DRAFT ENVIRONMENTAL IMPACT ASSESSMENT

&

ENVIRONMENT MANAGEMENT PLAN

FOR OBTAINING

Prior – Environmental Clearance under EIA Notification – 2006

Schedule Sl. No. 1 (a) (i): Mining Project

"B1" CATEGORY – MINOR MINERAL – CLUSTER – NON-FOREST LAND

CLUSTER EXTENT = 8.00 ha

Tvl.CITY BLUE METAL ROUGH STONE QUARRY

Project Location	Extent
S.F. Nos. 135 (Part-2) Iynkunam Village, Kilpennathur Taluk, Tiruvannamalai District, Tamil Nadu State	1.00.0 ha

as per ToR obtained vide Lr No. SEIAA-TN/F.No.7908/SEAC/TOR-871/2020 Dated: 12.03.2021;

Project Proponent

Tvl. City Blue Metal,

Thiru.Alaudeen Batcha, Managing Partner,
S/o. Dhasthagir, Iynkunam,
Kilpennathur taluk,
Tiruvannamalai District– 606 611.

Environmental Consultant

GEO EXPLORATION AND MINING SOLUTIONS

Old No. 260-B, New No. 17,
Advaitha Ashram Road, Alagapuram,
Salem – 636 004, Tamil Nadu, India
Accredited for sector 1, 28 & 38 Category 'A'
Certificate No : NABET/EIA/1821/RA0123
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Email: ifthiahmed@gmail.com, geothangam@gmail.com
Web: www.gemssalem.com

AUGUST 2021

For easy represantation of Proposed and Existing Quarries in the Cluster are given unique codes and identifies and studied in this EIA EMP Report.

PROPOSED QUARRIES				
CODE	**Name of the Owner**	**S.F. Nos**	**Extent**	**Status**
P1	**Tvl. City Blue Metal,** Thiru.Alaudeen Batcha, Managing Partner, S/o. Dhasthagir, Iynkunam, Kilpennathur taluk, Tiruvannamalai District– 606 611.	135 (Part-2)	1.00.0 ha	Received for TOR Vide Lr No. SEIAA-TN/F.No.7908/SEAC/TOR-871/2020 Dated :12.03.2021
P2	**Tmt.A.Kalpana,** W/o. Adhimoolam, No.4, Gandhi Nagar, 6th Street, Thiruvannamalai	135 (Part-4)	1.00.0 ha	Future Proposed
P3	**Thiru. P.Adimoolam,** 57A, Tamizhnagar, Thiruvannamalai.	135 (Part-5)	1.00.0 ha	Future Proposed
P4	**Thiru. P.Adimoolam,** 57A, Tamizhnagar, Thiruvannamalai	135 (Part-7)	4.00.0 ha	Future Proposed
TOTAL			**7.00 ha**	
EXISTING QUARRIES				
CODE	**Name of the Owner**	**S.F. Nos**	**Extent**	**Status**
E1	**Thiru. R. Karthikeyan,** 23/29, Lakshmipuram, Gandhinagar, Thiruvannamalai	135 (Part-3)	1.00.0 ha	20.04.2011 to 19.04.2021
TOTAL			**1.00 ha**	
Total cluster extent			**8.00 ha**	

Source: Rc.No.50/Kanimam/2020, Dated: 15.07.2020

Note: -

- **Cluster area is calculated as per MoEF & CC Notification – S.O. 2269 (E) Dated: 01.07.2016**

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1. INTRODUCTION

1.0 PREAMBLE

Environmental Impact Assessment (EIA) is the management tool to ensure sustainable development and it is a process, used to identify the environmental, social and economic impacts of a project prior to decision-making. It is a decision-making tool, which guides the decision makers in taking appropriate decisions for any project. EIA systematically examines both beneficial and adverse consequences of the project and ensures that these impacts are taken into account during the project designing. It also reduces conflicts by promoting community participation, information, decision makers, and helps in developing the base for environmentally sound project.

Rough Stone is the major requirements for construction industry. This EIA report is prepared by considering the Cumulative load of four proposed Rough Stone Quarries (including Tvl.City Blue Metals) along with one existing quarry having a total extent of Cluster of.8.00 ha at Iynkunam Village, Kilpennathur Taluk, Thiruvannamalai District and Tamil Nadu State, cluster area calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016.

The baseline monitoring study was carried out during March - May 2021 in compliance with ToR obtained vide Letter No. SEIAA-TN/F.No.7908/SEAC/TOR-871/2020 Dated: 12.03.2021 and the Cumulative Environmental Impact Assessment study is undertaken, which is followed by preparation of a detailed Environmental Management Plan (EMP) to minimize those adverse impacts.

1.1 PURPOSE OF THE REPORT

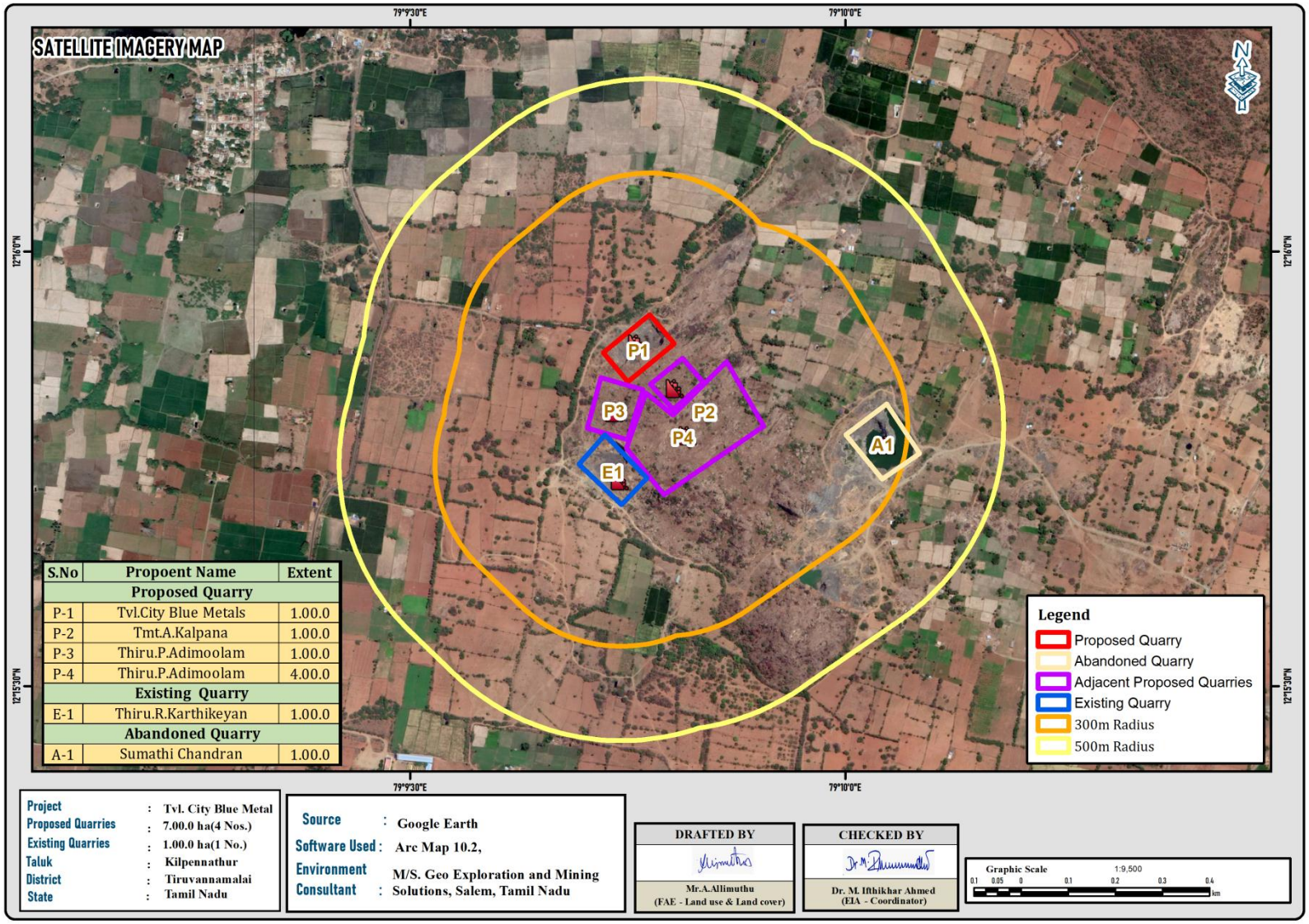
The Ministry of Environment and Forests, Govt. of India, through its EIA notification S.O. 1533(E) of 14thSeptember 2006 and its subsequent amendments as per Gazette Notification S.O. 3977 (E) of 14thAugust 2018, Mining Projects are classified under two categories i.e., A (> 100 Ha) and B (≤ 100 Ha), and Schematic Presentation of Requirements on Environmental Clearance of Minor Minerals including cluster situation in Appendix–XI.

Now, as per Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green Tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No, 186 of 2016 and MoEF & CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018 clarified the requirement for EIA, EMP and therefore, Public Consultation for all areas from 5 to 25 ha falling in Category B- 1 and appraised by SEAC/ SEIAA as well as for cluster situation.

This proposed project is categorized under category "B1" Activity 1(a) (mining lease area in cluster situation) and will be considered at SEIAA – TN after conducting Public Hearing and Submission of EIA/EMP Report for Grant of Environmental Clearance.

"Draft EIA report prepared on the basis of ToR Issued for carrying out public hearing for the grant of Environmental Clearance from SEIAA, Tamil Nadu"

FIGURE1.1: SATELLITE IMAGERY CLUSTER QUARRIES



S.No	Propoent Name	Extent
Proposed Quarry		
P-1	Tvl.City Blue Metals	1.00.0
P-2	Tmt.A.Kalpana	1.00.0
P-3	Thiru.P.Adimoolam	1.00.0
P-4	Thiru.P.Adimoolam	4.00.0
Existing Quarry		
E-1	Thiru.R.Karthikeyan	1.00.0
Abandoned Quarry		
A-1	Sumathi Chandran	1.00.0

1.2 IDENTIFICATION OF PROJECT AND PROJECT PROPONENT

1.2.1 Identification of Project

TABLE 1.1: PROJECT IDENTIFICATION

Name of the Project	Tvl.City Blue metal- Rough Stone Quarry
S.F. No.	135 (Part-2)
Extent	1.00.0 ha
Land Type	Government poramboke Land
Village Taluk and District	Iyangunam Village, Kilpennathur Taluk, Thiruvannamalai District

Source: Approved Mining Plan

1.2.2 Identification of Project Proponent

TABLE 1.2: DETAILS OF PROJECT PROPONENT

Name of the Project Proponent	**Tvl.City Blue metal**
Communication Address	**Tvl. City Blue Metal,** Thiru.Alaudeen Batcha, Managing Partner, S/o. Dhasthagir, Iynkunam, Kilpennathur taluk, Tiruvannamalai District– 606 611.
Mobile	+91 98422 45786 & 94432 39459
Status	Partnership firm

Source: Approved Mining Plan

1.3 BRIEF DESCRIPTION OF THE PROJECT

1.3.1 Nature and Size of the Project

The quarrying operation is proposed to be carried out by Opencast Mechanized Mining Method by deploying Heavy Earth Moving Machineries without deep hole drilling and blasting by Jack Hammer Drilling & Slurry Explosive during blasting by forming 5.0 m bench height and 5.0 m bench width. Excavator and tippers are proposed for Loading and transportation. Rock Breakers are proposed to be deployed to avoid secondary blasting.

TABLE 1.3: BRIEF DESCRIPTION OF THE APPLIED PROJECT

Name of the Quarry	Tvl.City Blue Metals Rough Stone Quarry	
Toposheet No	57 P/03	
Latitude between	12°15'52.05"N to 12°15'55.69"N	
Longitude between	79°09'46.88"E to 79°09'51.62"E	
Highest Elevation	220 m AMSL	
Proposed Depth of Mining	71 m (46mAGL + 25m BGL) (1m Topsoil + 70m Rough Stone)	
Geological Resources	Rough Stone in m^3	Topsoil m^3
	5,30,000	7,623
Mineable Reserves	Rough Stone in m^3	Topsoil m^3
	3,17,200	7,623
Proposal for this Mining Plan Period	Rough Stone in m^3	Topsoil m^3
	3,17,200	7,623
Existing Pit Dimension	100m (L) x 55m (W) x 10m (D) bgl	
Ultimate Pit Dimension	Pit-I	126m (L) x 80m (W) x 71m (D) (46mAGL + 25m BGL)
Water Level in the surrounds area	52 - 56 m bgl	
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Topography	The lease applied area is hilly terrain. The area has gentle slope with a gradient of 1 to 8 towards north western side. The altitude of the area is 220-180m (max) above mean sea level. The area is covered by 1m (avg) thickness of Topsoil Formation. Massive Charnockite is found after 1m (Topsoil Formation) which is clearly inferred from the nearby existing quarry pit.	
Machinery proposed	Jack Hammer	8 Nos
	Compressor	2 Nos

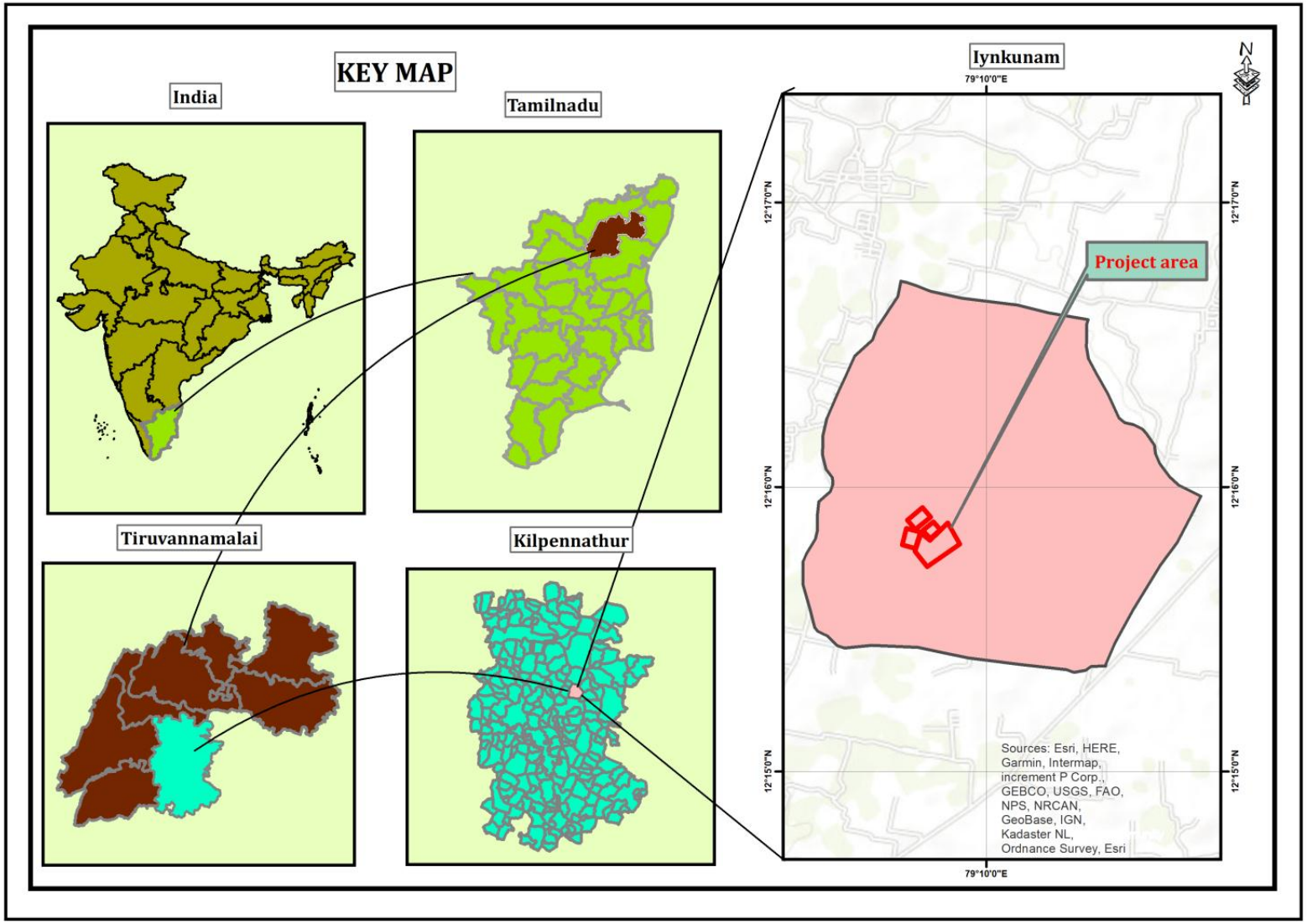
	Excavator with Bucket & Rock Breaker	1 Nos
	Tippers	3 Nos
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.	
Proposed Manpower Deployment	30 Nos	
Total Project Cost	Project Cost	Rs.62,30,000/-
	Environment Monitoring Cost	Rs.3,80,000/-
	Total	Rs.66,10,000/-
CER Cost @ 2% of Project Cost	Rs.1,32,200/-	
Nearby Water Bodies	Thurunjal River	6km South West
	Tank Near Namiyandal	1.5km SW
	Tank Near Noimalai	8km SW
	Tank Near Tirumalai Nagar	7.8km SW
	Tank Near Avalurpettai	9.8km NE
	Tank near Karungalikuppam	5km SE
	Kolathur Tank	9.7km SE
	Tank near Su.Palliampattu	5km SW
	Tank near Kasthambadi	6.8km NW
	Tank near Ganalapadi	2.3km N
	Tank near Pallikondapattu	6km SW
	Tank near Hariyankuppam	800m N
Greenbelt Development Plan	Proposed to plant 500 trees	
Proposed Water Requirement	6.5 KLD	
Nearest Habitation	700m NW	

Source: Approved Mining Plan

1.3.2 Location of the Project

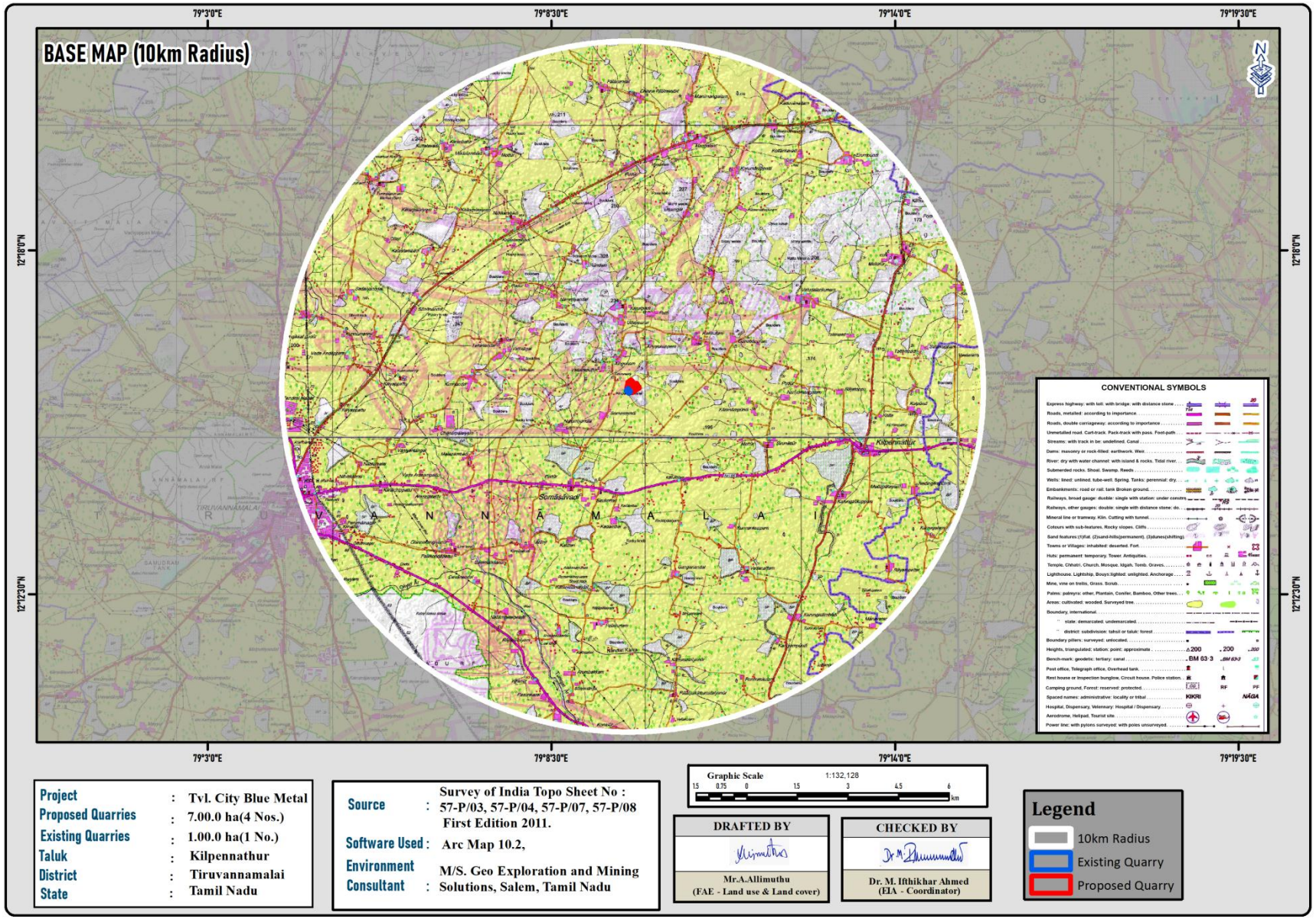
- The Lease Applied Area is located about 1Km South east side of Iynkunam village, 7.Km northwest side of kilpennathur taluk and 10.0 Km Northeast side of Tiruvannnamalai District.

FIGURE1.2: KEY MAP SHOWING THE LOCATION OF THE CLUSTER SITE



Source: Survey of India Toposheet 57-P/03

FIGURE 1.3: TOPOSHEET MAP OF THE STUDY AREA 10 KM RADIUS



1.4 ENVIRONMENTAL CLEARANCE

The Environmental Clearance process for the proposed project will comprise of four stages. These stages in sequential order are given below: -

1. Screening
2. Scoping
3. Public Consultation &
4. Appraisal

SCREENING –

- The project proponent applied for Rough Stone Quarry Lease Dated: 12.02.2020
- Precise Area Communication Letter was issued by the District Collector, Tiruvannamalai Rc.No.50/Mines/2020, Dated: 04.03.2020
- The Mining Plan was prepared by Recognized Qualified Person and approved by Assistant Director, Geology and Mining, Tiruvannamalai District, vide R.C. No. 50/Mines/2020, Dated: 15.07.2020
- The proposed project falls under "B1" Category as per Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No, 186 of 2016 and MoEF & CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018
- Proponent applied for ToR for Environmental Clearance vide online Proposal No. SIA/TN/MIN/57120/2020 Date: 30.09.2020

SCOPING –

- The proposal was placed in 197rd SEAC meeting held on 03.02.2021 and the committee recommended for issue of ToR.
- The proposal was considered in 427th SEIAA meeting held on 01.03.2021 and issued ToR vide Letter No SEIAA-TN/F.No.7908/SEAC/ToR-871/2020 Dated 12.03.2021

PUBLIC CONSULTATION –

Application to The Member Secretary of the Tamil Nadu Pollution Control Board (TNPCB) to conduct Public Hearing in a systematic, time bound and transparent manner ensuring widest possible public participation at the project site or in its close proximity in the District is submitted along with this Draft EIA/ EMP Report and the outcome of public hearing proceedings will be detailed in the Final EIA/EMP Report.

APPRAISAL –

Appraisal is the detailed scrutiny by the State Expert Appraisal Committee (SEAC) of the application and other documents like the final EIA & EMP Report, outcome of the Public Consultations including Public Hearing Proceedings, submitted by the proponent to the regulatory authority concerned for grant of environmental clearance.

The report has been prepared using the following references:

- Guidance Manual of Environmental Impact Assessment for Mining of Minerals, Ministry of Environment and Forests, February, 2010
- EIA Notification, 14thSeptember, 2006
- ToR Lr.No. SEIAA-TN/F.No.7908/SEAC/ToR-871/2020 Dated 12.03.2021
- Approved Mining Plan of the Proposed Project.

1.5 TERMS OF REFERENCE (ToR)

Compliance to ToR issued vide Lr.No. SEIAA-TN/F.No. 7908/SEAC/ToR-871/2020 Dated 12.03.2021 are detailed in Page No. I – VIII.

1.6 POST ENVIRONMENT CLEARANCE MONITORING

The project proponent shall submit a half-yearly compliance report in respect of stipulated Environmental Clearance terms and conditions to MoEF & CC Regional Office & SEIAA after grant of EC on 1st June and 1st December of each calendar year as per MoEF & CC Notification S.O. 5845 (E) Dated: 26.11.2018.

1.7 GENERIC STRUCTURE OF EIA DOCUMENT

The overall contents of the EIA report follow the list of contents prescribed in the EIA Notification 2006 and the "Environmental Impact Assessment Guidance Manual for Mining of Minerals" published by MoEF & CC.

1.8 THE SCOPE OF THE STUDY

The main scope of the EIA study is to quantify the cumulative impact in the study area due to cluster quarries and formulate the effective mitigation measures for this applied project area. A detailed account of the emission sources, emissions control equipment, background Air quality levels, Meteorological measurements, Dispersion model and all other aspects of pollution like effluent discharge, Dust generation etc., have been discussed in this report. The baseline monitoring study has been carried out during the Summer season (March to May 2021) for various environmental components so as to assess the anticipated impacts due the cluster quarry projects on the environment and suggest suitable mitigation measures for likely adverse impacts due to this proposed project.

TABLE 1.4: ENVIRONMENT ATTRIBUTES

Sl.No.	Attributes	Parameters	Source and Frequency
1	Ambient Air Quality	PM_{10}, $PM_{2.5}$, SO_2, NO_2	Continuous 24-hourly samples twice a week for three months at 8 locations (1 Core & 7 Buffer)
2	Meteorology	Wind speed and direction, temperature, relative humidity and rainfall	Near project site continuous for three months with hourly recording and from secondary sources of IMD station
3	Water quality	Physical, Chemical and Bacteriological parameters	Grab samples were collected at 6 locations – 4 ground water and 2 surface water samples; once during study period.
4	Ecology	Existing terrestrial and aquatic flora and fauna within 10 km radius circle.	Limited primary survey and secondary data was collected from the Forest department.
5	Noise levels	Noise levels in dB(A)	8 locations – data monitored once for 24 hours during EIA study
6	Soil Characteristics	Physical and Chemical Parameters	Once at 6 locations during study period
7	Land use	Existing land use for different categories	Based on Survey of India topographical sheet and satellite imagery and primary survey.
8	Socio-Economic Aspects	Socio-economic and demographic characteristics, worker characteristics	Based on primary survey and secondary sources data like census of India 2011.
9	Hydrology	Drainage pattern of the area, nature of streams, aquifer characteristics, recharge and discharge areas	Based on data collected from secondary sources as well as hydro-geology study report prepared.
10	Risk assessment and Disaster Management Plan	Identify areas where disaster can occur by fires and explosions and release of toxic substances	Based on the findings of Risk analysis done for the risk associated with mining.

Source: Onsite Monitoring Data/Sampling by OMEGAA Laboratories

The data has been collected as per the requirement of the ToR issued by SEIAA – TN.

1.8.1 Regulatory Compliance & Applicable Laws/Regulations

- Application for Quarrying Lease as per Tamil Nadu Minor Mineral Concession Rules, 1959
- Obtained Precise Area Communication Letter as per Tamil Nadu Minor Mineral Concession Rules, 1959 for Preparation of Mining Plan and obtaining Environmental Clearance
- The Mining Plan has been approved under Rule 41 & 42 as amended of Tamil Nadu Minor Mineral Concession Rules, 1959
- ToR Lr.No. SEIAA-TN/F.No.7908/SEAC/ToR-871/2020 Dated 12.03.2021

2. PROJECT DESCRIPTION

2.0 GENERAL

The Proposed Rough Stone Quarry -P1 requires Environmental Clearance. There are 4 proposed quarries forming a cluster; calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016 and the total extent of cluster is 8.00 ha

As the extent of cluster is more than 5 ha, the proposal falls under B1 Category as per the Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green Tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No, 186 of 2016 and MoEF & CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018, and requirement for EIA, EMP and Public Consultation for obtaining Environmental Clearance.

2.1 DESCRIPTION OF THE PROJECT

The proposed project is site specific and there is no additional area required for this project. There is no effluent generation/discharge from this proposed quarry.

The quarrying operation is proposed to be carried out by Opencast Mechanized Mining Method by deploying Heavy Earth Moving Machineries without deep hole drilling and blasting by Jack Hammer Drilling & Slurry Explosive during blasting by forming 5.0 m bench height and 5.0 m bench width. Excavators are proposed for Loading and tippers for transportation of Rough Stone & Gravel from pithead to the needy crushers. Rock Breakers are proposed to be deployed to avoid secondary blasting.

2.2 LOCATION OF THE PROJECT

- The Lease Applied Area is located about 1Km South east sid of Iynkunam village, 7.Km northwest side of kilpennathur taluk and 10.0 Km Northeast side of Tiruvannnamalai District.
- The project does not fall within 10 km radius of any Eco – sensitive zone, National Park, Tiger Reserve, Elephant Corridor and Biosphere Reserves.

TABLE 2.1: SITE CONNECTIVITY

Nearest Roadway	National Highway (NH-66) Krishnagiri - Puducherry- 3.5Km-South State Highway (SH-133A) Thiruvannamalai – Keaklur – 5.5Km-NorthWest
Nearest Village	Iynkunam – 1 km – North West
Nearest Town	Thiruvannamalai – 9.5 km – SouthWest
Nearest Railway Station	Thiruvannamalai – 9.5 km – SouthWest
Nearest Airport	Chennai - 145 km – North East
Seaport	Chennai - 145 km – North East

Source: Survey of India Toposheet

TABLE 2.2: BOUNDARY CO-ORDINATES OF PROPOSED PROJECT

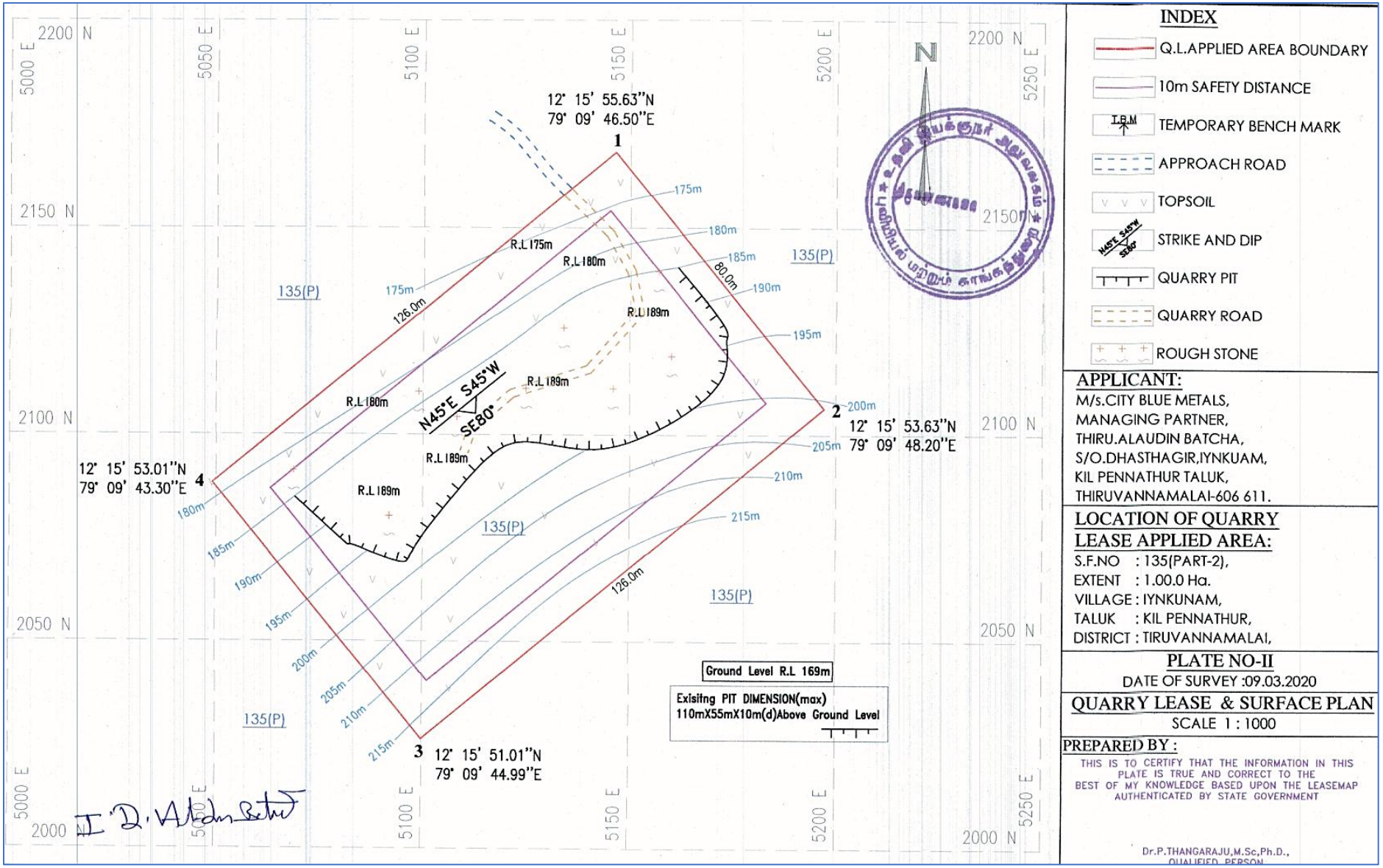
Boundary Pillar No.	Latitude	Longitude
1	12°15'53.01"N	79° 9'43.31"E
2	12°15'55.65"N	79° 9'46.49"E
3	12°15'53.62"N	79° 9'48.19"E
4	12°15'51.01"N	79° 9'45.00"E

Source: Approved Mining Plan

FIGURE 2.1: GOOGLE IMAGE OF THE PROJECT AREA

Source: Superimposed on Google Earth Imagery

FIGURE 2.2: QUARRY LEASE PLAN / SURFACE PLAN



Source: Approved Mining Plan

FIGURE 2.3: VILLAGE MAP SUPERIMPOSED ON GOOGLE EARTH IMAGE

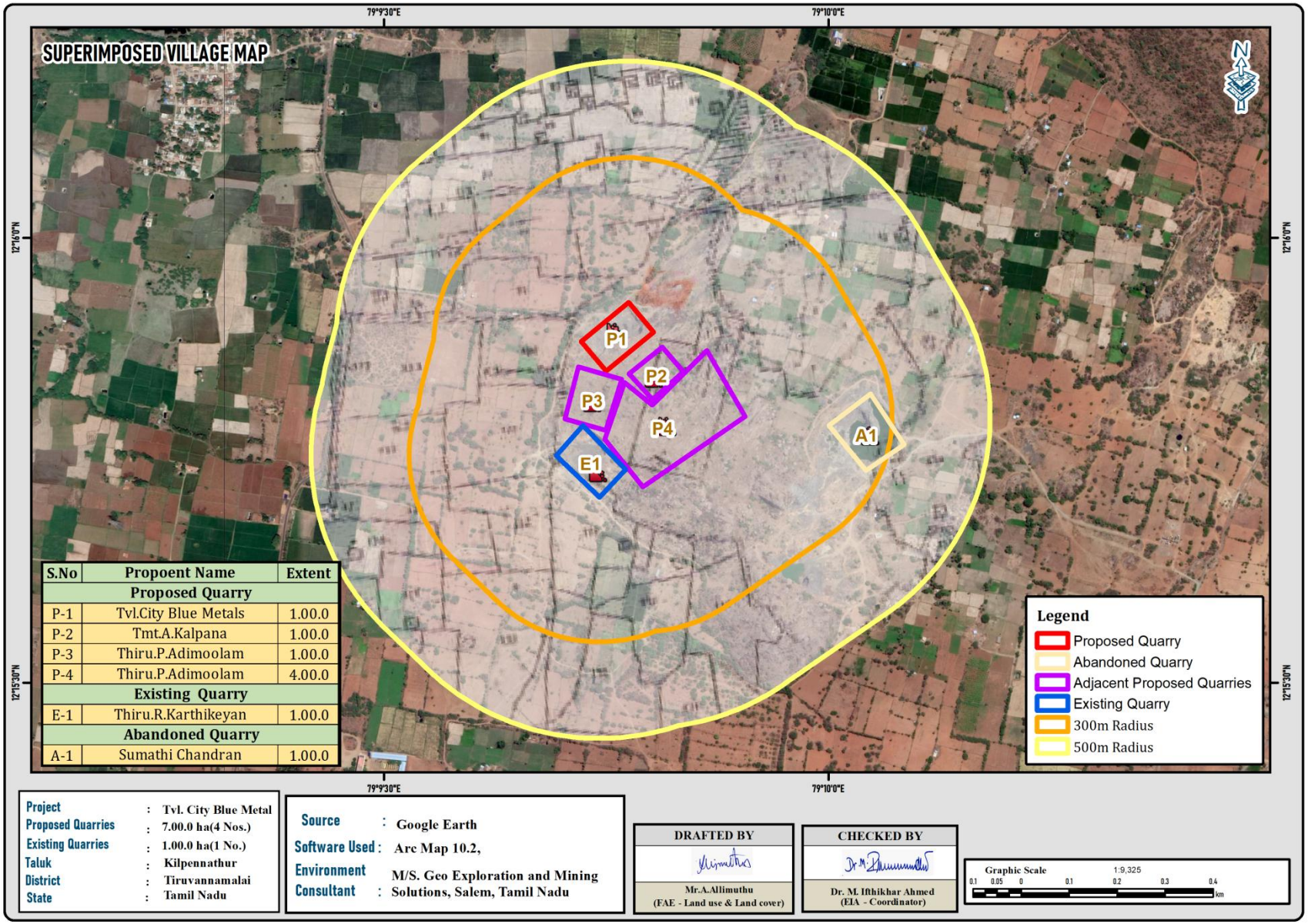


FIGURE 2.4: IMAGE SHOWING SURFACE FEATURES AROUND 10 KM RADIUS

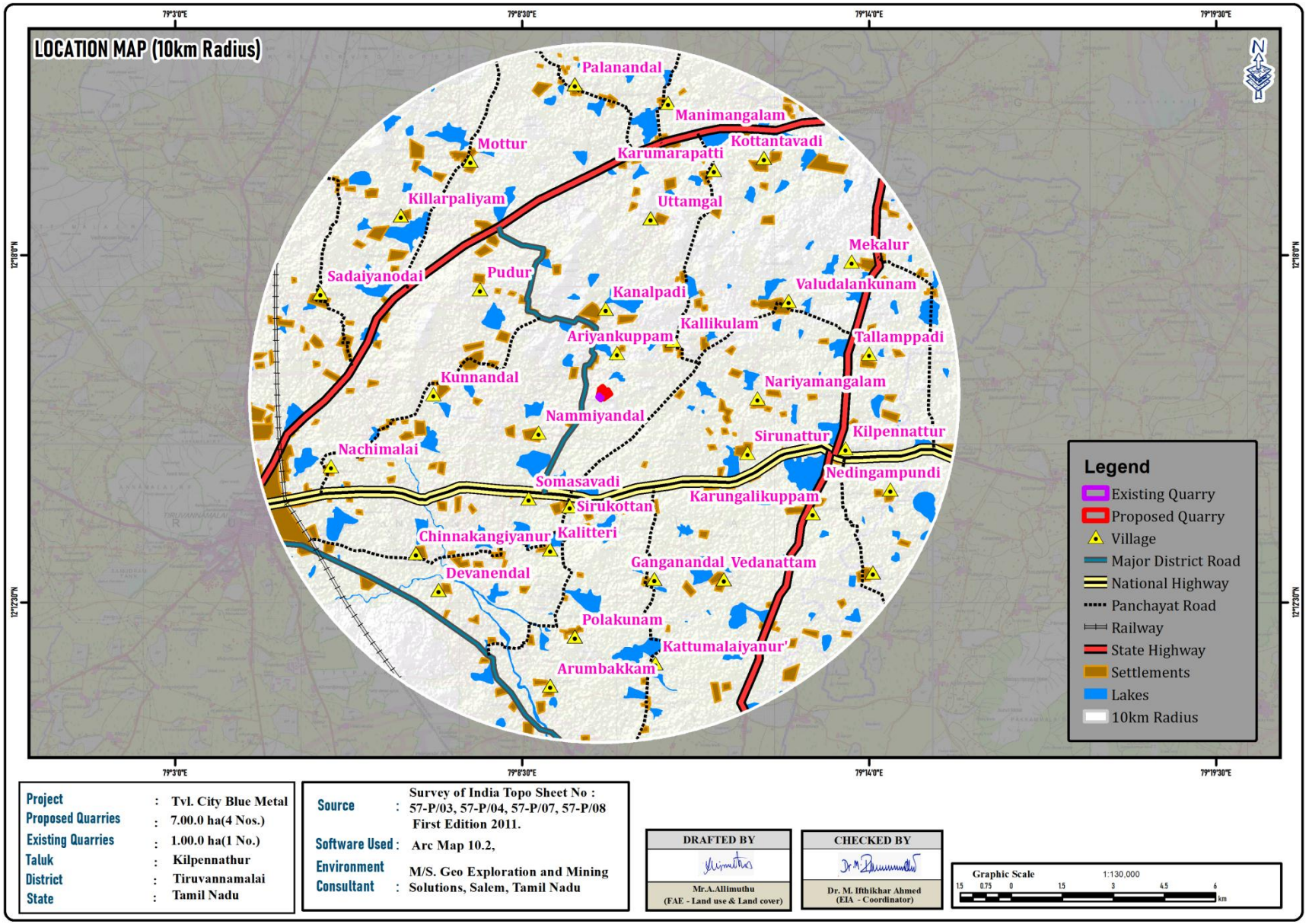


FIGURE 2.5: IMAGE SHOWING SURFACE FEATURES AROUND 5KM RADIUS

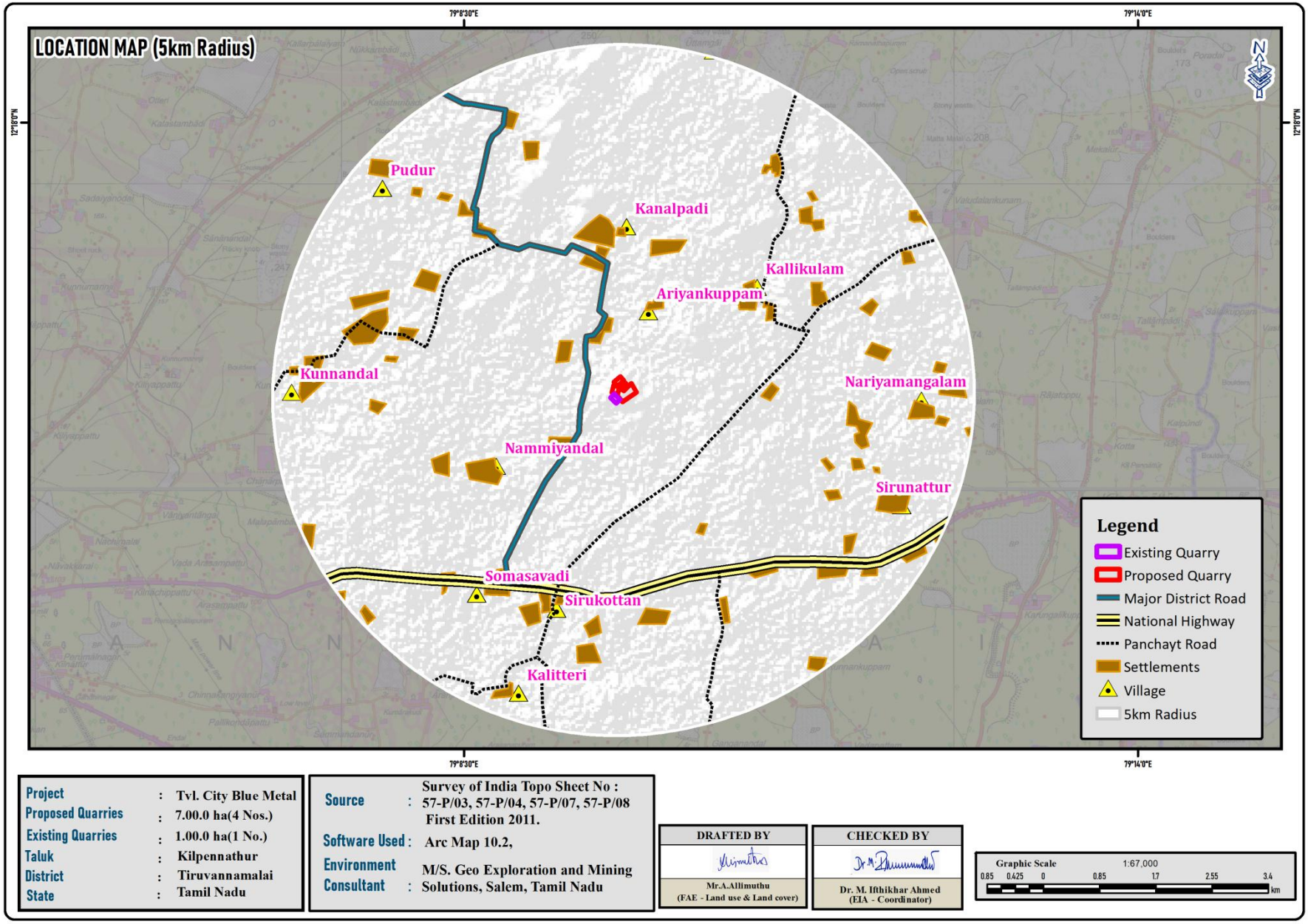
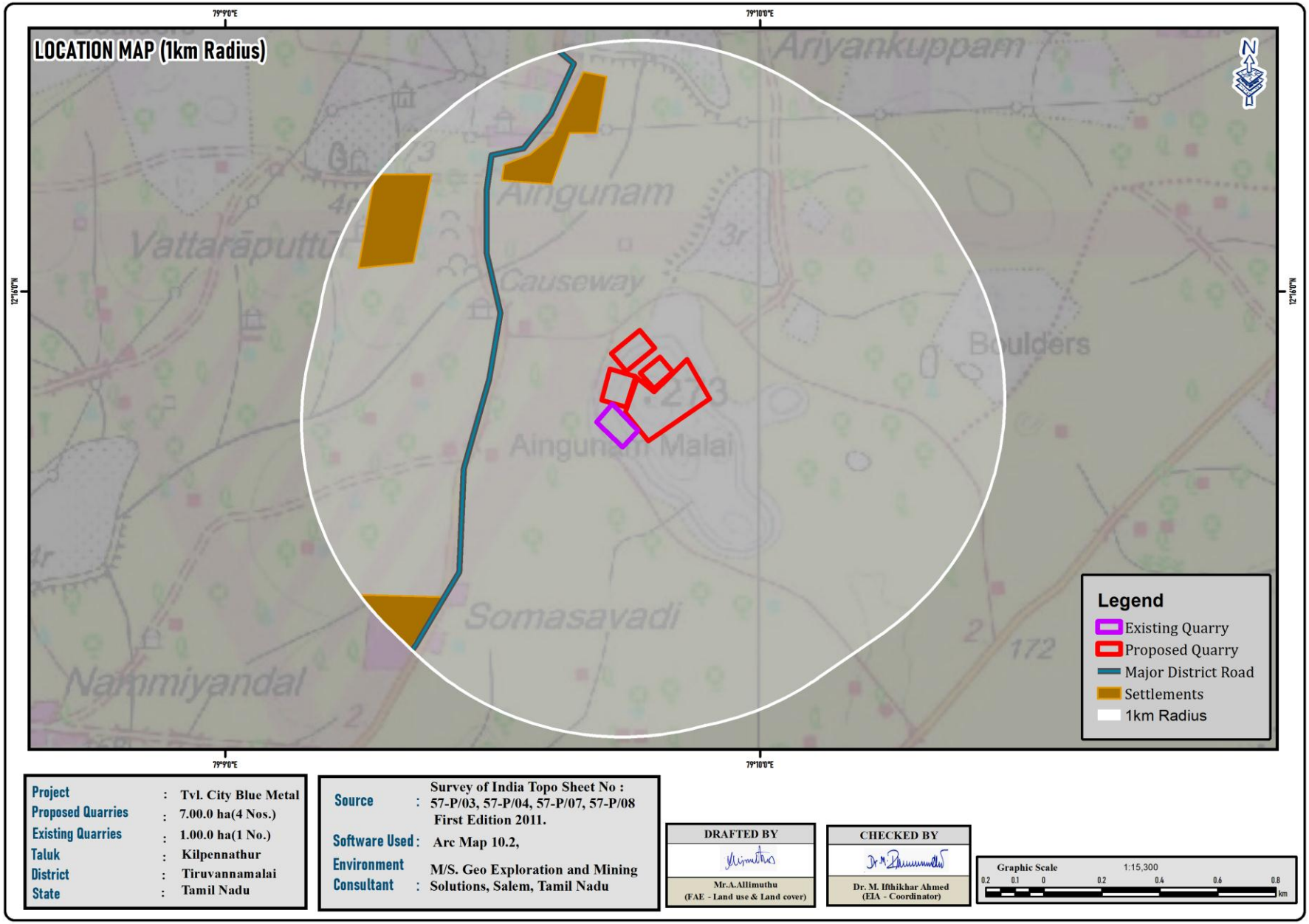


FIGURE 2.6: IMAGE SHOWING SURFACE FEATURES AROUND 1 KM RADIUS



2.2.1 Project Area

- The Proposed Project is site specific
- There is No beneficiation or processing proposed inside the project area.
- There is no forest land involved in the proposed project and is devoid of major vegetation and trees.

TABLE 2.3: LAND USE PATTERN OF THE LEASE APPLIED AREA

DESCRIPTION	PRESENT AREA IN (HA)	AREA AT THE END OF MINING PLAN (HA)
Area under Quarrying	0.32.9	1.00.0
Infrastructure	Nil	Nil
Road	Nil	Nil
Green Belt	Nil	Nil
Unutilized area	0.67.1	Nil
TOTAL	**1.00.0**	**1.00.0**

Source: Approved Mining Plan

2.2.2 Size or Magnitude of Operation

TABLE 2.4: OPERATIONAL DETAILS OF LEASE APPLIED AREA

PARTICULARS	DETAILS	
	Rough Stone	**Topsoil**
Geological Resources in m^3	5,30,000	7,623
Mineable Reserves in m^3	3,17,200	7,623
Yearwise Production for five years in m^3	3,17,200	7,623
Mining Plan Period	5 years	
Number of Working Days	300 days	
Production per day in m^3	**211**	**25**
No of Lorry loads ($6m^3$ per load)	**35**	**4**
Total Depth of Mining	71 m bgl (1 m Topsoil + 70 m Rough Stone) (46mAGL + 25m BGL)	

Source: Approved Mining Plan

2.3 GEOLOGY

2.3.1 Regional Geology

The entire district is underlain by the rocks belongs to hard crystalline rock masses of Archaen age. The Archaen rocks in this area are represented by rocks of Eastern Ghat complex comprising Charnockites, Migmatite complex off composite gneiss. The District is covered by metamorphic crystalline rocks of Charnockite composite gneiss of Archaen age. The rocks are highly metamorphosed and have been subjected to several folding, crushing and faulting. Charnockite group is occupied by North and Southern part of the basin.

The other rock type is encountered by composite granitic gneiss of Epidote hornblende biotite gneiss and hornblende biotite gneiss are occupy in the middle portion of the basin. Charnockite group occupies the high ground as well as plain and it is poorly weathered and jointed. The Hornblende biotite gneiss forms the country rock of the area and epidote hornblende gneiss (Proterozoic age) occur as small isolated outcrops.

The project area falls in the Cheyyar block comprising Archaean age group of rocks. The type of rocks found in the district are Charnockite, Granitic gneiss, Epidote Hornblende Gneiss, Amphibolite, Pyroxenite, Dunite, Migmatites, Banded Magnetite Quartzite, Shale and Clay. Dolerite dykes (Black Granite) are also noticed cutting across the country rocks.

Peninsular gneiss forms the oldest rock formations, in which the massive formation of Charnockite lies over with rich accumulation of recent quaternary formation. On regional scale the Charnockite body $N55^0E–S55^0W$ with dip towards $SE45^0E$.

The general geological sequences of the rocks in this area are given below:

AGE	FORMATION
Recent	- Quaternary Formation (Gravel)
---------Unconformity----------	
Archaean	- Charnockite Peninsular Gneiss complex

Local Geology:-

The study area follows the regional trend and mainly comprises of Hard Rock Formation as a homogeneous formation / Batholith formation of Charnockite. The entire cluster quarries area is a plaintopography, with gentle slope toward South Eastern with a highest altitude of 105m AMSL. The project area is covered with Gravel formation of 1m to 2m thickness followed by Massive Charnockite formation is found generally in this cluster.

Hydrogeology

The origin, occurrence and movement of groundwater are controlled by geological setup of a terrain. During the study it is inferred that the entire cluster area is a Hard rock terrain and the low resistance encountered at the depth between 52 – 62m, hence it is assumed that the possibility of Ground water occurrence will be below this level and it also proved that this hard batholith above 50m will not encounter any subsurface water.

There is a possibility of seepage water from the surface levels i.e., below 10m, this surface water will be collected in the mine pits and later used for dust suppression and afforestation. In the geophysical study it has been clearly inferred that the depth of the quarrying operation will not intersect the ground water table.

Aquifer Parameters

The thickness of aquifer in this district is highly erratic and varies between 20 m to 36 m below ground level. The inter granular Porosity is essentially dependent on the intensity and degree of weathering and fracture development in the bed rock. As discussed earlier deep weathering has developed in Gneissic formations and moderate weathering in Charnockite formations. The range of aquifer parameters in hard rock and sedimentary formations are given below:

TABLE 2.5: RANGE OF AQUIFER PARAMETERS

Type of Aquifer	Unconfined to Semi confined conditions
Aquifer parameters	Hard rock
Well yield in lpm	30 - 250
Transmissivity (T)m2/day	10.2 – 542.8
Permeability (K)(m/day))	0.39 – 1.56
Depth of Water level	3m to 22m

Source:https://www.twadboard.tn.gov.in/content/tiruvannamalai

FIGURE 2.7: REGIONAL GEOLOGY MAP

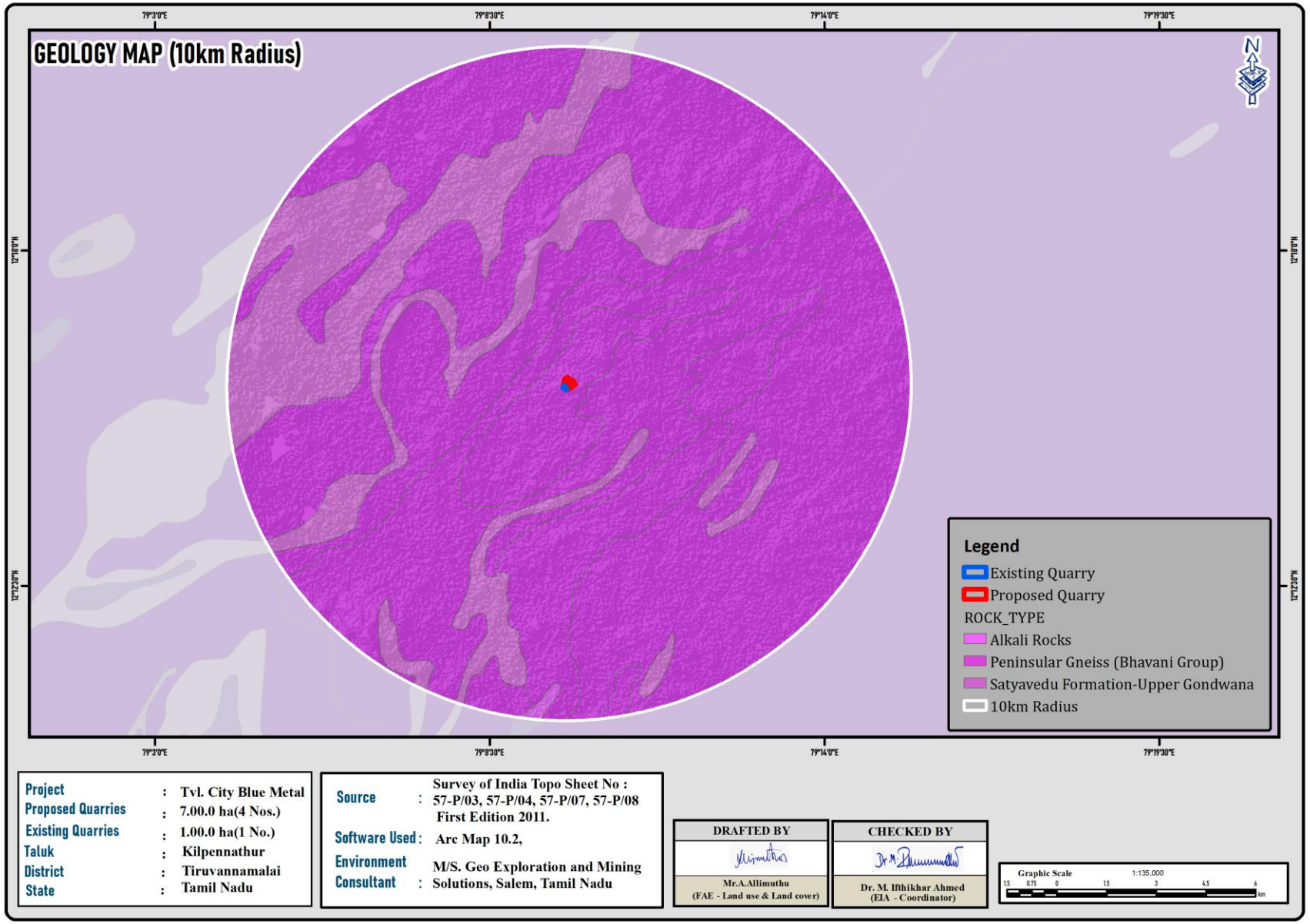


FIGURE 2.8: GEOMORPHOLOGY MAP

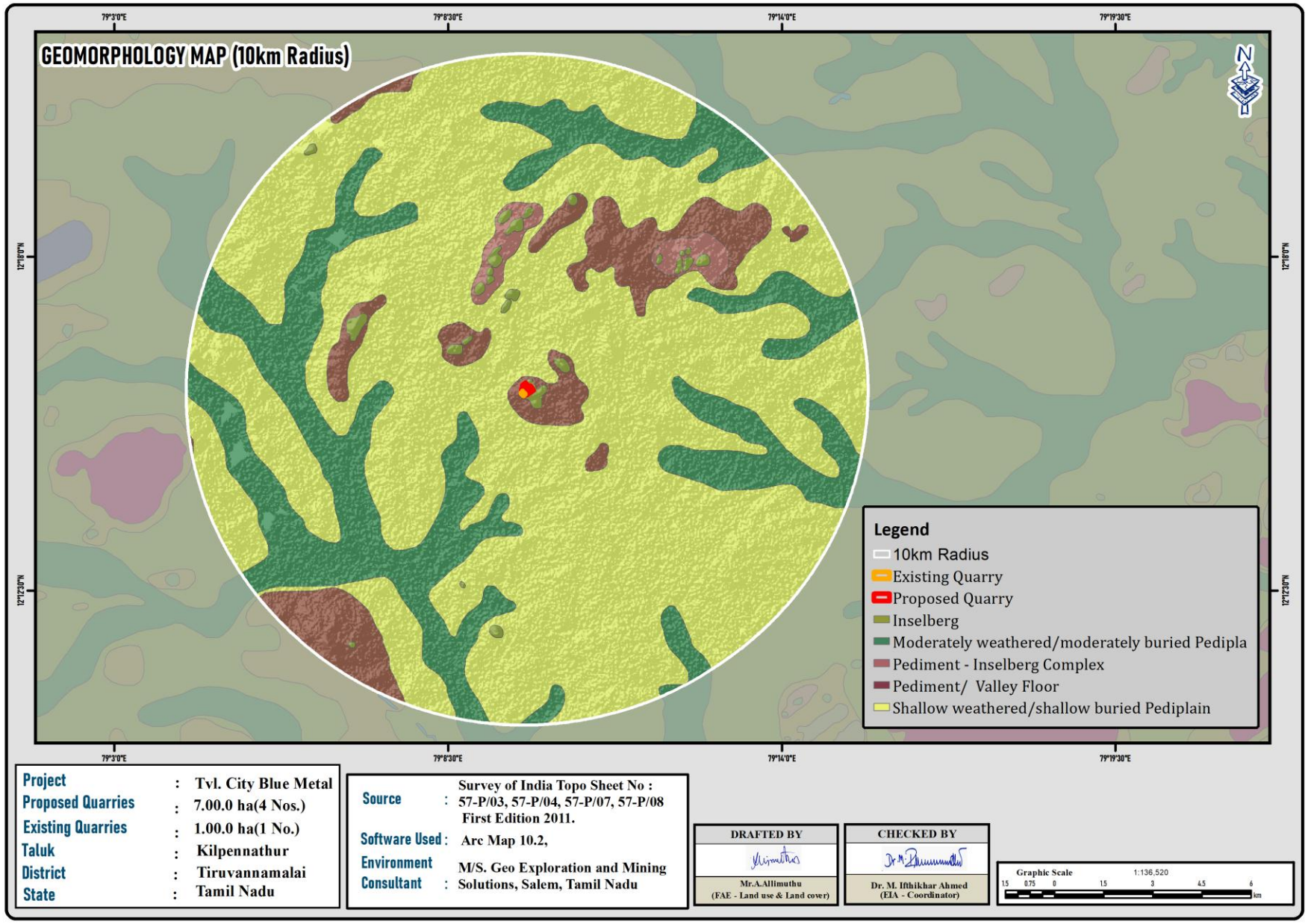
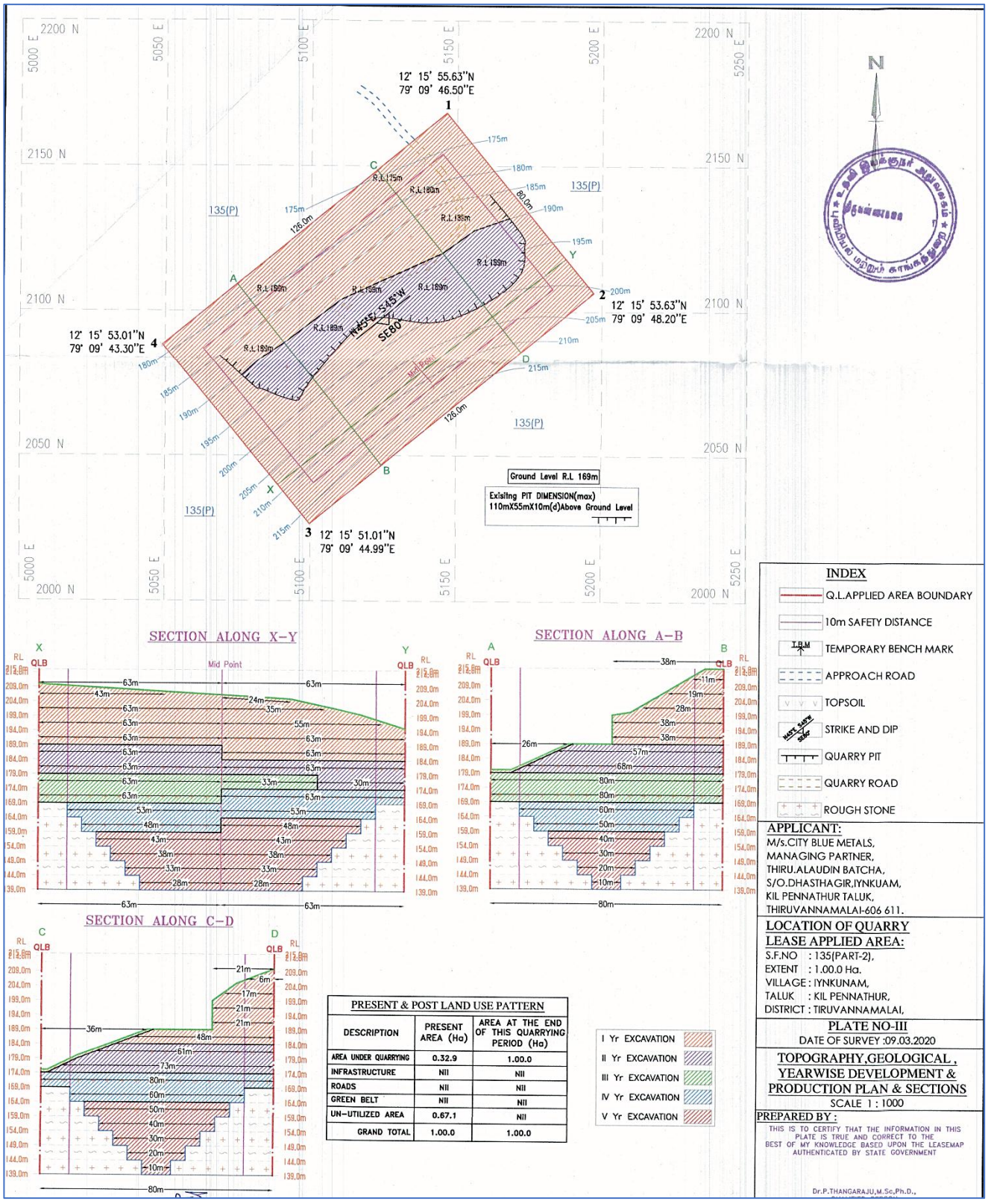


FIGURE 2.10: GEOLOGICAL, YEAR-WISE DEVELOPMENT PRODUCTION PLAN AND SECTIONS

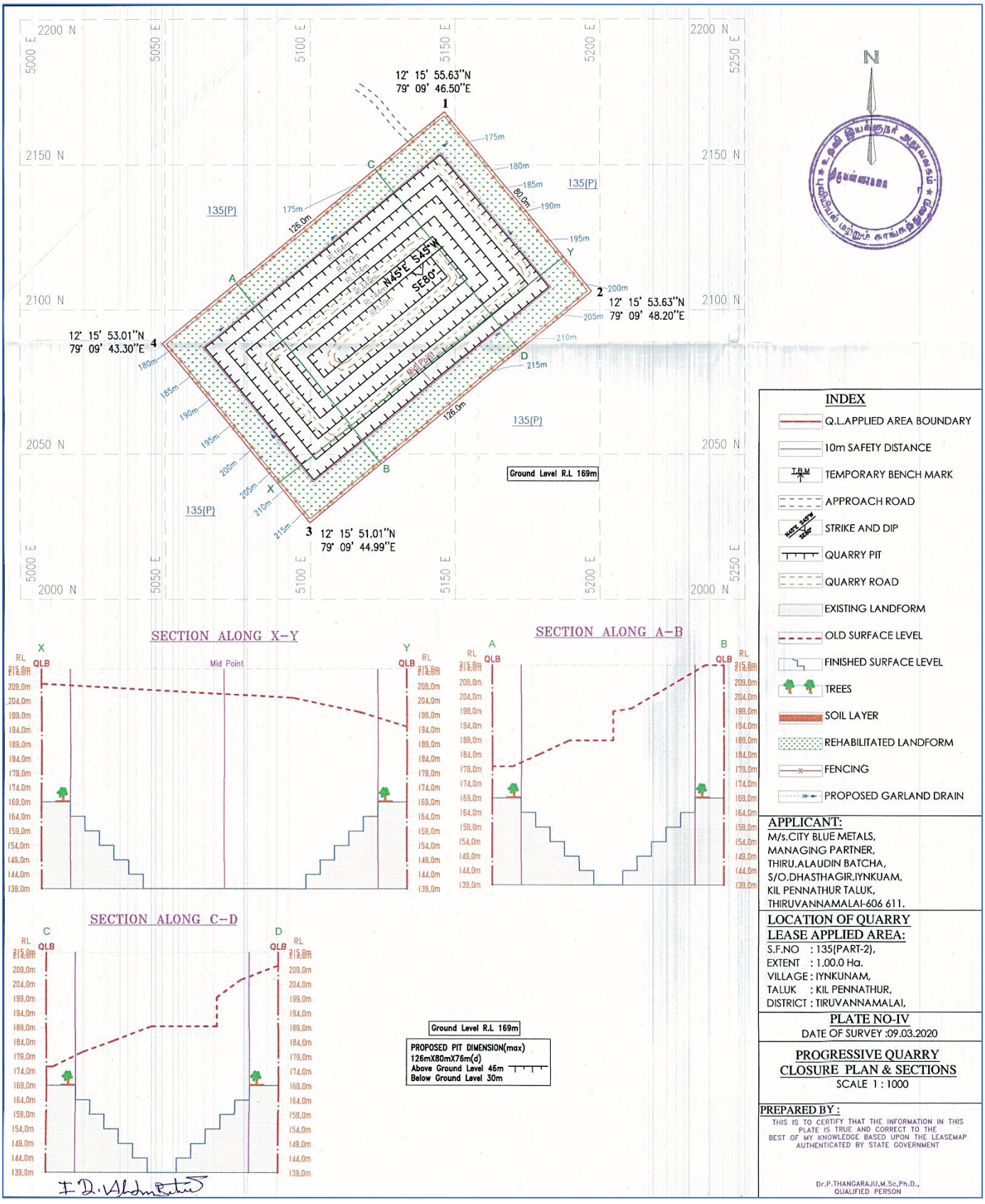


PRESENT & POST LAND USE PATTERN

DESCRIPTION	PRESENT AREA (Ha)	AREA AT THE END OF THIS QUARRYING PERIOD (Ha)
AREA UNDER QUARRYING	0.32.9	1.00.0
INFRASTRUCTURE	NIl	NIl
ROADS	NIl	NIl
GREEN BELT	NIl	NIl
UN-UTILIZED AREA	0.67.1	NIl
GRAND TOTAL	1.00.0	1.00.0

Source: Approved Mining Plan

FIGURE 2.11: CLOSURE PLAN AND SECTIONS



Source: Approved Mining Plan

2.4 RESOURCES AND RESERVES

The Resources and Reserves of Rough Stone were calculated based on Cross-Section Method by plotting sections to cover the maximum lease area of the proposed project.

