of geographic feature.

TABLE 3.18; Land Use

S No.	Category	Area in SQ Km	Area In Ha	Percentage
1	Forest land	0	0	0
2	Area under Non-Agricultural Uses	0	0	0
3	Barren & Un-cultivable Land	0	0	0
4	Permanent Pastures and Other Grazing Land	0	0	0
5	Land Under Misc. Tree Crops etc.	0	0	0
6	Culturable Waste Land	0	0	0
7	Fallows Land other than Current Fallows	0	0	0
8	Current Fallows	0	0	0
9	Net Area Sown	0	0	0
	Total	**0.00**	**0.00**	**0.00**

3.10.2 Results and Conclusions:

Land use Buffer zone:

The land use/ land cover map has been generated on 1:50,000 scale using Satellite Imagery and ground truth information. Based on the methodology developed for the present land use/ land cover, categories have been grouped under the following major land use/land cover categories.

The land use distribution in the buffer zone of 10 Km radius (from periphery) is given in the table given ahead.

Forest Land:

Based on Satellite Imagery and ground truth no forest land was found in 10 km radius area.

Area under Non-Agricultural Uses:

Based on Satellite Imagery and ground truth Non-Agricultural land their area extent has been extracted. The Non-Agricultural area is about 0 hectares which is 0 percent of the total 10 km radius study area.

Barren & Un-cultivable Land:
Based on Satellite Imagery and ground truth no Barren & Un-cultivable Land was found in 10 Km radius.

Permanent Pastures and Other Grazing Land:
Based on Satellite Imagery and ground truth no Permanent Pastures and Other Grazing Land were found in 10 Km radius.

Land Under Misc. Tree Crops etc.:
Based on Satellite Imagery and ground truth no Land under Misc. Tree Crops etc was found in 10 Km radius.

Culturable Waste Land:
Based on Satellite Imagery and ground truth no Culturable Waste Land was found in 10 Km radius.

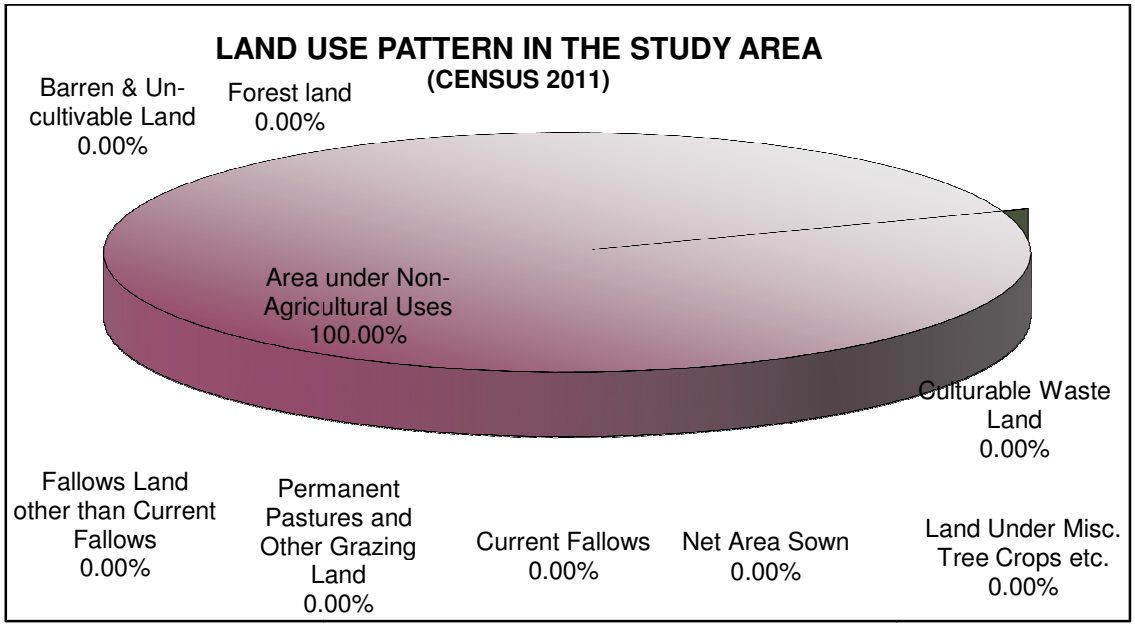
Fallows Land other than Current Fallows:
Based on Satellite Imagery and ground truth no Fallows Land other than Current Fallows was found in 10 Km radius.

Current Fallows Land:
Based on Satellite Imagery and ground truth no Current Fallows Land was found in 10 Km radius.

Net Area Sown:

Based on Satellite Imagery and ground truth no Sown Land was found in 10 Km radius.

Figure 3.10, Land use Map of 10 Km Buffer Zone



3.11 ECOLOGY & BIODIVERSITY:

The ecological information has been collected through field studies, consultation with various government departments and collection of available literature with relevant institutions/organizations.

3.11.1 Introduction on Ecology and Biodiversity:

The Ecology and Biodiversity is the study of mechanisms that regulates biodiversity and allow for the maintenance of ecosystem functioning in our changing world. In the web of life and natural ecology, the diversity, density and abundance of plants and animal species are decisive factors for assessing the bio diversity of any area. Documenting local species that are ecologically important may be helpful in restoration and planning of greenbelt development. With the help of actual field observations and published reports, a list of Flora and Fauna existing in the core zone and buffer zone was prepared.

An ecological survey of the study area was conducted, particularly with reference to listing of species and assessment of the existing baseline ecological conditions in the study area. The main objective of the ecological survey is aimed at assessing the existing flora and fauna components in the study area. Data has been collected

through extensive survey of the area with reference to flora and fauna. With the change in environmental conditions, the vegetation cover as well as animals reflects several changes in its structure, density and composition. The proposed project is for mining of Limestone mineral at Amkroh, Elaka- Nongtalang Jowai, District-West Jaintia Hills, Meghalaya.

Objectives of Biological Studies:

The present study was undertaken with the following objectives:

- To assess the nature and distribution of vegetation in and around the project site (within 10 km. radius)
- To assess the species richness, biodiversity (within 10 km radii)

To achieve the above objectives a study area was undertaken. The different methods adopted were as follows:

- Compilation of secondary data with respect to the study area from published literature and various government agencies;
- Generation of primary data by undertaking systematic ecological studies in the area.

Selection of Sampling Location for the study of Flora and Fauna:

- **Core Zone:** Core Zone is considered as the areas where Limestone Mine is proposed. The proposed project is a mining of Limestone mineral by semi mechanized opencast method with drilling and blasting at Amkroh, Elaka-Nongtalang, Jowai, District-West Jaintia Hills, Meghalaya.
- **Buffer Zone:** The zone falling within 10 km radius around the project area is Buffer Zone. For Study and sampling purpose, buffer zone is further divided in 1 Km and 5Km.

Introduction of the project highlighting the Environmental sensitivity:

- The proposed project is a mining of Limestone mineral by semi mechanized opencast method with drilling and blasting at Amkroh, Elaka- Nongtalang, Jowai, District-West Jaintia Hills, Meghalaya. There is no Wildlife Sanctuary in 10 km radius & and 1 water bodies Umngot River (10.5 Km, NW).

Type of Forest

Meghalaya, situated in the north eastern region of India is a narrow stretch of land, running between Bangladesh on the South and West and Assam on the North and East, Meghalaya lies between 24° 58′ N to 26° 07′N latitudes and 89° 48′E to 92° 51′ E longitudes. The state has three distinct regions namely, Garo Hills, Khasi Hills and Jaintia Hills. The climate is monsoonic with distinct warm-wet and cold dry periods

and soil largely lateritic. The forests of Meghalaya can be broadly grouped into tropical, subtropical and temperate types. The Indian Institute of Remote Sensing have classified the vegetation of Meghalaya into tropical evergreen, tropical semi-evergreen, tropical moist deciduous, subtropical broad leaved, subtropicalpineandtemperateforesttypes,grasslandsandsavanna.Theentireforestrichi nplantlike*Mesua ferrea, Terminalia myriocarpa, Vitex peduncularis, Mecheliachampaca, Amoorawallichii*etc which have economical and medicinal significanceand animal biodiversity like Hoollock Gibbon, Serow, Slow Loris, Sloth Bear, Irrawaddy Squirrel, Otter, Mongoose, varieties of fruit Bats etc.

3.11.2 Methodology for the study of Flora and Fauna:

Methodology for Study of Flora:

During the study, the floral composition of the area was evaluated through primary survey. The study area was divided according to habitat types followed by the random sampling method, surveys, exploration, collection, and preparation of specimens toward building an inventory of floral diversity of the area. Phyto sociological studies were conducted to assess the composition, diversity, distribution, and their status in the nature. This was cross-checked with the traditional knowledge of the people of the study region.

Methodology for study of Fauna:

Different species were observed at different timing during the day

Bird: Birds were watched during dawn.
Nocturnal and Burrowing animals: After Sunset.

Animals: Morning & Evening

Collection of Secondary Data

Secondary data is collected from the Forest Department, Working Plan of the Area other relevant records such as plantation journals and records of wild life / forest offence cases.

Cropping Pattern: The main crops grown in nearby areas are Wheat, rice, pulses, potatoes and pulses. In terms of productivity, rice is the predominant crop in Meghalaya. Beside these crops fruits like Banana, Citrus etc. and vegetables are also cultivated.

3.11.3 Description of Core Zone with flora and Fauna Details:

Flora of core Zone:

The density of the plant in core zone in general is very low due to rocky terrain and low soil content. In the core zone, place where mining is to be done is vacant land with patches of *Trema orientalis, Schimawallichii, Saccharum arundinaceum*.

Flora of Buffer Zone:

The floral found in the whole of the study area are representative of the Tropical Lower Montane Forest, Tropical Semi-Evergreen, Moist-Broadleaf Forest, Tropical Deciduous/Semi-Deciduous, Broadleaf Forest and Tropical Sparse trees. The forest besides the study area is quite dense. The general survey has shown extreme biotic pressure in the area due to limestone mining (excavation), leading to widespread reduction of trees in the area.

Due to heavy rainfall in the region, there is a admixture of trees in the broad leaved evergreen forest. The common species found in the area are of *Castonopeisindica, Castonopeishystrix, Derris robusta, Macaranga denticulate, Schimawallichii& Musa superba.*

The height of the dominant trees ranges from 4m to 9m which generally grow densely alongwith Musa superba and *Clerodendron* species. Numerous climbers are found in the area and they usually exhibit mesophytic adaption. The forest stands are dominated mostly by a Mimosaceae tree species of *Albizia*. Very few stands are dominated by *Tectona* and *Bombax ceiba* tree species. Overall forest areas are characterised by high species diversity. All the stands are dominated by *Castonopsis indica*, *Castonopsishytrix*, *Derris robusta, Macaranga denticulate* or *Schima*. There is no degraded forest because of heavy rainfall along with high intensity sunlight.

Perennial grasses like *Cynodondactylon* and *Saccharum spontaneum* of Poaceae family grow in this area. A thin layer of grass growth can be noticed after the rains. Various types of woody growth along with shrubs also can be noticed in the area. There are no threatened species in the area. List of Flora (Trees, Shrubs, Herbs, Climber, Ornamental spices) in the Core zone and Study area has been given as follows Table 3.19

In the Buffer Zone varieties trees, shrubs, herbs, Ornamental plants, weed and grasses such as *Bombax ceiba, Castanopsis indica, Citrus sp., etc.*

Table 3.19, Flora (Trees, Shrubs, Herbs Ornamental spices) of Buffer Zone

Trees: *Acacia auriculiformis, Actinodaphneobovata, Ailanthus grandis, Alangium chinensis, Albizia lucida, Albizia lebbeck, Alstoniascholaris, Anthocephaluschinense, Aralia armata, Ardisia nerifolia, Artocarpus heterophyllus, Azadirachta indica, Bauhinia acuminate, Bauhinia purpurea, Bischofiajavanica, Bombax ceiba, Bridelia tomentosa, Butea monosperma, Callicarpa arborea, Caralliabranchiata, Caryotaurens, Castanopsis indica, Castanopsis tribuloides, Cinnamomum bezolghota, Cinnamomum obtusifolium, Cyathea sp. Cynometrapolyandra, Dalbergia sp., Dalbergia sisso, Duabanga grandiflora, Delonix regia, Drypetesassamica, Dysoxylumbinectariferum, Elaeocarpus aristatus, Elaeocarpus sp., Englegardtia spicata, Exbucklandiapopulnea, Ficus benghalensis, Ficus elmeri, Ficus geniculata, Ficus hirta, Ficus hispida, Ficus religiosa, Ficus rumphii, Garugagamblei, Ficus sp., Garcinia acuminata, Gmelina arborea, Grewia disperma, Grewia sp., Hevea brasiliensis, Hydnocarpuskurzii, Lagerstroemia parviflora, Leucaena leucocephala, Licuala peltata, Litsaeasebifera, Litseacitrita, Litsealaeta, Litseasalicifolia, Litsea sp., Macaranga denticulate, Macropanaxdisperma, Magnolia hodgsonii, Mallotustetracoccus, Mangifera indica, Meliosma sp., Oroxylum indicum, Ostodespaniculata, Pandanus sp., Persea sp., Pithecellobium sp., Pongamia pinnata, Premnamilleflora, Prunus acuminata, Psidium guajava, Pterospermumacerifolium, Pterospermum lancifolium, Quercus lancifolia, Quercus spicata, Rhus javanica, Sapiumbaccatum, Sarcospermagriffithii, Saurauiaroxburghii, Saurauia sp., Schimawallichii, Shima sp., Spondias pinnata, Sterculia villosa, Streospermumchelenoides, Strobilanthusanisophyllus, Symplocosracemosa, Syzygiumcumini, Syzygium sp., Terminalia bellerica, Terminalia chebula, Terminalia myriocarpa, Tetramelesnudiflora, Toona ciliata, Toona febrifuga, Travesiapalmata, Trema orientalis, Villebrunea frutescens, Vitex negundo, Vitex pedunculata, Vitex sp., Wallichiidensiflora, Wendlandiapaniculata&Xerospermum sp.*
Shrubs: *Ageratum conyzoides, Allamanda cathartica, Allophylus sp., Alpinia sp. Amblyanthusgrandulosus, Ardisia crispa, Ardisia nerifolia, Ardisia paniculata, Aroides sp., Baliospermummontana, Baliospermum sp., Boehmaria sp., Breynia patens, Breynia vitis-idaea, Buddleja asiatica, Calotropis gigantia, Calotropis procera, Cassia alata, Cassia tora, Cassia occidentalis, Citrus sp., Clerodendroncolebrookianum, Clerodendronviscosum, Clerodendrum sp., Clorophytumkhasianum, Coffea sp., Coixlacryma-jobi, Datura metal, Dendrocalamushamiltonii, Dendrocnide sinuate, Dracaena angustifolia, Elaegnusconferta, Eupatorium odoratum, Helixantheraligustrina, Hibiscus macrophyllus, Holmskioldia sanguine, Homonoia riparia, Hymenodictyon sp., Ilex sp., Jasminium sp., Jatropha curcas, Lantana camara, Leea aspera, Leea indica, Manihot esculenta, Melastomamalabathricum, Morinda angustifolia, Mussaendaroxburghii, Nyctanthusarbortristis, Ocimumgratissimum, Ophiorrhiza sp., Phoenix sylvestris, Rauwolfia serpentine, Rubus alceifolius, Rubus ellipticus, Rubus lucens, Saccharum spontaneum, Saccharum arundinaceum, Salamona sp., Saurauia sp., Scoperia dulcis, Sidarhombifolia, Solanum torvum, Strobilanthesanisophyllus, Xerospermumglabratum*
Herbs: *Alternanthera sessilis, Amaranthus spinosus, Amaranthus viridis, Ambrosia artemesifolia, Amischotolypemollissima, Amorphophalusbulbifera, Amorphophalus sp.,*

Arundinagraminifolia, Begonia hatacoa, Begonia sp, Bidens biternata, Bidens pilosa, Blachnum sp., Boehmeria glomerulifera, Boehmeria sp., Calamus flagellum, Calamus leptospadix, Caraxcruciata, Castosspeciosus, Chenopodium sp., Coleus sp., Commelinabenghalensis, Commelina sp., Crassocephalumcrepidioides, Cyathula prostrate, Dichrocephala integrifolia, Dracenatrifasciata, Drymeriadiandra, Diplezium esculentum, Elatostemamonandrum, Eleusine indica, Erigeron Canadensis, Eupatorium adenophorum, Eupatorium odoratum, Euphorbia hirta, Euphorbia sp., Fagopyrum dibotrys, Fimbristylisdichotoma, Floscopa scandens, Fagopteris auriculata, Ferns sp., Forrestia sp., Globba multiflora, Globbaclarkeii, Hedychium sp., Jasminum sp., Laporteacrenulata, Leea indica, Leea sp., Licuala peltata, Luduwigiaoctovalis, Lycopodium sp., Maesa indica, Maesa sp., Melastomamalabathricum, Mannihot esculenta, Mimosa himalayana, Morinda angustifolia, Musa sp., Osbeckia sp., Osbekia crenata, Oscimum sanctum, Oxalis corniculata, Oxyspora sp., Ophiorrhiza sp., Phrynium capitata, Phryniumpubenervae, Pinangagracilis, Polygonum chinense, Pteris sp., Randia sp. Rhynchotecumellipticum, Rubus rugosus, Rungia sp., Scoparia dulcis, Selaginella monospora, Selaginella sp., Solanum torvum, Spilanthuspaniculata, Tabernaemontanadivericata, Thysanolaena maxima, Trevesia palmate, Triumfettapilosa, Urena lobata, Wallichiadensiflora, Sida acuta, Sida cordata, Spilanthespaniculata, Tridax procumbens, Vernonia cineraria & Viola betonicifolia
Climbers: *Acacia oxyphylla, Acacia pinnata, Acacia prunascens, Acampe sp., Aeschynanthus sp., Agapetes sp., Ampelocissusbarbata, Asplenium nidus, Bauhinia scandens, Bauhinia vahlii, Byttneria aspera, Calamus leptospadix, Cayratiapedata, Cissampelos pareira, Combretum dasystachyum, Cryptolepis sinensis, Diascoreaalata, Diascoreabulbifera, Dendrobium sp., Derris sp., Diascorea sp., Entada rheedei, Ficus sp., Gnetum scandens, Hedyotis scandens, Hodgsonia macrocarpa, Hoya sp., Ipomea nervosa, Jasminium flexile, Leeacompactiflora, Luisea sp., Lygodiumflexuosum, Lygodiumfluxuosa, Melocalamuscompectiflorus, Melothria heterophylla, Merremiaumbellate,Microsorumsp.,Mikania micrantha, Milletia cinerea, Mucuna sp., Nepenthes khasiana, Paederia scandens, Parabaenasagittata, Pegia nitida, Piper thomsonii, Poikilospermumsuaveolens, Poranapaniculata, Pothos sp., Raphidophoradecursiva, Raphidophoralancifolia, Rubus alceifolius, Sceffleravenulosa, Smilexlancifolia, Tetrastigma angustifolia, Tetrastigmaleucostophylum, Tetrastigmaserrulatum, Thunbergia grandiflora &Zizyphusoenoplia*
Grasses: *Apludamutica,Bambusatulda, Cymbopogon martini, Cynodondactylon, Cyperus compressus, Cyperus cyperinus, Cyperus rotundus, Dendrocalamushemiltonii, Dendrocalamusstrictus, Digitariabicornis, Heteropogoncontortus&Neohouzeauahelferii*
Epiphytes: *Aeschynanthus parasitica, Agapetessetigera, Aglaomorphacoronus, Asplenium nidus, Bulbophyllumcareyanum, Dendrobium densiflorum, Erialasiopetala, Hoya parasitica, Liparis viridiflora, Microsorum punctatum, Pholidota articulate, Pathos cathcartii, Pyrrosiaadnascens, Pyrrosiaflocculosa, Rhaphidophoracalophyllum, Rhaphidophora lancifolium, Rhynchostylis retusa, Cuscutareflexa&Vanda roxburghaii*
Hydrophytes: *Nelumbo nucifera & Nymphaea stellata*

The complete table is given in detail at **Annexure 14 of the EIA report**

3.11.4 Study of Fauna:

Fauna in core zone: - During study, it was found that the faunal diversity in the core site was limited to Butterflies, insects, some species of mammals & reptile. The core site has avifauna species like crow, pigeon, sparrow parrot, etc.

Table 3.20, Fauna (Mammals, Aves, Reptiles Amphibians, Fishes, Insects & Mollusca) of Study Area

Mammals: *Canis aureus, Cannomys badius, Callosciuruserythraeus, Crocidura attenuate, Suncus murinus, Felis chaus, Funambulus pennant, Funambulus palmarum, Herpestesedwardsi, Lepus nigricollis, LutraLutra, Muntiacusmuntjak, Mus booduga, Mus musculus, Niviventerfulvescens, Ratufa bicolor, Rattus nitidus, Rattus rattus, Rhinolophus affinis, Rhinolophus hipposideros, Vulpes bengalensis, Presbytis entellus & Presbytis pileatus*
Aves: *Acridotheres tristis, Bambusicolafytchii, Ketupaflavipes, Cinnyris asiaticus, Columba livia, Coracias bengalensis, Corvus splendens,Eudynamysscolopaceus, Milvus migrans, Francolinuspondicerianus, Hirundorustica, Dendronanthus indicus, Passer domesticus, Psittaculakrameri, Pycnonotuscafer, Scolopaxrusticola, Alcedoatthis&Streptopelia chinensis*
Reptiles & Amphibians: *Amolopsafghanus, Bufo parietalis, Bufo stomaticus, Bufo idesmeghalayana, Bungarus caeruleus, Calotes versicolor, Sinomicrurusmacclellandi, Natrixnatrix, Rhacophorus maximus, Hylaranagaroensis, Odorranalivida, Varanus bengalensis, Chameleon sp., Calotes maria, Mobuyacarinata, Microhyla ornate, Najanaja, Ptyasmucosus, Ptyctolaemusgularis*
Fishes: *Danio rerio, Catlacatla, Danioaequipinnatus, Danio dangila, Labeodero, Labeorohita, Labeofimbriatus, Mystusaor, Mystusvittatus& Puntius shalynius*
Insecta: *Acridaturrita, Acontia marmoralis, Orthetrumluzonicum, Agriocnemispygmaea, Apiscerana, Ariadne merione, Ceriagrioncoromandelianum, Euploca core, Euremabrigitta, Graphiumsarpedon, Halpe kumara, Heterojinussemilaetaneus, Holochlora indica, Ischnura aurora, Matapadruna, Musca domestica, Papilioarcturus, Periplaneta Americana, Pseudagrionrubriceps, Apodemiamejicanus& Vespa orientalis*
Mollusca: *Bellamyabendalensis, Cypraea limacine & Turbo marmoratus*

The complete table is given in detail at **Annexure 14 of the EIA report.**

3.11.5 Photographs of Study Area:

Vegetation in the study area

3.11.6 Endangered Species:

There is no schedule I Species of Fauna found in both core as well as buffer zone. Monkey of Schedule II is the only threatened species. There are no threatened species of plants also.

3.11.7 Cropping Pattern:

The main crops grown in nearby areas are Wheat, rice, potatoes and pulses. In terms of productivity, rice is the predominant crop in Meghalaya. Beside these crops fruits like Banana, Citrus etc. and vegetables are also cultivated.

3.12 SOCIO-ECONOMIC SCENARIO

The proposed project is for mining of limestone mineral from lease area of 1.25 ha. The maximum production from the mine will be 63091 TPA. Mining of mineral will be done by opencast semi mechanized method. The applicant of the project is Shri Solomon Gassah has applied for mining lease for minor mineral (Limestone) in his privately owned land over an area of 1.25 Ha.

The latitude of the project area N 25°14.713′ TO N 25°14.780′ and longitude is E 92°5.880′ TO 92°5.962′ E with maximum contour of 894 mRL and minimum contour of 887 mRL.

3.12.1Demographic profile

There is no habitation within the project area, i.e., the area of land acquired for the project. Hence, no rehabilitation will be required.

In the study area, i.e. the area falling within radius of 10 km from the proposed project, there are 76 inhabited revenue villages. Out of the 76 villages, 3 falls under Mawkynrew tehsil of East Khasi Hills district and 73 in Amlarem tehsil of West

Jaintia Hills district of Meghalaya. Demographic profile of individual villages as per Census 2011 Census records, are presented in **Annexure 12**. A summary of the same is presented in Table 3.21. Distribution of population & percentage of literates, and the percentage of SC & ST population are presented through pie graphs in Fig 3.11 and 3.12 respectively and tabulated in Table 3.22.

TABLE 3.21
TEHSIL WISE POPULATION

District	Tehsil	Total Population	Male	Female
East Khasi Hills	Mawkynrew	1812	899	913
West Jaintia Hills	Amlarem	35064	17424	17640
Grand Total		**36876**	**18323**	**18553**

TABLE 3.22
DEMOGRAPHIC DETAILS OF STUDY AREA

Description	Total	% of total population
No. of households	6352	
Total population	36876	100
Male Population	18323	49.69
Female Population	18553	50.31
Females/1000 males	1012.55	-
Family size, persons/family	5.645	-
Schedule caste	233	0.63
Schedule Tribe	35574	93.76
Total literates	21627	58.65
Male literate	10454	28.35
Female literate	11173	30.30

FIG 3.11 : LITERACY LEVEL IN THE STUDY AREA
(CENSUS 2011)

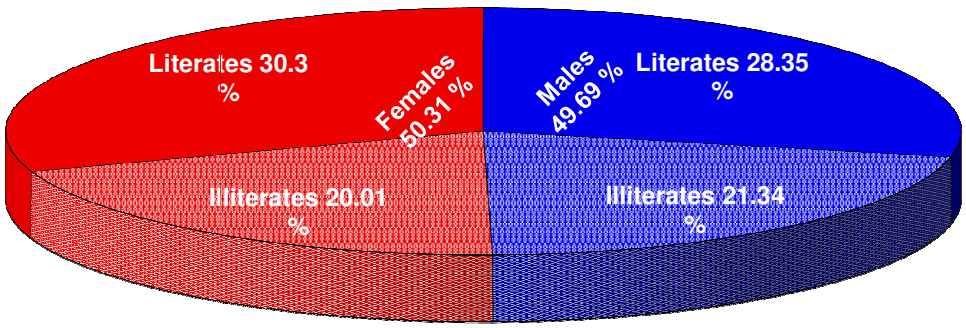
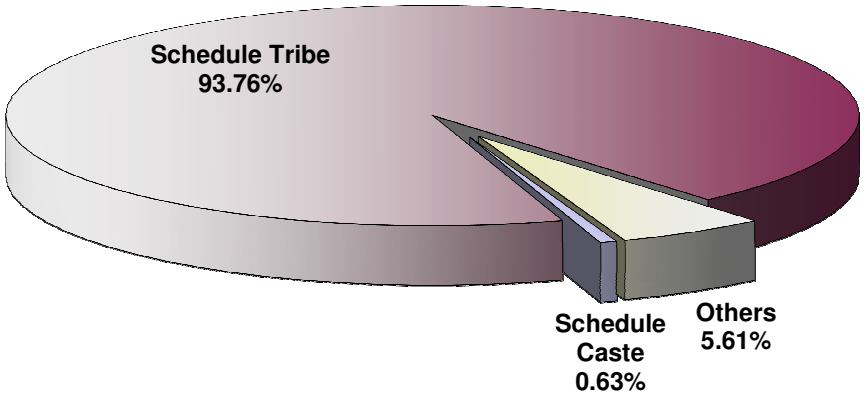


FIG 3.12 : BREAK UP OF SC & ST IN THE STUDY AREA
(CENSUS 2011)



Salient features of the demographic profile are as follows:

a) There is a slight predominance of Females (50.31%) to males (49.69%)
b) Schedule tribes form a large part of the population, about 93.76% of the total population.
c) Female literacy rate is higher than male literacy rate.
d) Schedule caste population is 0.41% of total population.

3.12.2 Employment and occupation

Employment pattern and occupation are the two main indicators of the economic profile, and the same for the individual villages based on 2011 Census data, are presented in **Annexure 15**. Pie diagrams showing employment pattern and occupation are depicted in Fig 3.13, 3.14, 3.15 & 3.16. A summary of employment pattern and occupation for the study area is presented in Table 3.23.

TABLE 3.23
SUMMARY OF EMPLOYMENT AND OCCUPATION IN STUDY AREA

Description	Total	% of total population
Main workers	10510	28.50
Marginal workers	4993	13.54
Non-workers	21373	57.96
Total	**36876**	**100.00**
Break-up of Main workers		
Cultivator	3218	30.62
Agricultural labour	2275	21.65
Household industries	90	0.86
Other workers	4927	46.88
Total	**10510**	**100.00**
Break-up of Marginal workers		
Cultivators	543	10.88
Agricultural labour	1880	37.65
Household industries	68	1.36
Other workers	2502	50.11
Total	**4993**	**100.00**

FIG 3.13 : EMPLOYMENT PATTERN IN THE STUDY AREA
(CENSUS 2011)

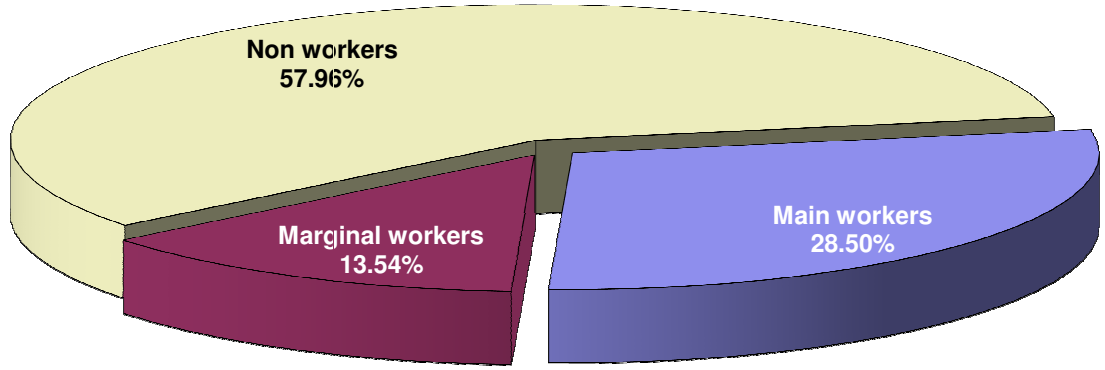


FIG 3.14 : BREAK UP OF MAIN WORKERS IN THE STUDY AREA
(CENSUS 2011)

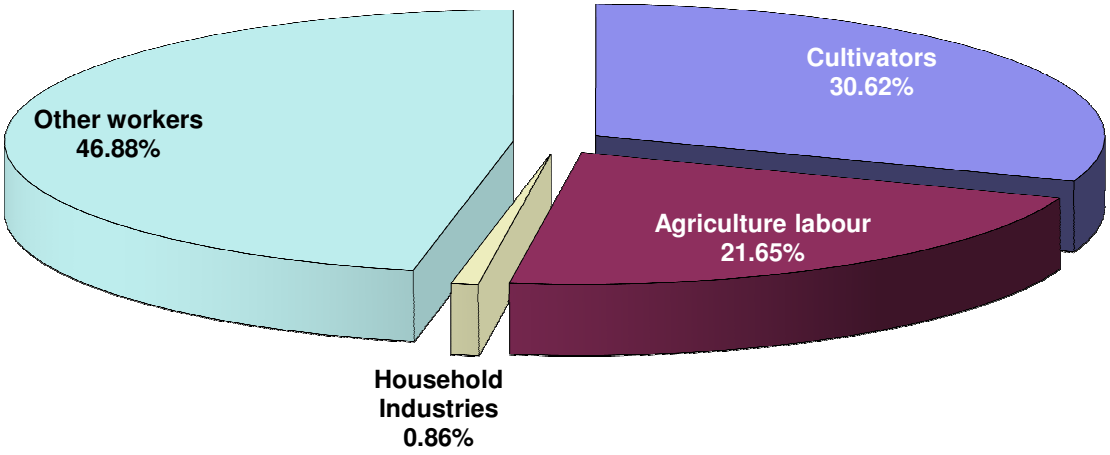


FIG 3.15 : BREAK UP OF MARGINAL WORKERS IN THE STUDY AREA
(CENSUS 2011)

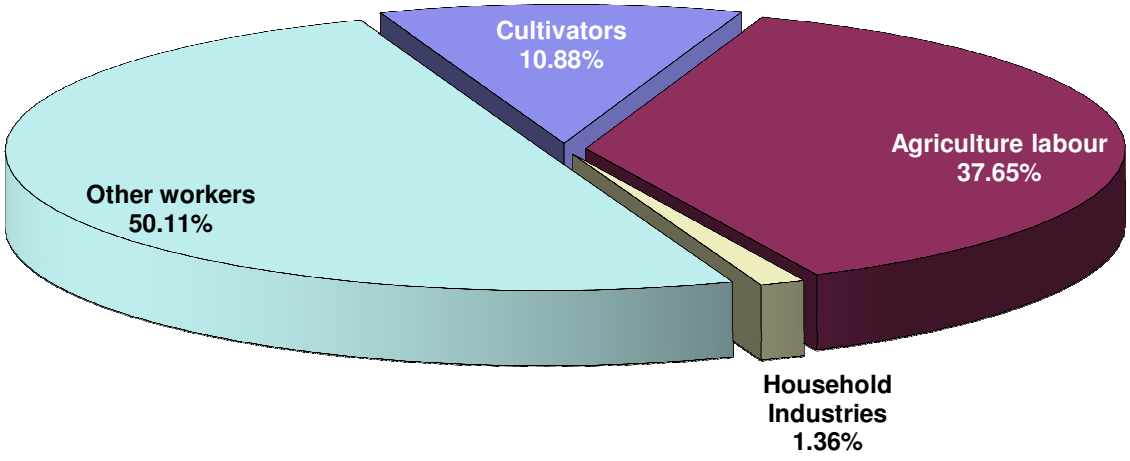
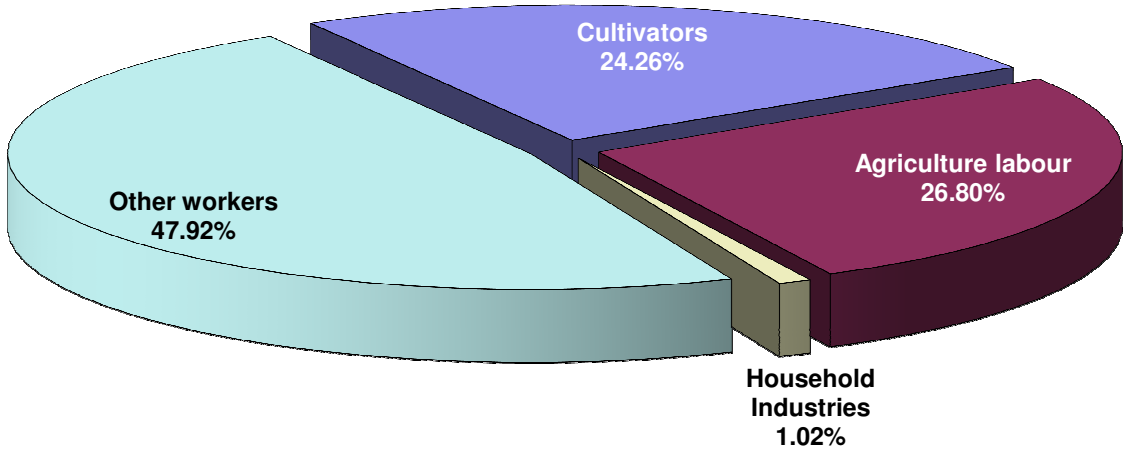


FIG 3.16 : BREAK UP OF TOTAL WORKERS (Main & Marginal) IN THE STUDY AREA
(CENSUS 2011)



3.12.3 Amenities

Details of amenities available in the individual villages are given in **Annexure 16.** A summary of the same is as follows:

- Educational facilities in the study area comprise of 91 Pre primary schools, 86 Primary Schools, 30 Middle Schools, 14 secondary schools & 5 senior secondary schools.
- For drinking water, hand pump are used is 1, tap water treated is 34, tap water un treated is 33, well water is 21, tank water is 6, tube well water is 3, 11 river or canal water, 18 spring water and 8 other water sources.
- Census data for power supply shows that from the total villages, 63 villages have power supply for domestic purpose.
- Census data for post and telegraph facilities shows that there are 1 Post Office, 11 villages have sub post offices & 9 telephone connections.
- There are 28 pucca roads, 55 Kachha roads, 11 MDR, 6 ODR, 13 SH and 13 AWR to villages in the study area.
- Census data for medical facilities shows that there are 1 CHC, 2 PHC, 6 PHSC, 3 MCWC, 3 family welfare centers, in the study area.
- Census data for communication shows that there are 2 Public Bus service and 6 Private Bus service in the study area.
- Census data for Banks/credit societies shows that there are 2 commercial, 2 co-operative banks, 26 Self Help Group in the study area.

3.13 PLACES OF TOURISM /HISTORICAL /ARCHAEOLOGICAL IMPORTANCE

There are no historical/tourist or religious places or places of archaeological importance in core zone of the proposed Limestone Mine. However there are some important places for tourists such as follows:

1. **Thlu Muwi-** This stone bridge built by U Mar Phalyngki and U Luh Lamare under the orders of the Jaintia King. It is about 12 KM in North East of lease area. Because of the rise of the Muwistream during the monsoon a bridge was required to be built for the King's journey from Jaintiapur to Nartiang. The bridge consists of huge well hewn granite stone slabs perched on equally similar pillars. Beside the stone bridge is also the Muwi Waterfalls.

2. **Nartiang Monoliths**- It is about 38.5 KM in the North-East Direction. Monoliths exist throughout the length and breadth of the Khasi and Jaintia Hills. However, the biggest collection of monoliths or Megalithic stones in one single area is to be found north of the Nartiang market. These consists of Menhirs (Upright stones) Moo Shynrang and Dolmens (flat stones in the horizontal position) locally known as Moo Kynthai. Within the perimeter of this Megalithic collection stands the tallest Menhir erected by U Mar Phalyngki a trusted lieutenant of the Jaintia King to commemorate his victory in battle. Other monoliths were erected by U Mar Phalyngki, U Luh Lyngskor Lamare and various clans of Nartiang village between 1500A.D.and l835A.D.

