

**DRAFT ENVIRONMENTAL IMPACT ASSESSMENT
&
ENVIRONMENT MANAGEMENT PLAN**

FOR OBTAINING

**Environmental Clearance under EIA Notification – 2006
Schedule Sl. No. 1 (a) (i): Mining Project**

“B1” CATEGORY – MINOR MINERAL – CLUSTER – NON-FOREST LAND

CLUSTER EXTENT = 6.85.5 ha

**THIRU. S. RAVI ROUGH STONE & GRAVEL
QUARRY**

BASELINE MONITORING PERIOD - OCTOBER TO DECEMBER 2022

Project Proponent

Proposed Project

Extent

Thiru. S. Ravi,
S/o. Sokkalingam,
No. 5/34A, Theradi Street,
Virachilai I Bit, Virachilai (Post),
Thirumayam Taluk,
Pudukkottai District – 622 412.

S.F. Nos: 425/6, 425/7 & 425/8,
Lembalakudi Village
Thirumayam Taluk
Pudukkottai District
Tamil Nādu State.

1.53.5ha

ToR obtained vide

Letter No. SEIAA-TN/F.No.9439/ToR-1271/2022 Dated: 08.10.2022



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 Cat 'A' & 38 Cat 'B'

Certificate No : NABET/EIA/1922/SA 0139

Phone: 0427-2431989,

Email: ifthiahmed@gmail.com, geothagam@gmail.com

Web: www.gemssalem.com



Laboratory

**CHENNAI METTEX LAB PRIVATE
LIMITED,**

Jothi Complex, 83, M.K.N. Road,

Guindy, Chennai 600 032.

AAI, AGMARK, APEDA, BIS, [IC, FSSAI, GAFTA,
IOPEPC, MOEF & TEA BOARD

For easy representation 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	Thiru. S. Ravi, S/o. Sokkalingam, No.5/34A, Theradi Street, Virachilai I Bit, Virachilai (Post), Thirumayam Taluk, Pudukkottai District.	425/6, 425/7 & 425/8	1.53.5ha	ToR Obtained vide Lr.No. SEIAA- TN/F.No.9439/ToR- 1271/2022 Dated: 08.10.2022
P2	Thiru. R. Karuppiyah, S/o. Ramathevar, No. 5/33G, Arasamarathu Veethi, Virachilai, Thirumayam Taluk, Pudukkottai (Dt)	995/1A	0.80.0	EC Granted vide Lr.No.SEIAA- TN/F.No.9027/EC.No:5315/2022 dated 20.09.2022
P3	Thiru. V. Nallaiya, S/o. Vellaisamy, No. 1/75, Vadakutheru, V. Lakshmipuram Post, Neikonam, Thirumayam Taluk, Pudukkottai District.	995/1B (Part)	0.81.0	EC Granted vide Lr.No.SEIAA- TN/F.No.9254/EC.No:5282/2022 dated 29.08.2022
TOTAL			3.14.5ha	
EXISTING QUARRIES				
CODE	Name of the Owner	S.F. Nos	Extent	Status
E1	Thiru. S. Ravi, S/o. Sokkalingam, No. 5/34A, Virachilai, Thirumayam Taluk, Pudukkottai District.	425/28	1.71.0	21.01.2019 to 20.01.2024
E2	Thiru. A.M.Xavier, S/o.Anthonymuthu, No. 10, Plot No. 78, MGR Street, Soodamanipuram Karaikudi, Sivangangai District.	454 (Part) and 455/2 (Part)	2.00.0	13.01.2020 to 12.01.2025
TOTAL			3.71.0ha	
EXPIRED QUARRIES				
CODE	Name of the Owner	S.F. No	Extent	Lease Period
EX1	Thiru. N. Murugan, S/o. V. Nallaiah, Neikkunam, V.Lakshmipuram, Thirumayam Taluk, Pudukkottai District.	995/1B	1.61.5	21.07.2014 to 20.07.2019
EX2	Tmt. K. Subbulakshmi, W/o. Krishnan, 2/91, Maruthakudipatti, Virachilai (Post), Thirumayam Taluk,Pudukkottai.	425/11	1.81.5	17.06.2009 to 16.06.2014
EX3	Thiru. M.A. Murugappan, S/o. M.R. Manickam, 33, Charles Nagar,Pudukkottai	425/1 (Pt)	1.00.0	10.12.2010 to 09.12.2015
EX4	Thiru. S. Appaz, S/o. K. Shahul Hameed, Chola Real Estate, Annvasal Road,Pudukkottai.	421/4 (Pt)	1.21.5	28.03.2011 to 27.03.2016
EX5	Thiru. A.M. Zavier, 78, Soodamani Nagar, MGR Salai, Karaikudi,Pudukkottai	425/28 (Pt)	1.00.0	17.06.2012 to 16.06.2017
TOTAL CLUSTER EXTENT			6.64.5 ha	
			6.85.5 ha	

Note:-

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

TERMS OF REFERENCE (ToR) COMPLIANCE

Thiru. S. Ravi

“ToR Obtained vide Lr.No Letter No.SEIAA-TN/F.No.9439/ToR-1271/2022 Dated: 08.10.2022”

SPECIFIC CONDITIONS		
1	The PP shall furnish DFO letter in regard to shortest distance of Reserve Forest & Protected areas/Wildlife sanctuaries & wild life corridors etc.	DFO Will be submitted during Final EIA
2	The Proponent shall provide adequate fencing for the existing quarry as it lies abutting the road.	It is a new quarry
3	The Proponent shall carryout Hydro geological study through reputed institution and the same shall be included in EIA report.	Detailed discussed in chapter 3
4	As habitation is located close to the site, the report should assess the implications of the proposal on the habitants	Noted and agreed
5	In the case of proposed lease in an existing (or old) quarry where the benches are not formed (or) partially formed as per the approved Mining Plan, the Project Proponent (PP) shall prepare and submit an 'Action Plan' for carrying out the realignment of the benches in the proposed quarry lease after it is approved by the concerned Asst. Director of Geology and Mining during the time of appraisal for obtaining the EC.	It is a new quarry
6	The Proponent shall submit a conceptual 'Slope Stability Plan' for the proposed quarry during the appraisal while obtaining the EC, when the depth of the working is extended beyond 30 m below ground level	'Slope Stability Plan' Will be submitted during Final EIA
7	The Proponent shall furnish the affidavit stating that the blasting operation in the proposed quarry is carried out by the statutory competent person as per the MMR 1961 such as blaster, mining mate, mine foreman, II/I Class mines manager appointed by the proponent.	Noted and agreed
8	The Proponent shall present a conceptual design for carrying out only controlled blasting operation involving line drilling and muffle blasting in the proposed quarry such that the blast-induced ground vibrations are controlled as well as no fly rock travel beyond 30m from the blast site	Noted and agreed
9	The EIA Coordinators shall obtain and furnish the details of quarry/quarries operated by the proponent in the past either in the same location or elsewhere in the State with video and photographic evidences	Noted and agreed
10	If the proponent has already carried out the mining activity in the proposed mining lease area after 15.01.2016, then the proponent shall furnish the following details from AD/DD, mines	It is a new quarry
11	What was the period of the operation and stoppage of the earlier mines with last work permit issued by the AD/DD mines? a. Quantity of minerals mined out b. Highest production achieved in any one year c. Detail of approved depth of mining. d. Actual depth of the mining achieved earlier. e. Name of the person already mined in that leases area. f. If EC and CTO already obtained, the copy of the same shall be submitted. g. Whether the mining was carried out as per the	It is a new quarry

	approved mine plan (or EC if issued) with stipulated benches.	
12	All corner coordinates of the mine lease area superimposed on a High-Resolution Imagery/Topo sheet, topographic sheet, geomorphology, lithology and geology of the mining lease area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone)	Map showing – Project area is superimposed on Satellite imagery is enclosed in Figure No. 2.1 Project area boundary coordinates superimposed on Toposheet – Figure No. 1.3 Surface Features around the project area covering 10km radius – Figure No. 2.4 Geology map of the project area covering 10km radius - Figure No. 2.7 Geomorphology Map of the Study Area covering 10 km radius – Figure No. 2.8
13	The Proponent shall carry out Drone video survey covering the cluster, Green belt, fencing etc	Noted and agreed
14	The proponent shall furnish photographs of adequate fencing, green belt along the periphery including replantation of existing trees & safety distance between the adjacent quarries & water bodies nearby provided as per the approved mining plan	Fencing, green belt and safety distance between the adjacent quarries and water bodies is discussed in chapter no.3
15	The Project Proponent shall provide the details of mineral reserves and mineable reserves, planned production capacity, proposed working methodology with justifications, the anticipated impacts of the mining operations on the surrounding environment and the remedial measures for the same	The details of Geological Resources and Proposed reserves are discussed under Chapter No. 2.
16	The Project Proponent shall provide the Organization chart indicating the appointment of various statutory officials and other competent persons to be appointed as per the provisions of Mines Act' 1952 and the MMR, 1961 for carrying out the quarrying operations scientifically and systematically in order to ensure safety and to protect the environment.	Discussed about Organisation chart in Chapter 6
17	The Project Proponent shall conduct the hydro-geological study considering the contour map of the water table detailing the number of ground water pumping & open wells, and surface water bodies such as rivers, tanks, canals, ponds etc. within 1 km (radius) along with the collected water level data for both monsoon and non-monsoon seasons from the PWD / TWAD so as to assess the impacts on the wells due to mining activity. Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation in this regard may be provided	The hydro-geological study was conducted to evaluate the possible impact on the ground water table. No significant impacts are anticipated on the water bodies around the project area. Details are discussed under Chapter No. 3.
18	The proponent shall furnish the baseline data for the environmental and ecological Parameters with regard to surface water/ground water quality, air quality, soil quality & flora/fauna including traffic/vehicular movement study	Baseline Data were collected for One Season (Pre-Monsoon) Oct to Dec 2022 as per CPCB Notification and MoEF & CC Guidelines.Details in Chapter No. 3.
19	The Proponent shall carry out the Cumulative impact study due to mining operations carried out in the quarry specifically with reference to the specific environment in terms of soil health, biodiversity, air pollution, water pollution, climate change and flood control & health impacts and its mitigation measures. Accordingly, the Environment Management plan should be prepared keeping the concerned quarry and the surrounding habitations in the mind.	The cumulative impact study has been carried out with reference to the Air Pollution, Water Pollution and Health impacts around the project site is discussed in Chapter 7.

20	Rain water harvesting management with recharging details along with water balance (both monsoon & non-monsoon) be submitted.	Detailed discussed in chapter 3
21	Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given.	Land use pattern of the study area discussed in chapter 3.
22	Details of the land for storage of Overburden/Waste Dumps (or) Rejects outside the mine lease, such as extent of and area, distance from mine lease, its land use, R&R issues, if any, should be provided.	No overburden waste dump present in this quarry
23	Proximity to Areas declared as 'Critically Polluted'(or) the Project areas which attracts the court restrictions for mining operations, should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the TMCB (or) Dept. of Geology and Mining should be secured and furnished to the effect that the proposed mining activities could be considered.	Noted and agreed
24	Description of water conservation measures proposed to be adopted in the Project should be given. Details of rainwater harvesting proposed in the Project, if any, should be provided	Detailed discussed in chapter 4.
25	Impact on local transport infrastructure due to the Project should be indicated	Detailed discussed in chapter 2.
26	A tree survey study shall be carried out (nos., name of the species, age, diameter etc.) both within the mining lease applied area & 300m buffer zone and its management during mining activity	There are no trees within the lease applied area and no cutting down of trees are anticipated as it's an existing quarry. There are few trees in buffer zone of 300 m from the proposed lease area and it shall not be cut down or have any impact due to the mining activities and project proponent ensures to carrying out activities like watering for preserving the green cover around 300 m from proposed project site. The detailed Greenbelt Development Plan is discussed in Chapter No. 4.
27	A detailed mine closure plan for the proposed project shall be included in EIA/EMP report which should be site-specific	Noted and agreed, Detailed study at chapter 4.
28	Public Hearing points raised and commitments of the Project Proponent on the same along with time bound action plan with budgetary provisions to implement the same should be provided and also incorporated in the final EIA/EMP report of the project and to be submitted to SEIAA/SEAC with regard to the Office Memorandum of MoEF & CC accordingly.	Noted & agreed. Details will be provided in Final EIA/EMP report after the completion of public hearing
29	The Public hearing advertisement shall be published in one major National daily and one most circulated Tamil daily	Public hearing advertisement will be made as per the ToR Recommendations
30	The Proponent shall produce/display the EIA report, Executive summary and other related information with respect to public hearing in Tamil Language also	Noted and agreed
31	As a part of the Study of flora and fauna around the vicinity of the proposed Site the EIA coordinator shall strive to educate the local students on the	Noted and agreed

	importance of preserving local flora and fauna by involving them in the study, wherever possible	
32	The purpose of Greenbelt around the project is to capture the fugitive emissions, carbon sequestration and to attenuate the noise generated, in addition to improving the aesthetics. A wide range of indigenous plant species should be planted as given in the Appendix-I in consultation with the DFO, state Agriculture University and local school / college authorities' The plant species with dense/moderate canopy of native origin should be chosen Species of small/medium/tall trees alternating with shrubs should be planted in a mixed manner.	Noted & agreed. It is proposed to plant 500 nos of trees in the 7.5m safety barrier and approach roads
33	Taller/one year old Saplings raised in appropriate size of bags, preferably eco-friendly bags should be planted as per the advice of local forest authorities/ botanist/Horticulturist with regard to site specific choices. The proponent shall earmark the greenbelt area with GPS coordinates all along the boundary of the project site with at least 3 meters wide and in between blocks in an organized manner	The proponent ensuring the purchase trees with bags nearest nursery garden and will planted in safety barrier with 3m intervals each one.
34	A Disaster management Plan shall be prepared and included in the EIA./EMP Report for the complete life of the proposed quarry (or) till the end of the lease period	Noted and agreed, details in Chapter 7.
35	A Risk Assessment and management Plan shall be prepared and included in the EIA/EMP Report for the complete life of the proposed quarry (or) till the end of the lease period.	Noted and agreed, details in Chapter 7.
36	Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific Occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	Noted and agreed, details in Chapter 10.
37	Public health implications of the Project and related activities for the population in the impact zone should be systematically evaluated and the proposed remedial measures should be detailed along with budgetary allocations	Noted and agreed
38	The Socio-economic studies should be carried out within a 5 km buffer zone from the mining activity. Measures of socio-economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	Socio Economic study has been carried out the details are given in the Chapter No.3.
39	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given	No litigation pending cases
40	Benefits of the Project if the Project is implemented should be spelt out. The benefits of the Project shall clearly indicate environmental, social, economic, employment potential, etc	Detailed discussed in the chapter 8.
41	If any quarrying operations were carried out in the proposed quarrying site for which now the EC is sought, the Project Proponent shall furnish the detailed compliance to EC conditions given in the previous EC with the site photographs which shall	Noted & and the compliance report will be submitted along with Final EIA report.