Based on the availability of Geological Resources the Mineable Reserves are calculated by considering excavation system of bench formation and leaving essential safety distance of 7.5 m (Safety Barrier all around the applied area) and safety distance as per precise area communication letter and deducting the locked up reserves during bench formation (Also called as Bench Loss) and the Mineable Reserves is calculated considering there is no waste / overburden / side burden (100% Recovery Anticipated) for the proposed project.

TABLE 2.6: AVAILABLE GEOLOGICAL RESOURCES OF PROPOSED PROJECT

	Rough Stone	Topsoil
Geological Resource in m^3	5,30,000	7,623
Mineable Resource in m^3	3,17,200	7,623

Source: Approved Mining Plan

TABLE 2.7: YEAR-WISE PRODUCTION PLAN

YEAR	ROUGH STONE (m^3)	TOPSOIL (m^3)
I	70,415	7,623
II	69,540	-
III	62,445	-
IV	69,000	-
V	45,800	-
TOTAL	**3,17,200**	**7,623**

Source: Approved Mining Plan

Disposal of Waste

There is no waste anticipated in this Rough Stone quarrying operation. The entire quarried out materials will be utilized (100%). Top layer of Topsoil formation will be removed and stored within the project premises and later will be used for Green-belt development.

Conceptual Mining Plan/ Final Mine Closure Plan

The ultimate pit size is designed based on certain practical parameters such as economical depth of mining, safety zones, permissible area, etc.

TABLE 2.8: ULTIMATE PIT DIMENSION

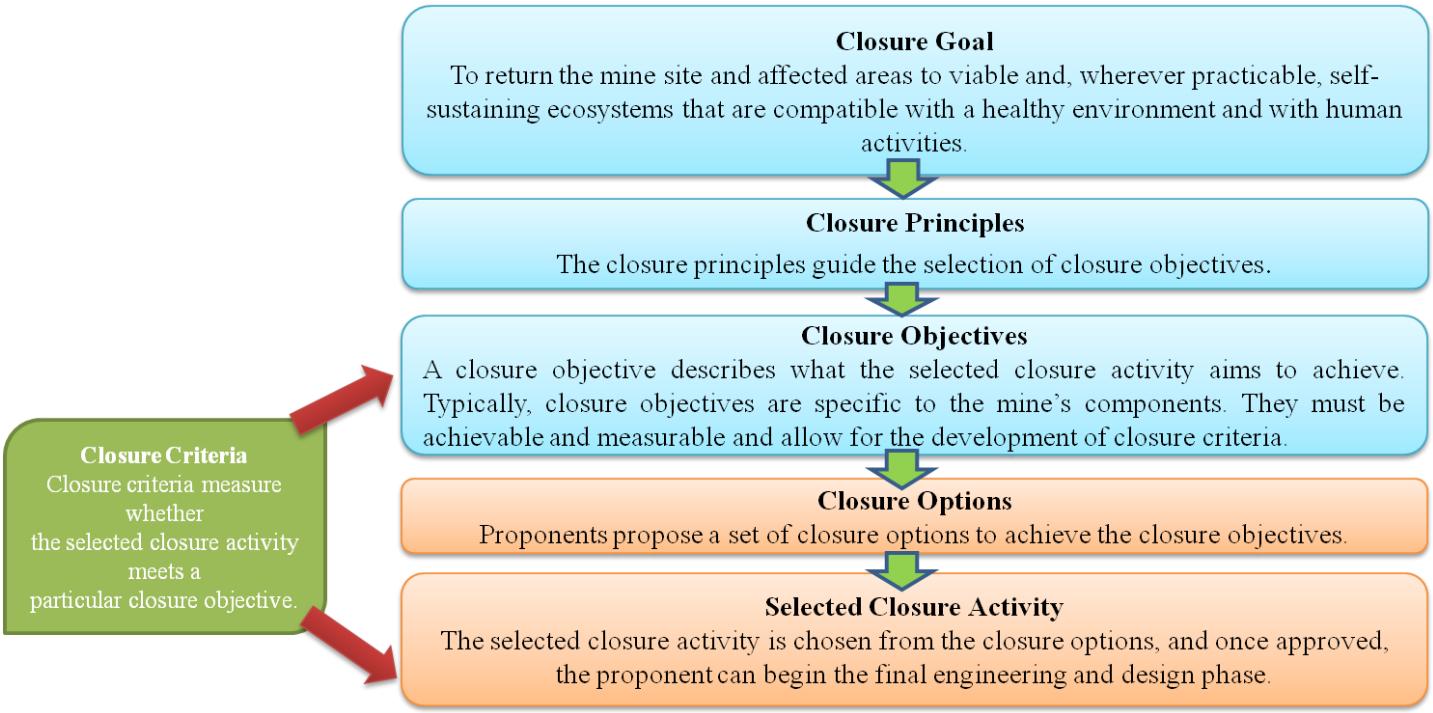
Pit	Length (Max) (m)	Width (Max) (m)	Depth (Max)
I	126	80	71m (46mAGL + 25m BGL)

Source: Approved Mining Plan

- At the end of life of mine, the excavated mine pit / void will act as artificial reservoir for collecting rain water and helps to meet out the demand or crises during drought season.
- After mine closure the greenbelt developed along the safety barrier and top benches and temporary water reservoir will enhance the ecosystem
- Mine Closure is a process of returning a disturbed site to its natural state or which prepares it for other productive uses that prevents or minimizes any adverse effects on the environment or threats to human health and safety.
- The principal closure objectives are for rehabilitated mines to be physically safe to humans and animals, geo-technically stable, geo-chemically non-polluting/ non-contaminating, and capable of sustaining an agreed post-mining land use.

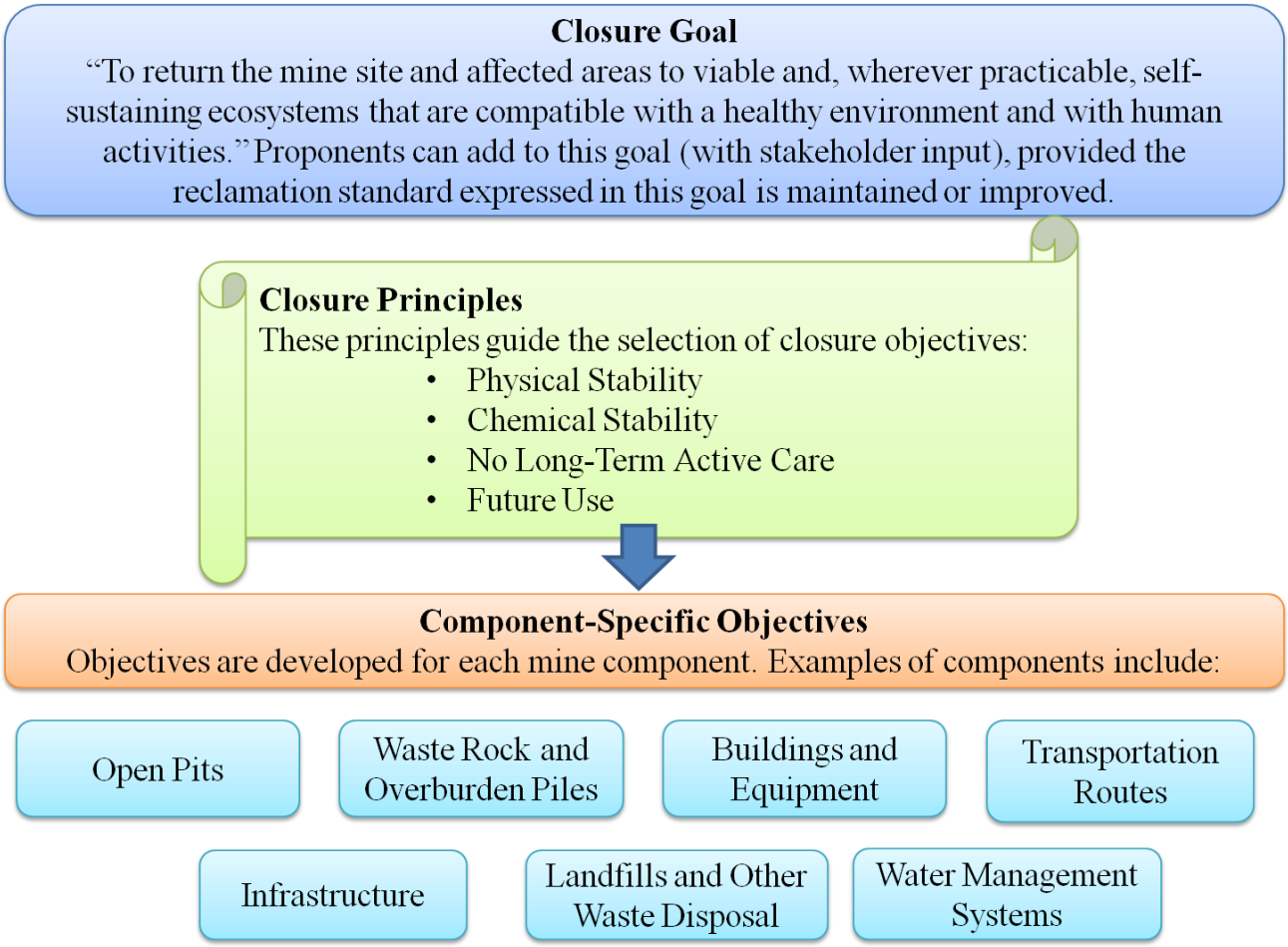
Closure Objectives –

- Access to be limited, for the safety of humans and wildlife.
- The open pit mine workings and pit boundary are physically and geo-technically stable.
- Water quality in flooded pits is safe for humans, aquatic life, and wildlife.
- Discharge of contaminated drainage has been minimized and controlled.
- Original or desired new surface drainage patterns have been established.
- For flooded pits, in-pit aquatic habitat has been established where practical and feasible.
- Emergency access and escape routes from flooded pits for humans and wildlife are in place.
- Dust levels are safe for people, vegetation, aquatic life, and wildlife.



Closure Planning & Options Considerations in Mine Design –

- The closure of mine is well planned at the initial stage of planning & design consideration by the internal and external stake holders
- Construction of 2m height bund all along the mine pit boundary and ensure its stability all time & construction of garland drain along the natural slope to avoid sliding and collection of soil to the pit & surface runoff during rainfall
- After complete exploitation of mineral, the lowest bench foot wall side will be maintained as plain surface without any sump pits to avoid any accidents
- All the sharp edges will be dressed to smoother face before the closure of mine and ensure no loose debris on hanging wall side
- There is a river on southern side of the project area. The river will not be hindered by any of mine closure activities
- The project proponent as a part of social responsibilities assures to supply the stored mine pit water to the nearby villages after effective treatment process as per the standards of TNPCB & TWAD
- Native species will be planted in 3 row patterns on the boundary barriers and 1st bench, a full-time sentry will be appointed at the gate to prevent inherent entry of public & cattle.
- The access road to the quarry will be cut-off immediately after the closure
- The layout design shall be prepared and get approved from Department of Geology and Mining.
- The proponent is instructed to construct as per the layout approved
- Physical and chemical stability of structures left in place at the site, the natural rehabilitation of a biologically diverse, stable environment, the ultimate land use is optimized and is compatible with the surrounding area and the requirements of the local community, and taking the needs of the local community into account and minimizing the socio-economic impact of closure
- There will be a positive change in the environmental and ecology due to the mine closure



Post-Closure Monitoring –

The purpose of post-closure monitoring with respect to open pit mine workings is to ensure the attainment of closure objectives.

- Monitor physical and geotechnical stability of remnant pit walls.
- Monitor the ground regime in pit walls to confirm achievement of design objectives.
- Monitor water level in pit to confirm closure objectives regarding fish, fish habitat, and wildlife safety are being achieved.
- Sample water quality and quantity at controlled pit discharge points.
- Identify and test unanticipated areas where water management is an issue.
- Inspect integrity of barriers such as berms & fences.
- Monitor wildlife interactions with barriers to determine effectiveness.
- Inspect aquatic habitat in flooded pits where applicable.
- Monitor dust levels.

TABLE 2.9: MINE CLOSURE BUDGET

Activity	Year					Cost	Total Cost
	I	II	III	IV	V		
Plantation in Nos	100	100	100	100	100	@ 100 Rs/ Saplings	Rs 50,000
Plantation & Maintenance cost	10000	10000	10000	10000	10000		
Wire Fencing (400 meters)	1,20,000					@ 300Rs per meter	Rs 1,20,000
Garland Drain (250 meters)	75,000					@ 300Rs per meter	Rs 75,000
TOTAL							**Rs 2,45,000/-**

Source: Proposed by FAE's and EC

2.5 METHOD OF MINING

The method of mining is Opencast Mechanized Mining Method is being proposed by formation of 5.0-meter height bench with a bench width not less than the bench height. However, as far as the quarrying of Rough Stone is concerned, observance of the provisions of Regulation 106 (2) (b) as above is seldom possible due to various inherent petro genetic factors coupled with mining difficulties. Hence it is proposed to obtain relaxation to the provisions of the above regulation from the Director of Mines Safety for which necessary provision is available with the Regulation 106 (2) (b) of MMR-1961, under Mine Act – 1952.

The Rough Stone is a batholith formation and the splitting of rock mass of considerable volume from the parent rock mass will be carried out by deploying jackhammer drilling and Slurry Explosives will be used for blasting. Hydraulic Excavators attached with Rock Breakers unit will be deployed for breaking large boulders to required fragmented sizes to avoid secondary blasting and hydraulic excavators attached with bucket unit will be deployed for loading the Rough Stone into the tippers and then the stone is transported from pithead to the nearby crushers.

2.5.1 Drilling & Blasting Parameters

Drilling & Blasting will be carried out as per parameters given below: -

Spacing	–	1.2m
Burden	–	1.0 m
Depth of hole	–	1.5 m
Charge per hole	–	0.50 – 0.75kg
Powder factor	–	6.0 tonnes/kg
Diameter of hole	–	32 mm

Type of Explosives to be used –

Slurry explosives (An explosive material containing substantial portions of a liquid, oxidizers, and fuel, plus a thickener), NONEL / Electric Detonator &Detonating Fuse

Storage of Explosives –

No proposal for storage of explosives within the project area, the project proponent has made agreement with authorized explosives agencies for carrying out blasting activities and competent person as per DGMS guidelines will be employed for safety and supervision of overall quarrying activities.

The explosives will be sourced from the blasting agency on daily basis and the blasting will be carried out under the supervision of competent qualified Blaster and it will be ensured that there shall be no balance of explosive stock; any balance stock will be taken back by the supplier.

2.5.2 Extent of Mechanization

TABLE 2.10 PROPOSED MACHINERY DEPLOYMENT

S.NO.	TYPE	NOS	SIZE/CAPACITY	MOTIVE POWER
1	Jack hammers	8	1.2m to 2.0m	Compressed air
2	Compressor	2	400psi	Diesel Drive
3	Excavator with Bucket / Rock Breaker Unit 4	1	300 HP	Diesel Drive
4	Tippers / Dumpers	3	20 Tonnes	Diesel Drive

Source: Approved Mining Plan

2.6 GENERAL FEATURES

2.6.1 Existing Infrastructures

Infrastructures like Mine office, Temporary Rest shelters for workers, Latrine and Urinal Facilities will be constructed as per the Mine Rule after the grant of quarry lease.

2.6.2 Drainage Pattern

Drainage pattern are created by stream erosion over time that reveals characteristics of the kind of rocks and geological structures in a landscape region drained by streams.

Drainage pattern is the pattern formed by the streams, rivers, and lakes in a particular drainage basin. They are governed by the topography of the land, whether a particular region is dominated by hard or soft rocks, and the gradient of the land.

Dendritic patterns, which are by far the most common, develop in areas where the rock (or unconsolidated material) beneath the stream has no particular fabric or structure and can be eroded equally easily in all directions.

There are no streams, canals or water bodies crossing within the project area. The drainage pattern of the area is dendritic – sub dendritic.

2.6.3 Traffic Density

The traffic survey conducted based on the transportation route of material, the Rough Stone is proposed to be transported mainly through SH-133A & Tiruvanamaali to Avalurpettai Road on Northwestern side and MDR & Nookambadi to Somasipadi Road on Southwestern Side.

Traffic density measurements were performed at two locations

1. Somasipadi - SH-133A & Tiruvanamaali to Avalurpettai Road
2. Nookambadi to Somasipadi Major District Road.

Traffic density measurement were made continuously for 24 hours by visual observation and counting of vehicles under three categories, viz., Heavy motor vehicles, light motor vehicles and two/three wheelers. As traffic densities on the roads are high, two skilled persons were deployed simultaneously at each station during each shift- one person on either direction for counting the traffic. At the end of each hour, fresh counting and recording was undertaken.

TABLE.2.11: TRAFFIC SURVEY LOCATIONS

Station Code	Road Name	Distance and Direction	Type of Road
TS1	SH-133A & Tiruvanamaali to Avalurpettai Road	5.6km NW	State Highways (Two Lane)
TS2	Nookambadi to Somasipadi Road	3.2km SW	Major District Road (Two Lane)

Source: On-site monitoring by GEMS FAE & TM

TABLE 2.12: EXISTING TRAFFIC VOLUME

Station code	HMV		LMV		2/3 Wheelers		Total PCU
	No	PCU	No	PCU	No	PCU	
TS1	238	714	107	107	316	158	979
TS2	206	618	96	96	292	146	860

Source: On-site monitoring by GEMS FAE & TM

* PCU conversion factor: HMV (Trucks and Bus) = 3, LMV (Car, Jeep and Auto) = 1 and 2/3 Wheelers = 0.5

TABLE 2.13: ROUGH STONE HOURLY TRANSPORTATION REQUIREMENT

Transportation of Rough Stone & Gravel per day		
Capacity of trucks	No. of Trips per day Cumulatively	Volume in PCU
10 tonnes	39	39

Source: Data analysed from Approved Mining Plan

FIGURE.2.12: MINERAL TRANSPORTATION ROUTE MAP

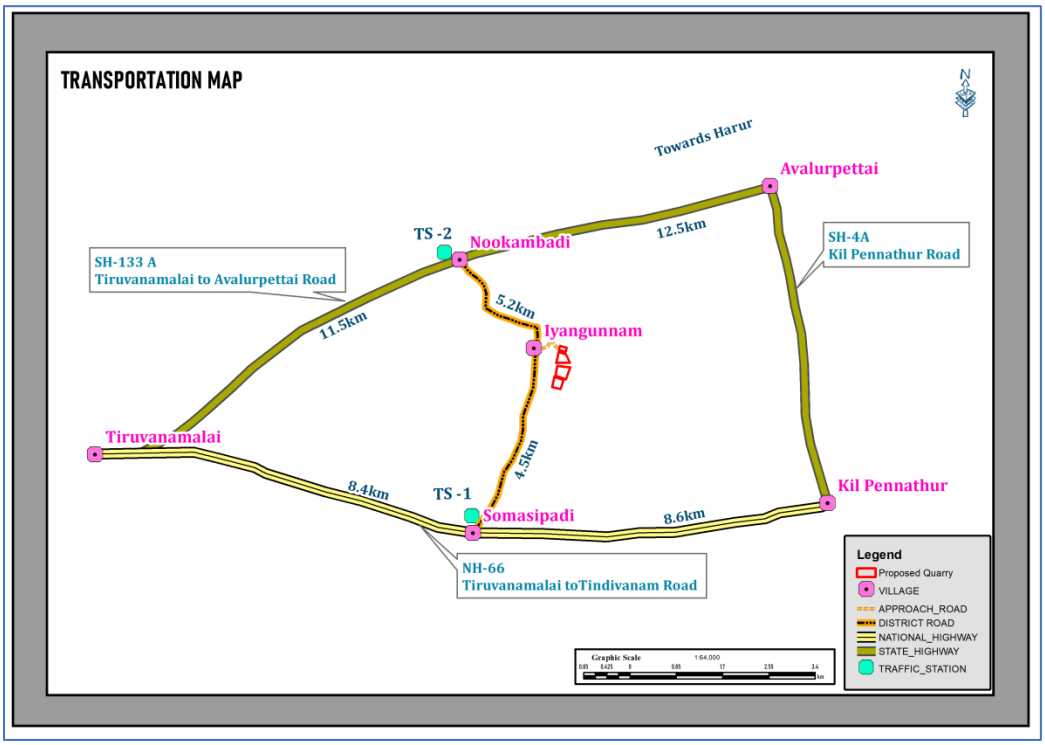


TABLE 2.14: SUMMARY OF TRAFFIC VOLUME

Route	Existing Traffic volume in PCU	Incremental traffic due to the project	Total traffic volume	Hourly Capacity in PCU as per IRC – 1960guidelines
(SH-18) Salem to Tirupattur Road	979	39	1018	1200
Ayodhiyapattinam to Belur Major District road	860	39	899	1200

Source: On-site monitoring analysis summary by GEMS FAE & TM

- Due to these projects the existing traffic volume will not exceed
- As per the IRC 1960 this existing village road can handle 1,200 PCU in hour and Major district road can handle 1500 PCU in hour hence there will not be any conjunction due to this proposed transportation.

2.6.4 Mineral Beneficiation and Processing

There is no proposal for the mineral processing or ore beneficiation in any of the proposed project

2.7 PROJECT REQUIREMENT

2.7.1 Water Source & Requirement

Detail of water requirements in KLD as given below:

TABLE 2.15: WATER REQUIREMENT FOR THE PROJECT

*Purpose	Quantity	Source
Dust Suppression	3.1 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Green Belt development	2.5 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Domestic purpose	0.9 KLD	Water Tankers
Total	**6.5 KLD**	

Source: Prefeasibility Report

* Drinking water will be sourced from Approved Water Vendors

2.7.2 Power and Other Infrastructure Requirement

This proposed project requires power supply for the mining operations. The quarrying activity is proposed during day time only (General Shift 8 AM – 5 PM, Lunch Break 1 PM – 2 PM). Electricity for use in office and other internal infrastructure will be obtained from SEB by respective project proponent.

No workshops are proposed inside the project area hence there will not be any process effluent generation from the project area. Domestic effluent from the mine office will be discharged to septic tank and soak pit. There is no toxic effluent expected to generate in the form of solid, liquid or gaseous form hence there is no requirement of waste treatment plant.

2.7.3 Fuel Requirement

High speed Diesel (HSD) will be used for mining machineries. Diesel will be brought from nearby Fuel Stations.
Average diesel consumption is around = 500 Liters of HSD / day per proposed project.

2.7.4 Project Cost

TABLE 2.16: PROJECT COST

Tvl.City Blue Metal Rough Stone Quarry	Rs. 66,10,000/-

Source: Approved Mining Plan &Prefeasibility Report

2.8 EMPLOYMENT REQUIREMENT:

The following manpower's are proposed in the mining plan to carry out the day-to-day quarrying activities, the same employment is maintaining aimed at the proposed production target and also to comply with the statutory provisions of The Metalliferous Mines Regulations, 1961 for the proposed project.

TABLE 2.17: PROPOSED MANPOWER DEPLOYMENT

Mines Manager/Mines Foreman	1
Mate/Blaster	1
Excavator Operator and Driver	4
Jack hammer operator	16
Security	1
Unskilled Labourers	7
Total	**30**

Source: Approved Mining Plan

2.9 PROJECT IMPLEMENTATION SCHEDULE

The commercial operation will commence after the grant of Environmental Clearance. CTO and CTE will be obtained from the Tamil Nadu State Pollution Control Board. The conditions imposed during the Environmental Clearance will be compiled before the start of mining operation.

TABLE 2.18: EXPECTED TIME SCHEDULE

Sl.No.	Particulars	Time Schedule (In Month)					Remarks if any
		1st	2nd	3rd	4th	5th	
1	Environmental Clearance						
2	Consent to Establish						Project Establishment Period
3	Consent to Operate						Production Start Period
Time line may vary; subjected to rules and regulations /& other unforeseen circumstances							

Source: Anticipated based on Timelines framed in EIA Notification & CPCB Guidelines

3. DESCRIPTION OF ENVIRONMENT

3.0 GENERAL

This chapter presents a regional background to the baseline data at the very onset, which will help in better appreciation of micro-level field data, generated on several environmental and ecological attributes of the study area. The baseline status of the project environment is described section wise for better understanding of the broad-spectrum conditions. The baseline environment quality represents the background environmental scenario of various environmental components such as Land, Water, Air, Noise, Biological and Socio-economic status of the study area. Field monitoring studies to evaluate the base line status of the project site were carried out covering, March, April & May 2021 with CPCB guidelines. Environmental data has been collected with reference to cluster quarries by OMEGAA LABORATORIES ISO 9001: 2008, OHSAS 18001: 2007 Certified & MoEF Notified Laboratory, for the below attributes –

- Land
- Water
- Air
- Noise
- Biological
- Socio-economic status

Study Area

An area of 10 km radius (aerial distance) from the periphery of the cluster is considered for EIA study. The data collection has been used to understand the existing environment scenario around the cluster against which the potential impacts of the project can be assessed. The study area has been divided into two zones viz **core zone** and **buffer zone** where core zone is considered as cluster and buffer zone taken as 10km radius from the periphery of the Cluster. Both Core zone and Buffer zone is taken as the study area.

Study Period

The baseline study was conducted during the summer season i.e., March - May 2021.

Study Methodology

- The project area was surveyed in detail with the help of Total Station and the boundary pillars were picked up with the help of GPS. The boundary coordinates were superimposed on the satellite imagery to understand the relief of the area, besides Land use pattern of the area was studied through the Bhuvan (ISRO)
- Soil samples were collected and analysed for relevant physio-chemical characteristics, exchangeable Cations, nutrients & micro nutrients etc., in order to assess the impact due to mining activities and to recommend saplings for Greenbelt development
- Ground water samples were collected during the study period from the existing bore wells, while surface water was collected from ponds in the buffer zone. The samples were analysed for parameters necessary to determine water quality (based on IS: 10500:2012 criteria) and those which are relevant from the point of view of environmental impact of the proposed mines
- An onsite meteorological station was setup in cluster area, to collect data about wind speed, wind direction, temperature, relative humidity, rainfall and general weather conditions were recorded throughout the study period
- In order to assess the Ambient Air Quality (AAQ), samples of ambient air were collected by installation of Respiratory Dust Samplers (RDS) for Fugitive dust, PM_{10} and SO_2, NO_X with gaseous attachments & Fine Dust Samplers (FDS) for $PM_{2.5}$ and other parameters as per NAAQ norms and analysed for primary air pollutants to work out the existing status of air quality.
- The Noise level measurements were also made at various locations in different intervals of time with the help of sound level meter to establish the baseline noise levels in the impact zone.

- Baseline biological studies were carried out to assess the ecology of the study area to study the existing flora and fauna pattern of the area.
- Socio-Economic survey was conducted at village and household level in the study area to understand the present socio-economic conditions and assess the extent of impact due to the proposed mining project.

The sampling methodologies for the various environmental parameters required for the study, frequency of sampling, method of samples analysis, etc., are given below Table 3.1.

TABLE 3.1: MONITORING ATTRIBUTES AND FREQUENCY OF MONITORING

Attribute	Parameters	Frequency of Monitoring	No. of Locations	Protocol
Land-use Land cover	Land-use Pattern within 10 km radius of the study area	Data's from census handbook 2011 and from the satellite imagery	Study Area	Satellite Imagery Primary Survey
*Soil	Physio-Chemical Characteristics	Once during the study period	6 (1 core & 5 buffer zone)	IS 2720 Agriculture Handbook - Indian Council of Agriculture Research, New Delhi
*Water Quality	Physical, Chemical and Bacteriological Parameters	Once during the study period	6 (2 surface water & 4 ground water)	IS 10500& CPCB Standards
Meteorology	Wind Speed Wind Direction Temperature Cloud cover Dry bulb temperature Rainfall	1 Hourly Continuous Mechanical/Automatic Weather Station	1	Site specific primary data& Secondary Data from IMD Station
*Ambient Air Quality	PM_{10} $PM_{2.5}$ SO_2 NO_X Fugitive Dust	24 hourly twice a week (March – May 2021)	8 (1 core & 7 buffer)	IS 5182 Part 1-23 National Ambient Air Quality Standards, CPCB
*Noise Levels	Ambient Noise	Hourly observation for 24 Hours per location	8 (1 core & 7 buffer zone)	IS 9989 As per CPCB Guidelines
Ecology	Existing Flora and Fauna	Through field visit during the study period	Study Area	Primary Survey by Quadrate & Transect Study Secondary Data – Forest Working Plan
Socio Economic Aspects	Socio–Economic Characteristics, Population Statistics and Existing Infrastructure in the study area	Site Visit & Census Handbook, 2011	Study Area	Primary Survey, census handbook & need based assessments.

Source: On-site monitoring/sampling by Omegaa Laboratories in association with GEMS

* All monitoring and testing have been carried out as per the Guidelines of CPCB and MoEF & CC.

3.1 LAND ENVIRONMENT

The main objective of this section is to provide a baseline status of the study area covering 10km radius around the proposed mine site so that temporal changes due to the mining activities on the surroundings can be assessed in future.

3.1.1 Land Use/ Land Cover

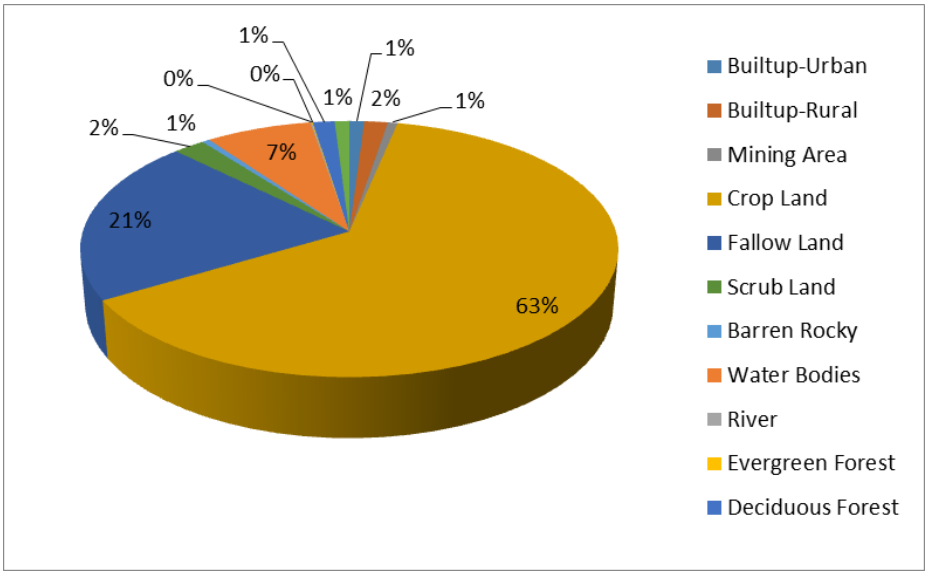
A visual interpretation technique has been adopted for land use classification based on the keys suggested in the chapter – V of the guidelines issued by NNRMS Bangalore & Level III classification with 1:50,000 scale for the preparation of land use mapping. Land use pattern of the area was studied through LISS III imagery of Bhuvan (ISRO). The 10 km radius map of study area was taken for analysis of Land use cover.

TABLE 3.2: LAND USE / LAND COVER TABLE 10 KM RADIUS

S.No	CLASSIFICATION	AREA_Ha	AREA_%
BUILTUP			
1	Builtup-Urban	331.599	1.01
2	Builtup-Rural	526.811	1.61
3	Mining Area	217.911	0.66
AGRICULTURAL LAND			
4	Crop Land	20599.4	63.1
5	Fallow Land	6808.38	20.8
BARREN/WASTE LANDS			
6	Scrub Land	707.644	2.17
7	Barren Rocky	175.979	0.53
WATER BODIES			
8	Water Bodies	2372.67	7.27
9	River	34.0057	0.1
FOREST			
10	Evergreen Forest	18.7107	0.05
11	Deciduous Forest	489.771	1.5
12	Scrub Forest	327.341	1
		32610.2224	100

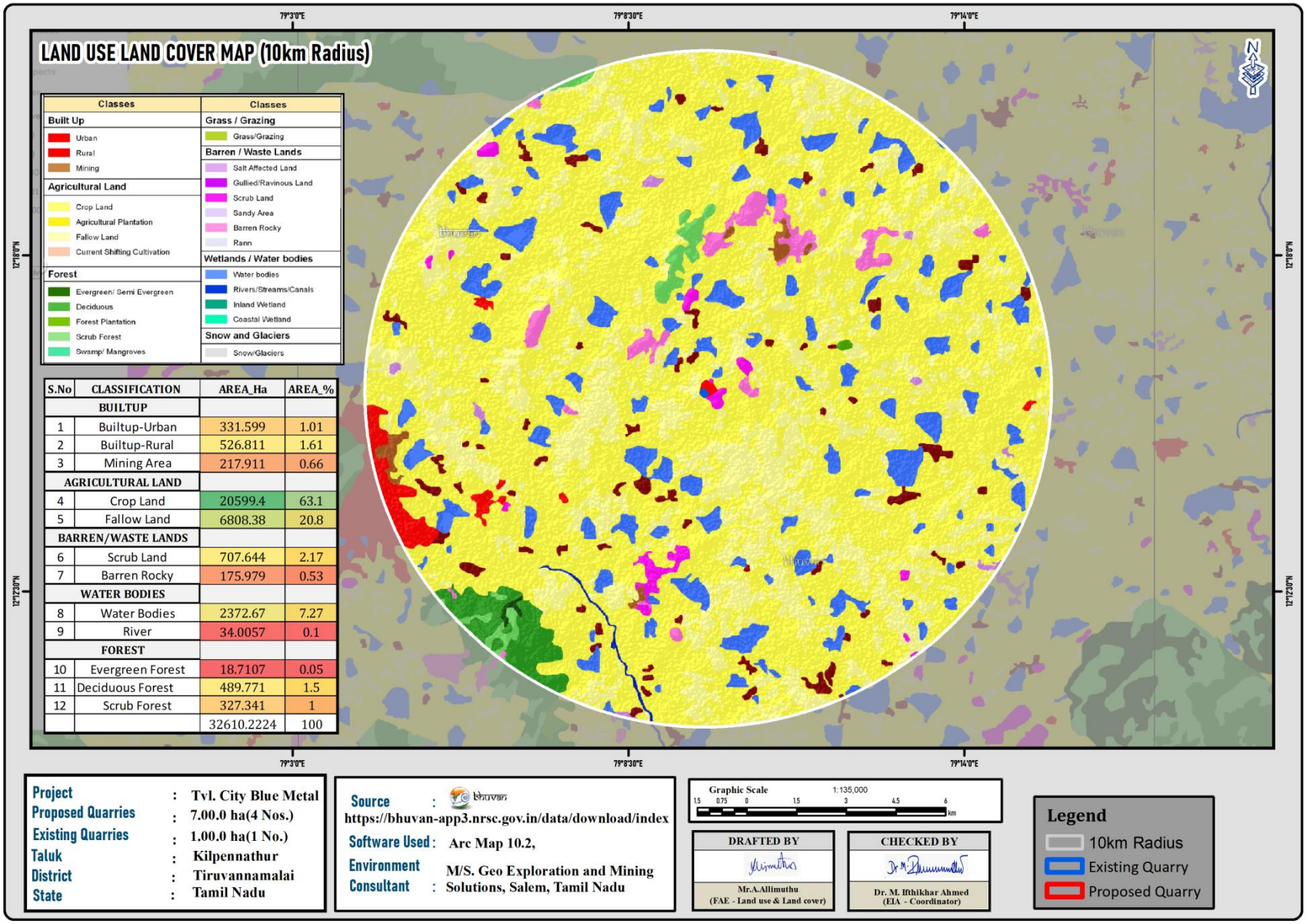
Source: Survey of India Toposheet and Landsat Satellite Imagery

FIGURE 3.1: PIE DIAGRAM OF LAND USE AND LAND IN STUDY AREA



Source: Table 3.2

FIGURE 3.2: LAND USE LAND COVER MAP 10KM RADIUS



From the above table, pie diagram and land use map it is inferred that the majority of the land in the study area is Agriculture land (includes crop and fallow land) 83.9% followed by Water bodies 7.37% , Barren land 2.7% , Built up area 2.62%, Forest land 2.55% and Mining land 0.66%

The total mining area within the study area is 217.911 ha i.e., 0.66%. The cluster area of 8.00ha contributes about 3.67% of the total mining area within the study area. This small percentage of Mining Activities shall not have any significant impact on the environment.

3.1.2 Topography

The Lease Applied area is hilly terrain, the gradient is gentle (1 to 8) towards Northwestern Side and altitude of the area is 220-180 AMSL. The area is covered with Topsoil formation of 1m thickness; Massive Charnockite formation is found after 1m Topsoil formation which is clearly inferred from the existing quarry pits nearby.

3.1.3 Drainage Pattern of the Area

Drainage pattern are created by stream erosion over time that reveals characteristics of the kind of rocks and geological structures in a landscape region drained by streams.Drainage pattern is the pattern formed by the streams, rivers, and lakes in a particular drainage basin. They are governed by the topography of the land, whether a particular region is dominated by hard or soft rocks, and the gradient of the land.

Dendritic patterns, which are by far the most common, develop in areas where the rock (or unconsolidated material) beneath the stream has no particular fabric or structure and can be eroded equally easily in all directions.

There are no streams, canals or water bodies crossing within the project area. The drainage pattern of the area is dendritic – sub dendritic.

3.1.4 Seismic Sensitivity

The proposed project site falls in the seismic Zone II, low damage risk zone as per BMTPC, Vulnerability Atlas of Seismic zone of India IS: 1893 – 2002. The project area falls in the hard rock terrain on the peninsular shield of south India which is highly stable.
(Source: https://moes.gov.in/writereaddata/files/LS_EN_20032020_385.pdf)

3.1.5 Environmental Features in the Study Area

There is no Wildlife Sanctuaries, National Park and Archaeological monuments within project area. No Protected and Reserved forest area is involved in the project area. Therefore, there will be no need to acquisition/diversion of forest land. The details related to the environment sensitivity around the proposed mine lease area i.e., 10 km radius, are given in the below Table 3.3.

TABLE 3.3: DETAILS OF ENVIRONMENT SENSITIVITY AROUND THE CLUSTER

Sl.No	Sensitive Ecological Features	Name	Arial Distance in km from Cluster
1	National Park / Wild life Sanctuaries	None	Nil within 10km Radius
2	Reserve Forest	Theppakadu R.F	8.5Km - SW
		Sorakolathur R.F	9.5km - NW
3	Lakes/Reservoir/ Dams/Stream/Rivers	Thurunjal River	6km South West
4	Tiger Reserve/ Elephant Reserve/ Biosphere Reserve	None	Nil within 10KM Radius
5	Critically Polluted Areas	None	Nil within 10km Radius
6	Mangroves	None	Nil within 10km Radius
7	Mountains/Hills	None	Nil within 10km Radius
8	Notified Archaeological Sites	None	Nil within 10km Radius
9	Industries/ Thermal Power Plants	None	Nil within 10km Radius
10	Defence Installation	None	Nil within 10km Radius

Source: Survey of India Toposheet

TABLE 3.4: NEARBY WATER BODIES FROM THE PROPOSED PROJECT SITE

Sl.No	NAME	DISTANCE & DIRECTION
1	Thurunjal River	6km South West
2	Tank Near Namiyandal	1.5km SW
3	Tank Near Noimalai	8km SW
4	Tank Near Tirumalai Nagar	7.8km SW
5	Tank Near Avalurpettai	9.8km NE
6	Tank near Karungalikuppam	5km SE
7	Kolathur Tank	9.7km SE
8	Tank near Su.Palliampattu	5km SW
9	Tank near Kasthambadi	6.8km NW
10	Tank near Ganalapadi	2.3km N
11	Tank near Pallikondapattu	6km SW
12	Tank near Hariyankuppam	800m N

Source: Village Cadastral Map and Field Survey

3.1.6 Soil Environment

Soil quality of the study area is one of the important components of the land environment. The composite soil samples were collected from the study area and analysed for different parameters. The locations of the monitoring sites are detailed in Table 3.5 and Figure 3.3.

The objective of the soil sampling is -

To determine the baseline soil characteristics of the study area; study the impact of proposed activity on soil characteristics and study the impact on soil more importantly agriculture production point of view.

TABLE 3.5: SOIL SAMPLING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	S-1	Core Zone	-	12°15'52.47"N 79° 9'46.09"E
2	S-2	Iyankulam	330m NW	12°16'19.50"N 79° 9'32.58"E
3	S-3	Vazhuthalangulam	4.5km NE	12°17'3.78"N 79°12'24.63"E
4	S-4	Nariyamangalam	3.5km East	12°15'39.67"N 79°11'58.62"E
5	S-5	Somasipadi	1.5km South	12°14'20.59"N 79° 9'13.35"E
6	S-6	Vallivagai	3.5km West	12°16'27.33"N 79° 7'37.24"E

Source: On-site monitoring/sampling by Omegaa Laboratories in association with GEMS

Methodology –

For studying soil quality, sampling locations were selected to assess the existing soil conditions in and around the project site representing various land use conditions. The samples were collected by auger boring into the soil up to 90-cm depth. Six (6) locations were selected for soil sampling on the basis of soil types, vegetative cover, industrial & residential activities including infrastructure facilities, which would accord an overall idea of the soil characteristics. The samples were analysed for physical and chemical characteristics. The samples were sent to laboratory for analysis. The samples were filled in Polythene bags, coded and sent to laboratory for analysis and the details of methodology in respect are given in below Table 3.5.

TABLE 3.6: METHODOLOGY OF SAMPLING COLLECTION

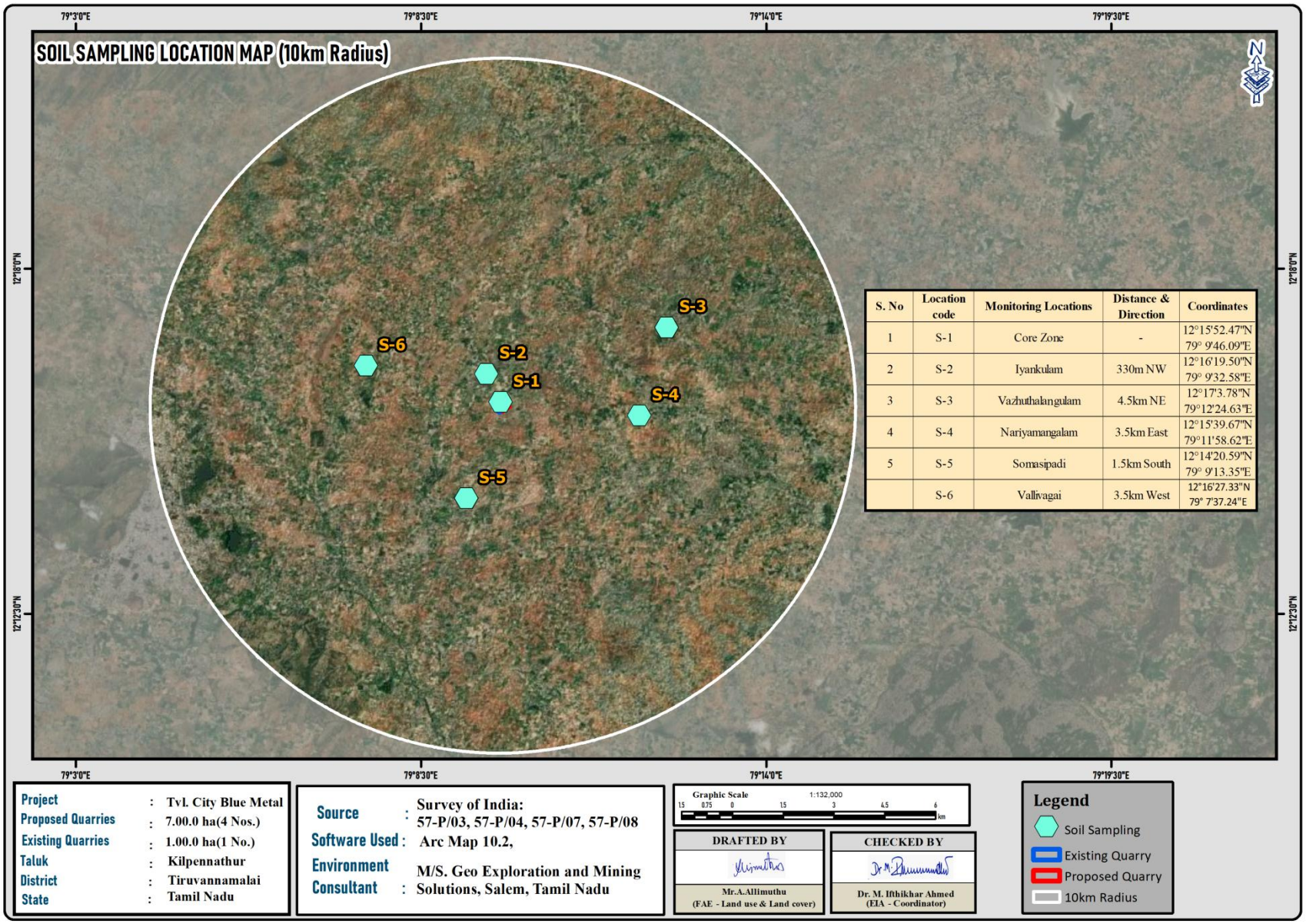
Particulars	Details
Frequency	One grab sample from each station-once during the study period
Methodology	Composite grab samples of the topsoil were collected from 3 depths, and mixed to provide a representative sample for analysis. They were stored in airtight Polythene bags and analysed at the laboratory.

Source: On-site monitoring/sampling by Omegaa Laboratories in association with GEMS

Soil Testing Result –

The samples were analysed as per the standard methods prescribed in "Soil Chemical Analysis (M.L. Jackson, 1967) & Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India". The important properties analysed for soil are bulk density, porosity, infiltration rate, pH and Organic matter, kjeldahi Nitrogen, Phosphorous and Potassium. The standard classifications of soil and physico-chemical characteristics of the soils are presented below in Table 3.6 & Test Results in Table 3.7.

FIGURE 3.3: SOIL SAMPLING LOCATIONS AROUND 10 KM RADIUS



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	S-6	Vallivagai	3.5km West	12°16'27.33"N 79° 7'37.24"E

FIGURE 3.4: SOIL MAP

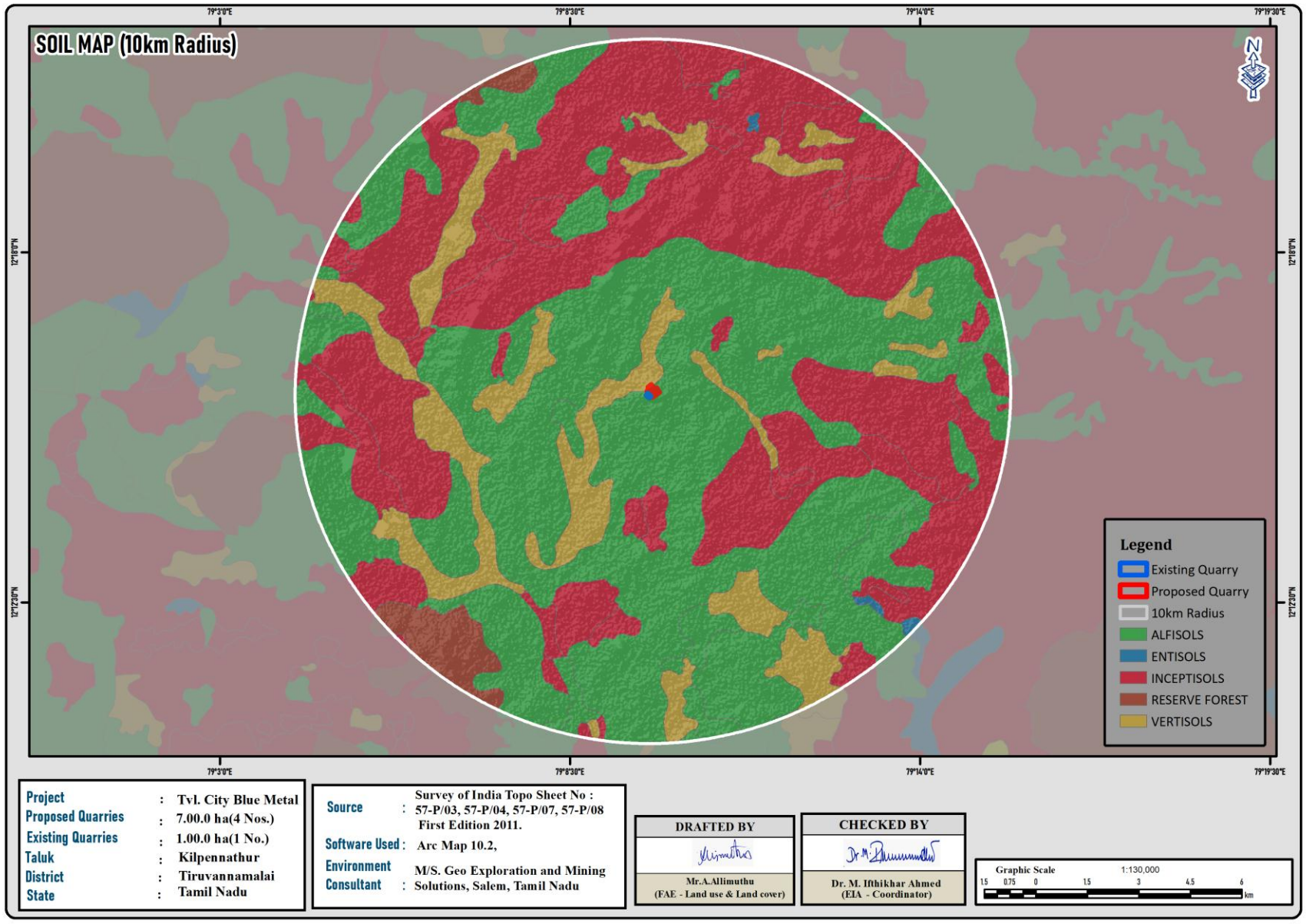


TABLE 3.7: SOIL QUALITY OF THE STUDY AREA

S.No	Parameters	Units	S1	S-2	S-3	S-4	S-5	S-6
1	pHat27°C	-	7.69	8.24	7.87	7.25	8.63	7.53
2	Electrical Conductivity@25°C	µs/cm	356	429	628	534	825	371
3	Texture	-	Sandy Loam	Sandy Clay Loam	Clay Loam	Sandy Loam	Clay	Clay Loam
4	Sand	%	63.9	58.6	42.9	72.3	36.4	41.9
5	Slit	%	19.9	15.7	24.5	12.5	13.8	19.7
6	Clay	%	16.2	25.7	32.6	15.2	43.9	38.4
7	Water Holding Capacity	%	35.7	40.6	42.8	34.2	47.2	35.4
8	Bulk Density	g/cc	0.75	0.93	1.09	0.83	1.25	0.87
9	Porosity	%	23.9	29.3	27.2	26.4	35.7	31.5
10	Exchangeable Calcium (as Ca)	mg/Kg	145	163	149	155	182	139
11	Exchangeable Magnesium (as Mg)	mg/Kg	23.8	26.8	30.7	24.2	38.5	25.2
12	Exchangeable Manganese (as Mn)	mg/Kg	25.3	29.1	33.8	30.4	40.7	22.6
13	Exchangeable Zinc as Zn	mg/Kg	0.42	0.56	1.04	0.68	1.34	0.74
14	Available Boron (as B)	mg/Kg	0.58	0.62	0.75	0.49	0.91	0.46
15	Soluble Chloride (as Cl)	mg/Kg	125	131	139	154	178	129
16	Soluble Sulphate (as SO_4)	mg/Kg	113	124	138	127	161	134
17	Available Potassium (as K)	mg/Kg	32.9	34.2	41.9	32.9	59.4	29.7
18	Available Phosphorous (as P)	Kg/hec	0.64	0.81	0.75	0.93	1.38	0.75
19	Available Nitrogen (as N)	Kg/hec	115	132	149	125	177	149
20	Cadmium (as Cd)	mg/Kg	BDL (DL:0.003)					
21	Chromium (as Cr)	mg/Kg	BDL (DL:0.05)					
22	Copper (as Cu)	mg/Kg	BDL (DL:0.05)					
23	Lead (as Pb)	mg/Kg	0.52	0.75	0.97	0.86	1.24	0.51
24	Total Iron	mg/Kg	1.36	1.62	1.77	1.54	2.19	1.13
25	Organic Matter	%	1.25	1.43	1.68	1.32	2.57	1.28
26	Organic Carbon	%	0.72	0.83	0.97	0.76	1.49	1.74
27	CEC	meq/l00g	30.9	35.1	41.7	31.9	46.8	36.8

Source: Sampling Results by Omegaa Laboratories

Interpretation & Conclusion

Physical Characteristics –

The physical properties of the soil samples were examined for texture, bulk density, porosity and water holding capacity. The soil texture found in the study area is Clay to Sandy Loam Soil and Bulk Density of Soils in the study area varied between 0.75 – 1.25 g/cc. The Water Holding Capacity and Porosity of the soil samples is found to be medium i.e. ranging from 34.2 – 47.2 %.

Chemical Characteristics –

- The nature of soil is slightly alkaline to strongly alkaline with pH range 7.25 to 8.63
- The available Nitrogen content range between 115 to 177 kg/ha
- The available Phosphorus content range between 0.64 to 1.38 kg/ha
- The available Potassium range between 29.7 to 59.4 mg/kg

3.2 WATER ENVIRONMENT

The water resources, both surface and groundwater play a significant role in the development of the area. The purpose of this study is to assess the water quality characteristics for critical parameters and evaluate the impacts on agricultural productivity, domestic community usage, recreational resources and aesthetics in the vicinity. The water samples were collected and transported as per the norms in pre-treated sampling cans to laboratory for analysis.

3.2.1 Surface Water Resources:

Tiruvannamalai district is drained by tributaries of Ponnaiyar and Cheyyar rivers. The major part of the district falls under the Palar sub catchment and extreme southern part of the district fall under Ponnaiyar sub catchment. In general, the district is characterized by dentritic drainage.

3.2.2 Ground Water Resources:

Groundwater occurs in all the crystalline formations of oldest Achaeans and Recent Alluvium. The occurrence and behaviour of groundwater are controlled by rainfall, topography, geomorphology, geology, structures etc.

Ground water is occurring in pheratic conditions in weathered and fractured gneiss rock formation. The weathering is controlled by the intensity of weathering and fracturing. Dug wells as wells as bore wells are more common ground water abstraction structures in the area. The diameter of the dug well is in the range of 7 to 10 m and depth of dug wells range from 10.5 to 13.6 m bgl. The dug wells yield up to 1 lps in summer months and few wells remains dry. The yield is adequate for irrigation for one or two crops in monsoon period.

3.2.3 Methodology

Reconnaissance survey was undertaken and monitoring locations were finalized based on;

- Drainage pattern;
- Location of Residential areas representing different activities/likely impact areas; and
- Likely areas, which can represent baseline conditions

Two (2) surface water and Four (4) ground water samples were collected from the study area and were analysed for physio-chemical, heavy metals and bacteriological parameters in order to assess the effect of mining and other activities on surface and ground water. The samples were analysed as per the procedures specified by CPCB, IS-10500:2012 and 'Standard methods for the Examination of Water and Wastewater' published by American Public Health Association (APHA). The water sampling locations are given in Table 3.9 and shown as Figure 3.6.