3. **Lalong Park**- It is about 28 KM in the North East of the lease area. The Park is located about 8 kms from Jowai. It is known for its sacred grove and for its setting which overlooks the beautiful Pynthorwah Valley. Through the Special DRDA Tourism Project the District Administration have taken step to beautify the park by creating infrastructure such as water dams and canals, toilet facilities with changing rooms, hoardings, jungle clearance which has attracted tourist far and wide. A water eco park is also taking shape with an intention to change Ialong into a major Tourism Hub of the District.

   All the places which are mentioned above are very far from proposed mining site and mining activities don't have any direct or indirect impact on these places.

3.14 INDUSTRIES IN THE STUDY AREA

There are a few Limestone mines in the vicinity of the proposed Limestone Mine. They are as follows:

TABLE 3.24; INDISTRIES IN THE STUDY AREA

S.N.	Approved Mining Plan	Area (hectares)	Mineral	Distance from the approved mining site of Sri Solomon Gassah (meters)
1	Smt. Pri-io Buam	4.0	Limestone	3
2	Shri Baisor Lamin	4.5	Limestone	104
3	Shri Damanbait Lamare	4.9	Limestone	450

3.15 TRAFFIC DENSITY

The traffic study was done in the nearby road ascertain the present traffic was on the road and thereafter impact be because of addition of traffic due to the operation of Project.

The traffic density for Dawki-Jowai Road-NH 40 Road & Approach Road is given in Table below.

Monitoring location and methodology

Traffic density monitoring station was located as follows:

Table 3.25; Trafic density monitoring station

Location	Name of the Location	Distance & Direction w.r.t Proposed Mine	Remarks
TD I	Between ML &Approach Road	0.2 KM-W	Village Road
TD 2	Dawki-Jowai Road (NH-40)	0.3 K M – W	NH-40

Traffic density measurements were made continuously for 24 hours by visual observation and counting of vehicles under four categories, viz., heavy motor vehicles, light motor vehicles, two/three wheelers and cycles. As traffic density on the roads is low, two skilled persons were deployed simultaneously during each shift – one person on each of the two directions for counting the traffic. At the end of each hour, fresh counting and recording was undertaken. Thus, total numbers of vehicles per hour under the four categories were determined. A summary of the traffic density monitored during survey period is given in Table 3.26.

TABLE 3.26
EXISTING PCU/HOUR OF ROAD BETWEEN MINING LEASE & APPROACH ROAD

S. No.	Vehicles Distribution	Number of Vehicles Distribution/Day	Passenger Car Unit (PCU)	Total Number of Vehicle (PCU)/hour
1.	Car	5	1.0	5
2.	Buses	0	3.0	0
3.	Trucks	16	3.0	48
4.	Two Wheelers	6	0.5	3
5.	Three Wheelers	0	1.5	0
6.	Tractors	14	1.5	21
	Total	**41**		**77/24 = 3.20 say 4**

ABLE 3.27

EXISTING PCU/HOUR OF DAWKI JOWAI ROAD (NH-40)

S. No.	Vehicles Distribution	Number of Vehicles Distribution/Day	Passenger Car Unit (PCU)	Total Number of Vehicle (PCU)/hour
1.	Car	151	1.0	151
2.	Buses	27	3.0	81
3.	Trucks	255	3.0	765
4.	Two Wheelers	389	0.5	195
5.	Three Wheelers	51	1.5	77
6.	Tractors	46	1.5	69
	Total	**919**		**1338/24 = 55.75 say 56**

TABLE 3.28

EXISTING TRAFFIC SCENARIO OF ROAD BETWEEN MINING LEASE & APPROACH ROAD & NH-40

Road	V (Volume in PCU/hr)	C (Capacity in PCU/hr)	Existing V/C Ratio	LoS
Between ML & Approach Road (Village Road)	4	1600 (as per IRC guidelines)	4/1600 =0.0025	A
Dawki-Jowai Road (NH-40)	56	1600 (as per IRC guidelines)	56/1600 =0.035	A

Where, V= Volume in PCU's/hr &

C= Capacity in PCU's/ hr

The existing Level of Service near Village Road & Dawki-Jowai Road (NH-40) is "A" i.e. excellent.

V/C	LOS	Performance
0.0-0.2	A	Excellent
0.2-0.4	B	Very Good
0.4-0.7	C	Good/ Average/ Fair
0.7-0.8	D	Poor
0.8-1.0	E	Very Poor
>1.0	F	Worst

TABLE 3.29

INCREMENTAL TRAFFIC AFTER MINING OPERATION

Proposed Production per Year	60391 Tonnes
Number of Working Days	300
Extraction and Transportation of Mineral	201 TPD
Working Hours	8 hours per day
Truck Capacity	10 T
Number of trucks required	20.1 say 21
No. of Trucks on road due to the mine (To & Fro)	42
No. of PCU deployed per day	42 x 3 = 126
No. of PCU deployed per Hour	126/8 = 15.75 Say 16

TABLE 3.30
ADDITIONAL TRAFFIC SCENARIO & LOS

ROAD	Increased PCU on the Road	V	C	Modified V/C Ratio	LoS
Between ML &Approach Road (Village Road)	4	4+ 16= 20	1600	20/1600 =	0.012
Dawki-Jowai Road (NH-40)	56	56+ 20= 77	1600	76/1600 =	0.047

The LoS value from the proposed mine may be "Excellent". So the additional load on the carrying capacity of the concern roads is not likely to have any significant adverse effect.

CHAPTER 4: ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

4.0 ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

4.1 GENERAL

Any economic development project has some environmental implications adverse or beneficial. An impact can be defined as any change in physical, chemical, biological, cultural and/or socio-economic environment that can be attributed to activities related to alternatives under study for meeting the project needs. The operations involved in proposed project are studied in details before implementation.

The objective of impact identification is to specify areas that are likely to be affected by the implementation of the project. Impact methodology provides an organized approach for prediction and assessing these impacts. The nature of the impacts due to said project activities are identified. This will help to minimize and mitigate the further additional pollution load due to the proposed project on surroundings. The objectives of impact identification are as follows:-

- To ensure compliance with regulations.
- To provide a comprehensive coverage of a full range of impacts, including social, economic and physical.
- To distinguish between positive and negative, large and small, long term and short term, reversible and irreversible impacts.
- To identify secondary, indirect and cumulative impacts as well as direct impacts.
- To consider impacts within the constraints of an area's carrying capacity.

4.2 DETAILS OF INVESTIGATED ENVIRONMENTALIMPACTS

The project activities influencing the following environmental attributes have been studied and their impacts on the following attributes have been assessed.

- Air Quality
- Noise Quality
- Water Quality
- Land use
- Soil Quality
- Biotic Condition
- Socio-Economic Condition
- Traffic Condition

The mining and allied activities in the proposed project area have influence on the above environmental attributes. These activities include:

- Site preparation
- Excavation
- Loading and Transportation

The magnitude of the proposed mining activity being small is not likely to create any serious impacts on the existing environmental set up of the area. However, the likely impacts of the proposed mining and allied activities on the various environmental parameters are discussed with the help of Monitoring done during **December 2020 to February 2021.**

4.3 AIRENVIRONMENT

Any surface mining, including opencast coal mining has always been a dusty business. Sources of particulate matter in open cast mine are excavation, transportation, handling, loading and hauling operation. Dust generation due to mining operation occurs within the mine pit, from overhaul roads as well as dumping areas. At the same time, the HEMM operations and truck movement will release air emissions from their exhausts also. The impacts due to the above listed activities are already occurring at the site as mine is in operation.

Operations that will cause addition to the pollution load in air in the form of particulate matters, SO_2, NOx etc. are:

- Operation of additional diesel fuel based equipments and vehicles
- Removal of vegetation and soil from excavation area
- Handling & transport of additional mineral and waste material (within/ outside of project)
- Dumping activities
- Drilling and blasting

Existing ambient air quality data on various sections of the project was collected to establish a baseline database **(December 2020 to February 2021)** for parameters PM_{10}, $PM_{2.5}$, SO_2, and NO_x values were analyzed**.** Samples were collected from 8 sampling locations:

Core Zone: The value of $PM_{2.5}$ is ranging from 31-38 μg/m^{3}and mean value is 34.2 μg/m^3 against standard limit of 60 μg/m^3. Value of PM_{10} is ranging from 67.0 -81.0 μg/m^{3}and mean value is 74.1 μg/m^{3}against standard limit of 100 μg/m^3. The mean value of SO_2 is 13.5 μg/m^{3}against standard limit of 80 μg/m^3& mean value of NOx is 18.9 μg/m^3 against standard limit of 80 μg/m^3.

Buffer Zone: The results of the Buffer Zone shows that PM_{10} was maximum at Pre-dominant DW Near Jowai-Dawki (NH-40) (within prescribed standard limits) and 3rd Pre-dominant DW near Pamtadong Village were minimum. The $PM_{2.5}$ is ranging from 29.0-44.0/μg/m^3. PM_{10} is ranging from 59.0-89.0μg/m^3. The SO_2 is ranges from 9.4-15.5 against standard limit of 80μg/m^3 & NOx ranges from 15.8-26.5 μg/m^3 against standard limit of 80 μg/m^3. These are within standard limits of National ambient air quality standards.

The values of both the parameters are well within prescribed limits.

4.3.1 Impact on air quality of the area

- Generation of suspended particulate matter during mining operations, material storage, transportation and handling (loading/unloading)
- Generation of SO_2, NOx due to fuel burning
- Generation of dust due to drilling blasting
- Deterioration in ambient air quality due to project
- Health impacts to workers working at dust generation area.
- Accidental Spillage of mineral during loading and unloading

For estimating the increase in the air pollutants, air quality prediction modeling has been carried out using Aermod model.

Aermod Model

AERMOD is a steady-state Gaussian plume model which was used to assess pollutant concentrations from a wide variety of sources associated with an industrial complex. This model can account for the following: settling and dry deposition of particles; downwash; point, area, line, and volume sources; plume rise as a function of downwind distance; separation of point sources; and limited terrain adjustment. Aermod operates in short-term mode.

Model Input Data: For the modeling purpose, the total fugitive particulates (suspended particulate matter i.e., SPM) has been estimated and PM_{10} and $PM_{2.5}$ have been proportioned with respect to it. SO_2 and NO_2 from machinery operation have also been modeled. This modelling has been done for the maximum possible excavation and material handling in any given year during plan period.

This modeling has been done considering 60391 TPA from Amkroh Limestone Mine from 1.25 Ha. Annually 300 working days with 6 hourly one shift has been considered as per approved Mining Plan. The assumptions, input data and other details are given in **Annexure 13** along with GLC isopleth maps and the results are summarized in **Table 4.1** for PM_{10}, $PM_{2.5}$, SO_2 and NO_2. While the GLC at various air quality locations are given in Table 4.2 below.

TABLE 4.1

PREDICTED INCREMENTAL GROUND LEVEL CONCENTRATION (μg/m^3) BY AERMOD MODEL

	X	Y	Elevation	PM_{10}	$PM_{2.5}$	SO_2	NO_2

A perusal of above table shows that the incremental values of 15.98 μg/m^3, 9.19 μg/m^3, 0.83 μg/m^3 and 1.66 μg/m^3 for PM_{10}, $PM_{2.5}$, SO_2 and NO_2, respectively are anticipated at a distance of 100 m from the mine lease boundary.

TABLE 4.2

ANTICIPATED INCREMENTAL GLC VALUES AT THE AIR QUALITY MONITORING STATIONS (µg/m³)

Pollutant	Sampling Station	Maximum observed value	Incre-mental	Total	NAAQS Standards 2009
PM_{10}	AAQ1	81.0			100
	AAQ2	89.0			
	AAQ3	85.0			
	AAQ4	82.0			
	AAQ5	78.0			
	AAQ6	71.0			
	AAQ7	73.0			
	AAQ8	83.0			
$PM_{2.5}$	AAQ1	38.0			60
	AAQ2	44.0			
	AAQ3	41.0			
	AAQ4	37.0			
	AAQ5	35.0			
	AAQ6	31.0			
	AAQ7	36.0			
	AAQ8	40.0			
SO_2	AAQ1	15.5			80
	AAQ2	15.1			
	AAQ3	14.9			
	AAQ4	14.3			
	AAQ5	12.9			
	AAQ6	11.2			
	AAQ7	12.9			
	AAQ8	17.6			
NO_2	AAQ1	20.6			80
	AAQ2	21.7			
	AAQ3	23.2			
	AAQ4	26.1			
	AAQ5	24.8			
	AAQ6	18.3			
	AAQ7	25.4			
	AAQ8	26.5			

It can be seen from **Table 4.1** that after addition of the incremental GLC's to the existing air quality, the concentration of pollutants would increase, but still they would remain within the prescribed standards at all the sampling stations as per applicable standards.

4.3.2 Mitigation Measures

- *Drilling machines will be equipped with dust collector arrangement and wherever required wet drilling arrangement will be used to prevent generation and spreading of dust.*
- *Optimum blast design parameters will be adopted after study. Optimum stemming in blast holes will be done to minimize generation of dust and fly rocks.*
- *Blasting will be done during favorable atmospheric conditions and will be avoided during high windy periods, night times and temperature inversion periods.*
- *To avoid secondary blasting rock breaker will be used.*
- *Optimum bucket size loading equipment will be used which will reduce the number of bucket passes to fill the dumper and thus comparatively less dust will be generated during loading. This will also reduce the chances of spillage from the bucket.*
- *Water sprinkling over blasted pile of ROM will be done which will reduce dust generation during loading.*
- *Water tankers with suitable sprinkling system will be deployed along haul roads and other unworked areas to control fugitive emission. The sprinkling frequency will depend upon the humidity present in the atmosphere.*
- *Overloading of the dumpers and tippers will be avoided.*
- *The vehicles deployed for material transportation shall be spillage proof to avoid or minimize the spillage of the material during transportation.*
- *Personnel working on the drills and other mining activities will be provided with dust mask and other necessary Personal Protective Equipments (PPE). Health checkups will be done biannually to monitor the health of the workers.*
- *Plantation of local thriving species will be done in the 7.5m statutory boundary for arresting dust.*
- *Regular maintenance of vehicles and machinery will be done.*
- *Vehicles/equipment will be periodically subjected for emission tests and will have valid POLLUTION UNDER CONTROL certificates.*
- *Excavators and dumpers will have dust proof cabins to minimize dust exposure of workers.*
- *No impacts are expected on micro-climatic conditions of the project due to this small scale mining activity.*
- *Monitoring to ensure compliance with emission limits would be carried out during operation.*
- *Air Dispersion Modeling study has been carried out and report is attached as annexure 13.*

From the results generated by AERMOD in form of Isopleth and results of same in table above show that maximum GLC of PM10/ PM2.5/ SO_2/ NO_2 after commencement of project does not have a significant impact on environment/ ambient air quality on sensitive receptors of the project.

Detailed Air Dispersion report is attached at **Annexure 13.**

4.4 NOISE &VIBRATION

4.4.1 Noise:

Environmental noise is a complex phenomenon because its intensity and characteristics vary with time loading and noise in buffer zone will be a result of transportation of the excavated mineral and local village activities. Depending upon the frequency as well as type of mining method to be applied along with the mining machinery and transportation vehicles. Ambient noise level in the core zone is likely to increase because of drilling & blasting operation, deployment of equipment such as heavy earth moving machineries,

4.4.2 Impact on noise quality

Generally, the main sources of noise and vibration in the mines occur due to drilling, blasting, mobile mining equipments, transportation, loading and unloading. Noise Quality study was conducted and the results are given below:

Noise Quality results: Samples were collected from 8 locations and the results show:

Core Zone: ANL1: The ambient noise level during day time at the proposed project site was 54.9 dB (A) which are within the standard limit of Industrial area~75 dB (A). During night the noise level at the project site was 39.6 dB (A) which is within the night-time noise standard limit of 70dB (A).

Buffer Zone: The ambient noise level at day time are maximum at Near Jowai-Dawki (NH-40) 57.1 dB(A) as per the standard limit of Commercial area are $\underline{\sim}$ 65 dB (A). The night time noise result at the locations is 40.8 dB (A) which is within the standard limits of commercial area $\underline{\sim}$ 55 dB (A).

In case of the proposed project additional likely impact of noise and vibration will be as follows:

- Mining can cause negative effect on noise quality in the area.
- Noise and vibration generated due to drilling and blasting activity involving Jack hammers drilling equipments.
- Noise and vibration due to mobile mining equipments like excavators, loaders.
- Noise generated due to transportation activity i.e. from dumpers, tippers, trucks and other vehicles.

4.4.3 Mitigation Measures

- *Drilling equipments will be regularly maintained as per maintenance manual. Anti- vibration mounts for compressors will be provided.*
- *Optimum parameters for drilling and blasting will be designed to have controlled blasting which will reduce noise and vibrations.*
- *Blasting will be carried out when the wind conditions are favorable (i.e. when wind is blowing in opposite directions of inhabitated areas or in low velocity).*
- *Ear Muffs will be provided to the exhaust of wagon drills to minimize the noise level.*
- *Blasting operations will be carried out during the noon time when the temperature inversions are not likely to occur.*
- *Proper stemming will be done to reduce air blast.*
- *To check vibration, values of peak particle velocity will be maintained within the prescribed limit by DGMS.*
- *The excavators which will be used for loading will have noise proof cabin to avoid adverse effect to the operator. The helpers working near the excavators will be provided ear plugs and muffs. The maintenance of the excavators will be carried out as per manual.*
- *Proper free face will be maintained for optimal blasting which will also reduce noise and vibration.*
- *Periodical monitoring of noise and vibrations will be done.*
- *The dumpers, trucks and other transportation vehicles will be maintained in good running condition so that noise will be reduced to minimum possible level.*
- *Plantation of trees along the 7.5m periphery of the lease area and along the slope of the dump will be done to dampen the noise.*
- *Each blast will be carefully planned, checked and executed under the supervision of a statutory personnel.*
- *Road will be regularly maintained as better road will lead to less noise.*
- *Imposition of speed limit on heavy earth moving machineries near residential areas.*
- *Truck drivers will be instructed and trained to make minimum use of horns at the residential area.*
- *Vehicles will have anti-vibration mountings, vibration- damped panels.*
- *Timely maintenance of vehicles and their silencers to minimize vibration and sound.*
- *Phasing out of old and worn out machineries.*
- *Task rotation of workers will be done exposed to noise.*

4.5 WATER ENVIRONMENT

The mining operations may have adverse impact on water regime. The important impacts on water regime include change in surface run-off and base flow relationship and possible contamination of surface run-off with excavated overburden. There is no river or water body flowing across the mine site. The nearest perennial water body is Wah Umngot river- 10.5 km NW from the mining site.

4.5.1 Hydro-geology of the area

The hydrogeological formation of the study area comprised of Granite Gneiss and intrusive of Archean Proterozoic, Quartzite of Paleo-Meso-Proterozoic of Shillong group, Granite of Neo Proterozoic- early Proterozoic, Sandstone and Limestone of Paleocene-Eocene age. The presence of weak planes like fractures and joints in these hard rock formation forms the principal aquifer in the area. The ground water in the district occurs under unconfined, semiconfined to confined conditions. Study of dug wells and exploration data reveals the presenceof phreatic/shallow and deep fractured aquifers in the district.
(Source: Central Ground Water Board, India)

GROUNDWATER DEVELOPMENT

Ground water exploration has been carried out in different parts of the district to delineate the potential aquifers and their geometry and to determine the hydrogeological parameters of the aquifer systems. Before NAQUIM programme started in the district, 5 EW and 1 OW were constructed and as a part of data gap generation 5 EW were constructed during the course of study. Details of the exploratory wells are presented below. The summarized details of Ground Water Exploration carried out in the district are given below-

Table 4.3: Summarized Details of Ground Water Exploration

Sl. No.	Location	Block	District	Latitude	Longitude	RL (m)	Type	Lithology
1	Raliang	Laskein	West Jaintia Hills	25°30′05.4″	92°23′56.2″	1276	Depression	Granite Gneiss
2	Madanrwan	Laskein	West Jaintia Hills	25°32′23.1″	92°28′08.8″	1041	Depression	Granite Gneiss
3	Niawkmai	Laskein	West Jaintia Hills	25°32′58.2″	92°29′59.8″	981	Depression	Granite Gneiss
4	Banmuhur	Laskein	West Jaintia Hills	25°31′46.1″	92°32′33.7″	906	Depression	Sandstone
5	Nongringkoh	Laskein	West Jaintia Hills	25°29′11.0″	92°30′54.2″	1082	Depression	Granite Gneiss
6	Shangpung	Laskein	West Jaintia Hills	25°28′49.6″	92°21′11.3″	1260	Depression	Sandstone
7	Thadlaskien	Thadlaskein	West Jaintia Hills	25°29′42.6″	92°10′13.4″	1368	Depression	Quartzite
8	Tyrsang	Thadlaskein	West Jaintia Hills	25°32′04.7″	92°08′52.3″	1328	Fracture	Quartzite
9	Lad Mukhla	Thadlaskein	West Jaintia Hills	25°30′37.0″	92°09′52.6″	1344	Depression	Quartzite
10	Mukhla	Thadlaskein	West Jaintia Hills	25°30′20.5″	92°10′17.9″	1362	Depression	Quartzite
11	Nartiang	Thadlaskein	West Jaintia Hills	25°34′09.7″	92°12′23.5″	1204	Depression	Quartzite
12	Moobakhon	Thadlaskein	West Jaintia Hills	25°38'37.4″	92°17′12.6″	1045	Depression	Quartzite
13	Namdong	Thadlaskein	West Jaintia Hills	25°39'33.0″	92°19′36.4″	990	Depression	Quartzite
14	Khonsaro	Thadlaskein	West Jaintia Hills	25°41'09.2"	92°20′49.4″	963	Depression	Quartzite
15	Saitsama	Thadlaskein	West Jaintia Hills	25°43'15.2"	92°23′01.9″	891	Depression	Quartzite
16	Khanduli	Thadlaskein	West Jaintia Hills	25°43'11.5"	92°24′55.0″	859	Depression	Quartzite
17	UmsyneirSaitsama	Thadlaskein	West Jaintia Hills	25°43'21.1"	92°23′46.7″	878	Depression	Quartzite
18	Mukoh	Thadlaskein	West Jaintia Hills	25°40'25.5"	92°21′01.1″	960	Depression	Quartzite
19	Nongbah	Thadlaskein	West Jaintia Hills	25°31'22.0"	92°14′56.7″	1313	Fracture	Granite Gneiss
20	Jowai	Thadlaskein	West Jaintia Hills	25°26'30.37"	92°11′20.47″	1263	Depression	Quartzite
21	Mostam	Amlarem	West Jaintia Hills	25°24'42.5"	92°10′14.0″	1318	Depression	Sandstone
22	Shkendyrsit	Amlarem	West Jaintia Hills	25°21'49.2"	92°08′51.5″	1304	Fracture	Sandstone
23	Umjarang	Amlarem	West Jaintia Hills	25°18'52.38"	92°07′49.51″	1142	Fracture	Sandstone
24	Dawki	Amlarem	West Jaintia Hills	25°11'11.8"	92°01′08.6″	28	Fracture	Sandstone
25	Amlari	Amlarem	West Jaintia Hills	25°11'00.68"	92°08′59.83″	418	Fracture	Limestone

(Source: Central Ground Water Board, India)

It may be clearly observed that the ground water development in the region, in which lease area falls in safe category.

4.5.2 Impact on water quality

- Additional load on water demand due to mining and allied activities
- Ground water quantity due to extraction for facilitating mining activity
- Ground water quality due to open defecation by mineworkers

Mine seepage and impact on ground water regime

Impact on surface water bodies through indiscrete disposal of liquid waste and suspended solids carried by flowing rainwater.

It would be apt to reiterate here that the quality of ground water was not potable at many places in core and buffer zone as summarized below-

- **Ground Water Quality**: The samples were collected from 5 ground water locations and 2 surface water sources:
- **Core Zone: (Lease Area, Hand Pump Water)** shows that parameters like Total Hardness (259.12 mg/l); Total dissolved solids (427.28 mg/l), Magnesium (22.8 mg/l), & Alkalinity (152 mg/l) is well within drinking water standards (IS: 10500).
- **Buffer zone: Ground Water results:** All results were found within standard drinking water standards (IS: 10500).
- **Surface Water results in Buffer Zone:** The Surface water quality of the Upstream and Downstream water of Wah Umngot River is within prescribed CPCB Water Quality Criteria Class of water.

  The excavated material will not carry any reacting and harmful constituent leading to deterioration of chemical quality.

4.5.3 Mitigation measures

- Total water requirement is about 4.00 KLD (1.0KLD Domestic Uses) + 2.0 (Dust Suppression) & 1.0 KLD (Green Belt) from nearby water sources. Water for drinking purpose will be met from nearby villages. For sprinkling & plantation water will be taken from Private tanker.
- ***Conservation of Ground Water:*** *Mining will be restricted up to a depth of 18 m. Water stored in the mined out area will act as water recharging source in the area. Therefore, mining activity in the leasehold area will have positive impact on ground water.*
- *There is no possibility of mining encountering any surface/subsurface water body. However, during the course of mining, rainwater in the form of surface runoff will be there during monsoon only. No water from the quarry will be discharged to any natural water course directly. The accumulated rain water will partly be used for dust suppression and afforestation and limestone being pervious in nature much of the water will percolate below the quarry surface.*
- *To avoid contamination of ground water from the open defecation by workers, toilets will be provided for the workers at site with septic tank followed by soak pit.*

- *To prevent silt being carried during monsoon period, series of plants would be planted.*

4.6 LAND ENVIRONMENT

Mine lease encompasses total area of 1.25 Ha. Mining will be open cast semi mechanized mining with drilling & blasting. There shall be maximum production of 60391 TPA from this mine. The project area is classified as "Non forestland".

4.6.1 Impact on land environment

Changes in the land use pattern will be caused due to the breaking, dislodging of rocks and transportation.

A) Impact on Land Use of Core Zone

As aforementioned, changes in the land use pattern are caused due to breaking, dislodging of rocks and transportation. The change /impact on land use pattern of core zone after the plan period is as follows:

Table 4.4Land Use: Core zone

Category	End of 5th year (In Ha)
Mined Out Land including road	0.93
Greenbelt in safety barrier	0.16
Total Area in use	1.09
Balance unused area	0.16
Total Applied Lease Area	**1.25**

The change in land-use is graphically depicted in the figure given below —

Over all Changes in Land use of the core zone area

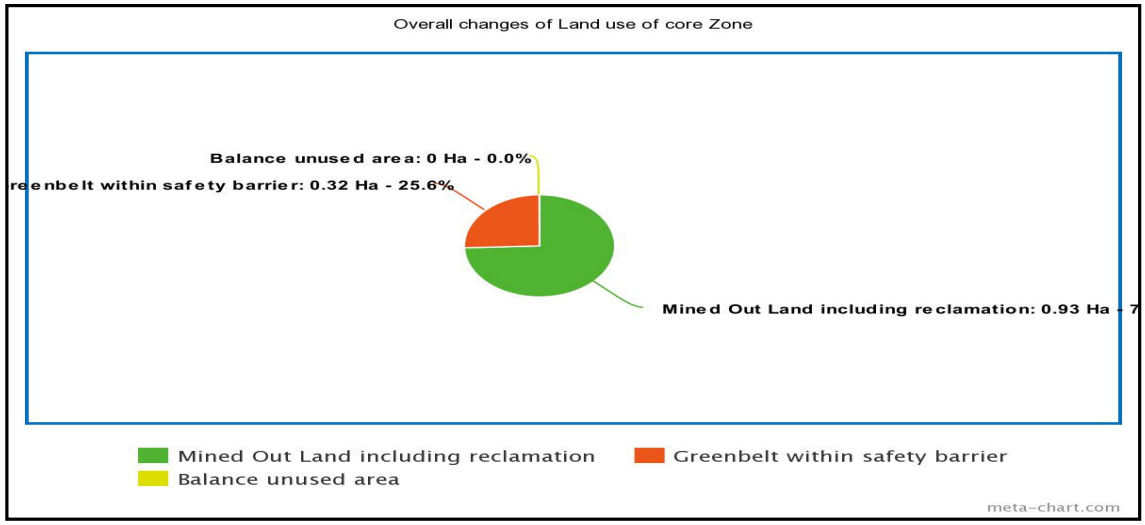


Figure 4.5; overall changes Land use of the core zone area

Impacts on Land Use: The possible impacts on land environment are —

- Effect on productivity of land due to mining by loss of topsoil.
- Dust generation due to mining cause dust cover problems on the nearby vegetation.
- Effect on public buildings of monuments if any.

4.6.2 Mitigation Measures

In order to prevent the environmental degradation of mine lease area and its surroundings, the following measures shall be taken;

- *The proposed project of limestone mining will definitely change the land use. However the area will be reclaimed by the following measures:*
  - *To minimize the effect of mining plantation will be in done along the 7.5m boundary of the mine area and after the exhaustion of the pit whole area will be reclaimed into green cover. After the conceptual mining there will be a mine void which will be extensively planted.*
  - *Mining operations will be confined strictly within the demarcated area.*
  - *During Plan period no waste or gritty soil is being proposed to be generated. After conceptual period exhausted quarry will be reclaimed to the extent possible.*
  - *The dust generation due to the mining will be minimized by sprinkling of water through water sprinkler.*
  - *No effect on public buildings or monuments is envisaged as there are no public buildings/ monuments in the close vicinity of the mining lease area.*

4.7 IMPACT ON SOILQUALITY

During Plan period no soil is being excavated. Mining operation and allied activities will not pollute the soil. However precautionary measures will be taken.

As no toxic substance will be generated or involved, the impact on soil quality is not likely to be more intensive than the existing level. The dust generated during loading and unloading operations and vehicular movements normally constitute heavier particles that would readily settle on very small areas within the plant itself. Raw material and product will also be stored. Thus negligible impact on soil quality is envisaged.

4.7.1 Mitigation Measures

- *Plantation shall be done on 7.5 m statutory boundary to increase quantity of humus in the area.*

4.8 SOLID WASTEMANAGEMENT

There is no gritty soil over the project area and therefore, no dumping will be done. After conceptual period exhausted quarry will be reclaimed to the extent possible. The types of wastes generated and their impacts on environment is discussed ahead—

Mine Waste generation: As per the scheme of mining, the waste generated at the end of plan period will be:

Alluvial Soil	: NIL
Siliceous Limestone	: NIL
Sandstone	: NIL

***Table for Waste generation is given in Chapter 2 Table no.2.6.*

Domestic Solid Waste generation: This type of waste comprises of organic and inorganic materials such as paper, kitchen refuse, bottles, foils, packaging etc. There will be about 36 workers working at the mine site at any point of time. It is expected that about 5 Kg/day of solid waste will be generation on this account. Out of which, organic waste will be around 3.5 kg and remaining 1.5 kg waste will be recyclable and inert waste.

Hazardous waste generation: In proposed project hazardous waste will be mainly generated due to used oil generated from machineries used in mining. There will be deployment of machinery such as excavator; trucks, water tanker, light vehicles etc. and thus about 100 Lit/day of diesel will be required during peak mining days. Thus, daily used oil generation will be 1.7 litres/day.

Plastic waste and E-Waste will be given to approved vendor.

4.8.1 Mitigation Measures

- ***Mine waste:*** *There is no gritty soil over the project area and therefore, no dumping will be done. After conceptual period exhausted quarry will be reclaimed to the extent possible.*
- *As per conceptual planning total area of 1.25 ha of the quarry area will be used to for mining. Afforestation will be carried out in the 0.32 ha of the land to develop green cover.*
- *Domestic Solid Waste generated due to mine workers will be collected in coloured bins of green and blue colour. Organic part of solid waste will be stored in green bins. There will be composting of biodegradable waste generated from both plant site and mine site will be undertaken and compost will be used for development of green belt in the plant as well as in the mine site.*
- *Inorganic waste such as wrappers, plastic waste, foils, etc will be stored in blue bins and will be sold to recycler authorized by CPCB.*
- *Mobile Toilets at the site will be maintained and waste water will be disposed off into septic tank followed by soak pit.*
- *Hazardous waste generated from the mine will be only used oil which will be stored into HDPE drums*

and used oil shall be sold only to the registered recycler.

- *Mining machinery engaged will not be washed at the site as the machines will be hired from the dealer.*

4.9 TRANSPORTATION

Proposed production from the mine will be 60391 TPA. As the daily production from the mine will be 201 Tonnes. Excavated mineral will be transported to market. There will be deployment of 2 no. of tippers of capacity 10 tones to. The lease area has no habitation in close proximity so traffic on the roads is minimal. Steps will be taken to coordinate and organize traffic in the mining area and the mining trucks route, road repairing in coordination with govt. officials. Awareness campaign among dumper/truck drivers will be generated for clearance of road and lower down the pollution load due to transportation.

4.9.1 Anticipated Impact Due to plying of Hauling units and its mitigation measures:

The generated OB from site will be transported by Haul road to the waste dump location in the ML area using dumpers and the Limestone raised from the mine face will be transported by haul road up to the stock yard to be centrally located in ML area. The entire production of mine shall be moved to through dumpers.

The direct impact on the existing traffic load due to the proposed project will be only due to service vehicles moving outside ML area. Therefore, the traffic to & fro of proposed "**Amkroh Limestone Mine**" will not create any traffic congestion.

4.9.2 Other Mitigation Measures:

- *To regulate the traffic, Sign boards shall be displayed for safety purposes during mineral transportation.*
- *The proposed increase in traffic density will not cause significant impact on the traffic since the connecting road and nearby NH-40 is capable of handling this increase in traffic density. The trucks will be properly covered with tarpaulin and overloading will not be allowed to avoid spillage on roads.*
- *Haul roads will be sprinkled with water to keep the dust suppressed.*
- *A supervisor will be appointed to regulate the traffic movement near the site.*
- *Speed breakers will be constructed accident prone areas to calm the traffic and its speed.*
- *Awareness campaign among dumper /truck drivers will be generated for clearance of road and lower down the pollution load due to transportation.*

4.10 BIOLOGICAL ENVIRONMENT

The details of impact and mitigation for the biodiversity in and around the lease area are given below:

4.10.1 Anticipated Impact on Flora

Mining can affect vegetation in the core zone. The mining activity will generate dust which may impact the nearby biological environment.

(A)Impact on Ecology:

There will hardly be any negative impacts on terrestrial eco-system comprising birds and animals as the ML area is only 1.25 Ha. On the contrary, with progressive growth of greenery, terrestrial eco-system will improve in course of time. Due to excess hunting of birds and animals, around, animal life is very less; hence adverse impact on biological environment will be negligible. The air pollutants will be the dust generated during earth moving activities and emissions from vehicles, portable diesel generators, etc.

Though the site is located within barren land, the impact zone is part of landscape involving rural areas. There is growth of vegetation and meager presence of fauna. Impacts on biological environment will be negligible. The dust emission will affect the effective photosynthesis and biological processes by covering the plant/tree leaves by thin dust layer during dry months which however will be washed away on rainy days. It may be noted that are plenty of rains, hence photosynthesis is not anticipated to be effected. Operation activities will have some impact on the eco-system as follows:

a. Impacts on fauna

Bright light and unusual noise during operation activity could shift the activity site of the birds and animals to little away from the location. Presence of water and food wastes during the day time will attract birds and animals. Due to excessive hunting the animals & birds are hardly seen on the fringes. They go deep inside the jungle and stay there. So, during the operation phase, there will hardly be any negative impact on the biological environment comprising birds and animals. On the contrary, with the progressive growth of greenery, biological terrestrial environment will improve in due course of time.

b. Impacts on flora

During operation phase, main pollutants will be emission from vehicles. There would be meager impact of such pollutants on vegetation and crops, since the predicted levels will be much less than the levels specified for industrial and mixed use areas. Waste water from domestic and other facilities will be released only after treatment.

c. Impact on Aquatic eco-system

Impact on Aquatic eco-system will be negligible as no polluted water will be released into natural drainage channels. The Project would adopt zero water discharge concept.

4.10.2 Mitigation Measures

Following measures are proposed to mitigate ecological impact

I. Plantation programme

To reduce the impact of air pollution, particularly the SPM content, it has been proposed to a green belt around Barrier/ safety Zone. Plantation will be carried out within the lease area where fugitive dust emissions are anticipated. Lawns and gardens will also be created near the office areas and other service areas like canteens, parking lot, etc. The plantation programme to be carried out is shown in Fig 4.7.

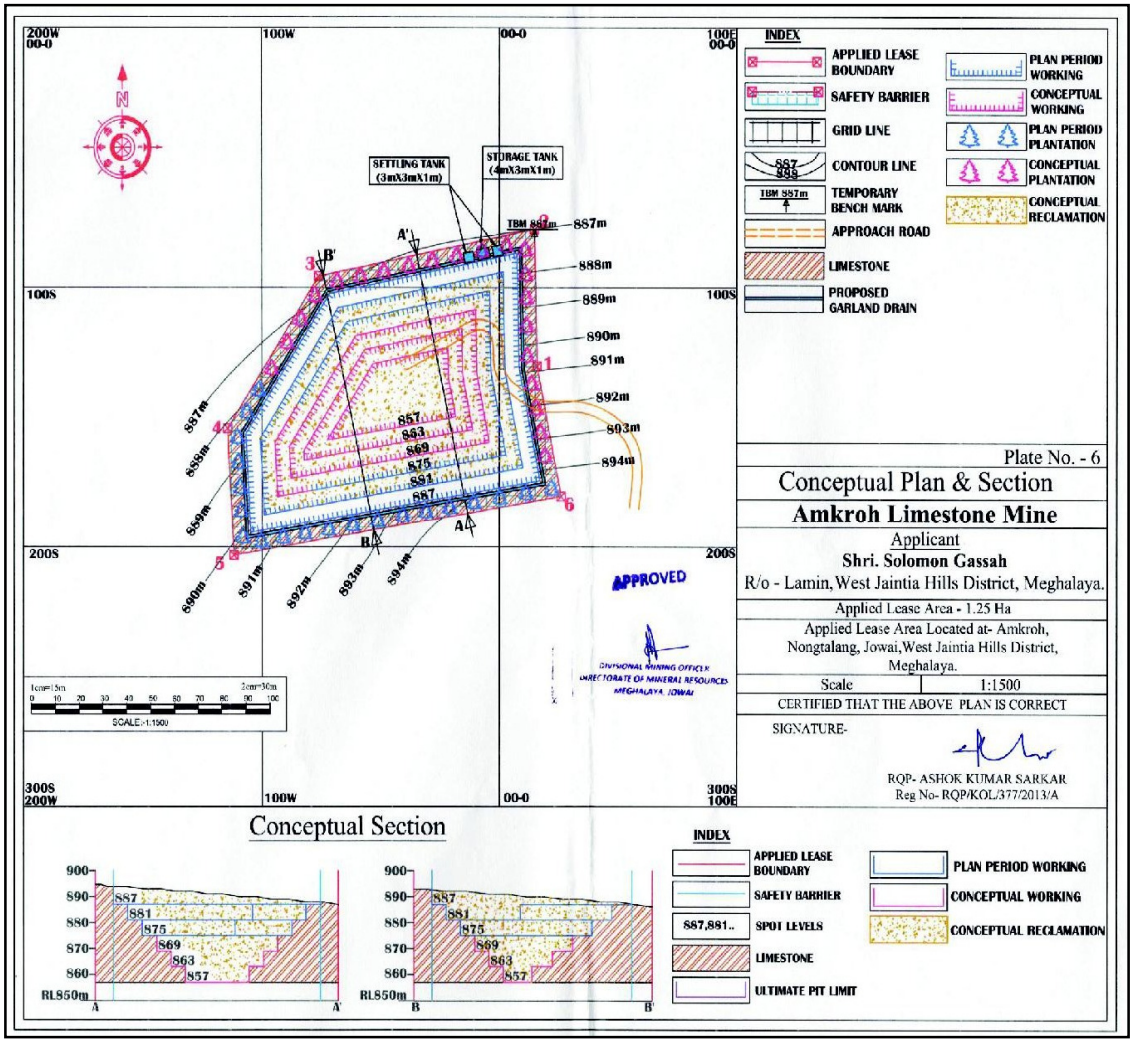
Special care has to be taken while planting trees, as regards the type and the number, within the plant premises in order to confine the pollutants to the area and prevent their dispersal. The number of trees to be planted as a part of the plantation programme is taken as 255 trees for green belt and along roads.