	duly be certified by MoEF&CC, Regional Office, Chennai (or) the concerned DEE/TNPCB	
42	The Proponent shall prepare the EMP for the entire life of mine and also furnish the sworn affidavit stating to abide the EMP for the entire life of mine	Detail discussed in chapter 10.
43	Concealing any factual information or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this Terms of Conditions besides attracting penal provisions in the Environment (Protection) Act, 1986.	Noted & agreed
ADDITIONAL CONDITIONS		
1	Considering the environmental impacts due to mining, safety of the working personnel and following the principle of sustainable mining, the ultimate depth of mining is restricted to 34m BGL(2m+2m+30m) considering the safety parameters leaving the last bench of width 10m in XY-AB section and the corresponding quantity of Rough stone- 1,36,000 cu.m and 21,060 cu.m of Gravel in 5 years as per the approved mine plan	Noted and agreed
2	Cluster Management Committee, which must include all the proponents in the cluster as members including the existing as well as proposed quarry	Noted and agreed
3	The members must coordinate among themselves for the effective implementation of EMP as committed including green Belt Development, water sprinkling, tree plantation, blasting etc.,	Noted and agreed
4	The List of members of the committee formed shall be submitted to AD/Mines before the execution of mining lease and the same shall be updated every year to the AD/Mines.	Noted and agreed
5	Detailed operational Plan must be submitted which must include the blasting frequency with respect to the nearby quarry situated in the cluster, the usage of haul roads by the individual quarry in the form of route map and network	Noted and agreed
6	The committee shall deliberate on risk management plan pertaining to the cluster in a holistic manner especially during natural calamities like intense rain and the mitigation measures considering the inundation of the cluster and evacuation plan	Details discussed in chapter 7.
7	The cluster Management committee shall form Environmental Policy to practice sustainable mining in a scientific and systematic manner in accordance with the law. The role played by the committee in implementing the environmental policy devised shall be given in detail	Noted and agreed
8	The committee shall furnish action plan regarding the restoration strategy with respect to the individual quarry falling under the cluster in a holistic manner	Noted and agreed
9	The committee shall furnish the Emergency Management plan within the cluster	Details discussed in chapter 7.
10	The committee shall deliberate on the health of the workers/staff involved in the mining as well as the health of the public	Details discussed in chapter 10.
11	Detailed Study Shall Be Carried Out in Regard to Impact of Mining Around the Proposed Mine Lease Area Covering the Entire Mine Lease Period as Per Precise Area Communication Order Issued from Reputed Research Institutions on The Following a) Soil Health & Bio-Diversity.	Noted and agreed. Study report will be submitted in the Final EIA/EMP report.

	<p>b) Climate Change Leading to Droughts, Floods etc.</p> <p>c) Pollution Leading to Release of Greenhouse Gases (GHG), Rise in Temperature, & Livelihood of The Local People.</p> <p>d) Possibilities Of Water Contamination and Impact on Aquatic Ecosystem Health</p> <p>e) Agriculture, Forestry & Traditional Practices.</p> <p>f) Hydrothermal/Geothermal Effect Due to Destruction In The Environment.</p> <p>g) Bio-geochemical processes and its foot prints including environmental stress.</p> <p>h) sediment geochemistry in the surface streams.</p>	
12	The committee shall furnish an action plan to achieve sustainable development goals with reference to water, sanitation & safety	Noted and agreed
13	The committee shall furnish the fire safety and evacuation plan in the case of fire accidents	Noted and agreed
14	The measures taken to control Noise, Air, Water, Dust Control and steps adopted to efficiently utilise the Energy shall be furnished	Noted and agreed
15	Details of type of vegetations including no. of trees & shrubs within the proposed mining area and. If so, transplantation of such vegetations all along the boundary of the proposed mining area shall committed mentioned in EMP	Noted and agreed
16	Impact on surrounding agricultural fields around the proposed mining Area	Noted and agreed
17	Erosion Control measures	Noted and agreed
18	Impact on soil flora & vegetation around the project site	Noted and agreed
19	Detailed study shall be carried out in regard to impact of mining around the proposed mine lease area on the nearby Villages, Water-bodies/ Rivers, & any ecological fragile areas	Noted and agreed
20	The project proponent shall furnish VAO certificate with reference to 300m radius regard to approved habitations, schools, Archaeological sites, Structures, railway lines, roads, water bodies such as streams, odai, vaari, canal, channel, river, lake pond, tank etc.	Noted and agreed
21	As per the MoEF&CC office memorandum F.No.22-65/2017-IA.III dated 30.09.2020 and 20.10.2020 the proponent shall address the concerns raised during the public consultation and all the activities proposed shall be part of the Environment Management plan	Noted and agreed
22	The Environmental Impact Assessment shall study in detail the carbon emission and also suggest the measures to mitigate carbon emission including development of carbon sinks and temperature reduction including control of other emission and climate mitigation activities	Detailed discussed in chapter 4.
23	The Environmental Impact Assessment should study the biodiversity, the natural ecosystem, the soil micro flora, fauna and soil seed banks and suggest measures to maintain the natural Ecosystem	There are some shrubs in the lease area. Trees are present in the 7.5m safety area so it will maintained good.
24	Action should specifically suggest for sustainable management of the area and restoration of ecosystem for flow of goods and services.	Detailed discussed in chapter 4.
25	The project proponent shall study impact on fish habitats and the food WEB/ food chain in the water body and Reservoir	Detailed discussed in chapter 4.

26	The Terms of Reference should specifically study impact on soil health, soil erosion, the soil physical, chemical components and microbial components	Detailed discussed in chapter 4.
27	The Environmental Impact Assessment should study impact on forest, vegetation, endemic, vulnerable and endangered indigenous flora and fauna	Details discussed in the chapter No.4
28	The Environmental Impact Assessment should study impact on standing trees and the existing trees should be numbered and action suggested for protection	Noted and agreed
29	The Environmental Impact Assessment should study on wetlands, water bodies, rivers streams, lakes and farmer sites.	. Noted and agreed
30	The Environmental Impact Assessment should hold detailed study on EMP with budget for Green belt development and mine closure plan including disaster management plan	Details discussed in the chapter No.10
31	The Environmental Impact Assessment should study impact on climate change, temperature rise, pollution and above soil & below soil carbon stock	Noted and agreed
32	The Environmental Impact Assessment should study impact on protected areas. Reserve Forests, National Parks, Corridors and Wildlife pathways, near project site	Noted and agreed
33	The project proponent shall study and furnish the impact of project on plantations in adjoining patta lands, Horticulture, Agriculture and livestock	Details discussed in the chapter No.3
34	The project proponent shall study and furnish the details on potential fragmentation impact of natural environment by the activities	Noted and agreed
35	The project proponent shall study and furnish the impact on aquatic plants and animals in water bodies and possible scars on the landscape, damages to nearby caves' heritage site' and archaeological sites possible land form changes visual and aesthetic impacts	Details discussed in the chapter No.3
36	The project proponent shall study and furnish the possible pollution due to plastic and microplastic On the environment. The ecological risks and impacts of plastic & microplastics on aquatic environment and fresh water systems due to activities, contemplated during mining may be investigated and reported	Noted and agreed
37	The project proponent shall detail study on impact of mining on Reserve forests free ranging wildlife	Noted and agreed
38	Hydro-geological study considering the contour map of the water table detailing the number of ground water pumping & open wells, and surface water bodies such as rivers, tanks, canals, ponds etc. within 1km (radius) so as to assess the impacts on the nearby waterbodies due to mining activity. Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation in this regard may be provided, covering the entire mine lease period	Details discussed in the chapter No.3
39	To furnish disaster management plan and disaster mitigation measures in regard to all aspects to avoid/reduce vulnerability to hazards & to cope with disaster/untoward accidents in & around the proposed mine lease area due to the proposed	Details discussed in the chapter No.7

	method of mining activity & its related activities covering the entire mine lease period as per precise area communication order issued	
40	To furnish risk assessment and management plan including anticipated vulnerabilities during operational and post operational phases of Mining	Details discussed in the chapter No.7
41	Detailed Mine closure Plan covering the entire mine lease period as per precise area communication order issued	Noted and agreed, Chapter 4
42	Detailed Environment Management Plan along with adaptation, mitigation & remedial strategies covering the entire mine lease period as per precise area communication order issued	Noted and agreed, Chapter 10
STANDARD TERMS OF REFERENCE		
1	Year-wise production details since 1994 should be given, clearly stating the highest production achieved in any one year prior to 1994. It may also be categorically informed whether there had been any increase in production after the EIA Notification 1994 came into force, w.r.t. the highest production achieved prior to 1994.	Not applicable. This is Not a violation category project. This proposal falls under B1 Category (Cluster Condition).
2	A copy of the document in support of the fact that the Proponent is the rightful lessee of the mine should be given.	The applied land for quarrying is a Patta Land. Document is enclosed along with Approved Mining Plan as Annexure Volume 1.
3	All documents including approved mine plan, EIA and Public Hearing should be compatible with one another in terms of the mine lease area, production levels, waste generation and its management, mining technology etc. and should be in the name of the lessee.	Noted & agreed.
4	All corner coordinates of the mine lease area, superimposed on a High-Resolution Imagery/ toposheet, topographic sheet, geomorphology and geology of the area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).	Map showing – Project area is superimposed on Satellite imagery is enclosed in Figure No. 2.1 Project area boundary coordinates superimposed on Toposheet – Figure No. 1.3 Surface Features around the project area covering 10km radius – Figure No. 2.2 Geology map of the project area covering 10km radius - Figure No. 2.7. Geomorphology Map of the Study Area covering 10 km radius – Figure No. 2.8.
5	Information should be provided in Survey of India Toposheet in 1:50,000 scale indicating geological map of the area, geomorphology of land forms of the area, existing minerals and mining history of the area, important water bodies, streams and rivers and soil characteristics.	Map showing – Geology map of the project area covering 10km radius - Figure No. 2.7. Geomorphology Map of the Study Area covering 10 km radius – Figure No. 2.8.
6	Details about the land proposed for mining activities should be given with information as to whether mining conforms to the land use policy of the State; land diversion for mining should have approval from State land use board or the concerned authority.	The applied area was inspected by the officers of Department of Geology along with revenue officials and found that the land is fit for quarrying under the policy of State Government.
7	It should be clearly stated whether the proponent Company has a well laid down Environment Policy approved by its Board of Directors? If so, it may be spelt out in the EIA Report with description of the prescribed operating process/procedures to bring into focus any infringement/deviation/ violation of the environmental or forest norms/conditions? The hierarchical system or administrative order of the Company to deal with the environmental issues and for ensuring compliance with the EC conditions may also be given. The system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the	The proponent has framed their Environmental Policy and the same is discussed in the Chapter No 10.1.

	Company and/or shareholders or stakeholders at large, may also be detailed in the EIA Report.	
8	Issues relating to Mine Safety, including subsidence study in case of underground mining and slope study in case of open cast mining, blasting study etc. should be detailed. The proposed safeguard measures in each case should also be provided.	It is an opencast quarrying operation proposed to operate in Mechanized method. The rough stone formation is a hard, compact and homogeneous body. The height and width of the bench will be maintained as 5m with 90° bench angles. Quarrying activities will be carried out under the supervision of Competent Persons like Mines Manager, Mines Foreman and Mining Mate. Necessary permissions will be obtained from DGMS after obtaining Environmental Clearance.
9	The study area will comprise of 10 km zone around the mine lease from lease periphery and the data contained in the EIA such as waste generation etc., should be for the life of the mine / lease period.	Noted & agreed. The study area considered for this study is 10 km radius and all data contained in the EIA report such as waste generation etc., is for the Life of the Mine / lease period.
10	Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given.	Land use and land cover of the study area is discussed in Chapter No. 3. Land use plan of the project area showing pre-operational, operational and post-operational phases are discussed in Chapter No. 2, Table No 2.3.
11	Details of the land for any Over Burden Dumps outside the mine lease, such as extent of land area, distance from mine lease, its land use, R&R issues, if any, should be given	Not Applicable. There is no waste anticipated during this quarry operation. The entire quarried out rough stone will be transported to the needy customers. No Dumps is proposed outside the lease area.
12	Certificate from the Competent Authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area. In the event of any contrary claim by the Project Proponent regarding the status of forests, the site may be inspected by the State Forest Department along with the Regional Office of the Ministry to ascertain the status of forests, based on which, the Certificate in this regard as mentioned above be issued. In all such cases, it would be desirable for representative of the State Forest Department to assist the Expert Appraisal Committees.	Not Applicable. There is no Forest Land involved in the proposed project area. The proposed project area is a patta land. Approved Mining Plan is enclosed as Annexure Volume 1.
13	Status of forestry clearance for the broken-up area and virgin forestland involved in the Project including deposition of net present value (NPV) and compensatory afforestation (CA) should be indicated. A copy of the forestry clearance should also be furnished.	Not Applicable. The proposed project area does not involve any Forest Land.
14	Implementation status of recognition of forest rights under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 should be indicated.	Not Applicable. The project doesn't attract Recognition of Forest Rights Act, 2006.
15	The vegetation in the RF / PF areas in the study area, with necessary details, should be given.	No Reserve Forest within the Study Area.
16	A study shall be got done to ascertain the impact of the Mining Project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the surrounding and any other protected area and accordingly, detailed mitigative measures required, should be worked out with cost implications and submitted.	Not Applicable. There are No National Parks, Biosphere Reserves, Wildlife Corridors, and Tiger/Elephant Reserves within 10 km Radius from the periphery of the project area.