TABLE 3.8: WATER SAMPLING LOCATIONS

S.NO	CODE	LOCATIONS	DISTANCE & DIRECTION	COORDINATES
SURFACE WATER				
1	SW-1	Mathalangulam	8km SW	12°14'45.96"N 79° 5'11.12"E
2	SW-2	Ganalapadi Tank	1.5km NW	12°16'49.55"N 79° 9'13.09"E
GROUND WATER				
3	WW-1	Core Zone	-	12°15'57.38"N 79° 9'58.60"E
4	WW-2	Vazhuthalangulam	4.5km NE	12°17'3.59"N 79°12'15.73"E
5	BW-1	Core Zone	-	12°15'56.96"N 79° 9'35.30"E
6	BW-2	Nookampadi	5km NW	12°18'19.58"N 79° 8'5.83"E

Source: On-site monitoring/sampling by Omegaa Laboratories in association with GEMS

FIGURE 3.5: WATER SAMPLING LOCATIONS AROUND 10 KM RADIUS

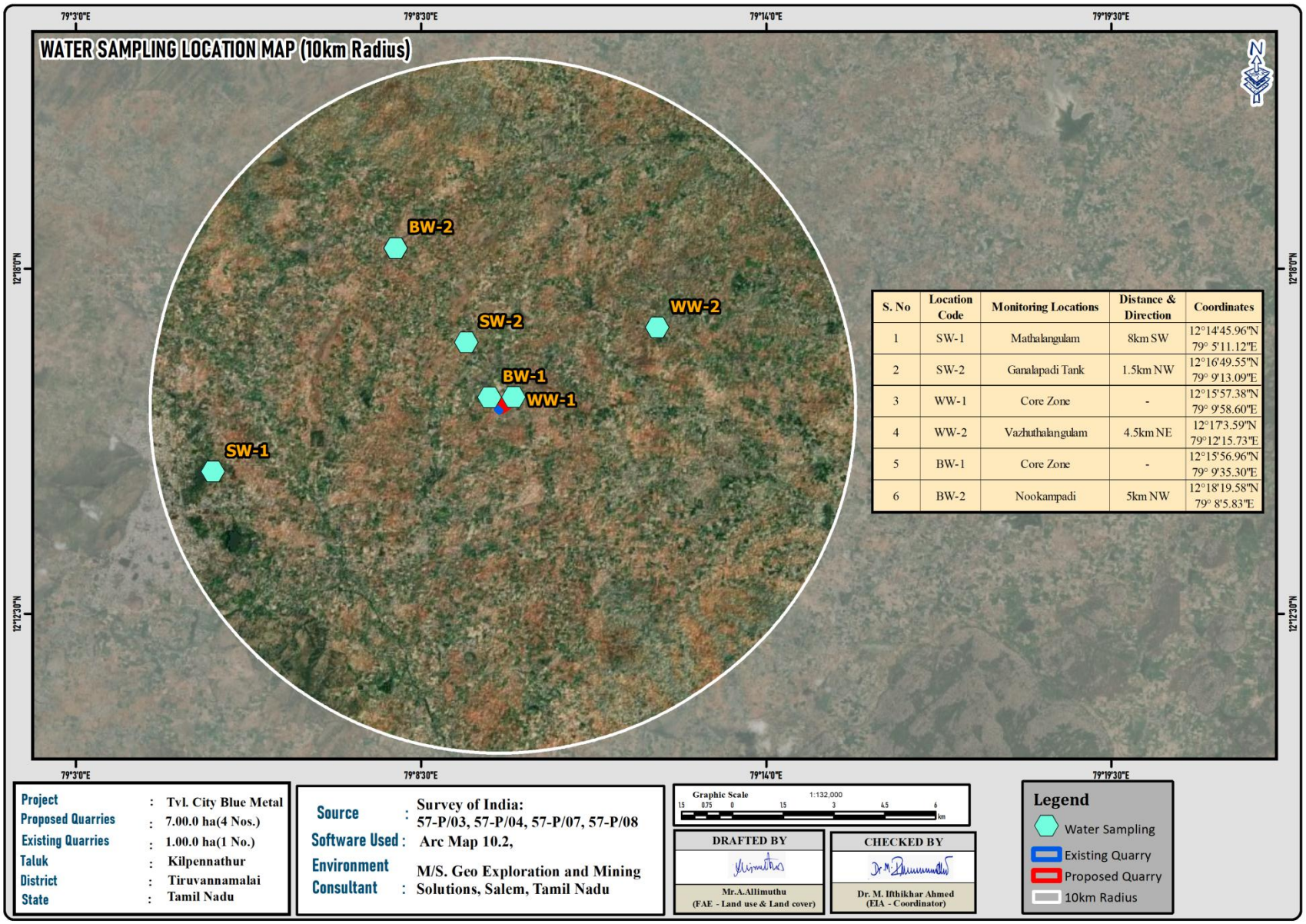


TABLE 3.9: GROUND WATER SAMPLING RESULTS

S.No	Parameters	Units	RESULTS				Standards as Per IS 10500: 2012	
			WW-1	WW-2	BW-1	BW-2	Acceptable limit	Permissible limit
1	Color	Hazen	< 5	< 5	< 5	< 5	5	5
2	Odour	-	Agreeable				Agreeable	Agreeable
3	Taste	-	Agreeable				Agreeable	Agreeable
4	pH@ 25°C	-	7.16	7.09	7.15	7.53	6.5-8.5	6.5-8.5
5	Electrical Conductivity @ 25°C	µs/cm	527	362	637	715	Not specified	Not specified
6	Turbidity	NTU	357	345	376	422	1	1
7	TDS	mg /l	174.9	127.5	247.1	208	500	500
8	Total Hardness	mg/l	34.2	27.6	41.5	38.2	200	200
9	Calcium as Ca	mg/l	21.7	14.2	34.8	27.5	75	75
10	Magnesium as Mg	mg/l	139	125	164	151	30	30
11	Total Alkalinity	mg/l	76.9	74.6	80.5	89.4	200	200
12	Chloride as Cl-	mg/l	26.5	26.1	27.2	29	250	250
13	Sulphate as SO4-	mg/l	357	345	376	422	200	200
14	Iron as Fe	mg/l	BDL(DL:0.1)	BDL(DL:0.1)	0.29	0.17	0.3	0.3
15	Free Residual Cl	mg/l	BDL(DL:2.0)				0.2	0.2
16	Fluoride as F	mg/l	0.16	0.14	0.38	0.26	1.0	1.0
17	Nitrates as NO3	mg/l	9.1	8.6	11.7	10.4	45	45
18	Copper as Cu	mg/l	BDL (DL:0.2)				0.05	0.05
19	Manganese as Mn	mg/l	BDL(DL:0.05)				0.1	0.1
20	Mercury as Hg	mg/l	BDL (DL:0.0005)				0.001	0.001
21	Cadmium as Cd	mg/l	BDL(DL:0.01)				0.003	0.003
22	Selenium as Se	mg/l	BDL(DL:0.05)				0.01	0.01
23	Aluminium as Al	mg/l	BDL(DL:0.03)				0.03	0.03
24	Lead as Pb	mg/l	BDL(DL:0.01)				0.01	0.01
25	Zinc as Zn	mg/l	BDL(DL:0.02)				5	5
26	Total Chromium	mg/l	BDL(DL:0.05)				0.05	0.05
27	Boron as B	mg/l	BDL (DL:0.1)				0.5	0.5
28	Mineral Oil	mg/l	BDL (DL:1.0)				0.5	0.5
29	Phenolic Compounds	mg/l	Absent				0.001	0.001
30	Anionic Detergents	mg/l	BDL (DL:0.1)				0.2	0.2
31	Cyanide as CN	mg/l	Absent				0.05	0.05
32	Total Coliform	MPN/ 100ml	< 2				Shall not be detectable in any100 ml	Shall not be detectable in any100 ml
33	E-Coli		< 2					
34	Barium as Ba	mg/l	BDL (DL:0.5)				0.7	0.7
35	Ammonia	mg/l	BDL (DL:0.1)				0.5	0.5
36	Sulphide as H_2S	mg/l	BDL(DL:0.05)				0.05	0.05
37	Molybdenum	mg/l	BDL (DL:0.5)				0.07	0.07
38	Total Arsenic	mg/l	BDL(DL:0.01)				0.01	0.01
39	Total Suspended Solids	Mg/l	BDL(DL:2)				-	-

* IS: 10500:2012-Drinking Water Standards; # within the permissible limit as per the WHO Standard. The water can be used for drinking purpose in the absence of alternate sources. Note: SW- Surface water, GW – Ground water

TABLE 3.10: SURFACE WATER SAMPLING RESULTS

Sl. No.	Parameter	Unit	RESULT		CPCB Designated Best Use
			SW1	SW2	
1	Color	Hazen	8	9	300
2	Odour	-	Agreeable	Agreeable	Not specified
3	pH@ 25^{o}C	-	7.24	7.62	6.5 – 8.5
4	Electrical Conductivity @ 25°C	µs/cm	568	724	
5	Turbidity	NTU	5.2	4.6	Not specified
6	Total Dissolved Solids	mg /l	335	427	1500
7	Total Hardness as $CaCO_3$	mg/l	192	172	Not specified
8	Calcium as Ca	mg/l	36.1	33.7	Not specified
9	Magnesium as Mg	mg/l	24.9	21.3	Not specified
10	Total Alkalinity as $CaCO_3$	mg/l	136	142	Not specified
11	Chloride as Cl^-	mg/l	72.8	90.4	600
12	Sulphate as SO_4^-	mg/l	25.7	29.2	400
13	Iron as Fe	mg/l	0.27	0.35	50
14	Free Residual Chlorine	mg/l	BDL(DL: 2.0)	BDL(DL: 2.0)	400
15	Fluoride as F	mg/l	0.22	0.34	1.5
16	Nitrates as NO_3	mg/l	11.3	13.5	50
17	Copper as Cu	mg/l	BDL (DL:0.2)		1.5
18	Manganese as Mn	mg/l	BDL (DL:0.05)		Not specified
19	Mercury as Hg	mg/l	(BDL (DL: 0.0005)		Not specified
20	Cadmium as Cd	mg/l	BDL (DL:0.01)		0.01
21	Selenium as Se	mg/l	BDL (DL: 0.05)		Not specified
22	Aluminium as Al	mg/l	BDL (DL: 0.03)		Not specified
23	Lead as Pb	mg/l	BDL (DL:0.01)		0.1
24	Zinc as Zn	mg/l	BDL (DL:0.02)		15
25	Total Chromium	mg/l	BDL (DL: 0.05)		0.05
26	Boron as B	mg/l	BDL (DL:0.1)		Not specified
27	Mineral Oil	mg/l	BDL (DL:1.0)		Not specified
28	Phenolic Compounds as C_6H_5OH	mg/l	Absent		0.005
29	Anionic Detergents as MBAS	mg/l	BDL (DL:0.1)		Not specified
30	Cyanide as CN	mg/l	Absent		0.05
31	Biological Oxygen Demand, 3 days @ 27°C		4.5	6.1	3
32	Chemical Oxygen Demand		21.3	25.6	Not specified
33	Dissolved Oxygen		4.1	5.9	4
34	Total Coliform	MPN/ 100ml	present		5000
35	E-Coli		present		Not specified
36	Barium as Ba	mg/l	BDL (DL:0.5)		300
37	Ammonia (as Total Ammonia-N)	mg/l	BDL (DL:0.1)		Not specified
38	Sulphide as H_2S	mg/l	BDL (DL:0.05)		Not specified
39	Molybdenum as Mo	mg/l	BDL (DL:0.5)		Not specified
40	Total Arsenic as As	mg/l	BDL (DL:0.01)		0.2
41	Total Suspended Solids	mg/l	8.3	10.7	-

3.2.4 Interpretation& Conclusion

Surface Water

Ph:

The pH is between 7.24 to 7.62 while turbidity found within the standards (Optimal pH range for sustainable aquatic life is 6.5 to 8.5 pH).

Total Dissolved Solids:

Total Dissolved Solids is 335 - 427 mg/l, the TDS mainly composed of carbonates, bicarbonates, Chlorides, phosphates and nitrates of calcium, magnesium, sodium and other organic matter.

Other parameters:

Chloride content is 72.8 – 90.4 mg/l. Nitrates is around 11.3 – 13.5 mg/l, while sulphates content is 25.7 – 0.35 mg/l.

Ground Water

The pH of the water samples collected ranged from 7.09 to 7.53 and within the acceptable limit of 6.5 to 8.5. pH, Sulphates and Chlorides of water samples from all the sources are within the limits as per the Standard. On Turbidity, the water samples meet the requirement. The Total Dissolved Solids were found in the range of 345 to 422 mg/l in all samples. The Total hardness varied between 127.5 to 247.1 mg/l for all samples.

On Microbiological parameters, the water samples from all the locations meet the requirement. The parameters thus analysed were compared with IS 10500:2012 and are well within the prescribed limits.

3.2.5 Hydrology and Hydrogeological studies

The district is underlain by hard rock formation fissured and fractured crystalline rocks constitute the important aquifer systems in the district. Geophysical prospecting was carried out in that area by SSRMP-80 Instrument by qualified Geo physicist with the help of IGIS software and it was inferred that the low resistance encountered at the depth between 52 - 56m. The maximum depth of this proposed project is 71m (46m AGL + 25m BGL). Hence there is no possibilities of water table intersection during the entire mine life period besides it is also inferred topographically that there are no major water bodies intersecting the project area. There is no necessity of stream, channel diversion due to this proposed project.

During the rainy season there is a possibility of collection of seepage water from the subsurface levels which will be collected and stored in the mine sump pits and will be used for dust suppression and greenbelt development and during the end of the life of the mine this collected water will act as a temporary reservoir.

TABLE 3.11: WINTER SEASON WATER LEVEL OF OPEN WELLS 1 KM RADIUS

Station Code	Water Level in Meters bgl				Latitude	Longitude
	March 2021	April 2021	May 2021	Average		
OW1	11.2	12.4	12.6	12.0	12° 16' 04.7372" N	79° 09' 45.9596" E
OW2	11.5	12.7	12.9	12.3	12° 16' 11.4768" N	79° 09' 37.4099" E
OW3	11	12.2	12.4	11.8	12° 15' 46.1906" N	79° 10' 08.5169" E
OW4	10.8	12	12.2	11.6	12° 15' 41.7732" N	79° 10' 03.9026" E
OW5	10.9	12.1	12.3	11.7	12° 16' 03.9340" N	79° 09' 36.8073" E
OW6	10.3	11.5	11.7	11.16	12° 15' 58.4191" N	79° 09' 31.2058" E
OW7	11.8	13	13.2	12.6	12° 15' 49.4662" N	79° 09' 30.2874" E
OW8	11.6	12.8	13	12.4	12° 15' 36.4046" N	79° 09' 27.7190" E
OW9	12	13.2	13.4	12.8	12° 15' 27.3585" N	79° 09' 32.5044" E
OW10	10.9	12.1	12.3	11.7	12° 15' 29.9967" N	79° 09' 44.1683" E
OW11	10.5	11.7	11.9	11.3	12° 15' 19.4941" N	79° 09' 53.8432" E

Source: Onsite monitoring data

TABLE 3.12: WINTER SEASON WATER LEVEL OF BOREWELLS 1 KM RADIUS

Station Code	Water Level in Meters bgl				Latitude	Longitude
	March 2021	April 2021	May 2021	Average		
BW1	75.5	76.7	76.9	76.3	12° 16' 13.3569" N	79° 10' 00.4354" E
BW2	74.5	75.7	75.9	75.3	12° 15' 48.1842" N	79° 09' 22.2869" E
BW3	70.2	71.4	71.6	71.0	12° 15' 23.8729" N	79° 09' 36.8090" E
BW4	73.2	74.4	74.6	74.0	12° 15' 16.8436" N	79° 09' 47.2827" E
BW5	74.6	75.8	76	75.4	12° 15' 18.6724" N	79° 09' 53.1127" E
BW6	71.2	72.4	72.6	72.0	12° 15' 32.9116" N	79° 10' 06.6457" E
BW7	72	73.2	73.4	72.8	12° 15' 56.4204" N	79° 10' 10.8722" E
BW8	73.5	74.7	74.9	74.3	12° 15' 56.0636" N	79° 09' 35.8612" E

Source: Onsite monitoring data

FIGURE 3.6: OPEN WELL CONTOUR MAP – MARCH 2021

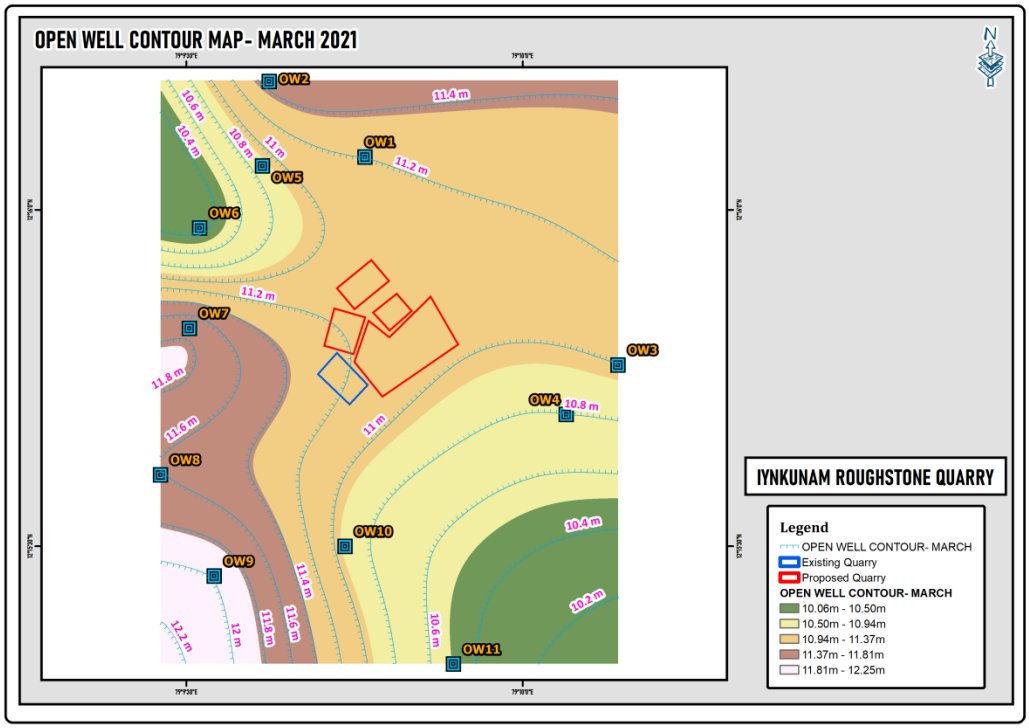


FIGURE 3.7: OPEN WELL CONTOUR MAP – APRIL 2021

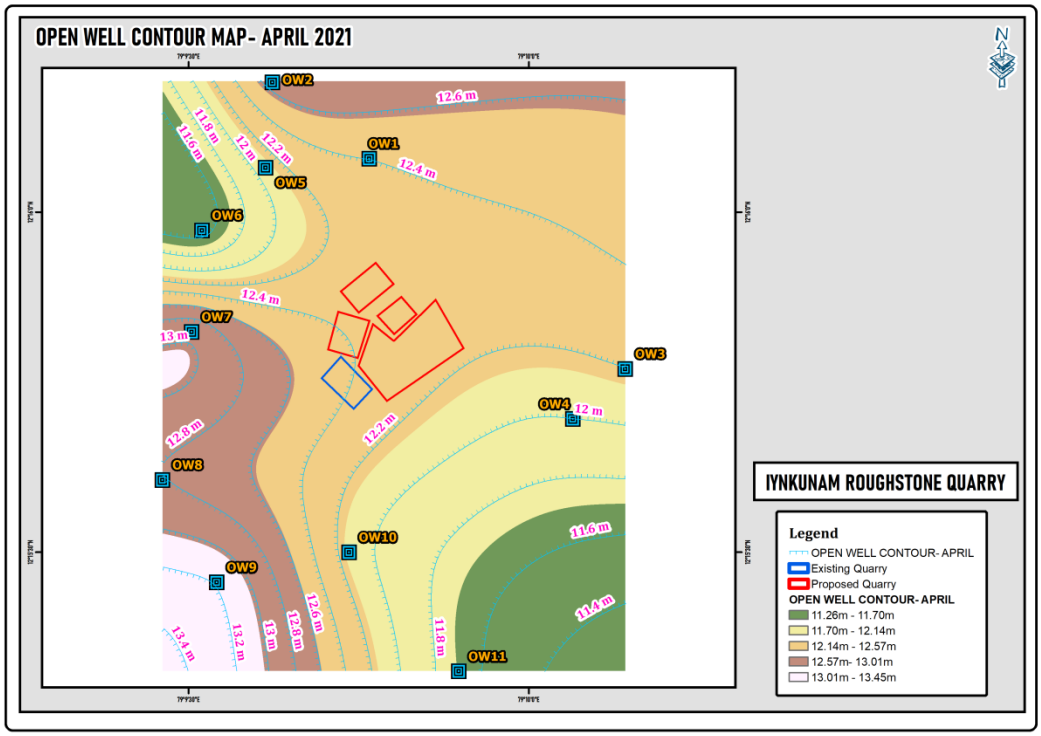


FIGURE 3.8: OPEN WELL CONTOUR MAP – MAY 2021

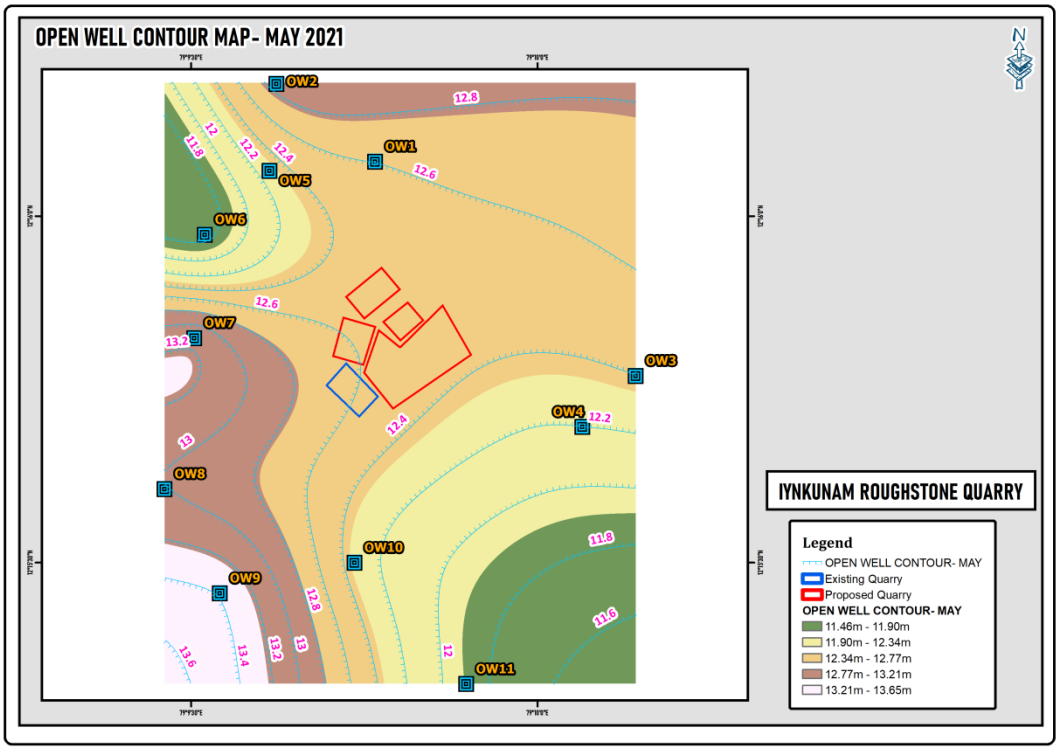


FIGURE 3.9: BORE WELL CONTOUR MAP – MARCH 2021

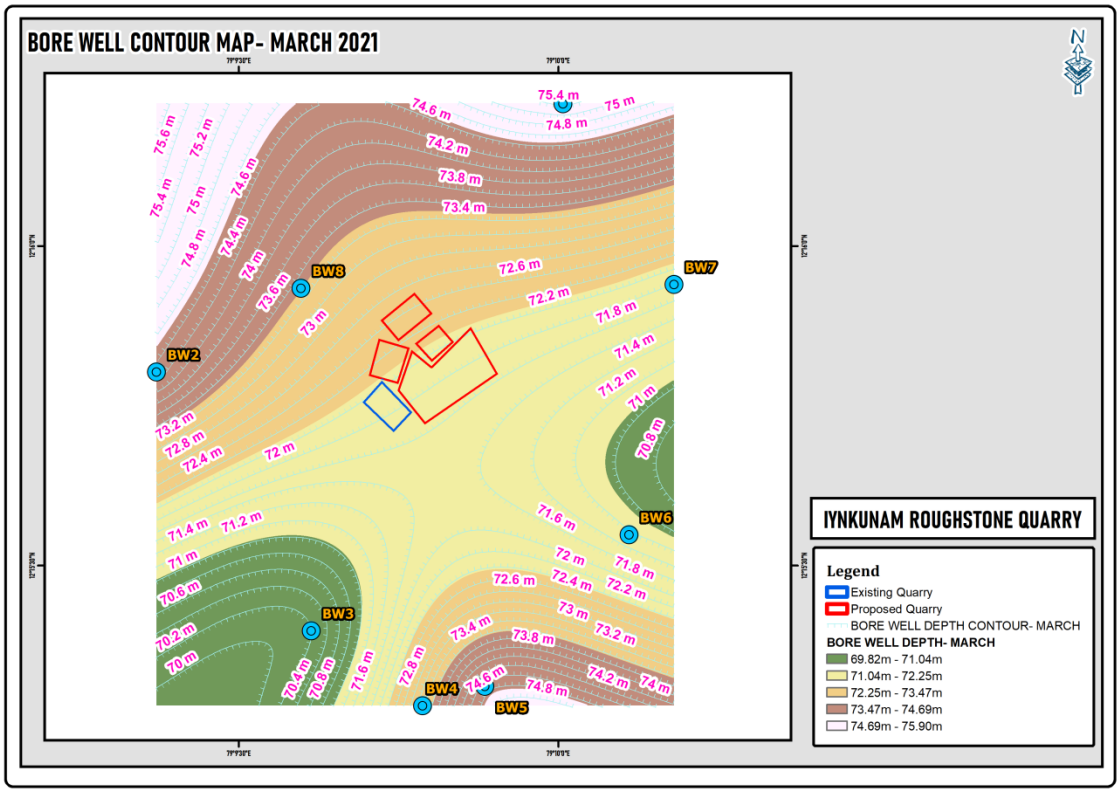


FIGURE 3.10: BORE WELL CONTOUR MAP – APRIL 2021

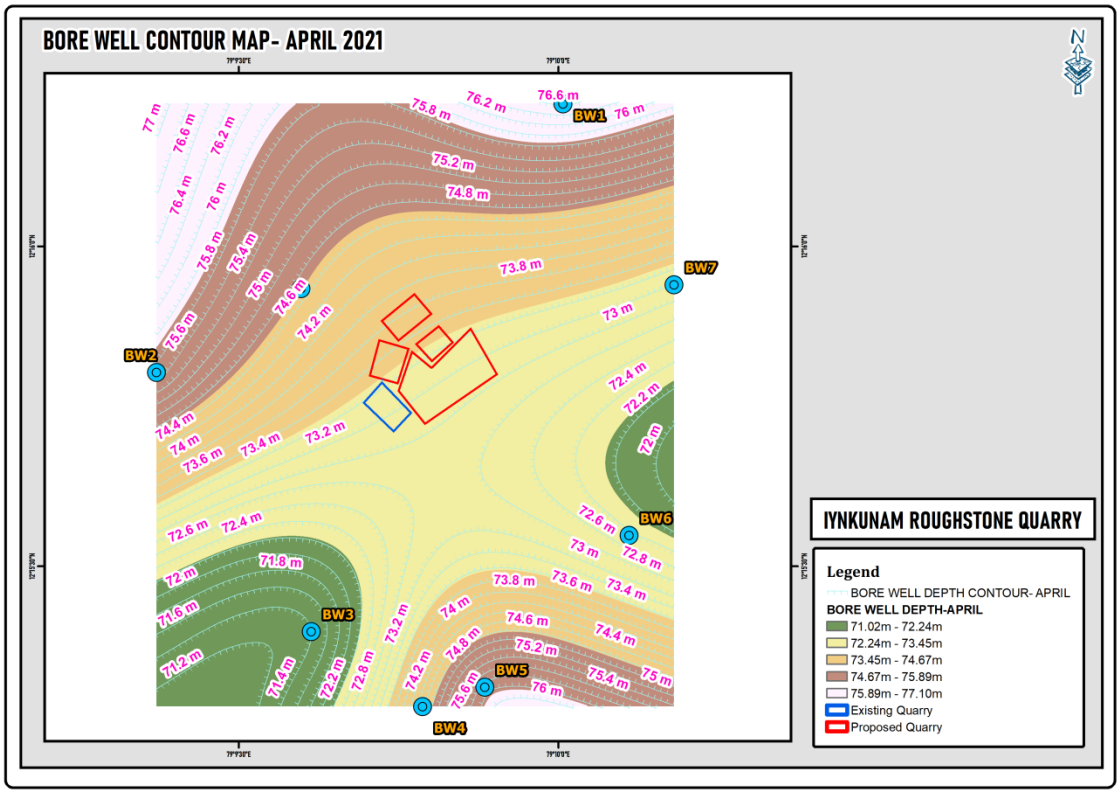


FIGURE 3.11: BORE WELL CONTOUR MAP – MAY 2021

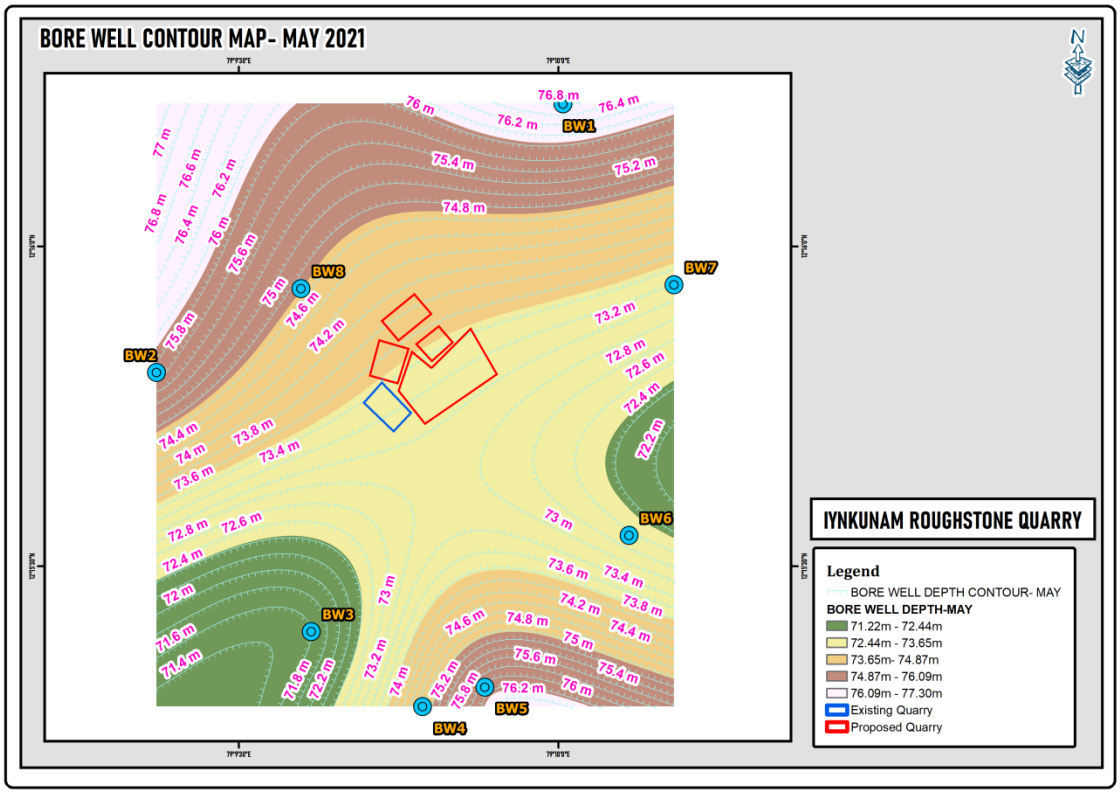


FIGURE 3.12: DRAINAGE MAP AROUND 10 KM RADIUS FROM PROJECT SITE

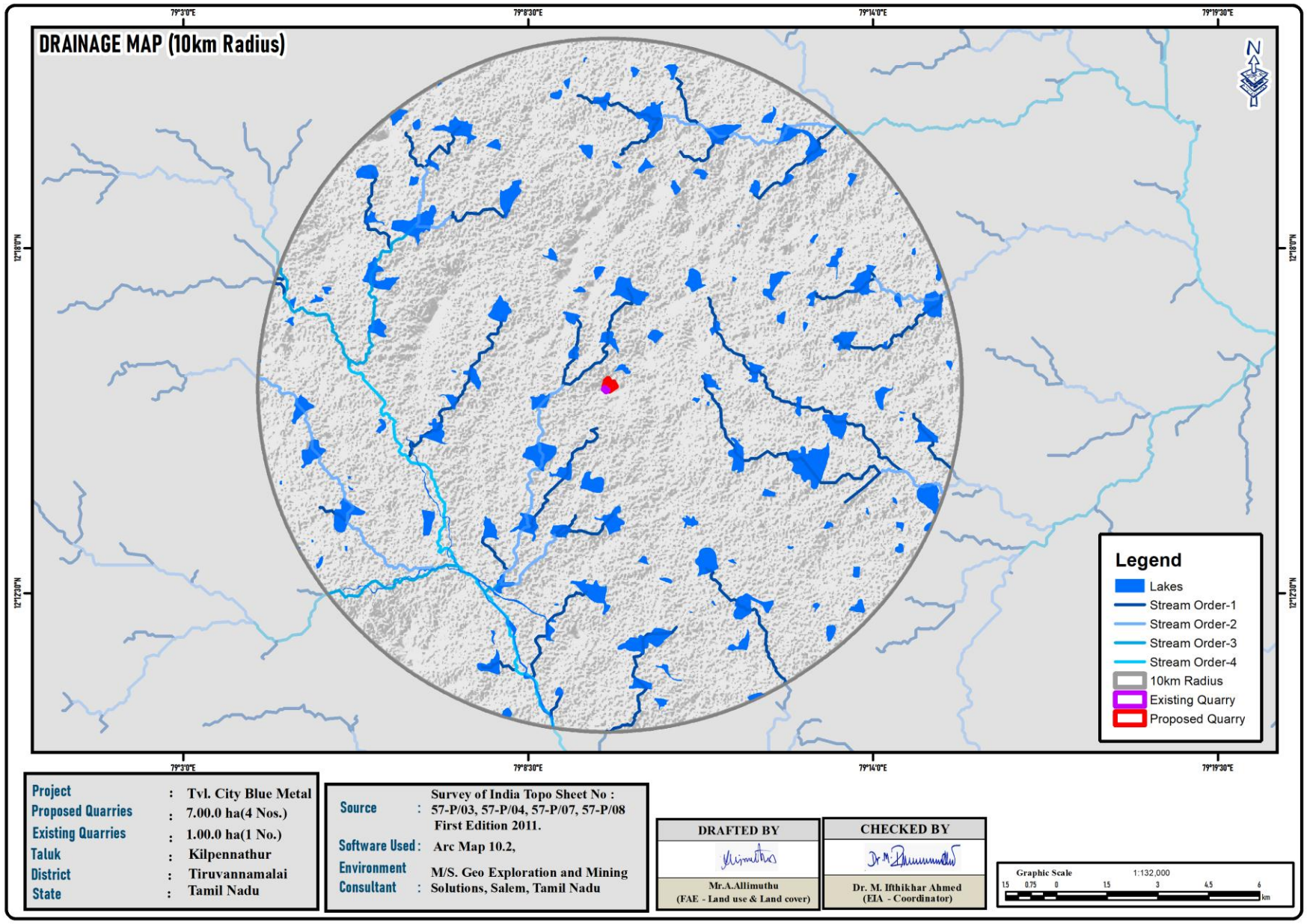
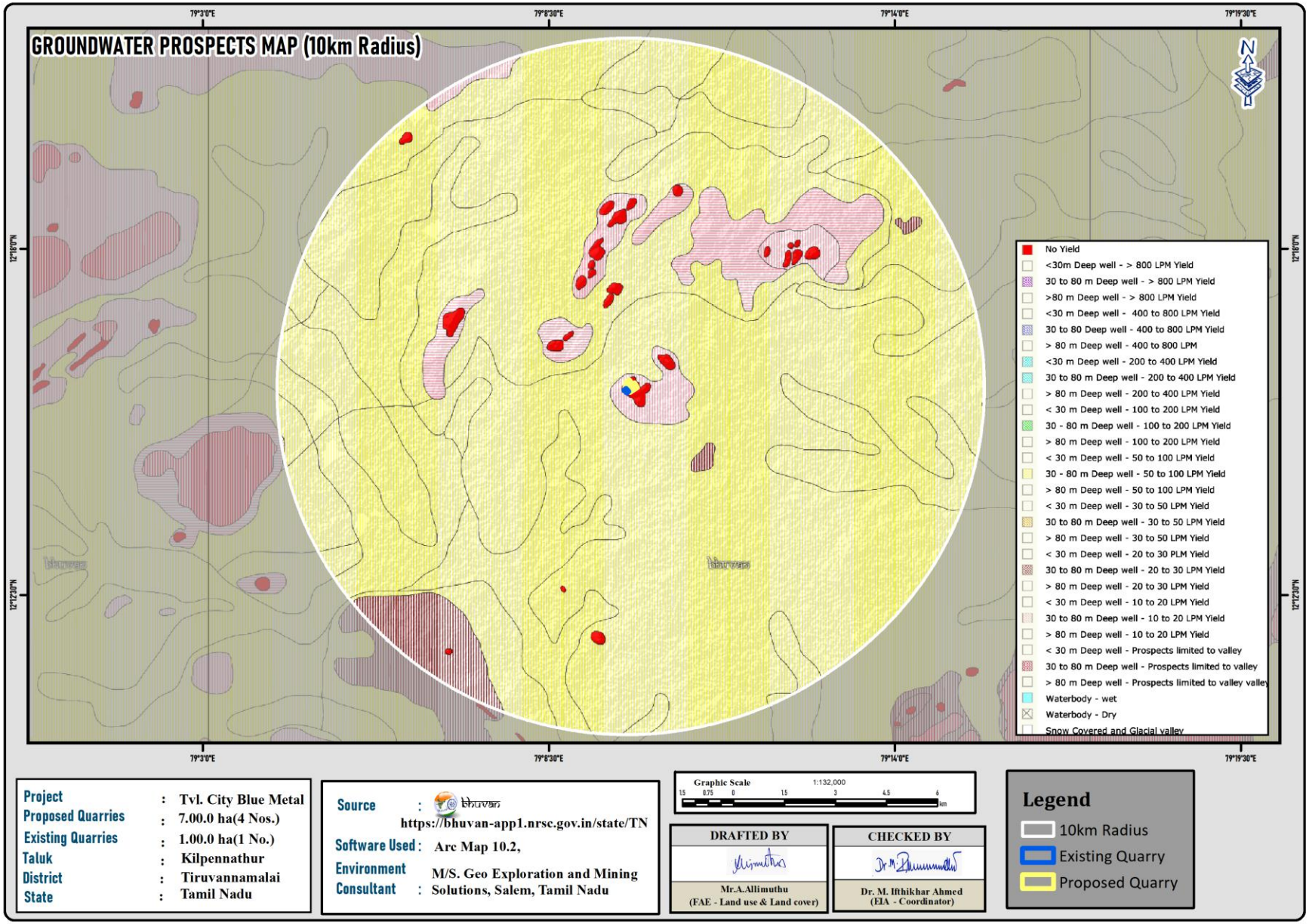


FIGURE 3.13: GROUND WATER PROSPECT MAP



3.2.5.1 Methodology and Data Acquisition

Electric Resistivity Method is well established for delineating lateral as well vertical discontinuities in the resistive structure of the Earth's subsurface. The present study makes use of vertical electric sounding (VES) to delineate the Vertical Resistivity structure at depth. Schlumberger electrode set up was employed for making sounding measurements. Since it is least influenced by lateral in homogeneities and is capable of providing higher depth of investigation. This is four electrodes collinear set up where in the outer electrodes send current into the ground and the inner electrodes measure the potential difference.

The present study utilizes maximum current electrode separation AB/2. The data from this survey are commonly arranged and contoured in the farm of Pseudo-section that gives an approximate of the subsurface resistivity. This technique is used for the inversion of Schlumberger VES data to predict the layer parameter namely layer resistivity and Geo electric layer thickness. The main goal of the present study is to search the vertical in homogeneities that is consistent with the measured data.
For a Schlumberger among the Apparent resistivity can be calculated as follows

$$\rho_a = \frac{G\Delta V}{I}$$

ΔV = potential difference between receiving electrodes
G = Geometric Factor.
Rocks show wide variation in resistivity ranging from 10-8 more than 10+14 ohmmeter. On a broad classification, one can group the rocks falling in the range of 10-8 to 1 ohmmeter as good conductors. 1 to 106 ohmmeter as intermediate conductors and 106 to 1012 ohmmeter as more as poor conductor. The resistivity of rocks and subsurface lithology, which is mostly dependent on its porosity and the pore fluid resistivity is defined by Archie's Law,

$$\rho_r = F\rho_w = a\,\emptyset^m\rho_w$$

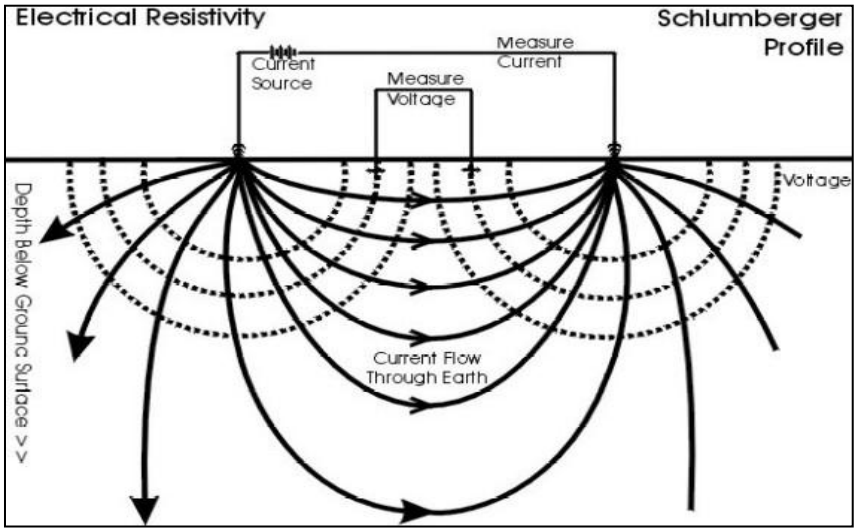
ρr = Resistivity of Rocks
ρw = Resistivity of water in pores of rock
F = Formation Factor
$\emptyset$ = Fractional pore volume
A = Constants with values ranging from 0.5 to 2.5

3.2.5.2 Survey Layout

The layout for a resistivity survey depends on the choice of the current and potential electrode arrangement, which is called electrode array. Here the present study is considered with Schlumberger array. In which the distance may be used for current electrode separation while potential electrode separation is kept on third to one fifth of the same. One interesting aspect in VES is the principle of reciprocity, which permits interchange of the potential and current electrode without any effect on the measured apparent resistivity.

The field equipment deployed for the study is in a deep resistivity meter with a model of SSR – MP – AT. This Signal stacking Resistivity meter is a high-quality data acquisition system incorporating several innovation features for Earth resistivity. In the presence of random earth Noises the signal to nose ration can be enhanced by $\sqrt{N}$ where N is the number of stacked readings. This SSR meter in which running averages of measurements [1, (1+2)/2, (1+2+3)/3 … (1+2...+16/16)] up to the chosen stacks are displayed and the final average is stored automatically, in memory utilizing the principles of stacking to achieve the benefit of high signals to noise ratio. Based on these above significations the signal stacking resistivity meter was used for (VES) Vertical Electric Resistivity Sounding.

RESISTIVITY SURVEY PROFILE



Measurements of ground Resistivity is essentially done by sending a current through two electrodes called current electrodes (C_1& $C_{2)}$ and measuring the resulting potential by two other electrodes called potential electrode (P_1& P_2). The amount of current required to be sent into the ground depends on the contact resistance at the current electrode, the ground resistivity and the depth of interest.

3.2.5.3 Data Presentation

It was inferred that the low resistance encountered at the depth between 52-56m. The maximum depth of this proposed project is 71 m(46m AGL + 25m BGL). Hence there is no possibilities of water table intersection during the entire mine life period besides it is also inferred topographically that there are no major water bodies intersecting the project area.

3.2.5.4 Geophysical Data Interpretation

The geophysical data was obtained to study the lateral variations, vertical in homogeneities in the sub – surface with respect to the availability of groundwater. From the interpreted data, it has inferred that the area has moderate groundwater potential in the investigated area. This small quarrying operation will not have any significant impact on the natural water bodies.

3.3 AIR ENVIRONMENT

The existing ambient air quality of the area is important for evaluating the impact of mining activities on the ambient air quality.

The baseline studies on air environment include identification of specific air pollution parameters and their existing levels in ambient air. The ambient air quality with respect to the study zone of 10 km radius around the cluster forms the baseline information. The sources of air pollution in the region are mostly due to vehicular traffic, dust arising from unpaved village road and domestic & agricultural activities. The prime objective of the baseline air quality study was to establish the existing ambient air quality of the study area. These will also be useful for assessing the conformity to standards of the ambient air quality during the operation of proposed projects in cluster.

This section describes the identification of sampling locations, methodology adopted during the monitoring period and sampling frequency.

3.3.1 Meteorology & Climate

Meteorology is the key to understand the Air quality. The essential relationship between meteorological condition and atmospheric dispersion involves the wind in the broadest sense. Wind fluctuations over a very wide range of time, accomplish dispersion and strongly influence other processes associated with them.

A temporary meteorological station was installed at project site by covering cluster quarries. The station was installed at a height of 3 m above the ground level in such a way that there are no obstructions facilitating flow of wind, wind speed, wind direction, humidity and temperature are recorded on hourly basis.

Climate –

Tiruvannamalai lies on 170m above sea level. The climate is tropical in Tiruvannamalai. The Summers are much rainier than the winter summer. This climate is considered to be Aw according to the Köppen-Geiger climate classification.

- The average annual temperature is 27.4 °C | 81.3°F.
- The annual rainfall here is around 811 mm | 31.49inch per year.
- The driest month is February, with 7 mm | 0.3 inch. The greatest amount of precipitation occurs in October, with an average of 154 mm | 6.1 inch.
- The warmest month of the year is May, with an average temperature of 31.3°C | 88.4°F.
- The lowest average temperatures in the year occur in December, when it is around 23.3°C | 73.9°F.
- The difference in precipitation between the driest month and the wettest month is 147 mm | 6 inch. The variation in temperatures throughout the year is 8.0°C | 46.5 °F.

Source; https://en.climate-data.org/asia/india/tamil-nadu/tiruvannamalai-24067/

Rainfall –

TABLE 3.13: RAINFALL DATA

Actual Rainfall in mm						Normal Rainfall in mm
2013	2014	2015	2016	2017	2018	
812.80	799.10	1247.4	684.7	1251.3	1039.66	812.80

Source: https://www.twadboard.tn.gov.in/content/tiruvannamalai

TABLE 3.14: METEOROLOGICAL DATA RECORDED AT SITE

S.No	Parameters		Mar-2021	April– 2021	May- 2021
1	Temperature (^{0}C)	Max	30.9	31.8	32.8
		Min	26.0	28.4	29.1
		Avg.	28.45	30.1	30.9
2	Relative Humidity (%)	Avg.	79.7	76.6	73.03
3	Wind Speed (m/s)	Max	1.806	2.778	3.986
		Min	0.347	0.556	0.625
		Avg.	1.076	1.667	2.305
4	Cloud Cover (OKTAS)		0-8	0-8	0-8
5	Wind direction		SE,SSE	SW,SSW	S,SSW

Source: On-site monitoring/sampling by Omegaa Laboratories in association with GEMS

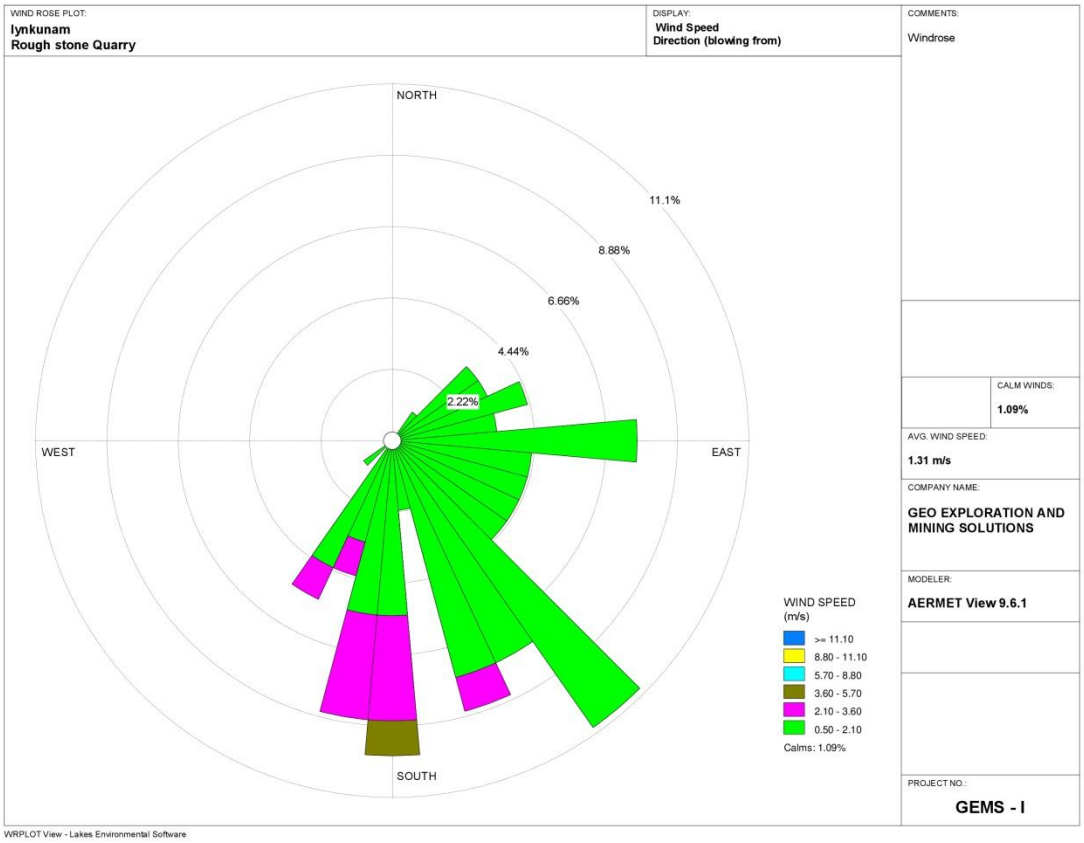
Correlation between Secondary and Primary Data

The meteorological data collected at the site is almost similar to that of secondary data collected from IMD Chennai. A comparison of site data generated during the three months with that of IMD, Chennai reveals the following:

- The average maximum and minimum temperatures of IMD, Chennai showed a higher in respect of on-site data i.e. in Iynkunam village.
- The relative humidity levels were lesser at site as compared to IMD, Chennai.
- The wind speed and direction at site shows similar trend that of IMD, Chennai.

Wind rose diagram of the study site is depicted in Figure. 3.14. Predominant downwind direction of the area during study season is South East to North West.

FIGURE 3.14: WINDROSE DIAGRAM



Source: Wind Rose plot view, Lake Environmental Software

In the abstract of collected data wind rose were drawn on presented in figure No.3.11 during the monitoring period in the study area

- Predominant winds were from SE – NW.
- Wind velocity readings were recorded between 0.347 to 3.986 m/s
- Calm conditions prevail of about 1.09 % of the monitoring period
- Temperature readings ranging from 26.0 to 32.8 °C
- Relative humidity ranging from 73.03 to 79.7 %
- The monitoring was carried out continuously for three months

3.3.2 Methodology and Objective

The prime objective of the ambient air quality study is to assess the existing air quality of study area and its conformity to NAAQS. The observed sources of air pollution in the study area are industrial, traffic and domestic activities. The baseline status of the ambient air quality has been established through a scientifically designed ambient air quality monitoring network considering the followings:

- Meteorological condition on synoptic scale;

- Topography of the study area;
- Representatives of regional background air quality for obtaining baseline status;
- Location of residential areas representing different activities;
- Accessibility and power availability; etc.,

3.3.3 Sampling and Analytical Techniques

TABLE 3.15: METHODOLOGY AND INSTRUMENT USED FOR AAQ MONITORING

Parameter	Method	Instrument
$PM_{2.5}$	Gravimetric Method Beta attenuation Method	Fine Particulate Sampler Make – Thermo Environmental Instruments – TEI 121
PM_{10}	Gravimetric Method Beta attenuation Method	Respirable Dust Sampler Make –Thermo Environmental Instruments – TEI 108
SO_2	IS-5182 Part II (Improved West & Gaeke method)	Respirable Dust Sampler with gaseous attachment
NO_x	IS-5182 Part II (Jacob & Hochheiser modifiedmethod)	Respirable Dust Sampler with gaseous attachment
Free Silica	NIOSH – 7601	Visible Spectrophotometry

Source: Sampling Methodology followed by Omegaa Laboratories & CPCB Notification

TABLE 3.16: NATIONAL AMBIENT AIR QUALITY STANDARDS

Sl. No.	Pollutant	Time Weighted Average	Concentration in ambient air	
			Industrial, Residential, Rural & other areas	Ecologically Sensitive area (Notified by Central Govt.)
1	Sulphur Dioxide ($\mu g/m^3$)	Annual Avg.* 24 hours**	50.0 80.0	20.0 80.0
2	Nitrogen Dioxide ($\mu g/m^3$)	Annual Avg. 24 hours	40.0 80.0	30.0 80.0
3	Particulate matter (size less than 10µm) PM_{10} ($\mu g/m^3$)	Annual Avg. 24 hours	60.0 100.0	60.0 100.0
4	Particulate matter (size less than 2.5 µm $PM_{2.5}$ ($\mu g/m^3$)	Annual Avg. 24 hours	40.0 60.0	40.0 60.0

Source: NAAQS CPCB Notification No. B-29016/20/90/PCI-I Dated: 18th Nov 2009

*Annual Arithmetic mean of minimum 104 measurements in a year taken twice a Week 24 hourly at uniform interval.

** 24 hourly / 8 hourly or 1 hourly monitored value as applicable shall be complied with 98 % of the time in a year. However, 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

3.3.4 Frequency & Parameters for Sampling

Ambient air quality monitoring has been carried out with a frequency of two samples per week at eight (8) locations, adopting a continuous 24 hourly (3 shift of 8-hour) schedule for the period March to May, 2021. The baseline data of ambient air has been generated for PM_{10}, $PM_{2.5}$, Sulphur Dioxide (SO_2) & Nitrogen Dioxide (NO_2) Monitoring has been carried out as per the CPCB, MoEF guidelines and notifications.

It was ensured that the equipment was placed preferably at a height of at least 3 ± 0.5m above the ground level at each monitoring station, for negating the effects of wind-blown ground dust. The equipment was placed at open space free from trees and vegetation which otherwise act as a sink of pollutants resulting in lower levels in monitoring results.

3.3.5 Ambient Air Quality Monitoring Stations

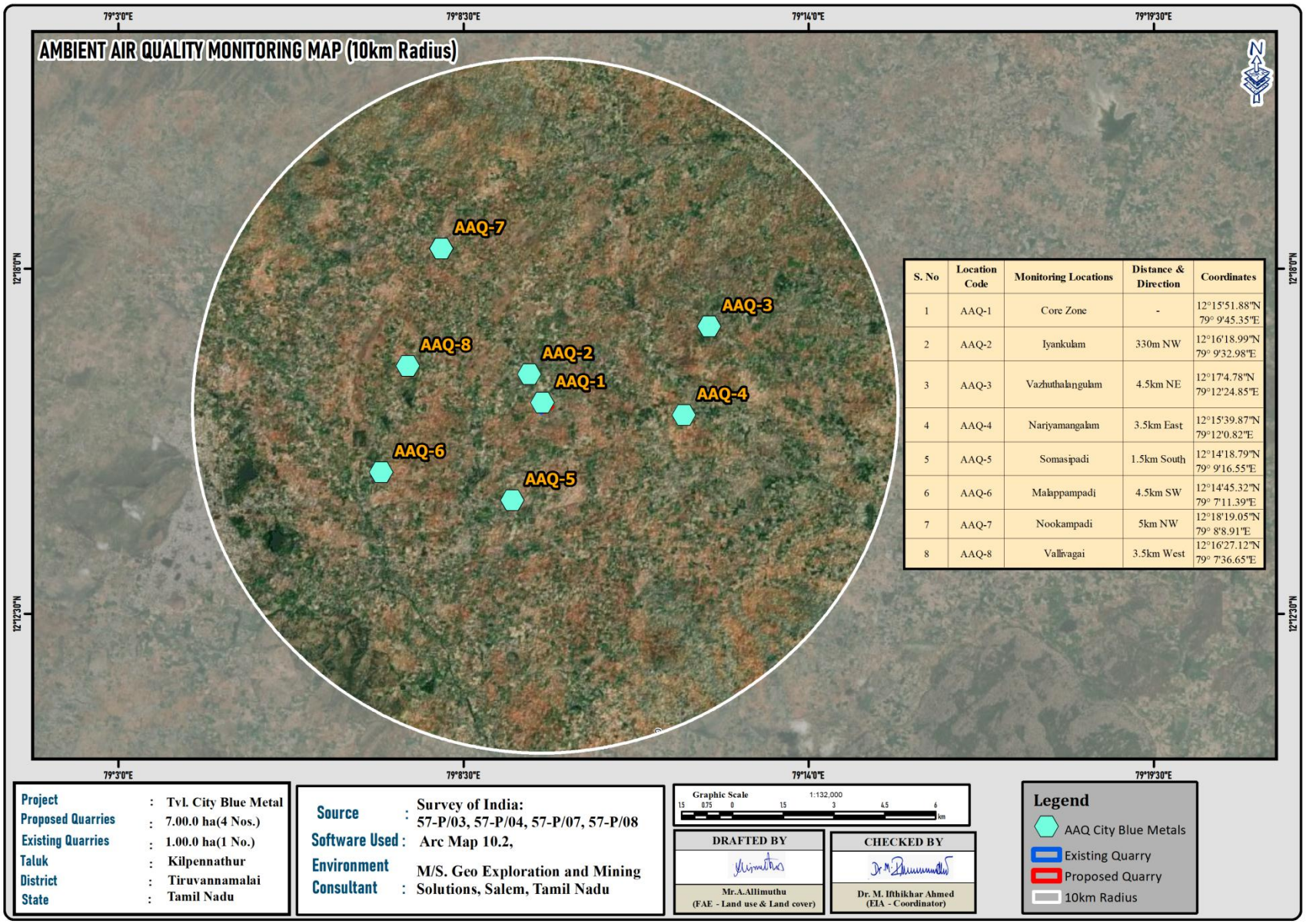
Eight (8) monitoring stations were set up in the study area as depicted in Figure 3.15 for assessment of the existing ambient air quality. Details of the sampling locations are as per given below.