Year wise plantation programme is given in **Table 4.5**.

TABLE 4.5
YEAR WISE PROPOSED PLANTATION PROGRAMME

Sl. No	Year of Plantatio	Target of Plantation	Spacing	Area of Plantation	Remarks
1.	First	51	2.5 m	Safety/Barrier Zone	Planting in Zig Zag pattern
2.	Second	51	2.5 m	Safety/Barrier Zone	
3.	Third	51	2.5 m	Safety/Barrier Zone	
4.	Fourth	51	2.5 m	Safety/Barrier Zone	
5.	Fifth	51	2.5 m	Safety/Barrier Zone	
TOTAL= 255					

Fig 4.6. Green Belt Development Programme



The selection of trees to be planted has to be done judiciously keeping in mind the adaptability of trees to the climate of the region. As mentioned in Chapter 3, the trees which are found in relative abundance as compared to the other species as well as species with proven survival rate will be preferred. Consultation with the forest officers and experts in the field will further help to identify the exact species to be planted, and these can be obtained from the nurseries in the nearby areas. The social aspects of requirements of fodder and fuel of the community will not be affected by this project.

II. **Wildlife conservation programme**

The list of animal diversity is prepared by visualizing and interviewing many local residents of nearby villages. Due to ban in poaching many animals have shown increasing trend. There is no schedule I species observed in the study area.

There are no threatened species of plants. Monkey of Schedule II is the only threatened species. No special measures are required except that the employees as well as the population of surrounding villages will be educated for conservation and protection of the Monkey through specially arranged camps and continuous campaign through posters at prominent places.

Some additional measures shall be taken as follows:

- *Mining will not affect flora in core and buffer zone because mining will be carried out within the demarcated area.*
- *In buffer zone there is good vegetation. Mining will be limited to the core zone. Therefore the flora and fauna will thrive in the buffer zone. Raw material will be transported in covered vehicles to market. Hence impact on surrounding flora will be minimal.*
- *The mined out area will be closed progressively along with reclamation of the land for the gainful use by developing green area. Thus, it is expected that the natural vegetation in the area will not be affected.*
- *A site reclamation plan will be developed that will addresses both interim and final reclamation requirements and that identifies vegetation, soil stabilization, and erosion reduction measures.*

4.10.3 Anticipated Impact on Fauna

- Noise from mining equipments, transportation, changes in land use may affect the migration of fauna.
- Mining may drive away the wild life from their habitat, and significantly affect wildlife.

4.10.4 Mitigation Measures

- *In core zone the land is non forest land which has vegetation and the mining activity will be carried out in that area. However, there is less biodiversity in the area hence mining will not adversely affect the fauna in the area.*
- *There is no wild life sanctuary in 25 km radius circle. As per forest working plans and records from*

MoEF reveals that there are no wildlife sanctuaries or national parks or biospheres/ tiger reserves in 10-km radius from mine lease area. Plant species observed are common in nature and there is no endangered, threatened, protected or rare plant species recorded during field surveys and also from forest department records.

- *Thus, the impact on the flora and fauna will be insignificant and addition of greenbelt may enhance the local aesthetic value in the region.*
- *To protect the fauna protective measures for reclamation and green belt development will be done. Emphasis will be given to local species & plants of economic importance.*
- *Measures for protection and conservation of wildlife species will be done by organizing awareness campaigns and vigilance program by involvement of community youth against poaching of animals.*
- *To check/reduce the impact of dust and noise, thick plantation cover will be developed which will provide acoustic buffer and therefore will dampen sound.*

4.11 SOCIO- ECONOMICENVIRONMENT

The impact of mining industry on socio-economic scenario has both the facets. On one hand it may degrade the fertile land leading to reduced agriculture income besides causing displacement. On the other hand being a commercial activity it provides opportunity for both direct & indirect employment. As mentioned earlier, there will be around 36 personnel, 80% staff will be employed from the local villages.

Impact of Mining:

- Socio Economic scenario of the study area should be done.
- Increase in dust generation due to transportation of the material by tippers and uncovered trucks.
- Increase in employment opportunities is a positive impact from the project.
- Impact on nearby habitat due to dust generation and mining activity
- Falling of children in mining pits
- Impact on agricultural fields due to mining activity

Mitigation Measures:

Results of Socio economic study: *Total 76 villages fall in the buffer zone. The study has been conducted by primary survey and secondary data source from Census of India 2011. The primary socio economic study has been conducted in 4 villages. The results are discussed below:*

- ***Core Zone:*** *There is no habitation in the core zone*
- ***Buffer Zone****:* The total number of Households of the study area in rural village area is 6532 as per Census of India, 2011 data. The details are given below.
- **Population:**

  The total population of the study area is 36876 constituting 6532 households, implying that there are average 5.645 members per house. The average sex ratio of the study area is 1000/1012.55 as per census 2011.
- **Social Structure**

  The proportion of Scheduled Caste (SC) population within the study area is 0.63 % and the percentage of schedule Tribe (ST) is 93.76%.
- **Literacy**

- The total proportion of literate within the study area is 58.65% of total population. In percentage the male literacy 28.35% and the female literacy is 30.30% respectively within study area.
- The project will generate employment for total 36 people. In which apart from the statutory employment mostly the local people will be hired.
- Regular sprinkling of water in the roads will be undertaken to arrest the dust. Besides plantation around the mine area has been proposed which will help minimizing ill effect from dust.
- A separate transportation route is proposed which will not pass through the villages.
- Regular maintenance of vehicles will be undertaken.
- Green barrier of native species along existing Road passing through the lease area will be developed.
- Truck will be covered by Tarpaulin.
- Wire fencing for mining pits.
- Barricading by using wire fencing to restrict the children to go towards the mine site.
- The area of agricultural fields will not be disturbed by mining.

SOCIAL IMPACT ASSESSMENT

- There are various social impacts of mining which should be identified before starting any developmental activity. The mining is one of the activity for which if pros and cons are not properly assessed may not only result in deterioration of local environmental scenario but also may have long term affects on the socio-economic status of the locals such as loss of agriculture land, degradation of water quality, contamination of ground

water and soil quality. Therefore, to prevent above problems following measures shall be undertaken:

- Ensuring developments contribute to economic growth and social development. The project will provide skill-based training to the locals and will generate chance of indirect employment in the area.
- During operation phase, there will be small influx of about 36 workers to the locality with ready income in cash. This work force will come from the surrounding areas. With the increased population and money supply, there will be need for daily consumption items as well as services, which have to be provided by suppliers from nearby locality. These developments will have both positive and negative impacts on the local socio-economic environment.

4.11.1 Impact on Occupational Health:

Impact on health:

Mining activity often leads to Respiratory disorders are occupational lung disease to miners, due to the inhalation of dust. There respiratory disorder that may happen to the miners in proposed case is Silicosis: This takes place due to breathing crystalline silica dust, which in severe cases can be disabling, or even fatal. When silica dust enters the lungs, it causes the formation of scar tissue, which makes it difficult for the lungs to take in oxygen. Miners may also suffer with occupational respiratory ailments, skin allergies etc, but the same are preventable if exposure is minimized. PP will take all the precautions as much possible to ensure healthy and safe environment for the mine workers. The chances of occurrence of disease due to dust generation can be minimized by providing Personal protective Equipment's to the workers and by organizing regular health check-up of the miners. The detailed measures to be followed are given below:

Preventive measures

- *Personal Protective equipments (such as dust mask, gloves, goggles, boots, earmuffs) shall be provided to the mine workers especially to those who are working at high noise & dust generation points.*
- *They will be guided and informed about the health hazards and the measures to cope up with them by conducting informative sessions.*

Table 4.6: List of safety equipments

S.No.	Item	Equipment
1.	Face protection	Face Shield
2	Eye protection	Different types of goggles used for different purposes.
3.	Ear protection	Ear Plug, ear muff
4.	Leg Protection	Safely shoes, gum shoes
5.	Working at height	Safety belts
6.	Head Protection	Safety helmets
7.	Protection from Dust	Dust Mask
8.	Hand Protection	Rubber gloves

***Medical Check-up**: Pre-employment and periodic medical examinations shall be conducted for all personnel, and specific surveillance programs instituted for personnel potentially exposed to health hazard.*

- *At the end of mining operation test will be conducted to assess health of workers.*
- *Workers will be informed and trained about occupational health hazards if identified.*
- *Any worker's health related problems will be properly addressed.*
- *The medical histories of all employees will be maintained in a standard format. Thereafter the employees showing symptoms of the diseases mentioned below will be subjected to medical examination. Mostly respiratory disorders are more likely therefore workers will be checked for respiratory diseases.*

4.12 PLANTATION/AFFORESTATIONPROGRAMME

Plantation of local thriving species will be done in the 7.5 m statutory boundary along the mine area. During the plan period about 0.16 ha area shall be planted whereas about 0.32 ha i.e. the entire lease area will be planted at ultimate stage. Precautionary measures will be taken for carrying of the afforestation made by regular watering in the afforested area, to protect from grazing animals and proper manuring. The detail of afforestation scheme is given below-

Table 4.7; Proposed Plantation

Year of Plantation	Target of Plantation	Spacing	Area of Plantation	Remarks
First	51	2.5 m	Safety/Barrier Zone	Planting in Zig Zag pattern
Second	51	2.5 m	Safety/Barrier Zone	
Third	51	2.5 m	Safety/Barrier Zone	
Fourth	51	2.5 m	Safety/Barrier Zone	
Fifth	51	2.5 m	Safety/Barrier Zone	
TOTAL	**255**			

4.13 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF ENVIRONMENTAL COMPONENTS

For a mining project of this type there would be significant irreversible environmental impacts of following nature:

- The primary and secondary impacts of the project.
- The project may involve potential environmental accidents associated.
- Use of Natural resources.

There are following irreversible and irreparable changes associated to mining and mitigation measures:

- **Land Use change and degradation of soil quality:** Mining causes change in land use resulting in mining pit which alters land use. As the mine area is only 1.25 ha hence there will be no backfilling. Instead of that soil will be spread and plantation will be done in the entire area at the ultimate stage.
- **Water Recharge Pit:** Till the conceptual period mining pit will be developed in the water recharge pit. During rains water will be collected in the pit and therefore result in overall development of water level of the area.
- **Loss of biodiversity:** Destruction or drastic modification of the original site and anthropogenic substances release can have majors impact on biodiversity in the area. Destruction of the habitat is the main component of biodiversity losses.
- **Green belt Development:** As per ultimate plan 7.5m of statutory boundary in the mining the area will be developed into green belt area and trees shall be planted. This will provide safe habitat for fauna and also provide fodder for the cattle of the nearby village people. Extensive plantation will be done in the entire area at the ultimate stage.
- **Fencing of the mining area:** Sometimes big pits result in accidents and animal falls into the pit. To protect them there shall be fencing done around the mining pit.

- **Contamination of ground or surface water:** There will be no contamination of ground water as the mining will be carried out above ground water table. The runoff from the mine is negligible so there will be no contamination of surface water.

4.14 ASSESSMENT OF SIGNIFICANCE OFIMPACTS

The environmental attributes which are likely to have an impact due to the proposed mine at Amkroh, Elaka- Nongtalang, Jowai, District-West Jaintia Hills, State- Meghalaya. After taking proper measures the possible impacts are summarized below.

Table 4.8; Summary of Impacts and mitigation measures

S.No.	Proposed Activity/Parameters	Significance of Impacts
1	**Air Environment**	-
	PM_{10}	-
	SO_2	-
	NO_X	-
2	**Water Environment**	+ve
3	**Biological Environment**	-
	Flora (Vegetation)	+ve
	Fauna (Wildlife)	-
	Plankton	-
4	**Noise Environment**	-
5	**Socio-economic Environment**	
	(a) Social Status	+ve
	(b) Economic Status	+ve
	(c) Generation of Employment	+ve
	(d) Infrastructure Resource Base	+ve
6.	**Traffic Environment**	-

4.15 SUMMARY OF MITIGATION MEASURESPROPOSED

A brief description of mitigation measures is given ahead —

Table 4.8; Summary of Mitigation Measures Proposed

Air Environment	*There shall be generation of dust due to point and non-point sources thus following measures shall be adopted:* • *Workers will be provided with protective gears such as dust masks and goggles etc.* • *Regular water sprinkling* • *Plantation of trees will be done at dust generating points* • *Vehicles shall have PUC Certificate*
Noise Environmen	*Ambient noise level in the core zone is likely to increases. To prevent noise pollution:* • *Optimum blasting parameters will be adopted.* • *Ear muffs will be provided to the workers.* • *Plantation will provide acoustic buffer therefore plantation shall be done along the periphery.* • *Regular maintenance of equipments shall be done to reduce noise pollution.*
Water Environmen	*Possible impacts due to contamination on water quality due to runoff of storm water and mine seepage.* • *No effluent discharge from mine* • *No toxic chemicals in mineral to contaminate water.* • *Water collected during rains shall be used for sprinkling and plantation.* • *The mining will act as water recharge reservoir which will help in development of ground water in the area.* • *Mining will not intersect water table; hence there will be no impact on groundwater.*
Biological Environment	• *Mined out land reclamation shall be done by doing extensive plantation in the entire lease at the conceptual stage.*
Socio-Economic Environment:	*It is evident from social survey that population is mostly unemployed.* • *The project will generate employment for 36 people.* • *Regular medical examinations, schooling, better infrastructure etc. shall benefit employees as well as the locals in the area.*

Mine Waste Management	• *No gritty soil is proposed to be generated during plan period.* • *Mining shall not be done during rains and there shall be construction of retaining wall and garland drain to prevent surface runoff.* • *Hazardous waste such as used oil shall be stored properly and sold to registered-processor.* • *Domestic waste water due to daily human activities which shall be properly disposed off into septic tanks followed by soak pits. Other domestic solid waste such as Wrappers, foils, leftover food material etc* • *Shall be collected in separate bins.*

CHAPTER: 5 ANALYSIS OF ALTERNATIVES

5.0 ANALYSIS OF ALTERNATIVES

5.1 GENERAL

Analysis of alternatives involves a thorough study of the possible future conditions in the project study of the possible future conditions in the project area in response to a set of alignment alternatives without the project or status quo condition. Consideration of alternatives to a project proposal is a requirement of EIA process.

5.2 ANALYSIS OFALTERNATIVES

1. **Project Alternative:** The project is for mining of limestone mineral. The mineral from the mine will be transported directly to the Market. There is a growing demand of quality limestone mineral in the local open market as well as for supply to the neighboring state as building and construction material for various construction purposes as well as for supply to limestone kilns. There is a huge demand for the low-grade Limestone boulder for construction purposes and to be use in lime burning both for domestic use within the state as well as for supply to other neighboring town and villages. The supply of limestone boulder will meet the demand adequately when production is allowed by the concerned authorities.

   Site Alternatives: The mineral is site specific & the lessee has applied mining lease to mine stone for the specified lease area. Thus, no alternatives site is proposed.
   Mining activities shall be carried out based on local geology and availability of the mineral. There are following causes due to which this site is most suitable:

i) The project is site specific in view of occurrence of mineral.

ii) The exiting road network is closer to the deposit and hence no additional land is required for road connectivity.

2. **Technology Alternative:**

   Mining shall be done by open cast semi mechanized method with drilling and blasting. Optimum blasting parameters will be adopted.

3. **Water Alternatives:** The water requirement in the mine will be for 3 heads namely Water requirement for Domestic activities, green belt development and sprinkling. The domestic demand of about 1.0 KLD will be sourced from nearby villages. For sprinkling & plantation water will be taken from Private tanker.
4. **Fuel & Power Alternatives:** Looking at the project requirements the best fuel High speed diesel is proposed to be used.
5. **Employment Alternatives:** Local workers will be employed as per availability and suitability and if required employment can be outsourced.
6. **Material Transportation**: Within the mine site the mineral can be transported through conveyor belts etc. However, the lease is so small and production is very less therefore a conveyor belt will not be feasible.
7. **Road:** Metallic road can also be constructed in place of haul road for transportation of mineral from mine site to main metallic road.

5.3 ADVERSE IMPACT OF ALTERNATIVES TECHNOLOGY

The existing technologies for mining of mineral are most suitable hence no change in project technology is proposed.

Mitigation Proposed for Alternatives: There will be no change in the technology opted hence no mitigation is proposed.

5.4 SELECTION OF ALTERNATIVE

There is no alternative technology proposed for the project as the mineral is found within the beds of the rocks. This is the safest and least expensive technology for the mining of limestone mineral from proposed mine.

CHAPTER: 6 ENVIRONMENTAL MONITORING PROGRAM

6.0 ENVIRONMENTAL MONITORING PROGRAM

6.1 GENERAL

The monitoring programme is devised to ensure that the envisaged purpose of the project is achieved and results in the desired benefit to the target population. To ensure the effective implementation of the EMP, it is essential that an effective monitoring programme be designed and carried out. Broad objectives of the monitoring programme are:

- To evaluate the performance of mitigation measures proposed in the EMP
- To suggest improvements in the management plans, if required
- To satisfy the statutory and community obligations

The monitoring programme contains monitoring plan for all performance indicators, reporting formats and necessary budgetary provisions. Monitoring plan for performance indicators and reporting system is presented in the following sections. The company has a well-defined environmental policy.

Physical, biological and environmental management components identified as of particular significance in affecting the environment at critical locations have been suggested as Performance Indicators (PIs). The Performance Indicators shall be evaluated under three heads as:

- Environmental condition indicators to determine efficacy of environmental management measures in control of air, noise, water and soil pollution;
- Environmental management indicators to determine compliance with the suggested environmental management measures.
- Operational performance indicators have also been devised to determine efficacy and utility of the mitigation/enhancement designs proposed.

The objectives of monitoring are:

- To identify the state of pollution within the mining lease area.
- To verify the result of the impact assessment study in particular with regards to new developments.
- Generate data for predictive or corrective purpose in respect of pollution.
- To assess and monitor the environmental impacts.
- To establish a database for future Impact Assessment Studies for new projects.

Mining: Mining of limestone mineral will be done as per approved mining plan to ensure safety of the workers and ambient environment.

- **Manual:** There shall be no manual mining.

Semi Mechanized: Mine shall be worked out by semi mechanized method with drilling and blasting. Shovels/Rock breakers, jack hammers, compressor and tippers will be used for mining operations.

Frequency & locations of environmental monitoring: Regular Monitoring of all the environmental parameters viz., air, noise, water and soil as per the formulated program based on CPCB and MoEF&CC guidelines will be carried out every year in order to cross check any changes from the baseline status. Monitoring program will be followed till the mining operations are continued. For implementation of the same Environment Monitoring Cell will be formed under control of the Mines manager. The job of this cell will be regular environmental monitoring and submission of environmental report, green belt development, etc. The plan for Monitoring is given in the following paragraphs:

6.2 PROPOSED MONITORING PROGRAMME

The details of the proposed program are given below:

6.2.1 Monitoring of Mining Parameters

Slope failure: Topographically, the mining lease area represents domain of gentle rolling topography. The average highest altitude recorded in the lease area is above 894 m ASL and the lowest of below 887 m ASL. The elevation difference is 7 m. However regular inspection (frequency and mechanism to be established) will be carried out to examine slope stability, mine faces, etc. A team constituting of Mines Manager will undertake monthly inspection.

Ground water drainage: The effectiveness of drainage system depends upon proper cleaning of all drains and sumps. Regular checking will be carried out to find any blockage due to silting or accumulation of loose materials. The drains will also be checked for any damage in lining / stone pitching etc. The environmental management cell defined will inspect the same and submit report to owner.

Blasting effect: Blasting is one of the most critical activities of mining operations. Therefore, Optimum drilling and blasting parameters have been developed taking into account different aspects generally adopted in similar cases to optimize the efficiency of blasting keeping the associated hazards at minimum.

6.2.2 Monitoring of Environmental Parameters:

The monitoring of environmental parameters will be undertaken as per guideline given in IBM CCoM's Circular Number 3/92.

Air Quality Monitoring: Air quality monitoring is essential for evaluations of the effectiveness of abatement program and to develop appropriate control measures. Particulate Matter (PM10 & PM2.5) will be monitored in continuation with Sulphur dioxide (SO_2) and Oxides of Nitrogen (NOx) monitoring in workplace and study area at 8 sampling locations.

Water Quality Monitoring: Water quality monitoring involves periodical assessment of quality of ground water and surface water. Parameters to be monitored are pH, Total Suspended solids, Chemical Oxygen Demand (COD), Oil &Grease, Phenolic compound, Copper, Fluoride, Manganese, iron, etc. Total collected samples 7; where 5 ground water samples and 2 surface water samples of nearby water bodies will be periodically studied to assess the impact of mining.

Noise Level Monitoring: Noise level monitoring is done for achieving the following objectives. To compare sound levels with the values specified in noise regulations. To determine the need and extent of noise control of various noise generating sources. Noise level monitoring will be done at 8 locations, the work zone to assess the occupational noise exposure levels and also at the noise generating sources like ore handling arrangements, maintenance workshop, nearby villages to assess the noise levels and their propagation for taking necessary control measures at the source.

Parameters: The noise level recordings are measured in dB(A) Leq values, where dB(A) denotes the time weighted average of the level of sound in decibels on scale A, which is related to human hearing.

Soil Quality: As a part of environmental monitoring soil sampling and analysis will be carried out from 5 no. of stations quarterly study shall be done.

6.2.3 Green Belt Development Monitoring

Monitoring of growth and survival rate of the plants planted for greenbelt development every year shall be done to replace the plants which are not grown. Following data shall be recorded every year:

- Area under plantation/vegetation
- Period of plantation
- Type of plantation: Trees, grass any other as seeds or saplings.
- Distance between plants
- Type & amount of fertilizer used

- Interval of watering
- Method and period of post plantation care
- Survival Rate
- Density of afforested land both pre & post plant condition

6.2.4 Occupational Health and Safety Monitoring

Concentration of Respirable dust in the workplace will be regularly measured as laid down by DGMS. Health checkup of the workers will be conducted at regular intervals. The information will be furnished to the relevant authority.

Environment Management Cell will also coordinate with general public, regulatory authorities, local administration to appraise environmental performance of the mine.

The plan of environmental monitoring for selected important parameters will be worked out as per format. **Table 6.1.**

The other steps for giving paramount importance to the occupational health and safety of mine worker are discussed as ahead—

- Use of safety/protective gears like rubber gloves, safety shoes, helmet, dust mask etc. will be a must. Routine check-ups to develop habit will be made by environmental cell.
- Regular training and refresher follow-ups on this regard will be given continuously to build the capacities of the mineworkers.
- Monitoring of quality of water, air, noise, and occupational health status of project personnel and surrounding habitations.
- Planned monitoring program to evaluate the effectiveness of various /specific aspects of technological/ mitigation measures.
- Plantation monitoring programme to ensure survival and growth rate of plantations.
- A plan for monitoring health of workers and community in vicinity will be drawn and submitted along with financial allocation. The details of the plan are discussed below.

Plan for monitoring health of workers:

It is proposed that at the outset of mine, all the workers will be medically checked. The History report of each employee will be made by the environment cell. This will include the X-Ray films also. A regular check-up of all the workers will be made as given ahead-

- Once in a year for all the workers having their work place close to the dust producing sites like and loading and unloading.
- Once in 2 years for all other workers

Any deviation will immediately be reported to mines manager for taking necessary and corrective action.

6.3 FREQUENCY OF MONITORING

The mining will be done in the existing old quarry both laterally and at depth. The mining can be started within 3-4 months after obtaining statutory clearances. No construction will be required therefore no environmental monitoring during the commencement phase is suggested.

Measurement Parameters, Frequency, Location & Cost of Measurements

Methodology of Monitoring Mechanism: Environmental monitoring at various locations, within the ML area and in the study area of 10 km radius will be carried out on a periodic basis. A comprehensive network for monitoring has been prepared. Sampling locations have been identified by considering the source of pollution due to mining operations, drainage pattern and topography of the area.

EMP implementation & monitoring: An internal monitoring team shall be constituted for implementing the monitoring plan of Rs. **1,20,000** rupees is expected for monitoring cost.

Table 6.1Environment Monitoring Schedule Details

Monitoring	Frequency of Monitoring	Methodology	Cost (Rs.)
Ambient Air Quality	Annually	Particulate Matter (PM2.5): USEPA Quality Assurance Handbook (Vol II) Part II, Quality Assurance Guideline Document 2.12 Publication 1988) Particulate Matter (PM10): IS: 5182; Part 23 :2006 Sulphur dioxide (SO2): IS: 5182 (Part – 2) – 2001 , Reaffirmed 2006 Nitrogen Oxides: IS: 5182(Part –6)-2006	48,000.00
Water Quality	Six Monthly	APHA 22nd Edition 2012:2120 B & C - 2012	20,000.00
Noise Monitoring	Annually	As per IS: 9989(1986) reaffirmed 2001	20,000.00
Soil Monitoring	Annually	Texture, Electrical Conductivity, Bulk Density etc	22,000.00
		Total Costing	**120,000.00**

- **Biological Environment Monitoring:** Monitoring shall be done regularly on the plantation and the records shall be maintained. The survival rate of trees will be checked and regular water sprinkling shall be done. There is provision of gardener to take care of the plantation in the area. There shall be fencing of pit done to avoid accidents to the nearby fauna.

- **Socio-economic Environment Monitoring:** Once in a year through physical survey for cross checking any adverse variation and prompt correctives. Health issues will be regularly addressed by organization of heath checkup camps shall be done.

Reporting Schedules of monitored data: The monitored data on air quality, water quality, soil quality and noise levels, will be periodically examined for taking necessary corrective measures. The monitored data will be submitted to State Pollution Control Board (SPCB). The post-project data will be submitted in half- yearly monitoring reports to the same.

6.4 INFRASTRUCTURE FOR ENVIRONMENTAL PROTECTION

A full-fledged environmental cell with qualified and experienced personnel established at the company's beneficiation plant, which is located close by, will supervise and implement the environmental issues. This environmental cell is supported by a fully equipped laboratory to carry out the analysis. The proposed organization of the environmental cell should have manpower on regular basis.

6.5 ENVIRONMENTAL MONITORING CELL DETAILS

Environmental data shall be monitored initially by using an outside agency.

Environmental Monitoring System & Methodology: Based on the results of improvements of adversity in the environmental parameters, monitoring schedules and duration will be restricted, if necessary, after consulting with SPCB and MoEF&CC.

6.6 FUNCTIONS OF THE MONITORING CELL

To carry out environmental monitoring at site for various environmental parameters as required either departmentally or through outside agencies. This will ensure that the environmental status of the core and buffer zone of the mine will be preserved in good status as per rules.

1. To observe the environmental control measures to be implemented.
2. To keep a watch on the flow patterns of drainage and surveillance on the efficiency of water management system.

3. To study the effects of project activities on the environment.
4. To ensure implementation of plantation programme. Regular monitoring of survival rate of plants should also be carried out to achieve the desired result, for five years.
5. To keep records of monitoring etc. in a systematic way, so as to facilitate easy access, when needed by statutory agencies, etc.
6. Conducting environmental studies and reporting to SPCB.
7. To interact and liaise with State and Central Government Departments.
8. To ensure the availability of the necessary spares for the pollution control equipment all the time so as to keep the pollutants of the environment within the stipulated limits.
9. To identify the source of pollution and to take immediate action to prevent further pollution.
10. Conducting safety audits and programmes to create safety awareness in workers/staff.
11. Conducting regular health audits to detect any health problems promptly to the workers/ staff. This will reduce occupational health problems.
12. Parting training on safety and conducting safety drills to educate employees.
13. Carrying out socio-economic study once in three years in the surrounding areas to find out the benefits derived by the society due to the project and also to fulfill the deficiency, if any, immediately.
14. The recorded data from monitoring of air, water and noise will be submitted half yearly by project proponent to Ministry of Environment and Forests (Regional office) and the SPCB, respectively.

6.7 REPORTING SCHEDULE

The recorded data from monitoring of air, water and noise will be submitted half yearly by project proponent to Ministry of Environment and Forests (Regional office) and the SPCB, respectively.

6.8 EMP BUDGETARY COST ESTIMATE

The cost estimates give only the indication of the likely cost. The estimated environmental i.e. mainly monitoring and green belt development, cost of the project is as follows.

Table 6.2; Cost of Environmental Protection Measures

Sl. No.	Particulars	Annual Recurring Cost (Rs in Lakhs)
1.	Reclamation & Rehabilitation of excavated pits	0.30
2.	Soil Dump Management	0.40
3.	Plantation & greenbelt development	0.24
4.	Air, Water & Noise Quality Monitoring	0.60
5.	Water sprinkling	0.20
6.	Occupational Health	0.30
	Total	**2.04**

6.9 MONITORING SCHEDULE

There shall be monitoring during operation phase. The sampling locations have already been mentioned in the report and a monitoring schedule has been proposed. Monitoring of the ambient environment shall be duly done. The P.P. will engage NABL accredited agency for carrying out regular monitoring as detailed in report.

CHAPTER 7: ADDITIONAL STUDIES

7.0 ADDITIONAL STUDIES

7.1 GENERAL

The report has been prepared on the basis of ToR granted. All the studies proposed in the TOR of the mining project have been complied with and the same has been covered in the EIA report. We have included the additional studies covered for the proposed project such as risk assessment (RA), Disaster Management Plan (DMP), Social Impact Assessment in connection with mining and allied operations of the proposed project. It also covers dangers/ risks/ explosions/ accidents etc likely to arise from the project operations, including onsite and offsite emergency plans to meet the disastrous situations.

7.2 PUBLIC CONSULTATION

Public hearing is very significant part of the process of public participation envisaged under the guidelines issued by MoEF&CC, Government of India. The public hearing for the project is proposed.

7.3 RISK ASSESSMENT

Human health and Environmental risk from developmental activities is mainly due to occurrence of some accident consisting of an event or sequence of events 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. These predictions of consequences are combined to provide numerical measures of the risk for the entire facility. Risk assessment should be done on the basis of past accident analysis at similar projects, previous judgments and expertise in the field of risk analysis especially in accident analysis.

The possible risks in the case of mining projects are erosion, inundation/floods, accidents due to vehicular movement and accidents during mineral loading and transporting etc. 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 conditions, which are adequately safe and healthy. At the same time the environmental conditions should be such as not to impair his working efficiency. This is possible only when there is adequate safety in mines.

7.3.1 Risk Management:

The following precautionary measures shall be taken to prevent any accident

- Elimination of the source of hazard.
- Substitution of hazardous process and materials by those which are less hazardous.
- Geographical/ physical isolation of hazards from vulnerable communities.
- Use of engineering controls to reduce the health risk.
- Adoption of safe working practices such as regular equipment maintenance.
- Use of Personal Protective Equipment should be mandatory.
- Top edge of opencast workings shall be kept properly fenced.
- Regular dressing of bench sides to ensure safety of workers employed within 5m or working face.
- Provision of safety belt or rope while persons are at work at the quarry sides or benches from where there are chances of falling down for more than 1.8m.
- Drafting and implementation of preventive maintenance schedule for various kinds of machinery deployed in opencast workings.

- Provision of maintenance of properly laid haul roads with parapet wall fencing or guards and road signs at strategic points.
- Precautions against danger while traversing dumpers, excavators etc. by installing audio-visual alarms and appointment of spotters.
- Transportation of mineral within mine workings by vehicles under the direction, supervision and control of Mine Management only.
- Proper maintenance of vehicles and weekly examination by an engineer and daily examination by a competent person.
- Training and retraining (at specified interval) of the machinery operators.
- Adequate maintenance of electrical equipments.
- Adequate illumination after daylight.

7.3.2 Hazard Identification

It is a mining project which may have the following types of hazards associated with it.

Natural Hazards

- Earthquake
- Flooding – Heavy Rainfall/ Water Bodies
- Landslide

Man-Made Hazards

- Bench Slope Failure
- Vehicles and Machinery
- Loading and Excavation of Mineral
- Drilling and Blasting
- Fugitive Emissions from Mining Operations

7.3.3 Assessment of Risks involved during Mining and Mitigation Measures:

Factors of risk involved due to natural calamities and human induced activities in connection with mining operations are as under:

1.Earthquake

2.Floods

Risk Involved: There is always a risk of flash floods due to heavy rain during rainy season.

Mitigation Measures: Limited mining will be done during rainy season**.**

3.Landslide

4.Open Cast Bench Slope Failure Risk Involved:

Reasons for failure are -

- Inadequate nos. of competent persons for carrying out statutory inspections.
- Lack of supervision.
- Failure to make and keep the quarry sides secure by proper benching, sloping and keeping benches of adequate height and width.
- Undercutting so as to cause dangerous covering.

Mitigation Measures:

- Bench height and width will be maintained as per approved Mine Plan so that not only slope of individual benches are maintained but over all safe pit slope be maintained.
- For determining factor of safety, the bench slopes will be monitored regularly by sensitive instruments at precise level at regular intervals to check for any possible ground movement.
- A well-developed drainage system over the lease hold area is to be ensured to check the water flow out of the lease area during rainy season.
- Adequate competent persons for carrying out statutory inspections will be deployed
- Monitoring and supervision of active mine benches and also exhausted benches will be made mandatory.
- Inspection report of the benches with suggested corrective measures to be place before the higher management from time to time.

5.Vehicular Movement

Risk Involved:

- Possibilities of road accidents are possible due to rash driving/brake failure/lack of visibility.
- Possibility of overloading may injure the passer-by public.
- Vehicles moving in a steep gradient or on benches of inadequate width.
- Accidents are common due to reversing of vehicles.

Mitigation Measures

- All transportation within the mining lease working will be carried out directly under the supervision and control of the management.
- The vehicles will be maintained in good condition and checked thoroughly at least once a month by the competent person authorized for the purpose by the management.
- Road signs will be provided at each and every turning point up to the main road (wherever

required).

- To avoid danger while reversing the equipments/ vehicles especially at the working place/loading points, stopper should be posted to properly guide reversing/spotting operating, otherwise no person should be there within 10m radius of machine.
- The maximum permissible speed limit shall been ensured.
- Overloading of material will be avoided.
- A statutory provision of the fences, constant education, training etc. will go a long way in reducing the incidents of such accidents.
- Unauthorized persons will not be allowed to ride on vehicles
- Strict code of conduct will be put in place to avoid driving in intoxicated condition by drivers

6.Mineral Loading, unloading and Transportation/Use of machinery:

Risk Involved:

- Use of substandard equipment.
- Accident due to generation of fly rock.
- Attempt to clean moving parts of machinery.
- Non provision or removal of guards for moving parts of machinery.

Mitigation Measures

- All the equipments deployed at the mine will be of highest standard
- All the loading and operating machines will have horns and proper maintenance of mining machinery shall be done
- Height of the bench will be maintained as per approved mining plan to avoid over hanging of rocks.
- The mineral will be loaded in trucks mechanically and in safe manner to avoid fly rocks
- There shall be fencing of the mined out area to prevent any accident of mine nearby habitants of nearby village and their live stock.
- The complete mining operation will be carried out under the Management and control of experienced and qualified Mines Manager having Certificate of Competency to manage the mines granted by DGMS.
- All the provisions of Mines Act 1952, MMR 1961 and Mines Rules 1955, RMMCR 1986 and other laws applicable to mine will strictly be complied with.
- During heavy rainfall the mining activities will be closed.
- Strict code of conduct will be put in place so that no one goes near the moving part of machines for maintenance.
- Secured cabin will be provided to all operators to shield them from any fly rocks.

7.Drilling and blasting:

Risk Involved:

The mining will be done with semi mechanized method with drilling of shot holes, sorting of stone and breaking of large sized boulders will be excavated using hydraulic rock breakers and excavators with deploying of Jack hammer drilling.The short holes drilled by jackhammers are normally of 34 mm diameter. Burden and spacing will be 2.0 m & 2.5 m. Following risks are involved during drilling and blasting operation.

- During the movement of drill machines from one place to other place and during change of drill rods and bits
- Improper handling of explosives
- Improper burden and spacing resulting in to fly rocks and excessive noise and vibration
- Misfires during blasting
- Lack of statutory staff during blasting operation

Mitigation Measures

- Drilling manual will be put in place which will have detailed procedure for shifting of drill machines and its operation
- Explosives will be stored in the Magazine approved by Controller of Explosives
- Transportation of explosives from Magazine to place of blasting will be undertaken by an approved explosive vehicle under statutory supervision
- Burden and spacing will be kept as per the study conducted by the expert agency for designing the blasting parameters
- Misfires during blasting will be handled as per procedures laid down by DGMS
- All the persons working in the mine will be provided safety shoes and helmet to prevent them from fly rock.
- Explosives will be used and handled under strict vigilance of the Mining Engineer/ Assistant Mining Engineer.

8.Fugitive emissions:

Fugitive emissions take place during mining from following activities:

- Drilling and blasting of mineral using explosives.
- Excavation of mineral with the help of excavators results in fugitive emission.

Risk Involved:

Respiratory disorders on workers.