17	Location of National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/ Elephant Reserves/(existing as well as proposed), if any, within 10 KM of the mine lease should be clearly indicated, supported by a location map duly authenticated by Chief Wildlife Warden. Necessary clearance, as may be applicable to such projects due to proximity of the ecologically sensitive areas as mentioned above, should be obtained from the Standing Committee of National Board of Wildlife and copy furnished	Not Applicable. There are No National Parks, Biosphere Reserves, Wildlife Corridors, and Tiger/Elephant Reserves within 10 km Radius from the periphery of the project area.
18	A detailed biological study of the study area [core zone and buffer zone (10 KM radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET Species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the Schedule of the fauna present. In case of any scheduled-I fauna found in the study area, the necessary plan along with budgetary provisions for their conservation should be prepared in consultation with State Forest and Wildlife Department and details furnished. Necessary allocation of funds for implementing the same should be made as part of the project cost.	Detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] was carried out and discussed under Chapter No. 3. 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.
19	Proximity to Areas declared as 'Critically Polluted' or the Project areas likely to come under the 'Aravalli Range', (attracting court restrictions for mining operations), should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the SPCB or State Mining Department should be secured and furnished to the effect that the proposed mining activities could be considered.	Not Applicable. Project area / Study area is not declared in 'Critically Polluted' Area and does not come under 'Aravalli Range'.
20	Similarly, for coastal Projects, A CRZ map duly authenticated by one of the authorized agencies demarcating LTL, HTL, CRZ area, location of the mine lease w.r.t CRZ, coastal features such as mangroves, if any, should be furnished. (Note: The Mining Projects falling under CRZ would also need to obtain approval of the concerned Coastal Zone Management Authority).	Not Applicable. The project doesn't attract The C. R. Z. Notification, 2018.
21	R&R Plan/compensation details for the Project Affected People (PAP) should be furnished. While preparing the R&R Plan, the relevant State/National Rehabilitation & Resettlement Policy should be kept in view. In respect of SCs /STs and other weaker sections of the society in the study area, a need-based sample survey, family-wise, should be undertaken to assess their requirements, and action programmes prepared and submitted accordingly, integrating the sectoral programmes of line departments of the State Government. It may be clearly brought out whether the village(s) located in the mine lease area will be shifted or not. The issues relating to shifting of village(s) including their R&R and socio-economic aspects should be discussed in the Report.	Not Applicable. There are no approved habitations within a radius of 300 meters. Therefore, R&R Plan / Compensation details for the Project Affected People (PAP) is not anticipated and Not Applicable for this project.
22	One season (non-monsoon) [i.e., March-May (Summer Season); October-December (post monsoon season); December-February (winter season)] primary baseline data on ambient air quality as per CPCB Notification of 2009, water quality, noise level, soil and flora and fauna shall be collected and the AAQ and other data so compiled presented date-wise in the EIA and EMP Report. Site-specific meteorological data should also be collected. The location of the monitoring stations should be such as to represent whole of the study area and justified keeping in view the pre-dominant downwind	Baseline Data were collected for One Season (Summer) October - December 2022 as per CPCB Notification and MoEF & CC Guidelines. Details in Chapter No. 3.

	direction and location of sensitive receptors. There should be at least one monitoring station within 500 m of the mine lease in the pre-dominant downwind direction. The mineralogical composition of PM10, particularly for free silica, should be given.	
23	Air quality modelling should be carried out for prediction of impact of the project on the air quality of the area. It should also take into account the impact of movement of vehicles for transportation of mineral. The details of the model used and input parameters used for modelling should be provided. The air quality contours may be shown on a location map clearly indicating the location of the site, location of sensitive receptors, if any, and the habitation. The wind roses showing pre-dominant wind direction may also be indicated on the map.	Air Quality Modelling for prediction of incremental GLC's of pollutant was carried out using AERMOD view 9.6.1 Model. Details in Chapter No. 4.
24	The water requirement for the Project, its availability and source should be furnished. A detailed water balance should also be provided. Fresh water requirement for the Project should be indicated.	Total Water Requirement: 2.0 KLD Discussed under Chapter 2, Table No 2.15.
25	Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the Project should be provided.	Not Applicable. Water for dust suppression, greenbelt development and domestic use will be sourced from accumulated rainwater/seepage water in mine pits and purchased from local water vendors through water tankers on daily requirement basis. Drinking water will be sourced from the approved water vendors.
26	Description of water conservation measures proposed to be adopted in the Project should be given. Details of rainwater harvesting proposed in the Project, if any, should be provided.	Part of the working pit will be allowed to collect rain water during the spell of rain will be used for greenbelt development and dust suppression. The Mine Closure Plan is prepared for converting the excavated pit into rain water harvesting structure and serve as water reservoir for the project village during draught season.
27	Impact of the Project on the water quality, both surface and groundwater, should be assessed and necessary safeguard measures, if any required, should be provided.	Impact Studies and Mitigation Measures of Water Environment including Surface Water and Ground Water are discussed in Chapter 4.
28	Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation in this regard may be provided. In case the working will intersect groundwater table, a detailed Hydro Geological Study should be undertaken and Report furnished. The Report inter-alia, shall include details of the aquifers present and impact of mining activities on these aquifers. Necessary permission from Central Ground Water Authority for working below ground water and for pumping of ground water should also be obtained and copy furnished.	Not Applicable. The ground water table inferred 60-65m below ground level. The ultimate depth of quarry is 39m. This proposal of 34m below ground level will not intersect the ground water table, which is inferred from the hydro-geological carried out at the project site. Discussed under Chapter 3.
29	Details of any stream, seasonal or otherwise, passing through the lease area and modification / diversion proposed, if any, and the impact of the same on the hydrology should be brought out.	Not Applicable. There is no stream, seasonal or other water bodies passing within the project area. Therefore, no modification/ diversion of water bodies is anticipated.
30	Information on site elevation, working depth, groundwater table etc. Should be provided both in AMSL and Bgl. A schematic diagram may also be provided for the same.	Highest elevation of the project area is 110m AMSL. Ultimate depth of the mine is 39m BGL Water level of the area is 60-65m BGL
31	A time bound Progressive Greenbelt Development Plan shall be prepared in a tabular form (indicating the linear	Greenbelt Development Plan is discussed under Chapter 4.

	and quantitative coverage, plant species and time frame) and submitted, keeping in mind, the same will have to be executed up front on commencement of the Project. Phase-wise plan of plantation and compensatory afforestation should be charted clearly indicating the area to be covered under plantation and the species to be planted. The details of plantation already done should be given. The plant species selected for green belt should have greater ecological value and should be of good utility value to the local population with emphasis on local and native species and the species which are tolerant to pollution.	
32	Impact on local transport infrastructure due to the Project should be indicated. Projected increase in truck traffic as a result of the Project in the present road network (including those outside the Project area) should be worked out, indicating whether it is capable of handling the incremental load. Arrangement for improving the infrastructure, if contemplated (including action to be taken by other agencies such as State Government) should be covered. Project Proponent shall conduct Impact of Transportation study as per Indian Road Congress Guidelines.	Traffic density survey was carried out to analyse the impact of Transportation in the study area as per IRC guidelines 1961 and it is inferred that there is no significant impact due to the proposed transportation from the project area. Details in Chapter 2.
33	Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.	Infrastructure & other facilities will be provided to the Mine Workers after the grant of quarry lease and the same has been discussed in the Chapter No.2.
34	Conceptual post mining land use and Reclamation and Restoration of mined out areas (with plans and with adequate number of sections) should be given in the EIA report.	Discussed under Chapter 2. Mine Closure Plan is a part of Approved Mining Plan enclosed as Annexure Volume – 1.
35	Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	Occupational Health Impacts of the project and preventive measures are detailed under Chapter 4.
36	Public health implications of the Project and related activities for the population in the impact zone should be systematically evaluated and the proposed remedial measures should be detailed along with budgetary allocations.	No Public Health Implications anticipated due to this project. Details of CER and CSR are discussed under Chapter 8.
37	Measures of socio-economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	No Negative Impact on Socio Economic Environment on the Study Area is anticipated and this project shall benefit the Socio-Economic Environment by ways of employment for 19 people directly and 10 people indirectly. Details in Chapter 2.
38	Detailed environmental management plan (EMP) to mitigate the environmental impacts which, should inter-alia include the impacts of change of land use, loss of agricultural and grazing land, if any, occupational health impacts besides other impacts specific to the proposed Project.	Detailed Environment Management Plan for the project to mitigate the anticipated impacts described under Chapter 4 is discussed under Chapter 10.
39	Public Hearing points raised and commitment of the Project Proponent on the same along with time bound Action Plan with budgetary provisions to implement the same should be provided and also incorporated in the final EIA/EMP Report of the Project.	The outcome of public hearing will be updated in the final EIA/AMP report
40	Details of litigation pending against the project, if any,	No litigation is pending in any court against

	with direction /order passed by any Court of Law against the Project should be given.	this project.
41	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	Project Cost is Rs.35,87,000/- CER Cost is Rs 5,00,000/-
42	A Disaster management Plan shall be prepared and included in the EIA/EMP Report.	Details in Chapter 7.
43	Benefits of the Project if the Project is implemented should be spelt out. The benefits of the Project shall clearly indicate environmental, social, economic, employment potential, etc.	Details in Chapter 8.
44	Besides the above, the below mentioned general points are also to be followed: -	
a	Executive Summary of the EIA/EMP Report	Enclosed as separate booklet.
b	All documents to be properly referenced with index and continuous page numbering.	All the documents are properly referenced with index and continuous page numbering.
c	Where data are presented in the Report especially in Tables, the period in which the data were collected and the sources should be indicated.	List of Tables and source of the data collected are indicated.
d	Project Proponent shall enclose all the analysis/testing reports of water, air, soil, noise etc. using the MoEF & CC/NABL accredited laboratories. All the original analysis/testing reports should be available during appraisal of the Project	Baseline monitoring reports are enclosed with This report in Chapter 3. Original Baseline monitoring reports will be submitted in the final EIA report during appraisal.
e	Where the documents provided are in a language other than English, an English translation should be provided.	Not Applicable.
f	The Questionnaire for environmental appraisal of mining projects as devised earlier by the Ministry shall also be filled and submitted.	Will be enclosed along with Final EIA EMP Report.
g	While preparing the EIA report, the instructions for the Proponents and instructions for the Consultants issued by MoEF&CC vide O.M. No. J-11013/41/2006-IA. II(I) Dated: 4th August, 2009, which are available on the website of this Ministry, should be followed.	Noted & agreed. Instructions issued by MoEF & CC O.M. No. J-11013/41/2006-IA. II (I) Dated: 4th August, 2009 are followed.
h	Changes, if any made in the basic scope and project parameters (as submitted in Form-I and the PFR for securing the TOR) should be brought to the attention of MoEF&CC with reasons for such changes and permission should be sought, as the TOR may also have to be altered. Post Public Hearing changes in structure and content of the draft EIA/EMP (other than modifications arising out of the P.H. process) will entail conducting the PH again with the revised documentation	Noted & agreed.
i	As per the circular no. J-11011/618/2010-IA. II(I) Dated: 30.5.2012, certified report of the status of compliance of the conditions stipulated in the environment clearance for the existing operations of the project, should be obtained from the Regional Office of Ministry of Environment, Forest and Climate Change, as may be applicable.	Not Applicable.
j	The EIA report should also include (i) surface plan of the area indicating contours of main topographic features, drainage and mining area, (ii) geological maps and sections and (iii) sections of the mine pit and external dumps, if any, clearly showing the land features of the adjoining area.	Surface Plan – Figure No. 2.2. Geological Plan – Figure No 2.9. Working Plan – Figure No 2.9. Closure Plan – Figure No.2.10.

TABLE OF CONTENTS

1.	INTRODUCTION.....	1
1.0	PREAMBLE.....	1
1.1	PURPOSE OF THE REPORT.....	1
1.2	IDENTIFICATION OF PROJECT AND PROJECT PROPONENT.....	3
1.3	BRIEF DESCRIPTION OF THE PROJECT.....	3
1.4	ENVIRONMENTAL CLEARANCE.....	7
1.5	TERMS OF REFERENCE (ToR).....	7
1.6	POST ENVIRONMENT CLEARANCE MONITORING.....	8
1.7	GENERIC STRUCTURE OF EIA DOCUMENT.....	8
1.8	THE SCOPE OF THE STUDY.....	8
2.	PROJECT DESCRIPTION.....	10
2.0	GENERAL.....	10
2.1	DESCRIPTION OF THE PROJECT.....	10
2.2	LOCATION OF THE PROJECT.....	10
2.4	RESOURCES AND RESERVES.....	26
2.5	METHOD OF MINING.....	29
2.6	GENERAL FEATURES.....	30
2.7	PROJECT REQUIREMENT.....	32
2.8	EMPLOYMENT REQUIREMENT:.....	32
2.9	PROJECT IMPLEMENTATION SCHEDULE.....	33
3.	DESCRIPTION OF ENVIRONMENT.....	34
3.0	GENERAL.....	34
3.1	LAND ENVIRONMENT.....	36
3.2	WATER ENVIRONMENT.....	43
3.3	AIR ENVIRONMENT.....	63
3.4	NOISE ENVIRONMENT.....	83
3.6	SOCIO ECONOMIC ENVIRONMENT.....	104
4.	ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES.....	111
4.0	GENERAL.....	111
4.1	LAND ENVIRONMENT:.....	111
4.2	WATER ENVIRONMENT.....	113
4.3	AIR ENVIRONMENT.....	114
4.4	NOISE ENVIRONMENT.....	119
4.6	SOCIO ECONOMIC.....	127