TABLE 3.17: AMBIENT AIR QUALITY (AAQ) MONITORING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	AAQ-1	Core Zone	-	12°15'51.88"N 79° 9'45.35"E
2	AAQ-2	Iyankulam	330m NW	12°16'18.99"N 79° 9'32.98"E
3	AAQ-3	Vazhuthalangulam	4.5km NE	12°17'4.78"N 79°12'24.85"E
4	AAQ-4	Nariyamangalam	3.5km East	12°15'39.87"N 79°12'0.82"E
5	AAQ-5	Somasipadi	1.5km South	12°14'18.79"N 79° 9'16.55"E
6	AAQ-6	Malappampadi	4.5km SW	12°14'45.32"N 79° 7'11.39"E
7	AAQ-7	Nookampadi	5km NW	12°18'19.05"N 79° 8'8.91"E
8	AAQ-8	Vallivagai	3.5km West	12°16'27.12"N 79° 7'36.65"E

Source: On-site monitoring/sampling by Omegaa Laboratories in association with GEMS

FIGURE 3.15: AMBIENT AIR QUALITY LOCATIONS AROUND 10 KM RADIUS



S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	AAQ-1	Core Zone	-	12°15'51.88"N 79° 9'45.35"E
2	AAQ-2	Iyankulam	330m NW	12°16'18.99"N 79° 9'32.98"E
3	AAQ-3	Vazhuthalangulam	4.5km NE	12°17'4.78"N 79°12'24.85"E
4	AAQ-4	Nariyamangalam	3.5km East	12°15'39.87"N 79°12'0.82"E
5	AAQ-5	Somasipadi	1.5km South	12°14'18.79"N 79° 9'16.55"E
6	AAQ-6	Malappampadi	4.5km SW	12°14'45.32"N 79° 7'11.39"E
7	AAQ-7	Nookampadi	5km NW	12°18'19.05"N 79° 8'8.91"E
8	AAQ-8	Vallivagai	3.5km West	12°16'27.12"N 79° 7'36.65"E

TABLE 3.18: AMBIENT AIR QUALITY DATA LOCATION AAQ1

Period: March 2021 – May-2021 Location: AAQ1- *Core Zone* Sampling Time: 24-hourly

Monitoring		Particulates, µg/m^3			Gaseous Pollutants, µg/m^3					Other Pollutants (Particulate Phase) , µg/m^3				
Date	**Period, hrs.**	**SPM**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**NO_2**	**NH_3**	**O_3 (8-hly Avg.)**	**CO (8-hly Avg.)**	**Pb, µg/m^3**	**As, ng/m^3**	**Ni, ng/m^3**	**C_6H_6, ng/m^3**	**BaP, ng/m^3**
NAAQ Norms*		**(24 hrs)**	**60(24 hrs.)**	**100 (24 hrs.)**	**80 (24 hrs.)**	**80 (24 hrs.)**	**400 (24 hrs.)**	**100 (8 hrs.)**	**2.0 (8hrs.)**	**1.0 (24 hrs.)**	**6.0 (annual)**	**20 (annual)**	**5.0 (annual)**	**1.0 (annual)**
04.12.2020	07.00-07.00	65.3	24.3	42.7	11.9	28.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.12.2020	07.15-07.15	63.4	22.7	44.9	10.7	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.12.2020	07.00-07.00	62.8	23.9	43.6	12.3	27.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.12.2020	07.15-07.15	66.8	25.4	41.7	11.7	26.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
15.12.2020	07.00-07.00	63.4	24.7	43.9	8.3	25.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.12.2020	07.15-07.15	65.2	22.5	44.9	10.4	29.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.12.2020	07.00-07.00	63.9	23.4	42.7	11.5	28.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.12.2020	07.15-07.15	62.7	22.8	42.7	12.9	26.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.01.2021	07.00-07.00	63.6	22.6	41.9	11.7	25.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
07.01.2021	07.15-07.15	62.8	23.5	43.4	12.3	25.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.01.2021	07.00-07.00	63.4	22.8	42.9	12.5	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.01.2021	07.15-07.15	65.5	24.7	44.6	13.7	28.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.01.2021	07.00-07.00	63.9	25.7	43.8	10.6	25.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
21.01.2021	07.15-07.15	62.5	22.1	44.3	11.4	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
28.01.2021	07.00-07.00	63.1	23.8	42.6	12.3	24.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
29.01.2021	07.15-07.15	62.8	25.6	43.5	12.9	27.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
02.02.2021	07.00-07.00	63.4	24.7	44.2	12.5	25.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.02.2021	07.15-07.15	62.7	23.6	43.7	10.2	27.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.02.2021	07.00-07.00	62.5	22.8	42.9	12.6	25.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.02.2021	07.15-07.15	63.9	21.2	43.3	8.4	26.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.02.2021	07.00-07.00	62.4	25.3	42.5	10.7	25.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.02.2021	07.15-07.15	62.8	23.8	44.7	11.3	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.02.2021	07.00-07.00	63.5	22.4	42.3	9.8	27.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.02.2021	07.15-07.15	64.9	23.6	43.9	10.6	26.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.19: AMBIENT AIR QUALITY DATA LOCATION AAQ2

Period: March 2021 – May-2021 Location: AAQ2- Iyankulam (NW) Sampling Time: 24-hourly

Monitoring		Particulates, µg/m^3			Gaseous Pollutants, µg/m^3					Other Pollutants (Particulate Phase) , µg/m^3				
Date	Period, hrs.	SPM	PM2.5	PM10	SO_2	NO_2	NH_3	O_3 (8-hly Avg.)	CO (8-hly Avg.)	Pb, µg/m^3	As, ng/m^3	Ni, ng/m^3	C_6H_6, ng/m^3	BaP, ng/m^3
NAAQ Norms*		(24 hrs)	60(24 hrs.)	100 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
04.12.2020	07.15-07.15	62.9	23.7	42.7	10.7	29.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.12.2020	07.30-07:30	64.2	21.9	44.3	11.3	27.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.12.2020	07.15-07.15	65.3	22.5	43.4	8.3	28.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.12.2020	07.30-07:30	62.9	24.3	42.7	7.6	26.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
15.12.2020	07.15-07.15	63.6	22.5	41.9	10.3	29.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.12.2020	07.30-07:30	61.2	24.3	43.6	12.7	28.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.12.2020	07.15-07.15	62.7	22.9	42.5	11.7	27.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.12.2020	07.30-07:30	65.4	23.8	41.8	12.3	25.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.01.2021	07.15-07.15	62.9	22.5	43.3	12.9	26.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
07.01.2021	07.30-07:30	66.3	22.1	42.7	12.4	29.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.01.2021	07.15-07.15	64.2	23.6	42.5	10.7	27.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.01.2021	07.30-07:30	63.2	25.7	43.5	12.3	28.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.01.2021	07.15-07.15	62.5	24.3	43.6	9.3	28.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
21.01.2021	07.15-07.15	62.9	23.8	41.8	11.7	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
28.01.2021	07.00-07.00	64.8	22.5	44.6	8.3	27.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
29.01.2021	07.15-07.15	63.7	24.6	42.7	9.7	29.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
02.02.2021	07.00-07.00	62.1	23.7	41.3	8.4	25.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.02.2021	07.15-07.15	63.2	22.9	42.8	11.3	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.02.2021	07.00-07.00	62.7	25.5	44.7	10.7	27.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.02.2021	07.15-07.15	63.4	24.7	42.3	11.6	24.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.02.2021	07.00-07.00	65.9	23.2	43.5	10.3	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.02.2021	07.15-07.15	64.4	25.6	41.9	8.7	25.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.02.2021	07.00-07.00	63.9	23.5	42.5	7.8	24.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.02.2021	07.15-07.15	64.7	25.8	44.3	8.1	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.20: AMBIENT AIR QUALITY DATA LOCATION AAQ3

Period: March 2021 – May-2021 Location: AAQ3 - Vazhuthalangulam (NE) Sampling Time: 24-hourly

Monitoring		Particulates, µg/m^3			Gaseous Pollutants, µg/m^3					Other Pollutants (Particulate Phase) , µg/m^3				
Date	**Period, hrs.**	**SPM**	**PM2.5**	**PM10**	**SO_2**	**NO_2**	**NH_3**	**O_3 (8-hly Avg.)**	**CO (8-hly Avg.)**	**Pb, µg/m^3**	**As, ng/m^3**	**Ni, ng/m^3**	**C_6H_6, ng/m^3**	**BaP, ng/m^3**
NAAQ Norms*		**(24 hrs.)**	**60 (24 hrs.)**	**100 (24 hrs.)**	**80 (24 hrs.)**	**80 (24 hrs.)**	**400 (24 hrs.)**	**100 (8 hrs.)**	**2.0 (8hrs.)**	**1.0 (24 hrs.)**	**6.0 (annual)**	**20 (annual)**	**5.0 (annual)**	**1.0 (annual)**
04.12.2020	07.15-07.15	62.7	26.3	42.4	10.3	25.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.12.2020	07.30-07:30	63.8	24.2	44.7	8.4	26.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.12.2020	07.15-07.15	61.4	23.5	43.3	7.2	28.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.12.2020	07.30-07:30	62.5	22.8	42.8	7.6	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
15.12.2020	07.15-07.15	66.3	23.5	41.9	9.4	25.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.12.2020	07.30-07:30	64.7	21.9	42.7	8.3	25.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.12.2020	07.15-07.15	63.9	23.5	41.5	7.6	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.12.2020	07.30-07:30	62.5	22.4	42.6	8.5	26.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.01.2021	07.15-07.15	65.8	23.6	42.7	7.1	28.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
07.01.2021	07.30-07:30	61.3	22.5	41.5	6.4	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.01.2021	07.15-07.15	62.8	21.7	43.6	9.3	25.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.01.2021	07.30-07:30	63.6	24.3	42.5	10.5	25.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.01.2021	07.15-07.15	62.7	23.8	44.2	6.3	25.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
21.01.2021	07.15-07.15	64.9	23.9	41.6	8.4	26.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
28.01.2021	07.00-07.00	63.3	25.4	43.3	8.5	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
29.01.2021	07.15-07.15	65.8	23.3	44.7	6.3	25.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
02.02.2021	07.00-07.00	64.7	22.7	41.9	9.6	24.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.02.2021	07.15-07.15	64.2	21.3	43.8	8.7	26.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.02.2021	07.00-07.00	63.9	22.6	42.2	5.2	28.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.02.2021	07.15-07.15	62.8	24.7	41.6	5.9	26.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.02.2021	07.00-07.00	62.5	23.3	43.7	7.3	27.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.02.2021	07.15-07.15	63.3	25.9	41.2	9.5	26.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.02.2021	07.00-07.00	64.9	24.7	43.5	8.5	27.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.02.2021	07.15-07.15	63.4	22.4	42.8	7.8	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.21: AMBIENT AIR QUALITY DATA LOCATION AAQ4

Period: March 2021 – May-2021 Location: AAQ4 – Nariyamangalam (E) Sampling Time: 24-hourly

Monitoring		Particulates, µg/m^3			Gaseous Pollutants, µg/m^3					Other Pollutants (Particulate Phase) , µg/m^3				
Date	**Period, hrs.**	**SPM**	**PM2.5**	**PM10**	**SO_2**	**NO_2**	**NH_3**	**O_3 (8-hly Avg.)**	**CO (8-hly Avg.)**	**Pb, µg/m^3**	**As, ng/m^3**	**Ni, ng/m^3**	**C_6H_6, ng/m^3**	**BaP, ng/m^3**
NAAQ Norms*		**(24 hrs.)**	**60(24 hrs.)**	**100 (24 hrs.)**	**80 (24 hrs.)**	**80 (24 hrs.)**	**400 (24 hrs.)**	**100 (8 hrs.)**	**2.0 (8hrs.)**	**1.0 (24 hrs.)**	**6.0 (annual)**	**20 (annual)**	**5.0 (annual)**	**1.0 (annual)**
04.12.2020	07.00-07.00	63.9	23.7	42.3	8.4	26.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.12.2020	07.15-07:15	62.5	24.4	43.9	7.3	25.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.12.2020	07.00-07.00	64.3	22.8	44.2	9.6	24.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.12.2020	07.15-07:15	62.8	23.9	42.5	8.5	26.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
15.12.2020	07.00-07.00	62.5	23.5	41.6	8.4	25.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.12.2020	07.15-07:15	63.8	23.6	43.3	7.3	25.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.12.2020	07.00-07.00	61.5	24.4	42.8	9.3	26.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.12.2020	07.15-07:15	63.9	23.7	42.5	8.5	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.01.2021	07.00-07.00	62.7	21.5	43.9	7.6	27.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
07.01.2021	07.15-07:15	62.5	23.2	44.3	7.4	24.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.01.2021	07.00-07.00	63.8	25.8	41.3	8.5	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.01.2021	07.15-07:15	62.6	22.7	42.6	9.3	25.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.01.2021	07.00-07.00	63.9	24.9	43.5	8.7	25.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
21.01.2021	07.15-07.15	61.4	23.6	41.7	9.6	24.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
28.01.2021	07.00-07.00	62.5	24.8	42.8	6.3	25.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
29.01.2021	07.15-07.15	61.8	23.4	43.5	8.5	26.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
02.02.2021	07.00-07.00	62.5	22.7	41.9	7.5	25.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.02.2021	07.15-07.15	63.6	21.9	42.7	6.7	24.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.02.2021	07.00-07.00	64.9	23.6	42.5	5.9	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.02.2021	07.15-07.15	63.3	25.7	43.6	6.3	25.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.02.2021	07.00-07.00	64.8	23.9	42.5	8.7	28.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.02.2021	07.15-07.15	64.7	21.6	43.4	5.4	26.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.02.2021	07.00-07.00	63.6	22.7	41.7	6.8	25.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.02.2021	07.15-07.15	65.9	24.3	43.3	7.3	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.22: AMBIENT AIR QUALITY DATA LOCATION AAQ5

Period: March 2021 – May-2021 Location: AAQ5- Somasipadi (S) Sampling Time: 24-hourly

Monitoring		Particulates, µg/m^3			Gaseous Pollutants, µg/m^3					Other Pollutants (Particulate Phase) , µg/m^3				
Date	Period, hrs.	SPM	PM2.5	PM10	SO_2	NO_2	NH_3	O_3 (8-hly Avg.)	CO (8-hly Avg.)	Pb, µg/m^3	As, ng/m^3	Ni, ng/m^3	C_6H_6, ng/m^3	BaP, ng/m^3
NAAQ Norms*		(24 hrs.)	60(24 hrs.)	100 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
04.12.2020	07:30-07:30	63.7	22.7	43.3	6.7	25.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.12.2020	07:45-07:45	64.2	24.3	41.7	7.3	24.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.12.2020	07:30-07:30	61.8	23.9	42.9	5.9	23.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.12.2020	07:45-07:45	62.5	22.5	43.3	6.8	26.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
15.12.2020	07:30-07:30	62.9	21.7	42.7	7.4	25.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.12.2020	07:45-07:45	63.8	22.6	41.6	7.2	24.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.12.2020	07:30-07:30	62.7	23.3	44.8	5.9	26.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.12.2020	07:45-07:45	63.4	22.4	42.7	6.2	27.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.01.2021	07:30-07:30	62.9	21.6	43.3	5.3	25.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
07.01.2021	07:45-07:45	61.5	23.3	43.9	6.8	26.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.01.2021	07:30-07:30	62.3	22.9	41.5	7.9	28.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.01.2021	07:45-07:45	64.8	21.4	41.7	6.8	25.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.01.2021	07:30-07:30	61.6	22.5	42.6	7.3	24.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
21.01.2021	07.15-07.15	62.8	23.8	41.5	8.9	22.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
28.01.2021	07.00-07.00	66.3	23.6	42.4	7.3	25.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
29.01.2021	07.15-07.15	62.9	23.7	41.9	7.1	28.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
02.02.2021	07.00-07.00	63.3	21.4	42.6	6.8	25.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.02.2021	07.15-07.15	64.4	22.3	43.3	5.4	26.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.02.2021	07.00-07.00	62.8	23.8	44.1	6.3	25.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.02.2021	07.15-07.15	62.3	21.9	42.7	8.9	25.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.02.2021	07.00-07.00	62.8	22.3	43.3	5.2	24.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.02.2021	07.15-07.15	63.4	21.7	42.4	7.3	25.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.02.2021	07.00-07.00	62.5	22.3	41.6	7.9	27.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.02.2021	07.15-07.15	63.9	21.9	43.9	6.4	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.23: AMBIENT AIR QUALITY DATA LOCATION AAQ6

Period: March 2021 – May-2021 Location: AAQ6 – Malappampadi (SW) Sampling Time: 24-hourly

Monitoring		Particulates, µg/m^3			Gaseous Pollutants, µg/m^3					Other Pollutants (Particulate Phase) , µg/m^3				
Date	Period, hrs.	SP/m	PM2.5	PM10	SO_2	NO_2	NH_3	O_3 (8-hly Avg.)	CO (8-hly Avg.)	Pb, µg/m^3	As, ng/m^3	Ni, ng/m^3	C_6H_6, ng/m^3	BaP, ng/m^3
NAAQ Norms*		(24 hrs.)	60(24 hrs.)	100 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
04.12.2020	08:00-08:00	61.7	24.3	41.7	7.3	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.12.2020	08:15-08:15	63.9	21.6	43.2	8.2	24.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.12.2020	08:00-08:00	65.2	22.3	44.7	6.5	23.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.12.2020	08:15-08:15	63.3	24.7	41.9	7.8	25.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
15.12.2020	08:00-08:00	64.4	22.9	43.3	8.3	24.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.12.2020	08:15-08:15	62.8	23.4	42.7	5.9	25.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.12.2020	08:00-08:00	63.3	21.9	41.6	6.4	26.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.12.2020	08:15-08:15	62.7	22.5	44.2	7.9	24.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.01.2021	08:00-08:00	62.8	24.4	43.3	8.3	24.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
07.01.2021	08:15-08:15	62.9	23.9	42.7	7.1	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.01.2021	08:00-08:00	62.5	22.2	41.9	8.2	25.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.01.2021	08:15-08:15	63.3	23.5	42.6	8.9	25.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.01.2021	08:00-08:00	62.8	21.7	43.8	7.4	26.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
21.01.2021	07.15-07.15	61.5	23.6	43.5	7.3	24.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
28.01.2021	07.00-07.00	62.7	23.5	41.6	9.6	25.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
29.01.2021	07.15-07.15	63.6	24.9	43.3	8.5	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
02.02.2021	07.00-07.00	62.8	23.5	42.7	5.9	25.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.02.2021	07.15-07.15	62.5	24.8	43.3	5.6	25.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.02.2021	07.00-07.00	63.9	23.6	44.6	6.3	24.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.02.2021	07.15-07.15	64.5	24.7	42.4	8.7	23.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.02.2021	07.00-07.00	63.8	23.3	44.9	5.5	25.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.02.2021	07.15-07.15	62.7	25.8	41.6	7.2	24.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.02.2021	07.00-07.00	62.3	24.3	43.2	6.3	25.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.02.2021	07.15-07.15	62.9	23.9	44.7	7.9	23.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.24: AMBIENT AIR QUALITY DATA LOCATION AAQ7

Period: March 2021 – May-2021 Location: AAQ7 – Nookampadi (NW) Sampling Time: 24-hourly

Monitoring		Particulates, µg/m^3			Gaseous Pollutants, µg/m^3					Other Pollutants (Particulate Phase) , µg/m^3				
Date	Period, hrs.	SPM	PM2.5	PM10	SO_2	NO_2	NH_3	O_3 (8-hly Avg.)	CO (8-hly Avg.)	Pb, µg/m^3	As, ng/m^3	Ni, ng/m^3	C_6H_6, ng/m^3	BaP, ng/m^3
NAAQ Norms*		(24 hrs.)	60(24 hrs.)	100 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
04.12.2020	08:00-08:00	61.9	23.3	44.7	8.6	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.12.2020	08:15-08:15	63.7	21.9	43.2	6.3	24.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.12.2020	08:00-08:00	61.8	22.7	42.5	5.9	23.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.12.2020	08:15-08:15	62.6	23.4	43.9	5.4	25.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
15.12.2020	08:00-08:00	63.4	22.9	41.5	7.8	23.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.12.2020	08:15-08:15	62.5	23.6	42.7	5.9	25.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.12.2020	08:00-08:00	63.9	22.3	43.3	5.8	25.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.12.2020	08:15-08:15	62.5	25.9	44.5	5.1	23.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.01.2021	08:00-08:00	63.3	24.4	42.7	7.3	25.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
07.01.2021	08:15-08:15	65.4	23.9	43.4	6.3	25.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.01.2021	08:00-08:00	61.8	25.7	42.9	5.8	26.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.01.2021	08:15-08:15	62.2	24.3	44.6	7.9	25.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.01.2021	08:00-08:00	63.9	23.9	42.5	6.3	26.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
21.01.2021	07.15-07.15	62.7	25.7	44.7	8.5	25.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
28.01.2021	07.00-07.00	62.5	24.4	43.3	5.9	26.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
29.01.2021	07.15-07.15	63.4	23.3	42.5	6.9	25.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
02.02.2021	07.00-07.00	62.8	25.7	41.8	8.7	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.02.2021	07.15-07.15	64.3	26.6	42.7	5.3	25.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.02.2021	07.00-07.00	64.1	25.8	42.5	6.9	25.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.02.2021	07.15-07.15	62.9	24.3	43.6	5.8	25.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.02.2021	07.00-07.00	63.7	25.7	42.5	6.3	25.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.02.2021	07.15-07.15	65.3	24.4	44.9	5.9	26.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.02.2021	07.00-07.00	64.8	23.9	44.1	7.4	24.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.02.2021	07.15-07.15	63.5	22.3	43.7	5.2	25.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.25: AMBIENT AIR QUALITY DATA LOCATION AAQ8

Period: March 2021 – May-2021 Location: AAQ8 – Vallivagai (NW) Sampling Time: 24-hourly

Monitoring		Particulates, µg/m^3			Gaseous Pollutants, µg/m^3					Other Pollutants (Particulate Phase) , µg/m^3				
Date	**Period, hrs.**	**SPM**	**PM2.5**	**PM10**	**SO_2**	**NO_2**	**NH_3**	**O_3 (8-hly Avg.)**	**CO (8-hly Avg.)**	**Pb, µg/m^3**	**As, ng/m^3**	**Ni, ng/m^3**	**C_6H_6, ng/m^3**	**BaP, ng/m^3**
NAAQ Norms*		**(24 hrs.)**	**60(24 hrs.)**	**100 (24 hrs.)**	**80 (24 hrs.)**	**80 (24 hrs.)**	**400 (24 hrs.)**	**100 (8 hrs.)**	**2.0 (8hrs.)**	**1.0 (24 hrs.)**	**6.0 (annual)**	**20 (annual)**	**5.0 (annual)**	**1.0 (annual)**
04.12.2020	08:00-08:00	61.7	22.1	41.7	8.3	23.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.12.2020	08:15-08:15	63.1	24.4	43.3	9.1	25.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.12.2020	08:00-08:00	62.9	22.3	42.7	5.3	26.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.12.2020	08:15-08:15	62.3	23.9	41.8	6.7	23.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
15.12.2020	08:00-08:00	64.4	21.5	42.5	5.8	25.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.12.2020	08:15-08:15	63.8	23.6	43.6	6.2	25.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.12.2020	08:00-08:00	62.5	25.7	41.2	8.4	26.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.12.2020	08:15-08:15	63.9	23.5	43.9	5.3	25.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.01.2021	08:00-08:00	64.9	21.4	43.3	9.3	25.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
07.01.2021	08:15-08:15	62.3	22.5	42.5	6.2	24.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.01.2021	08:00-08:00	62.5	23.3	43.6	5.7	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.01.2021	08:15-08:15	63.3	23.8	44.5	5.3	27.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.01.2021	08:00-08:00	62.5	21.5	41.4	8.4	25.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
21.01.2021	07.15-07.15	63.9	22.6	42.7	6.7	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
28.01.2021	07.00-07.00	65.5	23.4	43.3	8.5	25.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
29.01.2021	07.15-07.15	61.2	21.9	42.9	6.3	26.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
02.02.2021	07.00-07.00	62.4	23.6	41.7	9.4	25.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.02.2021	07.15-07.15	62.3	21.5	41.2	5.3	26.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.02.2021	07.00-07.00	63.6	23.4	43.2	5.6	26.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.02.2021	07.15-07.15	62.5	24.9	43.9	5.2	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.02.2021	07.00-07.00	62.9	21.5	42.5	5.7	24.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.02.2021	07.15-07.15	61.5	23.3	43.9	6.3	25.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.02.2021	07.00-07.00	63.4	21.4	42.5	9.8	25.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.02.2021	07.15-07.15	62.8	22.8	41.3	8.1	24.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.26: SUMMARY OF AAQ – 1 to AAQ – 8

Suspended Particulate Matter as SPM					
Station ID	**Max**	**Min**	**Mean**	**98 Percentile**	**STDEV**
AAQ-1	66.8	62.4	63.6	66.2	1.1
AAQ-2	66.3	61.2	63.7	66.1	1.2
AAQ-3	66.3	61.3	63.7	66.1	1.3
AAQ-4	65.9	61.4	63.3	65.4	1.1
AAQ-5	66.3	61.5	63.1	65.6	1.1
AAQ-6	65.2	61.5	63.1	64.9	0.9
AAQ-7	65.4	61.8	63.3	65.4	1.0
AAQ-8	65.5	61.2	63.0	65.2	1.0
Particulate matter PM_{-10}					
Station ID	**Max**	**Min**	**Mean**	**98 Percentile**	**STDEV**
AAQ-1	44.9	41.7	43.4	44.9	0.9
AAQ-2	44.7	41.3	43.0	44.7	0.9
AAQ-3	44.7	41.2	42.8	44.7	1.0
AAQ-4	44.3	41.3	42.8	44.3	0.9
AAQ-5	44.8	41.5	42.7	44.5	0.9
AAQ-6	44.9	41.6	43.1	44.8	1.1
AAQ-7	44.9	41.5	43.3	44.8	1.0
AAQ-8	44.5	41.2	42.7	44.2	1.0
Particulate matter $PM_{-2.5}$					
Station ID	**Max**	**Min**	**Mean**	**98 Percentile**	**STDEV**
AAQ-1	25.7	21.2	23.7	25.7	1.2
AAQ-2	25.8	21.9	23.7	25.8	1.2
AAQ-3	26.3	21.3	23.5	26.1	1.3
AAQ-4	25.8	21.5	23.6	25.8	1.1
AAQ-5	24.3	21.4	22.7	24.1	0.9
AAQ-6	25.8	21.6	23.6	25.4	1.1
AAQ-7	26.6	21.9	24.2	26.3	1.3
AAQ-8	25.7	21.4	22.9	25.3	1.2
Sulphur Di-oxide as SO_2					
Station ID	**Max**	**Min**	**Mean**	**98 Percentile**	**STDEV**
AAQ-1	13.7	8.3	11.4	13.3	1.4
AAQ-2	12.9	7.6	10.4	12.8	1.7
AAQ-3	10.5	5.2	8.0	10.4	1.4
AAQ-4	9.6	5.4	7.8	9.6	1.2
AAQ-5	8.9	5.2	6.9	8.9	1.0
AAQ-6	9.6	5.5	7.4	9.3	1.1
AAQ-7	8.7	5.1	6.6	8.7	1.1
AAQ-8	9.8	5.2	7.0	9.6	1.6
Oxide of Nitrogen as NO_2					
Station ID	**Max**	**Min**	**Mean**	**98 Percentile**	**STDEV**
AAQ-1	29.4	24.1	26.6	29.1	1.3
AAQ-2	29.6	24.7	27.2	29.5	1.5
AAQ-3	28.7	24.9	26.5	28.7	1.0
AAQ-4	28.4	24.3	26.0	27.9	1.0
AAQ-5	28.9	22.6	25.8	28.8	1.5
AAQ-6	26.9	23.3	25.1	26.9	1.1
AAQ-7	26.8	23.7	25.5	26.8	0.9
AAQ-8	27.4	23.1	25.5	27.2	1.1

TABLE 3.27: ABSTRACT OF AMBIENT AIR QUALITY DATA

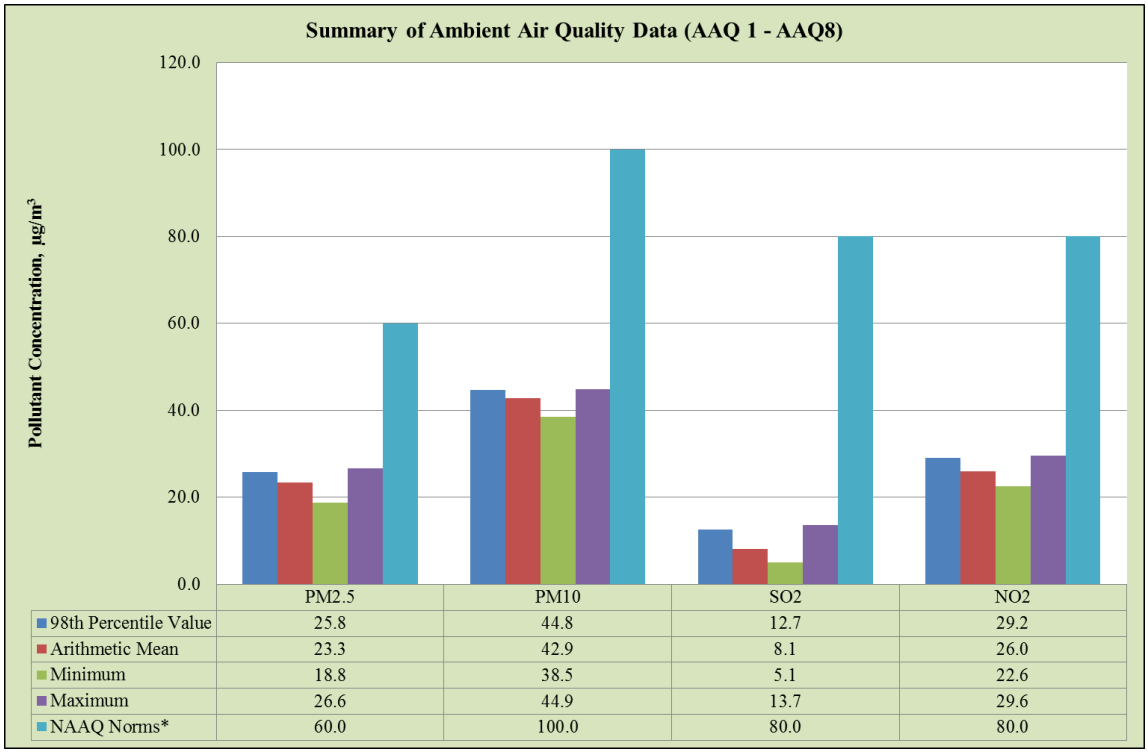
Sl. No.	Parameter	Pollutant Concentration, µg/m^3				
		SPM	$PM_{2.5}$	PM_{10}	SO_2	NO_x
1	No. of Observations	192	192	192	192	192
2	10th Percentile Value	62.3	21.9	41.7	5.9	24.3
3	20th Percentile Value	62.5	22.5	42.0	6.3	25.2
4	30th Percentile Value	62.7	22.7	42.5	7.1	25.4
5	40th Percentile Value	62.9	23.3	42.7	7.4	25.7
6	50th Percentile Value	63.3	23.6	42.8	8.0	25.9
7	60th Percentile Value	63.6	23.8	43.3	8.5	26.3
8	70th Percentile Value	63.9	24.3	43.5	8.9	26.7
9	80th Percentile Value	64.3	24.5	43.9	10.4	26.9
10	90th Percentile Value	64.9	25.5	44.5	11.7	28.3
11	95th Percentile Value	65.5	25.7	44.7	12.4	28.7
12	98th Percentile Value	66.2	25.9	44.9	12.8	29.3
13	Arithmetic Mean	63.4	23.6	43.0	8.3	26.1
14	Geometric Mean	63.4	23.5	43.0	8.1	26.1
15	Standard Deviation	1.1	1.2	1.0	2.1	1.4
16	NAAQ Norms*	-	**60**	**100**	**80**	**80**
17	% Values exceeding	**0**	**0**	**0**	**0**	**0**

Legend: $PM_{2.5}$-Particulate Matter size less than 2.5 µm; PM_{10}-Respirable Particulate Matter size less than 10 µm; SO_2-Sulphur dioxide; NO_x-Oxides of Nitrogen; CO-Carbon monoxide; O_3-Ozone; NH_3-Ammonia;

Pb-Particulate Lead; As-Particulate Arsenic; Ni-Particulate Nickel; C_6H_6-Benzene &BaP- Benzo (a) pyrene in particulate phase levels were monitored below their respective detectable limits

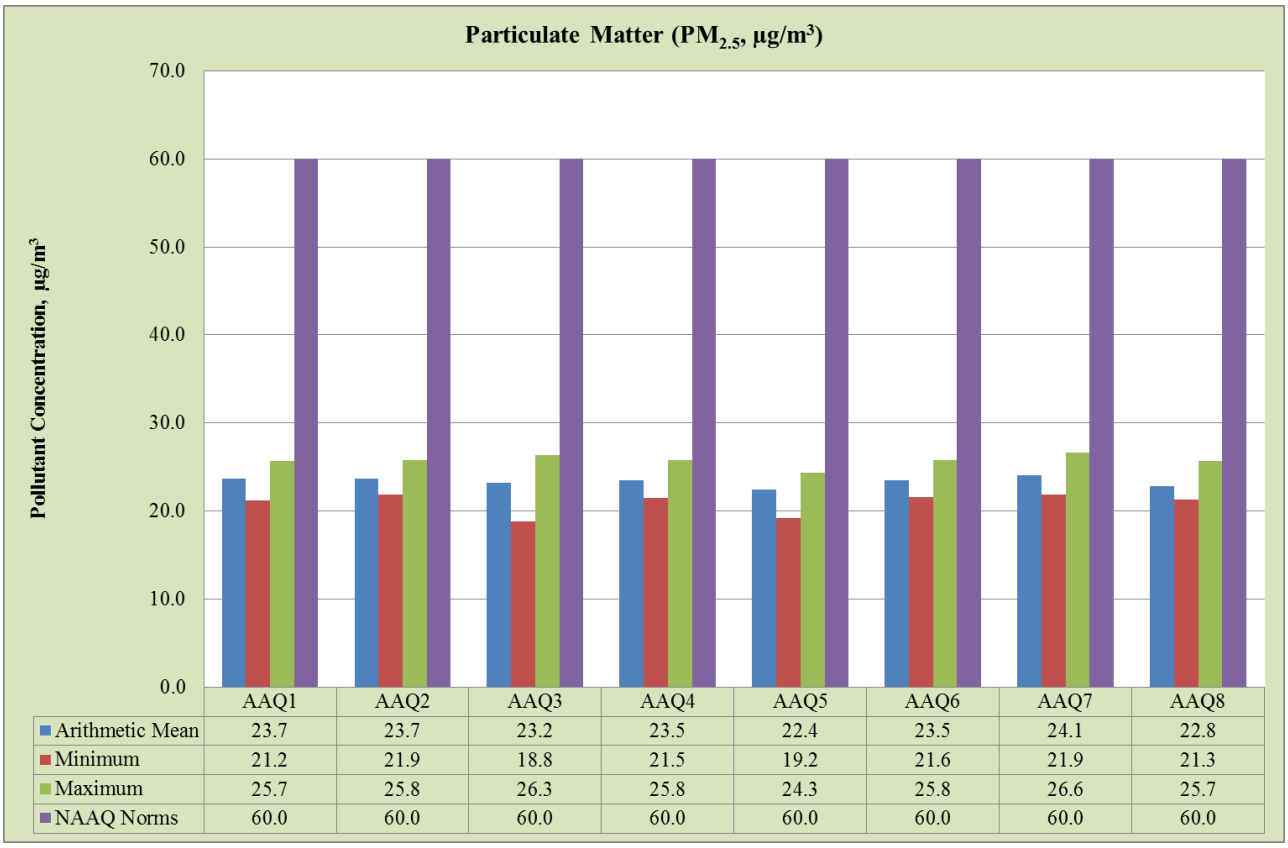
* NAAQ Norms-National Ambient Air Quality Norms-Revised as per GSR 826(E) dated 16.11.2009 for Industrial, Residential, Rural and other Areas.

FIGURE 3.16: BAR DIAGRAM OF SUMMARY OF AAQ 1 – AAQ 8



Source: Table 3.17 to 3.26

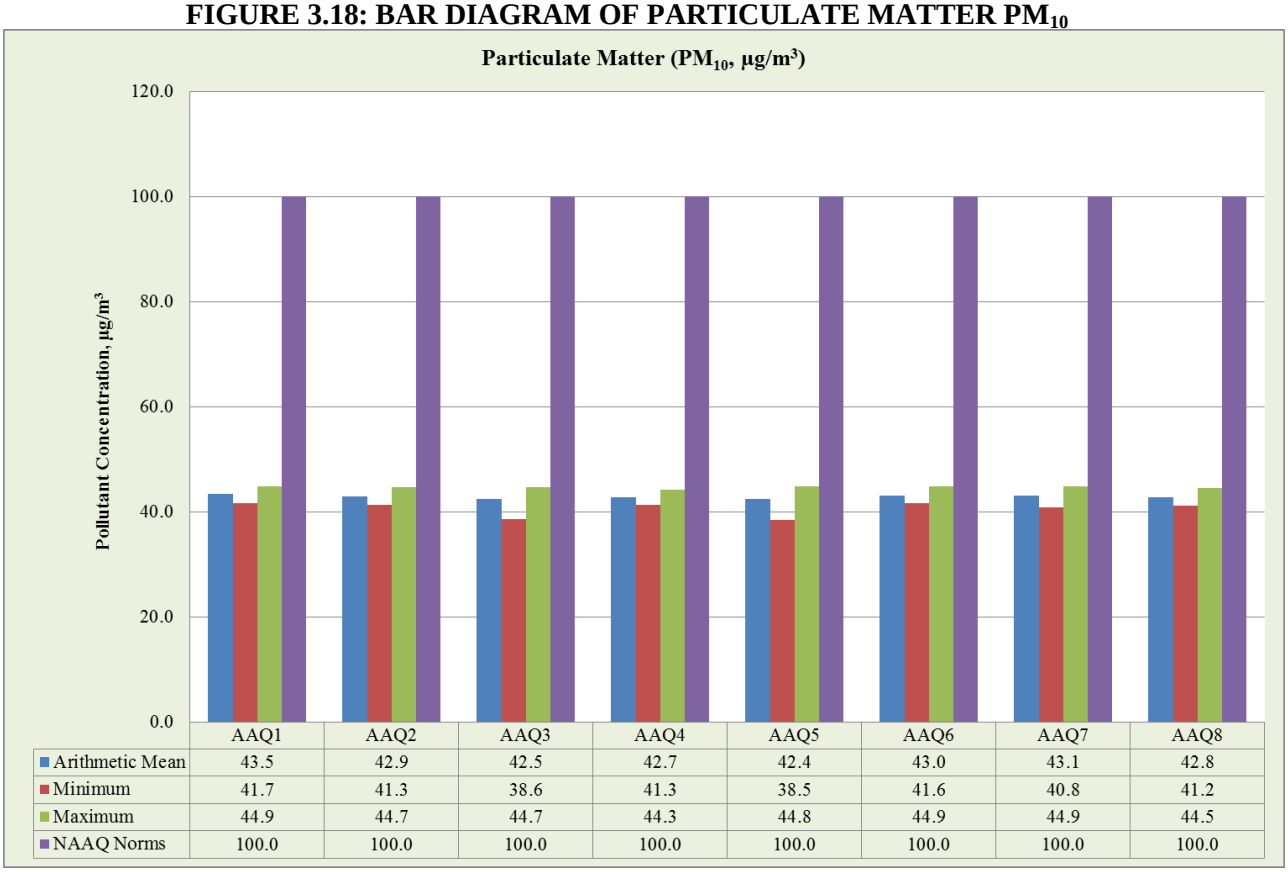
FIGURE 3.17: BAR DIAGRAM OF PARTICULATE MATTER $PM_{2.5}$



	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	23.7	23.7	23.2	23.5	22.4	23.5	24.1	22.8
Minimum	21.2	21.9	18.8	21.5	19.2	21.6	21.9	21.3
Maximum	25.7	25.8	26.3	25.8	24.3	25.8	26.6	25.7
NAAQ Norms	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0

Source: Table 3.17 to 3.26

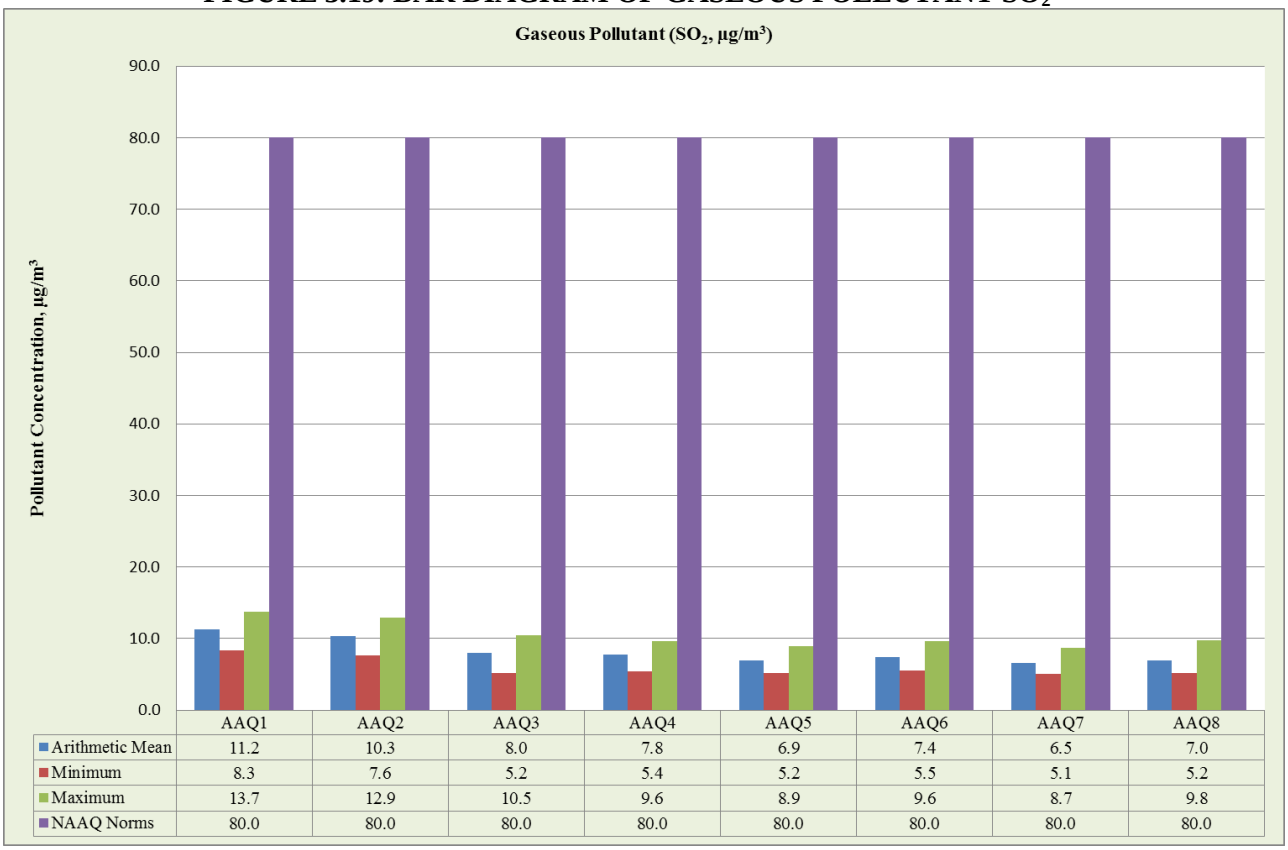
FIGURE 3.18: BAR DIAGRAM OF PARTICULATE MATTER PM_{10}



	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	43.5	42.9	42.5	42.7	42.4	43.0	43.1	42.8
Minimum	41.7	41.3	38.6	41.3	38.5	41.6	40.8	41.2
Maximum	44.9	44.7	44.7	44.3	44.8	44.9	44.9	44.5
NAAQ Norms	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Table 3.17 to 3.26

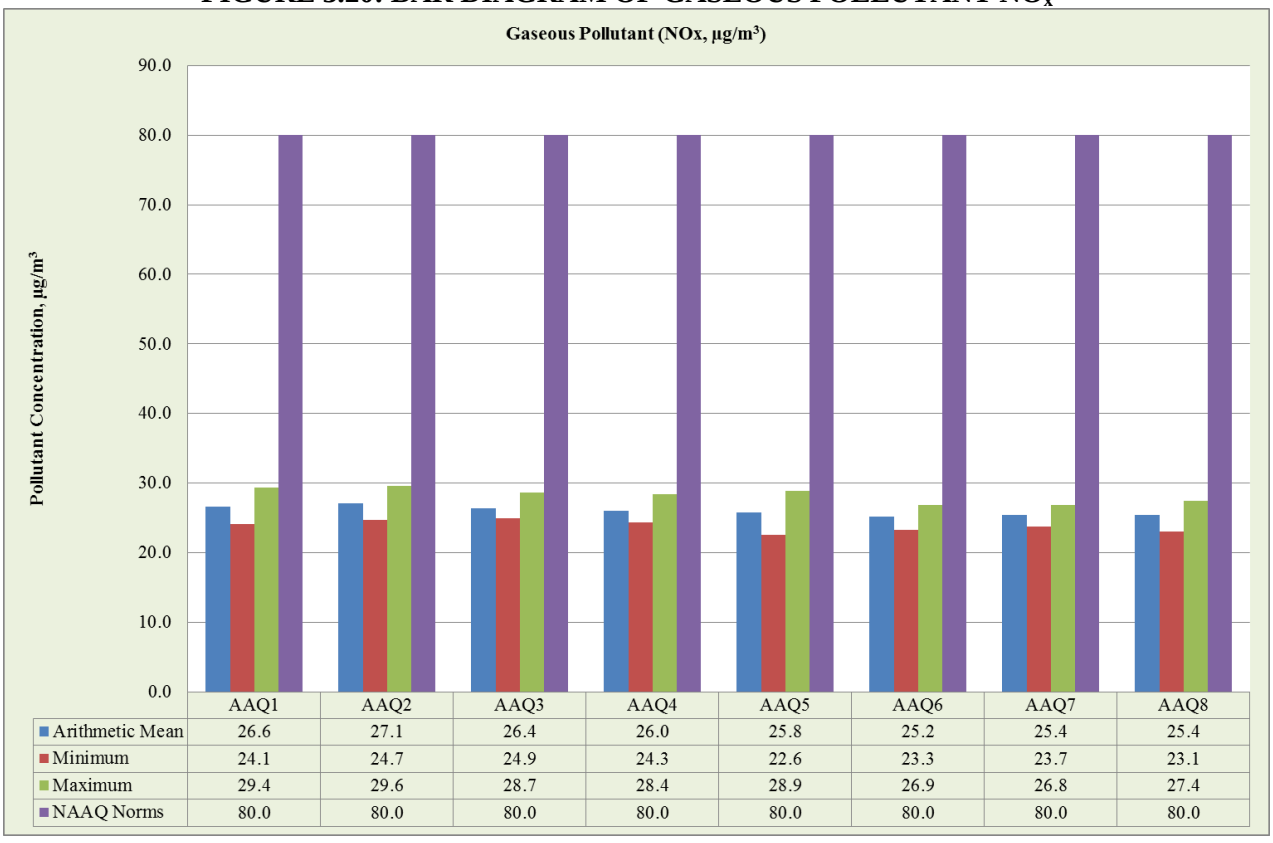
FIGURE 3.19: BAR DIAGRAM OF GASEOUS POLLUTANT SO_2



	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	11.2	10.3	8.0	7.8	6.9	7.4	6.5	7.0
Minimum	8.3	7.6	5.2	5.4	5.2	5.5	5.1	5.2
Maximum	13.7	12.9	10.5	9.6	8.9	9.6	8.7	9.8
NAAQ Norms	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0

Source: Table 3.17 to 3.26

FIGURE 3.20: BAR DIAGRAM OF GASEOUS POLLUTANT NO_x



	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	26.6	27.1	26.4	26.0	25.8	25.2	25.4	25.4
Minimum	24.1	24.7	24.9	24.3	22.6	23.3	23.7	23.1
Maximum	29.4	29.6	28.7	28.4	28.9	26.9	26.8	27.4
NAAQ Norms	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0

Source: Table 3.17 to 3.26

3.3.6 Interpretations & Conclusion

As per monitoring data, PM_{10} ranges from 38.5 µg/m^3 to 44.9 µg/m^3, $PM_{2.5}$ data ranges from 18.8 µg/m^3 to 26.6 µg/m^3, SO_2 ranges from 5.1 µg/m^3 to 13.7 µg/m^3 and NO_2 data ranges from 22.6 µg/m^3 to 29.6 µg/m^3. The concentration levels of the above criteria pollutants were observed to be well within the limits of NAAQS prescribed by CPCB.

3.3.7 FUGITIVE DUST EMISSION –

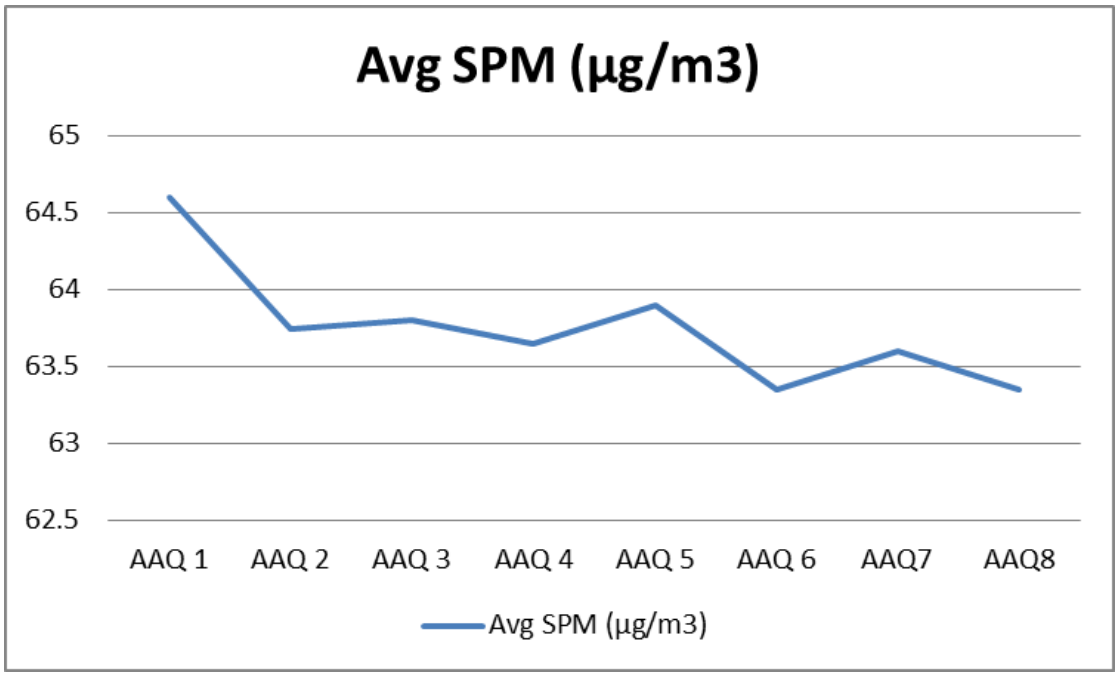
Fugitive dust was recorded at 8AAQ monitoring stations for 30 days average during the study period.

TABLE 3.28: AVERAGE FUGITIVE DUST SAMPLE VALUES

AAQ Locations	Avg SPM (µg/m^3)
AAQ 1	64.6
AAQ 2	63.75
AAQ 3	63.8
AAQ 4	63.65
AAQ 5	63.9
AAQ 6	63.35
AAQ7	63.6
AAQ8	63.35

Source: Onsite monitoring/ sampling by Omega Laboratories

FIGURE 3.21: LINE DIAGRAM OF AVERAGE SPM VALUES



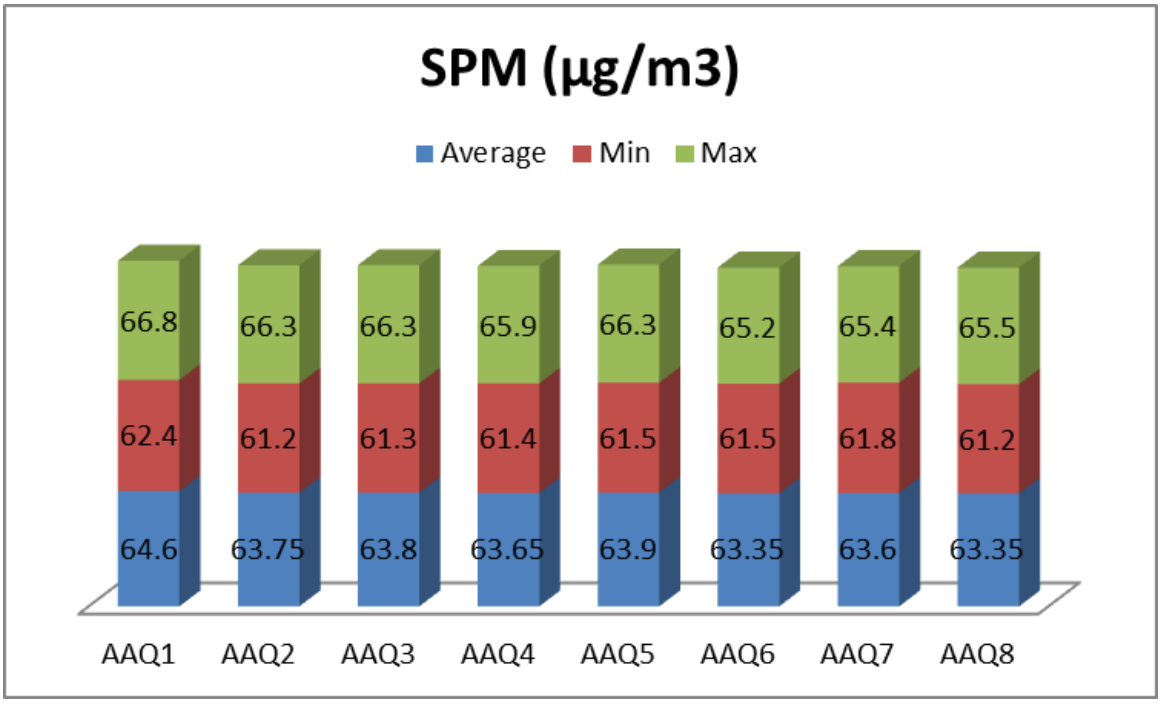
Source: Table 3.28

TABLE 3.29: FUGITIVE DUST SAMPLE VALUES IN µg/m^3

SPM (µg/m^3)	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Average	64.6	63.75	63.8	63.65	63.9	63.35	63.6	63.35
Min	62.4	61.2	61.3	61.4	61.5	61.5	61.8	61.2
Max	66.8	66.3	66.3	65.9	66.3	65.2	65.4	65.5

Source: Calculations from Lab Analysis Reports

FIGURE 3.22: BAR DIAGRAM OF SPM VALUES



Source: Table 3.29

3.4 NOISE ENVIRONMENT

The vehicular movement on road and mining activities is the major sources of noise in study area, the environmental assessment of noise from the mining activity and vehicular traffic can be undertaken by taking into consideration various factors like potential damage to hearing, physiological responses, and annoyance and general community responses.

The main objective of noise monitoring in the study area is to establish the baseline noise level and assess the impact of the total noise expected to be generated during the project operations around the project site.

3.4.1 Identification of Sampling Locations

In order to assess the ambient noise levels within the study area, noise monitoring was carried out at Eight (8) locations. The noise level monitoring locations were carried out by covering commercial, residential, rural areas within the radius of 10km. A noise monitoring methodology was chosen such that it best suited the purpose and objectives of the study.

TABLE 3.30: DETAILS OF SURFACE NOISE MONITORING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	N1	Core Zone	-	12°15'51.41"N 79° 9'44.99"E
2	N2	Iyankulam	330m NW	12°16'19.44"N 79° 9'32.97"E
3	N3	Vazhuthalangulam	4.5km NE	12°17'4.71"N 79°12'24.56"E
4	N4	Nariyamangalam	3.5km East	12°15'40.05"N 79°12'0.04"E
5	N5	Somasipadi	1.5km South	12°14'19.50"N 79° 9'17.23"E
6	N6	Malappampadi	4.5km SW	12°14'45.26"N 79° 7'11.09"E
7	N7	Nookampadi	5km NW	12°18'19.55"N 79° 8'8.65"E
8	N8	Vallivagai	3.5km West	12°16'26.77"N 79° 7'36.97"E

Source: On-site monitoring/sampling by Omegaa Laboratories in association with GEMS

3.4.2 Method of Monitoring

Digital Sound Level Meter was used for the study. All reading was taken on the 'A-Weighting' frequency network, at a height of 1.5 meters from ground level. The sound level meter does not give a steady and consistent reading and it is quite difficult to assess the actual sound level over the entire monitoring period. To mitigate this shortcoming, the Continuous Equivalent Sound level, indicated by Leq, is used. Equivalent sound level, 'Leq', can be obtained from variable sound pressure level, 'L', over a time period by using following equation. The equivalent noise level is defined mathematically as

Measured noise levels, displayed as a function of time, is useful for describing the acoustical climate of the community. Noise levels recorded at each station with a time interval of about 60 minutes are computed for equivalent noise levels. Equivalent noise level is a single number descriptor for describing time varying noise levels.

Leq = 10 Log L / T∑ (10Ln/10)
Where L = Sound pressure level at function of time dB (A)
T = Time interval of observation

3.4.3 Analysis of Ambient Noise Level in the Study Area

The Digital Sound pressure level has been measured by a sound level meter (Model: HTC SL-1352)

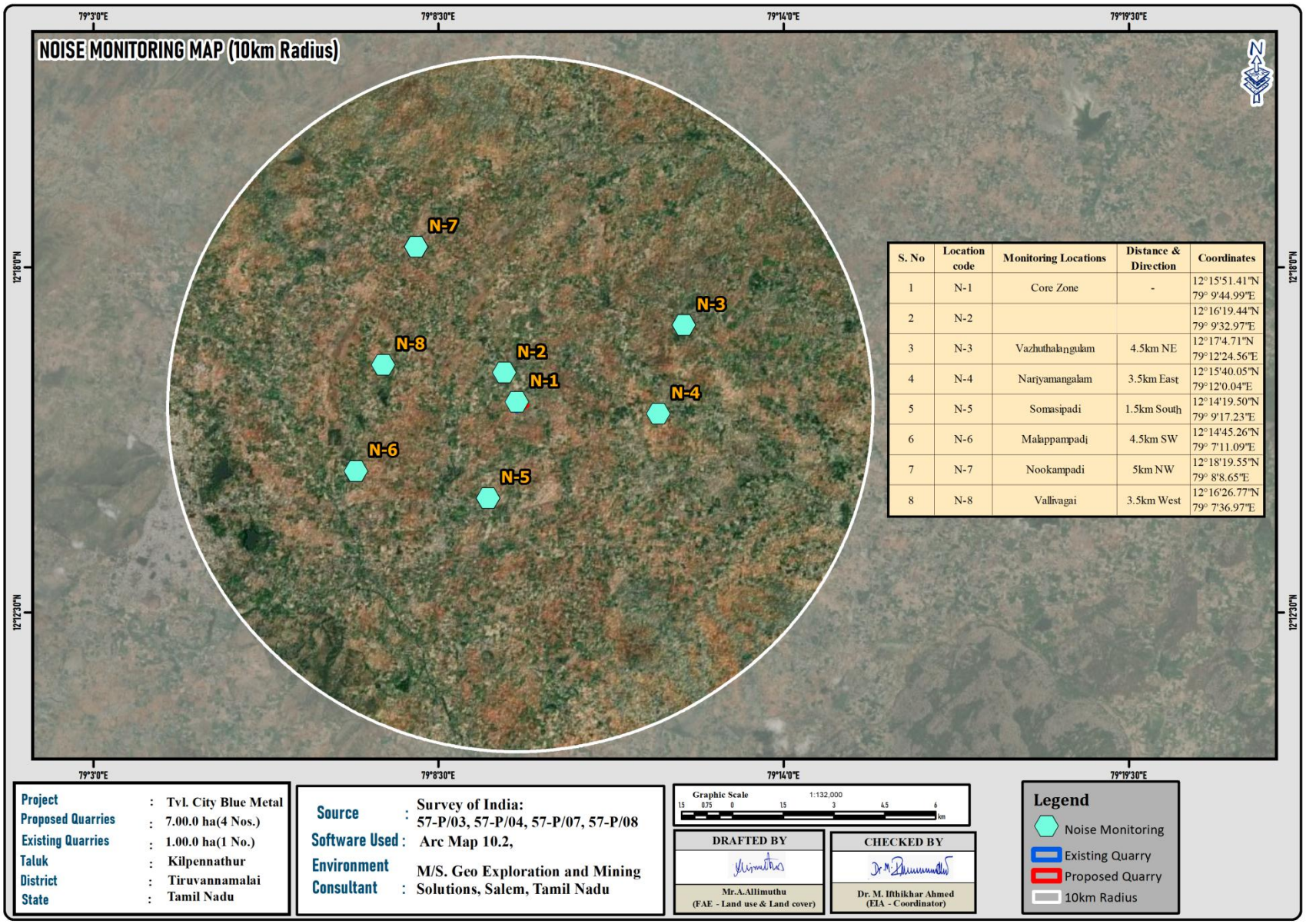
An analysis of the different Leq data obtained during the study period has been made. Variation was noted during the day-time as well as night-time. The results are presented in below Table 3.31
Day time: 6:00 hours to 22.00 hours.
Night time: 22:00 hours to 6.00 hours.

TABLE 3.31: AMBIENT NOISE QUALITY RESULT

S. No	Locations	Noise level (dB (A) Leq)		Ambient Noise Standards
		Day Time	Night Time	
1	Core Zone	48.7	37.7	**Industrial** **Day Time- 75 dB (A)** **Night Time- 70 dB (A)**
2	Iyankulam	49.3	37.7	Residential Day Time– 55 dB (A) Night Time- 45 dB (A)
3	Vazhuthalangulam	47.2	39.0	
4	Nariyamangalam	46.7	39.1	
5	Somasipadi	48.1	37.6	
6	Malappampadi	46.9	38.5	
7	Nookampadi	47.5	37.4	
8	Vallivagai	47.8	39.5	

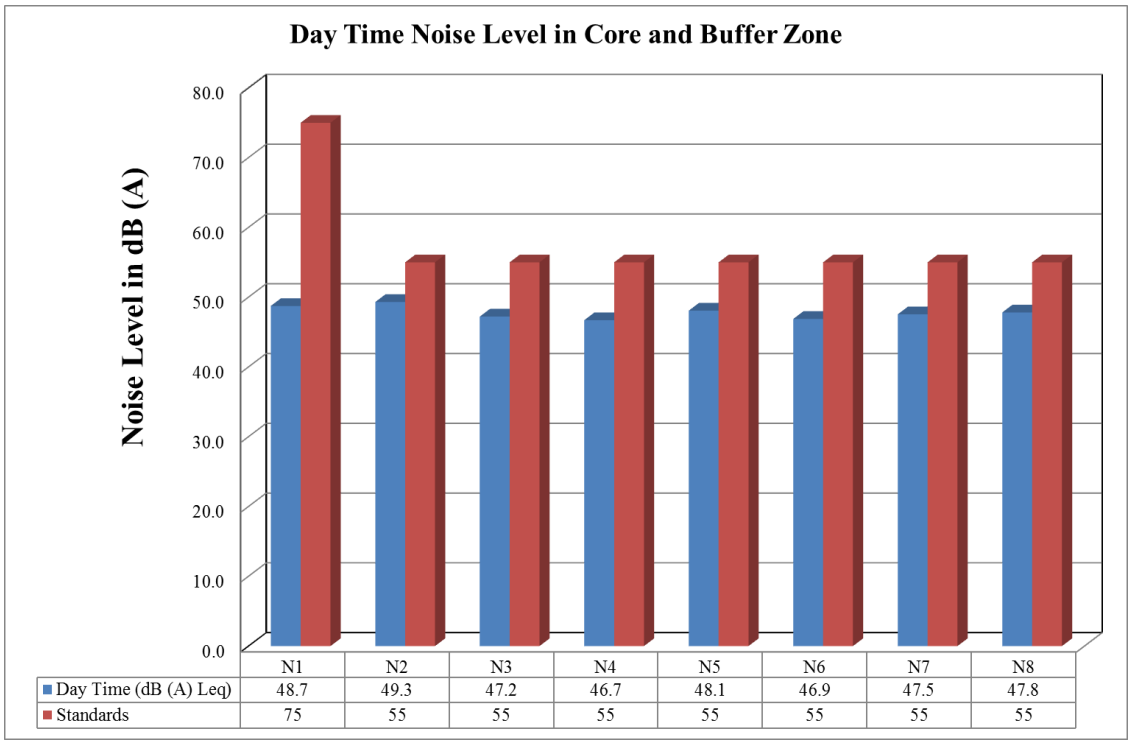
Source: On-site monitoring/sampling by Omegaa Laboratories in association with GEMS

FIGURE 3.23: NOISE MONITORING STATIONS AROUND 10 KM RADIUS



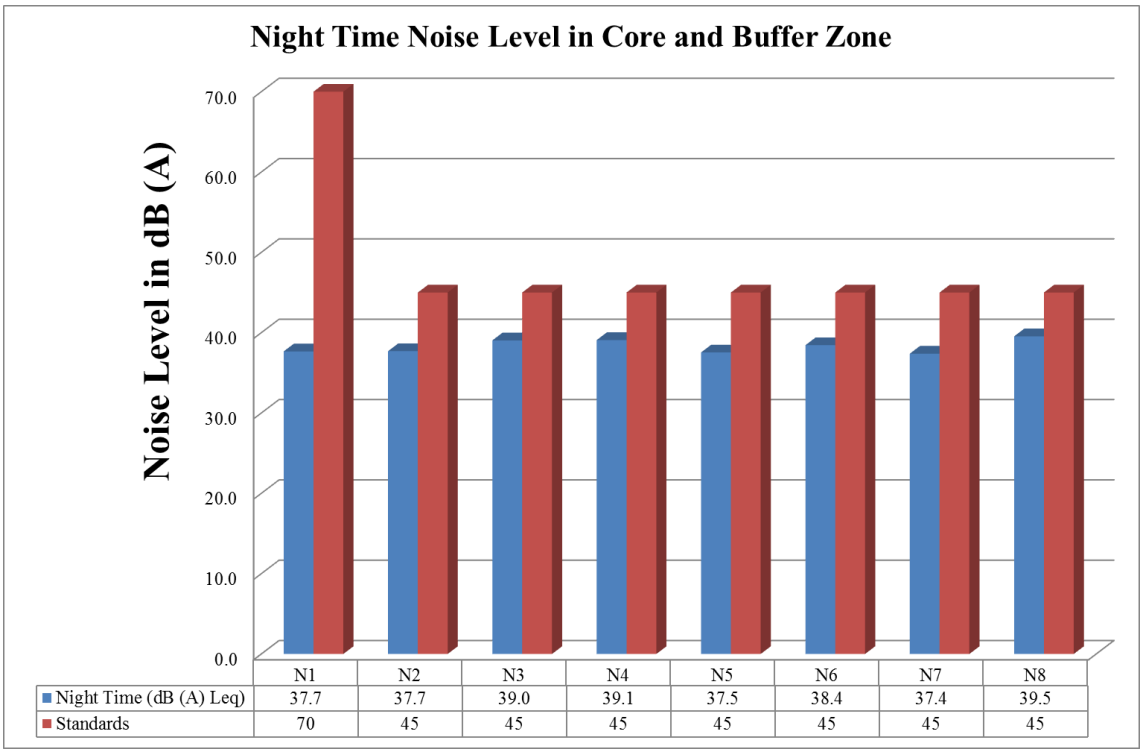
S. No	Location code	Monitoring Locations	Distance & Direction	Coordinates
1	N-1	Core Zone	-	12°15'51.41"N 79° 9'44.99"E
2	N-2			12°16'19.44"N 79° 9'32.97"E
3	N-3	Vazhuthalangukam	4.5km NE	12°17'4.71"N 79°12'24.56"E
4	N-4	Nariyamangalam	3.5km East	12°15'40.05"N 79°12'0.04"E
5	N-5	Somasipadi	1.5km South	12°14'19.50"N 79° 9'17.23"E
6	N-6	Malappampadi	4.5km SW	12°14'45.26"N 79° 7'11.09"E
7	N-7	Nookampadi	5km NW	12°18'19.55"N 79° 8'8.65"E
8	N-8	Vallivagai	3.5km West	12°16'26.77"N 79° 7'36.97"E

FIGURE 3.24: DAY TIME NOISE LEVELS IN CORE AND BUFFER ZONE



	N1	N2	N3	N4	N5	N6	N7	N8
Day Time (dB (A) Leq)	48.7	49.3	47.2	46.7	48.1	46.9	47.5	47.8
Standards	75	55	55	55	55	55	55	55

FIGURE 3.25: NIGHT TIME NOISE LEVELS IN CORE AND BUFFER ZONE



	N1	N2	N3	N4	N5	N6	N7	N8
Night Time (dB (A) Leq)	37.7	37.7	39.0	39.1	37.5	38.4	37.4	39.5
Standards	70	45	45	45	45	45	45	45

3.4.4 Interpretation & Conclusion:

Ambient noise levels were measured at 8 (Eight) locations around the proposed project area. Noise levels recorded in core zone during day time is 48.7 dB (A) Leq and during night time is 37.7 dB (A) Leq. Noise levels recorded in buffer zone during day time were from 46.7 to 49.3 dB (A) Leq and during night time were from 37.4 to 39.5 dB (A) Leq.Thus, the noise level for Industrial and Residential area meets the requirements of CPCB.