Mitigation Measures

- Regular water sprinkling will be done at dust generation points and on the haul road to control dust.
- Controlled drilling and blasting based on study conducted for the purpose shall be carried out to avoid excessive dust generation.
- Secondary drilling and blasting will be kept bare minimum.
- During loading and unloading workers involved in the activity will wear dust masks.
- Loaders will have closed cabins.
- Transportation in covered dumpers will be done.

7.3.4 Vulnerability Analysis

A vulnerability assessment is performed for the hazards associated with the project. The natural hazards cannot be prevented. However, vulnerability to the hazards can be substantially reduced by preparedness and mitigation measures.

Table7.1; Vulnerability Analysis

S.NO	HAZARDIDENTIFICATION	Severity (1-5)	Likelihood (1-5)	Severity x Likelihood (1-25) (Hazards scoring 1-9 are less serious hazards & 9-25 are very serious hazards &require risk assessment)	Proposed General Mitigation Measure/ Control
	Natural hazard				
1	Flood	4	2	8	• Limited mining will be done during rainy season. • Pre-warning signs on possible heavy rains or floods or cyclones from the meteorological department will be followed. Hence during any such case the project site will be evacuated. Or if possible the excavated site will be fenced. • To prevent inadvertent entry of people near the excavated pits, long poles will be grouted as a sign of excavated site. • Warning signs in local language will be erected at the site to avoid any mishappening. Nearby villagers will be informed.

	Man-made hazards				
2	Opencast bench Slope Failure	2	2	4	• The depth of mining will be 18 m during Plan period and bench height will be maintained at 6m with overall pit slope will be kept at 45^0 as per mining plan. Hence, it is less likely that any slope failure will take place in this mine. However, slope failure study will be conducted through an accredited agency and an ongoing assessment of the stability of these slopes will be regularly done. • There shall be adequate supervising staff and mining operation will be done under strict supervision of the Mining Engineers and Asst. Mining Engineer to avoid any mishap. • For determining factor of safety, the bench slopes shall be monitored regularly by sensitive instruments at precise level at regular intervals to check for any possible ground movement. • Stability of benches and slope shall be ensured by full compliance of the mine plan duly approved by Director of Mineral Resources, Meghalaya.
3	Vehicular Movement	4	4	16	• All transportation within the mining lease working shall be carried out directly under the supervision and control of the management. • The vehicles will be maintained in good condition and checked thoroughly at least once a month by the competent person authorized for the purpose by the management. • Road signs will be provided at each and every turning point up to the main road (wherever required). • To avoid danger while reversing the equipment's/ vehicles especially at the working place/loading points, stopper

					shall be posted to properly guide reversing/spotting operating, otherwise no person shall be there within 10m radius of machine. • Reverse horns will be fitted in all vehicles. • The maximum permissible speed limit shall be ensured. • Overloading of material will be avoided. • A statutory provision of the fences, constant education, training etc. will go a long way in reducing the incidents of such accidents. • Edge protection will be done to prevent inadvertent movement. • Visibility defects can be eliminated by the use of visibility aids such as closed circuit television and suitable mirrors.
4	Fugitive Emissions during mine operations such as excavation and loading.	2	5	10	• Regular sprinkling shall be done with operations generating dust emission. • Dumpers shall be covered with tarpaulin during transportation of material and waste. • Dust masks shall be provided for operations involving high fugitive emissions or when required.

5	Mineral Loading and Excavation/ Machinery Operation/Slip and Trip of Workers in Working Areas	4	4	16	• Regular safety audit shall be carried out. • Only authorized personnel will be allowed in the operation area. • Vocational training shall be given to all operators and workers of the mine. Mining operations shall be carried out under proper supervision. • All the trucks loading and operating machines will have horns. • The mineral will be loaded in trucks mechanically *i.e.* by JCB during mining. There is least possibility of injury to the person during loading operation at mine. • Complete mining operation will be carried out under the Management and control of experienced and qualified Mines Manager. • During heavy rainfall the mining activities will be closed. • All persons in supervisory capacity will be provided with proper communication facilities. • Competent persons will be provided first aid kits which they will always carry. • Mobile Fencing shall be installed during Operation at the bench. • Signage shall be installed for all movement areas of machines and everyone on site will be made to wear PPE in these areas. • All machines and vehicles shall be maintained by the maintenance in charge.
6	Drilling & Blasting	4	3	12	• Drilling and blasting will be carried out intermittently. • Training shall be given for proper drilling operation • Proper PPE shall be used for drilling operation • Signage and restricted entry shall be done in areas of drilling operation • Blasting shall be done with proper safety measures and warnings.

7.4 DISASTER MANAGEMENT PLAN:

Safety of mine and the employees is taken care of by the mining rules & regulations as per Metalliferous mines regulations 1961, 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. Disaster Management Plans are prepared as proactive measures which help reduce effect of the accident/disaster and enable quicker recovery.

Plans for Disaster Management Onsite emergency planning:

An onsite emergency is caused by an accident or hazard that takes place within the plan area and the effects are confined to the plant area.

The onsite emergency plan consists of following key elements:

- Planning as per hazard analysis
- Preventive measures
- Emergency response procedure
- Recovery procedure

On Site plan shall be in place which includes the following:

a. Regular safety audit/inspection
b. Incident Response team and role and responsibility of each member
c. Procedures for taking care of incidents/emergencies
d. Mock drills
e. Assembly point
f. Communication system/arrangement with administrative and regulatory agencies, media and public etc.
g. Siren for declaring/closing emergency.
h. Regular training on first aid and evacuation etc.

Flood

- A training plan will be prepared for mine workers to cope up with the disaster.
- Limited Mining will be done during rainy season.
- Warning from meteorological department on possible heavy rains or floods or cyclones will be checked.
- There will be warning signs in local language will be erected at the site to avoid any mis happening.

Waste Dump Management

There is no gritty soil over the project area and therefore, no dumping will be done. After conceptual period exhausted quarry will be reclaimed to the extent possible.

Fire Management

There shall be provision of mobile fire extinguishers at the mine office.

Explosive Handling

Explosives will be stored and handled as per standard method.

Training

Following training shall be provided to the workers from time to time:

- Safety Education &Awareness
- Holding annual safety weeks
- Imparting basic and refresher training to new and old employees respectively.

Communication

Supervisor will be provided with wireless/mobile phones to communicate in case of any abnormality.

Offsite Emergency Planning:

Offsite emergency plan defines the various steps to tackle any offsite emergencies which may affect surrounding areas of the project has to be prepared after due final discussion with local panchayat and revenue officials.

Offsite emergency planning mainly consists of –

a.Contact details of fire brigade, local police, hospitals, local district administration, factory inspector, state pollution control board, state electricity board etc.
b.Demographic details and topography map of the surrounding area.

c.Communication system/arrangement with above mentioned agencies, media and public.

Communication

The telephone numbers and addresses of adjoining mines, rescue station, police station, fire service station, local hospital, electricity supply agency and standing consultative committee members are also maintained for any emergency requirement.

Disaster Management Team

A standing consultative committee will be formed under the head of mines manager. The members consist of safety officer/medical officer/Asst. manager/ public relation officer/ Foreman/ and environmental engineer.

Roles and responsibilities of the team shall be-

- The management shall make cordial relations with the local authorities, hospitals etc. to help them during crisis.
- There will be communication facilities provided by the management at the mining site.
- Provision of first aid facilities at the site.

7.5 SOCIAL IMPACT ASSESSMENT:

There are various social impacts of mining which should be identified before starting any developmental activity. The mining is one of the activity for which if pros and cons are not properly assessed may not only result in deterioration of local environmental scenario but also may have long term affects on the socio economic status of the locals such as loss of agriculture land, degradation of water quality, contamination of ground water and soil quality. Therefore to prevent above problems following measures shall be undertaken:

- Ensuring developments contribute to economic growth and social development. The project will provide skill based training to the locals and will generate chance of indirect employment in the area.

- Reducing project risks and providing greater certainty to the society by doing regular environmental monitoring, prediction of risks and hazards and their mitigation, etc.

- Planning for social and physical infrastructure; in proposed project CSR budget ensures provision of proper infrastructure with the help of local authorities such as, providing scholarship to students in nearby schools, organizing health awareness camps and medical camps, emphasis on use of clean toilets, plantation of trees etc.

- Proposed project will improve the quality of life of employees and retention of skilled workers; there is provision for providing training to workers and locals to have better health keeping, and organizing health check up camps for them to lead a healthy life.

- The project shall enhance competitive advantage and reputation, by implementing innovative approaches, setting high standards for other businesses and leaving a positive legacy beyond the life of the project;

- The proposed project shall comply with principles and standards.

7.6 REHABILITATION & RESETTLEMENT ACTION PLAN:

The lease area comprises of 1.25 ha which is non forest land. There is no habitation within the mine area. Hence no R&R is applicable.

7.7 CORPORATE ENVIRONMENTAL RESPONSIBILITY:

As mentioned earlier, the scale of operations are too small to produce significant impact excepting providing employment to few local residents. However, corporate environmental responsibility, welfare activities will be taken up. The social welfare activities will include assistance in-

Education

In order to improve the educational activities in the area, following assistance will be provided.

- Provisions for Imparting vocational training at near village for technical skills, self employment training for women and youngsters.

Sanitations & drinking water facilities

- Provisions for Water purifier & its maintenance (1 no.) at CHC center of Near village.
- Provision of Toilets in the nearby villages
- Distribution of Sanitary Napkins, Contraceptives etc.

Medical Assistance: Assistance will be provided in organizing health camps

Medical camps –Medical camps will be organized from time to time in nearby village with free medicines and free health checkup.

Budgetary Provisions for CER: 5% of project cost shall be spent under CER. Total Project cost is 12.00 Lakhs and 5 % of Project Cost is 60,000. Total 60,000 Rs will be spent on CER Cost breakup is given below:

Table7.2 Proposed CER Budget

CER Budget				
S. No.	**Activity**	**Per Unit Cost**	**No.**	**Total Cost INR**
1	Provisions for Imparting vocational training at near village for technical skills, self employment training for women and youngsters.	-----		20,000.00
2	Energy Conservation i.e. Distribution of LED Bulbs	100	50	5,000.00
3	Provisions for Water purifier & its maintenance (1 no.) at CHC center of Near village.	15000	1	15,000,00
4	Provision of Toilets in the nearby villages	10000	1	10,000.00
5	Organization of Health Camps Provisions for Health Check-up camp at Gram Panchayat of Near village			5,000.00
6	Distribution of Sanitary Napkins, Contraceptives etc.			5,000.00
Total				**60,000.00**

7.8 OCCUPATIONAL HEALTH

Occupational health and safety deals with the safety and health of the persons employed at the work zone. Working in mines has harmful effects on the health of those employed and there are numerous diseases arising from employment in opencast mines such as various respiratory disorders like silicosis, manganese poisoning, hearing impairment, asthma etc. Some of the hazards are dust, vibration, noise, ergonomics etc.

The personnel employed in the mine are also exposed to a number of hazards at work which may cause them to be involved in an accident due to material handling, machinery etc. as mentioned in Risk Assessment. Accidents cause injuries and can be life-threatening to personnel. Thus occupational health and safety is a crucial aspect to be considered in mines for the well-being of the personnel involved. Proper measures will be taken for injury prevention decrease probability and severity of accidents.

7.8.1 Safety Audits and Accident Prevention

Regular safety audits shall be carried out at site to decrease possibilities of hazards causing accidents or injury. All mining activities shall be carried out under proper supervision of mining engineers and safety officers. All personnel involved in mining shall undergo training for mine safety.

7.8.2 Occupational Disease

The reported figures and surveys conducted by Directorate General of Mines Safety (DGMS) and other organizations like National Institute of Occupational Health (NIOH) etc. revealed that there have been some new trends in the occupational health scenario other than the conventional diseases like Respiratory disorders.

Following areas of occupational diseases are emerging with the changes in the mining industry:

- Noise induced hearing losses
- Health impact due to diesel particulates from emission of diesel operated vehicles and equipment
- Hand-arm vibration, whole body vibration due to use of drills, HEMM etc
- Presence of snakes and other reptiles in the mining area
- Polluted drinking water
- Excess working load and overtime
- Presence of mosquitoes in the lease area
- Sudden accident in the mining area causing personal injury

7.8.3 Health measures to be considered

- Sanitary facilities shall be well equipped with suppliers and employees shall be encouraged to wash frequently, particularly those exposed to dust.
- In the event of temporary closer, approaches will be fenced off and cautionary notice displayed in English and regional language.
- Rotation of workers exposed to dusty and noisy areas.
- First aid facilities in the mining areas.
- Provision of personal protection devices to the workers. The personal protection equipment being provided are–

Table7.3: List of safety equipments

S.No.	Item	Equipment
1.	Face protection	Face Shield
2.	Eye protection	Different types of goggles used for different purposes.
3.	Ear protection	Ear plugs, ear muffs
4.	Leg Protection	Safety shoes, gum shoes
5.	Working at height	Safety belts
6.	Head Protection	Safety helmets
7.	Protection from Dust	Dust Mask

- Periodic medical examinations shall be conducted for all personnel, and specific surveillance programs instituted for personnel potentially exposed to health hazard. The medical examination required to carry out at the time of appointment of every employee. Provided that in case any dust related disease, test shall be conducted more frequently as the examination authority deems necessary.
- Medical camp will be organized for the worker every year.
- At the end of mining operation, test will be conducted to assess health of workers.
- Workers will be informed and trained about occupational health hazards, if identified.
- Any worker's health related problems will be properly addressed.
- The personnel working in dust prone areas will be examined every year as per the DGMS circular No.01 of 21.01.2010.
- Quick-Fix designed by OSHA's ergonomics standards will be followed to reduce work-related musculoskeletal disorders (MSDs).
- Rotation of workers exposed to high noise areas will be carried out.
- Lyophilized Polyvalent Anti snake venom serum will be available at the mine site for snakebites.

7.8.4 Activities posing risks during mining

1. Loading and Excavation of Mineral

Affected Personnel: All operators of machinery for loading and excavation are at high risk. All helpers and other personnel in the mine are at moderate to low risk.

S.no.	Hazard Identified	Severity (1-5)	Likelihood (1-5)	Severity x Likelihood (1 x 25)	Proposed Mitigation
1	Injury due to Falling of rock from the boom of excavators	4	2	8	• Cabin shall be provided on all excavators/ other machinery so that no rocks hit the operator. • All operators and other workers in close proximity shall be trained in their jobs and wear all PPE.
2	Accidents due to bench Collapse Due to under cutting of Benches	1	2	2	• Undercutting shall be avoided by mine supervisor.
3	Accidents due to movement and operation of Heavy Machinery	4	4	16	• Signage in all movement areas of machines • Areas of movement of vehicles shall be marked and everyone in the site will be made to wear PPE at all times when present in these areas. • Only authorized/ designated personnel shall be allowed in the operation area • Reverse horn shall be installed on all machines prior to their deployment for operation • Vocational training to all operators and workers of the mine. Awareness programme for health effects on exposure to mineral dust will be organized for employed person a well as for nearby villagers.
4	Dust Exposure	2	5	10	• Personal Protective Equipment (Dust masks) shall be provided to workers • Dust suppression measures such as usage of dust collectors and water sprinkling shall be carried out in working areas.

5	Exposure to Noise	2	5	10	• Mining operation do not include any major source of generation of noise in the working area, drilling & blasting will be involved which will be intermittent thus noise levels are not of significant levels. However, ear plugs will be provided to all workers in the area. • Audiometry test of the workers shall be done regularly &medical health provided wherever required.

2. Transportation of Material

Affected Personnel: Drivers and operators of machinery are at high risk from this activity. All other personnel working in the mine are at moderate risk by this activity.

S.No.	Hazard Identified	Severity (1-5)	Likelihood (1-5)	Severity x Likelihood (1 x 25)	Proposed Mitigation
1.	Injury due to falling of minerals from truck	4	2	8	• It shall be ensured by senior personnel that trucks are not overloaded. • Material outside the mine shall go in a covered truck; covering shall be done by tarpaulin.
2.	Accidents due to movement of vehicles	3	3	9	• Signage of vehicular movement areas. • PPE shall be worn by operators and Workers in these designated areas.
3.	Injury due to falling of machines/ vehicles from bench and in the working area	4	3	12	• Use of helpers during reverse operation of the machine • Working bench width shall be kept adequate to the width and turn of the vehicles/machines • Overcrowding of vehicles shall be avoided near loading areas.
4.	Brake Failure	3	1	3	• All vehicles/machines shall be Maintained by the maintenance in charge.
5.	Speed control	3	2	6	• Speed of vehicles will be restricted below 25 km/hr to mitigate dust generation while transporting of mineral.

3. Drilling

Affected Personnel: Two Operators in close proximity are at high risk due to the activity. Exposure area of 10m around the operation is at moderate risk due to drilling.

S.No.	Hazard Identified	Severity (1-5)	Likelihood (1-5)	Severity x Likelihood (1 x 25)	Proposed Mitigation
1.	Accidents due to movement of Drilling Machine	4	3	12	• Personal Protective Equipment (PPE) shall be worn by operators at all times • Signage shall be put in all areas of operation • Designated areas are identified for movement of drilling machine and the drilling is restricted to these areas
2.	Inhalation of Dust	2	5	10	• PPE shall be worn by the operators at times of drilling operation. • Dust Collector is installed by the crawler manufacturer to collect coarse dust particles • If necessary, wet drilling might be used for the activities. This shall be decided as per the personal exposure levels (PEL).
3.	Falling off the edge of the bench	3	3	9	• Mobile Fencing shall be installed during operation at the bench • Proper training is given to all personnel involved for the drilling operation Working bench width shall be kept adequate to the width and turn of the vehicles/machines

4. Blasting

Blasting will be carried out by using gel explosives such as powergel 901 which is a water resistant packaged explosive designed to deliver high energy. All safety measures shall be taken especially for storage. The storage is guarded and only authorized people will be allowed to enter.

S.no.	Hazard Identified	Severity (1-5)	Likelihood (1-5)	Severity x Likelihood (1 x25)	Proposed Mitigation
1.	Accidents during blasting such as Sudden blast shock to workers, Dangerous rock conditions after blast, presence of undetonated explosives, and/or initiators, fly rock etc.	4	4	16	• Drillers & blasters will be given protective gears eg. Helmets, goggles, gloves, boots, ear muffs and dust masks to avoid negative impacts of drilling and blasting. • Except for the crew other people's entry will be banned for at least 30 minutes before the blast initiation. • Pre-blast warnings will be given out loudspeaker. • All misfires will be safely removed, and other hazardous condition corrected or secured. • First-aid will be provided at the time.
2.	Injury due to Falling of rock from the boom of excavators	1	2	2	• Cabin shall be provided on all excavators/ other machinery so that no rocks hit the operator • All operators and other workers in close proximity shall be trained in their jobs and wear all PPE
3.	Accidents due to bench Collapse due to undercutting of Benches				• Undercutting shall be avoided by mine supervisor

4.	Accidents due to movement and operation of Heavy Machinery				• Signage in all movement areas of machines • Areas of movement of vehicles shall be marked and everyone in the site will be made to wear PPE at all times when present in these areas. • Only authorized/ designated personnel shall be allowed in the operation area • Reverse horn shall be installed on all machines prior to their deployment for operation. • Vocational training to all operators and workers of the mine.

5. Slope stability

Affected Personnel: All workers in the mine are at high risk with respect to this activity

S.No.	Hazard Identified	Severity (1-5)	Likelihood (1-5)	Severity x Likelihood (1 x 25)	Proposed Mitigation
1.	Accidents due to slope stability	1	2	2	• Prior to start of mining operation there shall be a study carried out for fixing of parameters with respect to mining to maintain stability of slope • For determining factor of safety, the bench slopes shall be monitored regularly by sensitive instruments at precise level at regular intervals to check for any possible ground movement. • Stability of benches and slope shall be ensured by maintaining optimum overall slope of 45^0 and by full compliance of the mine plan duly approved by Director of Mineral Resources, Meghalaya.

6. Plan for Accidents

Mining site shall arrange for /provide at least the following to mitigate any accident that occurs due to operation:

1. First Aid facilities at site
2. Ambulance
3. Tie up with primary health center for immediate treatment
4. Strict implementation and training of a detailed on-site emergency plan. The Plan shall be prepared by a competent agency.

7. Monitoring Mechanism

Following Activities shall be done by the proponent as a proactive measure for mitigation of Occupational Risks:

- Six monthly monitoring of Exposure levels (Total Suspended Particulate, Fraction of Fine Dust {$PM_{2.5}$}, of high risk workers of all activities. In case necessary a onetime chemical speciation of the dust shall be done to measure levels of Sulphates, Lead, Nickel, Arsenic, Silicates in the dust collected etc.
- Six Monthly Health check-ups for all workers which includes Chest X-Ray, Lung Function Test, ENT Check-ups, Vision Check-ups, Audiometric Tests, Liver and Kidney Function Tests, ECG, Blood Sugar etc.
- Six Monthly Check-up of Drinking water for the site workers to ensure compliance to IS 10500:2012 standards.

7.8.5 Separate budget of Occupational Health

Table 7.4; Capital and Recurring Budget for Occupational Health

S.No	Description	Amount (Rupees In Lakhs)
1	Workers will be subjected to primary health check-up before they are employed to ascertain their health conditions. Thereafter, Regular Medical check-up will be organized for workers & villagers to evaluate the adverse impact if any on these persons due to proposed mining activity.	0.50
2	Workers will be provided with masks, gloves, goggles & ear muffs will be provided.	0.20
3	First Aid facility and training to workers.	0.10
4	Insurance for worker	1.00
	Total	**Rs. 1.80 Lakh**

7.8.6 Public Health Measures:

The mine is in the Thanghunai Village and the nearby habitant might get affected due to the working of mine hence a sum of Rs 0.50 Lakhs has been dedicated towards the betterment of local people.

Table 7.5 Recurring Budget for Public Health and Safety

Sr. No	Impact	Mitigation	Amount (In Lakhs)
1.	Health and Safety	• Health Check-up camps shall be organized.	Rs 0.50
Total			0.50 Lakhs

CHAPTER 8: PROJECT BENEFITS

8.0 PROJECT BENEFITS

This chapter gives a comprehensive description of various advantages and benefits anticipated from the proposed project to the locality, neighborhood, region and nation as a whole.

Limestone is a rock that has a variety of uses. For example, it is often crushed and used as construction material and placed in roads and other locations, but it can also be placed in concrete or cement, and it often shows up as flooring and in other parts of a home. The beautiful finish and strong material makes it highly versatile in many different areas of a house.

Limestone is often chosen over other materials because it is more cost effective. It is a plentiful material that, though it is heavier than some, is easier to transport and install. When looking into materials for a home, consider the long-term effects as well. Limestone is cost effective up front, but it will also last for many years into the future and will not have to be replaced.

The mined out material from this mine can be good source of construction material to nearby market. Provide gainful employment generation through development of the associated down-stream industry i.e. stone-crushers, screening plants, washeries, transport services etc. Serve as source of revenue for the State

8.1 IMPROVEMENTS IN THE PHYSICAL INFRASTRUCTURE

The roads connecting to lease area will be maintained by lessee. The community member of surrounding community especially the residents of Amkroh village will have advantage in this regard. Improved road, communication facilities and provision of community development programmes such as health programme, communicable disease awareness and family welfare programmes will elevate the socio- economic conditions of the locals.

8.2 IMPROVEMENTS IN THE SOCIAL INFRASTRUCTURE

The project activities will create awareness with the local people for preferring permanent services than periodical agricultural activities. The activities will help them to analyze the importance of education. With the increased amount of income people can send their children to nearby schools and colleges. These schools are taking care of the local students for their studies. The Project proponent has decided to improve the literacy level of the local

elders also. The implementation of this project shall naturally augment the education status of the local people.

Social welfare measures

The social welfare measures will always strengthen the bond between the project proponent and the local population/ communities. The proposed mining project would contribute in implementing social welfare activities in collaboration with local bodies for better development within the study area. Following schemes shall benefit locals:

1. Approach roads will be developed at par with the mining site.
2. There shall be water supply arrangements and sanitation for the villagers.
3. The proponent will make provisions for contributions to the local schools, dispensaries for the welfare of the villagers.

8.3 EMPLOYMENT POTENTIAL

The project will contribute direct employment scope for about 36 persons including Managerial, skilled, semi-skilled and Maintenance personnel. The project will create indirect employment scope for many other persons.

8.4 SOCIO ECONOMIC BENEFITS ARISING OUT OF MININGACTIVITY

It would be apt to reiterate here that no human settlements will be disturbed due to proposed mining activity; consequently, no negative impacts will be applicable in this case. The benefits of mining activity will be similar to any industrial set-up. There will be opportunities of direct and indirect employments. However, the operations being semi mechanized will not generate large scale direct employment. As mentioned earlier there will be around 36 personnel, most of them will be skilled & semi-skilled. Total 80% staff will be employed from the local villages. The jobs, from which local community can be benefited, will be –

- ✓ Providing tippers for raw material transport from mine to the consumers.
- ✓ Maintenance services

- All personnel in worksites shall have protective gears like helmets, boots etc. so that injuries to personnel are minimized.
- Children and pregnant women shall not be allowed to work under any circumstances.
- Working will be carried out in one shift only and no personnel shall be allowed to work at site

for more than 8 hours per day

- Materials pertaining to archeological / historical importance, Department of Archeology, Meghalaya Govt. shall be immediately informed.
- Any coins, artifacts or any other chance find will be notified by the workers. The work will be stopped and instruction will be taken from archeological department.

8.5 OTHER TANGIBLE BENEFITS

Environmental Benefits: Plantation will be carried out in the 7.5 m statutory boundaries of the mine area which will not only increase the aesthetic beauty of the area but will also prove to be a hub of native bird's species. Mining will be carried out in a scientific manner which will not cause harm to the environment.

Other Benefits:

This project, on implementation shall help in increasing the overall income pattern of the neighboring people which shall indirectly help them to improve their living standards. Facilities like electricity and telephone are available in these interior/remote areas. No village people reside in them. However, barricading will be done to prevent any accident.

CHAPTER 9: ENVIRONMENTAL COST BENEFIT ANALYSIS

9.0 ENVIRONMENTAL COST BENEFIT ANALYSIS

As per EIA Notification vide Gazette Notification No. S.O. 1533 Dt: 14th Sept., 2006 and amendments thereof, Appendix III, Generic Structure of EIA, SL. No. 9, "Environmental Cost Benefit Analysis" is applicable only, if the same is recommended at the Scoping stage.

As per the ToR points issued by SEAC/SEIAA, Shillong, Meghalaya for the proposed project, the Environmental Cost Benefit Analysis is not mentioned.

CHAPTER 10: ENVIRONMENTAL MANAGEMENT PLAN

10.1 ENVIRONMENTAL MANAGEMENT PLAN

An Environmental Management Plan (EMP) is a site-specific plan developed to ensure that all necessary measures are identified and implemented in order to protect the environment and comply with environmental legislation. The Environment Management Plan (EMP) is required to ensure sustainable development in the study area. This chapter covers the genesis of pollution, the principal sources of pollution, the nature of pollution, the proposed measures required for meeting the prevailing statutory requirements of dust & gaseous emissions, waste water discharge characteristics, noise levels etc. for environmental management purpose in connection with the mining and mining related activities in the study area. For attaining the desired objective of good environmental quality in the study area, several management strategies in different phases are proposed and evaluated.

- Planned improvements including additional control measures
- Fugitive dust reduction on roads and internal roads for ore transport
- Progressive planning for the closure of mines

This section discusses the management plan for mitigation/abatement impacts and enhancement of beneficial impacts due to mining. The Environmental Management Plan (EMP) has been designed within the framework of various Indian legislative and regulatory requirements on environmental and socio- economic aspects. Environmental Management plan giving the environmental protection measures at mine to meet the stipulated norms of IBM/MoEF are detailed below.

10.2 MANAGEMENT OF LAND & POST MINING LANDUSE

The mine area is 1.25 ha of Non forest land. Initially as the mine is not functioning, the land use pattern is mainly negligible with few shrubs and small trees in patches. However, later due to mining operations, the land scape of the area changes. But this can be taken care of by developing a green belt on the safety barrier and afforestation of the mined out area.

The periphery/safety barrier of the mines including the safety residual benches will have green belt/plantation at interval of 2.5 m between one sapling planted and the next one. Also, saplings will be planted after back filling the periphery/safety belt sufficiently with soil. The saplings shall be of species of local variety which will have better growth and survival. Thus this will help in improving the environment and also the aesthetic beauty of

the area post mining operations.

Proposed land use pattern after the plan period and conceptual land use is given below in the table:

LAND USE :

Category	As on date (Hectares)	After first five years plan period (Hectares)	After Life of the Mine (Hectares)
Mined out Land including road	0.00	0.93	0.93
Storage of top soil	0.00	0.00	0.00
Road	0.01	0.00	0.00
Overburden dump	0.00	0.00	0.00
Mineral/Sub-grade stack	0.00	0.00	0.00
Infrastructure	0.00	0.00	0.00
Green belt in Safety Barrier	0.00	0.16	0.32
Reclamation	0.00	0.00	0.00
Balance unused area	1.24	0.16	0.00
Total	**1.25**	**1.25**	**1.25**

The entire produce of Limestone will be used as building material and according to its end use. During Plan period no gritty soil is proposed to be generated. After conceptual period de-stoned area of quarry will be reclaimed to the extent possible.

10.2.1 Mine Closure

Mining will be carried out as per approved mining plan and Progressive Mine Closure Plan. The accumulated rain water in the pit will help in recharging the ground water. At present land is covered with patches of grass, soft broom and one or two standing 'tarew' trees which usually grow in limestone bearing lands. Usually in such lands, especially having heavy seasonal rainfall, there is very little soil cover. The soil is formed only in cavities and between limestone blocks. No trees would grow and flourish in such areas except the 'tarew' tree which has no value and cannot be used as firewood nor as timber because the wood of the 'tarew' is fibrous and soft. However, in the mined out spaces which have been backfilled with soil, hardwood trees and fruit trees can be planted.

The soil that is available during mine development and is stored in stack yards shall be used for backfilling the mined out spaces. On these backfilled areas, planting of saplings of local variety or suitable varieties shall be done to raise a plantation.

10.3PROPOSED GREEN BELT DEVELOPMENT PLAN

- It is proposed to develop green belt in the 7.5 m boundary of the mine area. Precautionary

measures will be taken for carrying of the afforestation by regular watering in the afforested area.

- Wire fencing will be done around trees to protect from grazing animals and proper manuring.
- The species survival will be monitored and dead plants will be replaced. The green belt development plan has been given below:

Table 10.1; Proposed Plantation

Sl. No.	Year of Plantation	Target of Plantation	Spacing	Area of Plantation	Remarks
1	First	51	2.5 m	Safety/Barrier Zone	Planting in Zig Zag pattern
2	Second	51	2.5 m	Safety/Barrier Zone	
3	Third	51	2.5 m	Safety/Barrier Zone	
4	Fourth	51	2.5 m	Safety/Barrier Zone	
5	Fifth	51	2.5 m	Safety/Barrier Zone	
TOTAL		**255**			

10.4 IMPACT ON HYDROLOGY OF THE AREA

The hydrogeological formation of the study area comprised of Granite Gneiss and intrusive of Archean Proterozoic, Quartzite of Paleo-Meso-Proterozoic of Shillong group, Granite of Neo Proterozoic- early Proterozoic, Sandstone and Limestone of Paleocene-Eocene age. The presence of weak planes like fractures and joints in these hard rock formation forms the principal aquifer in the area. The ground water in the district occurs under unconfined, semi confined to confined conditions. Study of dug wells and exploration data reveals the presence of phreatic/shallow and deep fractured aquifers in the district.

(**Source:** Central Ground Water Board, India)

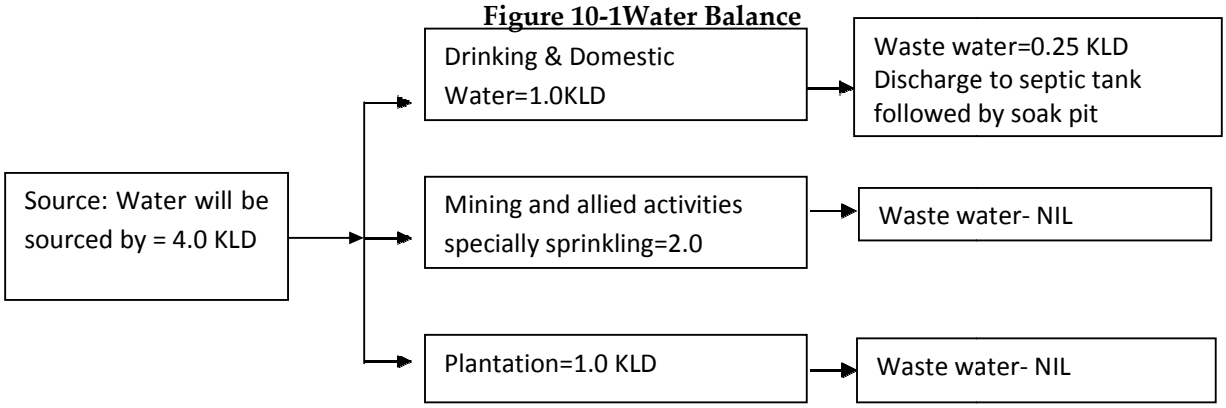
10.5 MEASURES FOR CONTROLLING WATER POLLUTION AND CONSERVATION OF WATER

- Water pollution from the mine can be mainly due to runoff during rainy season. Therefore to restrict the runoff into any surface water body precautionary measures will be taken up and no water from the quarry will be discharged to any natural water course directly.
- The accumulated rain water will partly be used for dust suppression and afforestation and

limestone being pervious in nature much of the water will percolate below the quarry surface.

- Potable drinking water shall be sourced from the nearby villages. It is estimated that daily drinking/domestic water requirement will be about 1.0 KLD. Besides for sprinkling & green belt development water requirement will be 2.0 KLD and 1.0 KLD respectively.

Figure 10-1Water Balance



- To prevent silt being carried during monsoon period, series of plants would be planted.
- **Conservation of Ground Water:** Mining will be restricted up to a depth of 18 m. Water stored in the mined out area will act as water recharging source in the area. Therefore, mining activity in the leasehold area will have positive impact on ground water.
- To avoid contamination of ground water from the open defecation by workers, toilets will be provided for the workers at site with septic tank followed by soak pit.

10.6MEASURES FOR CONTROLLING AIR POLLUTION

Major pollution in air quality is expected due to drilling, blasting, transportation, loading, unloading of mineral. Dust is likely to be generated during transportation for which water sprinkling shall be done. The mining area, due to its very nature and scale of operation is likely to marginally contribute towards air pollution in the area. The effect is analyzed and this effect is mostly due to fugitive emission. For the mine, the only pollution occurs from dust during vehicular traffic and loading of mineral. There is no other source for SO_2 and NOx except a little contributed by the vehicular traffic, which is well below the prescribed limits. Still, the following different control measures are proposed.

- Construction of well-compacted roads.
- Regular water spraying on roads by tankers.

- Drilling machines will be equipped with dust collector arrangement and wherever required wet drilling arrangement will be used to prevent generation and spreading of dust.
- Optimum blast design parameters will be adopted after study. Optimum stemming in blast holes will be done to minimize generation of dust and fly rocks.
- Blasting will be done during favorable atmospheric conditions and will be avoided during high windy periods, night times and temperature inversion periods.
- To avoid secondary blasting rock breaker will be used.
- Optimum bucket size loading equipment will be used which will reduce the number of bucket passes to fill the dumper and thus comparatively less dust will be generated during loading. This will also reduce the chances of spillage from the bucket.
- Plantation of local thriving species will be done in the 7.5m statutory boundary for arresting dust.

10.7 NOISE ABATEMENT

Noise will be generated due to drilling and blasting operation which will be done intermittingly, transportation and machineries. The results of ambient noise are within the permissible limits of industrial area. However, following measures will be adopted to abate noise effects.

- Proper and regular maintenance of excavators, tippers and other vehicles will be done. Green Belt will be developed (thick foliage) along the lease boundary.
- Drilling equipments will be regularly maintained as per maintenance manual. Anti-vibration mounts for compressors will be provided.
- Optimum parameters for drilling and blasting will be designed to have controlled blasting which will reduce noise and vibrations.
- Blasting will be carried out when the wind conditions are favorable (i.e. when wind is blowing in opposite directions of in habitated areas or in low velocity).
- Mufflers will be provided to the exhaust of wagon drills to minimize the noise level.
- Blasting operations will be carried out during the noon time when the temperature inversions are not likely to occur.
- Proper stemming will be done to reduce air blast.
- To check vibration, values of peak particle velocity will be maintained within the

prescribed limit by DGMS.

- The excavators which will be used for loading will have noise proof cabin to avoid adverse effect to the operator. The helpers working near the excavators will be provided ear plugs and muffs. The maintenance of the excavators will be carried out as per manual.
- Proper free face will be maintained for optimal blasting which will also reduce noise and vibration.
- Periodical monitoring of noise and vibrations will be done.
- The dumpers, trucks and other transportation vehicles will be maintained in good running condition so that noise will be reduced to minimum possible level.
- Each blast will be carefully planned, checked and executed under the supervision of statutory personnel.

10.8 SOILCONSERVATION

At present land is covered with patches of grass, soft broom and one or two standing 'tarew' trees which usually grow in limestone bearing lands. Usually in such lands, especially having heavy seasonal rainfall, there is very little soil cover. The soil is formed only in cavities and between limestone blocks. No trees would grow and flourish in such areas except the 'tarew' tree which has no value and cannot be used as firewood nor as timber because the wood of the 'tarew' is fibrous and soft. However, in the mined out spaces which have been backfilled with soil, hardwood trees and fruit trees can be planted.

The soil that is available during mine development and is stored in stack yards shall be used for backfilling the mined out spaces. On these backfilled areas, planting of saplings of local variety or suitable varieties shall be done to raise a plantation.

10.9 SOLID WASTE MANAGEMENT

There is no gritty soil over the project area and therefore, no dumping will be done. After conceptual period exhausted quarry area will be reclaimed to the extent possible.

Table 10.2; Solid Waste Management

Year	Production of Stone in Tonnes	Production of waste in Tonnes
1st	60021	NIL
2nd	60167	NIL
3rd	60045	NIL
4th	60197	NIL
5th	60391	NIL
Total	**300821**	**NIL**

- Domestic Solid waste will be generated due to 36 workers who will be working at the site. This waste will be properly collected in coloured bins. The green bin waste or biodegradable waste will be composted by pit management and manure will be used in plantation. The blue bin waste will be sold to authorized recycler.
- Hazardous waste generation will be due to used oil which will be stored in HDPE drums and shall be sent to authorize re-processor.
- Other waste such as plastic waste, E-waste will be separately stored and sent to authorize vendor.
- There will not be generation of any other type of waste from the mine site.