4.7	<i>OCCUPATIONAL HEALTH AND SAFETY</i>	127
4.8	<i>MINE WASTE MANAGEMENT</i>	128
4.9	<i>MINE CLOSURE</i>	128
5.	<i>ANALYSIS OF ALTERNATIVES (TECHNOLOGY AND SITE)</i>	131
5.1	<i>INTRODUCTION</i>	131
5.2	<i>FACTORS BEHIND THE SELECTION OF PROJECT SITE</i>	131
5.3	<i>ANALYSIS OF ALTERNATIVE SITE</i>	131
5.4	<i>FACTORS BEHIND SELECTION OF PROPOSED TECHNOLOGY</i>	131
5.5	<i>ANALYSIS OF ALTERNATIVE TECHNOLOGY</i>	131
6.	<i>ENVIRONMENTAL MONITORING PROGRAMME</i>	132
6.0	<i>GENERAL</i>	132
6.1	<i>METHODOLOGY OF MONITORING MECHANISM</i>	132
6.2	<i>IMPLEMENTATION SCHEDULE OF MITIGATION MEASURES</i>	133
6.3	<i>MONITORING SCHEDULE AND FREQUENCY</i>	134
6.4	<i>BUDGETARY PROVISION FOR EMP</i>	134
6.5	<i>REPORTING SCHEDULES OF MONITORED DATA</i>	135
7.	<i>ADDITIONAL STUDIES</i>	136
7.0	<i>GENERAL</i>	136
7.1.	<i>PUBLIC CONSULTATION</i>	136
7.2	<i>RISK ASSESSMENT</i>	136
7.3	<i>DISASTER MANAGEMENT PLAN</i>	138
7.4	<i>CUMULATIVE IMPACT STUDY</i>	141
7.5	<i>PLASTIC WASTE MANAGEMENT PLAN</i>	149
8.	<i>PROJECT BENEFITS</i>	151
8.0	<i>GENERAL</i>	151
8.1	<i>EMPLOYMENT POTENTIAL</i>	151
8.2	<i>SOCIO-ECONOMIC WELFARE MEASURES PROPOSED</i>	151
8.3	<i>IMPROVEMENT IN PHYSICAL INFRASTRUCTURE</i>	151
8.4	<i>IMPROVEMENT IN SOCIAL INFRASTRUCTURE</i>	151
8.5	<i>OTHER TANGIBLE BENEFITS</i>	151
9.	<i>ENVIRONMENTAL COST BENEFIT ANALYSIS</i>	153
10.	<i>ENVIRONMENTAL MANAGEMENT PLAN</i>	154
10.0	<i>GENERAL</i>	154
10.1	<i>ENVIRONMENTAL POLICY</i>	154
10.2	<i>LAND ENVIRONMENT MANAGEMENT</i>	155
10.3	<i>SOIL MANAGEMENT</i>	155

10.4	WATER MANAGEMENT.....	155
10.5	AIR QUALITY MANAGEMENT	156
10.6	NOISE POLLUTION CONTROL	156
10.7	GROUND VIBRATION AND FLY ROCK CONTROL.....	157
10.8	BIOLOGICAL ENVIRONMENT MANAGEMENT	157
10.9	OCCUPATIONAL SAFETY & HEALTH MANAGEMENT.....	158
10.10	CONCLUSION –	166
11.	SUMMARY AND CONCLUSION	167
12.	DISCLOSURE OF CONSULTANT	168

LIST OF TABLES

TABLE 1.1: SALIENT FEATURES OF THE PROPOSED PROJECT	3
TABLE 1.2: DETAILS OF PROJECT PROPONENT	3
TABLE 1.3: BRIEF DESCRIPTION OF THE PROJECT.....	3
TABLE 1.4: ENVIRONMENT ATTRIBUTES.....	8
TABLE 2.1: SITE CONNECTIVITY	10
TABLE 2.2: BOUNDARY CO-ORDINATES OF PROPOSED PROJECT	10
TABLE 2.3: LAND USE PATTERN.....	17
TABLE 2.4: OPERATIONAL DETAILS FOR PROPOSED PROJECT	17
TABLE 2.4A: RANGE OF AQUIFER PARAMETERS	19
TABLE 2.5: GROUND WATER LEVEL VARIATIONS OF PUDUKKOTTAI DISTRICT	19
TABLE 2.6: AVAILABLE GEOLOGICAL RESOURCES OF PROPOSED PROJECT	26
TABLE 2.7: YEAR-WISE PRODUCTION PLAN	26
TABLE 2.8: ULTIMATE PIT DIMENSION.....	26
TABLE 2.9: MINE CLOSURE BUDGET	29
TABLE 2.10 PROPOSED MACHINERY DEPLOYMENT	30
TABLE.2.11: TRAFFIC SURVEY LOCATIONS	30
TABLE 2.12: EXISTING TRAFFIC VOLUME.....	31
TABLE 2.13: ROUGH STONE HOURLY TRANSPORTATION REQUIREMENT	31
TABLE 2.14: SUMMARY OF TRAFFIC VOLUME	31
TABLE 2.15: WATER REQUIREMENT.....	32
TABLE 2.16: PROJECT COST OF PROPOSED PROJECT	32
TABLE 2.17: PROPOSED MANPOWER DEPLOYMENT	32
TABLE 2.18: EXPECTED TIME SCHEDULE	33
TABLE 3.1: MONITORING ATTRIBUTES AND FREQUENCY OF MONITORING	35
TABLE 3.2: LAND USE / LAND COVER TABLE 10 KM RADIUS	36
TABLE 3.3: DETAILS OF ENVIRONMENT SENSITIVITY AROUND THE CLUSTER.....	38
TABLE 3.4: NEARBY WATER BODIES FROM THE PROPOSED PROJECT SITE	39
TABLE 3.5: SOIL SAMPLING LOCATIONS.....	39
TABLE 3.6: METHODOLOGY OF SAMPLING COLLECTION	39
TABLE 3.7: SOIL QUALITY OF THE STUDY AREA	42

TABLE 3.8: WATER SAMPLING LOCATIONS	43
TABLE 3.9: GROUND WATER SAMPLING RESULTS.....	45
TABLE 3.10: SURFACE WATER SAMPLING RESULTS.....	46
TABLE 3.11: PRE-MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS	48
TABLE 3.12: PRE-MONSOON WATER LEVEL OF BOREWELLS 1 KM RADIUS	48
TABLE 3.13: PRE-MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS	51
TABLE 3.14: PRE-MONSOON WATER LEVEL OF BORE WELLS 1 KM RADIUS	53
TABLE 3.15: GPS CO-ORDINATES OF VES LOCATION.....	60
TABLE 3.16: VES RESULTS OF STATION – 1	60
TABLE 3.17: VES RESULTS OF STATION – 2	61
TABLE 3.18: VES RESULTS OF STATION – 3	62
TABLE 3.19: RAINFALL DATA.....	64
TABLE 3.20: METEOROLOGICAL DATA RECORDED AT SITE	65
TABLE 3.21: METHODOLOGY AND INSTRUMENT USED FOR AAQ ANALYSIS.....	66
TABLE 3.22: NATIONAL AMBIENT AIR QUALITY STANDARDS	66
TABLE 3.23: AMBIENT AIR QUALITY (AAQ) MONITORING LOCATIONS	67
TABLE 3.24: AMBIENT AIR QUALITY DATA LOCATION AAQ1	69
TABLE 3.25: AMBIENT AIR QUALITY DATA LOCATION AAQ2.....	70
TABLE 3.26: AMBIENT AIR QUALITY DATA LOCATION AAQ3.....	71
TABLE 3.27: AMBIENT AIR QUALITY DATA LOCATION AAQ4.....	72
TABLE 3.28: AMBIENT AIR QUALITY DATA LOCATION AAQ5.....	73
TABLE 3.29: AMBIENT AIR QUALITY DATA LOCATION AAQ6.....	74
TABLE 3.30: AMBIENT AIR QUALITY DATA LOCATION AAQ7.....	75
TABLE 3.31: AMBIENT AIR QUALITY DATA LOCATION AAQ8.....	76
TABLE 3.32: SUMMARY OF AAQ – 1 to AAQ – 8	77
TABLE 3.26: ABSTRACT OF AMBIENT AIR QUALITY DATA	78
TABLE 3.34: AVERAGE FUGITIVE DUST SAMPLE VALUES	81
TABLE 3.35: FUGITIVE DUST SAMPLE VALUES IN $\mu\text{g}/\text{m}^3$	82
TABLE 3.36: DETAILS OF SURFACE NOISE MONITORING LOCATIONS	83
TABLE 3.37: AMBIENT NOISE QUALITY RESULT	86
TABLE 4.1: WATER REQUIREMENTS	113
TABLE 4.2: ESTIMATED EMISSION RATE FOR PM_{10}	114

TABLE 4.3: ESTIMATED EMISSION RATE FOR SO ₂	114
TABLE 4.4: ESTIMATED EMISSION RATE FOR NO _x	114
TABLE 4.5: INCREMENTAL & RESULTANT GLC OF PM ₁₀	116
TABLE 4.6: INCREMENTAL & RESULTANT GLC OF PM _{2.5}	117
TABLE 4.7: INCREMENTAL & RESULTANT GLC OF SO ₂	117
TABLE 4.8: INCREMENTAL & RESULTANT GLC OF NO _x	117
TABLE 4.9: INCREMENTAL & RESULTANT GLC OF FUGITIVE DUST	118
TABLE 4.10: ACTIVITY AND NOISE LEVEL PRODUCED BY MACHINERY	120
TABLE 4.11: PREDICTED NOISE INCREMENTAL VALUES.....	120
TABLE 4.12: PREDICTED PPV VALUES DUE TO BLASTING	121
TABLE 6.1 IMPLEMENTATION SCHEDULE FOR PROPOSED PROJECT	133
TABLE 6.2: PROPOSED MONITORING SCHEDULE POST EC.....	134
TABLE 6.3 ENVIRONMENT MONITORING BUDGET	134
TABLE 7.1 RISK ASSESSMENT& CONTROL MEASURES.....	136
TABLE 7.2: PROPOSED TEAMS TO DEAL WITH EMERGENCY SITUATION	139
TABLE 7.4: LIST OF QUARRIES WITHIN 500 METER RADIUS	141
TABLE 7.5: SALIENT FEATURES OF PROPOSAL P1	142
TABLE 7.6: SALIENT FEATURES OF PROPOSAL “P2”	143
TABLE 7.8: SALIENT FEATURES OF PROPOSAL “P3”	143
TABLE 7.9: SALIENT FEATURES OF EXISTING QUARRY “E1”.....	144
TABLE 7.9: SALIENT FEATURES OF EXISTING QUARRY “E2”.....	144
TABLE 7.7: CUMULATIVE PRODUCTION LOAD OF ROUGH STONE	145
TABLE 7.8: CUMULATIVE PRODUCTION LOAD OF GRAVEL/WEATHERED GRAVEL	145
TABLE 7.9: EMISSION ESTIMATION FROM QUARRIES WITHIN 500 METER RADIUS	146
TABLE 7.10: INCREMENTAL & RESULTANT GLC WITHIN CLUSTER	146
TABLE 7.11: PREDICTED NOISE INCREMENTAL VALUES FROM CLUSTER.....	147
TABLE 7.12: NEAREST HABITATION FROM EACH MINE.....	148
TABLE 7.13: GROUND VIBRATIONS AT 5 MINES.....	148
TABLE 7.14: SOCIO ECONOMIC BENEFITS FROM 5 MINES	148
TABLE 7.15: EMPLOYMENT BENEFITS FROM 5 MINES.....	149
TABLE 7.16: GREENBELT DEVELOPMENT BENEFITS FROM 5 MINES.....	149
TABLE 7.17: ACTION PLAN TO MANAGE PLASTIC WASTE	150

TABLE 8.1: CER – ACTION PLAN	152
TABLE 10.1: PROPOSED CONTROLS FOR LAND ENVIRONMENT	155
TABLE 10.2: PROPOSED CONTROLS FOR SOIL MANAGEMENT	155
TABLE 10.3: PROPOSED CONTROLS FOR WATER ENVIRONMENT	156
TABLE 10.4: PROPOSED CONTROLS FOR AIR ENVIRONMENT	156
TABLE 10.5: PROPOSED CONTROLS FOR NOISE ENVIRONMENT	156
TABLE 10.6: PROPOSED CONTROLS FOR GROUND VIBRATIONS & FLY ROCK.....	157
TABLE 10.7 PROPOSED GREENBELT ACTIVITIES FOR5 YEAR PLAN PERIOD	158
TABLE 10.8: RECOMMENDED SPECIES TO PLANT IN THE GREENBELT	158
TABLE 10.9: MEDICAL EXAMINATION SCHEDULE	159
TABLE 10.10: LIST OF PERIODICAL TRAININGS PROPOSED FOR EMPLOYEES	162
TABLE 10.11: EMP BUDGET FOR PROPOSED PROJECT	163

LIST OF FIGURES

FIGURE.1.1 SATELLITE IMAGERY CLUSTER QUARRIES	2
FIG1.2 KEY MAP SHOWING THE LOCATION OF THE CLUSTER SITE	5
FIGURE 1.3: TOPOSHEET MAP OF THE STUDY AREA 10 KM RADIUS	6
FIGURE 2.1: GOOGLE IMAGE OF THE PROJECT AREA	11
FIGURE 2.2: QUARRY LEASE PLAN / SURFACE PLAN	12
FIGURE 2.3: PHOTOGRAPHS OF PROPOSED SITE	13
FIGURE 2.4: IMAGE SHOWING SURFACE FEATURES AROUND 10 KM RADIUS	14
FIGURE 2.5: IMAGE SHOWING SURFACE FEATURES AROUND 5KM RADIUS	15
FIGURE 2.6: IMAGE SHOWING SURFACE FEATURES AROUND 1 KM RADIUS	16
FIGURE 2.7: REGIONAL GEOLOGY MAP	20
FIGURE 2.8: GEOMORPHOLOGY MAP	21
FIGURE 2.9: TOPOGRAPHY, GEOLOGICAL, YEAR-WISE DEVELOPMENT PRODUCTION PLAN AND SECTIONS	22
FIGURE 2.10: CLOSURE PLAN AND SECTIONS	23
FIGURE.2.11: MINERAL TRANSPORTATION ROUTE MAP	31
FIGURE 3.1: PIE DIAGRAM OF LAND USE AND LAND IN STUDY AREA	37
FIGURE 3.2: LAND USE LAND COVER MAP 10KM RADIUS	37
FIGURE 3.3: SOIL SAMPLING LOCATIONS AROUND 10 KM RADIUS	40
FIGURE 3.4: SOIL MAP	41
FIGURE 3.5: WATER SAMPLING LOCATIONS AROUND 10 KM RADIUS	44
FIGURE 3.6: DRAINAGE MAP AROUND 10 KM RADIUS FROM PROJECT SITE	49
FIGURE 3.7: GROUND WATER PROSPECT MAP	50
FIGURE 3.14: BAR CHART OF PRE-MONSOON WATER LEVEL OF BORE WELLS 1 KM	51
FIGURE 3.11: PRE-MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS – OCT 2022	52
FIGURE 3.12: PRE-MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS – NOV 2022	52
FIGURE 3.13: PRE-MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS – DEC 2022	53
FIGURE 3.14: BAR CHART OF PRE-MONSOON WATER LEVEL OF BORE WELLS 1 KM	54
FIGURE 3.16: PRE-MONSOON WATER LEVEL OF BORE WELLS 1 KM RADIUS–NOV 2022	55
FIGURE 3.19: INVERSE SLOP METHOD GRAPHS OF STATION – 1	61
FIGURE 3.20: INVERSE SLOP METHOD GRAPHS OF STATION – 2	62
FIGURE 3.21: INVERSE SLOP METHOD GRAPHS OF STATION – 3	63