3.5 ECOLOGICAL ENVIRONMENT

Ecology is a branch of science which dealing the relations and interactions between organisms and their environment. 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 biological study is to collect the baseline data regarding flora and fauna in the study area. Data has been collected through extensive survey of the area with reference to flora and fauna. Information is also collected from different sources i.e., government departments such as District Forest Office, Government of Tamil Nadu. On the basis of onsite observations as well as forest department records the checklist of flora and fauna was prepared.

3.5.1 Scope of Work

Scope of work for this study includes identification of ecologically sensitive receptors, based on literature survey, field investigations and their mitigation with conservation action plan. The study was carried out in the core as well as buffer zone of the Proposed Rough stone quarry. The study was carried out systematically and scientifically using primary and secondary data in order to bring out factual information on the ecological conditions of the mine site and 10 km radius study area.

The study involved assessment of general habitat type, vegetation pattern, preparation of inventory of flora and fauna of terrestrial ecosystem within 10 km radius from the boundary of all the Proposed Mine site. Biological assessment of the site was done to identify ecologically sensitive areas and whether there are any rare, endangered, endemic or threatened (REET) species of flora & fauna in the core area as well its buffer zone to be impacted. The study also designed to suggest suitable mitigation measures if necessary, for protection of wildlife habitats and conservation of REET species if any.

3.5.2 Objectives of Biological Studies

The present study was undertaken with the following objectives:

1. To study the likely impact of the proposed mining project on the local biodiversity and to suggest mitigation measure, if required, for vulnerable biota.
2. To assess the nature and distribution of vegetation (Terrestrial and Aquatic) in and around the mining activity.
3. Detail of flora and fauna, Endemic, Rare, Endangered and Threatened (RET Species) separately for core and buffer area based on such primary field survey and clearly indicating the Schedule of fauna present. In case of any schedule- I fauna found in the study area, the necessary plan along with budgetary provisions for their conservation should be prepared in consultation with State Forest and Wildlife Department and details furnished.
4. Devise management & conservation measures for biodiversity.

3.5.3 Methodology of Sampling

The present study was carried out in given steps

1. Field survey was conducted by visual encounter survey for flora present within the 10 km radius study area of all the proposed mine site.
2. After surveying the core and buffer areas, a detailed floral inventory has been compiled. List of all plants of the study area was prepared and their habitats were recorded.
3. Verification of Rare, Endangered and Threatened Flora species from IUCN Red Data Book.
4. Plants and Animals communities were noted.

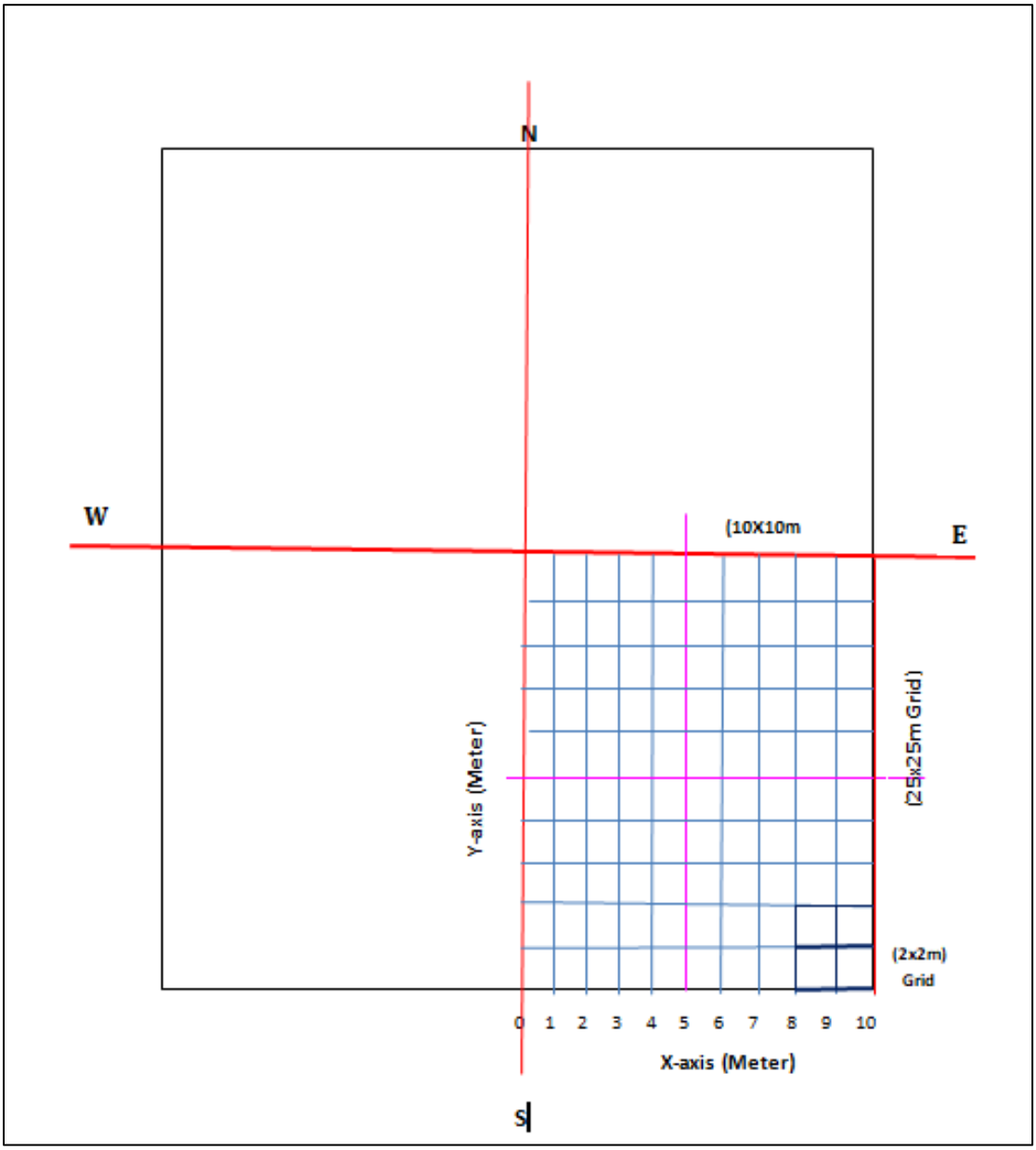
Site selection criteria: The core study area is located at Village: Iynkunam, Taluk: Kilpennathur, District: Tiruvannamalai, Tamil Nadu. The buffer study area comprises of 10 km radius from all the proposed Rough stone quarry area.

Selection of sampling locations was made with reference to topography, land use, vegetation pattern, etc. The observations were taken on natural vegetation, roadside plantation and non-forest area (agricultural field, in plain areas, village wasteland, etc.) for quantitative representation of different species.

A methodology of Sampling Flora and fauna studies were carried out to assess the list of terrestrial plant and animal species that occur in the core area and the buffer area up to 10 km radius from the project site. No damage is created to flora and fauna during the sampling.

In order to provide representative ecological status for the study area, the 10-km buffer zone has been divided into four quartiles for biodiversity sampling, i.e., NE (Quartile-1), NW (Quartile-2) SW (Quartile-3) and SE (Quartile-4) is given in Fig. 3.26. Each of the quartiles have been examined for representative flora on randomly sampled quadrats for trees (25x25-m), shrubs (10x10-m) and herbs (2x2-m) depending upon prevailing geographical conditions and bio-diversity aspects of study area.

FIGURE 3.26: A SCHEMATIC DIAGRAM FOR FLORAL RANDOM SAMPLING



Phyto-sociological Survey method

Phyto-sociological parameters, viz., Abundance, Density, Frequency (%) were measured. A total of 10 quadrats were laid down randomly within core area and 40 quadrats were laid down within four quartiles randomly (10/quartile) in buffer area. In core area 10 quadrats were laid randomly to enumerated trees, shrubs, and herbs as per the Following formulae used for calculating the frequency (%), abundance and density of the floral species encountered in the 10 quadrats studied.

Quadrats method

Quadrats of 25 × 25-m were laid down randomly within core and 5-km buffer area; each quadrat was laid to assess the trees (>5 cm GBH) and one, 10 × 10-m sub-quadrat nested within the quadrat for shrubs. The quadrats were laid randomly to cover the area to maximize the sampling efforts and minimize the species homogeneity, such as small stream area, trees in agricultural bunds, tank bunds, farm forestry plantations, wildlife areas, natural forest area, avenue plantations, house backyards, etc. In each quadrat individuals belonging to tree (25 × 25-m) and shrub (10 × 10-m) were recorded separately and have been identified on the field. quadrates sampling methods is given in Fig no.3.26.

FLORA IN CORE ZONE

Taxonomically a total of 23 species belonging to 16 families have been recorded from the core mining lease area. Based on habitat classification of the enumerated plants the majority of species were Herb 8 (35%) followed by Trees 6 (26%), Shrub 5 (22%) and Climbers 2 (8%), Grasses 2 (9%). Details of flora with the scientific name were mentioned in Table No. 3.32. The result of core zone of flora studies shows that Fabaceae and Amaranthaceae, Lamiaceae are the main dominating species in the study area it mentioned in Table No.3.32 and the details of diversity of flora family's pattern are given in Fig No.3.27. No species found as threatened category (Table No. 3.32).

FLORA IN BUFFER ZONE

Similar type of environment also in buffer area but with more flora diversity compare than core zone area because of nearby forest covers and agriculture land was found to dominate mostly in Northwest and Southwest directions. It contains a total of 107 species belonging to 47 families have been recorded from the buffer zone. The floral (107) varieties among them Tree forty two 42 (39%) Twenty three herbs 23 (21%) and eighteen Herbs 18 (17%) and twelve Climbers 12 (11%), Creeper seven 7 (7%), Grasses four 4 (4%), Cactus one 1 (1%) were identified. The result of buffer zone of flora studies shows that Fabaceae and Poaceae, Euphorbiaceae are the main dominating species in the study area it mentioned in.3.33

There is no Rare, Endangered and Threatened Flora species in mining area and their surrounding area. Details of flora with the scientific name were mentioned in Table No.3.33. The diversity of flora families is given in Fig No.3.28.

TABLE 3.32: FLORA IN CORE ZONE

SI. No	English Name	Vernacular Name	Scientific Name	Family Name
TREES				
1	Acacia Nilotica	Karuvelam maram	*Vachellia nilotica*	Fabaceae
2	Asian Palmyra palm	Panai maram	*Borassus flabellifer*	Arecaceae
3	Mesquite	Velikathan maram	*Prosopis juliflora*	Fabaceae
4	Millettia pinnata	Pongam oiltree	*Pongamia pinnata*	Fabaceae
5	Neem	Vembu	*Azadirachta indica*	Meliaceae
6	Noni	Nuna maram	*Morinda citrifolia*	Rubiaceae
SHRUBS				
7	Touch-me-not	Thottalchinungi	*Mimosa pudica*	Mimosaceae
8	Milk Weed	Erukku	*Calotropis gigantea*	Apocynaceae
9	Indian mallow	Thuththi	*Abutilon indicum*	Malvaceae
10	Night shade plan	Sundaikai	*Solanum torvum*	Solanaceae
11	Wild sage	Unichedi	*Lantana camara*	Verbenaceae
HERBS				
12	Common leucas	Thumbai	*Leucas aspera*	Lamiaceae
13	Indian doab	Arugampul	*Cynodon dactylon*	Poaceae
14	Basil	Karunthulasi	*Ocimum basilicum*	Lamiaceae
15	Devil‘s thorn	Nerunji	*Tribulus terrestris*	Zygophyllales
16	Common nut sedge	Korai	*Cyperus rotundus*	Cyperaceae
17	Yellow-fruit Nightshade	Kantang kathrikai	*Solanum virginianum*	Solanaceae
18	Prickly chaff flower	Nayuruv	*Achyranthes aspera*	Amaranthaceae
19	Mountain knotgrass	Poolai poondu	*Aerva lanata*	Amaranthaceae
CLIMBER				
20	Stemmed vine	Perandai	*Cissus quadrangularis*	Vitaceae
21	Wild bitter	Pavarkai	*Momordica charantia*	Cucurbitaceae
GRASSES				
22	Indian doab	Arugampul	*Cynodon dactylon*	Poaceae
23	Eragrostis	Pullu	*Eragrostis ferruginea*	Poaceae

TABLE 3.33: FLORA IN BUFFER ZONE

SI.No	English Name	Vernacular Name	Scientific Name	Family Name	Resource use type *(E,M,EM)
			TREES		
1	Neem or Indian lilac	Vembu	*Azadirachta indica*	Meliaceae	M
2	Peepal	Arasanmaram	*Ficus religiosa*	Moraceae	M
3	Portia tree	Poovarasan maram	*Thespesia populnea*	Malvaceae	E
4	Asian Palmyra palm	Panai maram	*Borassus flabellifer*	Arecaceae	E
5	Bitter Albizia	Arappu	*Albizia amara*	Fabaceae	M
6	Eucalyptus	Eucalyptus	*Eucalyptus globules*	Myrtaceae	EM
7	Coconut	Thennai maram	*Cocos nucifera*	Arecaceae	EM
8	Noni	Nuna maram	*Morinda citrifolia*	Rubiaceae	M
9	Lemon	Ezhumuchaipalam	*Citrus lemon*	Rutaceae	EM
10	Madras Thorn	Kuduka puli	*Pithecellobium dulce*	Mimosaceae	EM
11	Teak	Thekku	*Tectona grandis*	Verbenaceae	E
12	Sesban	Chitthakathi	*Sesbania sesban*	Fabaceae	M
13	Tamarind	Puliyamaram	*Tamarindus indica*	Legumes	EM
14	Creamy Peacock Flower	Vadanarayani	*Delonix elata*	Fabaceae	M
15	Manilkara zapota	Sapota	*Manilkara zapota*	Sapotaceae	E
16	Beauty leaf	Punnai	*Calophyllu inophyllum*	Calophyllaceae	M
17	Castor oil plant	Amanakku	*Ricinus communis*	Euphorbiaceae	M
18	Gum arabic tree	Karuvelam	*Acacia nilotica*	Mimosaceae	NE
19	Black plum	Navalmaram	*Sygygium cumini*	Myrtaceae	EM
20	Chebulic myrobalan	Kadukkai	*Terminalia chebula*	Combretaceae	M
21	Indian fig tree	Athi	*Ficus recemosa*	Moraceae	EM
22	Banana tree	Vazhaimaram	*Musa*	Musaceae	EM
23	Giant thorny bamboo	Perumungil	*Bambusa bambos*	Poaceae	M
24	Mango	Manga	*Mangifera indica*	Anacardiaceae	E
25	Millettia pinnata	Pongam oiltree	*Pongamia pinnata*	Fabaceae	E
26	Banyan tree	Alamaram	*Ficus benghalensis*	Moraceae	E
27	Gooseberry	Arai nelli	*Phyllanthus acidus*	Euphorbiaceae	EM
28	Indian gooseberry	Nelli	*Emblica officinalis*	Phyllanthaceae	EM
29	Rosewood trees	Eeti	*Dalbergia latifolia*	Fabaceae	E
30	Jack fruit	Palamaram	*Artocarpus heterophyllus*	Moraceae	E
31	Henna	Marudaani	*Lawsonia inermis*	Lythraceae	EM
32	Five leaf chastera	Nochi	*Vitex negundo*	Lamiaceae	M
33	Papaya	Pappali maram	*Carica papaya L*	Caricaceae	EM
34	Acacia Nilotica	Karuvelam maram	*Vachellia nilotica*	Fabaceae	M

35	Indian bael	Vilvam	*Aegle marmelos*	Rutaceae	EM
36	Chinese chaste tree	Nochi	*Vitex negundo*	Verbenaceae	E
37	Peepal	Arasanmaram	*Ficus religiosa*	Moraceae	M
38	Indian fir tree	Nettilinkam	*Polylathia longifolia*	Annonaceae	E
39	Guava	Koyya	*Psidium guajava*	Myrtaceae	EM
40	Custard apple	Seethapazham	*Annona reticulata*	Annonaceae	E
41	Curry tree	Velipparuthi	*Murraya koenigii*	Asclepiadaceae	EM
42	Bamboo	Moonghil	*Bambusa bambo*	Poaceae	E
SHRUBS					
43	Avaram	Avarai	*Senna auriculata*	Fabaceae	M
44	Indian Oleander	Arali	*Nerium indicum*	Apocynaceae	M
45	Rosy Periwinkle	Nithyakalyani	*Cathranthus roseus*	Apocynaceae	M
46	Shoe flower	Chemparuthi	*Hibiscu rosa-sinensis*	Malvaceae	EM
47	Wild Caper Bush.	Karindu	*Capparis sepiaria*	Capparaceae	M
48	Rosary pea	Kundumani	*Abrus precatorius*	Fabaceae	M
49	Ceylon Date Palm	Icham	*Phoenix pusilla*	Arecaceae	EM
50	Flame of the Woods	Idlipoo	*Xoracoc cinea*	Rubiaceae	M
51	Puriging nut	Kattamanakku	*Jatropha curcas*	Euphorbiaceae	EM
52	Columnar Cactus	Sappathikalli	*Cereus pterogonus*	Cactaceae	M
53	Night shade plan	Sundaikai	*Solanum torvum*	Solanaceae	EM
54	Indian mallow	Thuthi	*Abutilon indicum*	Meliaceae	M
55	Thorn apple	Oomathai	*Datura stramonium*	Solanaceae	E
56	Triangular spruge	Chaturakalli	*Euphorbia antiquorum*	Euphorbiaceae	NE
57	Hygrophila spinosa	Neermulli	*Hydrophila auriculata*	Acanthaceae	M
58	Datura metel	Uumaththai	*Datura metel*	Solanaceae	NE
59	Milk Weed	Erukku	*Calotropis gigantea*	Apocynaceae	M
60	Touch-me-not	Thottalchinungi	*Mimosa pudica*	Mimosaceae	M
HERBS					
61	Prickly chaff flower	Nayuruv	*Achyranthes aspera*	Amaranthaceae	M
62	Tridax daisy	Veetukaayapoondu	*Tridax procumbens*	Asteraceae	M
63	Common nut sedge	Korai	*Cyperus rotundus*	Cyperaceae	NE
64	Peanuts	Mallatai	*Arachis hypogaea*	Fabaceae	EM
65	Hibiscus hispidissimus	Kaattu piral	*Hibiscus hispidissimus*	Malvaceae	M
66	Indian Copperleaf	Kuppaimeni	*Acalypha indica*	Euphorbiaceae	M
67	Cleome viscosa	Nai kadugu	*Celome viscosa*	Capparidaceae	M
68	False daisy	Karisilanganni	*Eclipta prostata*	Asteraceae	EM
69	Punarnava	Mukkirattai	*Boerhaavia diffusa*	Nyctaginaceae	EM
70	Creeping wood sorrel	Pulliyari	*Oxalis corniculata*	Oxalidaceae	M

71	Node Flower	Kumattikkirai	*Allmania nodiflora*	Amaranthaceae	M
72	Poor land flatsedg	Kunnakora	*Cyperus compressus*	Cyperaceae	NE
73	Gale of the wind	Keelaneeli	*Phyllanthus niruri*	Phyllanthaceae	EM
74	Benghal dayflower	Kanamvazha	*Commelina benghalensis*	Commelinaceae	M
75	Common leucas	Thumbai	*Leucas aspera*	Lamiaceae	M
76	Carrot grass	Parttiniyam	*Parthenium hysterophorus*	Asteraceae	NE
77	Turmeric's	Manjal	*Curcuma longa*	Zingiberaceae	EM
78	European black nightshade	Manathakkali	*Solanumnigrum*	Solanaceae	EM
79	Black Mustard Seed	Kaduku	*Brassica juncea*	Brassaceae	EM
80	Red Hogweed	Mukurattai	*Boerhavia diffusa*	Nyctaginaceae	M
81	Holy basil	Thulasi	*Ocimum tenuiflorum*	Lamiaceae	M
82	Digeria muricata	Thoiya keerai	*Digeria muricata*	Amarantheceae	EM
83	Indian doab	Arugampul	*Cynodon dactylon*	Poaceae	E
CLIMBER					
84	Ivy gourd	Kovai	Coccinia grandis	Cucurbitaceae	M
85	Stemmed vine	Perandai	Cissus quadrangularis	Vitaceae	M
86	Balloon vine	Mudakkotan	Cardiospermum helicacabum	Sapindaceae	M
87	Betel	Vetrilai	Piper betle	Piperaceae	EM
88	Butterfly pea	Karkakartum	Clitoria ternatea	Fabaceae	M
89	Wild bitter	Pavarkai	Momordica charantia	Cucurbitaceae	EM
90	Purple fruited pea eggplant	Thuthuvelai	Solanum trilobatum	Solanaceae	EM
91	Indian sarsparilla	Nannari	Hemidesmus indicus	Asclepiadaceae	M
92	Pointed gourd	Kovakkai	Trichosanthes dioica	Cucurbitaceae	EM
93	Butterfly-pea	Sangupoo	Clitoriaternatia	Fabaceae	M
94	Wild jasmine	Malli	Jasminum augustifolium	Oleaceae	EM
95	Bottle Guard	Sorakkai	Lagenaria siceraria	Cucurbitaceae	EM
CREEPER					
96	Water spinach	Vallikeerai	Ipomoea aquatica	Convolvulaceae	EM
97	Frog fruit	Poduthalai	Phyla nodifolia	Verbenaceae	NE
98	Grona triflora	Siru puladi	Desmodium triflorum	Fabaceae	EM
99	Bindii plant	Seppu nerunjil	Indigofera enneaphylla	Fabaceae	M
100	Ground Spurge	Sithrapaalavi	Euphorbia prostrata	Euphorbiaceae	EM
101	Nut grass	Korai	Cyperus rotandus	Poaceae	M
102	Creeping-oxeye	Malai mookuthi poondu	Wedelia trilobata	Asteraceae	M
GRASS					
103	Jungle rice	Kuthirai vaal Kattu arusi	Echinochloa colona	Poaceae	NE

104	Eragrostis	Pullu	Eragrostis ferruginea	Poaceae	E
105	Windmill grass	Chevvarakupul	Chloris barbata	Amaranthaceae	NE
106	Kyllinga brevifolia	Musthakasu	Kyllinga brevifolia	Cyperaceae	NE
CACTUS					
107	Prickly pear	Nagathali	Opuntia dillenii	Cactaceae	M

*E- Economical, M- Medicinal, EM- Both Economical and Medicinal, NE- Not evaluated

AQUATIC VEGETATION

The field survey for assessing the aquatic vegetation was also undertaken during the study period. The list of aquatic plants observed in the study area is given in Table 3.34.

TABLE 3.34: AQUATIC VEGETATION

Sl.No	Scientific name	Common Name	Vernacular Name (Tamil)	IUCN Red List of Threatened Species
1	*Eichornia crassipe*	Water hyacinth	Agayatamarai	NA
2	*Aponogetonnatans*	Floating laceplant	Kottikizhnagu	NA
3	*Nymphaea nouchali*	Blue waterlily	Nellambal	LC
4	*Brachiaria mutica*	Buffalo grass	-	NA
5	*Carex cruciata*	Cross Grass	Koraipullu	NA
6	*Chrysopogon aciculatus*	Golden false beardgrass	Kampuputpi	NA
7	*Colocassia esculenta*	Taro	Seppakizhangu	LC
8	*Cynodon dactylon*	Scutch grass	Arugampul	LC
9	*Cyperus exaltatus*	Tall Flat Sedge	Koraikizhangu	LC
10	*Hydrilla verticillata*	Water thymes	Amiranappaci	LC
11	*Nelumbo nucifera*	Sacred lotus	Chenthaamarai	LC
12	*Nymphaea nauchali*	Blue lotus	Alli	LC

*LC- Least Concern, NA-Not yet assessed

FAUNA

The faunal survey has been carried out as per the methodology cited and listed out Mammals, birds, Reptiles, Amphibians and Butterflies. All the listed species were compared with Red Data Book and Indian Wildlife Protection Act, 1972. There are no rare, endangered, threatened (RET) and endemic species present in core area.

FAUNA METHODOLOGY

The study of fauna takes substantial amount of time to understand the specific faunal characteristics of the area. The assessment of fauna has been done on the bases of primary data collected from the lease sites. The presence was also confirmed from the local inhabitants depending on the animal sightings and the frequency of their visits in the project area. In addition, officials, local peoples were another source of information for studying the fauna of the area. Field activities are physical/active search, covering rocks, burrows, hollow inspection and location of nesting sites and habitat assessment etc. Taxonomical identification was done by the field guide book and wildlife envis data base (wiienvis.nic.in/Database/Schedule Species Database) and Zoological Survey of India (ZSI). Detailed faunas are mentioned in the Table No. 3.35 and 3.36.

Survey and Monitoring of Mammals

Intensive survey has been done by line transect methods (Walking and in vehicle) for all major habitats for surveying of mammals by direct and indirect evidence. Indirect methods such as faecal matter (i.e., scat) and pug mark by establishing 10 × 100-m linear transects depending on the habitat (i.e., existing wildlife game routes/forest trails used).

Direct observation technique has been used for surveying large and medium sized mammals. But this technique is perfectly suitable for surveying of diurnal mammals; however, good photographs were also taken for species identification.

Survey and Monitoring of Birds

Birds are sampled by using point count methods, and opportunistic bird sightings. By this bird vocal sounds and photographs, the species were identified in consultation with village local people. Point count: in this method, the observer will stand in a randomly chosen point and birds seen or heard in 50m radius are recorded for

5-min. this observation is repeated in another point at least 30m from the first point. We have enumerated 20 point – counts in each quartile, which constitute a total of 80 points-count (20 x 4) within 10 km radius area.

Opportunistic bird sightings: while traveling in study area, many bird species will be detected in survey time. Such species are recoded by their appearance or by their call.

Survey and Monitoring of reptiles

Several survey techniques such as standard walk transect visual encounter survey methods were used to sampling reptiles in each and every habitat of the study area. While doing this survey, photographs were taken for identification of species. Species identification was done by using standard field guides in consultation with village people expert.

The butterfly was enumerated by 2 linear transects of 10 × 100 m were laid within each quartile at minimum interval of 1 km. Further, amphibians and fishes documented in existing literature and secondary information in consultation with local people and wildlife experts.

FAUNA IN CORE ZONE

A total of 22 varieties of species observed in the Core zone of Iyangunam Village Rough stone quarry (Table No.3.3) among them numbers of Insects 7 (32%), Reptiles 5 (23%), Mammals 3 (13%) and Avian 7 (32%). A total of 22 species belonging to 18 species belonging to 18 families have been recorded from the core mining lease area. None of these species are threatened or endemic in the study area and surroundings. There is no Schedule I species and seven species are under schedule IV according to Indian wild life Act 1972. A total eight species of bird were sighted in the mining lease area..

There are no critically endangered, endangered, vulnerable and endemic species were observed. Details of fauna in core zone with the scientific name were mentioned in Table No. 3.35.

TABLE 3.35: FAUNA IN CORE ZONE

S. No	Common name/English name	Family name	Scientific name	Schedule list wildlife Protection act 1972	IUCN Red List data
INSECTS					
1	Common Tiger	Nymphalidae	*Danaus genutia*	NL	NL
2	Grasshopper	Acrididae	*Hieroglyphus sp*	NL	LC
3	Striped tiger	Nymphalidae	*Danaus plexippus*	Schedule IV	LC
4	Mottled emigrant	Peridae	*Catopsilia pyranthe*	NL	LC
5	Praying mantis	Mantidae	*mantis religiosa*	NL	NL
6	Red-veined darter	Libellulidae	*Sympetrum Sonscolombii*	NL	LC
7	Stick insect	Lonchodidae	*carausius morosus*	NL	LC
REPTILES					
8	Garden lizard	Agamidae	*Calotes versicolor*	NL	8
9	Fan-Throated Lizard	Agamidae	*Sitanaponticeriana*	NL	9
10	Brahminy skink	Scincidae	*Eutropis carinata*	NL	10
11	Common skink	Scincidae	*Mabuya carinatus*	NL	11
12	Common house gecko	Gekkonidae	*Hemidactylus frenatus*	NL	12
MAMMALS					
13	Indian Field Mouse	Muridae	*Mus booduga*	Schedule IV	NL
14	Asian Small Mongoose	Herpestidae	*Herpestes javanicus*	Schedule II	LC
15	Common rat	Muridae	*Rattus rattus*	Schedule IV	LC
AVES					
16	Asian green bee-eater	Meropidae	*Meropsorientalis*	NL	LC
17	Koel	Cucalidae	*Eudynamys*	Schedule IV	LC
18	Two-tailed Sparrow	Dicruridae	*Dicrurus macrocercus*	Schedule IV	LC
19	Common myna	Sturnidae	*Acridotheres tristis*	NL	LC

20	common quail	Phasianidae	*Coturnix coturnix*	Schedule IV	LC
21	House crow	Corvidae	*Corvussplendens*	NL	LC
22	Indian pond heron	Ardeidae	*Ardeola grayii*	Schedule IV	LC

*NE- Not evaluated; LC- Least Concern, NT –Near Threatened, T-Threatened

FAUNA IN BUFFER ZONE

Taxonomically a total of 48 species belonging to 38 families have been recorded from the buffer mining lease area. Based on habitat classification the majority of species Birds 19 (40%) followed by Insects 15 (31%), Reptiles 7 (15%), Mammals 4 (8%) and amphibians 3 (6%). There are three Schedule II species and twenty four species are under schedule IV according to Indian wild life Act 1972. A total twenty species of bird were sighted in the study area. There are no critically endangered, endangered, vulnerable and endemic species were observed..

Dominant species are mostly birds and insects and three amphibians were observed during the extensive field visit (Hoplobatrachus tigerinus), (Rana hexadactyla), (Bufo melonosticatus). The result of core & Buffer zone of fauna studies shows that Nymphalidae and Scincidae, Agamidae are the main dominating species in the study area it mentioned inTable No.3.36. There is no schedule I Species in study area. A detail of fauna diversity of family's pattern is given in Fig No.3.30. There are no critically endangered, endangered, vulnerable and endemic species were observed. Details of faunal diversity in buffer zone are given in Table No.3.36.

TABLE 3.36: FAUNA IN BUFFER ZONE

SI.No	***Common name/English Name***	***Family Name***	***Scientific Name***	***Schedule list wildlife Protection act 1972***	***IUCN Red List data***
INSECTS					
1	Blue tiger	Nymphalidae	*Tirumala limniace*	Schedule IV	LC
2	Common Indian crow	Nymphalidae	*Euploea core*	Schedule IV	LC
3	Milkweed butterfly	Nymphalidae	*Danainae*	NL	LC
4	Tawny coster	Nymphalidae	*Danaus chrysippus*	Schedule IV	LC
5	Jewel beetle	Buprestidae	*Eurythyrea austriaca*	Schedule IV	NA
6	Grasshopper	Acrididae	*Hieroglyphus sp*	NL	LC
7	Red-veined darter	Libellulidae	*Sympetrum fonscolombii*	NL	LC
8	Lime butterfly	Papilionidae	*Papilio demoleus*	Schedule IV	LC
9	Ant	Formicidae	*Camponotus Vicinus*	NL	NL
10	Dragonfly	Gomphidae	*Ceratogomphus pictus*	Schedule IV	LC
11	Common Tiger	Nymphalidae	*Danaus genutia*	Schedule IV	LC
12	Indian honey bee	Apidae	*Apis cerana*	Schedule IV	LC
13	Praying mantis	Mantidae	*mantis religiosa*	NL	NL
14	Striped tiger	Nymphalidae	*Danaus plexippus*	Schedule IV	LC
15	Lesser grass blue	Lycaenidae	*Zizina Otis indica*	Schedule IV	LC
REPTILES					
16	Garden lizard	Agamidae	*Calotes versicolor*	NL	LC
17	Common house gecko	Gekkonidae	*Hemidactylus frenatus*	NL	LC
18	Indian chameleon	Chamaeleonidae	*Chamaeleo zeylanicus*	Sch II (Part I)	LC
19	Olive keelback water snake	Natricidae	*Atretium schistosum*	Sch II (Part II)	LC
20	Brahminy skink	Scincidae	*Eutropis carinata*	NL	LC
21	Rat snake	Colubridae	*Ptyas mucosa*	Sch II (Part II)	LC
22	Common skink	Scincidae	*Mabuya carinatus*	NL	LC
MAMMALS					
23	Indian palm squirrel	Sciuridae	*Funambulus palmarum*	Schedule IV	LC
24	Indian hare	Leporidae	*Lepus nigricollis*	Schedule IV	LC
25	Indian Field Mouse	Muridae	*Mus booduga*	Schedule IV	LC
26	Asian Small Mongoose	Herpestidae	*Herpestes javanicus*	Schedule (Part II)	LC
AVES					

27	Indian pond heron	Ardeidae	*Ardeola grayii*	Schedule IV	LC
28	Black drongo	Dicruridae	*Dicrurus macrocercus*	Schedule IV	LC
29	Asian green bee-eater	Meropidae	*Meropsorientalis*	NL	LC
30	Common Quail	Phasianidae	*Coturnix coturnix*	Schedule IV	LC
31	Red-breasted parakeet	Psittaculidae	*Psittacula alexandri*	NL	LC
32	Common Coot	Rallidae	*Fulica atra*	Schedule IV	LC
33	Common myna	Sturnidae	*Acridotheres tristis*	NL	LC
34	Shikra	Accipitridae	*Accipiter badius*	NL	LC
35	Koel	Cucalidae	*Eudynamys*	Schedule IV	LC
36	House crow	Corvidae	*Corvussplendens*	NL	LC
37	Red-vented Bulbul	Pycnonotidae	*Pycnonotuscafer*	Schedule IV	LC
38	Brahminy starling	Sturnidae	*Sturnia pagodarum*	Schedule IV	LC
39	Indian golden oriole	Oriolidae	*Oriolus kundoo*	Schedule IV	LC
40	Cattle egret	Ardeidae	*Bubulcus ibis*	NL	LC
41	Common quail	Phasianidae	*Coturnix coturnix*	Schedule IV	LC
42	White-breasted waterhen	Rallidae	*Amaurornis phoenicurus*	NL	LC
43	Two-tailed Sparrow	Dicruridae	*Dicrurus macrocercus*	Schedule IV	LC
44	Grey Francolin	Phasianidae	*Francolinus pondicerianus*	Schedule IV	LC
45	Rose-ringed parkeet	Psittaculidae	*Psittacula krameri*	NL	LC
AMPHIBIANS					
46	Indian Burrowing frog	Dicroglossidae	*Sphaerotheca breviceps*	Schedule IV	LC
47	Green Pond Frog	Ranidae	*Rana hexadactyla*	Schedule IV	LC
48	Tiger Frog	Chordata	*Hoplobatrachus tigerinus (Rana tigerina)*	Schedule IV	LC

*NL- Not listed, LC- Least concern, NT- Near threatened

FIGURE 3.27: FLORAL DIVERSITY IN CORE ZONE

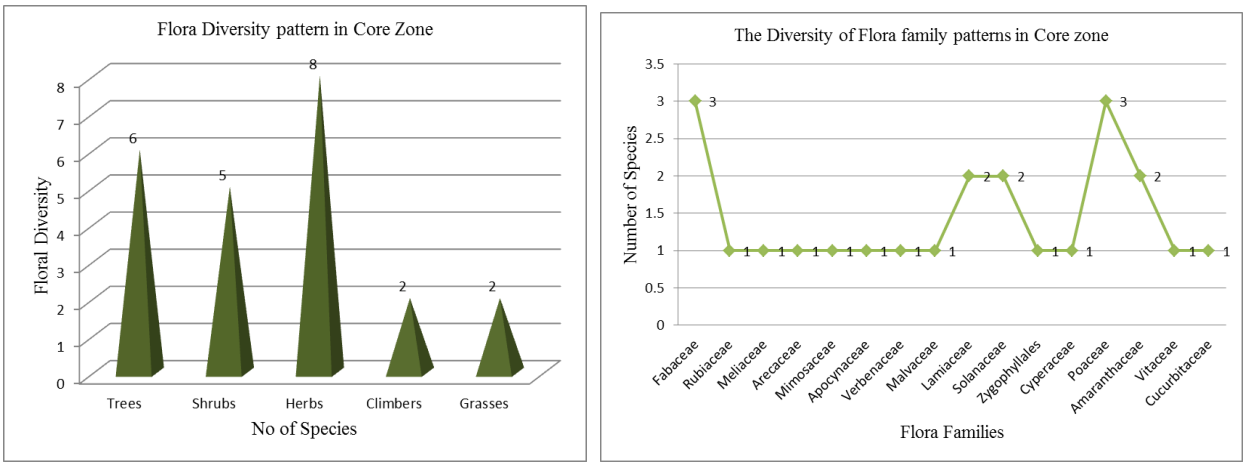
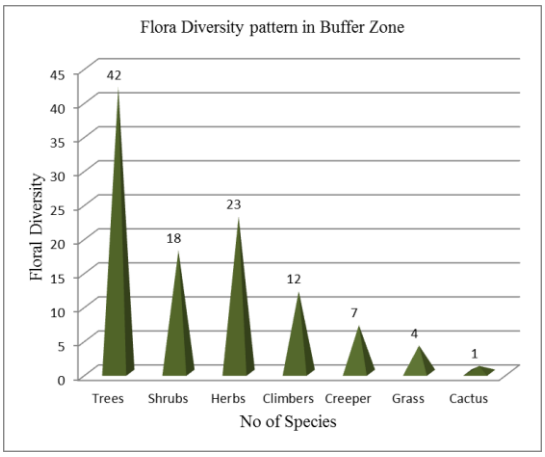


FIGURE 3.28: FLORAL DIVERSITY IN BUFFER ZONE



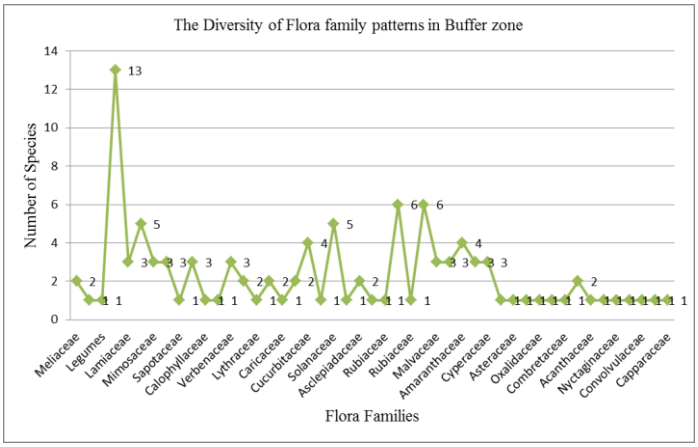
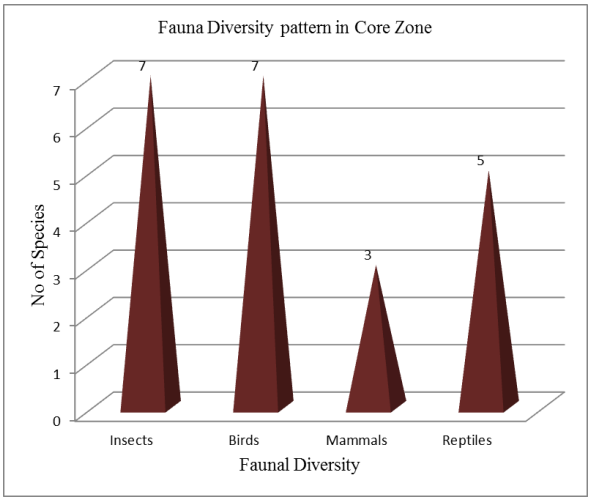


FIGURE 3.29: FAUNA DIVERSITY IN CORE ZONE



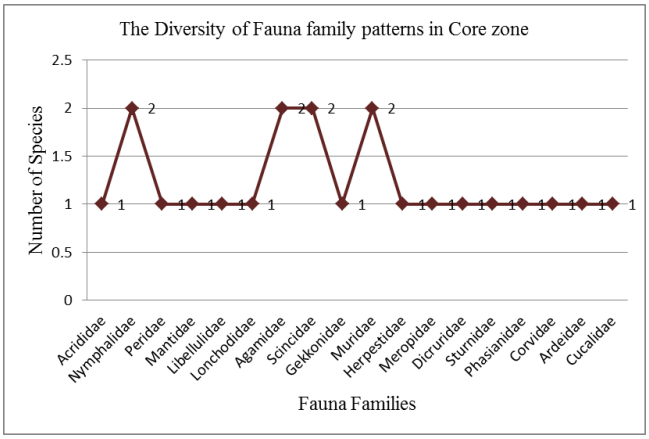
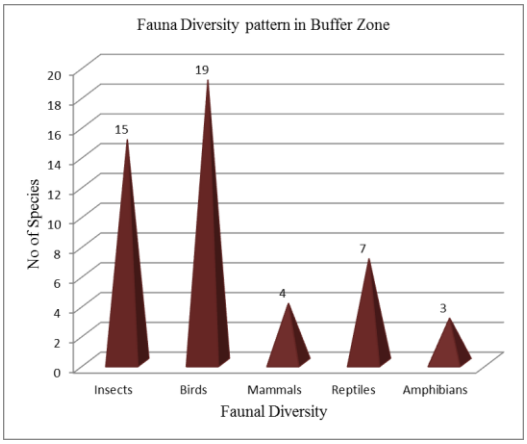
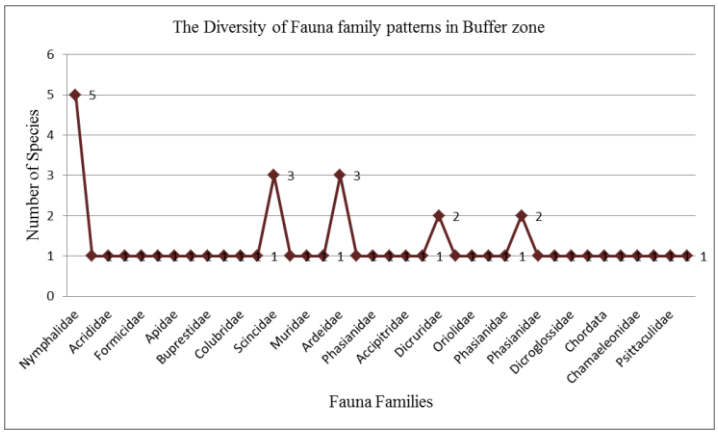


FIGURE 3.30: FAUNA DIVERSITY IN BUFFER ZONE





3.5.4 Interpretation& Conclusion:

There is no schedule I species of animals observed within study area as per Wildlife Protection Act 1972 as well as no species is in vulnerable, endangered or threatened category as per IUCN. There is no endangered red list species found in the study area. Hence this small operation over short period of time will not have any significant impact on the surrounding flora and fauna.

3.6 SOCIO ECONOMIC ENVIRONMENT

Socio-economic study is an essential part of environmental study. It includes demographic structure of the area, provision of basic amenities viz., housing, education, health and medical services, occupation, water supply, sanitation, communication, transportation, prevailing diseases pattern as well as feature like temples, historical monuments etc., at the baseline level. This will help in visualizing and predicting the possible impact depending upon the nature and magnitude of the project.

It is expected that the Socio-Economic Status of the area will substantially improve because of this proposed project. As the proposed project will provide direct and indirect employment and improve the infrastructural facilities in that area and, thus, improve their standard of living.

3.6.1 Objectives of the Study

The objectives of the socio-economic study are as follows:

- To study the socio-economic status of the people living in the study area of the proposed mining project.
- To assess the impact of the project on Quality of life of the people in the study area.
- To recommend Community Development measures needs to be taken up in the study Area.

3.6.2 Scope of Work

- To study the Socio-economic Environment of the area from the secondary sources;
- Data Collection & Analysis
- Prediction of project impact
- Mitigation Measures

3.6.3 District Profile

Tiruvannamalai is one of the most venerated places in Tamil Nadu. In ancient times, the term “Annamalai” meant an inaccessible mountain. The word “Thiru” was prefixed to signify its greatness, and coupled with the two terms, it is called Tiruvannamalai.

The Temple Town of Tiruvannamalai is one of the most ancient heritage sites of India and is a centre of the Saiva religion. The Arunachala hill and its environs have been held in great regard by the Tamils for centuries. The temple is grand in conception and architecture and is rich in tradition, history and festivals. The main Deepam festival attracts devotees from far and wide throughout South India. It has historic places besides Tiruvannamalai, Arni, Vandavasi, Devigapuram connected to East India and French companies. In the late Chola period this district was ruled by the Cholan of Sambuvarayar having Padavedu near Arni as HQ. We can now find the fort and note along with a Shiva temple namely Kailasanathar in Arni town.

3.6.4 Study area:

IYNKUNAM VILLAGE

Iynkunam village is situated in Teshil kilpennathur, District Tiruvannamalai and in State of Tamil Nadu India. Village has population of 2251 as per census data of 2011, in which male population is 1113 and female population is 1138. Total geographical area of Iynkunam village is 447.49 Hectares. Population density of Iynkunam is 5 persons per Hectares. Total number of house hold in village is 521.

TABLE 3.37: IYNKUNAM VILLAGE POPULATION FACTS

Number of Households	521
Population	2251
Male Population	1113
Female Population	1138
Children Population	262
Sex-ratio	1022
Literacy	77.58%
Male Literacy	83.81%

Female Literacy	71.43%
Scheduled Tribes (ST) %	0.6%
Scheduled Caste (SC) %	24.3%

Source: https://etrace.in/census/village/iyangunnam-tiruvannamalai-district-tiruvannamalai-tamil-nadu-632115/

Gram Panchayat name of the Iyangunnam village is Iyengunam. CD Block name is Keelapennathur and Teshil/Taluk or sub-district is Tiruvannamalai. Data Reference year is 2009 of Census 2011. Sub District HQ Name is TIRUVANNAMALAI and Sub District HQ Distance is 14 Km from the village. District Head Quarter name is TIRUVANNAMALAI and it's distance from the village is 14KM. Nearest Town of the Iyangunnam village is KILPENNATHUR and nearest town distance is 13 km. Pincode of Iyangunnam village is 606611. As per census 2011 village code of village Iyangunnam is 632115.

TABLE 3.38: DEMOGRAPHICS POPULATION OF IYNKUNAM VILLAGE

Total Population	Male Population	Female Population
2251	**1113**	**1138**

Source: https://etrace.in/census/village/iyangunnam-tiruvannamalai-district-tiruvannamalai-tamil-nadu-632115/

Sex Ratio of Iyangunnam Village -Census 2011

As per the Census Data 2011 there are 1022 Femals per 1000 males out of 2251 total population of village. There are 1096 girls per 1000 boys under 6 years of age in the village.

Literacy of Iyangunnam Village

Out of total poplation total 1543 people in Iyangunnam Village are literate, among them 828 are male and 715 are female in the village. Total literacy rate of of Iyangunnam is 77.58%, for male literacy is 83.81% and for female literacy rate is 71.43%

Workers profile of Iyangunnam Village

Total working population of Iyangunnam is 1021 which are either main or marginal workers. Total workers in the village are 1021 out of which 535 are male and 486 are female. Total main workers are 929 out of which female main workers are 486 and male main workers are 443. Total marginal workers of village are 92.

TABLE 3.39: IYNKUNAM VILLAGE CENSUS 2011 DATA

Description	Census 2011 Data
Village Name	Iyangunnam
Teshil Name	Tiruvannamalai
District Name	Tiruvannamalai
State Name	Tamil Nadu
Total Population	2251
Total Area	447 (Hectares)
Total No of House Holds	521
Total Male Population	1113
Total Female Population	1138
0-6 Age group Total Population	262
0-6 Age group Male Population	125
0-6 Age group Female Population	137
Total Person Literates	1543
Total Male Literates	828
Total Male Literates	715
Total Person Illiterates	708
Total Male Illiterates	285
Total Male Illiterates	423
Scheduled Cast Persons	547
Scheduled Cast Males	268

Scheduled Cast Females	279
Scheduled Tribe Persons	15
Scheduled Tribe Males	8
Scheduled Tribe Females	15

Source: https://etrace.in/census/village/iyangunnam-tiruvannamalai-district-tiruvannamalai-tamil-nadu-632115/

TABLE 3.40: PALAPATTI WORKING POPULATION ---CENSUS 2011

	Total	**Male**	**Female**
Total Workers	1021	535	486
Main Workers	929	486	443
Main Workers Cultivators	270	151	119
Agriculture Labourer	427	167	260
Household Industries	29	11	18
Other Workers	203	157	46
Marginal Workers	92	49	43
Non Working Persons	1230	578	652

Source: https://etrace.in/census/village/iyangunnam-tiruvannamalai-district-tiruvannamalai-tamil-nadu-632115/

TABLE 3.41: POPULATION DATA OF STUDY AREA

SI.No.	Village Name	No of House Holds	Total Population	Male	Female	Total Literate Population	Male Literate	Female Literate	Total Illiterate Population	Male Illiterate	Female Illiterate
1	Andapattu (V)	458	2136	1050	1086	1329	722	607	807	328	479
2	Aranji	304	1171	584	587	752	440	312	419	144	275
3	Arumbakkam	243	1081	533	548	759	404	355	322	129	193
4	Chinnakangiyanur	370	2598	1513	1085	2257	1387	870	341	126	215
5	Drugiammiandal	461	1836	904	932	1234	706	528	602	198	404
6	Erumpoondi	779	3440	1716	1724	2075	1158	917	1365	558	807
7	Ganalapadi	653	2806	1399	1407	1584	892	692	1222	507	715
8	Ganapapuram	442	1775	903	872	1155	684	471	620	219	401
9	Iyangunnam	521	2251	1113	1138	1543	828	715	708	285	423
10	Kadambai	385	1817	890	927	1046	562	484	771	328	443
11	Kalasthambadi	578	2340	1200	1140	1314	784	530	1026	416	610
12	Kalingaleri	112	468	238	230	341	193	148	127	45	82
13	Kalitheri	201	851	433	418	568	328	240	283	105	178
14	Kalpoondi	360	1526	758	768	944	507	437	582	251	331
15	Kaniyampoondi	210	884	448	436	605	344	261	279	104	175
16	Karampoondi	384	1774	893	881	1098	626	472	676	267	409
17	Karikilambadi	467	2163	1123	1040	1381	820	561	782	303	479
18	Kathalampattu	350	1483	746	737	896	512	384	587	234	353
19	Kattumalaiyanur	835	3819	1934	1885	2479	1386	1093	1340	548	792
20	Kattuvalanandal	116	494	245	249	319	179	140	175	66	109
21	Kiliapattu	667	2772	1404	1368	1565	910	655	1207	494	713
22	Kilnachipattu (S.O.)	560	2375	1217	1158	1576	884	692	799	333	466
23	Kilnathur	564	2485	1292	1193	1736	996	740	749	296	453
24	Koothala Vadi	139	575	292	283	352	207	145	223	85	138
25	Kothantavadi	813	3253	1641	1612	2054	1165	889	1199	476	723
26	Kumarakudi	193	826	400	426	528	286	242	298	114	184
27	Kunnandal	321	1207	611	596	677	407	270	530	204	326
28	Kunnankuppam	139	591	297	294	339	196	143	252	101	151
29	Kunnumuringi	232	892	456	436	570	340	230	322	116	206
30	Madalambadi	867	3590	1815	1775	2231	1288	943	1359	527	832
31	Malappambadi	458	1972	966	1006	1304	722	582	668	244	424
32	Mangalam	2278	9405	4721	4684	6137	3471	2666	3268	1250	2018
33	Mekalore	1150	4657	2333	2324	2871	1613	1258	1786	720	1066
34	Nallanpillaipetral	453	1904	928	976	1194	658	536	710	270	440
35	Namiyandal	188	816	410	406	557	315	242	259	95	164
36	Namiyandal (SO)	366	1418	698	720	1070	579	491	348	119	229
37	Nariyamangalam	376	1460	761	699	994	596	398	466	165	301
38	Nochimalai	294	1298	629	669	976	514	462	322	115	207

39	Nookambadi	781	3302	1625	1677	2029	1148	881	1273	477	796
40	Palanandal	716	2803	1415	1388	1697	1000	697	1106	415	691
41	Pallikondapattu	130	532	279	253	313	185	128	219	94	125
42	Randam	263	1027	518	509	626	383	243	401	135	266
43	Rayampettai	268	1034	513	521	782	421	361	252	92	160
44	Sadayanodail	362	1523	761	762	902	500	402	621	261	360
45	Sammandanur	273	1066	541	525	710	416	294	356	125	231
46	Sananandal	373	1602	811	791	1059	622	437	543	189	354
47	Sirukothan	135	582	289	293	392	207	185	190	82	108
48	Sirunathur	711	3032	1508	1524	1866	1063	803	1166	445	721
49	Somaspadi	1266	5486	2799	2687	3636	2010	1626	1850	789	1061
50	Sorappanandal	74	351	178	173	202	114	88	149	64	85
51	Su. Polakunam	388	1602	815	787	1124	620	504	478	195	283
52	Tellanandal	184	783	401	382	553	302	251	230	99	131
53	Thurinjapuram	663	2880	1445	1435	1961	1095	866	919	350	569
54	Udappoondi	37	152	80	72	102	66	36	50	14	36
55	Vadakarimbalore	336	1483	742	741	903	510	393	580	232	348
56	Vallivagai	592	2543	1260	1283	1831	991	840	712	269	443
57	Vaniyanthangal	168	690	342	348	447	261	186	243	81	162
58	Vatraputhur	159	664	317	347	429	251	178	235	66	169
59	Vazhuthalangunnam	727	3230	1580	1650	2284	1220	1064	946	360	586
60	Vedantham	580	2521	1271	1250	1721	983	738	800	288	512

Source: www.censusindia.gov.in - Tamilnadu Census of India – 2011

TABLE 3.42: WORKERS PROFILE OF STUDY AREA

SI.No.	Village Name	Total Workers Population	Male Workers	Female Workers	Total Main Workers	Main Workers Male	Main Workers Female	Main Cultivation Workers	Main Agriculture Workers	Main Other Workers	Non-Worker Population
1	Andapattu (V)	1150	607	543	676	398	278	135	366	111	986
2	Aranji	575	340	235	543	331	212	132	273	118	596
3	Arumbakkam	539	307	232	391	259	132	164	191	33	542
4	Chinnakangiyanur	811	460	351	768	440	328	235	373	154	1787
5	Drugiammiandal	945	517	428	778	436	342	333	247	188	891
6	Erumpoondi	1608	996	612	785	508	277	302	333	140	1832
7	Ganalapadi	1491	854	637	1390	772	618	583	602	166	1315
8	Ganapapuram	1033	548	485	1009	533	476	539	441	26	742
9	Iyangunnam	1021	535	486	929	486	443	270	427	203	1230
10	Kadambai	741	498	243	336	247	89	146	28	146	1076
11	Kalasthambadi	1416	764	652	1206	663	543	399	735	67	924
12	Kalingaleri	133	124	9	131	122	9	91	12	28	335
13	Kalitheri	449	246	203	441	241	200	319	33	88	402
14	Kalpoondi	756	463	293	369	299	70	85	177	100	770
15	Kaniyampoondi	357	275	82	304	251	53	94	114	96	527
16	Karampoondi	814	487	327	677	438	239	159	463	52	960
17	Karikilambadi	1062	660	402	1011	637	374	511	249	244	1101
18	Kathalampattu	734	436	298	427	300	127	123	200	96	749
19	Kattumalaiyanur	2450	1243	1207	2296	1167	1129	1876	293	103	1369
20	Kattuvalanandal	260	154	106	34	31	3	11	1	21	234
21	Kiliapattu	1524	830	694	924	488	436	383	400	139	1248
22	Kilnachipattu (S.O.)	1112	676	436	831	591	240	213	113	496	1263
23	Kilnathur	1014	684	330	852	580	272	247	272	322	1471
24	Koothala Vadi	397	195	202	67	54	13	4	5	57	178
25	Kothantavadi	1958	1034	924	1419	791	628	698	446	250	1295
26	Kumarakudi	496	264	232	3	2	1	1	0	2	330
27	Kunnandal	748	399	349	674	385	289	448	43	166	459
28	Kunnankuppam	267	171	96	257	168	89	189	58	5	324
29	Kunnumuringi	503	314	189	468	295	173	175	209	79	389
30	Madalambadi	1529	1045	484	1431	992	439	709	473	160	2061
31	Malappambadi	1069	617	452	698	490	208	138	153	405	903
32	Mangalam	5266	3037	2229	4833	2914	1919	2458	1500	722	4139
33	Mekalore	2468	1394	1074	1049	675	374	382	366	279	2189
34	Nallanpillaipetral	909	550	359	706	404	302	164	144	387	995
35	Namiyandal	544	277	267	496	272	224	245	244	5	272
36	Namiyandal (SO)	401	210	191	401	210	191	345	41	7	1017
37	Nariyamangalam	780	470	310	424	264	160	123	255	45	680
38	Nochimalai	698	404	294	692	403	289	141	266	274	600

39	Nookambadi	1787	984	803	1337	761	576	855	287	183	1515
40	Palanandal	1725	886	839	1657	862	795	1106	308	239	1078
41	Pallikondapattu	260	158	102	189	141	48	18	57	114	272
42	Randam	654	349	305	630	337	293	161	428	39	373
43	Rayampettai	461	315	146	431	302	129	15	209	68	573
44	Sadayanodail	671	446	225	496	378	118	321	5	168	852
45	Sammandanur	558	327	231	373	276	97	126	155	69	508
46	Sananandal	1012	524	488	445	387	58	124	224	92	590
47	Sirukothan	281	157	124	40	26	14	8	0	32	301
48	Sirunathur	1734	971	763	1669	930	739	829	628	202	1298
49	Somaspadi	2884	1618	1266	1948	1141	807	629	656	640	2602
50	Sorappanandal	133	95	38	34	25	9	6	0	17	218
51	Su. Polakunam	928	490	438	756	420	336	404	217	135	674
52	Tellanandal	696	355	341	694	353	341	207	485	2	87
53	Thurinjapuram	1639	877	762	1495	809	686	110	1137	239	1241
54	Udappoondi	100	50	50	100	50	50	94	1	5	52
55	Vadakarimbalore	1061	548	513	1057	546	511	401	571	80	422
56	Vallivagai	1481	819	662	1445	807	638	364	1001	75	1062
57	Vaniyanthangal	434	236	198	320	217	103	181	30	106	256
58	Vatraputhur	393	194	199	385	191	194	95	245	44	271
59	Vazhuthalangunnam	1800	946	854	1291	765	526	729	342	200	1430
60	Vedantham	1504	792	712	1051	593	458	368	493	180	1017