10.10 SOCIO ECONOMIC MEASURES

Social benefits will be anticipated from the proposed mining project in the surrounding villages includes; Employment generation and improve standard of living through welfare activities; Development of health, education, economy, and agriculture in 10 km study area w.r.t. project site for local community and welfare of tribal through implementation of social developments. Improvement in infrastructure like road etc. and activities through CSR will have positive impact.

Social benefits will also be anticipated by enhancing skill development, employee ability and rise in income level. The overall impact of the project on the socio-economics of the region has been discussed in Chapter – 4. Apart from overall beneficial impact of the project on the local people of the region, it is felt necessary to augment facilities in the fields of education, health and social awareness including concern for ecology. These are presented in an analyzing form in the following statement:-

Sl. No.	Environmental Attributes	Nature of Impact
a	Employment	Beneficial
b	Service, trade/commerce	- do -
c	Public utility/education, social awareness	Augmentation
d	Health care facilities	- do -

It is necessary to create awareness among the people. The beneficial aspects of the following measures that would be taken up by the mine as a periphery development project

- Family planning
- Abandonment of shift cultivation
- Planting of trees and social forestry
- Reduction in the consumption of fuel wood and encourage use of alternative fuels
- Use of clean and boiled water
- Reducing the consumption of alcohol
- Saving from earnings
- Personal hygiene
- Regular health check

In implementation of these measures, the mine management can contribute a lot on the overall socio- economic scenario of the region.

10.11 OCCUPATIONAL HEALTH & BUDGET ALLOCATION

The proposed mining will be operated by semi mechanized methods with drilling and blasting by deploying man and machines. Hence, it is envisaged to take up the following precautionary measures.

Safety Audits and Accident Prevention

Regular safety audits shall be carried out at site to decrease possibilities of hazards causing accidents or injury. All mining activities shall be carried out under proper supervision of mining engineers and safety officers. All personnel involved in mining shall undergo training for mine safety.

Occupational Disease

The reported figures and surveys conducted by Directorate General of Mines Safety (DGMS) and other organizations like National Institute of Occupational Health (NIOH) etc. revealed that there have been some new trends in the occupational health scenario other than the conventional diseases like Respiratory disorders.

Following areas of occupational diseases are emerging with the changes in the mining industry:

- Noise induced hearing losses
- Health impact due to diesel particulates from emission of diesel operated vehicles and equipment
- Hand-arm vibration, whole body vibration due to use of drills, HEMM etc
- Presence of snakes and other reptiles in the mining area
- Polluted drinking water
- Excess working load and overtime
- Presence of mosquitoes in the lease area
- Sudden accident in the mining area causing personal injury

10.11.1 Health measures to be considered

- Sanitary facilities shall be well equipped with suppliers and employees shall be encouraged to wash frequently, particularly those exposed to dust.
- In the event of temporary closer, approaches will be fenced off and cautionary notice displayed in English and regional language.
- Rotation of workers exposed to dusty and noisy areas.
- First aid facilities in the mining areas.
- Provision of personal protection devices to the workers. The personal protection equipment being provided are–

S.No.	Item	Equipment
1.	Face protection	Face Shield
2	Eye protection	Different types of goggles used for different purposes.
3.	Ear protection	Ear plugs, ear muffs
4.	Leg Protection	Safely shoes, gum shoes
5.	Working at height	Safety belts
6.	Head Protection	Safety helmets
7.	Protection from Dust	Dust Mask

- Periodic medical examinations shall be conducted for all personnel, and specific surveillance programs instituted for personnel potentially exposed to health hazard. The medical examination required to carry out at the time of appointment of every employee. Provided that in case any dust related disease, test shall be conducted more frequently as the examination authority deems necessary.
- Medical camp will be organized for the worker every year.

- At the end of mining operation, test will be conducted to assess health of workers.
- Workers will be informed and trained about occupational health hazards, if identified.
- Any worker's health related problems will be properly addressed.
- The personnel working in dust prone areas will be examined every year as per the DGMS circular No.01 of 21.01.2010.
- Quick-Fix designed by OSHA's ergonomics standards will be followed to reduce work-related musculoskeletal disorders (MSDs).
- Rotation of workers exposed to high noise areas will be carried out.
- Lyophilized Polyvalent Anti snake venom serum will be available at the mine site for snakebites.

10.11.2Activities posing risks during mining

The activities have been detailed in Chapters 7, heading 7.8.4

1. **Plan for Accidents**

   Mining site shall arrange for /provide at least the following to mitigate any accident that occurs due to operation:

- First Aid facilities at site
- Ambulance
- Tie up with primary health center for immediate treatment
- Strict implementation and training of a detailed on-site emergency plan. The Plan shall be prepared by a competent agency.

2. **Monitoring Mechanism**

   Following Activities shall be done by the proponent as a proactive measure for mitigation of Occupational Risks:

- Six monthly monitoring of Exposure levels (Total Suspended Particulate, Fraction of Fine Dust {$PM_{2.5}$}, of high risk workers of all activities. In case necessary a onetime chemical speciation of the dust shall be done to measure levels of Sulphates, Lead, Nickel, Arsenic, Silicates in the dust collected etc.
- Six Monthly Health check-ups for all workers which includes Chest X-Ray, Lung Function Test, ENT Check-ups, Vision Check-ups, Audiometric Tests, Liver and Kidney Function Tests,

ECG, Blood Sugar etc.

- Six Monthly Check-up of Drinking water for the site workers to ensure compliance to IS 10500:2012 standards.
- Under Occupational Health and safety, the mine workers will be subjected to primary health check-up before they are employed to ascertain their health conditions. There will be provision of First Aid Facility and Medical Insurance for workers.
- The mine is in the Amkroh; the nearby habitant might get affected due to the working of mine hence a sum of Rs. 0.50 Lakhs has been dedicated towards organizing Health Check-up camps for local people and Supporting Public health care center in the nearby village.

10.12 TRANSPORTATION:

Proposed production from the mine will be 60391 TPA. As the daily production from the mine will be 201 Tonnes. No waste is being produced during plan period. There will be deployment of 2 no. of tippers of capacity 10 tonnes. The lease area has no habitation in close proximity so traffic on the roads is minimal. Steps will be taken to coordinate and organize traffic in the mining area and the mining trucks route, road repairing in coordination with govt. officials. Awareness campaign among dumper/truck drivers will be generated for clearance of road and lower down the pollution load due to transportation. Due to small lease area, less production, low movement of vehicle and only one shift, the traffic to & fro of proposed "**Amkroh Limestone Mine**" will not create any traffic congestion.

10.13 IMPLEMENTATION AND MONITORING

As the major attributes of environment are not confined to the project area alone, implementations of the proposed control measures and monitoring thereof have to be undertaken on a regional basis. The mine management will implement the control measures and monitor the efficacy within the lease area relating to the following specific areas as per the action plan.

- Collection of air and water samples at strategic locations with appropriate frequency and testing thereof. If the parameters exceed the permissible tolerance limits, corrective measures should be taken to arrest the pollution.
- Collection of soil samples at strategic location at least once in every year and testing thereof

with regards to deleterious constituents, if any.

- Desiltation of drainage system and check dams.
- Measurement of water level fluctuation in the nearby dug wells and bore wells periodically.
- Plantation/ afforestation as per programme, regular watering of plants and fencing to protect them from animals.
- Measurement of noise levels at the mine site, stationery and mobile sources, mine office, canteen would be taken during day time only as mining operation will be carried out in one long dayshift.

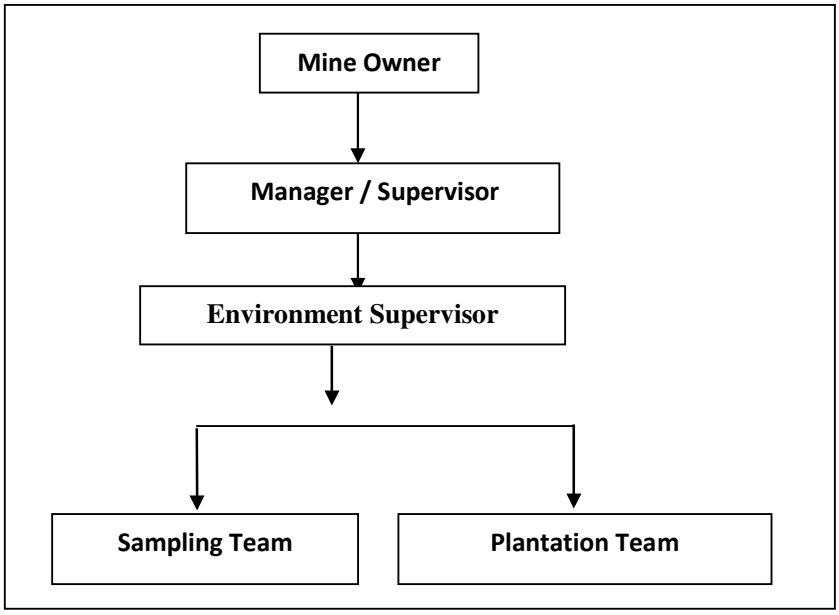
10.14 PLANS TO MAINTAIN BETTER ENVIRONMENT IN THE AREA

The environmental Policy has been prepared for better management of the environment. For maintaining better environment in the area the components relevant to the project that need to be taken into account include:

- Afforestation/plantation details of plantation/afforestation programme
- Reclamation of degraded land and quarries. Maintenance of haul roads etc.
- Monitoring of environmental parameters.

Organizational Chart (Environmental Management)

Organizational chart for environmental monitoring in the mining lease area, fiscal estimates for year-wise expenditure (both capital and recurring) and action plan to maintain better environment and to augment the environmental development, the following measures are suggested.



Organizational Structure of Environment Monitoring Cell (EMC)

10.15 EMP BUDGETARY COST ESTIMATES

The cost estimates presented in this section are for the recommendations made these cost estimates give only the indication of the likely cost. The estimated environmental cost of the project is as follows. The total cost of the project will be Rs. 12.0 Lakh. A fully fledged environmental cell will comply with the all the environmental monitoring jobs.

Table 10.3, Cost of Environmental Protection Measures as Annual Recurring Cost

Sl. No.	Particulars	Annual Recurring Cost (Rs in Lakhs)
1.	Reclamation & Rehabilitation of excavated pits	0.30
2.	Soil Dump Management	0.40
3.	Plantation & greenbelt development	0.24
4.	Air, Water & Noise Quality Monitoring	0.60
5.	Water sprinkling	0.20
6.	Occupational Health	0.30
	Total	**2.04**

10.16 CORPORATE ENVIRONMENTAL RESPONSIBILITY AND BUDGETARY ALLOCATION

Corporate Environmental Responsibility: Corporate Environmental Responsibility (CER) refers to responsibility of a company to ensure positive impact on environment, consumers, employees, communities, stakeholders and all other members of public sphere. The CER activities are increasingly being taken up by the project proponents not only as fulfilling of mandatory provisions but also for the formation and or enhancement of brand image. Besides the above, CER is seen more as a responsibility towards society rather than a business promotion activity.

In order to improve the quality of life of nearby villagers of the proposed project area, amount of Rs. 60,000.00 which is 5% of the total cost (Rs.12,00,000) of project shall be spent under the guidance of District/Local authorities (MoEF&CC Notification for CER activity dated 01.05.2018)

As a corporate responsibility following measures along with budget provision is proposed for improving the conditions of persons in and around the project area:

Table 10.4 Proposed CER Budget

CER Budget				
S. No.	**Activity**	**Per Unit Cost**	**No.**	**Total Cost INR**
1	Provisions for Imparting vocational training at near village for technical skills, self employment training for women and youngsters.	-----	-	20,000.00
2	Energy Conservation i.e. Distribution of LED Bulbs	100	50	5,000.00
3	Provisions for Water purifier & its maintenance (1 no.) at CHC center of Near village.	15000	1	15,000,00
4	Provision of Toilets in the nearby villages	10000	1	10,000.00
5	Organization of Health Camps Provisions for Health Check-up camp at Gram Panchayat of Near village	-	-	5,000.00
6	Distribution of Sanitary Napkins, Contraceptives etc.	-	-	5,000.00
Total				**60,000.00**

CHAPTER 11: SUMMARY AND CONCLUSION

11. SUMMARY AND CONCLUSION

Introduction: The proposed project is for mining of limestone mineral from lease area of 1.25 ha. The maximum production from the mine will be 60391 TPA. Mining of mineral will be done by opencast semi mechanized method. Shri Solomon Gassah, owner of Amkroh Limestone Mine is the authorized signatory. The Government of Meghalaya has issued Letter of Intent for mining lease of limestone (minor mineral) mining in Shri Solomon Gassah on dated Jowai 20.07.2020 vide letter no. JH/S.G/M.L/L.S/2020-21/B/459. He has applied for an Environment Clearance after obtaining the necessary approval of the Mining Plan and Progressive Mine Closure Plan from the Directorate of Mineral Resources, Meghalaya.

The project area is of private land category. No forest area is involved. The mine will be in operation as per the Mining Plan approved by Director of Mineral Resources, Meghalaya.

The project has been granted ToR by SEIAA vide Letter ML.SEIAA/MIN/WJH/P-152/2021 dated 2 August, 2021. The latitude of the project area is N 25°14.713' TO N 25°14.780' and longitude is E 92°5.880' TO 92°5.962' E with maximum contour of 894 mRL and minimum contour of 887 mRL. The area falls in the Survey of India Topo-sheet no. 83C/3 (Restricted topo sheet). The lease area forms a part of the individual owned land. The proposed land is a Non forest Land according to Divisional Forest Officer, Jaintia Hills (T) Division, Jowai (Ref No. JH/S. Quarry/2009-10/476/B/2235, Dated 05.08.2019.

Reserves & Life of Mine: The geological reserves and its quality have been established by surface sampling and recently through quarry groove sampling. For Reserve estimation the Cross Sectional Method has been adopted. Sections have been drawn from boundary to boundary across the applied area considering the litho units in the area. The sectional area has been estimated on the basis of the cross sections. Length of influence has been measured taking half of the sectional interval distance on both side of each section. Bulk density has been taken as 2.7.

Category of Resource	**Mineable Reserves in Tonnes**
Proved Mineral Reserves	569552
Probable Mineral Reserves	33893
Total Mineable Reserves	**603445**

The mineable reserve of the mine area is 603445 tonnes. Taking the maximum production target of 60391 tonnes and taking 300 as the average no. of working days per annum, the life of mine is estimated to be about 10 years.

Mining Method:

- Semi Mechanized open cast mining will be undertaken with drilling and blasting.
- The width of each bench shall always be maintained to be not less than the height which is 6 m.
- Since the deposit in this area is massive and compact in nature, it is proposed to carry out only opencast semi-mechanized mining during this plan period, i.e. five years.
- Drilling and Blasting - Jack hammer drill machine will be deployed for drilling of shot holes ranging from 39 to 34 mm diameter and breaking of limestone at the required size will also be done manually.To avoid fly rock problem at the edge of the hill, light charged muffle blasting shall be under taken.

Raw Material Required:

Inputs	**Approx Quantity required per day**
High Speed Diesel Requirement	
Diesel	100 Liters (at peak production)
Water Requirement	
Water for Drinking	1.0 KLD
Water for Sprinkling	2.0 KLD
Water for green belt development	1.0 KLD

Description of the Environment: The baseline data has been collected from December 2020 to February 2021. The details area given below:

i. **Temperature:** Temperature of the area varied from 2.0^0C to 36.0^0C.

ii. **Relative Humidity:** Humidity of the area varied from 25.0 % to 98.0%.

iii. **Wind Speed:** Wind speed was in the range of 0.0 Km/hr to 54.0Km/hr.

Ambient Air Quality Results: Samples were collected from 8 sampling locations during Baseline season from December 2020 to February 2021. The results are given below:

Core Zone: The value of $PM_{2.5}$ is ranging from 31-38 μg/m^{3}and mean value is 34.2 μg/m^3 against standard limit of 60 μg/m^3. Value of PM_{10} is ranging from 67.0 -81.0 μg/m^{3}and mean value is 74.1 μg/m^{3}against standard limit of 100 μg/m^3. The mean value of SO_2 is 13.5 μg/m^{3}against standard limit of 80 μg/m^3& mean value of NOx is 18.9 μg/m^3 against standard limit of 80 μg/m^3.

Buffer Zone: The results of the Buffer Zone shows that PM_{10} was maximum at Pre-dominant DW near Jowai-Dawki (NH-40) (within prescribed standard limits) and 3rd Pre-dominant DW near Pamtadong Village were minimum. The $PM_{2.5}$ is ranging from 29.0-44.0/μg/m^3. PM_{10} is ranging from 59.0-89.0μg/m^3. The SO_2 is ranges from 9.4-15.5 against standard limit of 80μg/m^3 & NOx ranges from 15.8-26.5 μg/m^3 against standard limit of 80 μg/m^3. These are within standard limits of National ambient air quality standards.

The values of both the parameters are well within prescribed limits.

Noise Quality results: Samples were collected from 8 locations.

Core Zone: The ambient noise level during day time at the proposed project site was 54.9 dB (A) which are within the standard limit of Industrial area~75 dB (A). During night the noise level at the project site was 39.6 dB (A) which is within the night-time noise standard limit of 70dB (A).

Buffer Zone: The ambient noise level at day time are maximum at Near Jowai-Dawki (NH-40) 57.1 dB(A) as per the standard limit of Commercial area are ~ 65 dB (A). The night time noise result at the locations is 40.8 dB (A) which is within the standard limits of commercial area ~ 55 dB (A).

- **Ground Water Quality Results**: The samples were collected from 5 ground water locations and 2 surface water sources:

- **Core Zone: (Lease Area, Hand Pump Water)** shows that parameters like Total Hardness (259.12 mg/l); Total dissolved solids (427.28 mg/l), Magnesium (22.8 mg/l), & Alkalinity (152 mg/l) is well within drinking water standards (IS: 10500).
- **Buffer zone: Ground Water results:** All results were found within standard drinking water standards (IS: 10500).
- **Surface Water results:** The Surface water quality of the Upstream and Downstream water of Wah Umngot River is within prescribed CPCB Water Quality Criteria Class of water.

Soil Quality Results: The samples were collected from 5 locations:

Core Zone: The result shows that pH is 6.58. The availability of many plant nutrients in the soil changes as a result of reactions in the soil, which are largely controlled by soil pH. Amount of primary nutrients like Organic Carbon 1.47 %, the available nitrogen 27.40 mg/100g is lower in range, the available Potassium 0.52 mg/100g is moderate in range while available Phosphorous 0.83 mg/100g is higher in range, Primary nutrient profile shows that soil is low in fertility due to the availability of low amount of nitrogen and potassium.

Buffer Zone: Data collected shows as below:

The result shows that texture of soil has clay loam texture. pH ranges from 6.43 to 6.76. Amount of primary nutrients like Organic carbon 1.44% to 1.56%, the available nitrogen 25.20 to 29.20 mg/100g, the available phosphorus 0.69- 0.83 mg/100g is higher in range while

Available Potassium 0.59 to 0.67 meq/100g is lower in range, Primary nutrient profile shows that soil is low in fertility due to the availability of low amount of nitrogen, available potassium.

Ecology and Biodiversity Results:

Flora Core Zone: The density of the plant in core zone in general is very low due to rocky terrain and low soil content. In the core zone, place where mining is to be done is vacant land with patches of *Trema orientalis, Schimawallichii, Saccharum arundinaceum*, *Xerospermum glabratum*.

Buffer Zone: Few species are trees, shrubs, herbs, Ornamental plants, weed and *Bombax ceiba, Castanopsis indica, Citrus sp etc.*

Fauna Core zone: During study, it was found that the faunal diversity in the core site was limited to butterflies, insects, some species of mammals & reptile and common avifauna such as crow, pigeon etc.

Buffer Zone: Common fauna was reported in buffer zone.

Dust generation during mining and transportation may impact vegetation.

Socio Economic Study Results: Results of Socio economic study: Total 76 villages fall in the buffer zone. The study has been conducted by primary survey and secondary data source from Census of India 2011. The primary socio economic study has been conducted in 4 villages. The results are discussed below:

- ***Core Zone:*** *There is no habitation in the core zone*
- ***Buffer Zone****:* The total number of Households of the study area in rural village area is 6532 as per Census of India, 2011 data. The details are given below.
- **Population:**

  The total population of the study area is 36876 constituting 6532 households, implying that there are average 5.645 members per house. The average sex ratio of the study area is 1000/1012.55 as per census 2011.
- **Social Structure**

  The proportion of Scheduled Caste (SC) population within the study area is 0.63 % and the percentage of schedule Tribe (ST) is 93.76%.
- **Literacy**

  The total proportion of literate within the study area is 58.65% of total population. In percentage the male literacy 28.35% and the female literacy is 30.30% respectively within study area.

- **Traffic**

Location	Name of the Location	Distance & Direction w.r.t Proposed Mine	Remarks
TD I	Between ML &Approach Road	0.2 KM-W	Village Road
TD 2	Dawki-Jowai Road (NH-40)	0.3 K M – W	NH-40

Traffic density measurements were made continuously for 24 hours by visual observation and counting of vehicles under four categories, viz., heavy motor vehicles, light motor vehicles, two/three wheelers and cycles. As traffic density on the roads is low, two skilled persons were deployed simultaneously during each shift – one person on each of the two directions for counting the traffic. At the end of each hour, fresh counting and recording was undertaken. Thus, total numbers of vehicles per hour under the four categories were determined. A summary of the traffic density monitored during survey period is given in Table 3.26.

TABLE 3.26
INCREMENTAL TRAFFIC DUE TO PROPOSED MINING ACTIVITIES

ROAD	Increased PCU on the Road	V	C	Modified V/C Ratio	LoS
Between ML &Approach Road (Village Road)	4	4+ 16= 20	1600	20/1600 =	0.012
Dawki-Jowai Road (NH-40)	56	56+ 20= 77	1600	76/1600 =	0.047

The LoS value from the proposed mine may be "Excellent". So the additional load on the carrying capacity of the concern roads is not likely to have any significant adverse effect.

Anticipated Impact and Mitigation Measures:

- **Land Environment:** Mining may cause land degradation. Hence, Green belt development shall be done from the top soil excavated during mining in the 7.5m statutory boundary and at ultimate stage whole area will be planted.

- **Water Environment:** Total water requirement in the proposed mining project is 4.0 KLD. Water for drinking purpose will be met from nearby villages. For sprinkling & plantation water will be taken from private Tanker.
- **Air Environment:** The air borne particulate matter is the main air pollutant contributed by opencast mining with drilling and blasting. Various emission sources are identified from the proposed mining operations. Therefore, sprinkling shall be done and workers will be

given protective gears such as goggles, dust masks, gloves, and helmets.

- **Noise Environment:** The proposed mining operations will be carried by using latest equipments by open cast semi mechanized mining method. Hydraulic excavator will be used in excavation. Hence workers will be given protective gears such as goggles, dust masks, gloves, helmets and earmuffs. Plantation will be done to create cover from high noise.

- **Biological Environment:** Lease area is in Non Forest Land. There will be no impact on flora and fauna due to the proposed project.
- **Socio- Economic environment:** The project will enhance direct and indirect employment in the area. Therefore overall economic development is much likely after the commencement of the project.

- **Mine Waste:** The entire product of Limestone will be used in kilns for manufacturing of lime used as building materials. There is no gritty soil over the project area and therefore, no dumping will be done. After conceptual period exhausted quarry area will be reclaimed to the extent possible.

Impacts due to transportation: The entire mineral will be transported to the market through trucks. Transportation shall be done by 2 tippers of 10 T capacities will be deployed to transport the minerals from quarry to stockyard. As per study done there will not be any congestion due to proposed project on the road.

Environmental Monitoring Programme: Environmental monitoring at various locations, within the mining lease area and in the study area of 10 km radius will be carried out on periodic basis. A comprehensive network for monitoring has been prepared. Sampling locations have been identified by considering the source of pollution due to mining operations, drainage pattern, topography of the area and biological environment.

Risk Assessment & Disaster Management Plan: Mining will be carried out by semi mechanized opencast mining, with mining equipments as hydraulic excavator, dumpers etc involving drilling and blasting. Mining will be done under strict supervision hence the rate of operational risks is minimal.

Rehabilitation and Resettlement- There will be no rehabilitation and resettlement on account of mining. There is no human habitation at the project site and the land is deemed forest land.

Project benefits: The proposed mining project has a significant positive impact on the socio-economic environment and it will help sustain the overall development of the area.

The proposed project significantly contributes the economic development by providing direct employment to 36 people and indirect employment to many more people in the area.

Environmental Management Plan: Preparation of Environmental Management Plan (EMP) is required for formulation, implementation and monitoring of environmental protection measures during and after commissioning of the proposed mining project. The project cost is Rs. 12 Lakh and the EMP capital cost Rs. 2.04 Lakh (Annual recurring cost).

Budget towards Corporate Environmental Responsibilities (CER) will be Rs.0.60 Lakh as capital budget.

Green belt development has been initiated by the proponent 0.16 ha will be planted during plan period. However as per conceptual plan 0.32 Ha will be planted. Locally thriving species will be planted in consultation with forest department.

Among other environmental protection following measures are listed below:

- Sprinkling of water for dust suppression on mine haul roads.
- Regular Compaction & grading of haul roads and service roads to clear accumulation of loose material.
- Avoid overloading of dumpers and consequent spillage on the roads.
- Good maintenance of vehicles &machinery.
- Water sprinklers of fixed type will be provided at the mine approach roads from mine face / benches to crush hopper to prevent the generation of dust.

CHAPTER-11 DISCLOSURE OF CONSULTANTS

About Environmental Consultant

INTRODUCTION

Indian Mine Planners & Consultants, established by experienced environmental and related experts, provides specialized services in the field of Environment and Pollution Control for all types of **Mining of Minerals including opencast / underground mining**. Our transparent and professional approach, commitment to excellent quality and service, timely deliveries have contributed to create a name in the field of environment. A group of advisors from various disciplines with over 40 years of experience from organizations like Geological Survey of India, Various subsidiaries of Coal India Limited (CIL) including Central Mine Planning and Design Institute Limited (CMPDIL) & Indian School of Mines etc.

Indian Mine Planners & Consultants management, experience, excellence, professionalism and ultimate satisfaction has helped in achieving the heights of success in their specialized field of environment.

IMPCON also delivers advisory services in all aspects of geological exploration, geo-technical services, hydro-geology, mine planning and detailed design, electrical installations and maintenance, possible improvement area of mechanical performance of the high capacity mining machineries, civil and infrastructural job planning, choice of equipment for mining, manpower planning and finally total economics for project viability.

Declaration by Experts contributing to the EIA for proposed Amkroh Limestone Mine (MLA: 1.25 ha.) located at 60391 TPA in 1.25 Ha) of Sri Solomon Gassah located at Amkroh, Elaka-Nongtalang, Jowai, District-West Jaintia Hills, State- Meghalaya.

I, hereby, certify that I was a part of the EIA team under the capacity of EIA coordinator from that prepared the above EIA.

Signature & Date

Dr. Nirode Behari Chanda
(EIA Coordinator)
Indian Mine Planners & Consultants
GE-61, Rajdanga Main Road, EM- Bypass, Kolkata- 700107
NABET Certificate No. & Issue Date- NABET/EIA/1821/IA0037 dated 13.08.2018

Team for EIA

	Name	**Involvement (Period of task)**	**Signature**
EIA Coordinator	Dr. Nirode Behari Chanda	I had visited the site and was involved in preparation of EIA. **Period of Involvement: October 2020 to till date**	

Functional Area Experts:

S. No	Functional Areas	Name of the expert/s	Involvement (Task)	Involvement Period	Signature
1	AP(A)	Dr. N. B Chanda	Identification & Assessment of Impacts, suggestion Mitigation Measures	October 2020 to till date	
2	AQ(B)	Ardhendu Shekhar Shannigrahi	Identification & Assessment of Impacts, suggestion Mitigation Measures	October 2020 to till date	
3	WP(A)	Dr. N. B Chanda	Identification & Assessment of Impacts, suggestion Mitigation Measures	October 2020 to till date	
4	GEO(A)	Dr. N. B Chanda	Identification & Assessment of Impacts, suggestion Mitigation Measures	October 2020 to till date	
5	NV(B)	Sanjib Chattopadhyay	Identification & Assessment of Impacts, suggestion Mitigation Measures	October 2020 to till date	
6	HG(A)	James Nelso Narputharaj	Identification & Assessment of Impacts, suggestion Mitigation Measures	October 2020 to till date	
7	SC(B)	Gopal Chandra Das.	Identification & Assessment of Impacts, suggestion Mitigation Measures	October 2020 to till date	
8	LU(B)	Gopal Chandra Das.	Identification & Assessment of Impacts, suggestion Mitigation Measures	October 2020 to till date	
9	SHW(B)	Sanjib Chattopadhyay	Identification & Assessment of Impacts, suggestion Mitigation Measures	October 2020 to till date	
10	SHW(A)	Tapan Kumar Mishra	Identification & Assessment of Impacts, suggestion Mitigation Measures	October 2020 to till date	

11	RH(B)	Tapan Kumar Mishra	Identification & Assessment of Impacts, suggestion Mitigation Measures	October 2020 to till date	
12	SE(A)	Mrs. Nidhi Singh Rathod	Identification & Assessment of Impacts, suggestion Mitigation Measures	October 2020 to till date	

ACCREDITATIONS OBTAINED:

ISO-9001:2015 Certification

QCI – NABET Scheme for Accreditation of EIA Consultant Organization

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

I, **Dr. Nirode Behari Chanda**, hereby, confirm that the above-mentioned experts prepared the EIA of Lime Stone Mine over Area 1.25 Ha located at Amkroh, Elaka- Nongtalang, Jowai, District-West Jaintia Hills & State- Meghalaya.

I also confirm that as an EIA Coordinator (EC) I have gone through the report, and the consultant organization shall be fully accountable for any misleading information.

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

Signature & Date

Dr. Nirode Behari Chanda
(Managing Partner)
Indian Mine Planners & Consultants
GE-61, Rajdanga Main Road, EM- Bypass, Kolkata- 700107

NABET Certificate No. & Issue Date- NABET/EIA/1821/IA0037 dated 13.08.2018

CERTIFICATE OF ACCREDITATION

Quality Council of India

National Accreditation Board for Education & Training

CERTIFICATE OF ACCREDITATION

Indian Mine Planners and Consultants

GE-61, Rajdanga Main Road, Behind Gateway Hotel, EM-Bypass, Kolkata 700107

Accredited as Category - A organization under the QCI-NABET Scheme for Accreditation of EIA Consultant Organizations: Version 3 for preparing EIA/EMP reports in the following sectors:

Sl. No	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1.	Mining of minerals including opencast/ Underground mining	1	1 (a) (i)	A

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in IAAC minutes dated July 06, 2018 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in NABET's letter of accreditation bearing no. QCI/NABET/ENV/ACO/18/0727 dated August 13, 2018. The accreditation needs to be renewed before the expiry date Centre for Sustainable Development following due process of assessment.

Sr. Director, NABET
Dated: August 13, 2018

Certificate No.
NABET/EIA/1821/IA0037

Valid till
June 13, 2021

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.

National Accreditation Board for Education and Training
(Member - International Accreditation Forum & Pacific Accreditation Cooperation)

Ref. No. -QCI/NABET/ENV/ACO/18/0727 August 13, 2018

To,

Indian Mine Planners and Consultants
GE-61, Rajdanga Main Road, Behind Gateway Hotel
EM-BYPASS, Kolkata 700107

Sub: Accreditation of EIA Consultant Organizations under NABET Scheme

Ref.: Your application dated Nov 17, 2017, subsequent correspondence on subject and office assessment at your premises on Feb 27-28 and supplementary assessment date June 14, 2018.

Dear Sir

QCI-NABET is hereby pleased to accredit Indian Mine Planners and Consultants as Category-A organization. Details of sectors mentioned in the Certificate of Accreditation.

The validity of accreditation is subject to continued compliance to the Scheme and the terms & conditions mentioned in **Annexure I to IV.**

NABET look forward for your association and continued support.

With best regards,

13/08/2018

A K Jha
Senior Director
QCI- NABET

Institute of Town Planners India, 6th Floor, 4-A, Ring Road, I.P Estate, New Delhi-110 002, India
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File No.ML.SEIAA/MIN/WJH/P-152/2021

Goverment of India

State Level Environment Impact Assessment Authority

Meghalaya

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To,

M/s SHRI SOLOMON GASSAH
Amkroh, Nongtalang, Jowai, Meghalaya,
West Jaintia Hills-793150
Meghalaya

Tel.No.-; Email:amkrohsolomon@gmail.com

Sub. Terms of Reference to the Amkroh Limestone Mine, Lamin, West Jaintia Hills District, Meghalaya.

Dear Sir/Madam,

This has reference to the proposal submitted in the Ministry of Environment, Forest and Climate Change to prescribe the Terms of Reference (TOR) for undertaking detailed EIA study for the purpose of obtaining Environmental Clearance in accordance with the provisions of the EIA Notification, 2006. For this purpose, the proponent had submitted online information in the prescribed format (Form-1) along with a Pre-feasibility Report. The details of the proposal are given below:

1. Proposal No.:	SIA/ML/MIN/62881/2021
2. Name of the Proposal:	Amkroh Limestone Mine
3. Category of the Proposal:	Non-Coal Mining
4. Project/Activity applied for:	1(a) Mining of minerals 2(b) Mineral beneficiation
5. Date of submission for TOR:	26 Apr 2021

Date : 02-08-2021

Shri W.S Manner,IFS

(Chief Conservator of Forest,SF & E-Cum Member Secretary , SEIAA)

Office : **Sylvan House, Lower Lachumiere, shillong-793001**

Phone No : Mobile : **8787727681**

Email id : **ms.seiaamegh@gmail.com**

Note : This is auto tor granted letter.

In this regard, under the provisions of the EIA Notification 2006 as amended, the Standard TOR for the purpose of preparing environment impact assessment report and environment management plan for obtaining prior environment clearance is prescribed with public consultation as follows:

STANDARD TERMS OF REFERENCE (TOR) FOR EIA/EMP REPORT FOR PROJECTS/ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE

Terms of Reference (TOR) for preparation of Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for "Mining of Minerals" as per the EIA Notification, 2006 has been devised to improve the quality of the reports and facilitate decision-making transparent and easy. TOR will help the project proponents to prepare report with relevant project specific data and easily interpretable information. TOR for mining of minerals is expected to cover all environmental related features.

Mining of minerals plays a positive role in the process of country's economic development. In addition to the contribution towards economic growth, mining can also be a major source of degradation of physical as well as social environment, unless it is properly managed. Environmental impacts can arise during all activities of the mining process. Minimizing the damage due to mining operations depends on sound environmental practices in a framework of balanced environmental legislation. The potential adverse effects of mining activities include air pollution, surface and groundwater pollution, noise and vibration, damage to local ecology, natural topography and drainage, depletion of water resources etc. All these environmental components are required to be considered while selecting a proper methodology of mining, mitigation measures to reduce pollution load, conservation of natural resources etc.

The projects of mining of minerals as stated in the schedule require prior environment clearance under the EIA notification, 2006. Category 'A' Projects are handled in the MoEF&CC and Category 'B' projects are being handled by the respective State Environment Impact Assessment Authorities (SEIAAs) notified by MoEF&CC and following the procedure prescribed under the EIA Notification, 2006. As per this Notification, as amended, the projects of mining of minor minerals with mining lease area equal to or greater than 50 hectare are to be handled at the level of the MoEF&CC for grant of EC. Such projects with mining lease area less than 50 hectare are to be handled by the respective State Environment Impact Assessment Authority (SEIAA).

1(a):STANDARD TERMS OF REFERENCE FOR CONDUCTING ENVIRONMENT IMPACT ASSESSMENT STUDY FOR NON-COAL MINING PROJECTS AND INFORMATION TO BE INCLUDED IN EIA/EMP REPORT

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.

2) A copy of the document in support of the fact that the Proponent is the rightful lessee of the mine should be given.

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.

4) All corner coordinates of the mine lease area, superimposed on a High Resolution Imagery/ toposheet, topographic sheet, geomorphology and geology of the areashould 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).

5) Information should be provided in Survey of India Toposheet in 1:50,000 scale indicating geological map of the area, geomorphology of land forms of the area, existing minerals and mining history of the area, important water bodies, streams and rivers and soil characteristics.

6) Details about the land proposed for mining activities should be givenwith 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.

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.

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.

9) The study rea will comprise of 10 km zone around the mine lease from lease periphery and the data contained in the EIA such as waste generation etc. should be for the life of the mine / lease period.

10) Land use of the study rea 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.

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.

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.

13) Status of forestry clearance for the broken up area and virgin forestland involved in the Project including deposition of net present value (NPV) and compensatory afforestation (CA) should be indicated. A copy of the forestry clearance should also be furnished.

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.

15) The vegetation in the RF / PF areas in the study area, with necessary details, should be given.

16) A study shall be got done to ascertain the impact of the Mining Project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the surrounding and any other protected area and accordingly, detailed mitigative measures required, should be worked out with cost implications and submitted.

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 Wildlifeand copy furnished.

18) A detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET Species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the Schedule of the fauna present. In case of any scheduled-I fauna found in the study area, the necessary plan alongwith 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.

19) Proximity to Areas declared as 'Critically Polluted' or the Project areas likely to come under the 'Aravali Range', (attracting court restrictions for mining operations), should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the SPCB or State Mining Dept. Should be secured and furnished to the effect that the proposed mining activities could be considered.

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).

21) R&R Plan/compensation details for the Project Affected People (PAP) should be furnished. While preparing the R&R Plan, the relevant State/National Rehabilitation & Resettlement Policy should be kept in view. In respect of SCs /STs and other 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.

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 of PM10, particularly for free silica, should be given.

23) Air quality modeling should be carried out for prediction of impact of the project on the air quality of the area. It should also take into account the impact of movement of vehicles for transportation of mineral. The details of the model used and input parameters used for modeling 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.

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.

25) Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the Project should be provided.

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.

27) Impact of the Project on the water quality, both surface and groundwater, should be assessed and necessary safeguard measures, if any required, should be provided.

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.

29) Details of any stream, seasonal or otherwise, passing through the lease area and modification / diversion proposed, if any, and the impact of the same on the hydrology should be brought out.