FIGURE 3.22: WINDROSE DIAGRAM.....	65
FIGURE 3.23: AMBIENT AIR QUALITY LOCATIONS AROUND 10 KM RADIUS	68
FIGURE 3.24: BAR DIAGRAM OF SUMMARY OF AAQ 1 – AAQ 8.....	79
FIGURE 3.25: BAR DIAGRAM OF PARTICULATE MATTER PM _{2.5}	79
FIGURE 3.26: BAR DIAGRAM OF PARTICULATE MATTER PM ₁₀	80
FIGURE 3.27: BAR DIAGRAM OF GASEOUS POLLUTANT SO ₂	80
FIGURE 3.28: BAR DIAGRAM OF GASEOUS POLLUTANT NO _x	81
FIGURE 3.29: LINE DIAGRAM OF AVERAGE SPM VALUES	82
FIGURE 3.30: BAR DIAGRAM OF SPM VALUES	83
FIGURE 3.31: NOISE MONITORING STATIONS AROUND 10 KM RADIUS	85
FIGURE 3.32: DAY TIME NOISE LEVELS IN CORE AND BUFFER ZONE	86
FIGURE 3.33: NIGHT TIME NOISE LEVELS IN CORE AND BUFFER ZONE	87
FIGURE 4.1: AERMOD TERRAIN MAP.....	115
FIGURE 4.2: PREDICTED INCREMENTAL CONCENTRATION OF PM ₁₀	115
FIGURE 4.3: PREDICTED INCREMENTAL CONCENTRATION OF SO ₂	115
FIGURE 4.4: PREDICTED INCREMENTAL CONCENTRATION OF NO _x	116
FIGURE 4.5: PREDICTED INCREMENTAL CONCENTRATION OF FUGITIVE DUST	116
FIGURE 4.6: GROUND VIBRATION PREDICTION	122
FIGURE 6.1: PROPOSED ENVIRONMENTAL MONITORING CELL	133
FIGURE 7.1: DISASTER MANAGEMENT TEAM LAYOUT	138
FIGURE 10.1: PERSONAL PROTECTIVE EQUIPMENT TO THE MINE WORKERS	160

1. INTRODUCTION

1.0 PREAMBLE

Environmental Impact Assessment (EIA) is the management tool to ensure the 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 Cumulative load of proposed & existing quarries of Thiru. S. Ravi Rough Stone and Gravel Quarry consisting of one Proposed, Two Nearby Proposed Quarries and Two Existing Quarry with total extent of Cluster of 6.85.5 ha in Lembalakudi Village, Thirumayam Taluk, Pudukkottai District and Tamil Nadu State, cluster area calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016.

Baseline Monitoring study has been carried out during the period of October to December 2022 and this EIA and EMP report is prepared for considering cumulative impacts arising out of this project, the Cumulative Environmental Impact Assessment study is undertaken, which is followed by preparation of a detailed Environmental Management Plan (EMP) individually to minimize those adverse impacts.

1.1 PURPOSE OF THE REPORT

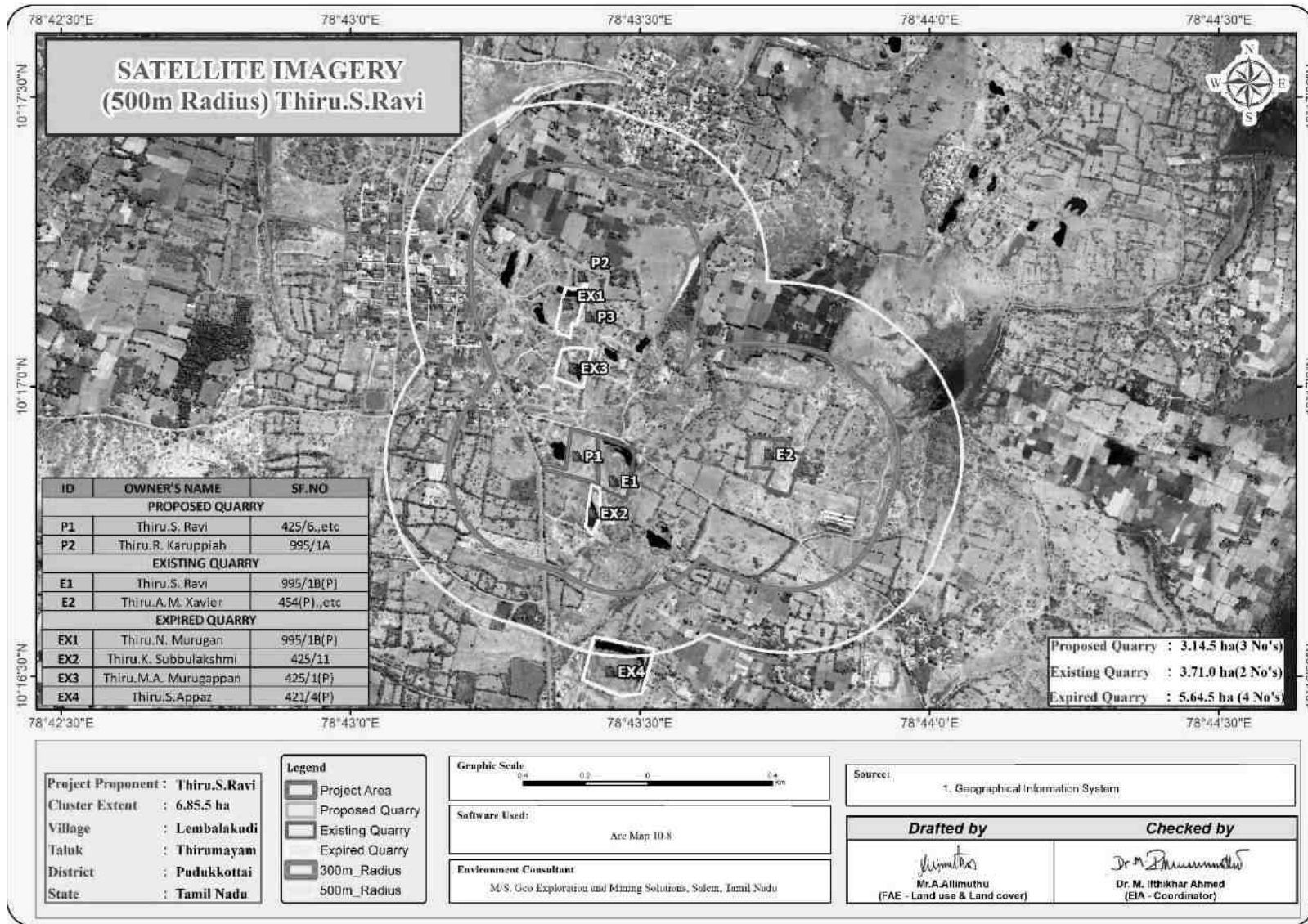
The Ministry of Environment and Forests, Govt. of India, through its EIA notification S.O. 1533(E) of 14th September 2006 and its subsequent amendments as per Gazette Notification S.O. 3977 (E) of 14th August 2018, Mining Projects are classified under two categories i.e. A (> 100 Ha) and B (\leq 100 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.

The 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 ToR for carrying out public hearing for the grant of Environmental Clearance from SEIAA, Tamil Nadu”

FIGURE.1.1 SATELLITE IMAGERY CLUSTER QUARRIES



1.2 IDENTIFICATION OF PROJECT AND PROJECT PROPONENT

1.2.1 Identification of Project

TABLE 1.1: SALIENT FEATURES OF THE PROPOSED PROJECT

Name of the Project	Thiru. S. Ravi Rough Stone and Gravel Quarry Project
S.F. No.	425/6, 425/7 and 425/8
Extent	1.53.5 ha
Land Type	Patta Land
Village Taluk and District	Lembalakudi Village, Thirumayam Taluk, Pudukkottai District

Source: Approved Mining Plan.

1.2.2 Identification of Project Proponent

TABLE 1.2: DETAILS OF PROJECT PROPONENT

Name of the Company	Thiru. S. Ravi Rough Stone and Gravel Project
Address	S/o. Sokkalingam, No. 5/34A, Theradi Street, Virachilai (Post), Thirumayam Taluk, Pudukkottai District.
Mobile	+91 98849 70012
Status	Individual

Source: Approved Mining Plan.

1.3 BRIEF DESCRIPTION OF THE PROJECT

1.3.1 Nature and Size of the Project

Common Mining Methodology is proposed for one proposed mine.

The quarrying operation is to be carried out by Opencast Mechanized Mining method with 5.0m bench height and 5.0m bench width by deploying Jack Hammer Drilling & Slurry Explosive during blasting. Hydraulic Excavator and tippers are used for Loading and transportation. Rock Breakers are deployed to avoid secondary blasting.

TABLE 1.3: BRIEF DESCRIPTION OF THE PROJECT

Name of the Quarry	Thiru. S. Ravi Rough Stone and Gravel Quarry		
Toposheet No	58-J/11		
Latitude between	10°16'49.9061"N to 10°16'55.6024"N		
Longitude between	78°43'20.0066"E to 78°43'25.6247"E		
Highest Elevation	110 m AMSL		
Proposed Depth of Mining	34m bgl (2m Gravel + 2m Weathered rock + 30m Rough Stone)		
Geological Resources	Rough Stone in m ³	Weathered rock m ³	Gravel m ³
	5,37,250	30,700	30,700
Mineable Reserves	Rough Stone in m ³	Weathered rock m ³	Gravel m ³
	1,38,950	18,600	21,060
Year wise Production for 5 years as per TOR	Rough Stone in m ³	Weathered rock m ³	Gravel m ³
	1,36,000	18,600	21,060
Ultimate Pit Dimension	130m (L) x 81m (W) x 39m (D) bgl		
Water Level in the surrounds area	60 – 65m bgl		
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting		
Topography	The lease applied area is exhibits flat terrain. The area has gentle sloping towards eastern side. The altitude of the area is 110m (max) above mean sea level. The area is covered by 2m thickness of gravel and 2m weathered rock. Massive charnockite is found after 2m gravel and 2m weathered rock which is clearly inferred from the nearby existing quarrying pits.		
Machinery proposed	Jack Hammer	4 Nos	
	Compressor	1 No	

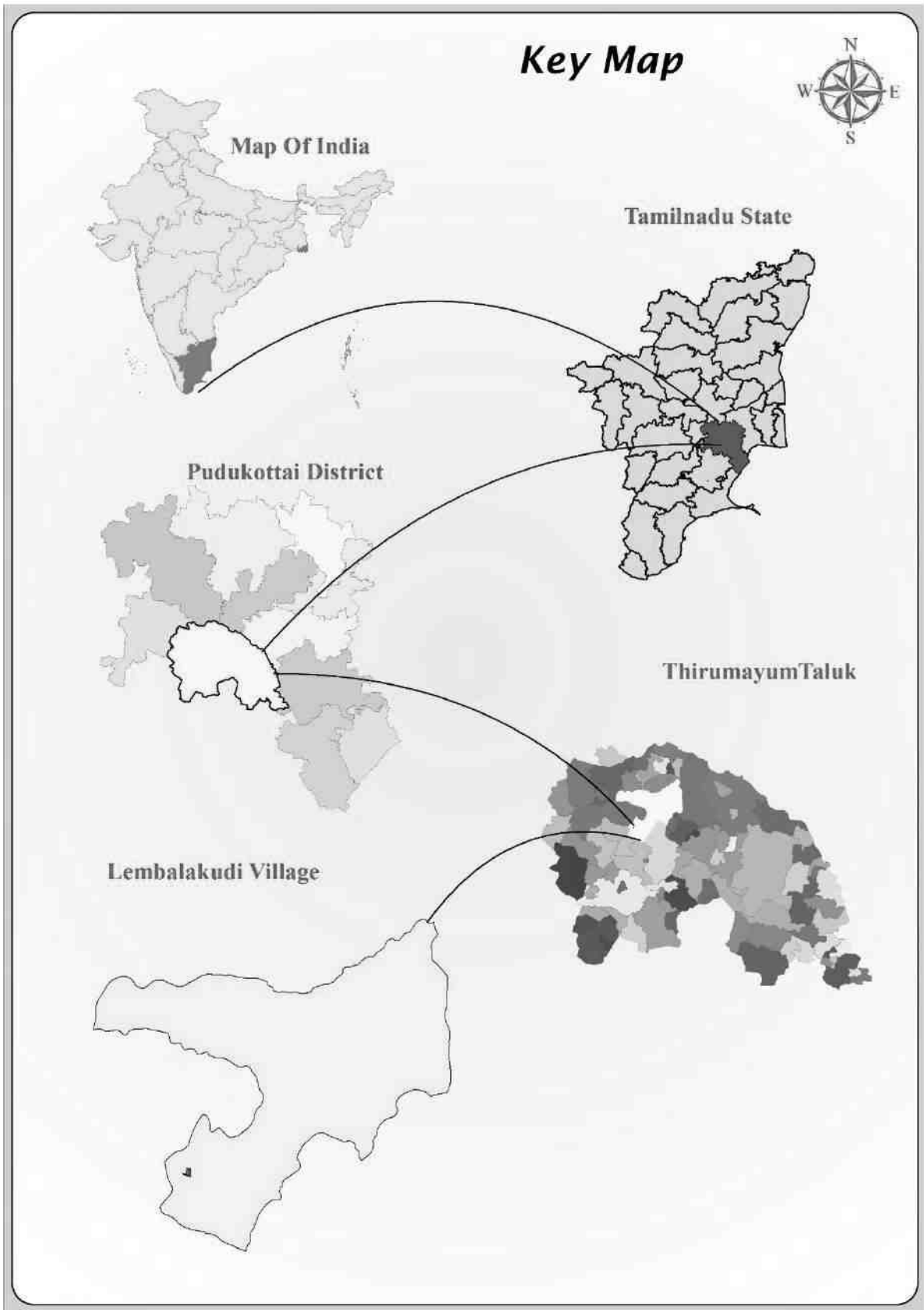
	Excavator with bucket and rock breaker	1 No
	Trucks	2 Nos
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.	
Proposed Manpower Deployment	19 Nos	
Project Cost	Rs. 35,87,000/-	
CER Cost (@ 2% of Project Cost)	Rs 5,00,000/-	
Nearby Water Bodies	Vellar River	7Km & North
	Senthamangalam Dam	9Km & North
	Thulaiyanur Lake	4Km & South
	Tank	840m & East
	Pond	480m & North
	Tank	100m & North East
Greenbelt Development Plan	Proposed to plant 750 trees in 3400Sq.m area in the Safety Zone and panchayat roads	
Proposed Water Requirement	2.0 KLD	
Nearest Habitation	320m Northwest	