Source: www.censusindia.gov.in – Tamil Nadu Census of India – 2011

TABLE 3.43: COMMUNICATION & TRANSPORT FACILITIES IN THE STUDY AREA

Sl	Village Name	PO	SPO	PTO	T	PCO	MP	IC / CSC	PCF	BS	PBS	RS	NH	SH	MDR	BTR	GR	NWR	FP
1	Andapattu (V)	1	1	1	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
2	Aranji	2	2	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
3	Arumbakkam	2	2	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
4	Chinnakangiyanur	2	2	2	1	2	1	2	2	1	1	2	1	2	1	1	1	2	1
5	Drugiammiandal	2	2	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
6	Erumpoondi	2	1	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
7	Ganalapadi	2	1	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
8	Ganapapuram	2	2	2	1	2	1	2	2	1	1	2	2	2	2	1	1	2	1
9	Iyangunnam	2	2	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
10	Kadambai	2	2	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
11	Kalasthambadi	2	1	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
12	Kalingaleri	2	2	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
13	Kalitheri	2	2	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
14	Kalpoondi	2	2	2	1	2	1	2	2	2	1	1	2	2	2	1	1	2	1
15	Kaniyampoondi	2	2	2	2	1	1	2	2	1	1	2	2	2	2	1	1	2	1
16	Karampoondi	2	2	2	1	2	1	2	2	1	1	2	2	2	2	1	1	2	1
17	Karikilambadi	2	2	2	2	1	1	2	2	1	1	2	2	2	2	1	1	2	1
18	Kathalampattu	2	2	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
19	Kattumalaiyanur	1	2	1	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
20	Kattuvalanandal	2	2	2	2	1	1	1	2	1	1	2	2	2	1	1	1	2	1
21	Kiliapattu	2	1	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
22	Kilnachipattu (S.O.)	1	2	1	1	1	1	2	2	1	1	2	1	2	1	1	1	2	1
23	Kilnathur	2	2	2	1	1	1	1	2	1	1	2	2	1	1	1	1	2	1
24	Koothala Vadi	2	2	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
25	Kothantavadi	2	1	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
26	Kumarakudi	2	2	2	2	1	1	2	2	1	1	2	2	2	2	1	1	2	1
27	Kunnandal	2	2	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
28	Kunnankuppam	2	2	2	2	2	1	2	2	1	1	2	2	2	2	1	1	2	1
29	Kunnumuringi	2	2	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
30	Madalambadi	2	2	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
31	Malappambadi	1	1	1	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
32	Mangalam	1	1	1	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
33	Mekalore	2	1	2	1	1	1	1	2	1	1	2	2	2	1	1	1	2	1
34	Nallanpillaipetral	2	2	2	1	2	1	2	2	1	1	2	2	1	1	1	1	2	1
35	Namiyandal	2	2	2	2	1	1	2	2	1	1	2	2	2	2	1	1	2	1
36	Namiyandal (SO)	2	2	2	2	1	1	2	2	1	1	2	2	2	2	1	1	2	1
37	Nariyamangalam	2	2	2	1	2	1	2	2	1	2	2	2	2	1	1	1	2	1
38	Nochimalai	2	2	2	1	2	1	2	2	1	1	2	1	2	1	1	1	2	1
39	Nookambadi	2	1	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1

40	Palanandal	2	1	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
41	Pallikondapattu	2	2	2	1	2	1	2	2	1	1	2	2	2	1	1	1	2	1
42	Randam	2	2	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
43	Rayampettai	2	1	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
44	Sadayanodail	2	2	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
45	Sammandanur	2	2	2	1	2	1	2	2	1	1	2	2	2	1	1	1	2	1
46	Sananandal	2	2	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
47	Sirukothan	2	2	2	1	1	1	2	2	1	1	2	1	2	1	1	1	2	1
48	Sirunathur	2	2	2	1	1	1	2	2	1	1	2	1	2	1	1	1	2	1
49	Somaspadi	1	2	1	1	1	1	2	2	1	1	2	1	2	1	1	1	2	1
50	Sorappanandal	2	2	2	2	1	1	2	2	1	1	2	2	2	2	1	1	2	1
51	Su. Polakunam	2	1	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
52	Tellanandal	2	2	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
53	Thurinjapuram	2	1	2	1	1	1	2	2	1	1	1	2	2	1	1	1	2	1
54	Udappoondi	2	2	2	2	1	1	2	2	1	1	2	2	2	2	1	1	2	1
55	Vadakarimbalore	2	2	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
56	Vallivagai	2	1	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
57	Vaniyanthangal	2	2	2	1	2	1	2	2	1	1	2	1	2	1	1	1	2	1
58	Vatraputhur	2	2	2	2	1	1	2	2	1	1	2	2	2	2	1	1	2	1
59	Vazhuthalangunnam	2	1	2	1	1	1	1	2	1	1	2	2	2	2	1	1	2	1
60	Vedantham	2	1	2	1	1	1	2	2	1	1	2	1	2	2	1	1	2	1

Abbreviations: PO - Post Office; MP - Mobile Phone Coverage; RS - Railway Station; GR - Gravel Roads; SPO - Sub Post Office; IC / CSC - Internet Cafe/Common Service Centre; NH - National Highways; NWR - Navigate waterways River; PTO - Post & Telegraph office; PCF - Private Courier Facility; SH - State Highways; FP - Foot path; T- Telephone (Landline); BS - Public Bus Service; MDR - Major District Road; PCO - Public call office / Mobile; PBS - Private Bus Service; BTR - Black Topped (Pucca Roads). Note: 1 - Available within the village 2 - Not available

TABLE 3.44: WATER & DRAINAGE FACILITIES IN THE STUDY AREA

Sl	Village Name	TP	CW	UCW	HP	TW/BH	S	R/C	T/P/L	CD	OD	CT
1	Andapattu (V)	1	1	1	2	1	2	2	2	1	1	1
2	Aranji	2	2	1	2	1	2	2	2	1	1	2
3	Arumbakkam	1	1	2	1	1	2	2	2	2	1	2
4	Chinnakangiyanur	1	2	1	2	1	2	2	2	1	1	2
5	Drugiammiandal	1	1	1	1	1	2	2	2	1	1	2
6	Erumpoondi	1	1	1	2	2	2	2	2	1	1	2
7	Ganalapadi	1	2	1	1	2	2	2	2	1	1	2
8	Ganapapuram	2	1	1	2	1	2	2	2	1	2	2
9	Iyangunnam	1	2	1	1	1	2	2	2	1	1	2
10	Kadambai	1	1	1	2	1	2	2	2	1	1	2
11	Kalasthambadi	1	2	1	1	2	2	2	2	1	1	2
12	Kalingaleri	2	2	1	1	2	2	2	2	2	1	2
13	Kalitheri	1	1	1	2	2	2	2	2	1	1	1
14	Kalpoondi	1	2	1	2	2	2	2	2	2	1	2
15	Kaniyampoondi	1	2	1	1	2	2	2	2	2	2	2
16	Karampoondi	1	2	1	1	2	2	2	2	1	1	2
17	Karikilambadi	2	2	1	2	1	2	2	2	2	1	2
18	Kathalampattu	1	2	1	1	1	2	2	2	1	1	2
19	Kattumalaiyanur	1	1	1	1	1	2	2	2	1	1	1
20	Kattuvalanandal	2	1	1	2	2	2	2	2	2	1	2
21	Kiliapattu	1	1	1	1	1	2	2	2	1	2	2
22	Kilnachipattu (S.O.)	1	1	1	1	1	2	2	2	1	1	2
23	Kilnathur	1	2	1	1	1	1	2	2	1	1	2
24	Koothala Vadi	1	2	2	2	2	2	2	2	1	1	2
25	Kothantavadi	1	1	1	2	1	2	2	2	1	1	2
26	Kumarakudi	2	2	2	1	2	2	2	2	2	2	2
27	Kunnandal	1	2	1	2	2	2	2	2	1	2	2
28	Kunnankuppam	1	1	1	2	2	2	2	2	1	2	2
29	Kunnumuringi	1	2	1	2	2	2	2	2	2	2	2
30	Madalambadi	1	1	1	1	1	2	2	2	2	1	2
31	Malappambadi	1	2	1	2	1	2	2	2	1	1	2
32	Mangalam	1	1	1	1	1	2	2	2	1	1	2
33	Mekalore	1	1	1	1	1	2	2	2	1	1	2
34	Nallanpillaipetral	1	2	2	1	1	2	2	2	2	1	2
35	Namiyandal	1	2	1	2	2	2	2	2	2	1	2
36	Namiyandal (SO)	1	2	1	2	2	2	2	2	2	1	2
37	Nariyamangalam	1	2	1	2	2	2	2	2	1	2	2
38	Nochimalai	1	1	1	2	1	2	2	2	1	1	2
39	Nookambadi	1	1	1	1	1	2	2	2	1	1	2

40	Palanandal	1	2	1	1	2	1	2	2	1	1	2
41	Pallikondapattu	1	2	2	1	1	2	2	2	1	2	2
42	Randam	1	2	1	1	2	2	1	2	1	2	2
43	Rayampettai	1	2	2	2	2	2	2	2	1	2	2
44	Sadayanodail	1	1	1	2	1	2	2	2	1	1	1
45	Sammandanur	2	2	1	1	1	2	2	2	1	1	2
46	Sananandal	1	2	1	2	2	2	2	2	2	1	1
47	Sirukothan	1	2	2	2	1	2	2	2	1	2	2
48	Sirunathur	1	2	1	1	1	2	2	2	1	1	2
49	Somaspadi	1	2	1	1	1	1	2	2	1	1	1
50	Sorappanandal	1	2	2	2	2	2	2	2	1	1	2
51	Su. Polakunam	1	2	1	1	2	2	2	2	1	1	2
52	Tellanandal	1	2	1	2	2	2	2	2	2	1	2
53	Thurinjapuram	1	1	1	2	1	2	2	2	1	1	2
54	Udappoondi	2	2	2	2	2	2	2	2	1	2	2
55	Vadakarimbalore	1	1	1	2	2	2	2	2	1	1	2
56	Vallivagai	1	2	1	2	1	2	2	2	1	1	2
57	Vaniyanthangal	2	2	1	2	2	2	2	2	2	1	2
58	Vatraputhur	1	2	2	2	2	2	2	2	1	1	2
59	Vazhuthalangunnam	1	1	1	2	1	2	2	2	1	1	2
60	Vedantham	1	2	1	2	1	2	2	2	2	1	2

Abbreviations: T - Tap Water; R / C - River / Canal; CW - Covered Well; T/P/L - Tank / Pond / Lake; UCW - Uncovered Well; CD - Covered Drainage; HP - Hand Pump; OD - Open Drainage; TW/BH - Tube / Bore Well; CT - Community Toilet Complex for General public; S - Spring

Note – 1 - Available within the village; 2 - Not available

TABLE 3.45: OTHER FACILITIES IN THE STUDY AREA

Sl	Village Name	ATM	CB	COB	ACS	SHG	PDS	RM	AMS	NC	NC-AC	CC	SF	PL	NPS	APS	BDRO
1	Andapattu (V)	2	2	2	2	1	1	2	2	1	1	2	2	1		1	1
2	Aranji	2	2	2	2	1	1	2	2	1	1	2	2	2		2	1
3	Arumbakkam	2	2	2	2	1	1	2	2	1	1	2	1	1		1	1
4	Chinnakangiyanur	2	2	2	2	1	1	2	2	1	1	1	2	1		1	1
5	Drugiammiandal	2	2	2	1	1	1	2	2	1	1	2	2	2		1	1
6	Erumpoondi	2	2	2	2	1	1	2	2	2	1	2	2	2		1	1
7	Ganalapadi	2	2	2	2	1	1	2	2	1	1	2	2	2		1	1
8	Ganapapuram	2	2	2	2	1	1	2	2	1	1	2	1	2		1	1
9	Iyangunnam	2	2	2	2	1	1	2	2	1	1	2	1	2		1	1
10	Kadambai	2	2	2	2	1	1	2	2	1	1	2	2	1		1	1
11	Kalasthambadi	2	2	2	2	1	1	2	2	1	1	2	2	1		1	1
12	Kalingaleri	2	2	2	1	1	1	2	1	1	1	2	1	1		1	2
13	Kalitheri	2	2	2	2	1	1	2	2	1	1	1	2	2		2	1
14	Kalpoondi	2	2	2	2	1	1	2	2	1	1	1	1	1		1	1
15	Kaniyampoondi	2	2	2	2	1	1	2	2	1	1	1	2	2		2	1
16	Karampoondi	2	2	2	2	1	1	2	2	1	1	2	2	2		1	1
17	Karikilambadi	2	2	2	2	1	1	2	2	1	1	1	1	1		1	1
18	Kathalampattu	2	2	2	2	1	1	2	2	2	1	2	2	2		1	1
19	Kattumalaiyanur	2	2	2	2	1	1	2	2	1	1	1	1	1		1	1
20	Kattuvalanandal	2	2	2	2	1	1	2	2	1	1	1	2	2		2	2
21	Kiliapattu	2	2	2	2	1	1	2	2	1	1	2	2	1		1	1
22	Kilnachipattu (S.O.)	2	2	2	2	2	1	2	2	1	1	2	1	1		1	1
23	Kilnathur	2	2	2	2	1	1	2	2	1	1	2	2	1		1	1
24	Koothala Vadi	2	2	2	2	1	1	2	2	2	1	1	1	2		1	2
25	Kothantavadi	2	2	2	2	1	1	2	2	2	1	2	1	2		1	1
26	Kumarakudi	2	2	2	2	1	1	2	2	1	1	2	2	2		2	2
27	Kunnandal	2	2	2	2	1	1	2	2	1	1	2	2	1		1	2
28	Kunnankuppam	2	2	2	2	1	1	2	2	2	1	2	2	2		2	1
29	Kunnumuringi	2	2	2	2	1	1	2	2	1	1	2	2	2		1	1
30	Madalambadi	2	2	2	2	1	1	2	2	1	1	1	1	1		1	1
31	Malappambadi	2	2	2	2	1	1	2	2	1	1	2	1	1		1	1
32	Mangalam	2	1	2	1	1	1	2	2	1	1	1	1	1		1	1
33	Mekalore	2	2	1	2	1	1	2	2	1	1	2	1	2		1	1
34	Nallanpillaipetral	2	2	2	2	2	2	2	2	1	1	2	1	1		1	1
35	Namiyandal	2	2	2	2	1	1	2	2	1	1	1	2	1		1	1
36	Namiyandal (SO)	2	2	2	2	1	1	2	2	1	1	2	1	2		1	1
37	Nariyamangalam	2	2	2	2	1	1	2	2	1	1	2	1	1		1	1
38	Nochimalai	2	2	2	2	1	1	2	2	1	1	1	1	1		1	1
39	Nookambadi	2	2	2	2	1	1	2	2	1	1	1	1	2		1	1
40	Palanandal	2	2	2	2	1	1	2	2	1	1	1	2	1		1	1

41	Pallikondapattu	2	2	2	2	1	1	2	2	1	1	2	2	1		1	2
42	Randam	2	2	2	2	1	1	2	2	2	1	1	2	1		1	1
43	Rayampettai	2	2	2	2	2	1	2	2	1	1	2	1	2		2	1
44	Sadayanodail	2	2	2	2	1	1	2	2	1	1	1	1	1		1	1
45	Sammandanur	2	2	2	2	1	1	2	2	1	1	2	2	2		1	1
46	Sananandal	2	2	2	2	1	1	2	2	1	1	2	1	1		1	1
47	Sirukothan	2	2	2	2	1	2	2	2	2	2	2	2	2		1	2
48	Sirunathur	2	2	1	1	1	1	2	2	1	1	2	1	1		1	1
49	Somaspadi	2	1	1	1	1	1	2	2	1	1	1	1	1		1	1
50	Sorappanandal	2	2	2	2	1	1	2	1	1	1	2	1	1		1	2
51	Su. Polakunam	2	2	2	2	1	1	2	2	1	1	1	1	1		1	1
52	Tellanandal	2	2	2	2	1	2	2	2	1	1	2	2	2		1	2
53	Thurinjapuram	2	1	2	2	1	1	2	2	1	1	1	1	1		1	1
54	Udappoondi	2	2	2	2	1	2	2	2	2	2	2	2	2		2	2
55	Vadakarimbalore	2	2	2	2	1	1	2	2	1	1	1	1	2		1	1
56	Vallivagai	2	2	2	1	1	1	2	2	1	1	2	2	1		1	1
57	Vaniyanthangal	2	2	2	2	1	1	2	2	1	1	2	2	2		2	2
58	Vatraputhur	2	2	2	2	1	1	2	2	1	1	2	2	2		2	2
59	Vazhuthalangunnam	2	2	2	2	1	1	2	2	1	1	1	1	2		1	1
60	Vedantham	2	2	2	2	1	1	2	2	1	1	2	1	1		1	1

Abbreviations: ATM - Automatic Teller Machine; PDS - Public Distribution System (Shop); CB - Commerical Bank; RM - Regular Market; COB - Co-operative Bank; AMS - Agricultural Market Society; ACS - Agricultural Credit Societies; NC - Nutritional Centres; SHG - Self Help Group; NC-AC - Nutritional Centres - Anganwadi Centre; DBRO - Birth & Death Registration Office; PS - Power Supply Note – 1 - Available within the village; 2 - Not available

TABLE 3.46: EDUCATIONAL FACILITIES IN THE STUDY AREA

		PPS		PS		MS		SS		SSS		DC		EC		MC		MI		PT		VTS		SSD	
Sl	Village Name	G	P	G	P	G	P	G	P	G	P	G	P	G	P	G	P	G	P	G	P	G	P	G	P
1	Andapattu (V)	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	Aranji	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	Arumbakkam	1	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
4	Chinnakangiyanur	1	2	1	2	1	2	1	2	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2	1
5	Drugiammiandal	1	1	1	1	1	1	1	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
6	Erumpoondi	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
7	Ganalapadi	1	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
8	Ganapapuram	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9	Iyangunnam	1	2	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10	Kadambai	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
11	Kalasthambadi	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
12	Kalingaleri	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
13	Kalitheri	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
14	Kalpoondi	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
15	Kaniyampoondi	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
16	Karampoondi	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
17	Karikilambadi	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
18	Kathalampattu	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
19	Kattumalaiyanur	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
20	Kattuvalanandal	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
21	Kiliapattu	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
22	Kilnachipattu (S.O.)	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
23	Kilnathur	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
24	Koothala Vadi	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
25	Kothantavadi	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
26	Kumarakudi	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
27	Kunnandal	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
28	Kunnankuppam	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
29	Kunnumuringi	1	1	1	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
30	Madalambadi	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31	Malappambadi	1	1	1	1	1	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
32	Mangalam	1	1	1	1	1	1	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
33	Mekalore	1	2	1	1	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
34	Nallanpillaipetral	1	2	1	2	1	2	1	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	1
35	Namiyandal	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
36	Namiyandal (SO)	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
37	Nariyamangalam	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
38	Nochimalai	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

39	Nookambadi	1	1	1	1	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
40	Palanandal	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
41	Pallikondapattu	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
42	Randam	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
43	Rayampettai	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
44	Sadayanodail	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
45	Sammandanur	1	2	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
46	Sananandal	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
47	Sirukothan	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
48	Sirunathur	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
49	Somaspadi	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2
50	Sorappanandal	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
51	Su. Polakunam	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
52	Tellanandal	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
53	Thurinjapuram	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
54	Udappoondi	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
55	Vadakarimbalore	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
56	Vallivagai	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
57	Vaniyanthangal	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
58	Vatraputhur	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
59	Vazhuthalangunnam	1	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
60	Vedantham	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Abbreviations: PPS-Pre Primary School; SSS-Senior Secondary School; DC-Degree School; PT-Polytechnic; PS-Primary School; G-Government; EC-Engineering College; VTS-Vocational School /ITI; MS-Middle School; P-Private; MC-Medical College; SSD-Special School For Disabled; SS-Secondary School; MI-Management College/Institute;
Note – 1 - Available within the village; 2 - Not available

TABLE 3.47: MEDICAL FACILITIES IN THE STUDY AREA

Sl. No.	Village Name	CHC	PHC	PHSC	MCW	TBC	HA	HAM	D	VH	MHC	FWC	NGM-I/O
1	Andapattu (V)	0	0	0	0	0	0	0	0	0	0	0	5
2	Aranji	0	0	0	0	0	0	0	0	0	0	0	5
3	Arumbakkam	0	0	0	0	0	0	0	0	0	0	0	2
4	Chinnakangiyanur	0	0	1	0	0	0	0	0	0	0	0	5
5	Drugiammiandal	0	0	0	0	0	0	0	0	0	0	0	6
6	Erumpoondi	0	0	1	0	0	0	0	0	0	0	0	2
7	Ganalapadi	0	0	1	0	0	0	0	0	0	0	0	3
8	Ganapapuram	0	0	0	0	0	0	0	0	0	0	0	1
9	Iyangunnam	0	0	1	1	0	0	0	0	0	0	0	3
10	Kadambai	0	0	0	0	0	0	0	0	0	0	0	3
11	Kalasthambadi	0	0	0	0	0	0	0	0	0	0	0	2
12	Kalingaleri	0	0	0	0	0	0	0	0	0	0	0	4
13	Kalitheri	0	0	0	0	0	0	0	0	0	0	0	3
14	Kalpoondi	0	0	1	0	0	0	0	0	0	0	0	2
15	Kaniyampoondi	0	0	0	0	0	0	0	0	0	0	0	7
16	Karampoondi	0	0	0	0	0	0	0	0	0	0	0	2
17	Karikilambadi	0	0	0	0	0	0	0	0	0	0	0	7
18	Kathalampattu	0	0	0	0	0	0	0	0	0	0	0	3
19	Kattumalaiyanur	0	0	1	1	0	0	0	0	0	0	0	2
20	Kattuvalanandal	0	0	0	0	0	0	0	0	0	0	0	5
21	Kiliapattu	0	0	1	0	0	0	0	0	0	0	0	7
22	Kilnachipattu (S.O.)	0	0	0	0	0	0	0	0	1	0	0	6
23	Kilnathur	0	0	0	0	0	0	0	0	0	0	0	8
24	Koothala Vadi	0	0	0	0	0	0	0	0	0	0	0	3
25	Kothantavadi	0	0	1	0	0	0	0	0	0	0	0	4
26	Kumarakudi	0	0	0	0	0	0	0	0	0	0	0	4
27	Kunnandal	0	0	0	0	0	0	0	0	0	0	0	8
28	Kunnankuppam	0	0	0	0	0	0	0	0	0	0	0	3
29	Kunnumuringi	0	0	0	0	0	0	0	0	0	0	0	5
30	Madalambadi	0	0	1	0	0	0	0	0	0	0	0	4
31	Malappambadi	0	0	0	0	0	0	0	0	0	0	0	5
32	Mangalam	1	1	1	1	1	0	0	1	1	0	1	0
33	Mekalore	0	1	1	1	1	0	0	1	1	0	1	0
34	Nallanpillaipetral	0	0	0	0	0	0	0	0	0	0	0	6
35	Namiyandal	0	0	0	0	0	0	0	0	0	0	0	6
36	Namiyandal (SO)	0	0	0	0	0	0	0	0	0	0	0	2
37	Nariyamangalam	0	0	1	1	0	0	0	0	0	0	0	3
38	Nochimalai	0	0	0	0	0	0	0	0	0	0	0	6
39	Nookambadi	0	0	1	0	0	0	0	0	0	0	0	2
40	Palanandal	0	0	1	0	0	0	0	0	0	0	0	3

41	Pallikondapattu	0	0	0	0	0	0	0	0	0	0	0	6
42	Randam	0	0	0	0	0	0	0	0	0	0	0	3
43	Rayampettai	0	0	0	0	0	0	0	0	0	0	0	3
44	Sadayanodail	0	0	0	0	0	0	0	0	0	0	0	2
45	Sammandanur	0	0	0	0	0	0	0	0	0	0	0	5
46	Sananandal	0	0	1	0	0	0	0	0	0	0	0	4
47	Sirukothan	0	0	0	0	0	0	0	0	0	0	0	3
48	Sirunathur	0	0	1	1	0	0	0	0	0	0	0	2
49	Somaspadi	0	1	1	1	1	0	0	1	1	0	1	0
50	Sorappanandal	0	0	0	0	0	0	0	0	0	0	0	6
51	Su. Polakunam	0	0	1	0	0	0	0	0	0	0	0	3
52	Tellanandal	0	0	0	0	0	0	0	0	0	0	0	5
53	Thurinjapuram	0	1	1	1	1	0	0	1	1	0	1	0
54	Udappoondi	0	0	0	0	0	0	0	0	0	0	0	2
55	Vadakarimbalore	0	0	0	0	0	0	0	0	0	0	0	5
56	Vallivagai	0	0	1	0	0	0	0	0	0	0	0	5
57	Vaniyanthangal	0	0	0	0	0	0	0	0	0	0	0	5
58	Vatraputhur	0	0	0	0	0	0	0	0	0	0	0	4
59	Vazhuthalangunnam	0	0	1	1	0	0	0	0	0	0	0	3
60	Vedantham	0	0	1	1	0	0	0	0	0	0	0	6

Abbreviations: CHC-Community Health Centre; TBC-TB Clinic; VH- Veternity Hospital; PHC-Primary Health Centre; HA-Aallopathic Hospital; FWC-Family Welfare Centre; PHSC-Primary Health Sub Centre ; HAM-Alternative Medicine Hospital; MH-Mobile Health Clinic; MCW-Maternity and Child Welfare Centre; D-Dispensary; NGM-I/O-Non Government Medical Facilities In & Out Patient

Note – 1 - Available within the village; 2 - Not available a-facility available at <5kms b-facility available at>10kms

Source: www.censusindia.gov.in – Tamil Nadu Census of India – 2011

3.6.6 Recommendation and Suggestion

- Awareness program to be conducted to make the population aware to get education and a better livelihood.
- Vocational training programme can be organized to make the people self - employed, particularly for women and unemployed youth.
- On the basis of qualification and skills local community may be preferred. Long term and short-term employments can be generated.
- Health care centre and ambulance facility can be provided to the population to get easy access to medical facilities. Maternity facility should be made available at the place to avoid going to distant places for treatment which involves risks. Apart from that as these areas are prone to various diseases a hospital with modern facilities should be opened on a priority basis in a central place to provide better health facilities to the villagers around the project.
- While developing an Action Plan, it is very important to identify the population who falls under the marginalized and vulnerable groups. So that special attention can be given to these groups with special provisions while making action plans.

3.6.7 Summary & Conclusion

The socio-economic study of surveyed villages gives a clear picture of its population, average household size, literacy rate and sex ratio etc. It is also found that a part of population is suffering from lack of permanent job to run their day-to-day life. Their expectation is to earn some income for their sustainability on a long-term basis.

The proposed project will aim to provide preferential employment to the local people there by improving the employment opportunity in the area and in turn the social standards will improve.

4. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.0 GENERAL

Environmental impacts both direct and indirect on various environmental attributes due to proposed mining activity will be created in the surrounding environment, during the operational and post–operational phases. The occurrence of mineral deposits, being site specific, their exploitation, often, does not allow for any choice except adoption of eco-friendly operation. The methods are required to be selected in such a manner, so as to maintain environmental equilibrium ensuring sustainable development.

In order to maintain the environmental commensuration with the mining operation, it is essential to undertake studies on the existing environmental scenario and assess the impact on different environmental components. This would help in formulating suitable management plans sustainable resource extraction.

Several scientific techniques and methodologies are available to predict impacts of physical environment. Mathematical models are the best tools to quantitatively describe the cause-and-effect relationships between sources of pollution and different components of environment. In cases where it is not possible to identify and validate a model for a particular situation, predictions have been arrived at based on logical reasoning / consultation / extrapolation.

The following parameters are of significance in the Environmental Impact Assessment and are being discussed in detail

- Land environment
- Soil environment
- Water Environment
- Air Environment
- Noise Environment
- Socio economic environment
- Biological Environment

Based on the baseline environmental status at the project site, the environmental factors that are likely to be affected (Impacts) are identified, quantified and assessed.

4.1 LAND ENVIRONMENT:

4.1.2 Anticipated Impacts

- Permanent or temporary change on land use and land cover.
- Change in Topography: Topography of the ML area will change at the end of the life of the mine.
- Movement of heavy vehicles sometimes cause problems to agricultural land, human habitations due to dust, noise and it also causes traffic hazards.
- Due to degradation of land by pitting the aesthetic environment of the core zone may be affected.
- Earthworks during the rainy season increase the potential for soil erosion and sediment laden water entering the water ways.
- If no due care is taken wash off from the exposed working area may choke the water course & can also causes the siltation of water course

4.1.2 Mitigation Measures

- The mining activity will be gradual confined in blocks and excavation will be undertaken progressively along with other mitigative measures like phase wise development of greenbelt etc.
- Construction of garland drains all around the quarry pits and construction of check dam at strategic location in lower elevations to prevent erosion due to surface runoff during rainfall and also to collect the storm water for various uses within the proposed area
- Green belt development along the boundary within safety zone. The small quantity of water stored in the mined-out pit will be used for greenbelt

- Thick plantation will be carried out on unutilized area, top benches of mined out pits, on safety barrier, etc.,
- At conceptual stage, the land use pattern of the quarry will be changed into Greenbelt area and temporary reservoir
- In terms of aesthetics, natural vegetation surrounding the quarry will be retained (such as in a buffer area i.e., 7.5 m safety barrier and other safety provided) so as to help minimise dust emissions.
- Proper fencing will be carried out at the conceptual stage, Security will be posted round the clock, to prevent inherent entry of the public and cattle

4.1.3 Soil Environment

The proposed project area is covered by thin layer of Topsoil formation of about 1 m, the excavated Topsoil will be stored within the project area and later on will be used for green belt development.

4.1.4 Impacts on Soil Environment

Erosion and Sedimentation (Removal of protective vegetation cover; Exposure of underlying soil horizons that may be less pervious, or more erodible than the surface layers; Reduced capacity of soils to absorb rainfall; Increased energy in storm-water runoff due to concentration and velocity; and Exposure of subsurface materials which are unsuitable for vegetation establishment).

4.1.5 Mitigation Measures

- Run-off diversion – Garland drains will be constructed all around the project boundary to prevent surface flows from entering the quarry works areas. And will be discharged into vegetated natural drainage lines, or as distributed flow across an area stabilised against erosion.
- Sedimentation ponds - Run-off from working areas will be routed towards sedimentation ponds. These trap sediment and reduce suspended sediment loads before runoff is discharged from the quarry site. Sedimentation ponds should be designed based on runoff, retention times, and soil characteristics. There may be a need to provide a series of sedimentation ponds to achieve the desired outcome.
- Retain vegetation – Retain existing or re-plant the vegetation at the site wherever possible.
- Monitoring and maintenance – Weekly monitoring and daily maintenance of erosion control systems so that they perform as specified specially during rainy season.

4.1.6 Waste Dump Management

There is no waste anticipated in this Rough Stone quarrying operation. The entire quarried out materials will be utilized (100%).

4.2 WATER ENVIRONMENT

4.2.1 Anticipated Impacts

- The major sources of water pollution normally associated due to mining and allied operations are:
    - Generation of waste water from vehicle washing.
    - Washouts from surface exposure or working areas
    - Domestic sewage
    - Disturbance to drainage course in the project area
    - Mine Pit water discharge
- Increase in sediment load during monsoon in downstream of lease area
- This being a mining project, there will be no process effluent. Waste from washing of machinery may result in discharge of Oil & grease, suspended solids.
- The sewage from soak pit may percolate to the ground water table and contaminate it.
- Surface drainage may be affected due to Mining
- Abstraction of water may lead to depletion of water table

Detail of water requirements in KLD as given below:

TABLE 4.1: WATER REQUIREMENT

*Purpose	Quantity	Source
Dust Suppression	3.1 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Green Belt development	2.5 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Domestic purpose	0.9 KLD	Water Tankers
Total	**6.5 KLD**	

* Water for drinking purpose will be brought from approved water vendors
Source: Approved Mining Plan Pre-Feasibility Report

4.2.2 Mitigation Measures

- Garland drain, settling tank will be constructed along the proposed mining lease area. The Garland drain will be connected to settling tank and sediments will be trapped in the settling traps and only clear water will be discharged out to the natural drainage
- Rainwater will be collected in sump in the mining pits and will be allowed to store and pumped out to surface setting tank of 15 m x 10m x 3m to remove suspended solids if any. This collected water will be judiciously used for dust suppression and such sites where dust likely to be generated and for developing green belt. The proponent will collect and judicially utilize the rainwater as part of rainwater harvesting system.
- Providing benches with inner slopes and through a system of drains and channels, allowing rain water to descent into surrounding drains, so as to minimize the effects of erosion & water logging arising out of uncontrolled descent of water.
- Reuse the water collected during storm for dust suppression and greenbelt development within the mines
- Installing interceptor traps/oil separators to remove oils and greases. Water from the tipper wash-down facility and machinery maintenance yard will pass through interceptor traps/oil separators prior to its reuse;
- Using flocculating or coagulating agents to assist in the settling of suspended solids during monsoon seasons;
- Periodic (every 6 month once) analysis of quarry pit water and ground water quality in nearby villages
- Domestic sewage from site office & urinals/latrines provided in ML is discharged in septic tank followed by soak pits
- Waste water discharge from mine will be treated in settling tanks before using for dust suppression and tree plantation purposes
- De-silting will be carried out before and immediately after the monsoon season
- Regular monitoring (every 6 month once) and analysing the quality of water in open well, bore wells and surface water

4.3 AIR ENVIRONMENT

4.3.1. Anticipated Impacts

- During mining, at various stages activities such as excavation, drilling, blasting, and transportation of materials, particular matter (PM), gases such as Sulphur dioxide, oxides of Nitrogen from vehicular exhaust are the main air pollutants.
- Emissions of noxious gases due to incomplete detonation of explosive may sometimes pollute the air.
- The fugitive dust released from the mining operations may cause effect on the mine workers who are directly exposed to the fugitive dust.
- Simultaneously, the air-borne dust may travel to longer distances and settle in the villages located near the mine lease area.

4.3.1.1. Modelling of Incremental Concentration

Wind erosion of the exposed areas and the air borne particulate matter generated by quarrying operation, and transportation are mainly PM_{10} & $PM_{2.5}$ and emissions of Sulphur dioxide (SO_2) & Oxides of Nitrogen (NOx)

due to excavation/loading equipment and vehicles plying on haul roads are the cause of air pollution in the project area.

Similarly, loading - unloading and transportation of Rough Stone, wind erosion of the exposed area and movement of light vehicles causes of pollution. This leads to an impact on the ambient air environment around the project area.

Anticipated incremental concentration due to this quarrying activity and net increase in emissions due to quarrying activities within 500 meters around the project area is predicted by Open Pit Source modelling using AERMOD Software.

The impact on Air Environment is due to the mining and allied activities during Land Development phase, Mining process and Transportation. The emissions of Sulphur dioxide (SO_2), Oxides of Nitrogen (NOx) due to excavation/loading equipment and vehicles plying on haul roads are marginal. Loading - unloading and transportation of Rough Stone, wind erosion of the exposed area and movement of light vehicles will be the main polluting source in the mining activities releasing Particulate Matter (PM_{10}) affecting Ambient Air of the area. Prediction of impacts on air environment has been carried out taking into consideration cumulative production the proposed quarries. Air environment and net increase in emissions by Open pit source modelling in AERMOD Software.

4.3.2.1 Emission Estimation

An emissions factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant.
The general equation for emissions estimation is:

$$E = A \times EF \times (1-ER/100)$$

Where:
E = emissions;
A = activity rate;
EF = emission factor, and
ER =overall emission reduction efficiency, %

The proposed mining activity includes various activities like ground preparation, excavation, handling and transport of Rough Stone. These activities have been analysed systematically basing on USEPA-Emission Estimation Technique Manual, for Mining AP-42, to arrive at possible emissions to the atmosphere and estimated emissions are given in Table 4-2.

4.3.2 Frame work of Computation & Model details

By using the above-mentioned inputs, ground level concentrations due to the quarrying activities have been estimated to know the incremental concentration in ambient air quality and impact in the study area. The effect of air pollutants upon receptors are influenced by concentration of pollutants and their dispersion in the atmosphere. Air quality modelling is an important tool for prediction, planning and evaluation of air pollution control activities besides identifying the requirements for emission control to meet the regulatory standards and to apply mitigation measures to reduce impact caused by quarrying activities. Suspended Particulate Matter (SPM) is the major pollutant occurred during quarrying activities. The prediction included the impact of Excavation, Drilling, blasting (Occasionally), loading and movement of vehicles during transportation and meteorological parameters such as wind speed, wind direction, temperature, rainfall, humidity and Cloud cover.

Impact was predicted over the distance of 10 km around the source to assess the impact at each receptor separately at the various locations and maximum incremental GLC value at the project site. Maximum impact of PM_{10} was observed close to the source due to low to moderate wind speeds. Incremental value of PM_{10} was superimposed on the base line data monitored at the proposed site to predict total GLC of PM_{10} due to combined impacts.

TABLE 4.2: ESTIMATED EMISSION RATE FOR PM_{10}

Activity	Source type	Value	Unit
Drilling	Point Source	0.091799701	g/s
Blasting	Point Source	0.001439561	g/s
Mineral Loading	Point Source	0.044487396	g/s
Haul Road	Line Source	0.002539061	g/s/m
Overall Mine	Area Source	0.047628721	g/s

TABLE 4.3: ESTIMATED EMISSION RATE FOR SO_2

Activity	Source type	Value	Unit
Overall Mine	Area Source	0.000794369	g/s

TABLE 4.4: ESTIMATED EMISSION RATE FOR NO_X

Activity	Source type	Value	Unit
Overall Mine	Area Source	0.000020541	g/s

FIGURE 4.1: AERMOD TERRAIN MAP

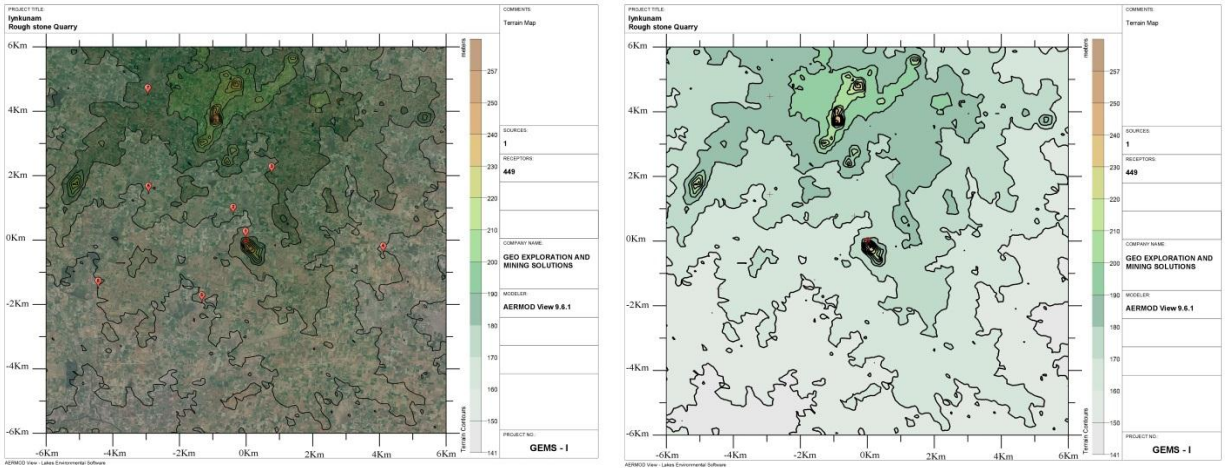


FIGURE 4.2: PREDICTED INCREMENTAL CONCENTRATION OF $PM_{2.5}$

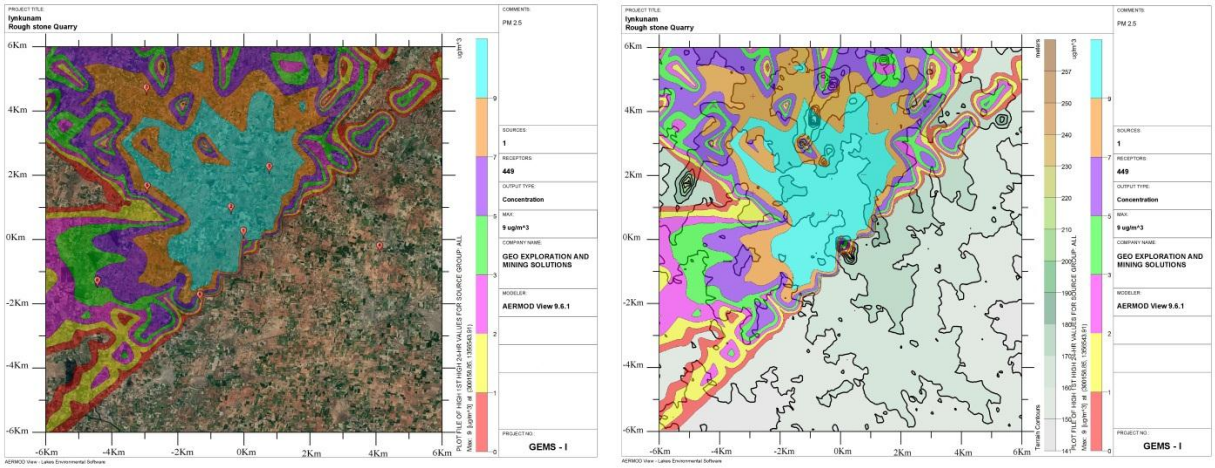


FIGURE 4.3: PREDICTED INCREMENTAL CONCENTRATION OF PM_{10}

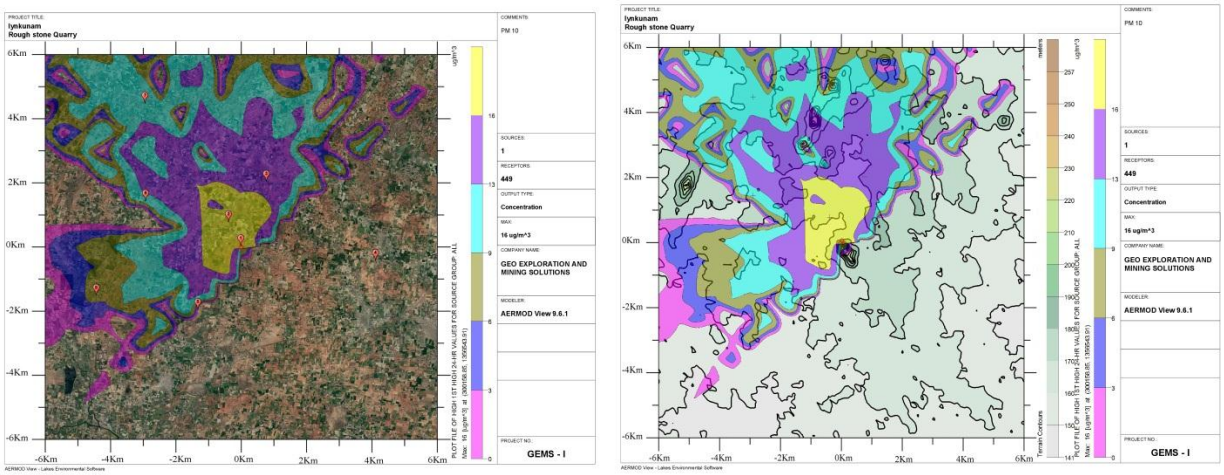


FIGURE 4.4: PREDICTED INCREMENTAL CONCENTRATION OF SO_2

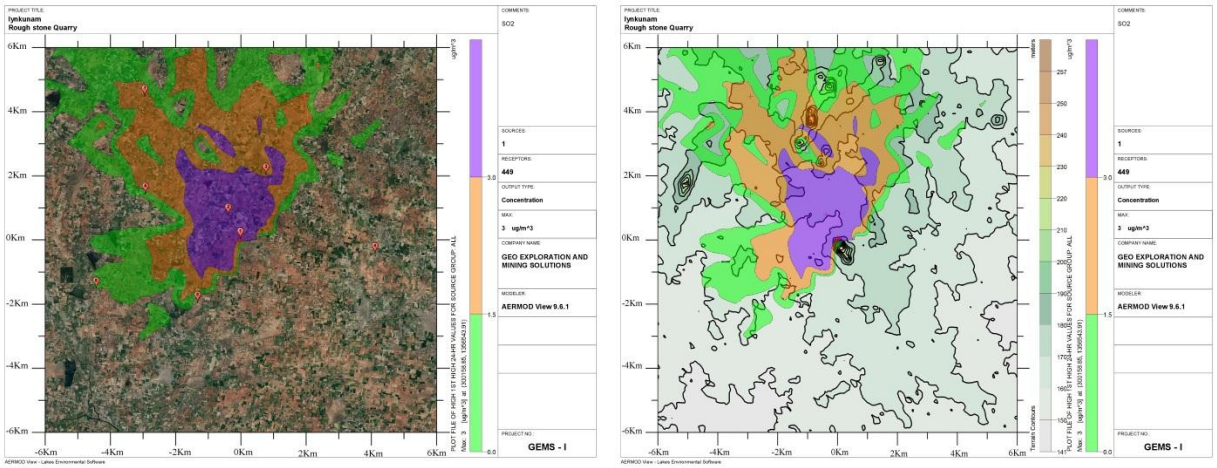


FIGURE 4.5: PREDICTED INCREMENTAL CONCENTRATION OF NO_X

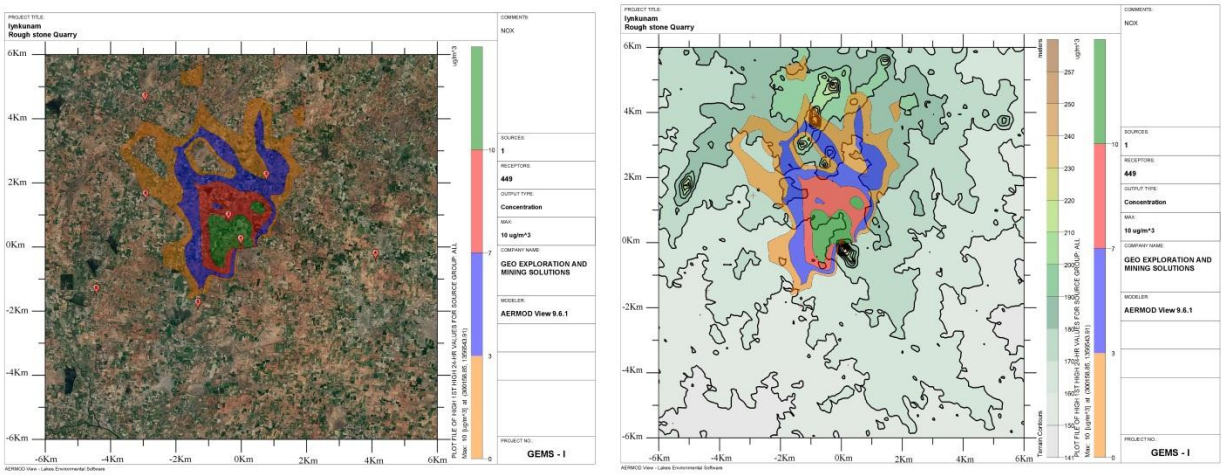
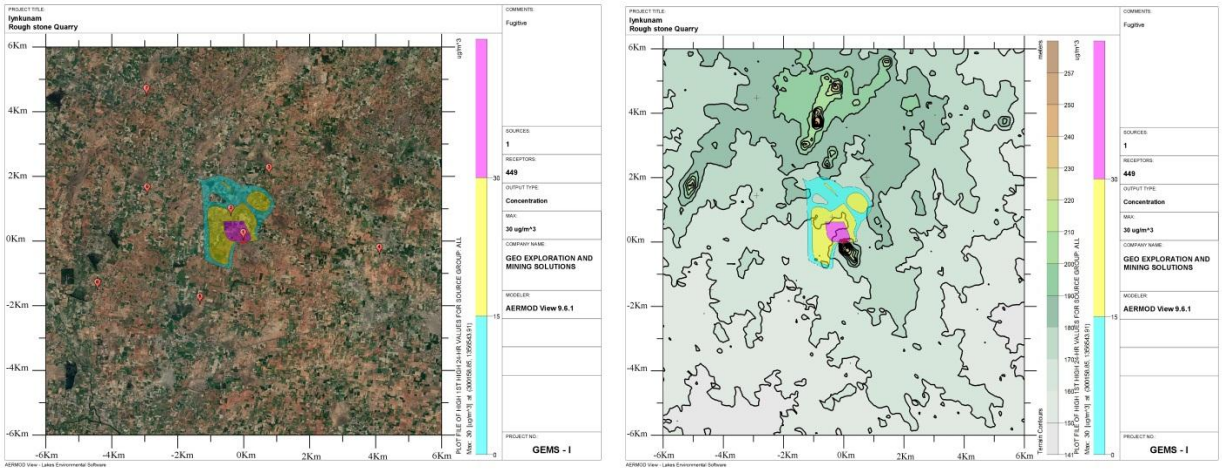


FIGURE 4.6: PREDICTED INCREMENTAL CONCENTRATION OF FUGITIVE DUST



4.3.2.1 Model Results

The post project Resultant Concentrations of PM_{10}, $PM_{2.5}$, SO_2& NO_X (GLC) is given in Table below:

TABLE 4.5: INCREMENTAL & RESULTANT GLC OF PM_{10}

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline PM_{10} ($\mu g/m^3$)	Incremental value of PM_{10} due to mining ($\mu g/m^3$)	Total PM_{10} ($\mu g/m^3$)
AAQ1	12°15'54.68"N 79° 9'45.34"E	-20	34	43.4	16.89	60.29
AAQ2	12°16'18.99"N 79° 9'32.98"E	-394	776	43.0	16.12	59.12
AAQ3	12°16'59.71"N 79°10'10.93"E	760	2033	42.8	14.79	57.59
AAQ4	12°15'39.87"N 79°12'0.82"E	4101	-414	42.8	0	42.8
AAQ5	12°14'50.39"N 79° 9'2.15"E	-1332	-1957	42.7	1.02	43.72
AAQ6	12°16'40.18"N 79° 8'9.56"E	-2933	1432	43.1	10.35	53.45
AAQ7	12°18'19.05"N 79° 8'8.91"E	-2952	4481	43.3	12.09	55.39
AAQ8	12°15'4.73"N 79° 7'20.08"E	-4440	-1514	42.7	8.22	50.92

TABLE 4.6: INCREMENTAL & RESULTANT GLC OF $PM_{2.5}$

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline $PM_{2.5}$ ($\mu g/m^3$)	Incremental value of $PM_{2.5}$ due to mining ($\mu g/m^3$)	Total $PM_{2.5}$ ($\mu g/m^3$)
AAQ1	12°15'54.68"N 79° 9'45.34"E	-20	34	23.7	9.96	33.66
AAQ2	12°16'18.99"N 79° 9'32.98"E	-394	776	23.7	9.61	33.31
AAQ3	12°16'59.71"N 79°10'10.93"E	760	2033	23.5	9.16	32.66
AAQ4	12°15'39.87"N 79°12'0.82"E	4101	-414	23.6	0	23.6
AAQ5	12°14'50.39"N 79° 9'2.15"E	-1332	-1957	22.7	1.64	24.34
AAQ6	12°16'40.18"N 79° 8'9.56"E	-2933	1432	23.6	6.42	30.02
AAQ7	12°18'19.05"N 79° 8'8.91"E	-2952	4481	24.2	8.28	32.48
AAQ8	12°15'4.73"N 79° 7'20.08"E	-4440	-1514	22.9	4.41	27.31

TABLE 4.7: INCREMENTAL & RESULTANT GLC OF SO_2

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline SO_2 ($\mu g/m^3$)	Incremental value due to mining ($\mu g/m^3$)	Total SO_2($\mu g/m^3$)
AAQ1	12°15'54.68"N 79° 9'45.34"E	-20	34	11.4	3.09	14.49
AAQ2	12°16'18.99"N 79° 9'32.98"E	-394	776	10.4	3.01	13.41
AAQ3	12°16'59.71"N 79°10'10.93"E	760	2033	8.0	2.22	10.22
AAQ4	12°15'39.87"N 79°12'0.82"E	4101	-414	7.8	0	7.8

AAQ5	12°14'50.39"N 79° 9'2.15"E	-1332	-1957	6.9	0	6.9
AAQ6	12°16'40.18"N 79° 8'9.56"E	-2933	1432	7.4	1.15	8.55
AAQ7	12°18'19.05"N 79° 8'8.91"E	-2952	4481	6.6	1.77	8.37
AAQ8	12°15'4.73"N 79° 7'20.08"E	-4440	-1514	7.0	0.23	7.23

TABLE 4.8: INCREMENTAL & RESULTANT GLC OF NO_X

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline NOx ($\mu g/m^3$)	Incremental value due to mining ($\mu g/m^3$)	Total NOx ($\mu g/m^3$)
AAQ1	12°15'54.68"N 79° 9'45.34"E	-20	34	26.6	10.65	37.25
AAQ2	12°16'18.99"N 79° 9'32.98"E	-394	776	27.2	8.99	36.19
AAQ3	12°16'59.71"N 79°10'10.93"E	760	2033	26.5	5.88	32.38
AAQ4	12°15'39.87"N 79°12'0.82"E	4101	-414	26.0	0	26.0
AAQ5	12°14'50.39"N 79° 9'2.15"E	-1332	-1957	25.8	0	25.8
AAQ6	12°16'40.18"N 79° 8'9.56"E	-2933	1432	25.1	0	25.1
AAQ7	12°18'19.05"N 79° 8'8.91"E	-2952	4481	25.5	0	25.5
AAQ8	12°15'4.73"N 79° 7'20.08"E	-4440	-1514	25.5	0	25.5

TABLE 4.9: INCREMENTAL & RESULTANT GLC OF FUGITIVE DUST

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline Fugitive ($\mu g/m^3$)	Incremental value due to mining ($\mu g/m^3$)	Total Fugitive Dust ($\mu g/m^3$)
AAQ1	12°15'54.68"N 79° 9'45.34"E	-20	34	63.6	30.05	93.65
AAQ2	12°16'18.99"N 79° 9'32.98"E	-394	776	63.7	22.19	85.89
AAQ3	12°16'59.71"N 79°10'10.93"E	760	2033	63.7	0	63.7
AAQ4	12°15'39.87"N 79°12'0.82"E	4101	-414	63.3	0	63.3
AAQ5	12°14'50.39"N 79° 9'2.15"E	-1332	-1957	63.1	0	63.1
AAQ6	12°16'40.18"N 79° 8'9.56"E	-2933	1432	63.1	0	63.1
AAQ7	12°18'19.05"N 79° 8'8.91"E	-2952	4481	63.3	0	63.3
AAQ8	12°15'4.73"N 79° 7'20.08"E	-4440	-1514	63.0	0	63.0

From the resultant of cumulative concentration i.e., Background + Incremental Concentration of pollutant in all the receptor locations without effective mitigation measures are still within the prescribed NAAQ limits of 100, 80 & 80 $\mu g/m^3$ for PM_{10}, SO_2 & NO_X respectively. By adopting suitable mitigation measures, the pollutant levels in the atmosphere can be further being controlled.

4.3.4. Mitigation Measures

Drilling – To control dust at source, wet drilling will be practiced. Where there is a scarcity of water, suitably designed dust extractor will be provided for dry drilling along with dust hood at the mouth of the drill-hole collar.

Advantages of Wet Drilling: -

- In this system dust gets suppressed close to its formation. Dust suppression become very effective and the work environment will be improved from the point of occupational comfort and health.
- Due to dust free atmosphere, the life of engine, compressor etc., will be increased.
- The life of drill bit will be increased.
- The rate of penetration of drill will be increased.
- Due to the dust free atmosphere visibility will be improved resulting in safer working conditions.

Blasting –

- Establish time of blasting to suit the local conditions and water sprinkling on blasting face
- Avoid blasting i.e., when temperature inversion is likely to occur and strong wind blows towards residential areas

- Controlled blasting includes Adoption of suitable explosive charge and short delay detonators, adequate stemming of holes at collar zone and restricting blasting to a particular time of the day i.e. at the time lunch hours, controlled charge per hole as well as charge per round of hole
- Before loading of material water will be sprayed on blasted material
- Dust mask will be provided to the workers and their use will be strictly monitored

Haul Road & Transportation –

- Water will be sprinkled on haul roads twice a day to avoid dust generation during transportation
- Transportation of material will be carried out during day time and material will be covered with taurpaulin
- The speed of tippers plying on the haul road will be limited below 20 km/hr to avoid generation of dust.
- Water sprinkling on haul roads & loading points will be carried out twice a day
- Main source of gaseous pollution will be from vehicle used for transportation of mineral; therefore, weekly maintenance of machines improves combustion process & makes reduction in the pollution.
- The un-metalled haul roads will be compacted weekly before being put into use.
- Over loading of tippers will be avoided to prevent spillage.
- It will be ensured that all transportation vehicles carry a valid PUC certificate
- Grading of haul roads and service roads to clear accumulation of loose materials

Green Belt –

- Planting of trees all along main mine haul roads and regular grading of haul roads will be practiced to prevent the generation of dust due to movement of dumpers/trucks
- Green belt of adequate width will be developed around the project areas

Occupational Health –

- Dust mask will be provided to the workers and their use will be strictly monitored
- Annual medical checkups, trainings and campaigns will be arranged to ensure awareness about importance of wearing dust masks among all mine workers & tipper drivers
- Ambient Air Quality Monitoring will be conducted six months once to assess effectiveness of mitigation measures proposed

4.4 NOISE ENVIRONMENT

Noise pollution is mainly due to operation like drilling & blasting and plying of trucks & HEMM. These activities will not cause any problem to the inhabitants of this area because there is no human settlement in close proximity to the project area. Noise modelling has been carried out considering blasting and compressor operation (drilling) and transportation activities.

Predictions have been carried out to compute the noise level at various distances around the working pit due to these major noise-generating sources. Noise modelling has been carried out to assess the impact on surrounding ambient noise levels.

Basic phenomenon of the model is the geometric attenuation of sound. Noise at a point generates spherical waves, which are propagated outwards from the source through the air at a speed of 1,100 ft/sec, with the first wave making an ever-increasing sphere with time. As the wave spreads the intensity of noise diminishes as the fixed amount of energy is spread over an increasing surface area of the sphere. The assumption of the model is based on point source relationship i.e., for every doubling of the distance the noise levels are decreased by 6 dB (A).

For hemispherical sound wave propagation through homogeneous loss free medium, one can estimate noise levels at various locations at different sources using model based on first principle.

$$Lp_2 = Lp_1 - 20 \log (r_2/r_1) - Ae_{1,2}$$

Where:

Lp_1& Lp_2 are sound levels at points located at distances r_1& r_2 from the source.

$Ae_{1,2}$ is the excess attenuation due to environmental conditions. Combined effect of all sources can be determined at various locations by logarithmic addition.

$$Lp_{total} = 10 \log \{10^{(Lp1/10)} + 10^{(Lp2/10)} + 10^{(Lp3/10)} + \ldots\ldots\}$$

4.4.1 Anticipated Impacts

Attenuation due to Green Belt has been taken to be 4.9 dB (A). The inputs required for the model are:

- Source data
- Receptor data
- Attenuation factor

Source data has been computed taking into account of all the machinery and activities used in the mining process. Same has been listed in Table 4-8.

TABLE 4.10: ACTIVITY AND NOISE LEVEL PRODUCED BY MACHINERY

Sl.No.	Machinery / Activity	Impact on Environment?	Noise Produced in dB(A) at 50 ft from source*
1	Blasting	Yes	94
2	Jack Hammer	Yes	88
3	Compressor	No	81
4	Excavator	No	85
5	Tipper	No	84
Total Noise Produced			95.8

*50 feet from source = 15.24 meters

Source: U.S. Department of Transportation (Federal Highway Administration) – Construction Noise Handbook

The total noise to be produced by mining activity is calculated to be 95.8 dB (A). Generally, most mining operations produce noise between 100-109 dB (A). We have considered equipment and operation noise levels (max) to be approx. 109 dB (A) for nose prediction modelling.

TABLE 4.11: PREDICTED NOISE INCREMENTAL VALUES

Location ID	**N1**	**N2**	**N3**	**N4**	**N5**	**N6**	**N7**	**N8**
Maximum Monitored Value (Day) dB(A)	48.7	49.3	47.2	46.7	48.1	46.9	47.5	47.8
Incremental Value dB(A)	62.0	49.7	27.0	29.2	36.6	27.0	26.1	29.2
Total Predicted Noise level dB(A)	62.2	52.5	47.2	46.8	48.4	46.9	47.5	47.9

The incremental noise level is found to be 62.0 dB (A) in Core Zone and 26.1 to 49.7 dB (A) in Buffer zone. The noise level at different receptors in buffer zone is lower due to the distance involved and other topographical features adding to the noise attenuation. The resultant Noise level due to monitored values and calculated values at the receptors are based on the mathematical formula considering attenuation due to Green Belt as 4.9 dB (A) the barrier effect. From the above table, it can be seen that the ambient noise levels at all the locations are within permissible limits of Industrial area (core zone) & Residential area (buffer zone) as per THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 (The Principal Rules were published in the Gazette of India, vide S.O. 123(E), dated 14.2.2000 and subsequently amended vide S.O. 1046(E), dated 22.11.2000, S.O. 1088(E), dated 11.10.2002, S.O. 1569 (E), dated 19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment (Protection) Act, 1986.).

4.4.2 Mitigation Measures

The following noise mitigation measures are proposed for control of Noise

- Usage of sharp drill bits while drilling which will help in reducing noise;
- Secondary blasting will be totally avoided and hydraulic rock breaker will be used for breaking boulders;

- Controlled blasting with proper spacing, burden, stemming and optimum charge/delay will be maintained;
- The blasting will be carried out during favourable atmospheric condition and less human activity timings by using nonelectrical initiation system;
- Proper maintenance, oiling and greasing of machines will be done every week to reduce generation of noise;
- Provision of sound insulated chambers for the workers working on machines (HEMM) producing higher levels of noise;
- Silencers / mufflers will be installed in all machineries;
- Green Belt/Plantation will be developed around the project area and along the haul roads. The plantation minimizes propagation of noise;
- Personal Protective Equipment (PPE) like ear muffs/ear plugs will be provided to the operators of HEMM and persons working near HEMM and their use will be ensured though training and awareness.
- Regular medical check–up and proper training to personnel to create awareness about adverse noise level effects

4.4.3 Ground Vibrations

Ground vibrations due to the proposed mining activities are anticipated due to operation of Mining Machines like Excavators, drilling and blasting, transportation vehicles, etc., However, the major source of ground vibration from the quarry is blasting. The major impact of the ground vibrations is observed on the domestic houses located in the villages nearby the mine lease area. The kuchha houses are more prone to cracks and damage due to the vibrations induced by blasting whereas RCC framed structures can withstand more ground vibrations. Apart from this, the ground vibrations may develop a fear factor in the nearby settlements.

Another impact due to blasting activities is fly rocks. These may fall on the houses or agricultural fields nearby the mining lease area and may cause injury to persons or damage to the structures. Nearest habitation from the proposed project area is listed in below table. The ground vibrations due to the blasting in the quarry are calculated using the empirical equation.