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.

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.

32) Impact on local transport infrastructure due to the Project should be indicated. Projected increase in truck traffic as a result of the Project in the present road network (including those outside the Project area) should be worked out, indicating whether it is capable of handling the incremental load. Arrangement for improving the infrastructure, if contemplated (including action to be taken by other agencies such as State Government) should be covered. Project Proponent shall conduct Impact of Transportation study as per Indian Road Congress Guidelines.

33) Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.

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.

35) Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.

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.

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.

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.

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.

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.

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.

42) A Disaster management Plan shall be prepared and included in the EIA/EMP Report.

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.

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.

b) Where data are presented in the Report especially in Tables, the period in which the data were collected and the sources should be indicated.

c) Project Proponent shall enclose all the analysis/testing reports of water, air, soil, noise etc. using the MoEF&CC/NABL accredited laboratories. All the original analysis/testing reports should be available during appraisal of the Project.

d) Where the documents provided are in a language other than English, an English translation should be provided.

e) The Questionnaire for environmental appraisal of mining projects as devised earlier by the Ministry shall also be filled and submitted.

f) While preparing the EIA report, the instructions for the Proponents and instructions for the Consultants issued by MoEF vide O.M. No. J-11013/41/2006-IA.II(I) dated 4th August, 2009, which are available on the website of this Ministry, should be followed.

g) Changes, if any made in the basic scope and project parameters (as submitted in Form-I and the PFR for securing the TOR) should be brought to the attention of MoEF&CC with reasons for such changes and permission should be sought, as the TOR may also have to be altered. Post Public Hearing changes in structure and content of the draft EIA/EMP (other than modifications arising out of the P.H. process) will entail conducting the PH again with the revised documentation.

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.

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.

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2(b):STANDARD TERMS OF REFERENCE FOR CONDUCTING ENVIRONMENT IMPACT ASSESSMENT STUDY FOR MINERAL BENEFICIATION PROJECTS AND INFORMATION TO BE INCLUDED IN EIA/EMP REPORT

1) The alternate sites considered, the relative merits and demerits and the reasons for selecting the proposed site for the Beneficiation Plant should be indicated.

2) Details of the technology and process involved for beneficiation should be given. .

3) Location of the proposed Plant w.r.t. the source of raw material and mode of transportations of the ore from mines to the beneficiation plant should be justified.

4) Treatment of run of mine (ROM) and or of the fines/waste dump should be spelt out.

5) Estimation of the fines going into the washings should be made and its management described.

6) Details of the equipment, settling pond etc. should be furnished.

7) Detailed material balance should be provided.

8) Sources of raw material and its transportation should be indicated. Steps proposed to be taken to protect the ore from getting air borne should be brought out.

9) Management and disposal of tailings and closure plan of the tailing pond, if any after the project is over, should be detailed in a quantified manner.

10) 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 also be indicated.

11) A copy of the document in support of the fact that the Proponent is the rightful lessee of the unit should be given.

12) All documents including EIA and public hearing should be compatible with one another in terms of the production levels, waste generation and its management and technology and should be in the name of the lessee.

13) All corner coordinates of the Unit, superimposed on a High Resolution Imagery/Toposheet should be provided. Such an Imagery of the proposed Unit should clearly show the land use and other ecological features of the study area (core and buffer zone).

14) It should be clearly indicated 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.

15) Issues relating to Safety should be detailed. The proposed safeguard measures in each case should also be provided. Disaster management plan shall be prepared and included in the EIA/EMP Report.

16) The study area will comprise of 10 km zone around the Plant.

17) Cumulative impact study of both Beneficiation Plant with suggested mitigation measures as per the study should be described.

18) Location of Railway siding with its handling capacity and safety measures should be indicated.

19) Option to provide only silo for storage of minerals instead of open stacking to avoid fugitive dust should be explored and arrangements finalized justified.

20) 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 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.

21) Details of the land for any Over Burden Dumps outside the lease, such as extent of land area, distance from lease, its land use, R&R issues, if any, should be given.

22) 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.

23) Status of forestry clearance for the broken up area and virgin forestland involved in the Project including deposition of net present value (NPV) and compensatory afforestation (CA) should be indicated. A copy of the forestry clearance should also be furnished.

24) 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.

25) The vegetation in the RF / PF areas in the study area, with necessary details, should be given.

26) A study shall be got done to ascertain the impact of the Project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the surrounding and any other protected area and accordingly detailed mitigative measures required, should be worked out with cost implications and submitted.

27) Location of National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, 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.

28) A detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET Species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the Schedule of the fauna present. In case of any scheduled-I fauna found in the study area, the necessary plan alongwith 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.

29) Proximity to Areas declared as 'Critically Polluted' shall also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the SPCB/CPCBshall be secured and furnished to the effect that the proposed activities could be considered.

30) Similarly, for coastal Projects, A CRZ map duly authenticated by one of the authorized agencies demarcating LTL. HTL, CRZ area, location of the unit w.r.t CRZ, coastal features such as mangroves, if any, should be furnished. (Note: The Projects falling under CRZ would also need to obtain approval of the concerned Coastal Zone Management Authority).

31) R&R Plan/compensation details for the Project Affected People (PAP) should be furnished. While preparing the R&R Plan, the relevant State/National Rehabilitation & Resettlement Policy should be kept in view. In respect of SCs /STs and other weaker sections of the society in the study area, a need based sample survey, family-wise, should be undertaken to assess their requirements, and action programmes prepared and submitted accordingly, integrating the sectoral programmes of line departments of the State Government. It may be clearly brought out whether the village(s) located in the 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.

32) 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 unit in the pre-dominant downwind direction. The mineralogical composition of PM10, particularly for free silica, should be given.

33) Air quality modeling should be carried out for prediction of impact of the project on the air quality of the area. It should also take into account the impact of movement of vehicles for transportation of

mineral. The details of the model used and input parameters used for modeling 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.

34) 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.

35) Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the Project should be secured and copy furnished. .

36) 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.

37) Impact of the project on the water quality, both surface and groundwater should be assessed and necessary safeguard measures, if any required, should be provided.

38) Details of any stream, seasonal or otherwise, passing through the lease area and modification / diversion proposed, if any, and the impact of the same on the hydrology should be brought out.

39) 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. 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 the pollution.

40) Impact on local transport infrastructure due to the Project should be indicated. Projected increase in truck traffic as a result of the Project in the present road network (including those outside the Project area) should be worked out, indicating whether it is capable of handling the incremental load. Arrangement for improving the infrastructure, if contemplated (including action to be taken by other agencies such as State Government) should be covered.

41) Details of the onsite shelter and facilities to be provided to the workers should be included in the EIA report.

42) 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 should be be detailed.

43) 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.

44) 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.

45) Public hearing points raised and commitment of the Project Proponent on the same along with time bound Action Plan to implement the same should be provided and also incorporated in the final EIA/EMP Report of the Project.

46) Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the project should be given.

47) The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.

48) A brief background of the Project, its financial position, Group Companies and legal issues etc should be provided with past and current important litigations if any.

49) Benefits of the Project, if the project is implemented should be outlined. The benefits of the projects shall clearly indicate environmental, social, economic, employment potential, etc.

50) Besides the above, the below mentioned general points are also to be followed:-

a) All documents to be properly referenced with index and continuous page numbering.

b) Where data are presented in the report especially in Tables, the period in which the data were collected and the sources should be indicated.

c) Project Proponent shall enclose all the analysis/testing reports of water, air, soil, noise etc. using the MoEF&CC/NABL accredited laboratories. All the original analysis/testing reports should be available during appraisal of the project.

d) Where the documents provided are in a language other than English, an English translation should be provided.

e) The Questionnaire for environmental appraisal of project as devised earlier by the Ministry shall also be filled and submitted.

f) While preparing the EIA report, the instructions for the proponents and instructions for the consultants issued by MoEF vide O.M. No. J-11013/41/2006-IA.II(I) dated 4th August, 2009, which are available on the website of this Ministry, should also 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 draft EIA/EMP (other than modifications arising out of the P.H. process) will entail conducting the PH again with the revised documentation.

h) As per the circular no. J-11011/618/2010-IA.II(I) dated 30.5.2012, certifiedReport of the status of compliance of the conditions stipulated in the environment clearance for the existing operations of the project by the Regional Office of Ministry of Environment, Forest and Climate Change, as may be applicable.

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GOVERNMENT OF MEGHALAYA
OFFICE OF THE DIVISIONAL FOREST OFFICER (TERRITORIAL)
JAINTIA HILLS DIVISION: JOWAI.

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No. JH/S.G/M.L/L.S/2020-21/B/ 459 **Dated - Jowai, the** 20th **July, 2020.**

From: The Divisional Forest Officer.
Jaintia Hills Territorial Division. Jowai.

To: Shri. Solomon Gassah
Lamin, West Jaintia Hills District.

Subject: Letter of Intent (LOI) for granting of mining lease under MMMCR 2016 for Limestone Stone Mining at Amkroh, Nongtalang, West Jaintia Hills District.

In inviting a reference to your letter on the subject cited above, I am issuing this **Letter of Intent** for granting of **Mining Lease** under Rules 10 of the Meghalaya Minor Minerals Concession Rules 2016 for mining of **Limestone** on an area of **1.25 hectare** situated at Amkroh, Nongtalang, West Jaintia Hills District. On receipt of this LOI, you shall within a period of 6 (six) months, furnish the following documents for grant of **Mining Lease**:-

1. Mining plan duly approved by the Director of Mineral Resources;
2. Environmental Clearance under the Environmental (Protection) Act, 1986;
3. Consent to establish and operate under the Water (Prevention & Control of Pollution) Act, 1974 and Air (Prevention & Control of Pollution) Act, 1981;
4. Clearance from Revenue and Disaster Management Department;
   And
5. Clearance from Labour Department for occupational health and Labour laws including child labour.

This is for favour of your kind information and necessary action.

Divisional Forest Officer.
Jaintia Hills Territorial Division. Jowai.

APPROVED

DIVISIONAL MINING OFFICER
DIRECTORATE OF MINERAL RESOURCES.
MEGHALAYA, JOWAI

GOVERNMENT OF MEGHALAYA
OFFICE OF THE DIVISIONAL MINING OFFICER ::: WEST JAINTIA HILLS
JOWAI.

NO.DMO-J/40/MM/Mining Plan/2020-21/125 Dated Jowai, the 30th October 2020.

To,

Shri. Solomon Gassah,
Vill - Lamin,
West Jaintia Hills District, Meghalaya.

Sub: Approval of Mining Plan in respect of **Limestone Mine** of **Shri. Solomon Gassah, Vill – Lamin,** West Jaintia Hills District over an area of **1.25 ha.** located at **Amkroh, Nongtalang,** West Jaintia Hills District, Meghalaya submitted under Rule 19 (1) of Meghalaya Minor Mineral Concession Rule, 2016.

Sir,

In exercise of the power conferred under Rule 10 (a) & 19 (1) of Meghalaya Minor Mineral Concession Rules, 2016, I hereby approve the above said Mining Plan with following conditions:-

(i) The Mining Plan is approved without prejudice to any other applicable to the mine area from time to time made by the Central Government, State Government or any other authority and without prejudice to any order or direction from any court of competent jurisdiction.

(ii) The proposals shown on the plates and/or given in the documents are based on the lease map/sketch submitted by the applicant/lease and are applicable from the date of approval.

(iii) It is clarified that the approval of Mining Plan does not in any way imply the approval of the State Government in terms of any other provision of the Meghalaya Minor Mineral Concession Rules, 2016 or Acts and Rules relating to Mines and Minerals framed by Central Government and any other laws including Forest and Labour Laws.

(iv) The Divisional Mining Officer, West Jaintia Hills, Jowai does not undertake verification of the Mining lease boundary on the ground and does not undertake any responsibility regarding the correctness of the boundaries of the precise area as furnished by the applicant/lessee.

(v) At any stage, if it is observed/found that the information furnished data incorporated in the document are incorrect of misrepresent facts, the approval of the document shall be revoked with immediate effect.

(vi) If this approval conflicts with any other law or court order/direction under any statute, it shall be revoked immediately.

(vii) The granting authority may verify the Mining Lease boundary of the applied area.

Yours faithfully,

Enclo: 2(two) sets of
approved Mining Plan.

(Shri. M.Syrty)
Divisional Mining Officer
Directorate of Mineral Resources
Meghalaya:::::::::Jowai.

Contd…P/2…

Memo. No.DMO-J/40/MM/Mining Plan/2020-21/125-A Dt. Jowai, the 30th October 2020.

Copy to :-

1. The Controller General, India Bureau of Mines, Govt. of India Ministry of Mines, Indira Bhavan, Civil Lines, Nagpur – 440 102 for information and necessary action.

2. The Director General of Mines Safety, Dhanbad, Jharkhand – 826016 for information and necessary action.

3. The Secretary to the Govt. of Meghalaya, Mining & Geology Department, Shillong - 793001 for information and necessary action.

4. The Principal, Chief Conservator of Forest, Meghalaya, Shillong – 793001 for information and necessary action.

5. The Director of Mineral Resources, Meghalaya, Shillong for information.

6. The Commissioner of Labour, Meghalaya, Shillong – 793001 for information and necessary action.

7. The Chairman, Meghalaya State Pollution Control Board, Lumpyngngad, Shillong-793014 for information and necessary action.

8. The Deputy Commissioner, West Jaintia Hills District, Jowai for information and necessary action.

9. The RQP for information.

Divisional Mining Officer
Directorate of Mineral Resources
Meghalaya::::::::Jowai.

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GOVERNMENT OF MEGHALAYA
OFFICE OF THE DIVISIONAL MINING OFFICER
WEST JAINTIA HILLS ::: JOWAI

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No. DMO-J/40/MM/Mining Plan/2020-2021/135 Dated Jowai, the 8th March 2021.

TO WHOM IT MAY CONCERN

It is hereby certified that as on date, 3(three) approved Mining Plans for **Limestone** of :-

(1) Smt. Pri-io Buam, Area – 4.0 ha lies within a distance of **3.0 meters**
(2) Shri. Bisor Lamin, Area – 4.5 ha lies within a distance of **104 meters** and
(3)Shri. Damanbait Lamare,Area–4.9 ha lies within a distance of **450 meters** respectively from the periphery of the approved Mining Plan on **Limestone Mine** over an area **1.25 hectares** located at **Amkroh, Nongtalang**, District – West Jaintia Hills, Meghalaya of **Shri. Solomon Gassah,** r/o. Lamin, District – West Jaintia Hills District, Meghalaya.

(Shri. M. Syrty)
Divisional Mining Officer,
Directorate of Mineral Resources,
Meghalaya:::::Jowai.

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Ambient Air quality results of $PM_{2.5}$, PM_{10}, SO_x & NO_x

Name of project: Amkroh Limestone Mine (Shri Solomon Gassah)
At-Amkroh, Elaka Nongtalang, Jowai
District- West Jaintia Hills, State- Meghalaya

Location of Sampling: Core Zone

Details of client: Indian Mine Planners & Consultants
GE-61, Rajdanga Main Road, EM- Bypass
Kolkata- 700107

Dated	PM10 (µg/m3)	PM2.5 (µg/m3)	SO2 (µg/m3)	NOx (µg/m3)
02.12.2020	69	31	12.4	18.6
03.12.2020	70	35	12.6	18.9
09.12.2020	72	36	12.9	18.4
10.12.2020	74	38	13.4	19.0
16.12.2020	78	31	12.8	19.3
17.12.2020	81	33	13.0	19.8
23.12.2020	80	35	13.0	18.7
24.12.2020	81	36	13.1	19.4
06.01.2021	79	36	13.6	20.2
07.01.2021	74	37	14.9	19.0
13.01.2021	67	38	13.3	18.8
14.01.2021	69	38	14.2	19.0
20.01.2021	70	31	14.0	17.6
21.01.2021	67	31	13.3	18.1
27.01.2021	68	32	13.4	18.6
28.01.2021	72	36	13.7	19.1
03.02.2021	74	33	13.3	19.0
04.02.2021	76	31	13.5	19.7
10.02.2021	80	31	13.8	20.6
11.02.2021	78	32	13.9	18.3
17.02.2021	81	33	13.8	18.1
18.02.2021	68	32	13.5	18.4
24.02.2021	80	38	13.9	18.4
25.02.2021	70	37	14.1	18.2

Name of project: Amkroh Limestone Mine (Shri Solomon Gassah)
At-Amkroh, Elaka Nongtalang, Jowai
District- West Jaintia Hills, State- Meghalaya

Location of Sampling: Pre-dominant DW Near Jowai-Dawki (NH-40)

Details of client: Indian Mine Planners & Consultants
GE-61, Rajdanga Main Road, EM- Bypass
Kolkata- 700107

Dated	PM10 (µg/m3)	PM2.5 (µg/m3)	SO2 (µg/m3)	NOx (µg/m3)
02.12.2020	69	41	13.8	18.0
03.12.2020	81	42	14.3	18.3
09.12.2020	82	44	14.5	18.5
10.12.2020	83	33	14.6	19.4
16.12.2020	84	35	13.6	18.3
17.12.2020	68	37	13.8	18.5
23.12.2020	70	39	13.9	18.7
24.12.2020	72	40	14.2	17.0
06.01.2021	74	41	13.1	16.8
07.01.2021	76	44	13.6	16.3
13.01.2021	78	43	13.9	16.9
14.01.2021	80	42	14.1	17.0
20.01.2021	89	41	14.4	17.1
21.01.2021	82	33	14.0	17.6
27.01.2021	84	35	13.8	18.3
28.01.2021	86	34	14.1	19.8
03.02.2021	69	33	14.3	19.7
04.02.2021	68	39	14.0	19.0
10.02.2021	70	37	14.2	19.4
11.02.2021	74	41	14.3	18.2
17.02.2021	76	33	15.1	18.5
18.02.2021	81	35	14.6	19.1
24.02.2021	84	39	14.0	19.2
25.02.2021	86	39	14.4	21.7

Name of project: Amkroh Limestone Mine (Shri Solomon Gassah)
At-Amkroh, Elaka Nongtalang, Jowai
District- West Jaintia Hills, State- Meghalaya

Location of Sampling: Pre-dominant DW Near Khonglah Village

Details of client: Indian Mine Planners & Consultants
GE-61, Rajdanga Main Road, EM- Bypass
Kolkata- 700107

Dated	PM10 (µg/m3)	PM2.5 (µg/m3)	SO2 (µg/m3)	NOx (µg/m3)
04.12.2020	65	35	13.0	20.1
05.12.2020	69	32	13.2	19.9
11.12.2020	74	33	13.3	18.8
12.12.2020	83	34	13.0	16.8
18.12.2020	85	37	13.3	15.8
19.12.2020	83	38	13.2	16.6
25.12.2020	80	41	13.5	17.5
26.12.2020	78	32	13.7	18.0
08.01.2021	64	33	13.3	19.2
09.01.2021	66	34	13.5	16.2
15.01.2021	68	36	13.7	17.1
16.01.2021	70	35	14.1	18.7
22.01.2021	74	33	14.3	19.5
23.01.2021	76	32	13.1	20.3
28.01.2021	78	41	13.3	18.7
29.01.2021	81	40	13.7	23.2
05.02.2021	85	39	13.8	20.6
06.02.2021	77	38	13.9	21.0
12.02.2021	80	37	14.2	19.7
13.02.2021	64	32	14.5	17.3
19.02.2021	69	33	14.3	17.4
20.02.2021	72	35	13.6	18.4
26.02.2021	76	39	13.1	20.1
27.02.2021	75	40	13.4	21.6

Name of project: Amkroh Limestone Mine (Shri Solomon Gassah)
At-Amkroh, Elaka Nongtalang, Jowai
District- West Jaintia Hills, State- Meghalaya

Location of Sampling: Predominant UW near Pamtbuh Village

Details of client: Indian Mine Planners & Consultants
GE-61, Rajdanga Main Road, EM- Bypass
Kolkata- 700107

Dated	PM10 (µg/m3)	PM2.5 (µg/m3)	SO2 (µg/m3)	NOx (µg/m3)
06.12.2020	69	32	12.5	20.0
07.12.2020	70	35	12.7	20.1
13.12.2020	72	37	13.0	19.7
14.12.2020	74	30	13.3	19.5
20.12.2020	76	31	13.5	20.4
21.12.2020	78	31	13.5	19.4
27.12.2020	80	32	13.4	20.1
28.12.2020	82	32	13.7	22.4
10.01.2021	65	33	13.8	20.3
11.01.2021	67	35	13.2	21.2
17.01.2021	69	37	13.5	20.6
18.01.2021	70	30	13.6	21.3
24.01.2021	72	33	13.1	19.9
25.01.2021	74	37	12.9	16.3
30.01.2021	76	32	13.1	17.9
31.01.2021	78	34	13.3	18.7
07.02.2021	79	36	13.6	20.0
08.02.2021	65	33	13.4	20.9
14.02.2021	66	30	13.6	22.0
15.02.2021	67	32	13.3	26.1
21.02.2021	68	34	13.5	22.9
22.02.2021	69	36	13.5	22.3
28.02.2021	82	37	14.0	23.0
01.03.2021	80	32	14.1	22.9

Name of project: Amkroh Limestone Mine (Shri Solomon Gassah)
At-Amkroh, Elaka Nongtalang, Jowai
District- West Jaintia Hills, State- Meghalaya

Location of Sampling: 2nd Pre-dominant DW near Pdenkarong Village

Details of client: Indian Mine Planners & Consultants
GE-61, Rajdanga Main Road, EM- Bypass
Kolkata- 700107

Dated	PM10 (µg/m3)	PM2.5 (µg/m3)	SO2 (µg/m3)	NOx (µg/m3)
02.12.2020	59	35	11.0	20.2
03.12.2020	61	34	11.1	21.4
09.12.2020	65	33	11.5	24.8
10.12.2020	69	31	11.8	18.0
16.12.2020	70	30	11.5	18.7
17.12.2020	74	32	11.7	20.2
23.12.2020	72	34	11.2	19.4
24.12.2020	71	35	11.3	19.4
06.01.2021	59	29	11.7	20.6
07.01.2021	71	29	10.9	20.5
13.01.2021	74	30	11.3	20.1
14.01.2021	76	31	11.0	18.1
20.01.2021	78	31	11.4	16.4
21.01.2021	62	29	11.5	19.7
27.01.2021	64	29	11.8	20.5
28.01.2021	66	30	12.1	19.7
03.02.2021	69	30	11.4	21.2
04.02.2021	70	32	11.6	19.5
10.02.2021	74	32	11.5	19.5
11.02.2021	76	33	11.3	19.4
17.02.2021	78	33	11.4	20.5
18.02.2021	59	34	11.2	20.6
24.02.2021	62	35	11.7	19.0
25.02.2021	65	35	11.1	18.5

Name of project: Amkroh Limestone Mine (Shri Solomon Gassah)
At-Amkroh, Elaka Nongtalang, Jowai
District- West Jaintia Hills, State- Meghalaya

Location of Sampling: Pre-dominant UW near Pamtbuh Village

Details of client: Indian Mine Planners & Consultants
GE-61, Rajdanga Main Road, EM- Bypass
Kolkata- 700107

Dated	PM10 (µg/m3)	PM2.5 (µg/m3)	SO2 (µg/m3)	NOx (µg/m3)
06.12.2020	80	35	12.1	22.1
07.12.2020	81	36	12.3	23.5
13.12.2020	83	39	12.3	21.3
14.12.2020	71	31	12.1	22.0
20.12.2020	75	33	12.2	23.0
21.12.2020	77	32	12.6	23.8
27.12.2020	79	34	12.6	19.8
28.12.2020	71	35	12.9	21.2
10.01.2021	72	37	13.2	21.1
11.01.2021	75	39	12.5	21.5
17.01.2021	76	31	11.7	21.3
18.01.2021	81	32	11.8	22.5
24.01.2021	83	33	11.9	23.2
25.01.2021	75	35	12.2	24.2
30.01.2021	77	36	12.5	18.3
31.01.2021	71	39	12.6	19.4
07.02.2021	73	32	12.9	20.2
08.02.2021	74	32	11.6	21.2
14.02.2021	72	34	11.8	22.3
15.02.2021	75	31	12.0	20.2
21.02.2021	76	39	12.2	21.2
22.02.2021	78	38	12.4	27.4
28.02.2021	77	37	12.2	22.4
01.03.2021	80	31	12.1	21.6

Name of project: Amkroh Limestone Mine (Shri Solomon Gassah)
At-Amkroh, Elaka Nongtalang, Jowai
District- West Jaintia Hills, State- Meghalaya

Location of Sampling: 3rd Pre-dominant DW near Pamtadong Village

Details of client: Indian Mine Planners & Consultants
GE-61, Rajdanga Main Road, EM- Bypass
Kolkata- 700107

Dated	PM10 (µg/m3)	PM2.5 (µg/m3)	SO2 (µg/m3)	NOx (µg/m3)
04.12.2020	65	32	11.8	21.6
05.12.2020	68	34	12.1	22.5
11.12.2020	69	36	11.4	21.6
12.12.2020	60	30	11.0	20.9
18.12.2020	62	30	10.3	18.0
19.12.2020	64	31	10.4	18.9
25.12.2020	66	32	10.7	19.8
26.12.2020	69	33	11.7	22.0
08.01.2021	70	36	12.4	22.2
09.01.2021	73	35	11.2	20.8
15.01.2021	71	30	10.5	21.6
16.01.2021	60	32	11.5	22.3
22.01.2021	62	35	11.7	23.4
23.01.2021	63	36	12.0	17.9
28.01.2021	64	35	9.8	19.2
29.01.2021	65	30	10.1	19.7
05.02.2021	66	32	11.0	22.8
06.02.2021	67	34	11.3	25.4
12.02.2021	69	36	10.5	23.6
13.02.2021	73	36	10.3	18.6
19.02.2021	70	32	10.7	19.1
20.02.2021	72	31	10.6	19.8
26.02.2021	72	30	10.7	21.9
27.02.2021	70	36	12.2	22.6

Name of project: Amkroh Limestone Mine (Shri Solomon Gassah)
At-Amkroh, Elaka Nongtalang, Jowai
District- West Jaintia Hills, State- Meghalaya

Location of Sampling: Pre-dominant UW near Pdengkseh Village

Details of client: Indian Mine Planners & Consultants
GE-61, Rajdanga Main Road, EM- Bypass
Kolkata- 700107

Dated	PM10 (µg/m3)	PM2.5 (µg/m3)	SO2 (µg/m3)	NOx (µg/m3)
06.12.2020	74	35	12.8	21.0
07.12.2020	76	35	13.7	20.9
13.12.2020	78	37	11.5	19.9
14.12.2020	80	39	13.3	19.9
20.12.2020	82	40	12.1	19.8
21.12.2020	74	32	12.3	20.9
27.12.2020	70	32	12.4	22.8
28.12.2020	83	33	11.8	21.2
10.01.2021	81	35	11.7	19.1
11.01.2021	82	37	11.8	20.2
17.01.2021	80	40	12.4	22.0
18.01.2021	70	32	12.7	25.3
24.01.2021	74	35	13.1	26.5
25.01.2021	75	35	13.5	19.9
30.01.2021	76	32	13.7	17.3
31.01.2021	78	33	12.2	18.6
07.02.2021	79	32	11.4	19.8
08.02.2021	83	39	11.8	20.4
14.02.2021	80	37	11.7	21.6
15.02.2021	80	32	12.2	22.9
21.02.2021	75	39	12.5	16.4
22.02.2021	77	38	12.8	23.1
28.02.2021	76	35	13.1	20.3
01.03.2021	72	37	12.5	18.9

Ground Water Quality Report of Amkroh Limestone Mine

Name of project: Amkroh Limestone Mine (Shri Solomon Gassah)
At-Amkroh, Elaka Nongtalang, Jowai
District- West Jaintia Hills, State- Meghalaya
Date of Sampling: 27.02.2021
Date of Analysis: 03.03.2021-09.03.2021
Details of client: Indian Mine Planners & Consultants
GE-61, Rajdanga Main Road, EM- Bypass
Kolkata- 700107

SN	Parameter	Unit	IS:10500-93 Drinking Water Standards	Core Zone of Solomon (GW1)	Khonglah Village (GW2)	Pamtbuh Village-I (GW3)	Pamtbuh Village-II (GW4)	Pdengkseh Village (GW5)
1.	pH Value	-	6.5 to 8.5	6.68	6.87	6.72	6.82	6.78
2.	Turbidity NTU	NTU	5 (10)	0.6	0.5	0.7	0.7	0.6
3.	Electrical Conductivity at 25^0C	µS/cm	-	622.10	612.30	623.40	628.00	610.50
4.	Apparent Colour	Hazen	5	<1	<1	<1	<1	<1
5.	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
6.	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
7.	Total Dissolved Solids (TDS)	mg/l	500 (2000)	427.28	462.52	471.70	483.62	452.82
8.	Total Hardness (CaCO3)	mg/l	300 (600)	259.12	274.24	269.68	276.42	268.20
9.	Iron (as Fe)	mg/l	0.3 (1.0)	0.04	0.06	0.07	0.07	0.06
10.	Chlorides (as Cl)	mg/l	250 (1000)	32.7	41.9	38.3	37.4	33.1
11.	Calcium (as Ca)	mg/l	75 (200)	37.6	40.1	48.3	51.3	45.8
12.	Magnesium (as Mg)	mg / l	30 (100)	22.8	21.3	23.9	24.2	20.7
13.	Sulphate (as SO4)	mg / l	200 (400)	22.2	20.3	21.7	22.1	20.8
14.	Nitrates (as NO3)	mg / l	45	4.25	3.88	3.82	3.94	3.68
15.	Fluoride (as F)	mg / l	1.0 (1.5)	0.44	0.47	0.56	0.51	0.43
16.	Total Alkalinity (CaCO3)	mg /l	200 (600)	152	161	159	162	152
17.	Free Residual Chlorine	mg /l	Min 0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
18.	Copper as(Cu)	mg /l	0.05 (1.5)	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02

19.	Manganese as (Mn)	mg /l	0.1 (0.3)	0.05	0.04	0.06	0.07	0.04
20.	Mercury as (Hg)	mg / l	0.001	< 0.0005	< 0.0003	< 0.0004	< 0.0005	< 0.0005
21.	Cadmium as (Cd)	mg / l	0.01	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
22.	Selenium as (Se)	mg / l	0.01	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
23.	Arsenic as (As)	mg / l	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
24.	Lead as (Pb)	mg / l	0.05	< 0.005	< 0.004	< 0.005	< 0.005	< 0.005
25.	Zinc as (Zn)	mg / l	5 (15)	< 0.1	< 0.2	< 0.3	< 0.3	< 0.3
26.	Chromium as (Cr)	mg / l	0.05	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
27.	Aluminium as (Al)	mg / l	0.03 (0.2)	0.007	0.008	0.006	0.006	0.007
28.	Boron as (B)	mg / l	1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
29.	Cyanide as (CN)	mg / l	0.05	< 0.003	< 0.003	< 0.004	< 0.005	< 0.005
30.	Total Coliform	MPN/ 100 ml	Nil	Absent	Absent	Absent	Absent	Absent
31.	Phenolic Compounds	mg / l	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
32.	Anionic Detergents	mg / l	0.2(1.0)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
33.	Polynuclear aromatic Comp (as PAH)	µg / l	-	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
34.	Mineral Oil	mg / l	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Surface Water quality Report of Wah Umngot River

Name of project: Amkroh Limestone Mine (Shri Solomon Gassah)
At-Amkroh, Elaka Nongtalang, Jowai
District- West Jaintia Hills, State- Meghalaya
Date of Sampling: 27.02.2021
Date of Analysis: 03.03.2021-09.03.2021
Details of client: Indian Mine Planners & Consultants
GE-61, Rajdanga Main Road, EM- Bypass
Kolkata- 700107

S. No.	Parameters	Unit	As Per IS:2296: 1992 Category - C	SW1 (Upstream near Burma)	SW2 (Downstream near Dawki)
1.	Colour	Hazen units	300	<1	<1
2.	Odour	-	Un - Objectionable	Agreeable	Agreeable
3.	Turbidity NTU	NTU	-	<1	<1
4.	pH Value	-	6.5 to 8.5	7.28	7.48
5.	Dissolved Oxygen	mg / l	≥ 4	7.1	7.3
6.	BOD (3d, 250C)	mg / l	3	2.5	2.8
7.	COD	mg / l	-	7.1	7.7
8.	Total Hardness (CaCO3)	mg / l	-	91.2	94.7
9.	Oil and Grease	mg / l	0.1	<1	<1
10.	Iron (as Fe)	mg / l	59.2	63.7	0.14
11.	Chlorides (as Cl)	mg / l	600	58.2	61.4
12.	Electrical Conductivity at 25^0C	µs/cm	-	465.50	470.10
13.	Total Dissolved Solids (TDS)	mg / l	1500	293.28	299.12
14.	Calcium (as Ca)	mg / l	-	22.8	27.4
15.	Magnesium (as Mg)	mg / l	-	7.7	7.6
16.	Sulphate (as SO4)	mg / l	400	22.80	25.2
17.	Free residual chlorine	mg / l	-	< 0.1	< 0.1
18.	Nitrates (as NO3)	mg / l	50	2.62	2.72
19.	Fluoride (as F)	mg / l	1.5	0.27	0.30
20.	Free Ammonia (as NH3)	mg / l	-	<1.0	<1.0
21.	Copper as(Cu)	mg / l	1.5	< 0.02	< 0.02
22.	Manganese as (Mn)	mg / l	-	0.09	0.10
23.	Cadmium as (Cd)	mg / l	0.01	< 0.001	< 0.001
24.	Selenium (as Se)	mg / l	0.05	< 0.001	< 0.001

25.	Arsenic as (As)	mg / l	0.2	< 0.01	< 0.01
26.	Mercury as (Hg)	mg / l	-	< 0.0003	< 0.0003
27.	Lead as (Pb)	mg / l	0.1	< 0.005	< 0.005
28.	Zinc as (Zn)	mg / l	15	< 0.3	< 0.3
29.	Boron as (B)	mg / l	-	< 0.1	< 0.1
30.	Chromium as (Cr +6)	mg / l	0.05	< 0.03	< 0.03
31.	Cyanide as (CN)	mg / l	0.05	< 0.005	< 0.005
32.	Phenolic Compounds	mg / l	0.005	< 0.001	< 0.001
33.	Anionic Detergents as MBAS	mg / l	1	< 0.001	< 0.001
34.	Total Coliform	MPN/100 ml	Nil	< 0.001	< 0.001
35.	Faecal Coliform	MPN/100 ml	Nil	Absent	Absent
36.	Polynuclear aromatic Comp (as PAH)	ppb	-	Absent	Absent

Annexure –8
Public Hearing Details

Soil Quality Test report of Amkroh Limestone Mine

Name of project: Amkroh Limestone Mine (Shri Solomon Gassah)
At-Amkroh, Elaka Nongtalang, Jowai
District- West Jaintia Hills, State- Meghalaya

Date of Sampling: 27.02.2021; **Date of Analysis:** 03.03.2021-09.03.2021

Details of client: Indian Mine Planners & Consultants
GE-61, Rajdanga Main Road, EM- Bypass, Kolkata- 700107

S.N.	Parameters	Unit	Core Zone of Solomon Gassah (S1)	Near Jowai-Dawki (NH-40)(S2)	Khonglah Village (S3)	Pamtbuh Village (S4)	Pdengkseh Village (S5)
1	Texture	-	Loamy Sand	Clay Loam	Loamy Sand	Loamy Sand	Loamy Sand
2	pH	-	6.58	6.76	6.43	6.62	6.71
3	% Moisture	%	6.3	7.4	6.8	6.9	7.0
4	Total Alkalinity	mg/kg	328	333	339	328	338
5	Bulk Density	gm/cm^3	1.52	1.47	1.43	1.44	1.47
6	Infiltration Rates	cm/hr	44	38	41	46	40
7	Nitrogen	mg/100g	27.40	29.20	27.40	26.10	25.20
8	Phosphorus	mg/100g	0.83	0.69	0.77	0.83	0.79
9	Chloride	%	0.069	0.077	0.081	0.084	0.069
10	Sulphate	%	0.030	0.033	0.039	0.036	0.040
11	Carbonate	mg/100g	2.20	1.80	1.80	1.82	1.78
12	Electrical Conductivity	µs/sec	349.0	359.0	374.0	366.0	348.0
13	Salinity	PPT	0.041	0.042	0.044	0.041	0.039
14	Total Organic Carbon	%	1.47	1.44	1.49	1.56	1.49
15	Total Sulphur	%	0.023	0.024	0.019	0.019	0.023
16	Sodium Absorption Ratio		0.3488	0.3390	0.3421	0.3564	0.3479
17	Boron as B	mg/Kg	BDL	BDL	BDL	BDL	BDL
18	Potassium	mg/100g	0.52	0.59	0.64	0.63	0.67
19	Calcium as Ca	meq/100g	1.70	2.30	2.40	2.38	2.44
20	Magnesium as Mg	meq/100g	3.7	3.5	4.1	4.1	3.8

Annexure –10
Land Use Details

POPULATION AND LANDUSE OF STUDY AREA, CENSUS 2011 (Ha.)																			
AMKROH LIMESTONE MINE OF SHRI SOLOMON GASSAH IN DISTT. JAINTIA HILLS, MEGHALAYA																			
Town/ village code	**Town/village name**	**Population**	**Total area**	**Forest land**	**Area under Non-Agricultural Uses**	**Barren & Un-cultivable Land**	**Permanent Pastures and Other Grazing Land**	**Land Under Misc. Tree Crops etc.**	**Culturable Waste Land**	**Fallows Land other than Current Fallows**	**Current Fallows**	**Net Area Sown**	**Total Unirrigated Land**	**Area Irrigated by Source**	**Canals**	**Wells/ Tube Wells**	**Tanks/ Lakes**	**Waterfall**	**Other Source**
District	**East Khasi Hills**																		
Sub District	**Mawkynrew**																		
278494	Nongryngkoh	943	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
278495	New Nongryngkoh	276	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
278497	Nonghulew	593	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Sub total	**1812**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
District	**Jaintia Hills**																		
Sub District	**Amlarem**																		
279297	Shken Talang	921	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279307	Amshipai	295	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279308	Ammutong	397	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279309	Shmiashyiang	53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279310	Pamtadong	85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279311	Mawlong	307	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279312	Padu Mawsku	549	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279313	Padubah	1396	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279314	Amtapoh	389	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279315	Dapdeng	60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279316	Khonglah	1300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279317	Nongbareh Rim	752	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279318	Mawngap	197	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279319	Pdengkarong	316	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279320	Amlarang	56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279321	Pamtbuh	570	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