Source: Approved Mining Plan

1.3.2 Location of the Project

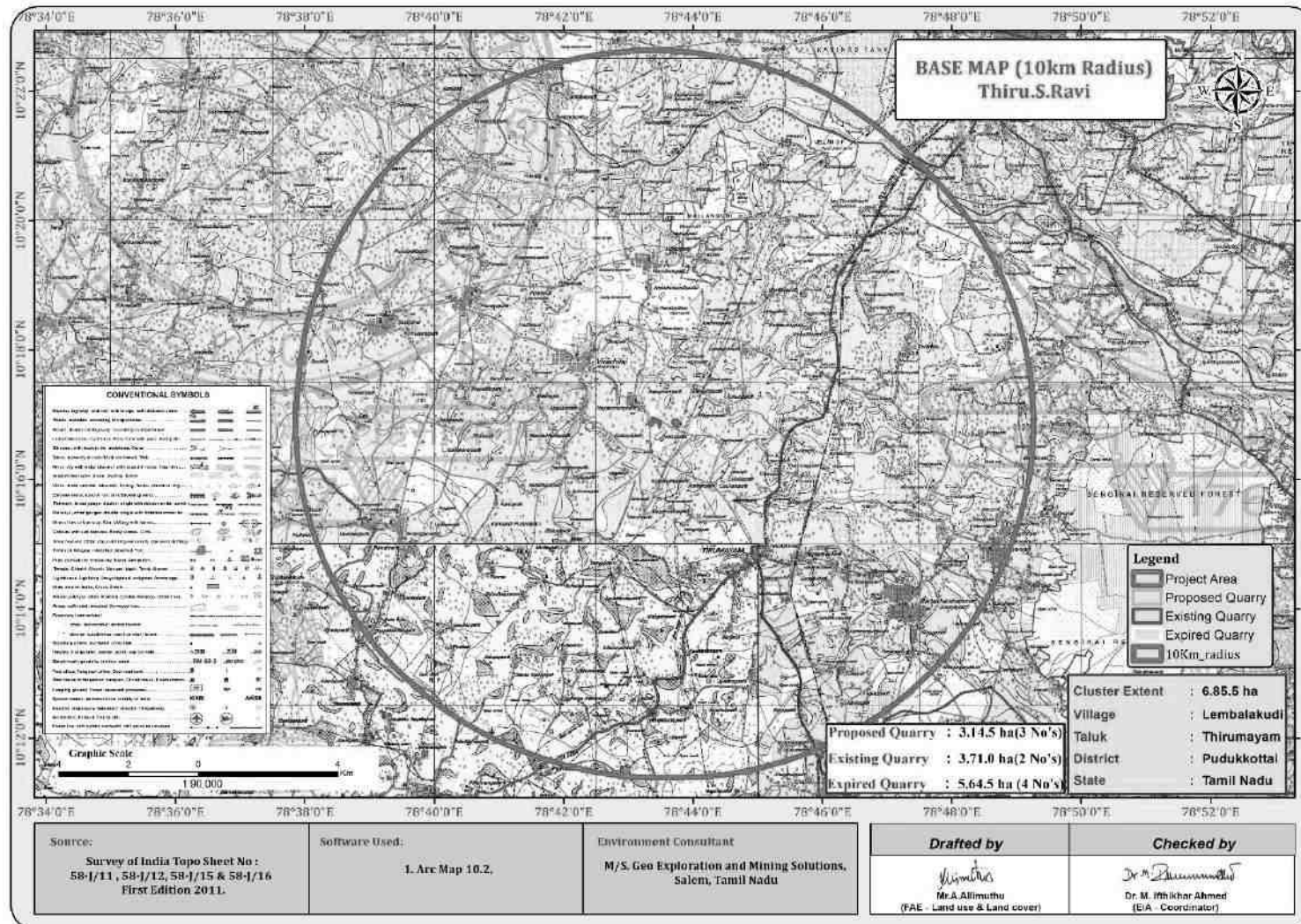
- The proposed quarry project falls in Lembalakudi Village, Thirumayam Taluk and Pudukkottai District.
- The proposed quarry cluster is located about 3.0 km Southwest side of Lembalakudi Village
- The Lembalakudi Village is located about 6 km North of Thirumayam Taluk.
- The area is marked in the Survey of India, Toposheet No. 58-J/11. The area lies between the Latitudes of 10°16'49.9061"N to 10°16'55.6024"N and Longitudes of 78°43'20.0066"E to 78°43'25.6247"E.

FIG1.2 KEY MAP SHOWING THE LOCATION OF THE CLUSTER SITE



Source: Survey of India Toposheet 58-J/11

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



Source: Survey of India Toposheet 58-J/11

1.4 ENVIRONMENTAL CLEARANCE

The Environmental Clearance process for the 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 proponent applied for Rough Stone and Gravel Quarry Lease Dated: 25.02.2022.
- Precise Area Communication Letter was issued by the District Collector, Pudukkottai, vide letter No. 145/2022 (G&M) dated 28.04.2022.
- The Mining Plan was prepared by Qualified Person and approved by Deputy Director, Geology and Mining, Pudukkottai District, vide Rc.No.145/2022 (G&M) dated 13.05.2022.
- 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/81132/2022, Dated: 26.07.2022.

SCOPING

- The proposal was placed in 312th SEAC meeting held on 16.09.2022 and the committee recommended for issue of ToR.
- The proposal was considered in 557th SEIAA meeting held on 08.10.2022 and issued ToR vide Lr No. SEIAA-TN/F.No.9439/ToR-1271/2022 Dated: 08.10.2022.

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, 2010
- EIA Notification, 14th September, 2006
 - Lr No. SEIAA-TN/F.No.9439/ToR-1271/2022 Dated: 08.10.2022.
 - Approved Mining Plan.

1.5 TERMS OF REFERENCE (ToR)

ToR issued vide –

- ToR Lr No. SEIAA-TN/F.No.9439/ToR-1271/2022 Dated: 08.10.2022. Area detailed in Page No. I – XLIX.
-

1.6 POST ENVIRONMENT CLEARANCE MONITORING

The respective proposed project proponents 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 each individual leases. 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 – May 2022) for various environmental components so as to assess the anticipated impacts of the cluster quarry projects on the environment and suggest suitable mitigation measures for likely adverse impacts due to the proposed project.

TABLE 1.4: ENVIRONMENT ATTRIBUTES

Sl.No.	Attributes	Parameters	Source and Frequency
1	Ambient Air Quality	PM10, PM 2.5, SO2, NO2	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 – 5 ground water and 1 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: Field Monitoring Data

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.9439/ToR-1271/2022 Dated: 08.10.2022.

2. PROJECT DESCRIPTION

2.0 GENERAL

The Proposed Rough Stone Quarries requires Environmental Clearance. There are one proposed, Two Nearby Proposed and Two existing quarry forming a cluster; calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016 and the total extent of cluster is **6.85.5 ha**.

As the extent of cluster are 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 the proposed quarries.

Method is mining is common for all the proposed quarries in the cluster. Rough Stone is proposed to be excavated by opencast mechanized method involving splitting of rock mass of considerable volume from the parent rock mass by jackhammer drilling and blasting, hydraulic excavators are used for loading the Rough Stone from pithead to the needy crushers and rock breakers to avoid secondary blasting.

2.2 LOCATION OF THE PROJECT

- The proposed quarry project falls in Lembalakudi Village, Thirumayam Taluk and Pudukkottai District.
- Thiru. S. Ravi Rough stone and Gravel quarry cluster is located about 3.0 km Southwest side of Lembalakudi Village
- The Lembalakudi Village is located about 6 km North of Thirumayam Taluk.
- The area is marked in the Survey of India, Toposheet No. 58-J/11. The area lies between the Latitudes of 10°16'49.9061"N to 10°16'55.6024"N and Longitudes of 78°43'20.0066"E to 78°43'25.6247"E.

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	NH-36 – Pudukkottai – Tirupattur– 5.0Km - East SH-201 – Panayapatti – Namanasamuthiram – 4.0Km - Northwest
Nearest Village	Aranginampatti - 1km – NE
Nearest Town	Thirumayam - 5km – SE
Nearest Railway	Thirumayam - 5km – SE
Nearest Airport	Trichy Airport – 56Km - North
Seaport	Thoothukudi - 179km – SW

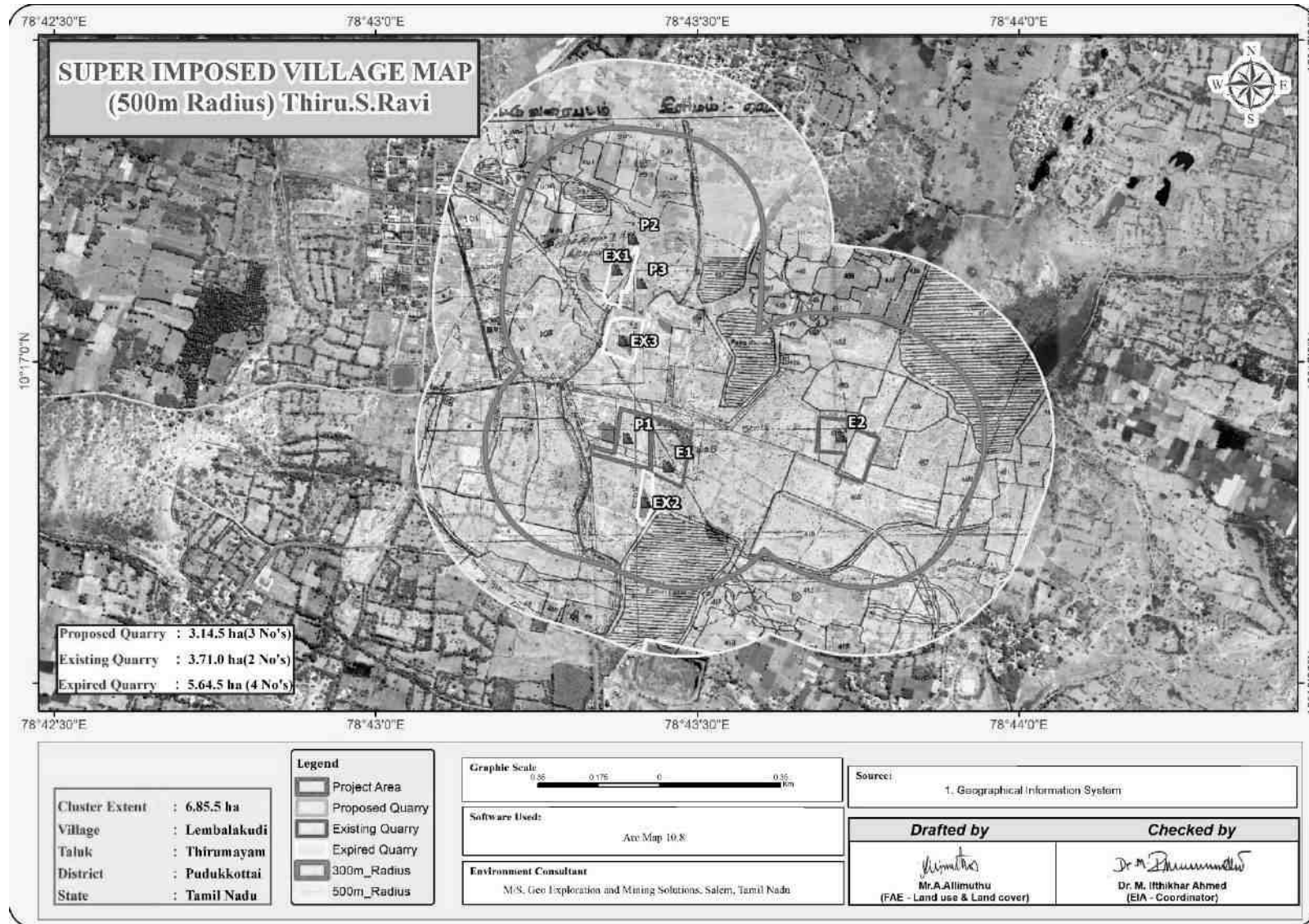
Source: Survey of India Toposheet

TABLE 2.2: BOUNDARY CO-ORDINATES OF PROPOSED PROJECT

Boundary Pillar No.	Latitude	Longitude
1	10°16'51.4085"N	78°43'20.1271"E
2	10°16'52.0547"N	78°43'20.0066"E
3	10°16'51.5004"N	78°43'22.2505"E
4	10°16'55.6024"N	78°43'22.8148"E
5	10°16'54.8839"N	78°43'25.6064"E
6	10°16'49.9061"N	78°43'25.6247"E