The empirical equation for assessment of peak particle velocity (PPV) is:

$$V = K\,[R/Q^{0.5}]^{-B}$$

Where –

V = peak particle velocity (mm/s)

K = site and rock factor constant

Q = maximum instantaneous charge (kg)

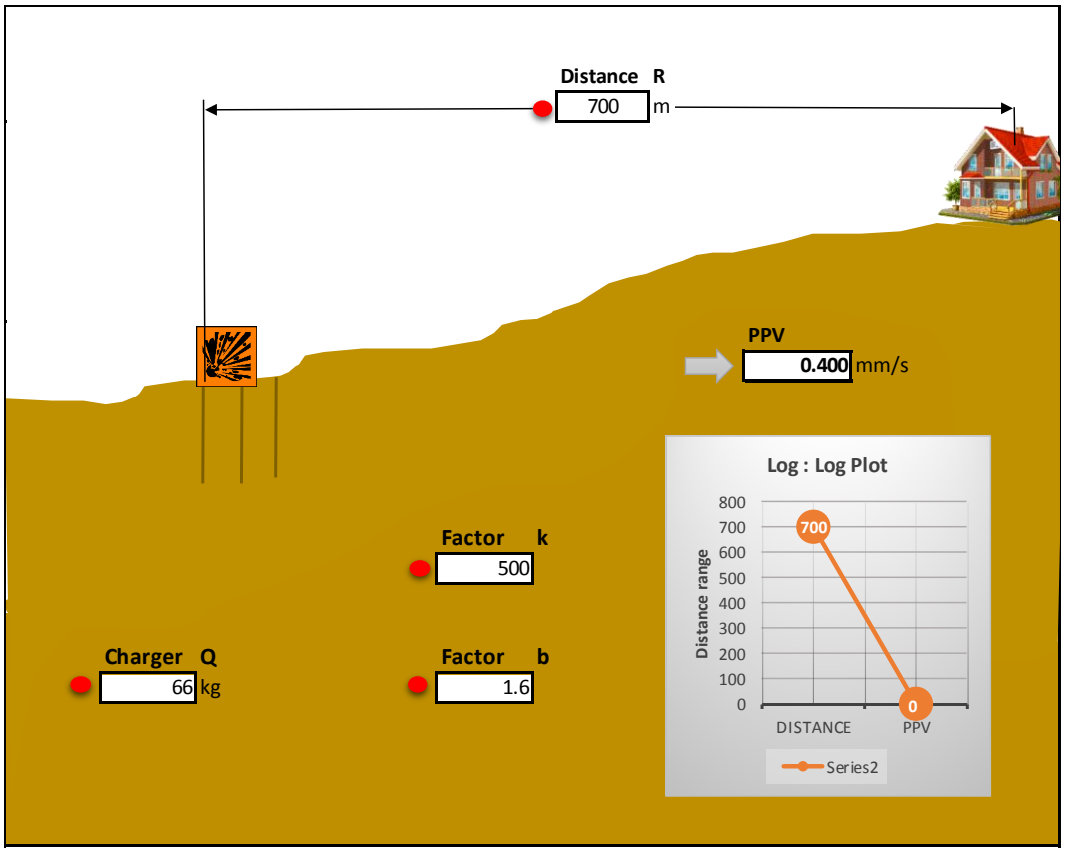
B = constant related to the rock and site (usually 1.6)

R = distance from charge (m)

TABLE 4.12: PREDICTED PPV VALUES DUE TO BLASTING

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in m/ms
P1	66	700m NW	0.400

FIGURE 4.7: GROUND VIBRATION PREDICTION



From the above graph, the charge per blast of 66 kg is well below the Peak Particle Velocity of 8 mm/s as per Directorate General of Mines Safety for safe level criteria through Circular No. 7 dated 29/8/1997. But the project proponent ensures that the charge per blast shall be less than 100 kg and carry out blasting twice or thrice a day based on the onsite conditions under the supervision of competent person employed. However, as per statutory requirement control measures will be adopted to avoid the impacts due to ground vibrations and fly rocks due to blasting.

4.4.3.1 Mitigation Measures

- The blasting operations in the cluster quarries are carried out without deep hole drilling and blasting using delay detonators, which reduces the ground vibrations;
- Proper quantity of explosive, suitable stemming materials and appropriate delay system will be adopted to avoid overcharging and for safe blasting;
- Adequate safe distance from blasting will be maintained as per DGMS guidelines;
- Blasting shelter will be provided as per DGMS guidelines;
- Blasting operations will be carried out only during day time;
- The charge per delay will be minimized and preferably more number of delays will be used per blasts;
- During blasting, other activities in the immediate vicinity will be temporarily stopped;
- Drilling parameters like depth, diameter and spacing will be properly designed to give proper blast;
- A fully trained explosives blast man (Mining Mate, Mines Foreman, 2nd Class Mines Manager/ 1st Class Mines Manager) will be appointed.
- A set of shot firing rules will be drawn up and blasting shall commence outlining the detailed operating procedures that will be followed to ensure that shot firing operations on site take place without endangering the workforce or public.
- Sufficient angular stemming material will be used to confine the explosive force and minimise environmental disturbance caused by venting / misfire.

- The detonators will be connected in a predetermined sequence to ensure that only one charge is detonated at any one time and a NONEL or similar type initiation system will be used.
- The detonation delay sequence shall be designed so as to ensure that firing of the holes is in the direction of free faces so as to minimise vibration effects.
- Appropriate blasting techniques shall be adopted such that the predicted peak particle velocity shall not exceed 8 Hz.
- Vibration monitoring will be carried out every 6 months to check the efficacy of blasting practices

4.5 ECOLOGY AND BIODIVERSITY

4.5.1 Impact on Ecology and Biodiversity

The impact on biodiversity is difficult to quantify because of its diverse and dynamic characteristics, mining activities generally result in the deforestation, land degradation, water, air and noise pollution which directly or indirectly affect the faunal and floral status of the project area. However, occurrence and magnitude of these impacts are entirely dependent upon the project location, mode of operation and technology involved. Impact prediction is the main footstep in impact evaluation and identifies project actions that are likely to bring significant changes in the project environment. The present study was carried out to predict the likely impacts of the proposed project at Kodangipalayam village and the surrounding environment with special reference to biological attributes covering habitats/ecosystems and associated biodiversity.

The proposed mining activities include removal of some scattered bushes and other thorny species. Although impacts on key habitat elements will occur on a local scale, but on a regional scale they would not be critical for the life cycle needs of the species observed or expected. Moreover, during conceptual stage, the mined-out areas on the top bench will be re-vegetated by planting local /native species and lower benches will be converted into rainwater harvesting structure following completion of mining activities, which will replace habitat resources for fauna species in this locality over a longer time. Existing roads will be used; new roads will not be constructed to reduce impact on flora.
Wild life is not commonly found in the project area and its immediate environs because of lack of vegetal cover and surface water. Except few domestic animals, reptiles, hares and some common birds are observed in the study area.

I. None of the plants will be cut during operational phase of the mine.
II. There shall be negligible air emissions or effluents from the project site. During loading the truck, dust generation will be likely. This shall be a temporary effect and not anticipated to affect the surrounding vegetation significantly.
III. Most of the land in the buffer area is undulating terrain with crop lands, grass patches and small shrubs. Hence, there will be no effect on flora of the region

4.5.2 Mitigation Measures

Keeping all this in mind the mitigations have been suggested under environmental management plan. With the understanding of the role of plant species as bio-filter to control air pollution, appropriate plant species (mainly tree species) have been suggested conceding the area/site requirements and needed performance of specific species. The details of year wise proposed plantation program are given in Table 4.13.

The main objective of the green belt is to provide a barrier between the source of pollution and the surrounding areas

In order to compensate the loss of vegetation cover, it is suggested to carry out afforestation program mainly in proposed areas falls in the cluster earmarked for plantation program as per Approved Mining Plan in different phases. This habitat improvement program would ensure the faunal species to re-colonize and improve the abundance status in the core zone.

The objectives of the green belt cover will cover the following:

- Noise abatement
- Ecological restoration
- Aesthetic, biological and visual improvement of area due to improved vegetative and plantations cover.

4.5.2.2.1. Species Recommendation for Plantation granted in the District

Following points have been considered while recommending the species for plantation:

- Natural growth of existing species and survival rate of various species.
- Suitability of a particular plant species for a particular type of area.
- Creating of biodiversity.
- Fast growing, thick canopy copy, perennial and evergreen large leaf area.
- Efficient in absorbing pollutants without major effects of natural growth.
- The following species may be considering primary for plantation best suited for the prevailing climate condition in the area.

TABLE 4.13: RECOMMENDED SPECIES FOR GREENBELT DEVELOPMENT PLAN

SI.No	Name of the plant (Botanical)	Family Name	Common Name	Habit
1	*Azadirachta indica*	Meliaceae	Neem, Vembu	Tree
2	*Albiziafalcatoria*	Fabaceae	Tamarind, Puliyamaram	Tree
3	*Polyalthialongifolia*	Annonaceae	Kattumaram	Tree
4	*Borassus Flabellifer*	Arecaceae	Palmyra Palm	Tree

The 7.5m Safety distance along the boundary has been identified to be utilized for subsequent Afforestation. However, the afforestation should always be carried out in a systematic and scientific manner. Regional trees like Neem, Pongamia, Pinnata, and Casuarina will be planted along the Lease boundary and avenue plantation will be carried out in project area. The rate of survival expected to be 80% in this area. Afforestation Plan is given in Table No.4.13 and budget of green belt development plan are given in Table No.4.14.

TABLE 4.14: GREENBELT DEVELOPMENT PLAN

Year	No. of trees proposed to be planted	Survival %	Name of the species	No. of trees expected to be grown
I	100	80%	Neem	80
II	100	80%		80
III	100	80%		80
IV	100	80%		80
V	100	80%		80

TABLE 4.15: BUDGET FOR GREENBELT DEVELOPMENT PLAN

Activity	Year					Cost	Total Cost
	I	II	III	IV	V		
Plantation in Nos	100	100	100	100	100	@ 100 Rs/ Saplings	Rs 50,000
Plantation cost and maintenence	10000	10000	10000	10000	10000		
TOTAL							**Rs 50,000**

After complete extraction of mineral, the excavated pits will be allowed to collect rainwater and seepage water to serve as a reservoir to charge the nearby wells. Fish culture will also be attempted. A bund will be constructed around the pits. In order to minimize the impact of mining on the vegetation outside the mine lease area, it is recommended that adequate protection measures must be implemented. As mining involves movement of vehicles and increased anthropogenic activities, some of the areas can be fenced by involving local people and educating them about increased benefits of such activities.

4.5.3. Anticipated Impact on Fauna

- There is no Wildlife Sanctuary and Biosphere Reserve within 10 km radius of the project site.
- No rare, endemic & endangered species are reported in the buffer zone. However, during the course of mining, the management will practice scientific method of mining with proper Environmental Management Plan

including pollution control measures especially for air and noise, to avoid any adverse impact on the surrounding wildlife.

- Fencing around all the proposed mine lease areas will be constructed to restrict the entry of stray animals
- Green belt development will be carried out which will help in minimizing adverse impact on the flora found in the area.

4.5.3.1. Measures for protection and conservation of wildlife species

- Undertaking mitigative measures for conducive environment to the flora and fauna in consultation with Forest Department.
- Dust suppression system will be installed within mine and periphery of mine lease boundary.
- Plantation around mine area will help in creating habitats for small faunal species and to create better environment for various fauna. Creating and developing awareness for nature and wildlife in the adjoining villages.

4.5.3.2. Mitigation Measures

- All the preventive measures will be taken for growth & development of fauna.
- Creating and development awareness for nature and wildlife in the adjoin villages.
- The workers shall be trained to not harm any wildlife, should it come near the project site. No work shall be carried out after 6.00 pm.

4.5.4. Impact on Aquatic Biodiversity

Mining activities will not disturb the existing aquatic ecology as there is no effluent discharge proposed from the Rough stone quarry. There is no natural perennial surface water body within the mine lease area. Hence, aquatic biodiversity is not observed in the mine lease area.

4.5.5. Impact Assessment on Biological Environment

A detail of impact and assessments was mentioned in Table No 4.16.

TABLE 4.16: ECOLOGICAL IMPACT ASSESSMENTS

SI.No	Attributes	Assessment
1	Activities of the project affects the breeding/nesting sites of birds and animals	No breeding and nesting site was identified in mining lease site. The fauna sighted mostly migrated from buffer area.
2	Located near an area populated by rare or endangered species	No endangered, critically endangered, vulnerable species sighted in core mining lease area.
3	Proximity to national park/wildlife sanctuary/reserve forest /mangroves/ coastline/estuary/sea	No national park or eco-sensitive zone around 10km radius.
4	Proposed project restricts access to waterholes for wildlife	'NO'
5	Proposed mining project impact surface water quality that also provide water to wildlife	'NO 'scheduled or threatened wildlife animal sighted regularly core in core area.
6	Proposed mining project increase siltation that would affect nearby biodiversity area.	Surface runoff management such as drains is constructed properly so there will be no siltation affect in nearby mining area.
7	Risk of fall/slip or cause death to wild animals due to project activities	'NO'
8	The project release effluents into a water body that also supplies water to a wildlife	No water body near to core zone so chances of water become polluted is low.

9	Mining project effect the forest based livelihood/ any specific forest product on which local livelihood depended	'NO'
10	Project likely to affect migration routes	'NO 'migration route observed during monitoring period.
11	Project likely to affect flora of an area, which have medicinal value	'NO'
12	Forestland is to be diverted, has carbon high sequestration	'NO 'There was no forest land diverted.
13	The project likely to affect wetlands, Fish breeding grounds, marine ecology	'NO'. Wetland was not present in near core Mining lease area. No breeding and nesting ground present in core mining area.

TABLE 4.17: ANTICIPATED IMPACT OF ECOLOGY AND BIODIVERSITY

Sl. No	Aspect Description	Likely Impacts on Ecology and Biodiversity (EB)	Impact Consequence - Probability Description / Justification	Significance	Mitigation Measures
Pre-Mining Phase					
1	Uprooting of vegetation of lease area	Site specific loss of common floral diversity (Direct impact)	Site possesses common floral (not trees) species. Clearance of these species will not result in loss of flora	Less severe	No immediate action required. However, Greenbelt /plantation will be developed in project site and in periphery of the project boundary, which will improve flora and fauna diversity of the project area.
		Site specific loss of associated faunal diversity (Partial impact)	Site supports only common species, which use wide variety of habitats of the buffer zone reserve forest area. So, there is no threat of faunal diversity.		
		-Loss of Habitat (Direct impact)	Site does not form Unique / critical habitat structure for unique flora or fauna.		
Mining phase					
2	Excavation of mineral using machine and labours, Transportation activities will generate noise.	Site-specific disturbance to normal faunal movements at the site due to noise. (Partial impact)	Site does not form unique / critical habitat structure for unique flora or fauna.	Less severe	Mining activity should not be operated after 5PM. Excavation of dump and transportation work should stop before 7PM.
3	Vehicular Movement for transportation of materials will result in generation of dust (SPM) due to haul roads and emission of SO2, NO2, CO etc.	Impact on surrounding agriculture and associated fauna due to deposition of dust and Emission of CO. (Indirect impact)	Impact is less as the agricultural land far from core area.	Less severe	All vehicles will be certified for appropriate Emission levels. More plantation has been suggested Upgrade the vehicles with alternative fuel such biodiesel, methanol and biofuel around the mining area.

4.6 SOCIO ECONOMIC

4.6.1 Anticipated Impacts

- Dust generation from mining activity can have negative impact on the health of the workers and people in the nearby area.
- Approach roads can be damaged by the movement of tippers
- Increase in Employment opportunities both direct and indirect thereby increasing economic status of people of the region

4.6.2 Mitigation Measures

- Good maintenance practices will be adopted for all machinery and equipment, which will help to avert potential noise problems
- Green belt will be developed in and around the project site as per Central Pollution Control Board (CPCB) guidelines
- Air pollution control measure will be taken to minimize the environmental impact within the core zone
- For the safety of workers, personal protective appliances like hand gloves, helmets, safety shoes, goggles, aprons, nose masks and ear protecting devices will be provided as per mines act and rules
- Benefit to the State and the Central governments through financial revenues by way of royalty, tax, duties, etc., from this project directly and indirectly
- From above details, the quarry operations will have highly beneficial positive impact in the area

4.7 OCCUPATIONAL HEALTH AND SAFETY

Occupational health and safety hazards occur during the operational phase of mining and primarily include the following:

- Respiratory hazards
- Noise
- Physical hazards
- Explosive storage and handling

4.7.1 Respiratory Hazards

Long-term exposure to silica dust may cause silicosis the following measures are proposed:

- Cabins of excavators and tippers will be enclosed with AC and sound proof
- Use of personal dust masks will be made compulsory

4.7.2 Noise

Workers are likely to get exposed to excessive noise levels during mining activities. The following measures are proposed for implementation

- No employee will be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection
- The use of hearing protection will be enforced actively when the equivalent sound level over 8 hours reaches 85 dB(A), the peak sound levels reach 140 dB(C), or the average maximum sound level reaches 110 dB(A)
- Ear muffs provided will be capable of reducing sound levels at the ear to at least 85 dB(A)
- Periodic medical hearing checks will be performed on workers exposed to high noise levels

4.7.3 Physical Hazards

The following measures are proposed for control of physical hazards

- Specific personnel training on work-site safety management will be taken up;
- Work site assessment will be done by rock scaling of each surface exposed to workers to prevent accidental rock falling and / or landslide, especially after blasting activities;
- Natural barriers, temporary railing, or specific danger signals will be provided along rock benches or other pit areas where work is performed at heights more than 2m from ground level;

- Maintenance of yards, roads and footpaths, providing sufficient water drainage and preventing slippery surfaces with an all-weather surface, such as coarse gravel will be taken up

4.7.4 Occupational Health Survey

All the persons will undergo pre-employment and periodic medical examination. Employees will be monitored for occupational diseases by conducting the following tests

- General physical tests
- Audiometric tests
- Full chest, X-ray, Lung function tests, Spirometric tests
- Periodic medical examination – yearly
- Lung function test – yearly, those who are exposed to dust
- Eye test

Essential medicines will be provided at the site. The medicines and other test facilities will be provided at free of cost. The first aid box will be made available at the mine for immediate treatment.

First aid training will be imparted to the selected employees regularly. The lists of first aid trained members shall be displayed at strategic places.

4.8 MINE WASTE MANAGEMENT

No waste is anticipated from this proposed quarry.

4.9 MINE CLOSURE

Mine closure plan is the most important environmental requirement in mining projects. The mine closure plan should cover technical, environmental, social, legal and financial aspects dealing with progressive and post closure activities. The closure operation is a continuous series of activities starting from the decommissioning of the project. Therefore, progressive mine closure plan should be specifically dealt with in the mining plan and is to be reviewed along with mining plan. As progressive mine closure is a continuous series of activities, it is obvious that the proposals of scientific mining have included most of the activities to be included in the closure plan. While formulating the closure objectives for the site, it is important to consider the existing or the pre-mining land use of the site; and how the operation will affect this activity.

The primary aim is to ensure that the following broad objectives along with the abandonment of the mine can be successfully achieved:

- To create a productive and sustainable after-use for the site, acceptable to mine owners, regulatory agencies, and the public
- To protect public health and safety of the surrounding habitation
- To minimize environmental damage
- To conserve valuable attributes and aesthetics
- To overcome adverse socio-economic impacts.

4.9.1 Mine Closure Criteria

The criteria involved in mine closure are discussed below:

4.9.1.1 Physical Stability

All anthropogenic structures, which include mine workings, buildings, rest shelters etc., remaining after mine decommissioning should be physically stable. They should present no hazard to public health and safety as a result of failure or physical deterioration and they should continue to perform the functions for which they were designed. The design periods and factors of safety proposed should take full account of extreme events such as floods, hurricane, winds or earthquakes, etc. and other natural perpetual forces like erosion, etc.,

4.9.1.2 Chemical Stability

The solid wastes on the mine site should be chemically stable. This means that the consequences of chemical changes or conditions leading to leaching of metals, salts or organic compounds should not endanger public health and safety nor result in the deterioration of environmental attributes. If the pollutant discharge likely to cause adverse impacts is predicted in advance, appropriate mitigation measures like settling of suspended solids or passive treatment to improve water quality as well as quantity, etc., could be planned. Monitoring should demonstrate that there is no adverse effect of pollutant concentrations exceeding the statutory limits for the water, soil and air qualities in the area around the closed mine.

4.9.1.3 Biological Stability

The stability of the surrounding environment is primarily dependent upon the physical and chemical characteristics of the site, whereas the biological stability of the mine site itself is closely related to rehabilitation and final land use. Nevertheless, biological stability can significantly influence physical or chemical stability by stabilizing soil cover, prevention of erosion/wash off, leaching, etc.,

A vegetation cover over the disturbed site is usually one of the main objectives of the rehabilitation programme, as vegetation cover is the best long-term method of stabilizing the site. When the major earthwork components of the rehabilitation programme have been completed, the process of establishing a stable vegetation community begins. For re-vegetation, management of soil nutrient levels is an important consideration. Additions of nutrients are useful under three situations.

- Where the nutrient level of spread topsoil is lower than material in-situ e.g. for development of social forestry
- Where it is intended to grow plants with a higher nutrient requirement than those occurring naturally e.g. planning for agriculture
- Where it is desirable to get a quick growth response from the native flora during those times when moisture is not a limiting factor e.g., development of green barriers

The Mine closure plan should be as per the approved mine plan. The mine closure is a part of approved mine plan and activities of closure shall be carried out as per the process described in mine closure plan.

5. ANALYSIS OF ALTERNATIVES (TECHNOLOGY AND SITE)

5.1 INTRODUCTION

Consideration of alternatives to a project proposal is a requirement of EIA process. During the scoping process, alternatives to a proposal can be considered or refined, either directly or by reference to the key issues identified. A comparison of alternatives helps to determine the best method of achieving the project objectives with minimum environmental impacts or indicates the most environmentally friendly and cost-effective options.

5.2 FACTORS BEHIND THE SELECTION OF PROJECT SITE

Tvl. City Blue Metals Rough Stone Quarry Project at Iynkunam Village is a mining project for excavation of Rough Stone, which is site specific. All the proposed mining lease areas have following advantages: -

- The mineral deposit occurs in a non-forest area.
- There is no habitation within the project area; hence no R & R issues exist.
- There is no river, stream, nallah and water bodies in the applied mine lease areas.
- Availability of skilled, semi-skilled and unskilled workers in this region.
- All the basic amenities such as medical, firefighting, education, transportation, communication and infrastructural facilities are well connected and accessible.
- The mining operations will not intersect the ground water level. Hence, no impact on ground water environment.
- Study area falls in seismic zone – II, there is no major history of landslides, earthquake, subsidence etc., recorded in the past history

5.3 ANALYSIS OF ALTERNATIVE SITE

No alternatives are suggested as all the mine sites are mineral specific

5.4 FACTORS BEHIND SELECTION OF PROPOSED TECHNOLOGY

Mechanized open cast mining operation with drilling and blasting method will be used to extract Rough Stone in the area. All the applied mining lease areas have following advantages –

- As the mineral deposition is homogeneous and batholith formation, therefore opencast method of working is preferred over underground method
- The material will be loaded with the help of excavators into dumpers / trippers and transported to the needy customers.
- Blasting and availability of drills along with controlled blasting technology gives desired fragmentation so that the mineral is handled safely and used without secondary blasting.
- Semi-skilled labours fit for quarrying operations are easily available around the nearby villages

5.5 ANALYSIS OF ALTERNATIVE TECHNOLOGY

Open cast mechanized method has been selected for this proposal. This technology is having least gestation period, economically viable, safest and less labour intensive. The method has inbuilt flexibility for increasing or decreasing the production as per market condition.

6. ENVIRONMENTAL MONITORING PROGRAMME

6.0 GENERAL

The monitoring and evaluation of environmental parameters indicates potential changes occurring in the environment, which paves way for implementation of rectifying measures wherever required to maintain the status of the natural environment. Evaluation is also a very effective tool to judge the effectiveness or deficiency of the measures adopted and provides insight for future corrections.

The main objective of environmental monitoring is to ensure that the obtained results in respect of environmental attributes and prevailing conditions during operation stage are in conformity with the prediction during the planning stage. In case of substantial deviation from the earlier prediction of results, this forms as base data to identify the cause and suggest remedial measures. Environmental monitoring is mandatory to meet compliance of statutory provisions under the Environment (Protection) Act, 1986, relevant conditions regarding monitoring covered under EC orders issued by the SEIAA as well as the conditions set forth under the order issued by Tamil Nadu Pollution Control Board while granting CTE/CTO.

6.1 METHODOLOGY OF MONITORING MECHANISM

Implementation of EMP and periodic monitoring will be carried out by Project Proponent (Mine Owner). A comprehensive monitoring mechanism has been devised for monitoring of impacts due to this proposed project; Environmental protection measures like dust suppression, control of noise and blast vibrations, maintenance of machinery and vehicles, housekeeping in the mine premises, plantation, implementation of Environmental Management Plan and environmental clearance conditions will be monitored by the Respective Mine Management. On the other hand, implementation of area level protection measures like green belt development, environmental quality monitoring etc., are taken up by a senior executive who reports to their Mine Management.

An Environment monitoring cell (EMC) will be constituted to monitor the implementation of EMP and other environmental protection measures in all the proposed quarry.

The responsibilities of this cell will be:

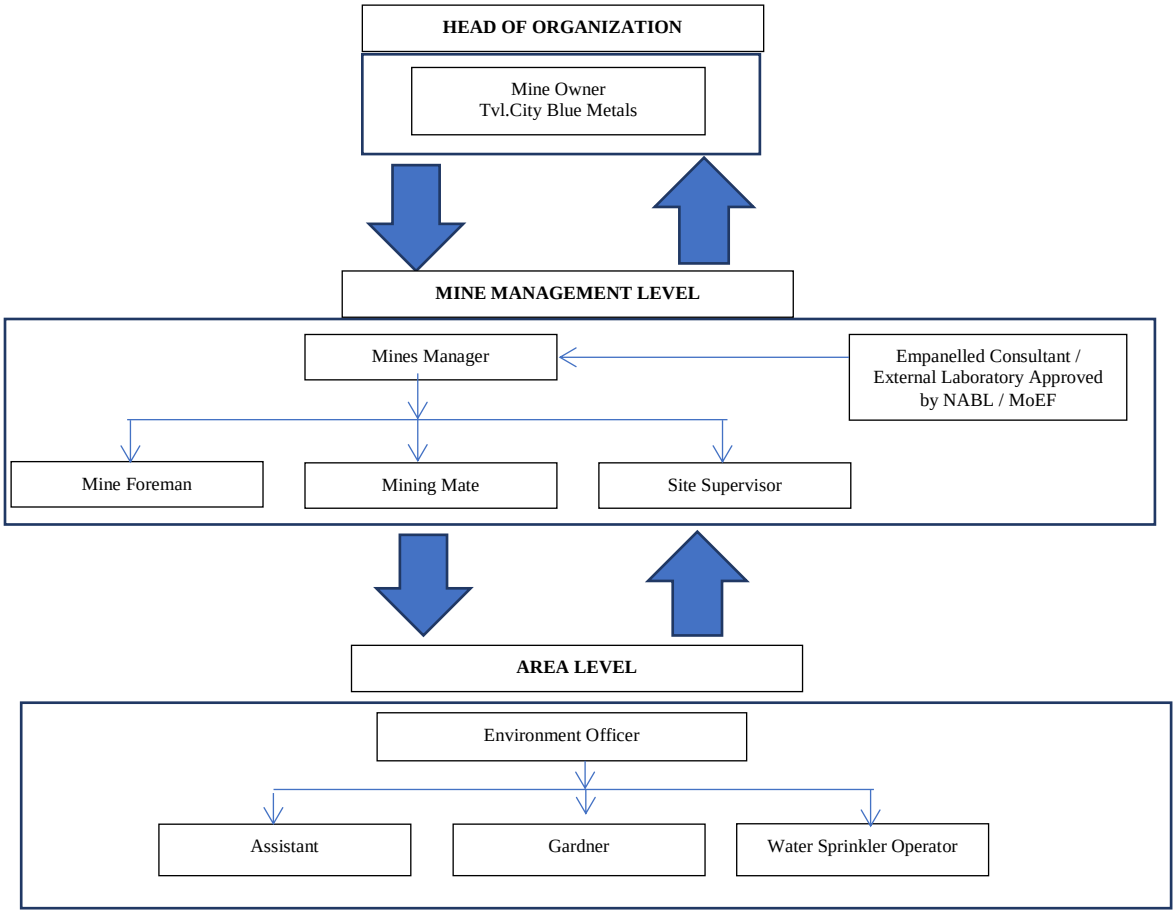
- Implementation of pollution control measures
- Monitoring programme implementation
- Post-plantation care
- To check the efficiency of pollution control measures taken
- Any other activity as may be related to environment
- Seeking expert's advice when needed.

The environmental monitoring cell will co-ordinate all monitoring programs at site and data thus generated will be regularly furnished to the State regulatory agencies as compliance status reports.

The sampling and analysis report of the monitored environmental attributes will be submitted to the Tamil Nadu Pollution Control Board (TNPCB) at a frequency of half-yearly and yearly by each proposed project proponent. The half-yearly reports are submitted to Ministry of Environment and Forest, Regional Office and SEIAA as well.

The sampling and analysis of the environmental attributes will be as per the guidelines of Central Pollution Control Board (CPCB)/Ministry of Environment, Forest and Climate Change (MoEF & CC).

FIGURE 6.1: PROPOSED ENVIRONMENTAL MONITORING CELL



6.2 IMPLEMENTATION SCHEDULE OF MITIGATION MEASURES

The mitigation measures proposed in Chapter-4 will be implemented so as to reduce the impact on the environment due to the operations of the proposed project. Implementation schedule of mitigation measures is given in Table 6.1.

TABLE 6.1 IMPLEMENTATION SCHEDULE

Sl No.	Recommendations	Time Period	Schedule
1	Land Environment Control Measures	Before commissioning of the project	Immediately after the commencement of project
2	Soil Quality Control Measures	Before commissioning of the project	Immediately after the commencement of project
3	Water Pollution Control Measures	Before commissioning of the project and along with mining operation	Immediately and as project progress
4	Air Pollution Control Measures	Before commissioning of the project and along with mining operation	Immediately and as project progress
5	Noise Pollution Control Measures	Before commissioning of the project and along with mining operation	Immediately and as project progress
6	Ecological Environment	Phase wise implementation every year along with mine operations	Immediately and as project progress

6.3 MONITORING SCHEDULE AND FREQUENCY

Monitoring shall confirm that commitments are being met. This may take the form of direct measurement and recording of quantitative information, such as amounts and concentrations of discharges, emissions and wastes, for measurement against statutory standards. Monitoring may include socio-economic interaction, through local liaison activities or even assessment of complaints.

The environmental monitoring will be conducted in the mine operations as follows:

- Air quality;
- Water and wastewater quality;
- Noise levels;
- Soil Quality; and
- Greenbelt Development

The details of monitoring are detailed in Table 6.2

TABLE 6.2: PROPOSED MONITORING SCHEDULE POST EC

S. No.	Environment Attributes	Location	Monitoring		Parameters
			Duration	Frequency	
1	Air Quality	2 Locations (1 Core & 1 Buffer)	24 hours	Once in 6 months	Fugitive Dust, $PM_{2.5}$, PM_{10}, SO_2 and NO_x.
2	Meteorology	At mine site before start of Air Quality Monitoring & IMD Secondary Data	Hourly / Daily	Continuous online monitoring	Wind speed, Wind direction, Temperature, Relative humidity and Rainfall
3	Water Quality Monitoring	2 Locations (1SW & 1 GW)	-	Once in 6 months	Parameters specified under IS:10500, 1993 & CPCB Norms
4	Hydrology	Water level in open wells in buffer zone around 1 km at specific wells	-	Once in 6 months	Depth in bgl
5	Noise	2 Locations (1 Core & 1 Buffer)	Hourly – 1 Day	Once in 6 months	Leq, Lmax, Lmin, Leq Day & Leq Night
6	Vibration	At the nearest habitation (in case of reporting)	–	During blasting Operation	Peak Particle Velocity
7	Soil	2 Locations (1 Core & 1 Buffer)	–	Once in six months	Physical and Chemical Characteristics
8	Greenbelt	Within the Project Area	Daily	Monthly	Maintenance

Source: Guidance of manual for mining of minerals, February 2010

6.4 BUDGETARY PROVISION FOR EMP

The cost in respect of monitoring of environmental attributes, parameter to be monitored, sampling/monitoring locations with frequency and cost provision against each proposal is shown in Table 6.3. Monitoring work will be outsourced to external laboratory approved by NABL / MoEF.

The proposed capital cost for Environmental Monitoring Programme is Rs 76,000/- and the recurring cost is Rs 76,000/- per annum

TABLE 6.3 ENVIRONMENT MONITORING BUDGET

Sl.No.	Parameter	Capital Cost	Recurring Cost per annum
1	Air Quality	Rs. 76,000/-	Rs. 76,000/-
2	Meteorology		
3	Water Quality		
4	Hydrology		
5	Soil Quality		
6	Noise Quality		
7	Vibration Study		
Total		**Rs 76,000/-**	**Rs 76,000/-**

Source: Approved Mining Plan

6.5 REPORTING SCHEDULES OF MONITORED DATA

The monitored data on air quality, water quality, noise levels and other environmental attributes will be periodically examined by the Mine Management Coordinator and Respective Head of Organization for taking necessary corrective measures. The monitoring data will be submitted to Tamil Nadu State Pollution Control Board in the Compliance to CTO Conditions & environmental audit statements every year to MoEF & CC and Half-Yearly Compliance Monitoring Reports to MoEF & CC Regional Office and SEIAA.

Periodical reports to be submitted to: -

- MoEF & CC – Half yearly status report
- TNPCB - Half yearly status report
- Department of Geology and Mining: quarterly, half yearly annual reports

Besides the Mines Manager/Agent of respective project will submit the periodical reports to –

- Director of mines safety,
- Labour enforcement officer,
- Controller of explosives as per the norms stipulated by the department.

7. ADDITIONAL STUDIES

7.0 GENERAL

The following Additional Studies were done as per items identified by project proponent and items identified by regulatory authority. And items identified by public and other stakeholders will be incorporated after Public Hearing.

- Public Consultation
- Risk Assessment
- Disaster Management Plan
- Cumulative Impact Study
- Plastic Waste Management
- Post-COVID Health Management Plan

7.1. PUBLIC CONSULTATION

Application to The Member Secretary of the Tamil Nadu Pollution Control Board (TNPCB) to conduct Public Hearing in a systematic, time bound and transparent manner ensuring widest possible public participation at the project site or in its close proximity in the District is submitted along with this Draft EIA / EMP Report and the outcome of public hearing proceedings will be detailed in the Final EIA/EMP Report.

7.2 RISK ASSESSMENT

The methodology for the risk assessment has been based on the specific risk assessment guidance issued by the Directorate General of Mine Safety (DGMS), Dhanbad, vide Circular No.13 of 2002, dated 31st December, 2002. The DGMS risk assessment process is intended to identify existing and probable hazards in the work environment and all operations and assess the risk levels of those hazards in order to prioritize those that need immediate attention. Further, mechanisms responsible for these hazards are identified and their control measures, set to timetable are recorded along with pinpointed responsibilities.

The whole quarry operation will be carried out under the direction of a Qualified Competent Mine Manager holding certificate of competency to manage a metalliferous mine granted by the DGMS, Dhanbad. Risk Assessment is all about prevention of accidents and to take necessary steps to prevent it from happening.

Factors of risks involved due to human induced activities in connection with these proposed mining & allied activities with detailed analysis of causes and control measures for the mine is given in below Table 7.1.

TABLE 7.1 RISK ASSESSMENT& CONTROL MEASURES

S. No	Risk factors	Causes of risk	Control measures
1	Accidents due to explosives and heavy mining machineries	Improper handling and unsafe working practice	▪ All safety precautions and provisions of Mine Act, 1952, Metalliferous Mines Regulation, 1961 and Mines Rules, 1955 will be strictly followed during all mining operations; ▪ Workers will be sent to the Training in the nearby Group Vocational Training Centre ▪ Entry of unauthorized persons will be prohibited; ▪ Fire-fighting and first-aid provisions in the mine office complex and mining area; ▪ Provisions of all the safety appliances such as safety boot, helmets, goggles etc. will be made available to the employees and regular check for their use ▪ Working of quarry, as per approved plans and regularly updating the mine plans; ▪ Cleaning of mine faces on daily basis shall be daily done in order to avoid any overhang or undercut;

			▪ Handling of explosives, charging and firing shall be carried out by competent persons only under the supervision of a Mine Manager; ▪ Maintenance and testing of all mining equipment as per manufacturer‘s guidelines.
2	Drilling	Improper and unsafe practices Due to high pressure of compressed air, hoses may burst Drill Rod may break	▪ Safe operating procedure established for drilling (SOP) will be strictly followed. ▪ Only trained operators will be deployed. ▪ No drilling shall be commenced in an area where shots have been fired until the blaster/blasting foreman has made a thorough Examination of all places, ▪ Drilling shall not be carried on simultaneously on the benches at places directly one above the other. ▪ Periodical preventive maintenance and replacement of worn-out accessories in the compressor and drill equipment as per operator manual. ▪ All drills unit shall be provided with wet drilling shall be maintained in efficient working in condition. ▪ Operator shall regularly use all the personal protective equipment.
4	Blasting	Fly rock, ground vibration, Noise and dust. Improper charging, stemming & Blasting/ fining of blast holes Vibration due to movement of vehicles	▪ Restrict maximum charge per delay as per regulations and by optimum blast hole pattern, vibrations will be controlled within the permissible limit and blasting can be conducted safely. ▪ SOP for Charging, Stemming & Blasting/Firing of Blast Holes will be followed by blasting crew during initial stage of operation ▪ Shots are fired during daytime only. ▪ All holes charged on any one day shall be fired on the same day. ▪ The danger zone will be distinctly demarcated (by means of red flags)
5	Transportation	Potential hazards and unsafe workings contributing to accident and injuries Overloading of material While reversal & overtaking of vehicle Operator of truck leaving his cabin when it is loaded.	▪ Before commencing work, drivers personally check the dumper/truck/tipper for oil(s), fuel and water levels, tyre inflation, general cleanliness and inspect the brakes, steering system, warning devices including automatically operated audio-visual reversing alarm, rear view mirrors, side indicator lights etc., are in good condition. ▪ Not allow any unauthorized person to ride on the vehicle nor allow any unauthorized person to operate the vehicle. ▪ Concave mirrors should be kept at all corners ▪ All vehicles should be fitted with reverse horn with one spotter at every tipping point ▪ Loading according to the vehicle capacity ▪ Periodical maintenance of vehicles as per operator manual
6	Natural calamities	Unexpected happenings	▪ Escape Routes will be provided to prevent inundation of storm water ▪ Fire Extinguishers & Sand Buckets
7	Failure of Mine Benches and Pit Slope	Slope geometry, Geological structure	▪ Ultimate or over all pit slope shall be below 60° and each bench height shall be 5m height.

Source: Analysed and Proposed by FAE & EC

7.3 DISASTER MANAGEMENT PLAN

Natural disasters like Earthquake, Landslides have not been recorded in the past history as the terrain is categorized under seismic zone II. The area is far away from the sea hence the disaster due to heavy floods and tsunamis are not anticipated

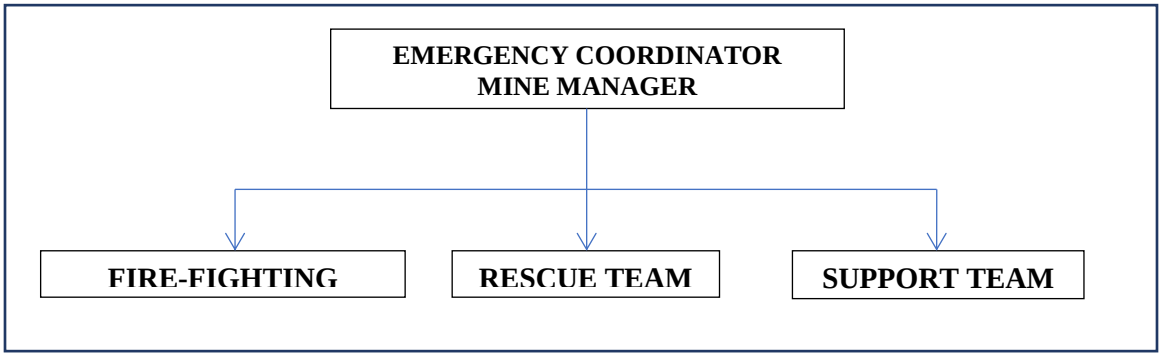
The Disaster Management Plan is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities.

The objective of the Disaster Management Plan is to make use of the combined resources of the mine and the outside services to achieve the following:

- Rescue and medical treatment of casualties;
- Safeguard other people;
- Minimize damage to property and the environment;
- Initially contain and ultimately bring the incident under control;
- Secure the safe rehabilitation of affected area; and
- Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the emergency

In case a disaster takes place, despite preventive actions, disaster management will have to be done in line with the descriptions below. There is an organization proposed for dealing with the emergency situations and the coordination among key personnel and their team has been shown in Fig 7.1.

FIGURE 7.1: DISASTER MANAGEMENT TEAM LAYOUT



The emergency organization shall be headed by emergency coordinator who will be qualified competent mine manager. In his absence senior most people available at the mine shall be emergency coordinator till arrival of mine manager. There would be three teams for taking care of emergency situations – Fire-Fighting Team, Rescue Team and Support Team. The proposed composition of the teams is given in Table 7.2.

TABLE 7.2: PROPOSED TEAMS TO DEAL WITH EMERGENCY SITUATION

DESIGNATION	QUALIFICATION
FIRE-FIGHTING TEAM	
Team Leader/ Emergency Coordinator (EC)	Mines Manager
Team Member	Mines Foreman
Team Member	Mining Mate
RESCUE TEAM	
Team Leader/ Emergency Coordinator (EC)	Mines Manager
Team Member/ Incident Controller (IC)	Environment Officer
Team Member	Mining Foreman
SUPPORT TEAM	
Team Leader/ Emergency Coordinator (EC)	Mines Manager
Assistant Team Leader	Environment Officer
Team Member	Mining Mate
Security Team Leader/ Emergency Security Controller	Mines Foreman

Once the mine becomes operational, the above table along with names of personnel will be prepared and made easily available to workers. A mobile communication network and wireless shall connect Mine Emergency Control Room (MECR) to control various departments of the mine, fire station and neighbouring industrial units/mines.

Roles and responsibilities of emergency team –

(a) Emergency coordinator (EC)

The emergency coordinator shall assume absolute control of site and shall be located at MECR.

(b) Incident controller (IC)

Incident controller shall be a person who shall go to the scene of emergency and supervise the action plan to overcome or contain the emergency. Shift supervisor or Environmental Officer shall assume the charge of IC.

(c) Communication and advisory team

The advisory and communication team shall consist of heads of Mining Departments i.e., Mines Manager

(d) Roll call coordinator

The Mine Foreman shall be Roll Call Coordinator. The roll call coordinator will conduct the roll call and will evacuate the mine personnel to assembly point. His prime function shall be to account for all personnel on duty.

(e) Search and rescue team

There shall be a group of people trained and equipped to carryout rescue operation of trapped personnel. The people trained in first aid and fire-fighting shall be included in search and rescue team.

(f) Emergency security controller

Emergency Security Controller shall be senior most security person located at main gate office and directing the outside agencies e.g. fire brigade, police, doctor and media men etc.,

Emergency control procedure –

The onset of emergency, will in all probability, commence with a major fire or explosion or collapse of wall along excavation and shall be detected by various safety devices and also by members of operational staff on duty. If located by a staff member on duty, he (as per site emergency procedure of which he is adequately briefed) will go to nearest alarm call point, break glass and trigger off the alarms. He will also try his best to inform about location and nature of accident to the emergency control room. In accordance with work emergency procedure the following key activities will immediately take place to interpret and take control of emergency.

- On site fire crew led by a fireman will arrive at the site of incident with fire foam tenders and necessary equipment.
- Emergency security controller will commence his role from main gate office
- Incident controller shall rush to the site of emergency and with the help of rescue team and will start handling the emergency.
- Site main controller will arrive at MECR with members of his advisory and communication team and will assume absolute control of the site.
    - He will receive information continuously from incident controller and give decisions and directions to:
        - Incident controller
        - Mine control rooms
        - Emergency security controller

Proposed fire extinguishers at different locations –

The following type of fire extinguishers has been proposed at strategic locations within the mine.

TABLE 7.3: PROPOSED FIRE EXTINGUISHERS AT DIFFERENT LOCATIONS

LOCATION	TYPE OF FIRE EXTINGUISHERS
Electrical Equipment's	CO_2 type, foam type, dry chemical powder type
Fuel Storage Area	CO_2 type, foam type, dry chemical powder type, Sand bucket
Office Area	Dry chemical type, foam type

Alarm system to be followed during disaster –

On receiving the message of disaster from Site Controller, fire-fighting team, the mine control room attendant will sound siren wailing for 5 minutes. Incident controller will arrange to broadcast disaster message through public address system. On receiving the message of "Emergency Over" from Incident Controller the emergency control room attendant will give "All Clear Signal", by sounding alarm straight for 2 minutes.

The features of alarm system will be explained to one and all to avoid panic or misunderstanding during disaster. In order to prevent or take care of hazard / disasters if any the following control measures have been adopted.

- All safety precautions and provisions of Metalliferous Mines Regulations (MMR), 1961 is strictly followed during all mining operations.
- Observance of all safety precautions for blasting and storage of explosives as per MMR 1961.
- Entry of unauthorized persons into mine & allied areas is completely prohibited.
- Fire-fighting and first-aid provisions in the mines office complex and mining area are provided.
- Provisions of all the safety appliances such as safety boot, helmets, goggles, dust masks, ear plugs and ear muffs etc. are made available to the employees and the use of same is strictly adhered to through regular monitoring.
- Training and refresher courses for all the employees working in hazardous premises.
- Working of mine, as per approved plans and regularly updating the mine plans.
- Cleaning of mine faces is regularly done.
- Handling of explosives, charging and blasting are carried out only by qualified persons following SOP.
- Checking and regular maintenance of garland drains and earthen bunds to avoid any inflow of surface water in the mine pit.
- Provision of high-capacity standby pumps with generator sets with enough quantity of diesel for emergency pumping especially during monsoon.
- A blasting SIREN is used at the time of blasting for audio signal.
- Before blasting and after blasting, red and green flags are displayed as visual signals.
- Warning notice boards indicating the time of blasting and NOT TO TRESPASS are displayed at prominent places.
- Regular maintenance and testing of all mining equipment were carried out as per manufacturer's guidelines.

7.4 CUMULATIVE IMPACT STUDY

For easy representation of Proposed and Existing Quarries in the Cluster are given unique codes and identifies and studied in this EIA EMP Report.

TABLE 7.4: LIST OF QUARRIES WITHIN 500 METER RADIUS

PROPOSED QUARRIES				
CODE	**Name of the Owner**	**S.F. Nos**	**Extent**	**Status**
P1	**Tvl. City Blue Metal,** Thiru.Alaudeen Batcha, Managing Partner, S/o. Dhasthagir, Iynkunam, Kilpennathur taluk, Tiruvannamalai District– 606 611.	135 (Part-2)	1.00.0 ha	Received for TOR Vide Lr No. SEIAA-TN/F.No.7908/SEAC/TOR-871/2020 Dated :12.03.2021
P2	**Tmt.A.Kalpana,** W/o. Adhimoolam, No.4, Gandhi Nagar, 6th Street, Thiruvannamalai	135 (Part-4)	1.00.0 ha	Future proposed
P3	**Thiru. P.Adimoolam,** 57A, Tamizhnagar, Thiruvannamalai.	135 (Part-5)	1.00.0 ha	Future proposed
P4	**Thiru. P.Adimoolam,** 57A, Tamizhnagar, Thiruvannamalai	135 (Part-7)	4.00.0 ha	Future proposed
TOTAL			**7.00 ha**	
EXISTING QUARRIES				
CODE	**Name of the Owner**	**S.F. Nos**	**Extent**	**Status**
E1	**Thiru. R. Karthikeyan,** 23/29, Lakshmipuram, Gandhinagar, Thiruvannamalai	135 (Part-3)	1.00.0 ha	20.04.2011 to 19.04.2021
TOTAL			**1.00 ha**	
Total cluster extent			**8.00 ha**	

Note: -

- **Cluster area is calculated as per MoEF & CC Notification – S.O. 2269 (E) Dated: 01.07.2016**

TABLE 7.5: SALIENT FEATURES OF PROPOSAL "P1"

Name of the Quarry	Tvl.City Blue Metals Rough Stone Quarry		
Toposheet No	57 P/03		
Latitude between	12°15'52.05"N to 12°15'55.69"N		
Longitude between	79°09'46.88"E to 79°09'51.62"E		
Highest Elevation	220 m AMSL		
Proposed Depth of Mining	71 m (46mAGL + 25m BGL) (1m Topsoil + 70m Rough Stone)		
Geological Resources	Rough Stone in m^3		Topsoil m^3
	5,30,000		7,623
Mineable Reserves	Rough Stone in m^3		Topsoil m^3
	3,17,200		7,623
Proposal for this Mining Plan Period	Rough Stone in m^3		Topsoil m^3
	3,17,200		7,623
Existing Pit Dimension	100m (L) x 55m (W) x 10m (D) bgl		
Ultimate Pit Dimension	Pit-I	126m (L) x 80m (W) x 71m (D) (46mAGL + 25m BGL)	
Water Level in the surrounds area	52 - 56 m bgl		
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting		
Topography	The lease applied area is hilly terrain. The area has gentle slope with a gradient of 1 to 8 towards north western side. The altitude of the area is		

	220-180m (max) above mean sea level. The area is covered by 1m (avg) thickness of Topsoil Formation. Massive Charnockite is found after 1m (Topsoil Formation) which is clearly inferred from the nearby existing quarry pit.	
Machinery proposed	Jack Hammer	8 Nos
	Compressor	2 Nos
	Excavator with Bucket & Rock Breaker	1 Nos
	Tippers	3 Nos
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.	
Proposed Manpower Deployment	30 Nos	
Total Project Cost	Project Cost	Rs.62,30,000/-
	Environment Monitoring Cost	Rs.3,80,000/-
	Total	Rs.66,10,000/-
CER Cost @ 2% of Project Cost	Rs.1,32,200/-	
Nearby Water Bodies	Thurunjal River	6km South West
	Tank Near Namiyandal	1.5km SW
	Tank Near Noimalai	8km SW
	Tank Near Tirumalai Nagar	7.8km SW
	Tank Near Avalurpettai	9.8km NE
	Tank near Karungalikuppam	5km SE
	Kolathur Tank	9.7km SE
	Tank near Su.Palliampattu	5km SW
	Tank near Kasthambadi	6.8km NW
	Tank near Ganalapadi	2.3km N
	Tank near Pallikondapattu	6km SW
	Tank near Hariyankuppam	800m N
Greenbelt Development Plan	Proposed to plant 500 trees	
Proposed Water Requirement	6.5 KLD	
Nearest Habitation	700m NW	

Source: Approved Mining Plan

TABLE 7.6: SALIENT FEATURES OF PROPOSAL "P2"

Name of the Quarry	Tmt. A.Kalpana - Rough Stone Quarry	
Toposheet No	57-P/03	
Latitude between	12°15'35"N to 12°15'46"N	
Longitude between	79°09'56"E to 79°10'01"E	
Highest Elevation	200 m AMSL	
Proposed Depth of Mining	Block-1: 18 m bgl (3m AGL + 15m BGL) Block-2: 20m (10m AGL + 10M BGL)	
Geological Resources	Rough Stone in m^3	
	4,72,500	
Mineable Reserves	Rough Stone in m^3	
	87,250	
Proposal for this Mining Plan Period	Rough Stone in m^3	
	87,250	
Existing Pit Dimension	20m BGL	
Ultimate Pit Dimension	Pit-I	140m (L) x 35m (W) x 18m (D) bgl
Water Level in the surrounds area	58 m bgl	
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Topography	The lease applied area is hilly terrain. The area has gentle slope with a gradient towards Southeastern side. The altitude of the area is 200m (max) above mean sea level. Massive Charnockite is clearly inferred from the nearby existing quarry pit.	
Machinery proposed	Jack Hammer	5 Nos

	Compressor	1 Nos
	Excavator with Bucket & Rock Breaker	1 Nos
	Tippers	2 Nos
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.	
Proposed Manpower Deployment	14 Nos	
Total Project Cost	Project Cost	Rs.65,50,000/-
	Environment Monitoring Cost	Rs.3,50,000/-
	Total	Rs.69,00,000/-
CER Cost @ 2% of Project Cost	Rs.1,38,000/-	
Nearby Water Bodies	Thurunjal River	6km SW
	Nandan Kalva	6.6Km SW
	Oliyar Ar	6.8Km SW
	VarahaNadi	12.3Km SE
Greenbelt Development Plan	Proposed to plant 100 trees in the 1000 sq.m.	
Proposed Water Requirement	2.0 KLD	
Nearest Habitation	820m Northwest	

Source: Approved Mining Plan

TABLE 7.7: SALIENT FEATURES OF EXISTING QUARRY "E1"

Name of the Quarry	Thiru.R.Karthikeyan - Rough Stone Quarry	
Toposheet No	57-P/03	
Latitude between	12°15'43"N to 12°15'47"N	
Longitude between	79°09'41"E to 79°09'47"E	
Highest Elevation	215 m AMSL	
Proposed Depth of Mining	20 m agl	
Geological Resources	Rough Stone in m^3	
	1,90,500	
Mineable Reserves	Rough Stone in m^3	
	1,03,500	
Proposal for this Mining Plan Period	Rough Stone in m^3	
	58,200	
Existing Pit Dimension	68m (L) * 45m (W) * 10m AGL (D)	
Ultimate Pit Dimension	Pit-I	152m (L) x 45m (W) x 20m (D) agl
Water Level in the surrounds area	35 – 40m bgl	
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Topography	The lease applied area is hilly terrain. The area has gentle slope towards Western side. The altitude of the area is 215m (max) above mean sea level. The area has. Massive Charnockite formation clearly inferred from the nearby existing quarry pit.	
Machinery proposed	Jack Hammer	1 Nos
	Compressor	-
	Excavator with Bucket & Rock Breaker	1 Nos
	Tippers	2 Nos
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.	
Proposed Manpower Deployment	13 Nos	
Total Project Cost	Project Cost	Rs.24,80,000/-
	Environment Monitoring Cost	Rs.3,50,000/-
	Total	Rs.28,30,000/-
CER Cost @ 2% of Project Cost	Rs.56,600/-	
Nearby Water Bodies	Thurunjal River	6km SW
	Nandan Kalva	6.6Km SW

	Oliyar Ar	6.8Km SW
	VarahaNadi	12.3Km SE
Greenbelt Development Plan	Proposed to plant 100 trees in the 1000 sq.m.	
Proposed Water Requirement	2.0 KLD	
Nearest Habitation	890m NW	

Source: Approved Mining Plan

The Cumulative Impact is mainly anticipated due to drilling & blasting and excavation and transportation activities in all the quarries (proposed and existing) within the cluster and major impact anticipated is on Air & Noise Environment and Ground Vibrations due to blasting.

Air Environment –

Calculating the Cumulative Load of Mining within the cluster is as shown in table 7.8 to 7.9.

TABLE 7.8: CUMULATIVE PRODUCTION LOAD OF ROUGH STONE

	PROPOSED PRODUCTION DETAILS			
Quarry	**5 Years in m^3**	**Per Year in m^3**	**Per Day in m^3**	**Number of Lorry Load Per Day**
P1	3,17,200	63,440	211	35
P2	87,250	17,450	58	10
Total	**4,04,450**	**80,890**	**269**	**45**
E1	58,200	11,640	39	6
Grand Total	**5,55,539**	**92,889**	**359**	**51**

TABLE 7.9: CUMULATIVE PRODUCTION LOAD OF TOPSOIL

	PROPOSED PRODUCTION DETAILS			
Quarry	**2 - 3 Years in m^3**	**Per Year in m^3**	**Per Day in m^3**	**Number of Lorry Load Per Day**
P1	7,623	7,623	24	4

On a cumulative basis considering all the 3 quarries it can be seen that the overall production of Rough Stone is 359 m^3 per day with a capacity of 51 trips of Rough Stone per day from the cluster.

The excavated topsoil will be stored within the project premises and later will be used for green belt development.

Note: Per day production of Rough Stone is calculated for 5 Years Lease Period and the excavated Topsoil will be used for green belt development.

Based on the above production quantities the emissions due to various activities in all the 4 mines includes various activities like ground preparation, excavation, handling and transport of ore. These activities have been analysed systematically basing on USEPA-Emission Estimation Technique Manual, for Mining AP-42, to arrive at possible emissions to the atmosphere and estimated emissions are given in Table 7.10.

TABLE 7.10: EMISSION ESTIMATION FROM QUARRIES WITHIN 500 METER RADIUS

EMISSION ESTIMATION FOR QUARRY "P1"				
	Activity	**Source type**	**Value**	**Unit**
Estimated Emission Rate for PM_{10}	Drilling	Point Source	0.091782333	g/s
	Blasting	Point Source	0.001438200	g/s
	Mineral Loading	Point Source	0.044293318	g/s
	Haul Road	Line Source	0.002538581	g/s/m
	Overall Mine	Area Source	0.047559112	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.000767232	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000019820	g/s
EMISSION ESTIMATION FOR QUARRY "P2"				
	Activity	**Source type**	**Value**	**Unit**
Estimated Emission Rate for PM_{10}	Drilling	Point Source	0.062326242	g/s
	Blasting	Point Source	0.000207672	g/s
	Mineral Loading	Point Source	0.038659139	g/s
	Haul Road	Line Source	0.002530587	g/s/m

	Overall Mine	Area Source	0.046142739	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.000203505	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000005155	g/s
EMISSION ESTIMATION FOR QUARRY "E1"				
Estimated Emission Rate for PM_{10}	**Activity**	**Source type**	**Value**	**Unit**
	Drilling	Point Source	0.055197347	g/s
	Blasting	Point Source	0.000113140	g/s
	Mineral Loading	Point Source	0.037125126	g/s
	Haul Road	Line Source	0.002529669	g/s/m
	Overall Mine	Area Source	0.045976991	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.000136065	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000003438	g/s

Source: Emission Calculations

TABLE 7.11: INCREMENTAL & RESULTANT GLC WITHIN CLUSTER

$PM_{2.5}$ in µg/m^3	
Location	**P1**
Background	23.7
Incremental	9.96
Resultant	33.66
NAAQ Norms	**60 µg/m^3**
PM_{10} in µg/m^3	
Location	**P1**
Background	43.4
Incremental	16.89
Resultant	60.29
NAAQ Norms	**100 µg/m^3**
SO_2 in µg/m^3	
Location	**P1**
Background	11.4
Incremental	3.09
Resultant	14.49
NAAQ Norms	**80 µg/m^3**
NO_x in µg/m^3	
Location	**P1**
Background	26.6
Incremental	10.65
Resultant	37.25
NAAQ Norms	**80 µg/m^3**

Noise Environment –

Noise pollution is mainly due to operation like drilling & blasting and plying of trucks & HEMM. Cumulative Noise modelling has been carried out considering blasting and compressor operation (drilling) and transportation activities. Predictions have been carried out to compute the noise level at various distances around the different quarries within the 500 m radius.

For hemispherical sound wave propagation through homogeneous loss free medium, one can estimate noise levels at various locations at different sources using model based on first principle.

$$\mathbf{Lp_2 = Lp_1 - 20 \log (r_2/r_1) - Ae_{1,2}}$$

Where:

Lp_1& Lp_2 are sound levels at points located at distances r_1& r_2 from the source.

$Ae_{1,2}$ is the excess attenuation due to environmental conditions. Combined effect of all sources can be determined at various locations by logarithmic addition.

$$Lp_{total} = 10 \log \{10^{(Lp1/10)} + 10^{(Lp2/10)} + 10^{(Lp3/10)} + \ldots\ldots\}$$

Attenuation due to Green Belt has been taken to be 4.9 dB (A). The inputs required for the model are:

Source data has been computed taking into account of all the machinery and activities used in the mining process.

TABLE 7.12: PREDICTED NOISE INCREMENTAL VALUES FROM CLUSTER

Location ID	Background Value (Day) dB(A)	Incremental Value dB(A)	Total Predicted dB(A)	Residential Area Standards dB(A)
Habitation Near P1	38.4	43.2	44.4	55
Habitation Near P2	39.2	41.8	43.7	
Habitation Near E1	40.2	41.1	43.7	

Source: Lab Monitoring Data

The incremental noise level is found within the range of 41.1 – 43.2 dB (A) in Buffer zone. The noise level at different receptors in buffer zone is lower due to the distance involved and other topographical features adding to the noise attenuation. The resultant Noise level due to monitored values and calculated values at the receptors are based on the mathematical formula considering attenuation due to Green Belt as 4.9 dB (A)the barrier effect. From the above table, it can be seen that the ambient noise levels at all the locations near habitations are within permissible limits of Residential Area (buffer zone) as per THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000(The Principal Rules were published in the Gazette of India, vide S.O.123(E), dated 14.2.2000 and subsequently amended vide S.O. 1046(E),dated 22.11.2000, S.O. 1088(E), dated 11.10.2002, S.O. 1569 (E), dated19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment(Protection) Act, 1986.).

Ground Vibrations

Ground vibrations due to mining activities in the all the 3 Mines within cluster are anticipated due to operation of Mining Machines like Excavators, drilling and blasting, transportation vehicles, etc. However, the major source of ground vibration from the all the 4 mines is blasting. The major impact of the ground vibrations is observed on the domestic houses located in the villages nearby the mine lease area. The kuchha houses are more prone to cracks and damage due to the vibrations induced by blasting whereas RCC framed structures can withstand more ground vibrations. Apart from this, the ground vibrations may develop a fear factor in the nearby settlements.

Another impact due to blasting activities is fly rocks. These may fall on the houses or agricultural fields nearby the mining areas and may cause injury to persons or damage to the structures. The nearest habitations from 3 mines are given below in Table 7.13

TABLE 7.13: NEAREST HABITATION FROM EACH MINE

Location ID	Distance & Direction
Habitation Near P1	700m NW
Habitation Near P2	820m NW
Habitation Near E1	890m NW

The ground vibrations due to the blasting in all the mines are calculated using the empirical equation for assessment of peak particle velocity (PPV) is:

$$V = K [R/Q^{0.5}]^{-B}$$

Where –
V = peak particle velocity (mm/s)
K = site and rock factor constant
Q = maximum instantaneous charge (kg)
B = constant related to the rock and site (usually 1.6)
R = distance from charge (m)

TABLE 7.14: GROUND VIBRATIONS AT 3 MINES

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in m/ms
P1	66	700	0.400
P2	18	820	0.110
E1	12	890	0.070

Source: Blasting Calculations

From the above table, the charge per blast is considered as maximum in each mine and the resultant PPV is well below the Peak Particle Velocity of 8 mm/s as per Directorate General of Mines Safety for safe level criteria through Circular No. 7 dated 29/8/1997.