279322	Jaralood	204	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279323	Amtasam	161	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279324	Amlamet	44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279325	Lurniang	77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279326	Pdengshakap	1472	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279327	Wahrong	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279328	Nongbareh Lyntiar	597	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279329	Kudeng Rim	467	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279330	Amkoi	649	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279331	Kudeng Thymmai	360	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279332	Amjajer Roko	180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279333	Sohkha Shnong	691	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279334	Lamin	1508	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279335	Shnongpdeng	655	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279336	Sohkha Mission	554	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279337	Sohkha Phlang	38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279338	Wahlyngdoh	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279339	Pdengkseh	176	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279340	Nongtalang Main	2401	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279341	Amsohmahalen g	156	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279342	New Nonglamin	164	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279343	Nongtalang Mission	591	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279344	Nongtalang Thymmai	175	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279345	Sohkha Model	326	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279346	Lymba	145	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279347	Kongwang	59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279348	Darang	1234	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279349	Dawki	483	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279350	Bakur	1911	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279351	Latang	32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279352	Tamabil	48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279353	Amdoh	118	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279354	Riahjalong	82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279355	Rhongkum	91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279356	Jong - u - Shen	503	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279357	Twah - u - Sdiah	420	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279358	Amsohtai	424	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279359	Amlari Rim	117	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279360	Amlari Model	367	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279361	Satpator	662	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

279362	Tarangblang	859	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279363	Syndai Kmaishnong	706	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279364	Syndai Lyngkot	215	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279365	Syndai Mission	413	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279366	Amjalong	484	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279367	Amlympiang	173	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279368	Amsku	129	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
279369	Bhoi Kyrweng	155	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Sub total	**29129**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
	GRAND TOTAL	**30941**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Name of project: Amkroh Limestone Mine (Sri Solomon Gassah)
At- Amkroh, Elaka Nongtalang, Dawki, Dist. West Jaintia Hills
Meghalaya

Date of Sampling: Given Below

Details of client: Indian Mine Planners & Consultants
GE-61, Rajdanga Main Road, EM- Bypass
Kolkata- 700107

S. No.	Locations	Class	L_{eq} noise level dB(A)	Maximum noise level dB(A)	Day time (6.00 A.M to 10.00P.M)	Night time (10.00 P.M to 6.00A.M)
					Standard (L_{eq} in dB(A)	Standard (L_{eq} in dB(A)
ANL1	**Core Zone**	Project Area	53.7	60.0	54.9	39.6
ANL2	**Near Jowai-Dawki (NH-40)**	Commercial	54.7	61.6	55.9	40.8
ANL3	**Khonglah Village**	Residential	53.7	58.8	54.8	40.4
ANL4	**Pamtbuh Village-I**	Residential	53.9	59.8	54.6	41.7
ANL5	**Pdenkarong Village**	Residential	53.8	59.4	54.6	41.4
ANL6	**Pamtbuh Village-II**	Residential	53.5	59.0	54.4	40.6
ANL7	**Pamtadong Village**	Residential	52.1	58.1	53.1	40.5
ANL8	**Pdengkseh Village**	Residential	53.6	59.4	54.6	40.6

Location	**Core Zone**	**Near Jowai-Dawki (NH-40)**	**Khonglah Village**	**Pamtbuh Village-I**	**Pdenkarong Village**	**Pamtbuh Village-II**	**Pamtadong Village**	**Pdengkseh Village**
Monitoring Date	**09 to 10 Dec 2020**	**09 to 10 Dec 2020**	**22 to 23 Jan 2021**	**08 to Jan Dec 2021**	**09 to 10 Dec 2020**	**08 to Jan Dec 2021**	**22 to 23 Jan 2021**	**22 to 23 Jan 2021**
Time	**Reading (In dB)**	**Reading (In dB)**	**Reading (In dB)**	**Reading (In dB)**	**Reading (In dB)**	**Reading (In dB)**	**Reading (In dB)**	**Reading (In dB)**
6.00	42.0	40.1	40.4	40.6	41.0	40.8	36.1	40.7
7.00	42.5	41.3	41.8	42.5	42.8	42.1	38.3	42.3
8.00	44.6	43.6	43.8	44.4	44.2	44.4	40.0	44.0
9.00	48.4	47.2	48.5	48.8	48.9	48.6	45.1	48.7
10.00	50.8	49.6	49.2	48.0	48.4	48.8	47.2	50.4
11.00	**55.4**	54.2	**55.6**	**56.6**	**56.4**	**55.8**	52.0	**56.0**
12.00	**57.8**	56.6	**56.2**	**55.0**	**55.4**	**55.8**	54.2	**55.8**
13.00	**60.0**	58.8	**58.2**	**56.4**	**57.0**	**57.6**	55.2	**59.4**
14.00	**57.0**	58.2	**58.6**	**59.8**	**59.4**	**59.0**	54.8	**57.4**
15.00	54.8	56.0	**55.2**	**57.2**	**56.8**	**55.6**	53.6	**56.0**
16.00	**57.9**	60.3	**57.7**	**57.5**	**57.3**	**57.9**	57.1	**57.9**
17.00	**57.9**	61.6	**57.9**	**56.0**	**55.5**	54.7	58.1	**55.0**
18:00	**56.2**	57.4	**57.6**	**56.9**	**57.6**	**56.9**	53.7	**56.9**
19:00	52.0	53.2	52.8	51.6	52.0	52.4	49.8	52.4
20:00	47.8	49.0	48.1	49.6	49.3	48.4	52.3	48.7
21:00	47.6	48.8	47.7	48.2	48.1	47.8	52.9	47.9
22:00	43.3	44.5	43.9	**46.9**	**46.3**	44.5	48.1	**45.1**
23:00	39.1	40.3	40.1	39.5	39.7	39.9	36.1	38.9
24:00	38.8	40.0	40.5	42.0	41.5	41.0	35.5	41.0
01.00	38.6	39.8	39.5	38.6	38.9	39.2	35.5	38.3
02.00	39.0	40.2	35.2	34.0	34.2	34.7	35.7	34.7
03.00	38.4	39.6	39.4	38.3	38.6	38.8	35.0	38.2
04:00	38.1	39.3	39.9	41.7	41.1	40.5	34.7	40.5
05:00	38.6	39.8	40.2	41.4	41.0	40.6	35.4	40.6

Annexure –12
Demography

VILLAGE WISE POPULATION AND LITERACY WITHIN 10KM STUDY AREA (CENSUS 2011)														
AMKROH LIMESTONE MINE OF SHRI SOLOMON GASSAH IN DISTT. JAINTIA HILLS, MEGHALAYA														
Town/	**Town/village**	**No. of**	**Population break-up**			**Population (0-6 years)**			**Schedule**	**Schedule**	**Literacy level**			**Employment pattern**
village	**name**	**house-**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	**Caste**	**Tribe**	**Total**	**Male**	**Female**	**Total**
code		**holds**									**literates**	**literates**	**literates**	**workers**
District	**East Khasi Hills**													
Sub District	**Mawkynrew**													
278494	Nongryngkoh	214	943	473	470	191	90	101	0	941	504	228	276	391
278495	New Nongryngkoh	67	276	130	146	53	29	24	0	271	206	98	108	119
278497	Nonghulew	117	593	296	297	156	76	80	0	579	309	142	167	251
	Sub total	**398**	**1812**	**899**	**913**	**400**	**195**	**205**	**0**	**1791**	**1019**	**468**	**551**	**761**
District	**Jaintia Hills**													
Sub District	**Amlarem**													
279297	Shken Talang	152	921	476	445	224	133	91	4	900	541	249	292	312
279298	Jarain	231	1603	806	797	369	194	175	0	1580	524	216	308	520
279299	Ladjaplem	16	141	80	61	14	7	7	0	141	111	61	50	34
279300	Umladkhur	185	1247	622	625	292	145	147	1	1239	668	310	358	428
279301	Thangbuli	247	1654	861	793	383	205	178	0	1643	1057	505	552	577
279302	Amsarim	35	174	77	97	42	23	19	0	163	93	40	53	60
279303	Amlarem	118	658	320	338	161	68	93	0	647	280	136	144	220
279304	Krangpamtadong	40	179	84	95	45	17	28	0	179	26	9	17	49
279305	Khliehamkshar	32	162	76	86	35	12	23	0	161	65	32	33	50
279306	Amsyrwai	23	117	62	55	35	14	21	0	117	36	22	14	33
279307	Amshipai	58	295	138	157	74	32	42	0	291	79	31	48	113
279308	Ammutong	62	397	196	201	77	47	30	0	395	137	39	98	181

279309	Shmiashyiang	13	53	28	25	10	8	2	0	53	14	4	10	19
279310	Pamtadong	19	85	44	41	17	11	6	0	85	14	3	11	31
279311	Mawlong	54	307	156	151	51	23	28	0	305	148	59	89	121
279312	Padu Mawsku	107	549	260	289	126	60	66	0	537	388	189	199	246
279313	Padubah	255	1396	658	738	274	132	142	0	1379	575	248	327	872
279314	Amtapoh	71	389	201	188	77	38	39	0	388	249	115	134	137
279315	Dapdeng	11	60	32	28	17	7	10	0	60	32	18	14	19
279316	Khonglah	219	1300	642	658	207	107	100	0	1295	750	353	397	548
279317	Nongbareh Rim	136	752	371	381	130	58	72	0	752	514	269	245	482
279318	Mawngap	37	197	89	108	47	22	25	0	197	123	48	75	85
279319	Pdengkarong	57	316	151	165	83	31	52	0	310	128	66	62	80
279320	Amlarang	13	56	28	28	14	7	7	0	56	22	8	14	21
279321	Pamtbuh	103	570	285	285	169	79	90	0	569	172	59	113	281
279322	Jaralood	49	204	111	93	57	32	25	0	204	114	56	58	85
279323	Amtasam	39	161	85	76	36	22	14	0	160	108	55	53	69
279324	Amlamet	7	44	22	22	10	5	5	0	44	30	13	17	14
279325	Lurniang	13	77	43	34	19	12	7	0	77	51	27	24	29
279326	Pdengshakap	257	1472	728	744	336	176	160	1	1463	620	268	352	811
279327	Wahrong	3	9	5	4	0	0	0	0	9	7	4	3	1
279328	Nongbareh Lyntiar	131	597	289	308	89	35	54	0	597	422	204	218	293
279329	Kudeng Rim	90	467	223	244	87	42	45	0	467	294	143	151	223
279330	Amkoi	107	649	311	338	125	60	65	0	649	414	193	221	293
279331	Kudeng Thymmai	51	360	184	176	55	31	24	0	360	239	126	113	135
279332	Amjajer Roko	34	180	101	79	47	29	18	0	180	80	39	41	76
279333	Sohkha Shnong	106	691	361	330	76	37	39	0	341	556	301	255	354
279334	Lamin	229	1508	734	774	188	91	97	1	1502	1188	589	599	625
279335	Shnongpdeng	126	655	326	329	138	66	72	0	650	390	199	191	290
279336	Sohkha Mission	90	554	279	275	56	30	26	0	553	474	236	238	175
279337	Sohkha Phlang	7	38	26	12	6	5	1	0	37	32	21	11	26
279338	Wahlyngdoh	1	1	1	0	0	0	0	0	1	1	1	0	0
279339	Pdengkseh	37	176	87	89	47	22	25	0	174	85	45	40	78
279340	Nongtalang Main	391	2401	1127	1274	371	189	182	2	1567	1466	681	785	892
279341	Amsohmahaleng	21	156	81	75	32	18	14	0	155	94	48	46	50
279342	New Nonglamin	25	164	80	84	29	15	14	0	162	96	43	53	55
279343	Nongtalang Mission	104	591	285	306	88	39	49	1	571	437	212	225	170

279344	Nongtalang Thymmai	29	175	89	86	39	24	15	0	175	97	45	52	53
279345	Sohkha Model	63	326	167	159	38	18	20	0	323	282	148	134	205
279346	Lymba	24	145	76	69	25	13	12	0	144	105	56	49	13
279347	Kongwang	13	59	31	28	6	3	3	0	59	46	26	20	37
279348	Darang	210	1234	632	602	181	93	88	0	1229	898	471	427	309
279349	Dawki	79	483	255	228	59	29	30	5	404	353	202	151	214
279350	Bakur	349	1911	976	935	299	155	144	210	1527	1356	720	636	903
279351	Latang	1	32	32	0	0	0	0	0	0	32	32	0	32
279352	Tamabil	12	48	27	21	8	5	3	0	10	18	10	8	14
279353	Amdoh	21	118	63	55	27	16	11	0	97	35	18	17	40
279354	Riahjalong	15	82	55	27	15	6	9	0	11	39	34	5	40
279355	Rhongkum	19	91	53	38	12	7	5	4	70	59	36	23	42
279356	Jong - u - Shen	98	503	244	259	94	44	50	0	502	293	132	161	198
279357	Twah - u - Sdiah	83	420	215	205	92	45	47	0	416	201	104	97	151
279358	Amsohtai	90	424	220	204	101	56	45	0	421	183	84	99	192
279359	Amlari Rim	27	117	54	63	24	11	13	0	116	70	32	38	67
279360	Amlari Model	77	367	186	181	67	38	29	0	366	185	86	99	200
279361	Satpator	120	662	312	350	146	58	88	0	660	410	195	215	390
279362	Tarangblang	135	859	402	457	162	74	88	0	858	651	308	343	303
279363	Syndai Kmaishnong	148	706	329	377	165	90	75	0	702	390	166	224	286
279364	Syndai Lyngkot	47	215	91	124	46	19	27	0	215	107	40	67	99
279365	Syndai Mission	76	413	195	218	75	37	38	0	413	305	145	160	166
279366	Amjalong	96	484	243	241	96	51	45	0	481	317	160	157	217
279367	Amlympiang	31	173	101	72	29	11	18	4	26	122	79	43	116
279368	Amsku	26	129	61	68	21	6	15	0	108	54	30	24	102
279369	Bhoi Kyrweng	33	155	83	72	32	17	15	0	85	56	34	22	90
	Sub total	**6134**	**35064**	**17424**	**17640**	**6724**	**3362**	**3362**	**233**	**32783**	**20608**	**9986**	**10622**	**14742**
	GRAND TOTAL	**6532**	**36876**	**18323**	**18553**	**7124**	**3557**	**3567**	**233**	**34574**	**21627**	**10454**	**11173**	**15503**
	Percentage		**100.00**	**49.69**	**50.31**	**19.32**	**9.65**	**9.67**	**0.63**	**93.76**	**58.65**	**28.35**	**30.30**	**42.04**

Calculation of ground level concentrations using Aermod model

LIST OF FLORA IN THE STUDY AREA FOR OPEN CAST STONE MINING PROJECT (60391 TPA IN 1.25 HA) OF SRI SOLOMON GASSAH LOCATED AT AMKROH, ELAKA- NONGTALANG, JOWAI, DISTRICT-WEST JANTIA HILLS, STATE- MEGHALAYA

Sl. No.	Botanical Name	Common Name	Family
	Trees		
1.	*Acacia auriculiformis*	Australian wattle	Mimosaceae
2.	*Actinodaphne obovata*		Lauraceae
3.	*Ailanthus grandis*	Lalong-baiong	Simaroubaceae
4.	*Alangium chinensis*		Cornaceae
5.	*Albizia lucida*	Siris	Mimosaceae
6.	*Albizia lebbeck*	Safed siris	Mimosaceae
7.	*Alstonia scholaris*	Diend-ryteng	Apocynaceae
8.	*Anthocephalus chinense*		Rubiaceae
9.	*Aralia armata*	Dieng-la-tymphu	Araliaceae
10.	*Ardisia nerifolia*		Myrsinaceae
11.	*Artocarpus heterophyllus*	Sohphan	Moraceae
12.	*Azadirachta indica*	Neem	Meliaceae
13.	*Bauhinia acuminata*		Caesalpiniaceae
14.	*Bauhinia purpurea*	Kachnar	Caesalpiniaceae
15.	*Bischofia javanica*		Bischofiaceae
16.	*Bombax ceiba*	Semal	Bombacaceae
17.	*Bridelia tomentosa*		Euphorbiaceae
18.	*Butea monosperma*	Palas	Papilionaceae
19.	*Callicarpa arborea*	Dieng-lakhoit	Verbenaceae
20.	*Carallia branchiata*		Rhizophoraceae
21.	*Caryota urens*		Palmae
22.	*Castanopsis indica*		Fagaceae
23.	*Castanopsis tribuloides*		Fagaceae
24.	*Cinnamomum bezolghota*		Lauraceae
25.	*Cinnamomum obtusifolium*		Lauraceae
26.	*Cyathea sp.*		Leguminosae
27.	*Cynometra polyandra*		Fabaceae
28.	*Dalbergia sp.*		Papilionaceae
29.	*Dalbergia sisso*	Shisham	Papilionaceae
30.	*Duabanga grandiflora*		Sonneratiaceae
31.	*Delonix regia*	Gulmohar	Caesalpiniaceae
32.	*Drypetes assamica*	Tyrkhang	Putranjivaceae
33.	*Dysoxylum binectariferum*		Meliaceae
34.	*Elaeocarpus aristatus*	Dieng-thang-khapiah	Eleocarpaceae
35.	*Elaeocarpus sp.*		Eleocarpaceae
36.	*Englegardtia spicata*	Dieng-lyba	Juglanaceae
37.	*Exbucklandia populnea*	Dieng-sohmyndot	Hammamelidaceae
38.	*Ficus benghalensis*	Bad	Moraceae
39.	*Ficus elmeri*	Dieng-jri	Moraceae
40.	*Ficus geniculata*		Moraceae
41.	*Ficus hispida*	Kathgular	Moraceae
42.	*Ficus religiosa*	Peepal	Moraceae
43.	*Ficus rumphii*		Moraceae
44.	*Garuga gamblei*		Burseraceae

Sl. No.	Botanical Name	Common Name	Family
45.	*Ficus sp.*	Dieng-jri	Moraceae
46.	*Garcinia acuminata*		Clusiaceae
47.	*Gmelina arborea*	Dieng-laphiang	Verbinaceae
48.	*Grewia disperma*	Dieng-tiewser	Tiliaceae
49.	*Grewia sp.*		Tiliaceae
50.	*Hevea brasiliensis*	Dieng-jri	Hernandiaceae
51.	*Hydnocarpus kurzii*	Flacourtiaceae	Dieng-sohlap
52.	*Lagerstroemia parviflora*	Senha	Lythraceae
53.	*Leucaena leucocephala*	Subabool	Mimosaceae
54.	*Licuala peltata*		Arecaeae
55.	*Litsaea sebifera*	Dieng-ja-lowan	Lauraceae
56.	*Litsea citrita*	Dieng-si-ing	Lauraceae
57.	*Litsea laeta*		Lauraceae
58.	*Litsea salicifolia*	Dieng-lali	Lauraceae
59.	*Litsea sp.*		Lauraceae
60.	*Macaranga denticulata*		Euphorbiaceae
61.	*Macropanax disperma*	Dieng-ia-rasi	Analiaceae
62.	*Magnolia hodgsonii*		Magnoliaceae
63.	*Mallotus tetracoccus*		Euphorbiaceae
64.	*Mangifera indica*	Aam	Anacardiaceae
65.	*Meliosma sp.*		Meliaceae
66.	*Oroxylum indicum*	Dieng-kawait-blai	Bigoniaceae
67.	*Ostodes paniculata*		Euphorbiaceae
68.	*Pandanus sp.*		Pandanaceae
69.	*Persea sp.*		Lauraceae
70.	*Pithecellobium sp.*	Leguminosae	Dieng-iap-iar
71.	*Pongamia pinnata*	Karanz	Papilionaceae
72.	*Premna milleflora*	Verbenaceae	Dieng-phonri
73.	*Prunus acuminata*	Rosaceae	Dieng-soh-iong-blei
74.	*Psidium guajava*	Amrud	Myrtaceae
75.	*Pterospermum acerifolium*	Dieng-tharo-masi	Sterculiaceae
76.	*Pterospermum lancifolium*		Sterculiaceae
77.	*Quercus lancifolia*	Dieng-sningrit, Dieng-patlua	Fagaceae
78.	*Quercus spicata*		Fagaceae
79.	*Rhus javanica*		Anacardiaceae
80.	*Sapium baccatum*	Dieng-jalong	Euphorbiaceae
81.	*Sarcosperma griffithii*	Dieng-ja-lytpai, Dieng-kymbu-blang	Sapotaceae
82.	*Saurauia roxburghii*	Dieng-soh-la-pied	Ternstroemiaceae
83.	*Saurauia sp.*	Ternstroemiaceae	Actinidiaceae
84.	*Schima wallichii*	Dieng-shyr-ngan	Theaceae
85.	*Shima sp.*		Theaceae
86.	*Spondias pinnata*	Amera	Anacardiaceae
87.	*Sterculia villosa*		Malvaceae
88.	*Streospermum chelenoides*	Bigoniaceae	Dieng-phsiar
89.	*Strobilanthus anisophyllus*		Acanthaceae

Sl. No.	Botanical Name	Common Name	Family
90.	*Symplocos racemosa*		Symplocaceae
91.	*Syzygium cumini*	Soh-um	Myrtaceae
92.	*Syzygium sp.*	Soh-um	Myrtaceae
93.	*Terminalia bellerica*	Bahera	Combretaceae
94.	*Terminalia chebula*	Diengsoh-khoru	Combretaceae
95.	*Terminalia myriocarpa*		Combretaceae
96.	*Tetrameles nudiflora*		Combretaceae
97.	*Toona ciliata*		Tetramelaceae
98.	*Toona febrifuga*		Meliaceae
99.	*Travesia palmata*		Araliaceae
100.	*Trema orientalis*	Dieng-lattar	Ulmaceae
101.	*Villebrunea frutescens*		Urticaceae
102.	*Vitex negundo*	Sinwar	Verbenaceae
103.	*Vitex pedunculata*		Verbenaceae
104.	*Vitex sp.*		Verbenaceae
105.	*Wallichii densiflora*		
106.	*Wendlandia paniculata*	Deing-ja-lakba	Rubiaceae
107.	*Xerospermum sp.*	Diengsoh-moniar-shree	Sapindaceae
	Shrubs		
1.	*Ageratum conyzoides*		Asteraceae
2.	*Allamanda cathartica*		Apocynaceae
3.	*Allophylus sp.*		Sapindaceae
4.	*Alpinia sp.*		Zingiberaceae
5.	*Amblyanthus grandulosus*		Primulaceae
6.	*Ardisia crispa*		Primulaceae
7.	*Ardisia nerifolia*		Primulaceae
8.	*Ardisia paniculata*		Primulaceae
9.	*Aroides sp.*		
10.	*Baliospermum montana*	Lasem-dumuin	Euphorbiaceae
11.	*Baliospermum sp.*		Euphorbiaceae
12.	*Boehmaria sp.*		Urticaceae
13.	*Breynia patens*		Phyllanthaceae
14.	*Breynia vitis-idaea*		Phyllanthaceae
15.	*Buddleja asiatica*		Scrophulariaceae
16.	*Calotropis gigantia*	Aak	Asclepiadaceae
17.	*Calotropis procera*		Asclepiadaceae
18.	*Cassia alata*	Candlebush	Caesalpiniaceae
19.	*Cassia tora*	Pomvar	Caesalpiniaceae
20.	*Cassia occidentalis*		Caesalpiniaceae
21.	*Citrus sp.*		Rutaceae
22.	*Clerodendron colebrookianum*	Syntiew-dohmahi	Verbenaceae
23.	*Clerodendron viscosum*		Verbenaceae
24.	*Clerodendrum sp.*		Lamiaceae
25.	*Clorophytum khasianum*		Asparagaceae
26.	*Coffea sp.*	Ja-laryngksang	Rubiaceae
27.	*Coix lacryma-jobi*		Poaceae
28.	*Datura metal*	Dhatura	Solanaceae

Sl. No.	Botanical Name	Common Name	Family
29.	*Dendrocalamus hamiltonii*	Siej	Gramineae
30.	*Dendrocnide sinuate*		Urticaceae
31.	*Dracaena angustifolia*		Asparagaceae
32.	*Elaegnus conferta*		Elaegnaceae
33.	*Eupatorium odoratum*		Asteraceae
34.	*Helixanthera ligustrina*		Loranthaceae
35.	*Hibiscus macrophyllus*	Tyllen-dkhar	Malvaceae
36.	*Holmskioldia sanguinea*		Lamiaceae
37.	*Homonoia riparia*		Euphorbiaceae
38.	*Hymenodictyon sp.*		Rubiaceae
39.	*Ilex sp.*		Aquifoliaceae
40.	*Jasminium sp.*		Oleaceae
41.	*Jatropha curcas*	Ratanjot	Euphorbiaceae
42.	*Lantana camara*	Raimunia	Verbenaceae
43.	*Leea aspera*		Vitaceae
44.	*Leea indica*		Vitaceae
45.	*Manihot esculenta*		Euphorbiaceae
46.	*Melastoma malabathricum*		Melastomataceae
47.	*Morinda angustifolia*		Rubiaceae
48.	*Mussaenda roxburghii*		Rubiaceae
49.	*Nyctanthus arbortristis*	Harsingar	Oleaceae
50.	*Ocimum gratissimum*	Banatulsi	Labiatae
51.	*Ophiorrhiza sp.*		Rubiaceae
52.	*Phoenix sylvestris*	Chhind	Palmae
53.	*Rauwolfia serpentine*		Apocynaceae
54.	*Rubus alceifolius*		Rosaceae
55.	*Rubus ellipticus*		Rosaceae
56.	*Rubus lucens*		Rosaceae
57.	*Saccharum spontaneum*		Andorpogonaceae
58.	*Saccharum arundinaceum*		Poaceae
59.	*Salamona sp.*		
60.	*Saurauia sp.*		Actinidiaceae
61.	*Scoperia dulcis*		Plantaginaceae
62.	*Sida rhombifolia*		Malvaceae
63.	*Solanum torvum*		Solanaceae
64.	*Strobilanthes anisophyllus*		Acanthaceae
65.	*Xerospermum glabratum*		Sapindaceae
	Herbs		
1.	*Alternanthera sessilis*		Amaranthaceae
2.	*Amaranthus spinosus*	chaulii	Amaranthaceae
3.	*Amaranthus viridis*		Amaranthaceae
4.	*Ambrosia artemesifolia*		Asteraceae
5.	*Amischotolype mollissima*		Commelinaceae
6.	*Amorphophalus bulbifera*		Araceae
7.	*Amorphophalus sp.*		Araceae
8.	*Arundina graminifolia*		Orchidaceae
9.	*Begonia hatacoa*	Jajew	Begoniaceae

Sl. No.	Botanical Name	Common Name	Family
10.	*Begonia sp*		Begoniaceae
11.	*Bidens biternata*		Asteraceae
12.	*Bidens pilosa*		Asteraceae
13.	*Blachnum sp.*		Asteraceae
14.	*Boehmeria glomerulifera*		Urticaceae
15.	*Boehmeria sp.*	Diengsoh-khar, thynrait	Urticaceae
16.	*Calamus flagellum*		Arecaceae
17.	*Calamus leptospadix*		Arecaceae
18.	*Carax cruciata*		Cyperaceae
19.	*Castos speciosus*		
20.	*Chenopodium sp.*		Chenopodiaceae
21.	*Coleus sp.*	Labiateae	Lamiaceae
22.	*Commelina benghalensis*	Kankawa	Commelinaceae
23.	*Commelina sp.*		Commelinaceae
24.	*Crassocephalum crepidioides*		Asteraceae
25.	*Cyathula prostrate*		Amaranthaceae
26.	*Dichrocephala integrifolia*		Asteraceae
27.	*Dracena trifasciata*	Snake Plant	Asparagaceae
28.	*Drymeria diandra*		Poaceae
29.	*Diplezium esculentum*		Athyriaceae
30.	*Elatostema monandrum*	Ja-ew	Urticaceae
31.	*Eleusine indica*		Poaceae
32.	*Erigeron Canadensis*		Compositae
33.	*Eupatorium adenophorum*	Kynbat-nongrim	Compositae
34.	*Eupatorium odoratum*		Asteraceae
35.	*Euphorbia hirta*	Dudhi bel	Euphorbiaceae
36.	*Euphorbia sp.*	Prostrate sandmat	Euphorbiaceae
37.	*Fagopyrum dibotrys*		Polygonaceae
38.	*Fimbristylis dichotoma*		Cyperaceae
39.	*Floscopa scandens*		Commelinaceae
40.	*Fagopteris auriculata*		
41.	*Ferns sp.*	Tyrkhang	
42.	*Forrestia sp.*		
43.	*Globba multiflora*		Zingiberaceae
44.	*Globba clarkeii*		Zingiberaceae
45.	*Hedychium sp.*		Zingiberaceae
46.	*Jasminum sp.*	Mei-lar-um	Oleaceae
47.	*Laportea crenulata*	Dieng-synrem	Urticaceae
48.	*Leea indica*		Ampelidaceae
49.	*Leea sp.*		Ampelidaceae
50.	*Licuala peltata*		Arecaceae
51.	*Luduwigia octovalis*		Onagraceae
52.	*Lycopodium sp.*	Tmain-khla	Lycopodiaceae
53.	*Maesa indica*	Diengsoh-jala-tyrkai	Myrsinaceae
54.	*Maesa sp.*		Myrsinaceae
55.	*Melastoma malabathricum*	Soh-khing	Melastomaceae
56.	*Mannihot esculenta*		Euphorbiaceae

Sl. No.	Botanical Name	Common Name	Family
57.	*Mimosa himalayana*		Leguminosae
58.	*Morinda angustifolia*	Dieng-shongrei	Rubiaceae
59.	*Musa sp.*	Lakait	Musaceae
60.	*Osbeckia sp.*	Soh-kthem	Melastomaceae
61.	*Osbekia crenata*	Jalang-kthem	Melastomaceae
62.	*Oscimum sanctum*	Tulsi	Labiatae
63.	*Oxalis corniculata*	Jajew	Oxalidaceae
64.	*Oxyspora sp.*	Tiew-sohkthem	Melastomaceae
65.	*Ophiorrhiza sp.*		Rubiaceae
66.	*Phrynium capitata*		Marantaceae
67.	*Phrynium pubenervae*		Marantaceae
68.	*Pinanga gracilis*		Arecaceae
69.	*Polygonum chinense*		Polygonaceae
70.	*Pteris sp.*	Tyrkhang	Pteridaceae
71.	*Randia sp.*	Sohladung	Rubiaceae
72.	*Rhynchotecum ellipticum*	Sieng-ia-mahek	Gesneraceae
73.	*Rubus rugosus*		Rosaceae
74.	*Rungia sp.*		Acanthaceae
75.	*Scoparia dulcis*		Plantaginaceae
76.	*Selaginella monospora*		Selagenaceae
77.	*Selaginella sp.*		Selaginellaceae
78.	*Solanum torvum*	Soh-nang	Solanaceae
79.	*Spilanthus paniculata*		Asteraceae
80.	*Tabernaemontana divericata*		Apocynaceae
81.	*Thysanolaena maxima*	Synsar	Thysanolaceae
82.	*Trevesia palmata*	Soh-kynthur	Araliaceae
83.	*Triumfetta pilosa*	Soh-byrthid	Liliaceae
84.	*Urena lobata*	Soh-byrthit	Malvaceae
85.	*Wallichia densiflora*		Arecaceae
86.	*Sida acuta*		Malvaceae
87.	*Sida cordata*	Bhuinii	Malvaceae
88.	*Spilanthes paniculata*		Asteraceae
89.	*Tridax procumbens*		Asteraceae
90.	*Vernonia cineraria*		Asteraceae
91.	*Viola betonicifolia*		Violaceae
	Climbers		
1.	*Acacia oxyphylla*	Mei-suai	Leguminosae
2.	*Acacia pinnata*	Jermai-sheih-lyngkshiah	Leguminosae
3.	*Acacia prunascens*	Shitli	Leguminosae
4.	*Acampe sp.*		Orchidaceae
5.	*Aeschynanthus sp.*		Gesneraceae
6.	*Agapetes sp.*		Vacciniaceae
7.	*Ampelocissus barbata*		Vitaceae
8.	*Asplenium nidus*		Aspleniaceae
9.	*Bauhinia scandens*		Fabaceae
10.	*Bauhinia vahlii*		Fabaceae
11.	*Byttneria aspera*		Malvaceae

Sl. No.	Botanical Name	Common Name	Family
12.	*Calamus leptospadix*		Arecaceae
13.	*Cayratia pedata*		Vitaceae
14.	*Cissampelos pareira*		Menispermaceae
15.	*Combretum dasystachyum*		Combretaceae
16.	*Cryptolepis sinensis*		Apocynaceae
17.	*Diascorea alata*		Dioscoreaceae
18.	*Diascorea bulbifera*		Dioscoreaceae
19.	*Dendrobium sp.*	Tie-dyeing	Orchidaceae
20.	*Derris sp.*	Diengthing, Diengphulot, Meisohphlang	Leguminosae
21.	*Diascorea sp.*		Dioscoreaceae
22.	*Entada rheedei*		Fabaceae
23.	*Ficus sp.*		Moraceae
24.	*Gnetum scandens*	Jermaisaprah	Gnetaceae
25.	*Hedyotis scandens*	Jylli-iamu-sem	Rubiaceae
26.	*Hodgsonia macrocarpa*		Cucurbitaceae
27.	*Hoya sp.*	Tiew-reng-synreh	Asclepidiaceae
28.	*Ipomea nervosa*		Convolvulaceae
29.	*Jasminium flexile*		Oleaceae
30.	*Leea compactiflora*		Vitaceae
31.	*Luisea sp.*		
32.	*Lygodium flexuosum*		Lygodiaceae
33.	*Lygodium fluxuosa*		Lygodiaceae
34.	*Melocalamus compectiflorus*		Poaceae
35.	*Melothria heterophylla*		Cucurbitaceae
36.	*Merremia umbellata*		Convolvulaceae
37.	*Microsorum sp.*		Polypodiaceae
38.	*Mikania micrantha*		Asteraceae
39.	*Milletia cinerea*		Fabaceae
40.	*Mucuna sp.*		Fabaceae
41.	*Nepenthes khasiana*	Tiew-rakot	Nepenthaceae
42.	*Paederia scandens*		Rubiaceae
43.	*Parabaena sagittata*		Menispermaceae
44.	*Pegia nitida*		Anacardiaceae
45.	*Piper thomsonii*		Piperaceae
46.	*Poikilospermum suaveolens*		Urticaceae
47.	*Porana paniculata*		Convolvulaceae
48.	*Pothos sp.*		Araceae
49.	*Raphidophora decursiva*		Araceae
50.	*Raphidophora lancifolia*	Lapadong	Araceae
51.	*Rubus alceifolius*		Rosaceae
52.	*Scefflera venulosa*		Araliaceae
53.	*Smilex lancifolia*		Smilacaceae
54.	*Tetrastigma angustifolia*		Vitaceae
55.	*Tetrastigma leucostophylum*		Vitaceae
56.	*Tetrastigma serrulatum*		Vitaceae
57.	*Thunbergia grandiflora*	Jyrmi-khnong	Acanthaceae

Sl. No.	Botanical Name	Common Name	Family
58.	*Zizyphus oenoplia*	Makor	Rhamnaceae
	Grasses		
59.	*Apluda mutica*	Phuli	Poaceae
60.	*Bambusa tulda*	Shken, seij	Poaceae
61.	*Cymbopogon martini*	Russa	Poaceae
62.	*Cynodon dactylon*	Doob	Poaceae
63.	*Cyperus compressus*		Cyperaceae
64.	*Cyperus cyperinus*		Cyperaceae
65.	*Cyperus rotundus*	Motha	Cyperaceae
66.	*Dendrocalamus hemiltonii*	seij	Poaceae
67.	*Dendrocalamus strictus*	Bans	Poaceae
68.	*Digitaria bicornis*	Crabgrass	Poaceae
69.	*Heteropogon contortus*	Kushul	Poaceae
70.	*Neohouzeaua helferii*		Poaceae
	Epiphytes		
1.	*Aeschynanthus parasitica*		Gesneriaceae
2.	*Agapetes setigera*		Ericaceae
3.	*Aglaomorpha coronus*		Polypodiaceae
4.	*Asplenium nidus*		Aspleniaceae
5.	*Bulbophyllum careyanum*		Orchidaceae
6.	*Dendrobium densiflorum*		Orchidaceae
7.	*Eria lasiopetala*		Orchidaceae
8.	*Hoya parasitica*		Apocynaceae
9.	*Liparis viridiflora*		Orchidaceae
10.	*Microsorum punctatum*		Polypodiaceae
11.	*Pholidota articulata*		Orchidaceae
12.	*Pathos cathcartii*		Araceae
13.	*Pyrrosia adnascens*		Polypodiaceae
14.	*Pyrrosia flocculosa*		Polypodiaceae
15.	*Rhaphidophora calophyllum*		Araceae
16.	*Rhaphidophora lancifolium*		Araceae
17.	*Rhynchostylis retusa*		Orchidaceae
18.	*Cuscuta reflexa*	Amarbel	Cuscutaceae
19.	*Vanda roxburghaii*	Banda	Orchidaceae
	Hydrophytes		
1.	*Nelumbo nucifera*	Lotus	Nelumbonaceae
2.	*Nymphaea stellata*	Water lily	Nymphaeaceae

LIST OF FLORA IN THE COR ZONE FOR OPEN CAST STONE MINING PROJECT (60391 TPA IN 1.25 HA) OF SRI SOLOMON GASSAH LOCATED AT AMKROH, ELAKA- NONGTALANG, JOWAI, DISTRICT-WEST JANTIA HILLS, STATE- MEGHALAYA