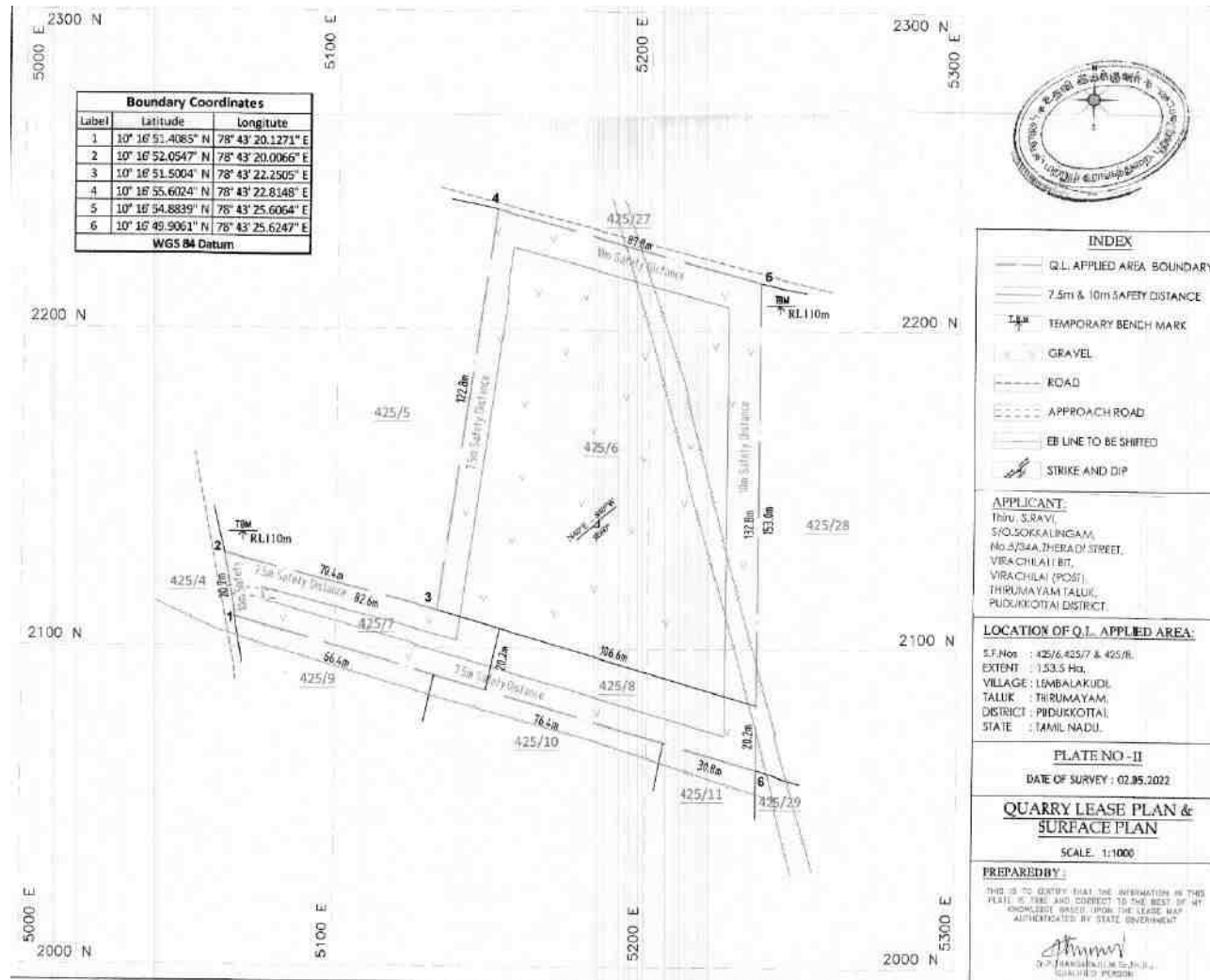
Source: Approved Mining Plan

FIGURE 2.1: GOOGLE IMAGE OF THE PROJECT AREA



Source: Superimposed on Google Earth Imagery

FIGURE 2.2: QUARRY LEASE PLAN / SURFACE PLAN

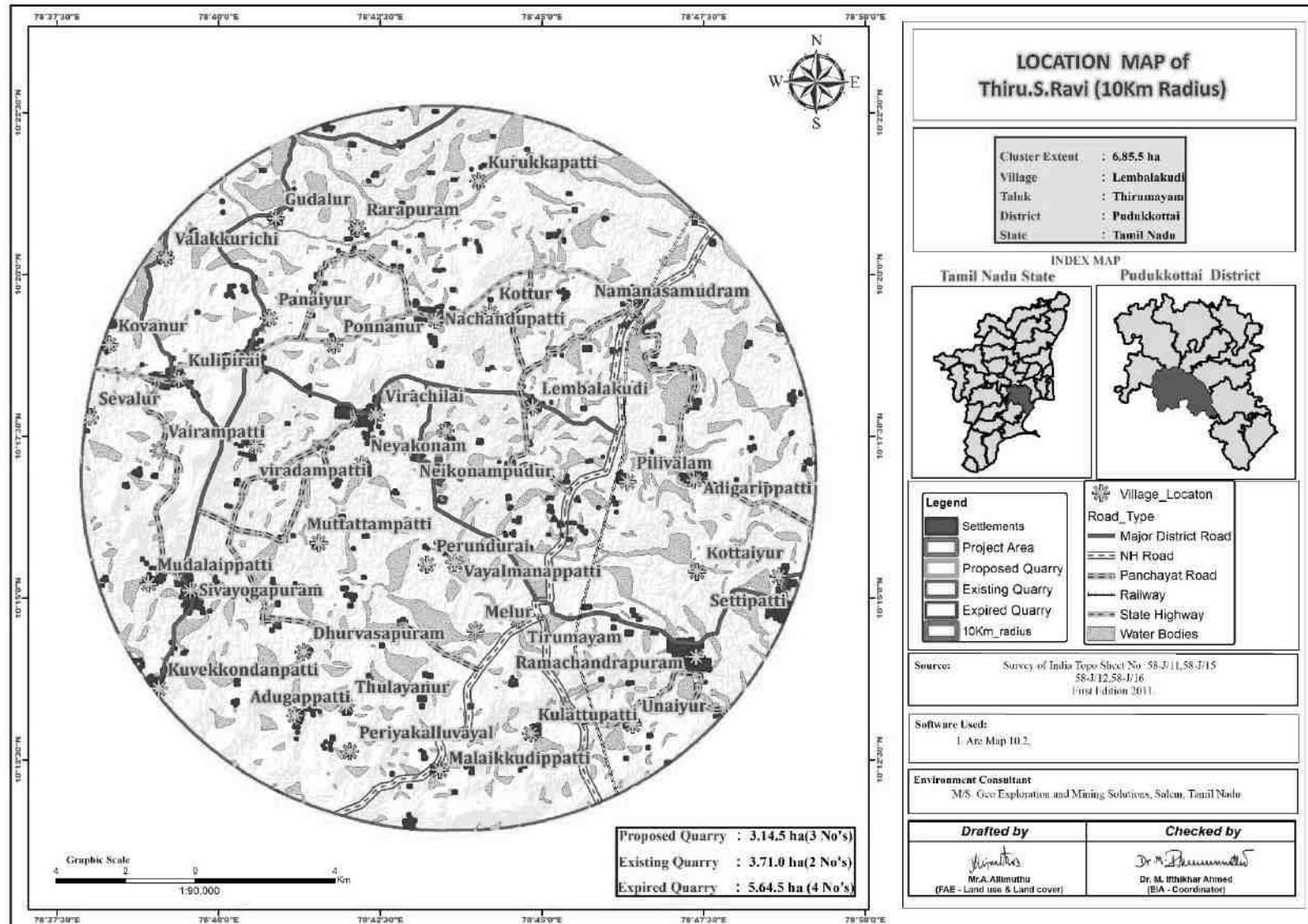


Source: Approved Mining Plan

FIGURE 2.3: PHOTOGRAPHS OF PROPOSED SITE

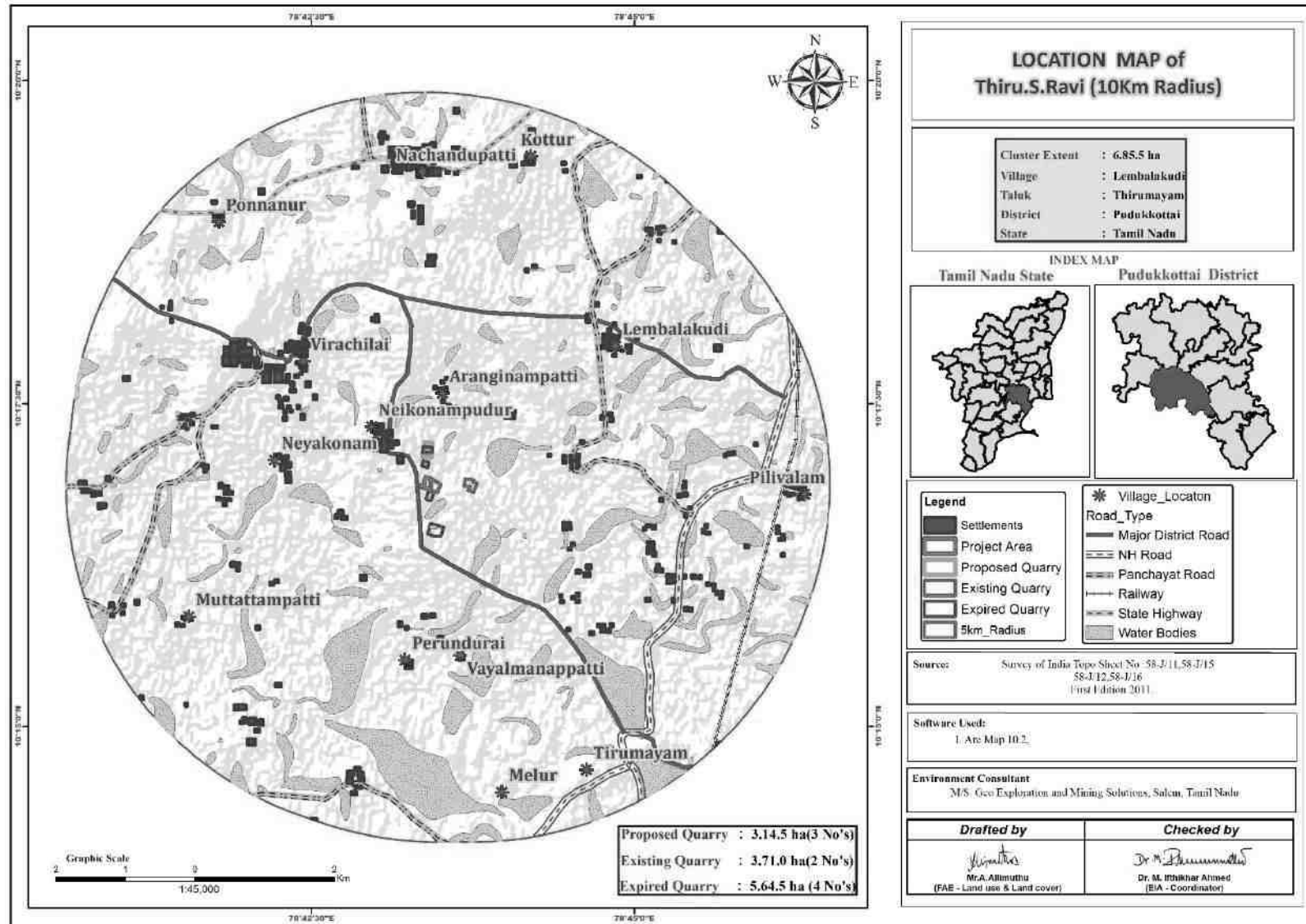


FIGURE 2.4: IMAGE SHOWING SURFACE FEATURES AROUND 10 KM RADIUS



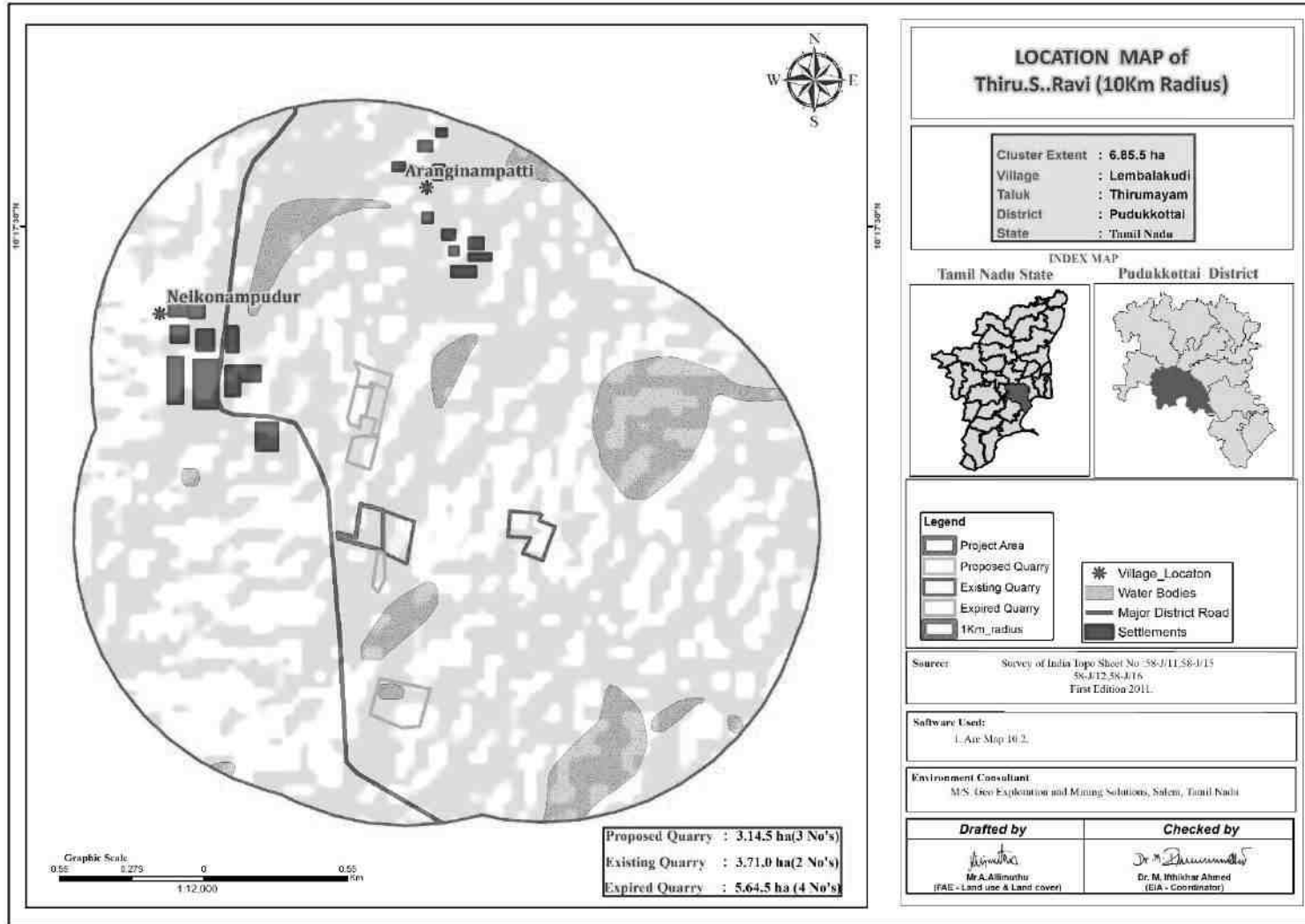
Source: Bhuvan

FIGURE 2.5: IMAGE SHOWING SURFACE FEATURES AROUND 5KM RADIUS



Source: Bhuvan

FIGURE 2.6: IMAGE SHOWING SURFACE FEATURES AROUND 1 KM RADIUS



Source: Bhuvan

2.2.1 Project Area

- 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

DESCRIPTION	PRESENT AREA IN (HA)	AREA AT THE END OF LIFE OF QUARRY (HA)
Area under quarry	Nil	1.04.6
Infrastructure	Nil	0.01.0
Roads	Nil	0.01.0
Green Belt	Nil	0.34.0
Un – utilized area	1.53.5	0.12.9
TOTAL	1.53.5	1.53.5

Source: Approved Mining Plan

2.2.2 Size or Magnitude of Operation

TABLE 2.4: OPERATIONAL DETAILS FOR PROPOSED PROJECT

PARTICULARS	DETAILS		
	Rough Stone (5Year Plan period)	Weathered rock (3 Years Plan period)	Gravel (3 Years Plan period)
Geological Resources in m ³	5,37,250	30,700	30,700
Mineable Reserves in m ³	1,38,950	18,600	21,060
Production in m ³ as per TOR	1,36,000	18,600	21,060
Mining Plan Period	5 Years		
Number of Working Days	300 Days		
Production per day in m ³	91	21	23
No of Lorry loads (12m ³ per load)	8	2	2
Total Depth of Mining	34m bgl		

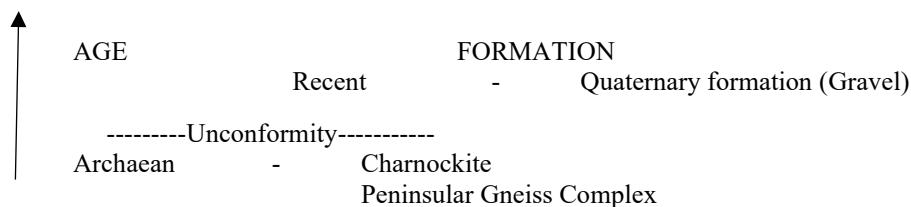
Source:Ps

2.3 GEOLOGY

2.3.1 Regional Geology

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 N40°E to S40°W with dipping SE60°.

Stratigraphy of the area –



The geological formation of Pudukkottai District comprises of the hard rocks formed in the Archean age to the sedimentary deposits of the Quaternary period. Geologically the entire study area can be divided into hard rock and sedimentary rock regions. The hard rocks are found on the western side and sedimentary formation towards the eastern direction of the study area. About 45 per cent of the study area is under hard massive formation of Archean age and the rest 55 per cent comprises of the sedimentary formation ranging from Pre-Cambrian to Quaternary period. The various types of hard rocks found here are Charnockites, Hornblende Gneiss, Biotite Gneiss, Granite and Quartzite's. Various types of Gneiss rocks are found in the western part of Pudukkottai District. Charnockites

and granites rocks are mostly found in the central part including the blocks of Kunnandavarkoil, Thirumayam and the southern parts of Pudukkottai Block. The various types of Gneiss rocks are found in the western part of the study area, consisting the blocks of Viralimalai, Annavasal and Ponamaravathy. Quartzite deposits are found in small quantity in some parts of Annavasal and Thirumayam Blocks. In the Blocks of Kulathur, Thirumayam and parts of Pudukkottai crystalline rocks are found. The sedimentary deposits found in this region consist of shaly sandstone, sand, clay and gravels. The sedimentary deposits formed during the Tertiary period consist of laterite, arenaceous and argillaceous sandstone clay. These deposits are found in the Blocks of Arantangi, Gandarvakottai, Alangudi and Thiruvarankulam. Cretaceous deposits consisting of clay, limestone, sand stone and clayey sand stone are found in some parts of Gandarvakottai, Thirumayam and Pudukkottai. Unconsolidated coastal alluvial deposits consisting of sand gravel and silt are found along the river bed. Silt and clay deposits of Quaternary period are found in the blocks of Avudaiyarkoil and Manalmelkudi. Sand deposits with beach ridges and dunes are identified near the coastal boundary of Pudukkottai District.

Source: District Survey Report for Minor Minerals Pudukkottai District – May 2019

<https://www.tnmines.tn.gov.in/pdf/dsr/6.pdf>

2.3.2 Local Geology: -