Socio Economic Environment –

The 3 mines shall contribute towards CER and the community shall develop.

TABLE 7.15: SOCIO ECONOMIC BENEFITS FROM 3 MINES

Location ID	Project Cost	CER @ 2%
P1	Rs.66,10,000/-	Rs.1,32,200/-
P2	Rs.69,00,000/-	Rs.1,38,000/-
Total	**Rs. 1,35,10,000/-**	**Rs.2,70,200/-**
E1	Rs.28,30,000/-	Rs.56,600/-
Grand Total	**Rs. 1,63,40,000**	**Rs.3,26,800/-**

As per para 6 (II) of the office memorandum, all the mines being a green field project & Capital Investment is ≤ 100 crores, they shall contribute 2% of Capital Investment towards CER as per directions of EAC/SEAC.

- The Proposed Project –P1 shall fund towards CER – **Rs 1,32,200/-/-**
- The 3 Projects in Cluster shall fund towards CER – **Rs 3,26,800/-**

TABLE 7.16: EMPLOYMENT BENEFITS FROM 3 MINES

Location ID	Employment
P1	30
P2	14
E1	13
Grand Total	**57**

A total of **57** people will get employment due to the proposed mines in cluster.

TABLE 7.17: GREENBELT DEVELOPMENT BENEFITS FROM 3 MINES

CODE	No of Trees proposed to be planted	Survival %	Name of the Species	No. of Trees expected to be grown
P1	500	80%	Neem, Casuarina	400
P2	100	80%	Neem, Casuarina	80
E1	100	80%	Neem, Casuarina	80
Total	**700**	**80%**	**Neem, Casuarina**	**560**

Based on the Proposed Mining Plan it is anticipated that the proponent P1 shall grow native species of Neem in the Cluster at a rate of 500 Trees Planted over a period of 5 Years with Survival Rate of 80% and expected growth is around 400 Trees in the Proposed Quarry.

7.5 PLASTIC WASTE MANAGEMENT PLAN

The Project Proponent shall comply with Tamil Nadu Government Order (Ms) No. 84 Environment and Forest (EC.2) Department Dated: 25.06.2018 regarding ban on one time use and throw away plastics irrespective of thickness with effect from 01.01.2019 under Environment (Protection) Act, 1986.

Objective –

- To investigate the actual supply chain network of plastic waste.
- To identify and propose a sustainable plastic waste management by installing bins for collection of recyclables with all the plastic waste
- Preparation of a system design layout, and necessary modalities for implementation and monitoring.

TABLE 7.18: ACTION PLAN TO MANAGE PLASTIC WASTE

Sl.No.	Activity	Responsibility
1	Framing of Layout Design by incorporating provision of the Rules, user fee to be charged from waste generators for plastic waste management, penalties/fines for littering, burning plastic waste or committing any other acts of public nuisance	Mines Manager
2	Enforcing waste generators to practice segregation of bio-degradable, recyclable and domestic hazardous waste	Mines Manager
3	Collection of plastic waste	Mines Foreman
4	Setting up of Material Recovery Facilities	Mines Manager
5	Segregation of Recyclable and Non-Recyclable plastic waste at Material Recovery Facilities	Mines Foreman
6	Channelization of Recyclable Plastic Waste to registered recyclers	Mines Foreman
7	Channelization of Non-Recyclable Plastic Waste for use either in Cement kilns, in Road Construction	Mines Foreman
8	Creating awareness among all the stakeholders about their responsibility	Mines Manager
9	Surprise checking's of littering, open burning of plastic waste or committing any other acts of public nuisance	Mine Owner

Source: Proposed by FAE's and EC

7.6 POST COVID HEALTH MANAGEMENT PLAN

COVID – 19 disease caused by SARS-CoV-2 Coronavirus is relatively a new disease, with fresh information being known on a dynamic basis about the natural history of the disease, especially in terms of post-recovery events.

After acute COVID-19 illness, recovered patients may continue to report wide variety of signs and symptoms including fatigue, body ache, cough, sore throat, difficulty in breathing, etc. As of now there is limited evidence of post-COVID sequalae and further research is required and is being actively pursued. A holistic approach is required for follow up care and well-being of all post COVID recovering patients.

Post-COVID Follow Up Protocol –

- Continue COVID appropriate behaviour (use of mask, hand & respiratory hygiene, physical distancing).
- Drink adequate amount of warm water (if not contra-indicated).
- Make sure your workplaces are clean and hygienic
- Surfaces (e.g., desks and tables) and objects (e.g., telephones, helmet) need to be wiped with disinfectant regularly
- Put sanitizing hand rub dispensers in prominent places around the workplace. Make sure these dispensers are regularly refilled
- Display posters promoting hand-washing
- Make sure that staff, contractors and customers have access to places where they can wash their hands with soap and water
- Display posters promoting respiratory hygiene.

- Brief your employees, contractors and customers that if COVID-19 starts spreading in your community anyone with even a mild cough or low-grade fever (37.3°C or more) need to stay at home. They should also stay home (or work from home) if they have had to take simple medications, such as paracetamol/acetaminophen, ibuprofen or aspirin, which may mask symptoms of infection
- Keep communicating and promoting the message that people need to stay at home even if they have just mild symptoms of COVID-19.
- Consider whether a face-to-face meeting or event is needed. Could it be replaced by a teleconference or online event?
- Could the meeting or event be scaled down so that fewer people attend?
- Pre-order sufficient supplies and materials, including tissues and hand sanitizer for all employees. Have surgical masks available to offer anyone who develops respiratory symptoms.
- It is also suggested by the Ministry of AYUSH that the use of Chyawanprash in the morning (1 teaspoonful) with luke warm water/milk is highly recommended (under the direction of Registered Ayurveda physician) as in the clinical practice Chyawanprash is believed to be effective in post-recovery period.
- If there is persistent dry cough / sore throat, do saline gargles and take steam inhalation. The addition of herbs/spices for gargling/steam inhalation. Cough medications, should be taken on advice of medical doctor or qualified practitioner of Ayush.
- Look for early warning signs like high grade fever, breathlessness, $Sp0_2 < 95\%$, unexplained chest pain, new onset of confusion, focal weakness.
- Avoid smoking and consumption of alcohol.
- Communicate to your employees and contractors about the plan and make sure they are aware of what they need to do – or not do – under the plan. Emphasize key points such as the importance of staying away from work even if they have only mild symptoms or have had to take simple medications (e.g. paracetamol, ibuprofen) which may mask the symptoms
- The plan should address how to keep your business running even if a significant number of employees, contractors and suppliers cannot come to your place of business - either due to local restrictions on travel or because they are ill.

8. PROJECT BENEFITS

8.0 GENERAL

This Proposed Project Tvl.City Blue Metals for Quarrying Rough Stone at Iynkunam Village aims to produce cumulatively 3,17,200 m^3 Rough Stone over a period of 5 Years. This will enhance the socio-economic activities in the adjoining areas and will result in the following benefits

- Increase in Employment Potential
- Improvement in Socio-Economic Welfare
- Improvement in Physical Infrastructure
- Improvement in Social infrastructure

8.1 EMPLOYMENT POTENTIAL

It is proposed to provide employment to about 30 persons for carrying out mining operations and give preference to the local people in providing employment in this project. In addition, there will be opportunity for indirect employment to many people in the form of contractual jobs, business opportunities, service facilities etc. the economic status of the local people will be enhanced due to mining project.

8.2 SOCIO-ECONOMIC WELFARE MEASURES PROPOSED

The impact of mining activity in the area will be more positive on the socio-economic environment in the immediate project impact area. The employment opportunities both direct and indirect will contribute to enhanced money incomes to job seekers with minimal skill sets especially among the local communities.

8.3 IMPROVEMENT IN PHYSICAL INFRASTRUCTURE

The proposed quarry is located in Iynkunam Village, Kilpennathur Taluk and Tiruvannamalai District of Tamil Nadu and the area have communications, roads and other facilities already well established. The following physical infrastructure facilities will further improve due to proposed mine.

- Road Transport facilities
- Communications
- Medical, Educational and social benefits will be made available to the nearby civilian population in addition to the workmen employed in the mine.

8.4 IMPROVEMENT IN SOCIAL INFRASTRUCTURE

Employment is expected during civil construction period, in trade, garbage lifting, sanitation and other ancillary services, Employment in these sectors will be primarily temporary or contractual and involvement of unskilled labour will be more. A major part of the labour force will be mainly from local villagers who are expected to engage themselves both in agriculture and mining activities. This will enhance their income and lead to overall economic growth of the area.

8.5 OTHER TANGIBLE BENEFITS

The proposed mine is likely to have other tangible benefits as given below.

- Indirect employment opportunities to local people in contractual works like construction of infrastructural facilities, transportation, sanitation, for supply of goods and services to the mine and other community services.
- Additional housing demand for rental accommodation will increase
- Cultural, recreation and aesthetic facilities will also improve
- Improvement in communication, transport, education, community development and medical facilities and overall change in employment and income opportunity
- The State Government will also benefit directly from the proposed mine, through increased revenue from royalties, cess, DMF, GST etc.,

CORPORATE SOCIAL RESPONSIBILITY

Project Proponent will take responsibility to develop awareness among all levels of their staff about CSR activities and the integration of social processes with business processes. Those involved with the undertaking of CSR activities will be provided with adequate training and re-orientation.

Under this programme, the project proponent will take-up following programmes for social and economic development of villages within 10 km of the project site. For this purpose, separate budget will be provided every year. For finalization of these schemes, proponent will interact with LSG. The schemes will be selected from the following broad areas –

- Health Services
- Social Development
- Infrastructure Development
- Education & Sports
- Self-Employment

CSR Cost Estimation

CSR activities will be taken up in the Iynkunam village mainly contributing to education, health, training of women self-help groups and contribution to infrastructure etc., CSR budget is allocated as 2.5% of the profit.

CORPORATE ENVIRONMENT RESPONSIBILITY

Allocation for Corporate Environment Responsibility (CER) shall be made as per Government of India, MoEF & CC Office Memorandum F.No.22-65/2017-IA.III, Dated: 01.05.2018.

As per para 6 (II) of the office memorandum, being a green field project & Capital Investment is ≤ 100 crores, This proposed project shall contribute 2% of Capital Investment towards CER as per directions of EAC/SEAC. Cumulative Capital cost is Rs.66,10,000/- and 2% of the same works out to Rs.1,32,200/-

TABLE 8.1: CER – ACTION PLAN

Activity	Beneficiaries	Total
Providing funds for improving Sanitation and drinking water facilities at Iynkunam Government School	Iynkunam Village peoples	Rs. 1,32,200/-
TOTAL		**Rs. 1,32,200/-**

Source: Field survey conducted by FAE, consultation with project proponent

9. ENVIRONMENTAL COST BENEFIT ANALYSIS

Not Applicable, Since Environmental Cost Benefit Analysis not recommended at the Scoping stage.

10. ENVIRONMENTAL MANAGEMENT PLAN

10.0 GENERAL

Environment Management Plan (EMP) aims at the preservation of ecological system by considering in-built pollution abatement facilities at the proposed site. Good practices of Environmental Management plan will ensure to keep all the environmental parameters of the project in respect of Ambient Air quality, Water quality, Socio – economic improvement standards.

Mitigation measures at the source level and an overall environment management plan at the study area are elicited so as to improve the supportive capacity of the receiving bodies. The EMP presented in this chapter discusses the administrative aspects of ensuring that mitigative measures are implemented and their effectiveness monitored after approval of the EIA.

10.1 ENVIRONMENTAL POLICY

The Project Proponent is committed to conduct all its operations and activities in an environmentally responsible manner and to continually improve environmental performance.

The Proponent Tvl. City Blue Metal will –

- Meet the requirements of all laws, acts, regulations, and standards relevant to its operations and activities
- Implement a program to train employees in general environmental issues and individual workplace environmental responsibilities
- Allocate necessary resources to ensure the implementation of the environmental policy
- Ensure that an effective closure strategy is in place at all stages of project development and that progressive reclamation is undertaken as early as possible to reduce potential long-term environmental and community impacts
- Implement monitoring programmes to provide early warning of any deficiency or unanticipated performance in environmental safeguards
- Conduct periodic reviews to verify environmental performance and to continuously strive towards improvement

Description of the Administration and Technical Setup –

The Environment Monitoring Cell discussed under Chapter 6 will ensure effective implementation of environment management plan and to ensure compliance of environmental statutory guidelines through Mine Management Level of each Proposed Quarry.

The said team will be responsible for:

- Monitoring of the water/ waste water quality, air quality and solid waste generated
- Analysis of the water and air samples collected through external laboratory
- Implementation and monitoring of the pollution control and protective measures/ devices which shall include financial estimation, ordering, installation of air pollution control equipment, waste water treatment plant, etc.
- Co-ordination of the environment related activities within the project as well as with outside agencies
- Collection of health statistics of the workers and population of the surrounding villages
- Green belt development
- Monitoring the progress of implementation of the environmental monitoring programme
- Compliance to statutory provisions, norms of State Pollution Control Board, Ministry of Environment and Forests and the conditions of the environmental clearance as well as the consents to establish and consents to operate.

10.2 LAND ENVIRONMENT MANAGEMENT –

Landscape of the area will be changed due to the quarrying operation, restoration of the land by converting the quarry pit into temporary reservoir and the remaining part of the area (un utilized areas, infrastructure, haul Roads) will be utilized for greenbelt development. Aesthetic of the Environment will not be affected. There is no major vegetation in the project area during the course of quarrying operation and after completion of the quarrying operation thick plantation will be developed under greenbelt development programme.

TABLE 10.1: PROPOSED CONTROLS FOR LAND ENVIRONMENT

CONTROL	RESPONSIBILITY
Design vehicle wash-down areas so that all runoff water is captured and passed through oil water separators and sediment catchment devices.	Mines Manager
Refueling to be undertaken in a safe location, away from vehicle movement pathways&100 m away of any watercourse Refueling activity to be under visual observation at all times. Drainage of refueling areas to sumps with oil/water separation	Mine Foreman & Mining Mate
Soil and groundwater testing as required following up a particular incident of contamination.	Mines Manager
At conceptual stage, the mining pits will be converted into Rain Water Harvesting. Remaining area will be converted into greenbelt area	Mines Manager
No external dumping i.e., outside the project area	Mine Foreman
Garland drains with catch pits / settlement traps to be provided all around the project area to prevent run off affecting the surrounding lands.	Mines Manager
The periphery of Project area will be planted with thick plantation to arrest the fugitive dust, which will also act as acoustic barrier.	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

10.3 SOIL MANAGEMENT

There is no overburden or waste anticipated from proposed project.

TABLE 10.2: PROPOSED CONTROLS FOR SOIL MANAGEMENT

CONTROL	RESPONSIBILITY
Surface run-off from the project boundary via garland drains will be diverted to the mine pits	Mine Foreman & Mining Mate
Design haul roads and other access roads with drainage systems to minimize concentration of flow and erosion risk	Mines Manager
Empty sediment from sediment traps Maintain, repair or upgrade garland drain system	Mines Manager
Test soils for pH, EC, chloride, size & water holding capacity	Manager Mines

Source: Proposed by FAE's & EIA Coordinator

10.4 WATER MANAGEMENT

In the proposed quarrying project, no process is involved for the effluent generation, only oil & grease from the machinery wash is anticipated and domestic sewage from mine office.

The quarrying operation is proposed upto a depth of 71 m (46mAGL + 25m BGL), the water table in the area is 52m – 56m below ground level, hence the proposed project will not intersect the Ground water table during entire quarry period.

TABLE 10.3: PROPOSED CONTROLS FOR WATER ENVIRONMENT

CONTROL	RESPONSIBILITY
To maximize the reuse of pit water for water supply	Mines Foreman
Temporary and permanent garland drain will be constructed to contain the catchments of the mining area and to divert runoff from undisturbed areas through the mining areas	Mines Manager
Natural drains/nallahs/brooklets outside the project area should not be disturbed at any point of mining operations	Mines Manager
Ensure there is no process effluent generation or discharge from the project area into water bodies	Mines Foreman
Domestic sewage generated from the project area will be disposed in septic tank and soak pit system	Mines Foreman
Monthly or after rainfall, inspection for performance of water management structures and systems	Mines Manager
Conduct ground water and surface water monitoring for parameters specified by CPCB	Manager Mines

Source: Proposed by FAE's & EIA Coordinator

10.5 AIR QUALITY MANAGEMENT

The proposed quarrying activity would result in the increase of particulate matter concentrations due to fugitive dust. Daily water sprinkling on the haul roads, approach roads in the vicinity would be undertaken and will be continued as there is possibility for dust generation due to truck mobility. It will be ensured that vehicles are properly maintained to comply with exhaust emission requirements

TABLE 10.4: PROPOSED CONTROLS FOR AIR ENVIRONMENT

CONTROL	RESPONSIBILITY
Generation of dust during excavation is minimized by daily (twice) water sprinkling on working face and daily (twice) water sprinkling on haul road	Mines Manager
Wet drilling procedure /drills with dust extractor system to control dust generation during drilling at source itself is implemented	Mines Manager
Maintenance as per operator manual of the equipment and machinery in the mines to minimizing air pollution	Mines Manager
Ambient Air Quality Monitoring carried out in the project area and in surrounding villages to access the impact due to the mining activities and the efficacy of the adopted air pollution control measures	Mines Manager
Provision of Dust Mask to all workers	Mines Manager
Greenbelt development all along the periphery of the project area	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

10.6 NOISE POLLUTION CONTROL

There will be intermittent noise levels due to vehicular movement, trucks loading, drilling and blasting and cutting activities. No mining activities are planned during night time.

TABLE 10.5: PROPOSED CONTROLS FOR NOISE ENVIRONMENT

CONTROL	RESPONSIBILITY
Development of thick greenbelt all along the Buffer Zone (7.5 Meters) of the project area to attenuate the noise and the same will be maintained	Mines Manager
Preventive maintenance of mining machinery and replacement of worn-out accessories to control noise generation	Mines Foreman
Deployment of mining equipment with an inbuilt mechanism to reduce noise	Mines Manager
Provision of earmuff / ear plugs to workers working in noise prone zones in the mines	Mining Mate
Provision of effective silencers for mining machinery and transport vehicles	Mines Manager
Provision of sound proof AC operator cabins to HEMM	Mines Manager

Sharp drill bits are used to minimize noise from drilling	Mines Foreman
Controlled blasting technologies are adopted by using delay detonators to minimize noise from blasting	Mines Manager
Annual ambient noise level monitoring are carried out in the project area and in surrounding villages to access the impact due to the mining activities and the efficacy of the adopted noise control measures. Additional noise control measures will be adopted if required as per the observations during monitoring	Mines Manager
Reduce maximum instantaneous charge using delays while blasting	Mining Mate
Change the burden and spacing by altering the drilling pattern and/or delay layout, or altering the hole inclination	Mines Manager
Undertake noise or vibration monitoring	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

10.7 GROUND VIBRATION AND FLY ROCK CONTROL

The Rough stone quarry operation creates vibration due to the blasting and movement of Heavy Earth moving machineries, fly rocks due to the blasting.

TABLE 10.6: PROPOSED CONTROLS FOR GROUND VIBRATIONS & FLY ROCK

CONTROL	RESPONSIBILITY
Controlled blasting using delay detonators will be carried out to maintain the PPV value (below 8Hz) well within the prescribed standards of DGMS	Mines Manager
Drilling and blasting will be carried under the supervision of qualified persons	Mines Manager
Proper stemming of holes should be carried out with statutory competent qualified blaster under the supervision of statutory mines manager to avoid any anomalies during blasting	Mines Manager
Suitable spacing and burden will be maintained to avoid misfire / fly rocks	Manager Mines
Number of blast holes will be restricted to control ground vibrations	Manager Mines
Blasting will be carried out only during noon time	Mining Mate
Undertake noise or vibration monitoring	Mines Manager
ensure blast holes are adequately stemmed for the depth of the hole and stemmed with suitable angular material	Mines Foreman

Source: Proposed by FAE's & EIA Coordinator

10.8 BIOLOGICAL ENVIRONMENT MANAGEMENT

The proponent will take all necessary steps to avoid the impact on the ecology of the area by adopting suitable management measures in the planning and implementation stage. During mining, thick plantation will be carried out around the project periphery, on safety barrier zone, on top benches of quarried out area etc.,

Following control measures are proposed for its management and will be the responsibility of the Mines Manager.

- Greenbelt development all along the safety barrier of the project area
- It is also proposed to implement the greenbelt development programme and post plantation status will be regularly checked for every season.
- The main attributes that retard the survival of sapling is fugitive dust, this fugitive dust can be controlled by water sprinkling on the haul roads and installing a sprinkler unit near the newly planted area.
- Year wise greenbelt development will be recorded and monitored
    - Based on the area of plantation.
    - Period of plantation
    - Type of plantation
    - Spacing between the plants
    - Type of manuring and fertilizers and its periods
    - Lopping period, interval of watering
    - Survival rate
    - Density of plantation

- The ultimate reclamation planned leaves a congenial environment for development of flora & immigration of small fauna through green belt and water reservoir. The green belt and water reservoir developed within the Project at the end of mine life will attract the birds and animals towards the project area in the post mining period.

10.8.1 Green Belt Development Plan

About 500 nos. of saplings is proposed to be planted for the Mining plan period in safety barrier of applied mine lease area with survival rate 80%. The greenbelt development plan has been prepared keeping in view the land use changes that will occur due to mining operation in the area.

TABLE 10.7 PROPOSED GREENBELT ACTIVITIES FOR5 YEAR PLAN PERIOD

Year	No. of trees proposed to be planted	Survival %	Name of the species	No. of trees expected to be grown
I	100	80%	Neem, Pongamia, Pinnata, casuarina..etc	80
II	100	80%		80
III	100	80%		80
IV	100	80%		80
V	100	80%		80

Source: Conceptual Plan of Approved Mining plan& Proposed by FAE's & EIA Coordinator

The objectives of the greenbelt development plan are –

- Provide a green belt around the periphery of the quarry area to combat the dispersal of dust in the adjoining areas,
- Protect the erosion of the soil, Conserve moisture for increasing ground water recharging,
- Restore the ecology of the area, restore aesthetic beauty of the locality and meet the requirement of fodder, fuel and timber of the local community.

A well-planned Green Belt with multi rows (three tiers) preferably with long canopy leaves shall be developed with dense plantations around the boundary and haul roads to prevent air, dust noise propagation to undesired places and efforts will be taken for the enhancement of survival rate.

10.8.2 Species Recommended for Plantation

Following points have been considered while recommending the species for plantation:

- Creating of bio-diversity.
- Fast growing, thick canopy cover, perennial and evergreen large leaf area,
- Efficient in absorbing pollutants without major effects on natural growth

TABLE 10.8: RECOMMENDED SPECIES TO PLANT IN THE GREENBELT

S.No	Botanical Name	Local Name	Importance
1.	Azadirachta indica	Neem, Vembu	Neem oil & neem products

Source: Proposed by FAE's & EIA Coordinator

10.9 OCCUPATIONAL SAFETY & HEALTH MANAGEMENT

Occupational safety and health are very closely related to productivity and good employer-employee relationship. The main factors of occupational health impact in quarries are fugitive dust and noise. Safety of employees during quarrying operation and maintenance of mining equipment will be taken care as per Mines Act 1952 and Rule 29 of Mines Rules 1955. To avoid any adverse effect on the health of workers due to dust, noise and vibration sufficient measures have been provided.

10.9.1 Medical Surveillance and Examinations –

- Identifying workers with conditions that may be aggravated by exposure to dust & noise and establishing baseline measures for determining changes in health.
- Evaluating the effect of noise on workers
- Enabling corrective actions to be taken when necessary
- Providing health education

The health status of workers in the mine shall be regularly monitored under an occupational surveillance program. Under this program, all the employees are subjected to a detailed medical examination at the time of employment. The medical examination covers the following tests under mines act 1952.

- General Physical Examination and Blood Pressure
- X-ray Chest and ECG
- Sputum test
- Detailed Routine Blood and Urine examination

The medical histories of all employees will be maintained in a standard format annually. Thereafter, the employees will be subject to medical examination annually. The below tests keep upgrading the database of medical history of the employees.

TABLE 10.9: MEDICAL EXAMINATION SCHEDULE

Sl.No	Activities	1st Year	2nd Year	3rd Year	4th Year	5th Year
1	Initial Medical Examination (Mine Workers)					
A	Physical Check-up					
B	Psychological Test					
C	Audiometric Test					
D	Respiratory Test					
2	Periodical Medical Examination (Mine Workers)					
A	Physical Check – up					
B	Audiometric Test					
C	Eye Check – up					
D	Respiratory Test					
3	Medical Camp (Mine Workers & Nearby Villagers)					
4	Training (Mine Workers)					

Medical Follow ups:- Work force will be divided into three targeted groups age wise as follows:-		
Age Group	**PME as per Mines Rules 1955**	**Special Examination**
Less than 25 years	Once in a Three Years	In case of emergencies
Between 25 to 40 Years	Once in a Three Years	In case of emergencies
Above 40 Years	Once in a Three Years	In case of emergencies
Medical help on top priority immediately after diagnosis/ accident is the essence of preventive aspects.		

10.9.2 Proposed Occupational Health and Safety Measures –

- The mine site will have adequate drinking water supply so that workers do not get dehydrated.
- Lightweight and loose-fitting clothes having light colours will be preferred to wear.
- Noise exposure measurements will be taken to determine the need for noise control strategies.
- The personal protective equipment will be provided for mine workers.
- Supervisor will be instructed for reporting any problems with hearing protectors or noise control equipment.
- At noisy working activity, exposure time will be minimized.

- Dust generating sources will be identified and proper control measure will be adopted.
- Periodic medical examinations will be provided for all workers.
- Strict observance of the provisions of DGMS Acts, Rules and Regulations in respect of safety both by management and the workers.
- The width of road will be maintained more than thrice the width of the vehicle. A code of traffic rules will be implemented.
- In respect of contract work, safety code for contractors and workers will be implemented. They will be allowed to work under strict supervision of statutory person/officials only after they will impart training at vocational training centres. All personal protective equipment's will be provided to them.
- A safety committee meeting every month will be organized to discuss the safety of the mines and the persons employed.
- Celebration of annual mines safety week and environmental week in order to develop safety awareness and harmony amongst employees and co quarry owners.

FIGURE 10.1: PERSONAL PROTECTIVE EQUIPMENT TO THE MINE WORKERS

10.9.3 Health and Safety Training Programme

The Proponent will provide special induction program along with machinery manufacturers for the operators and co-operators to run and maintain the machinery effectively and efficiently. The training program for the supervisors and office staffs will be arranged in the Group Vocational Training Centres in the State and engage Environmental Consultants to provide periodical training to all the employees to carry out the mining operation in and eco-friendly manner.

TABLE 10.10: LIST OF PERIODICAL TRAININGS PROPOSED FOR EMPLOYEES

Course	Personnel	Frequency	Duration	Instruction
New-Employee Training	All new employees exposed to mine hazards	Once	One week	Employee rights Supervisor responsibilities Self-rescue Respiratory devices Transportation controls Communication systems Escape and emergency evacuation Ground control hazards Occupational health hazards Electrical hazards First aid Explosives
Task Training Like Drilling, Blasting, Stemming, safety, Slope stability, Dewatering, Haul road maintenance,	Employees assigned to new work tasks	Before new Assignments	Variable	Task-specific health &safety procedures and SOP for various mining activity. Supervised practice in assigned work tasks.
Refresher Training	All employees who received new-hire training	Yearly	One week	Required health and safety standards Transportation controls Communication systems Escape ways, emergency evacuations Fire warning Ground control hazards First aid Electrical hazards Accident prevention Explosives Respirator devices
Hazard Training	All employees exposed to mine hazards	Once	Variable	Hazard recognition and avoidance Emergency evacuation procedures Health standards Safety rules Respiratory devices

Source: Proposed by FAE's & EIA Coordinator as per DGMS Norms

10.9.4 Budgetary Provision for Environmental Management –

Adequate budgetary provision has been made by the Company for execution of Environmental Management Plan. The Table 10.11 gives overall investment on the environmental safeguards and recurring expenditure for successful monitoring and implementation of control measures.

TABLE 10.11: EMP BUDGET FOR PROPOSED PROJECT

Sl.No.	Description	Item	Capital cost (Rs. In Lakhs)	Recurring cost per annum (Rs. in Lakhs)
1	Occupational health & safety	Dust Mask, Safety Shoes, Helmets Ear Plugs, Gloves, Goggles Reflector jacket, Safety Belt, Medical check ups	0.50	0.10
2	Environmental Monitoring	Air, Water, Noise & Vibration, Soil Parameters	0.76	0.76
3	Water & Soil erosion	Garland drains &Settling tanks, check dam/gully plugs, etc	0.75	0.20
4	Drinking Water Facilities and Sanitation Facilities		1.00	0.20
5	Water Sprinkling Arrangements		0.85	0.20
6	Haul Road Maintenance		1.00	0.30
7	Green belt Development & Plantation		0.50	0.10
8	Environmental Awareness Programme		0.10	0.02
9	Fencing, Fertilizer, Manure, Manpower, etc.		1.20	0.20
Total			**6.66**	**2.08**

In order to implement the environmental protection measures, an amount of Rs.6.66 lakhs as capital cost and recurring cost as Rs. 2.08 lakhs as recurring cost is proposed considering present market price considering present market scenario for the proposed project.

10.10 CONCLUSION –

Various aspects of mining activities were considered and related impacts were evaluated. Considering all the possible ways to mitigate the environmental concerns Environmental Management Plan was prepared and fund has been allocated for the same. The EMP is dynamic, flexible and subjected to periodic review. For project where the major environmental impacts are associated, EMP will be under regular review. Senior Management responsible for the project will conduct a review of EMP and its implementation to ensure that the EMP remains effective and appropriate. Thus, the proper steps will be taken to accomplish all the goals mentioned in the EMP and the project will bring the positive impact in the study area.

11. SUMMARY AND CONCLUSION

11.1 INTRODUCTION

This EIA report is prepared by considering Cumulative load of Iynkunam Rough Stone Cluster Quarries consisting of 4 Proposed Quarries and 1 existing quarry with total extent of Cluster of 8.00 ha in Iynkunam Village, Kilpenathur Taluk, Tiruvannamalai District and Tamil Nadu State, cluster area calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016.

This EIA Report is prepared in compliance with ToR obtained vide Lr.No. SEIAA-TN/F.No.7908/SEAC/TOR-871/2020 Dated: 12.03.2021. And the Baseline Monitoring study has been carried out during the period of March – May 2021.

11.2 PROJECT DESCRIPTION

TABLE 11.1: SALIENT FEATURES

Name of the Quarry	Tvl.City Blue Metals Rough Stone Quarry		
Toposheet No	57 P/03		
Latitude between	12°15'52.05"N to 12°15'55.69"N		
Longitude between	79°09'46.88"E to 79°09'51.62"E		
Highest Elevation	220 m AMSL		
Proposed Depth of Mining	71 m (46mAGL + 25m BGL) (1m Topsoil + 70m Rough Stone)		
Geological Resources	Rough Stone in m^3		Topsoil m^3
	5,30,000		7,623
Mineable Reserves	Rough Stone in m^3		Topsoil m^3
	3,17,200		7,623
Proposal for this Mining Plan Period	Rough Stone in m^3		Topsoil m^3
	3,17,200		7,623
Existing Pit Dimension	100m (L) x 55m (W) x 10m (D) bgl		
Ultimate Pit Dimension	Pit-I	126m (L) x 80m (W) x 71m (D) (46mAGL + 25m BGL)	
Water Level in the surrounds area	52 - 56 m bgl		
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting		
Topography	The lease applied area is hilly terrain. The area has gentle slope with a gradient of 1 to 8 towards north western side. The altitude of the area is 220-180m (max) above mean sea level. The area is covered by 1m (avg) thickness of Topsoil Formation. Massive Charnockite is found after 1m (Topsoil Formation) which is clearly inferred from the nearby existing quarry pit.		
Machinery proposed	Jack Hammer		8 Nos
	Compressor		2 Nos
	Excavator with Bucket & Rock Breaker		1 Nos
	Tippers		3 Nos
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.		
Proposed Manpower Deployment	30 Nos		
Total Project Cost	Project Cost		Rs.62,30,000/-
	Environment Monitoring Cost		Rs.3,80,000/-
	Total		Rs.66,10,000/-
CER Cost @ 2% of Project Cost	Rs.1,32,200/-		
Nearby Water Bodies	Thurunjal River		6km South West
	Tank Near Namiyandal		1.5km SW
	Tank Near Noimalai		8km SW
	Tank Near Tirumalai Nagar		7.8km SW

	Tank Near Avalurpettai	9.8km NE
	Tank near Karungalikuppam	5km SE
	Kolathur Tank	9.7km SE
	Tank near Su.Palliampattu	5km SW
	Tank near Kasthambadi	6.8km NW
	Tank near Ganalapadi	2.3km N
	Tank near Pallikondapattu	6km SW
	Tank near Hariyankuppam	800m N
Greenbelt Development Plan	Proposed to plant 500 trees	
Proposed Water Requirement	6.5 KLD	
Nearest Habitation	700m NW	

Source: Approved Mining Plan and Survey of India Toposheet

TABLE 11.2: LAND USE PATTERN OF THE PROPOSED PROJECT

DESCRIPTION	PRESENT AREA IN (HA)	AREA AT THE END OF MINING PLAN (HA)
Area under Quarrying	0.32.9	1.00.0
Infrastructure	Nil	Nil
Road	Nil	Nil
Green Belt	Nil	Nil
Unutilized area	0.67.1	Nil
TOTAL	**1.00.0**	**1.00.0**

Source: Approved Mining Plan

TABLE 11.3 RESOURCES AND RESERVES OF PROPOSED PROJECT

PARTICULARS	DETAILS	
	Rough Stone	**Topsoil**
Geological Resources in m^3	5,30,000	7,623
Mineable Reserves in m^3	3,17,200	7,623
Yearwise Production for five years in m^3	3,17,200	7,623
Mining Plan Period	5 years	
Number of Working Days	300 days	
Production per day in m^3	**211**	**25**
No of Lorry loads ($6m^3$ per load)	**35**	**4**
Total Depth of Mining	71 m bgl (1 m Topsoil + 70 m Rough Stone) (46mAGL + 25m BGL)	

Source: Approved Mining Plan

TABLE 11.4: ULTIMATE PIT DIMENSION

Pit	Length (Max) (m)	Width (Max) (m)	Depth (Max)
I	126	80	71m (46mAGL + 25m BGL)

Source: Approved Mining Plan

TABLE 11.5: WATER REQUIREMENT

*Purpose	Quantity	Source
Dust Suppression	3.1 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Green Belt development	2.5 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Domestic purpose	0.9 KLD	Water Tankers
Total	**6.5 KLD**	

* Drinking Water will be sourced from approved water vendors

Source: Prefeasibility report

11.3 DESCRIPTION OF THE ENVIRONMENT

The baseline monitoring study was carried out during March – May 2021 to assess the existing environmental scenario in the area. For the purpose of EIA studies, project area was considered as the core zone and area outside the project area up to 10km radius from the periphery of the project site was considered as buffer zone.

Baseline Environmental data has been collected with reference to proposed mines for: -

a) Land

b) Water

c) Air

d) Noise

e) Biological

f) Socio-economic status

11.3.1 Land Environment

The existing land use pattern of the study area based on the latest satellite imagery is given below:

TABLE 11.6: LAND USE / LAND COVER TABLE 10 KM RADIUS

S.No	CLASSIFICATION	AREA_Ha	AREA_%
BUILTUP			
1	Builtup-Urban	331.599	1.01
2	Builtup-Rural	526.811	1.61
3	Mining Area	217.911	0.66
AGRICULTURAL LAND			
4	Crop Land	20599.4	63.1
5	Fallow Land	6808.38	20.8
BARREN/WASTE LANDS			
6	Scrub Land	707.644	2.17
7	Barren Rocky	175.979	0.53
WATER BODIES			
8	Water Bodies	2372.67	7.27
9	River	34.0057	0.1
FOREST			
10	Evergreen Forest	18.7107	0.05
11	Deciduous Forest	489.771	1.5
12	Scrub Forest	327.341	1
		32610.2224	100

Source: Survey of India Toposheet and Landsat Satellite Imagery

The total mining area within the study area is 217.911 ha i.e., 0.66%. The cluster area of 8.00ha contributes about 3.67% of the total mining area within the study area. This small percentage of Mining Activities shall not have any significant impact on the environment.

The proposed project site falls in the seismic Zone II, low damage risk zone as per BMTPC, Vulnerability Atlas of Seismic zone of India IS: 1893 – 2002. The project area falls in the hard rock terrain on the peninsular shield of south India which is highly stable.

SOIL CHARACTERISTICS

Physical Characteristics –

The physical properties of the soil samples were examined for texture, bulk density, porosity and water holding capacity. The soil texture found in the study area is Clay to Sandy Loam Soil and Bulk Density of Soils in the study area varied between 0.75 – 1.25 g/cc. The Water Holding Capacity and Porosity of the soil samples is found to be medium i.e. ranging from 34.2 – 47.2 %.

Chemical Characteristics –

- The nature of soil is slightly alkaline to strongly alkaline with pH range 7.25 to 8.63
- The available Nitrogen content range between 115 to 177 kg/ha
- The available Phosphorus content range between 0.64 to 1.38 kg/ha
- The available Potassium range between 29.7 to 59.4 mg/kg

11.3.2 Water Environment

Surface Water

Ph:

The pH is between 7.24 to 7.62 while turbidity found within the standards (Optimal pH range for sustainable aquatic life is 6.5 to 8.5 pH).

Total Dissolved Solids:

Total Dissolved Solids is 335 - 427 mg/l, the TDS mainly composed of carbonates, bicarbonates, Chlorides, phosphates and nitrates of calcium, magnesium, sodium and other organic matter.

Other parameters:

Chloride content is 72.8 – 90.4 mg/l. Nitrates is around 11.3 – 13.5 mg/l, while sulphates content is 25.7 – 0.35 mg/l.

Ground Water

The pH of the water samples collected ranged from 7.09 to 7.53 and within the acceptable limit of 6.5 to 8.5. pH, Sulphates and Chlorides of water samples from all the sources are within the limits as per the Standard. On Turbidity, the water samples meet the requirement. The Total Dissolved Solids were found in the range of 345 to 422 mg/l in all samples. The Total hardness varied between 127.5 to 247.1 mg/l for all samples.

On Microbiological parameters, the water samples from all the locations meet the requirement. The parameters thus analysed were compared with IS 10500:2012 and are well within the prescribed limits.

11.3.3 Air Environment

Site Specific Meteorology –

Site specific meteorology during the study period was recorded by an automated weather station.

TABLE 11.7: METEOROLOGICAL DATA RECORDED AT SITE

S.No	Parameters		Mar-2021	April– 2021	May- 2021
1	Temperature (^{0}C)	Max	30.9	31.8	32.8
		Min	26.0	28.4	29.1
		Avg.	28.45	30.1	30.9
2	Relative Humidity (%)	Avg.	79.7	76.6	73.03
3	Wind Speed (m/s)	Max	1.806	2.778	3.986
		Min	0.347	0.556	0.625
		Avg.	1.076	1.667	2.305
4	Cloud Cover (OKTAS)		0-8	0-8	0-8
5	Wind direction		SE,SSE	SW,SSW	S,SSW

Source: On-site monitoring/sampling by Omegaa Laboratories in association with GEMS

Ambient Air Quality Results –

The results of ambient air quality monitoring for the period (March to May 2021) are presented in the report. Data has been complied for three months.

As per monitoring data, PM_{10} ranges from 38.5 µg/m^3 to 44.9 µg/m^3, $PM_{2.5}$ data ranges from 18.8 µg/m^3 to 26.6 µg/m^3, SO_2 ranges from 5.1 µg/m^3 to 13.7 µg/m^3 and NO_2 data ranges from 22.6 µg/m^3 to 29.6 µg/m^3. The concentration levels of the above criteria pollutants were observed to be well within the limits of NAAQS prescribed by CPCB.

11.3.4 Noise Environment

Ambient noise levels were measured at 8 (Eight) locations around the proposed project area. Noise levels recorded in core zone during day time is 48.7 dB (A) Leq and during night time is 37.7 dB (A) Leq. Noise levels recorded in buffer zone during day time were from 46.7 to 49.3 dB (A) Leq and during night time were from 37.4 to 39.5 dB (A) Leq.Thus, the noise level for Industrial and Residential area meets the requirements of CPCB.

11.3.5 Biological Environment

There is no schedule I species of animals observed within study area as per Wildlife Protection Act 1972 as well as no species is in vulnerable, endangered or threatened category as per IUCN. There is no endangered red list species found in the study area. Hence this small operation over short period of time will not have any significant impact on the surrounding flora and fauna.

11.3.6 Socio-Economic Environment

An attempt has been made to assess the impact of the proposed mining project at Iynkunam Village on Socio-economic aspect of the study area. The various attributes that have been taken into account are population composition, employment generation, occupational shift, household income and consumption pattern. Implementation of the Proposed Mine Project will generate both direct and indirect employment. Besides, Mining operation will be legally valid and it will bring income to the state exchequer. At present seasonal agriculture is the main occupation of the people as more than half of the population depends on it. With the implementation of the proposed mining project the occupational pattern of the people in the area will change making more people engaged in mining-based activities rather in seasonal agriculture.

11.4 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The summary of anticipated adverse environmental impacts due to the proposed project and mitigation measures are given below: -

TABLE 11.8: ANTICIPATED IMPACTS & MITIGATION MEASURES

Impact	Mitigation Measure
Land Environment	
▪ Destruction of natural landscapes ▪ Changes in soil characteristics ▪ Soil erosion and slope instability	▪ Mining will be carried out as per approved mine plan in scientific and systematic way ▪ Safety Zone or Buffer area will be maintained and will not be mined and instead plantation will be carried out in the safety zone ▪ Barbed wire fencing will be provided all along the proposed mine boundary ▪ At conceptual stage, the land use pattern of the quarry will be changed into Greenbelt area and temporary reservoir ▪ Construction of garland ▪ Construction of garland drains all around the quarry pit and construction of settling traps at strategic location in lower elevations to prevent soil erosion due to surface runoff during rainfall and also to collect the storm water for various uses within the proposed area
Water Environment	
▪ Decrease in aquifer recharge and increase in surface runoff; ▪ Disturbance to land drainage, overload and erosion of watercourses; ▪ Changes to the surface over which water flows; ▪ Changes to surface and groundwater resources quantity and quality due to stream blockage and contamination by particulate matter or waste; ▪ Contamination of aquifers due to removal of the natural filter medium.	▪ Construction of garland drains all around the quarry pit and construction of settling traps at strategic location in lower elevations to prevent soil erosion due to surface runoff during rainfall and also to collect the storm water for various uses within the proposed area ▪ De-silting will be carried out before and immediately after the monsoon season and the settling tank and drains will be cleaned weekly, especially during monsoons ▪ Domestic sewage from site office & urinals/latrines provided in project area will be discharged through septic tank followed by soak pit system. ▪ Tippers & HEMM will be washed in a designated area and the washed water will be routed through drains to a settling tank, which has an oil & grease trap, only clear water will be reused for greenbelt development.
Air Environment	
▪ Generation of Fugitive Dust ▪ Dust will be generated mainly during excavation, loading &unloading activities. ▪ Gaseous pollutants will by generated mostly by the traffic. ▪ Reduction in visibility due to dust plumes. ▪ Coating of surfaces leading to annoyance and loss of amenity. ▪ Physical and/or chemical contamination and corrosion. ▪ Increase in the concentration of suspended particles in runoff water. ▪ Coating of vegetation leading to reduced photosynthesis, ▪ Inhibited growth, destroying of foliage, degradation of crops; ▪ Increase in health hazards due to inhalation of dust.	▪ Haul roads will be well maintained by sprinkling water twice a day ▪ The access road will be cleaned and brushed to ensure that mud and dust deposits do not accumulate. ▪ To ensure that dust and debris is minimised on the access road, all the tipper drivers will be instructed to use water spray system on all the tyres and spray water on the loaded material that is provided at the compound area before leaving the site ▪ Speed restrictions will be imposed to avoid spillage of loaded materials upon the road and to reduce wear and tear of the road. ▪ Weekly inspections of the condition of the access road by competent person employed, and immediate action will be taken to address any potholes or damage to the road surface. ▪ Dust wetting agents can be mixed with the water applied to haul roads during hot, dry weather conditions to increase the duration that the road surface remains damp. ▪ Personal Protective Equipment's will be provided to all workers ▪ All drilling rods used will have dust suppression systems fitted which injects water into the hole.

	▪ Wet gunny bags will be used as a cover while drilling. ▪ The blast zone will be kept damp by the application of water from the rain gun fitted to the water tanker prior to each blast to control any fugitive dust emissions that could arise from the surface during detonation. ▪ A daily visual inspection shall be conducted by the site manager who will keep a daily log of all process operations and site activities and note any malfunctions which could lead to abnormal emissions from the quarry operations. ▪ A site speed limit of 20 km/h will be set to minimise the potential for dust generation ▪ Weekly maintenance programme to identify machinery due for maintenance, based on the number of hours it has been in operation. ▪ Air filters are renewed after every 1000 hours of use, unless otherwise indicated by an on-board computer system. ▪ All site machineries & tippers will be serviced and maintained 6 months once and drivers will report any defects immediately to the site manager to enable repairs to be carried out promptly.
Noise & Vibration	
▪ Annoyance and deterioration of the quality of life; ▪ Propelling of rocks fragments by blasting. ▪ Shaking of buildings and people due to blasting;	▪ Usage of sharp drill bits while drilling which will help in reducing noise; ▪ Secondary blasting will be totally avoided and hydraulic rock breaker will be used for breaking boulders; ▪ Controlled blasting with proper spacing, burden, stemming and optimum charge/delay will be maintained; ▪ The blasting will be carried out during favourable atmospheric condition and less human activity timings by using nonelectrical initiation system; ▪ Proper maintenance, oiling and greasing of machines will be done every week to reduce generation of noise; ▪ Provision of sound insulated chambers for the workers working on machines (HEMM) producing higher levels of noise; ▪ Silencers / mufflers will be installed in all machineries; ▪ Green Belt/Plantation will be developed around the project area and along the haul roads. The plantation minimizes propagation of noise; ▪ Personal Protective Equipment (PPE) like ear muffs/ear plugs will be provided to the operators of HEMM and persons working near HEMM and their use will be ensured though training and awareness.
Biological Environment	
▪ Direct impacts include land clearance and excavation causing destruction of flora and fauna and loss of habitats; ▪ Indirect impacts include habitat degradation due to noise, dust, and human activity.	▪ Only some common herbs, shrubs and grass will be cleared. So, there will be no impact on the biodiversity. ▪ Green belt development with suitable species will enhance the biodiversity of the project area. ▪ The core zone or buffer zone does not encompass any threatened flora or fauna species.
Socio-Economic Environment	
▪ Health and safety of workers and the general public; ▪ Increase in traffic volumes and sizes of road vehicles; ▪ Economic issues, including the increase in employment opportunities;	▪ The mining activity puts negligible change in the socio-economic profile. ▪ Around 14 local workers will get employment opportunities along with periodical training to generate local skills. ▪ New patterns of indirect employment/ income will generate. ▪ Regular health check-up camp. ▪ Assistance to schools and scholarship to children will be provided.

Occupational Health & Safety	
▪ Exposure to Dust ▪ Noise and Vibration Exposure ▪ Physical Hazards ▪ Respiratory hazards due to Dust exposure	▪ Provision of rest shelters for mine workers with amenities like drinking water etc. ▪ All safety measures like use of safety appliances, such as dust masks, helmets, shoes, safety awareness programs, awards, posters, slogans related to safety etc. ▪ Training of employees for use of safety appliances and first aid in vocational training center. ▪ Weekly maintenance and testing of all equipment as per manufacturers' guidelines. ▪ Pre placement and Yearly Medical Examination of all workers by a medical Officer ▪ First Aid facility will be provided at the mine site. ▪ Close surveillance of the factors in working environment and work practices which may affect environment and worker's health by the mine's manager employed. ▪ Working of mine as per approved mining plan and environmental plans

11.5 ANALYSIS OF ALTERNATIVES

There are no alternatives suggested as the proposed mining area has the following advantages –

- The mineral deposit occurs in a non-forest area.
- There is no habitation within the applied lease area; hence no R & R issues exist.
- There is no river, stream, nallas and water bodies in the or passing through the applied mine lease areas.
- Availability of skilled, semi-skilled and unskilled workers in this region.
- All the basic amenities such as medical, firefighting, education, transportation, communication and infrastructural facilities are accessible.
- Mine connectivity through road and rail is good.
- The proposed mining operations do not intersect the ground water level. Hence, no impact on ground water environment.

11.6 ENVIRONMENTAL MONITORING PROGRAM

Environmental Monitoring program will be conducted for various environmental components as per conditions stipulated in Environmental Clearance Letter issued by SEIAA & Consent to Operate issued by TNPCB.

TABLE 11.9: POST PROJECT MONITORING PROGRAM FOR P1

Sl.No.	ACTIVITY	SCHEDULE
	AIR POLLUTION MONITORING	
1	Ambient Air Monitoring of parameters specified by TNPCB/SEIAA in their CTO/EC Order within the Applied Area	Once in every Six Months
2	Ambient Air Monitoring of parameters specified by TNPCB/SEIAA in their CTO/EC Order outside the Applied Area	Once in every Six Months
	WATER QUALITY MONITORING	
3	Monitoring water quality of rain water collected in mine pit area. Rain water will be used for plantation purpose.	Once in every Six Months
4	Monitoring of samples of tube well and open well or Surface Water bodies in nearby location. Parameters as per IS: 10500:1991	Once in every Six Months
5	Monitoring of water spray units	Log-sheet of water spray will be maintained on daily basis
	NOISE QUALITY MONITORING	
6	Noise in the ambient atmosphere within and outside the applied area	Once in every Six Months
	GREENBELT MAINTENANCE	
7	Monitor schedule for Greenbelt development as per approved mining	Once in every Six Months

	plan	
SOIL QUALITY MONITORING		
8	Grab Samples within and around the applied area	Once in every Six Months

11.7 ADDITIONAL STUDIES

11.7.1 Public Consultation

Application to The Member Secretary of the Tamil Nadu Pollution Control Board (TNPCB) to conduct Public Hearing in a systematic, time bound and transparent manner ensuring widest possible public participation at the project site or in its close proximity in the District is submitted along with this Draft EIA / EMP Report and the outcome of public hearing proceedings will be detailed in the Final EIA/EMP Report.

11.7.2 Risk Analysis & Disaster Management Plan

The methodology for the risk assessment has been based on the specific risk assessment guidance issued by the Directorate General of Mine Safety (DGMS), Dhanbad, vide Circular No.13 of 2002, dated 31stDecember, 2002. The DGMS risk assessment process is intended to identify existing and probable hazards in the work environment and all operations and assess the risk levels of those hazards in order to prioritize those that need immediate attention. Further, mechanisms responsible for these hazards are identified and their control measures, set to timetable are recorded along with pinpointed responsibilities.

In the unlikely event that a consequence has occurred, disaster management kicks in. This includes instituting procedures pertaining to a number of issues such as communication, rescue, and rehabilitation. These are addressed in the disaster management plan. Both, the RA and DMP, are living documents and need to be updated whenever there are changes in operations, equipment, or procedures Assessment is all about preventing accidents and taking necessary steps to prevent it from happening.

The Disaster Management Plan (DMP) is a guide, giving general considerations, directions, and procedures for handling emergencies likely to arise from planned operations. The DMP has been prepared on the basis of the Risk Assessment and related findings covered in the report.

11.8 PROJECT BENEFITS

Various benefits are envisaged due to the proposed mine and a comprehensive description of various advantages and benefits anticipated from the proposed project to the locality, neighbourhood, region and nation as a whole are –

- Improved road communication
- Rain water harvesting structures to augment the water availability for irrigation and plantation and ground water recharge
- Creation of community assets (infrastructure) like school buildings, village roads/ linked roads, dispensary & health Centre, community Centre, market place etc.,
- Strengthening of existing community facilities through the Community Development Programme
- Skill development & capacity building like vocational training
- Awareness program and community activities, like health camps, medical aids, sports & cultural activities, plantation etc.

11.9 CONCLUSION

EIA study was performed as per the approved ToR. Various environmental attributes were studied relating with aspects of mining activities. The related impacts were identified and evaluated. Considering all the possible ways to mitigate the environmental concerns Environmental Management Plan was prepared and accordingly fund was allocated. The EMP has been dynamic, flexible and subject to periodic review. CER activities were identified and for its time bound implementation, fund has been allocated.

The project will increase the revenue of the State Govt. as well as it will help in the social upliftment of the local community. The green belt development programme will help in increasing the green cover in the area. Thus, the proposed project is not likely to affect the environment or adjacent ecosystem adversely.

The Mine Management will be responsible for the project review of EMP and its implementation to ensure that the EMP remains effective and appropriate. Thus, the proper steps will be taken to accomplish all the goals mentioned in the EMP and the project will bring the positive impact in the study area.

12. DISCLOSURE OF CONSULTANT

The Project Proponent Tvl.City Blue metal has engaged M/s Geo Exploration and Mining Solutions, an Accredited Organization under Quality Council of India – National Accreditation Board for Education & Training, New Delhi, for carrying out the EIA Study as per the ToR Issued.

Name and address of the consultancy:

GEO EXPLORATION AND MINING SOLUTIONS
No 17, Advaitha Ashram Road,
Alagapuram, Salem – 636 004
Tamil Nadu, India
Email:infogeoexploration@gmail.com
Web: www.gemssalem.com
Phone: 0427 2431989.

The Accredited Experts and associated members who were engaged for this EIA study as given below –

Sl.No.	Name of the expert	In house/ Empanelled	EIA Coordinator		FAE	
			Sector	Category	Sector	Category
1	**Dr. M. Ifthikhar Ahmed**	**In-house**	**1**	**A**	WP GEO SC	B A A
2	Dr. P. Thangaraju	In-house	-	-	HG GEO	A A
3	Mr. A. Jagannathan	In-house	-	-	AP NV SHW	B A B
4	Mr. N. Senthilkumar	Empanelled	38 28	B B	AQ WP RH	B B A
5	Mrs. Jisha parameswaran	In-house	-	-	SW	B
6	Mr. Govindasamy	In-house	-	-	WP	B
7	Mrs. K. Anitha	In-house	-	-	SE	A
8	Mrs. Amirtham	In-house	-	-	EB	B
9	Mr. Alagappa Moses	Empanelled	-	-	EB	A
10	Mr. A. Allimuthu	In-house	-	-	LU	B
11	Mr. S. Pavel	Empanelled	-	-	RH	B
12	Mr. J. R. Vikram Krishna	Empanelled	-	-	SHW RH	A A

Abbreviations

EC	EIA Coordinator	EB	Ecology and bio-diversity
AEC	Associate EIA Coordinator	NV	Noise and vibration
FAE	Functional Area Expert	SE	Socio economics
FAA	Functional Area Associates	HG	Hydrology, ground water and water conservation
TM	Team Member	SC	Soil conservation
GEO	Geology	RH	Risk assessment and hazard management
WP	Water pollution monitoring, prevention and control	SHW	Solid and hazardous wastes
AP	Air pollution monitoring, prevention and control	MSW	Municipal Solid Wastes
LU	Land Use	ISW	Industrial Solid Wastes
AQ	Meteorology, air quality modeling, and prediction	HW	Hazardous Wastes

DECLARATION BY EXPERTS CONTRIBUTING TO THE EIA/EMP

Declaration by experts contributing to the EIA/EMP of Tvl. City Blue Metal Rough Stone Quarry Project over an Extent of 1.00.0ha in S.F. Nos. 135(Part-2) at Iynkunam Village of Kilpennathur Taluk, Tiruvannamalai District of Tamil Nadu. It is also certified that information furnished in the above EIA study are true and correct to the best of our Knowledge.

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

Name**:** **Dr. M. Ifthikhar Ahmed**

Designation**:** **EIA Coordinator**

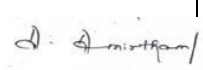
Date & Signature:

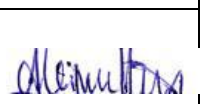
Period of Involvement: **January 2019 to till date**

Associated Team Member with EIA Coordinator:

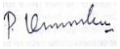
1. **Mr. S. Nagamani**
2. **Mr. Viswathanan**
3. **Mr. Santhoshkumar**
4. **Mr. S. Ilavarasan**

FUNCTIONAL AREA EXPERTS ENGAGED IN THE PROJECT

Sl. No.	Functional Area	Involvement	Name of the Expert/s	Signature
1	AP	▪ Identification of different sources of air pollution due to the proposed mine activity ▪ Prediction of air pollution and propose mitigation measures / control measures	Mr. A. Jagannathan	
2	WP	▪ Suggesting water treatment systems, drainage facilities ▪ Evaluating probable impacts of effluent/waste water discharges into the receiving environment/water bodies and suggesting control measures.	Dr. M. Ifthikhar Ahmed	
			Mr. N. Senthilkumar	
3	HG	▪ Interpretation of ground water table and predict impact and propose mitigation measures. ▪ Analysis and description of aquifer Characteristics	Dr. P. Thangaraju	
4	GEO	▪ Field Survey for assessing the regional and localgeology of the area. ▪ Preparation of mineral and geological maps. ▪ Geology and Geo morphological analysis/description and Stratigraphy/Lithology.	Dr. M. Ifthikhar Ahmed	
			Dr. P. Thangaraju	
5	SE	▪ Revision in secondary data as per Census ofIndia, 2011. ▪ Impact Assessment & Preventive ManagementPlan ▪ Corporate Environment Responsibility.	Mrs. K. Anitha	
6	EB	▪ Collection of Baseline data of Flora and Fauna. ▪ Identification of species labelled as Rare, Endangered and threatened as per IUCN list. ▪ Impact of the project on flora and fauna. ▪ Suggesting species for greenbelt development.	Mrs. Amirtham	
			Mr. Alagappa Moses	

7	RH	▪ Identification of hazards and hazardous substances ▪ Risks and consequences analysis ▪ Vulnerability assessment ▪ Preparation of Emergency Preparedness Plan ▪ Management plan for safety.	Mr. N. Senthilkumar	
			Mr. S. Pavel	
			Mr. J. R. Vikram Krishna	
8	LU	▪ Construction of Land use Map ▪ Impact of project on surrounding land use ▪ Suggesting post closure sustainable land use and mitigative measures.	Mr. A. Allimuthu	
9	NV	▪ Identify impacts due to noise and vibrations ▪ Suggesting appropriate mitigation measures for EMP.	Mr. A. Jagannathan	
10	AQ	▪ Identifying different source of emissions and propose predictions of incremental GLC using AERMOD. ▪ Recommending mitigations measures for EMP	Mr. N. Senthilkumar	
11	SC	▪ Assessing the impact on soil environment and proposed mitigation measures for soil conservation	Dr. M. Ifthikhar Ahmed	
12	SHW	▪ Identify source of generation of non-hazardous solid waste and hazardous waste. ▪ Suggesting measures for minimization of generation of waste and how it can be reused or recycled.	Mr. A. Jagannathan	
			Mr. J. R. Vikram Krishna	

LIST OF TEAM MEMBERS ENGAGED IN THIS PROJECT

Sl.No.	Name	Functional Area	Involvement	Signature
1	Mr. S. Nagamani	AP; GEO; AQ	▪ Site Visit with FAE ▪ Provide inputs & Assisting FAE with sources of Air Pollution, its impact and suggest control measures ▪ Provide inputs on Geological Aspects ▪ Analyse & provide inputs and assist FAE with meteorological data, emission estimation, AERMOD modelling and suggesting control measures	
2	Mr. Viswathanan	AP; WP; LU	▪ Site Visit with FAE ▪ Provide inputs & Assisting FAE with sources of Air Pollution, its impact and suggest control measures ▪ Assisting FAE on sources of water pollution, its impacts and suggest control measures ▪ Assisting FAE in preparation of land use maps	
3	Mr. Santhoshkumar	GEO; SC	▪ Site Visit with FAE ▪ Provide inputs on Geological Aspects ▪ Assist in Resources & Reserve Calculation and preparation of Production Plan & Conceptual Plan ▪ Provide inputs & Assisting FAE with soil conservation methods and identifying impacts	
4	Mr. Umamahesvaran	GEO	▪ Site Visit with FAE ▪ Provide inputs on Geological Aspects ▪ Assist in Resources & Reserve Calculation and preparation of Production Plan & Conceptual Plan	
5	Mr. A. Allimuthu	SE	▪ Site Visit with FAE ▪ Assist FAE with collection of data's ▪ Provide inputs by analysing primary and secondary data	

6	Mr. S. Ilavarasan	LU; SC	▪ Site Visit with FAE ▪ Assisting FAE in preparation of land use maps ▪ Provide inputs & Assisting FAE with soil conservation methods and identifying impacts	
7	Mr. E. Vadivel	HG	▪ Site Visit with FAE ▪ Assist FAE & provide inputs on aquifer characteristics, ground water level/table ▪ Assist with methods of ground water recharge and conduct pump test, flow rate	
8	Mr. D. Dinesh	NV	▪ Site Visit with FAE ▪ Assist FAE and provide inputs on impacts due to proposed mine activity and suggest mitigation measures ▪ Assist FAE with prediction modelling	
9	Mr. Panneer Selvam	EB	▪ Site Visit with FAE ▪ Assist FAE with collection of baseline data ▪ Provide inputs and assist with labelling of Flora and Fauna	
10	Mrs. Nathiya	EB	▪ Site Visit with FAE ▪ Assist FAE with collection of baseline data ▪ Provide inputs and assist with labelling of Flora and Fauna	

DECLARATION BY THE HEAD OF THE ACCREDITED CONSULTANT ORGANIZATION

I, Dr. M. Ifthikhar Ahmed, Managing Partner, Geo Exploration and Mining Solutions, hereby, confirm that the above-mentioned Functional Area Experts and Team Members prepared the EIA/EMP for Tvl. City Blue Metal Rough Stone Quarry Project over an Extent of 1.00 ha in S.F. Nos. 135(Part-2) at Iynkunam Village of Kilpennathur Taluk, Tiruvannamalai District of Tamil Nadu. It is also certified that information furnished in the EIA study are true and correct to the best of our Knowledge.

Signature& Date:

Name:	**Dr. M. Ifhikhar Ahmed**
Designation:	**Managing Partner**
Name of the EIA Consultant Organization:	**M/s. Geo Exploration and Mining Solutions**
NABET Certificate No & Issue Date: Validity:	**NABET/EIA/1821/RA0123 Dated: 27-03-2019** **Valid till 07.11.2021**

Minutes of 168th Accreditation Committee Meeting for Re-Accreditation held on 05.08.2020.