Sl. No.	Botanical Name	Common Name	Family
	Trees		
1.	*Acacia auriculiformis*	Australian wattle	Mimosaceae
2.	*Ailanthus grandis*	Lalong-baiong	Simaroubaceae
3.	*Albizia lebbeck*	Safed siris	Mimosaceae
4.	*Alstonia scholaris*	Diend-ryteng	Apocynaceae
5.	*Bauhinia acuminata*		Caesalpiniaceae
6.	*Callicarpa arborea*	Dieng-lakhoit	Verbenaceae
7.	*Caryota urens*		Palmae
8.	*Castanopsis indica*		Fagaceae
9.	*Elaeocarpus aristatus*	Dieng-thang-khapiah	Eleocarpaceae
10.	*Englegardtia spicata*	Dieng-lyba	Juglanaceae
11.	*Ficus elmeri*	Dieng-jri	Moraceae
12.	*Ficus geniculata*		Moraceae
13.	*Garuga gamblei*		Burseraceae
14.	*Ficus sp.*	Dieng-jri	Moraceae
15.	*Gmelina arborea*	Dieng-laphiang	Verbinaceae
16.	*Litsaea sebifera*	Dieng-ja-lowan	Lauraceae
17.	*Litsea citrita*	Dieng-si-ing	Lauraceae
18.	*Litsea salicifolia*	Dieng-lali	Lauraceae
19.	*Macaranga denticulata*		Euphorbiaceae
20.	*Macropanax disperma*	Dieng-ia-rasi	Analiaceae
21.	*Pongamia pinnata*	Karanz	Papilionaceae
22.	*Pterospermum acerifolium*	Dieng-tharo-masi	Sterculiaceae
23.	*Pterospermum lancifolium*		Sterculiaceae
24.	*Sarcosperma griffithii*	Dieng-ja-lytpai, Dieng-kymbu-blang	Sapotaceae
25.	*Saurauia roxburghii*	Dieng-soh-la-pied	Ternstroemiaceae
26.	*Saurauia sp.*	Ternstroemiaceae	Actinidiaceae
27.	*Schima wallichii*	Dieng-shyr-ngan	Theaceae
28.	*Spondias pinnata*	Amera	Anacardiaceae
29.	*Syzygium cumini*	Soh-um	Myrtaceae
30.	*Syzygium sp.*	Soh-um	Myrtaceae
31.	*Terminalia chebula*	Diengsoh-khoru	Combretaceae
32.	*Terminalia myriocarpa*		Combretaceae
33.	*Tetrameles nudiflora*		Combretaceae
34.	*Trema orientalis*	Dieng-lattar	Ulmaceae
	Shrubs		
1.	*Ageratum conyzoides*		Asteraceae
2.	*Allamanda cathartica*		Apocynaceae
3.	*Amblyanthus grandulosus*		Primulaceae
4.	*Baliospermum montana*	Lasem-dumuin	Euphorbiaceae
5.	*Baliospermum sp.*		Euphorbiaceae
6.	*Calotropis gigantia*	Aak	Asclepiadaceae
7.	*Calotropis procera*		Asclepiadaceae

Sl. No.	Botanical Name	Common Name	Family
8.	*Cassia alata*	Candlebush	Caesalpiniaceae
9.	*Cassia tora*	Pomvar	Caesalpiniaceae
10.	*Cassia occidentalis*		Caesalpiniaceae
11.	*Clerodendron colebrookianum*	Syntiew-dohmahi	Verbenaceae
12.	*Clerodendron viscosum*		Verbenaceae
13.	*Dendrocalamus hamiltonii*	Siej	Gramineae
14.	*Dendrocnide sinuate*		Urticaceae
15.	*Dracaena angustifolia*		Asparagaceae
16.	*Lantana camara*	Raimunia	Verbenaceae
17.	*Ocimum gratissimum*	Banatulsi	Labiatae
18.	*Ophiorrhiza sp.*		Rubiaceae
19.	*Phoenix sylvestris*	Chhind	Palmae
20.	*Saccharum spontaneum*		Andorpogonaceae
21.	*Saccharum arundinaceum*		Poaceae
22.	*Sida rhombifolia*		Malvaceae
	Herbs		
1.	*Amaranthus spinosus*	Chaulii	Amaranthaceae
2.	*Amaranthus viridis*		Amaranthaceae
3.	*Ambrosia artemesifolia*		Asteraceae
4.	*Amorphophalus bulbifera*		Araceae
5.	*Arundina graminifolia*		Orchidaceae
6.	*Begonia hatacoa*	Jajew	Begoniaceae
7.	*Bidens biternata*		Asteraceae
8.	*Bidens pilosa*		Asteraceae
9.	*Boehmeria sp.*	Diengsoh-khar, thynrait	Urticaceae
10.	*Calamus flagellum*		Arecaceae
11.	*Calamus leptospadix*		Arecaceae
12.	*Carax cruciata*		Cyperaceae
13.	*Coleus sp.*	Labiateae	Lamiaceae
14.	*Commelina benghalensis*	Kankawa	Commelinaceae
15.	*Cyathula prostrate*		Amaranthaceae
16.	*Dichrocephala integrifolia*		Asteraceae
17.	*Dracena trifasciata*	Snake Plant	Asparagaceae
18.	*Elatostema monandrum*	Ja-ew	Urticaceae
19.	*Eleusine indica*		Poaceae
20.	*Euphorbia hirta*	Dudhi bel	Euphorbiaceae
21.	*Euphorbia sp.*	Prostrate sandmat	Euphorbiaceae
22.	*Ferns sp.*	Tyrkhang	
23.	*Forrestia sp.*		
24.	*Laportea crenulata*	Dieng-synrem	Urticaceae
25.	*Leea indica*		Ampelidaceae
26.	*Maesa indica*	Diengsoh-jala-tyrkai	Myrsinaceae
27.	*Maesa sp.*		Myrsinaceae
28.	*Melastoma malabathricum*	Soh-khing	Melastomaceae
29.	*Musa sp.*	Lakait	Musaceae
30.	*Oxalis corniculata*	Jajew	Oxalidaceae
31.	*Oxyspora sp.*	Tiew-sohkthem	Melastomaceae

Sl. No.	Botanical Name	Common Name	Family
32.	*Ophiorrhiza sp.*		Rubiaceae
33.	*Phrynium capitata*		Marantaceae
34.	*Phrynium pubenervae*		Marantaceae
35.	*Rubus rugosus*		Rosaceae
36.	*Rungia sp.*		Acanthaceae
37.	*Selaginella sp.*		Selaginellaceae
38.	*Solanum torvum*	Soh-nang	Solanaceae
39.	*Triumfetta pilosa*	Soh-byrthid	Liliaceae
40.	*Urena lobata*	Soh-byrthit	Malvaceae
41.	*Wallichia densiflora*		Arecaceae
42.	*Sida acuta*		Malvaceae
43.	*Sida cordata*	Bhuinii	Malvaceae
44.	*Spilanthes paniculata*		Asteraceae
45.	*Tridax procumbens*		Asteraceae
46.	*Vernonia cineraria*		Asteraceae
47.	*Viola betonicifolia*		Violaceae
	Climbers		
1.	*Acacia pinnata*	Jermai-sheih-lyngkshiah	Leguminosae
2.	*Acacia prunascens*	Shitli	Leguminosae
3.	*Ampelocissus barbata*		Vitaceae
4.	*Asplenium nidus*		Aspleniaceae
5.	*Bauhinia scandens*		Fabaceae
6.	*Bauhinia vahlii*		Fabaceae
7.	*Calamus leptospadix*		Arecaceae
8.	*Cryptolepis sinensis*		Apocynaceae
9.	*Diascorea alata*		Dioscoreaceae
10.	*Diascorea bulbifera*		Dioscoreaceae
11.	*Dendrobium sp.*	Tie-dyeing	Orchidaceae
12.	*Derris sp.*	Diengthing, Diengphulot, Meisohphlang	Leguminosae
13.	*Raphidophora lancifolia*	Lapadong	Araceae
14.	*Rubus alceifolius*		Rosaceae
15.	*Scefflera venulosa*		Araliaceae
16.	*Smilex lancifolia*		Smilacaceae
17.	*Tetrastigma angustifolia*		Vitaceae
18.	*Tetrastigma leucostophylum*		Vitaceae
19.	*Zizyphus oenoplia*	Makor	Rhamnaceae
	Grasses		
1.	*Apluda mutica*	Phuli	Poaceae
2.	*Bambusa tulda*	Shken, seij	Poaceae
3.	*Cymbopogon martini*	Russa	Poaceae
4.	*Cynodon dactylon*	Doob	Poaceae
5.	*Cyperus rotundus*	Motha	Cyperaceae
6.	*Dendrocalamus hemiltonii*	seij	Poaceae
7.	*Dendrocalamus strictus*	Bans	Poaceae
8.	*Digitaria bicornis*	Crabgrass	Poaceae
9.	*Heteropogon contortus*	Kushul	Poaceae

LIST OF FAUNA IN THE STUDY AREA FOR OPEN CAST STONE MINING PROJECT (60391 TPA IN 1.25 HA) OF SRI SOLOMON GASSAH LOCATED AT AMKROH, ELAKA- NONGTALANG, JOWAI, DISTRICT-WEST JANTIA HILLS, STATE- MEGHALAYA

Sl. No.	Scientific name	Common name	Family	Reference to schedule as per Wild Life (Protection) Act 1972, as amended up to 2006
				Schedule
	Mammals			
1.	*Canis aureus*	Jackal	Canidae	II
2.	*Cannomys badius*	Bamboo Rat	Spalacidae	V (LC)
3.	*Callosciurus erythraeus*	Squirrel	Sciuridae	(LC)
4.	*Crocidura attenuata*	Grey Shrew	Soricidae	V(LC)
5.	*Suncus murinus*	House Shrew	Soricidae	(LC)
6.	*Felis chaus*	Jungle cat	Felidae	II
7.	*Funambulus pennanti*	Five striped palm squirrel	Sciuridae	IV
8.	*Funambulus palmarum*	Three striped palm squirrel	Sciuridae	IV(LC)
9.	*Herpestes edwardsi*	Indian Grey Mongoose	Herpestidae	II(LC)
10.	*Lepus nigricollis*	Indian hare	Leporidae	IV
11.	*Lutra Lutra*	Eurassion Otter	Mustelidae	II
12.	*Muntiacus muntjak*	Barking deer	Cervidae	III (LC)
13.	*Mus booduga*	Indian Field Mouse	Muridae	(LC)
14.	*Mus musculus*	House Mouse	Muridae	V
15.	*Niviventer fulvescens*	Chestnut White Bellied Rat	Muridae	V
16.	*Ratufa bicolor*	Black giant squirrel	Sciuridae	II
17.	*Rattus nitidus*	Himalayan Rat	Muridae	LC
18.	*Rattus rattus*	Black Rat	Muridae	LC
19.	*Rhinolophus affinis*	Intermediate Horse Shoe Bat	Rhinolophidae	LC
20.	*Rhinolophus hipposideros*	Horse Shoe Bat	Rhinolophidae	
21.	*Vulpes bengalensis*	Common fox	Canidae	II

Sl. No.	Scientific name	Common name	Family	Reference to schedule as per Wild Life (Protection) Act 1972, as amended upto 2006
				Schedule
22.	*Presbytis entellus*	Languor	Cercopithecidae	II
23.	*Presbytis pileatus*	Monkey	Cercopithecidae	II
	Aves			
1.	*Acridotheres tristis*	Indian myna	Sturnidae	IV
2.	*Bambusicola fytchii*	Assam Bamboo Patridge	Phasianidae	
3.	*Ketupa flavipes*	Tawny Fish Owl	Strigidae	
4.	*Cinnyris asiaticus*	Sunbird		IV
5.	*Columba livia*	Blue rock pigeon	Columbidae	-
6.	*Coracias bengalensis*	Indian roller	Coraciidae	IV
7.	*Corvus splendens*	House crow	Corvidae	V
8.	*Eudyna mysscolopaceus*	Asian Koel		IV
9.	*Milvus migrans*	Large Indian Kite	Accipitridae	
10.	*Francolinus pondicerianus*	Grey patridge	Phasianidae	IV
11.	*Hirundo rustica*	Barn swallow	Hirundinidae	IV
12.	*Dendronanthus indicus*	Forest Wagtail	Motacillidae	
13.	*Passer domesticus*	House sparrow	Passerinae	-
14.	*Psittacula krameri*	Rose ringed parakeet	Psittacidae	IV
15.	*Pycnonotus cafer*	Red-vented Bulbul	Pycnonotidae	IV
16.	*Scolopax rusticola*	Eurasian Wood Cock	Scolopacidae	
17.	*Alcedo atthis*	Eurasian Kingfisher	Alcedinidae	IV
18.	*Streptopelia chinensis*	Spotted dove	Columbidae	IV
	Reptiles & Amphibians			
1.	*Amolops afghanus*			-
2.	*Bufo parietalis*	Indian Toad	Bufonidae	IV

Sl. No.	Scientific name	Common name	Family	Reference to schedule as per Wild Life (Protection) Act 1972, as amended upto 2006
				Schedule
3.	*Bufo stomaticus*	Indus Valley toad	Bufonidae	IV
4.	*Bufoides meghalayana*	Khasi Hill Rock Toad	Bufonidae	-
5.	*Bungarus caeruleus*	Common Indian Krait	Elapidae	IV
6.	*Calotes versicolor*	Lizard	Agamidae	-
7.	*Sinomicrurus macclellandi*	Coral Snake	Elapidae	
8.	*Natrix natrix*	Water Snake	Colubridae	
9.	*Rhacophorus maximus*	Malabar Gliding Frog	*Rhacophoridae*	
10.	*Hylarana garoensis*	Boulenger's Garo hill frog	Ranidae	-
11.	*Odorrana livida*	Green Mountain Frog	Ranidae	-
12.	*Varanus bengalensis*	Common Indian Monitor	Varanidae	-
13.	*Chameleon sp.*	Indian Chameleon	Chamaeleonidae	II
14.	*Calotes maria*	Khasi Hills forest lizard	Agamidae	-
15.	*Mobuya carinata*	Common Keeled Grass Skink	Scincidae	-
16.	*Microhyla ornata*	Ornate Narrow-Mouthed Frog	Microhylidae	-
17.	*Naja naja*	Indian Cobra	Elapidae	II
18.	*Ptyas mucosus*	Dhaman	Colubridae	II
19.	*Ptyctolaemus gularis*	Green Fan-Throated Lizard	Agamidae	-
	Fishes			
1.	*Danio rerio*	Zebra Fish (Shalynnai)	Cyprinidae	-
2.	*Catla catla*	Catla	Cyprinidae	-
3.	*Danio aequipinnatus*	Giant Danio (Shalynnai)	Cyprinidae	-
4.	*Danio dangila*	Moustached Danio (Shalynnai)	Cyprinidae	-

Sl. No.	Scientific name	Common name	Family	Reference to schedule as per Wild Life (Protection) Act 1972, as amended upto 2006
				Schedule
5.	*Labeo dero*	Kha bah	Cyprinidae	
6.	*Labeo rohita*	Kha bah	Cyprinidae	
7.	*Labeo fimbriatus*	Mongri rou	Cyprinidae	-
8.	*Mystus aor*	Dingra	Bagridae	-
9.	*Mystus vittatus*	Singhara	Bagridae	-
10.	*Puntius shalynius*	Shalynnai Barb	Cyprinidae	-
	Insecta			
1.	*Acrida turrita*	Acrida (Grasshooper)	Acridodea	-
2.	*Acontia marmoralis*	Emmelia (Grasshooper)	Noctuidae	-
3.	*Orthetrum luzonicum*	Slender Blue Skimmer (Dragonfly)	Libelluidae	-
4.	*Agriocnemis pygmaea*	Midget Whisp	Coenagrionidae	-
5.	*Apis cerana*	Honey Bee	Apidae	-
6.	*Ariadne merione*	Common Castor	Nymphalidae	-
7.	*Ceriagrion coromandelianum*	Damselfly	Coenagrionidae	-
8.	*Euploca core*		Danaidae	IV
9.	*Eurema brigitta*	Small Grass Yellow Butterfly	Pieridae	-
10.	*Graphium sarpedon*	Common blue bottle Butterfly	Papilionidae	-
11.	*Halpe kumara*	Grass Skipper	Hesperinae	-
12.	*Heterojinus semilaetaneus*	Heterorrhina	Cucujidae	II
13.	*Holochlora indica*	Green grasshooper	Tettigonjoidea	-
14.	*Ischnura aurora*	Golden Dartlet	Coenagrionidae	-
15.	*Matapa druna*	Grey-branded Redeye	Hesperinae	-
16.	*Musca domestica*	House fly	Muscidae	-
17.	*Papilio arcturus*	Blue peacock Butterfly	Papilionidae	-
18.	*Periplaneta americana*	American cockroach	Blattidae	-
19.	*Pseudagrion rubriceps*	Damselfly	Coenagrionidae	-

Sl. No.	Scientific name	Common name	Family	Reference to schedule as per Wild Life (Protection) Act 1972, as amended upto 2006
				Schedule
20.	*Apodemia mejicanus*	Butterfly		
21.	*Vespa orientalis*	Wasps		-
	Mollusca			
1.	*Bellamya bendalensis*	Freshwater Snail	Viviparidae	-
2.	*Cypraea limacina*	Slug-Like Cowrie	Cypraeidae	IV
3.	*Turbo marmoratus*	Marbled turban		IV

LIST OF FAUNA IN THE CORE ZONE FOR OPEN CAST STONE MINING PROJECT (60391 TPA IN 1.25 HA) OF SRI SOLOMON GASSAH LOCATED AT AMKROH, ELAKA- NONGTALANG, JOWAI, DISTRICT-WEST JANTIA HILLS, STATE- MEGHALAYA

Sl. No.	Scientific name	Common name	Family	Reference to schedule as per Wild Life (Protection) Act 1972, as amended upto 2006
				Schedule
	Mammals			
1.	*Canis aureus*	Jackal	Canidae	II
2.	*Cannomys badius*	Bamboo Rat	Spalacidae	V (LC)
3.	*Callosciurus erythraeus*	Squirrel	Sciuridae	(LC)
4.	*Crocidura attenuata*	Grey Shrew	Soricidae	V(LC)
5.	*Felis chaus*	Jungle cat	Felidae	II
6.	*Funambulus pennanti*	Five striped palm squirrel	Sciuridae	IV
7.	*Funambulus palmarum*	Three striped palm squirrel	Sciuridae	IV(LC)
8.	*Herpestes edwardsi*	Indian Grey Mongoose	Herpestidae	II(LC)
9.	*Lepus nigricollis*	Indian hare	Leporidae	IV
10.	*Muntiacus muntjak*	Barking deer	Cervidae	III (LC)
11.	*Mus booduga*	Indian Field Mouse	Muridae	(LC)
12.	*Rattus nitidus*	Himalayan Rat	Muridae	LC
13.	*Rattus rattus*	Black Rat	Muridae	LC
14.	*Rhinolophus affinis*	Intermediate Horse Shoe Bat	Rhinolophidae	LC
15.	*Vulpes bengalensis*	Common fox	Canidae	II
16.	*Presbytis entellus*	Languor	Cercopithecidae	II
17.	*Presbytis pileatus*	Monkey	Cercopithecidae	II
	Aves			
1.	*Acridotheres tristis*	Indian myna	Sturnidae	IV
2.	*Cinnyris asiaticus*	Sunbird		IV
3.	*Columba livia*	Blue rock pigeon	Columbidae	-
4.	*Coracias bengalensis*	Indian roller	Coraciidae	IV

Sl. No.	Scientific name	Common name	Family	Reference to schedule as per Wild Life (Protection) Act 1972, as amended upto 2006
				Schedule
5.	*Francolinus pondicerianus*	Grey patridge	Phasianidae	IV
6.	*Hirundo rustica*	Barn swallow	Hirundinidae	IV
7.	*Psittacula krameri*	Rose ringed parakeet	Psittacidae	IV
8.	*Pycnonotus cafer*	Red-vented Bulbul	Pycnonotidae	IV
9.	*Alcedo atthis*	Eurasian Kingfisher	Alcedinidae	IV
10.	*Streptopelia chinensis*	Spotted dove	Columbidae	IV
	Reptiles & Amphibians			
1.	*Amolops afghanus*			-
2.	*Bufo parietalis*	Indian Toad	Bufonidae	IV
3.	*Bufo stomaticus*	Indus Valley toad	Bufonidae	IV
4.	*Bufoides meghalayana*	Khasi Hill Rock Toad	Bufonidae	-
5.	*Bungarus caeruleus*	Common Indian Krait	Elapidae	IV
6.	*Calotes versicolor*	Lizard	Agamidae	-
7.	*Odorrana livida*	Green Mountain Frog	Ranidae	-
8.	*Varanus bengalensis*	Common Indian Monitor	Varanidae	-
9.	*Chameleon sp.*	Indian Chameleon	Chamaeleonidae	II
10.	*Calotes maria*	Khasi Hills forest lizard	Agamidae	-
11.	*Mobuya carinata*	Common Keeled Grass Skink	Scincidae	-
12.	*Naja naja*	Indian Cobra	Elapidae	II
13.	*Ptyas mucosus*	Dhaman	Colubridae	II
14.	*Ptyctolaemus gularis*	Green Fan-Throated Lizard	Agamidae	-
	Insecta			

Sl. No.	Scientific name	Common name	Family	Reference to schedule as per Wild Life (Protection) Act 1972, as amended upto 2006
				Schedule
1.	*Acrida turrita*	Acrida (Grasshooper)	Acridodea	-
2.	*Acontia marmoralis*	Emmelia (Grasshooper)	Noctuidae	-
3.	*Orthetrum luzonicum*	Slender Blue Skimmer (Dragonfly)	Libelluidae	-
4.	*Agriocnemis pygmaea*	Midget Whisp	Coenagrionidae	-
5.	*Graphium sarpedon*	Common blue bottle Butterfly	Papilionidae	-
6.	*Halpe kumara*	Grass Skipper	Hesperinae	-
7.	*Heterojinus semilaetaneus*	Heterorrhina	Cucujidae	II
8.	*Holochlora indica*	Green grasshooper	Tettigonjoidea	-
9.	*Ischnura aurora*	Golden Dartlet	Coenagrionidae	-
10.	*Matapa druna*	Grey-branded Redeye	Hesperinae	-
11.	*Papilio arcturus*	Blue peacock Butterfly	Papilionidae	-
12.	*Periplaneta americana*	American cockroach	Blattidae	-
13.	*Pseudagrion rubriceps*	Damselfly	Coenagrionidae	-
14.	*Apodemia mejicanus*	Butterfly		
15.	*Vespa orientalis*	Wasps		-
	Mollusca			
1.	*Bellamya bendalensis*	Freshwater Snail	Viviparidae	-
2.	*Cypraea limacina*	Slug-Like Cowrie	Cypraeidae	IV
3.	*Turbo marmoratus*	Marbled turban		IV

Annexure –15
Employment Pattern

Town/	Town/village	Total	Main workers					Marginal workers					Non
Village Code	name	workers	Total	Cultivators	Agri. Labours	HH ind.	Others	Total	Cultivators	Agr. Labours	HH ind.	Others	workers
District	**East Khasi Hills**												
Sub District	**Mawkynrew**												
		391	261	0	2	0	259	130	0	4	2	124	552
278494	Nongryngkoh	119	117	1	0	0	116	2	0	0	0	2	157
278495	New Nongryngkoh	251	234	1	0	2	231	17	0	0	0	17	342
278497	Nonghulew												
	Sub total	**761**	**612**	**2**	**2**	**2**	**606**	**149**	**0**	**4**	**2**	**143**	**1051**
District	**Jaintia Hills**												
Sub District	**Amlarem**												
		312	301	279	1	4	17	11	1	0	0	10	609
279297	Shken Talang	520	490	36	366	0	88	30	1	14	2	13	1083
279298	Jarain	34	28	9	6	0	13	6	1	4	1	0	107
279299	Ladjaplem	428	326	118	43	1	164	102	7	79	0	16	819
279300	Umladkhur	577	467	128	119	7	213	110	3	31	1	75	1077
279301	Thangbuli	60	30	1	12	4	13	30	3	19	4	4	114
279302	Amsarim	220	174	11	3	0	160	46	0	1	0	45	438
279303	Amlarem	49	49	47	0	0	2	0	0	0	0	0	130
279304	Krangpamtadong	50	49	31	0	0	18	1	1	0	0	0	112
279305	Khliehamkshar	33	32	0	0	0	32	1	0	0	0	1	84
279306	Amsyrwai	113	97	69	5	0	23	16	5	4	0	7	182
279307	Amshipai	181	138	108	7	1	22	43	29	3	1	10	216
279308	Ammutong	19	18	17	0	0	1	1	1	0	0	0	34
279309	Shmiashyiang	31	30	10	20	0	0	1	0	0	0	1	54
279310	Pamtadong	121	117	33	70	1	13	4	1	2	0	1	186
279311	Mawlong	246	61	21	10	0	30	185	8	166	2	9	303
279312	Padu Mawsku	872	704	105	310	12	277	168	39	66	14	49	524
279313	Padubah	137	67	0	15	0	52	70	0	42	0	28	252
279314	Amtapoh	19	3	0	2	0	1	16	0	13	0	3	41
279315	Dapdeng	548	412	169	194	5	44	136	3	84	4	45	752

279316	Khonglah	482	123	60	9	1	53	359	88	56	5	210	270
279317	Nongbareh Rim	85	84	0	0	0	84	1	0	0	0	1	112
279318	Mawngap	80	77	0	1	0	76	3	0	0	0	3	236
279319	Pdengkarong	21	17	0	0	0	17	4	0	0	0	4	35
279320	Amlarang	281	267	43	101	0	123	14	0	4	0	10	289
279321	Pamtbuh	85	81	3	8	1	69	4	0	0	0	4	119
279322	Jaralood	69	61	8	5	0	48	8	0	1	0	7	92
279323	Amtasam	14	13	2	6	0	5	1	0	1	0	0	30
279324	Amlamet	29	27	6	8	0	13	2	0	0	0	2	48
279325	Lurniang	811	489	180	260	0	49	322	39	259	1	23	661
279326	Pdengshakap	1	1	1	0	0	0	0	0	0	0	0	8
279327	Wahrong	293	146	34	19	0	93	147	13	60	0	74	304
279328	Nongbareh Lyntiar	223	211	184	0	0	27	12	3	2	0	7	244
279329	Kudeng Rim	293	133	83	6	3	41	160	38	5	9	108	356
279330	Amkoi	135	112	74	1	0	37	23	8	1	0	14	225
279331	Kudeng Thymmai	76	67	51	5	1	10	9	1	8	0	0	104
279332	Amjajer Roko	354	267	33	171	0	63	87	6	60	0	21	337
279333	Sohkha Shnong	625	613	513	0	2	98	12	5	0	0	7	883
279334	Lamin	290	152	117	23	0	12	138	91	46	0	1	365
279335	Shnongpdeng	175	154	23	25	3	103	21	4	6	0	11	379
279336	Sohkha Mission	26	4	2	1	0	1	22	1	1	0	20	12
279337	Sohkha Phlang	0	0	0	0	0	0	0	0	0	0	0	1
279338	Wahlyngdoh	78	78	4	58	0	16	0	0	0	0	0	98
279339	Pdengkseh	892	589	194	162	8	225	303	32	193	2	76	1509
279340	Nongtalang Main	50	50	43	0	0	7	0	0	0	0	0	106
279341	Amsohmahaleng	55	52	9	25	0	18	3	0	0	0	3	109
279342	New Nonglamin	170	168	74	0	0	94	2	0	0	0	2	421
279343	Nongtalang Mission	53	41	24	3	0	14	12	0	12	0	0	122
279344	Nongtalang Thymmai	205	21	15	1	0	5	184	35	0	0	149	121
279345	Sohkha Model	13	2	0	0	0	2	11	5	3	0	3	132
279346	Lymba	37	25	21	0	0	4	12	0	0	0	12	22
279347	Kongwang	309	123	4	0	0	119	186	0	121	4	61	925
279348	Darang	214	104	13	4	1	86	110	4	1	0	105	269

279349	Dawki	903	673	14	7	3	649	230	4	6	1	219	1008
279350	Bakur	32	32	0	0	0	32	0	0	0	0	0	0
279351	Latang	14	14	1	7	0	6	0	0	0	0	0	34
279352	Tamabil	40	39	0	38	0	1	1	0	1	0	0	78
279353	Amdoh	40	40	0	14	0	26	0	0	0	0	0	42
279354	Riahjalong	42	41	0	11	0	30	1	0	0	0	1	49
279355	Rhongkum	198	97	55	5	0	37	101	4	89	1	7	305
279356	Jong - u - Shen	151	33	3	1	0	29	118	1	3	0	114	269
279357	Twah - u - Sdiah	192	49	1	0	0	48	143	1	2	0	140	232
279358	Amsohtai	67	41	0	1	1	39	26	0	0	0	26	50
279359	Amlari Rim	200	103	1	1	0	101	97	0	0	1	96	167
279360	Amlari Model	390	116	18	83	6	9	274	38	219	5	12	272
279361	Satpator	303	110	50	0	0	60	193	1	171	3	18	556
279362	Tarangblang	286	105	0	1	0	104	181	2	1	0	178	420
279363	Syndai Kmaishnong	99	97	3	0	0	94	2	0	1	0	1	116
279364	Syndai Lyngkot	166	154	7	5	0	142	12	0	1	0	11	247
279365	Syndai Mission	217	67	1	0	0	66	150	0	0	0	150	267
279366	Amjalong	116	56	11	0	0	45	60	12	1	0	47	57
279367	Amlympiang	102	55	30	6	19	0	47	0	10	1	36	27
279368	Amsku	90	31	11	8	4	8	59	4	3	4	48	65
279369	Bhoi Kyrweng												
	Sub total	**14742**	**9898**	**3216**	**2273**	**88**	**4321**	**4844**	**543**	**1876**	**66**	**2359**	**20322**
	GRAND TOTAL	**15503**	**10510**	**3218**	**2275**	**90**	**4927**	**4993**	**543**	**1880**	**68**	**2502**	**21373**
	Percentage	**42.04**	**28.50**	**30.62**	**21.65**	**0.86**	**46.88**	**13.54**	**10.88**	**37.65**	**1.36**	**50.11**	**57.96**

Annexure –16
Details of Amenities

SUMMARY OF AMENITIES AVAILABLE (CENSUS 2011) IN VILLAGES WITHIN THE STUDY AREA OF AMKROH LIMESTONE MINE OF SHRI SOLOMON GASSAH IN DISTT. JAINTIA HILLS, MEGHALAYA

AMENITIES	NOS.	AMENITIES	NOS.	AMENITIES	NOS.
EDUCATION FACILITIES		**DRINKING WATER FACILITY**		**APPROACH TO VILLAGE**	
PPS (Pre-Primary School)	91	TWT (Tap Water-Treated)	34	NH (National Highway)	8
PS (Primary school)	86	TWUT (Tap Water Untreated)	33	SH (State Highway)	13
MS (Middle school)	30	CW (Covered Well)	14	MDR (Major District Road)	11
SS (Secondary school)	14	UW (Uncovered Well)	7	ODR (Other District Road)	6
SSS (Sr. Sec. School)	5	HP (Hand Pump)	1	BTPR (Black Topped (pucca) Road)	28
DCAS (Deg. College Arts & Science only)	0	TW/ BW (Tube Wells/Borehole)	3	GCR (Gravel (kuchha) Roads)	55
EC (Engg. College)	0	S (Spring)	18	WBM (Water Bounded Macadam)	13
MC (Medicine College)	0	R/C (River/Canal)	11	AWR (All Weather Road)	13
MI (Management Institute)	0	T/P (Tank/Pond/Lake)	6	NWR/C (Navigable waterways:river/canal)	0
P (Polytechnic)	0	WO (Others)	8	FP (Foot Path)	67
VTS/ITI (Vocational Trg School/ITI)	0				
NFTC (Non Formal Training Centre)	0	**COMMUNICATION SYSTEM**		**BANKS AND COMMERCIAL SOCIETIES**	
SFD (School For Disabled)	0	PO (Post Office)	1	ATM (ATM)	0
EO (Others)	0	SPO (Sub Post Office)	11	CB (Commercial bank)	2
		P&T (Post & Telegraph office)	0	COB (Co-operative bank)	2
MEDICAL FACILITIES		PIN (Village PIN code)	67	ACS (Agricultural Crredit Societies)	0
CHC (Community Health Centres)	1	T (Telephone (landline))	9	SHG (Self-Help Group (SHG))	26
PHC (Primary Health Centre)	2	PCO (Public Call Office/ Mobile PCO)	5	PDS (Public Distribution System (PDS))	40
PHSC (Primary Health Sub-Centre)	6	MPC (Mobile phone coverage)	54	M/RM (Mandis/Regular Market)	2
MCWC (Maternity And Child Welfare Centre)	3	IC/CSC (Internet Cafes/Common Service Centre)	3	WH (Weekly Haat)	3
TBC (TB Clinic)	0	PCF (Private Courier Facility)	0	AMS (Agricultural Marketing Society)	0
HA (Hospital Allopathic)	0			NCICDS (Nutritional Centres-ICDS)	44
HAM (Hospiltal Alternative Medicine)	0	**TRANSPORT SYSTEM**		NCAC (Nutritional Centres: Anganwadi)	44
D (Dispensary)	1	PBS (Public Bus Service)	2	NCO (Nutritional Centres-Others)	3
VH (Veterinary Hospital)	0	PvtBS (Private Bus Service)	6	ASHA (ASHA)	60
MHC (Mobile Health Clinic)	0	RS (Railway station)	0	CC-TV (Community centre with/without TV)	16
FWC (Family Welfare Centre)	3	MA (Auto/Modified Autos)	0		
NGMF-OP (Non Govt. Med.Facilities: Out Patient)	0	Taxi (Taxi)	14	**SPORTS AND ENTERTAINMENT**	
NGMF-IOP (Non Govt.Med.Facilities: In&Out patient)	0	Van (Vans)	27	SF (Sports Field)	43
NGMF-C (Non Govt. Med.Facilities: Charitable)	0	T (Tractors)	0	SC/RC (Sports Club/Recreation Centre)	28
NGMF-MBBS (Non Govt. Med.Facilities: Medical prctitioner with MBBS degree)	1	CPR-Man (Cycle-pulled Rickshaws (manual driven))	12	C/VH (Cinema/Video Hall)	0
		CPR-Mec (Cycle-pulled Rickshaws (machine driven))	0	PL (Public Library)	0
NGMF-OD (Non Govt. Med.Facilities: Medical prctitioner with other degree)	0	CDA (Carts Drivens by Animals)	0	PRR (Public Reading Room)	0
		S/R/FS (Sea/River/Ferry Service)	1	DNS (Daily Newspaper Supply)	9
NGMF-ND (Non Govt. Med.Facilities: Medical practitioner with no degree)	0			APS (Assembly Polling Station)	23
		POWER SUPPLY		BDRO (Birth and Death Registration Office)	3
NGMF-TPFH (Non Govt. Med.Facilities: Traditional practitioner and faith healer)	17	PSDU (Power Supply For Domestic Use)	63		
		PSIAU (Power Supply ForAgriculture Use)	0		
NGMF-MS (Non Govt. Med.Facilities: Medicine shop)	5	PSCU (Power Supply For Commercial Use)	0		
NGMF-O (Non Govt. Med.Facilities: Others)	0	PSALL (Power Supply For All Users)	3		

OFFICE OF THE NONGTALANG VILLAGE DORBAR
P.O. & P.S. DAWKI WEST JAINTIA HILLS DISTRICT
MEGHALAYA - 793109

Dated: Nongtalang
The 28th Jan. 2019

NO OBJECTION CERTIFICATE

I SHRI. DU MYRCHIANG AMDAP, General Secretary Nongtalang Villgae Dorbar do hereby Certified that the Nongtalang Village Dorbar had NO OBJECTION whatsoever towards SHRI. MIN MYRCHIANG, SHRI. RAJU MYRCHIANG and SHRI. FULLMOON MYRCHIANG Resident of Nongtalang Village, who is the owner of the plot of land named AMKHROH AMSHLAI, Situated at LAD AMTAPOH, Elaka Nongtalang Dolloiship. The state of ownership of the said land by SHRI. MIN MYRCHIANG is only for 10 Years and by way of LEASE to SHRI. SOLOMON GASSAH, Resident of Lamin Village, Amlarem Sub-Division, Amlarem West Jaintia Hills District which is more fully described in the schedule below:

SCHEDULE OF THE PLOTED LAND:

NORTH	:	LAND OF KUR MYRCHIANG
SOUTH	:	LAND OF KUR MYRCHIANG
EAST	:	LAND OF KUR MYRCHIANG
WEST	:	LAND OF KUR MYRCHIANG

TOTAL AREA : 2.5 Ha (Approx)

(Shri. Du Myrchiang Amdap)
Genl. Secretary
Nongtalang Village Dorbar
General Secretary
Nongtalang Village
Durbar

Annexure –18
Undertaking for Environmental Policy

Undertaking for Environmental Policy

I, **Solomon Gassah** being the project proponent Amkroh Limestone Mine located at Amkroh, Elaka- Nongtalang, Jowai, District-West Jaintia Hills, and State- Meghalaya, hereby give my undertaking that I have a well defined Environmental Policy for Nongtalang Limestone Mine. The hierarchical system or administrative order of the Company is well established and it will follow all norms and regulation which is required to safeguard Environment and minimize any kind of Environmental issues.

For Amkroh Limestone Mine,

(Solomon Gassah)
Project Proponent

GOVERNMENT OF MEGHALAYA
OFFICE OF THE DIVISIONAL FOREST OFFICER (TERRITORIAL)
JAINTIA HILLS DIVISION: JOWAI.
****

No. JH/S. Quarry/2009-10/476/B/2235 Dated- Jowai, the 5th August, 2019.

To,

Shri. Solomon Gassah
Lamin
West Jaintia Hills District.

Sub: Application for Forest Clearance.

Ref: Your Application No. Nil, dated 06th March, 2019.

With reference to the above, It is to inform you that the proposed area of mining lease (1.25 ha. GPS map enclosed) located at Amkroh, Nongtalang, West Jaintia Hills District, Jowai has been identified as "Non Forest" by this office as per Meghalaya Forest Regulation (Amendment) Act, 2012 to process under Meghalaya Minor Minerals Concession Rules, 2016. GPS Coordinates of the corners of the proposed mining lease are given below:

Sl. No.	Latitude	Longitude
1	25° 14.751' N	92° 5.956' E
2	25° 14.780' N	92° 5.956' E
3	25° 14.770' N	92° 5.902' E
4	25° 14.739' N	92° 5.880' E
5	25° 14.713' N	92° 5.881' E
6	25° 14.725' N	92° 5.962' E

This is for information and further necessary action.

Divisional Forest Officer,
Jaintia Hills Territorial Division, Jowai.

Memo. No. JH/S.Quarry/2009-10/476/B/ Dated- Jowai, the August, 2019.
Copy to:

1. The Range Forest Officer, Passadwar Range for information.

APPROVED

DIVISIONAL MINING OFFICER
DIRECTORATE OF MINERAL RESOURCES
MEGHALAYA, JOWAI

Divisional Forest Officer,
Jaintia Hills Territorial Division, Jowai.

Annexure –20
Geological Plan & Section