The study area follows the regional trend and mainly comprises of Hard Rock Formation as a homogeneous formation / Batholith formation of Charnockite. All the project areas are plain terrain, all the project areas are covered with Gravel formation of 2m thickness and Weathered rock of 2m thickness; Massive Charnockite formation is found after 2m of Gravel and 2m of Weathered rock formation which is clearly inferred from the existing quarry pit.

2.3.3 Hydrogeology

The major aquifer systems in the district are constituted by weathered and fractured crystalline rocks consisting mainly hornblende gneisses, granitic gneisses and pink granites, sedimentary formations ranging in age from Cretaceous to Recent, consisting of sand stones, lime stones, shales and unconsolidated alluvium. In the former, ground water occurs under phreatic conditions in the weathered mantle at shallow depths and semiconfined conditions in the fractured systems at deeper levels, whereas in the latter, it occurs under phreatic to confined conditions depending upon the storage and conduit characterization of the confining layers.

The thickness of weathering in crystalline rock in the district ranges from less than a meter to maximum of 15.0 m bgl depending on the topography, lithology and structural features. The results of groundwater exploration indicate that there is a possibility of encountering 2 fracture zones within 50 m bgl, 2 zones in between 50 – 100 m depth and 1 fracture zone between 100 - 150 m and 150-200m depth ranges. However, all the zones may not be encountered at all places.

In case of porous formations, aquifers can be grouped into shallow aquifers with zones within the depth of 100 m bgl and deeper aquifers between the depth range of 100 – 450 m bgl. In the shallow aquifer zones, area south of Vellar has quality problem and groundwater extraction is only from beyond 100 m depth. In other places, the granular zones are present between 60 – 100 m depth. In case of deeper aquifers, the exploration has revealed that the presence of 2 to 22 aquifer zone with a total thickness varying between 21.43 and 314.5 m. The isopach contour showed an increase in thickness from less than 50 m in the northwestern part to more than 250 m in the southeastern part.

The dug wells tapping weathered formation are 12-15 m deep and can sustain a yield up to 5 lps for a pumping 2-4 hours, while the dug wells tapping the shallow aquifers in porous formations are 12 m deep and can sustain a yield of 5 lps for a pumping of 4-6 hrs.

The shallow aquifer down to 100 m bgl are tapped with shallow tube wells with a diameter of 150 mm with depth varying between 60 – 100m and slotted pipe of length of 10 to 20m. The wells can yield between 2 to 8 lps and can sustain a pumping of 8 – 10 hrs. The deeper aquifers are yet to be tapped for irrigation purposes and only tube wells are constructed for providing drinking water supply. The depth of the wells vary between 350– 450 m bgl

with a housing diameter of 20 – 30 cm and assembly diameter of 15 – 20 cm. The wells may yield between 19 – 56 lps.

The depth to water level in the phreatic aquifer varied from 0.85 to 9.50 m bgl during premonsoon (May 2006) and from 0.58 to 6.88 m bgl during post monsoon (Jan 2007). The depth to piezometric surface varied from 1.90 to 6.60 m bgl during pre-monsoon (May 2006) and from 1.70 to 7.60 m bgl during post monsoon (Jan 2007).

TABLE 2.4A: RANGE OF AQUIFER PARAMETERS

Parameters	Range
Well yield in LPM	1-2 lpm
Transmissivity (T) m ² /day	5-25 m ² /day
Permeability (K) m/day	3-16 m/day

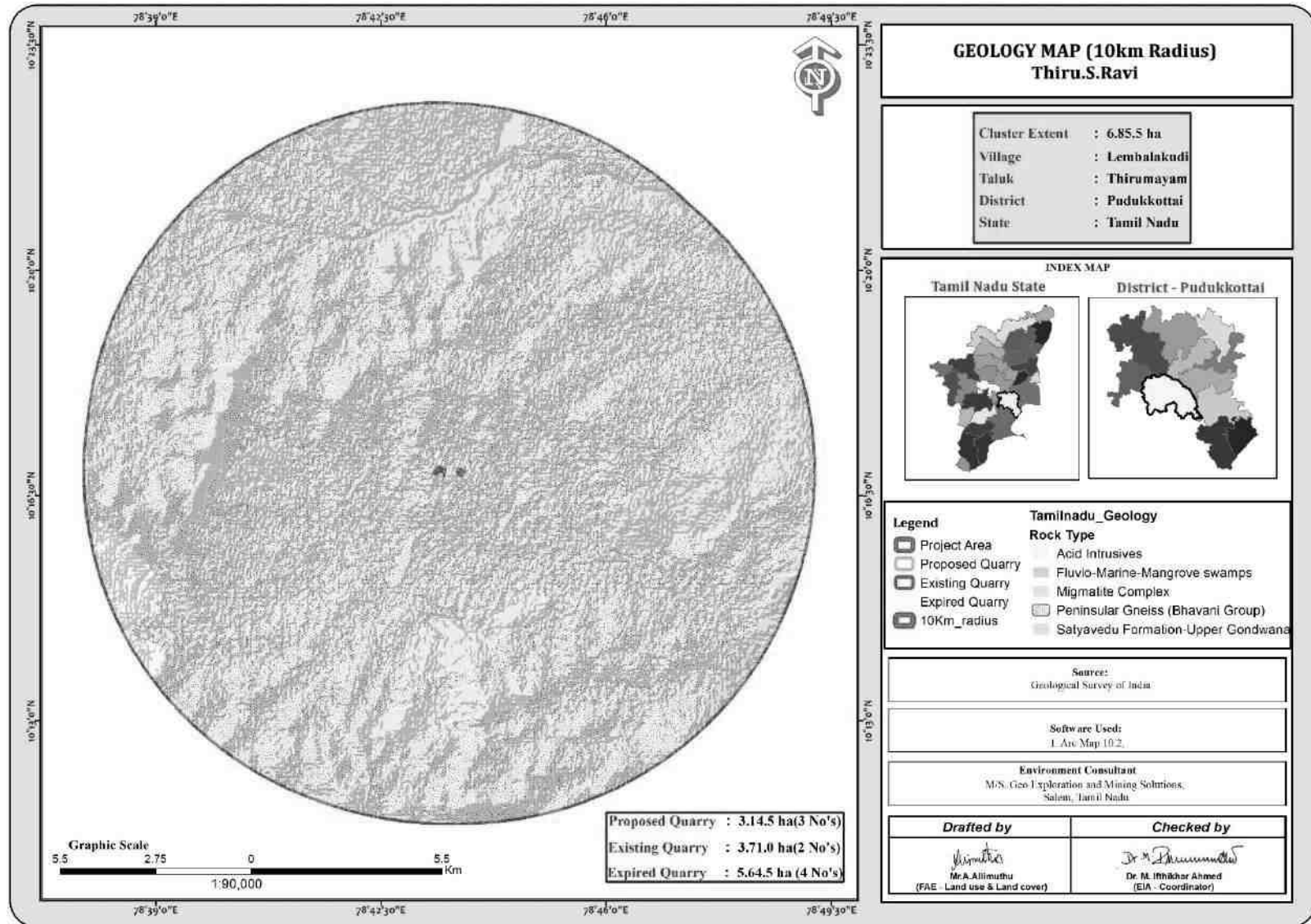
Source: <http://nwm.gov.in/sites/default/files/Notes%20on%20Pudukottai%20District.pdf>

TABLE 2.5: GROUND WATER LEVEL VARIATIONS OF PUDUKKOTTAI DISTRICT

Jan 2017	May 2017	Jan 2018	May 2018	Jan 2019	May 2019	Jan 2020	May 2020	Jan 2021	May 2021	5 Years Pre Monsoon Average	5Years Post Monsoon Average
30.2	35.5	33.8	32.2	41.0	43.9	38.7	25.3	30.3	22.3	27.0	30.4

Source: <https://www.twadboard.tn.gov.in/content/Pudukkottai>

FIGURE 2.7: REGIONAL GEOLOGY MAP



Source: From the above map it is inferred that the cluster quarries falls in the hard rock terrain (Peninsular Gneiss)

FIGURE 2.8: GEOMORPHOLOGY MAP

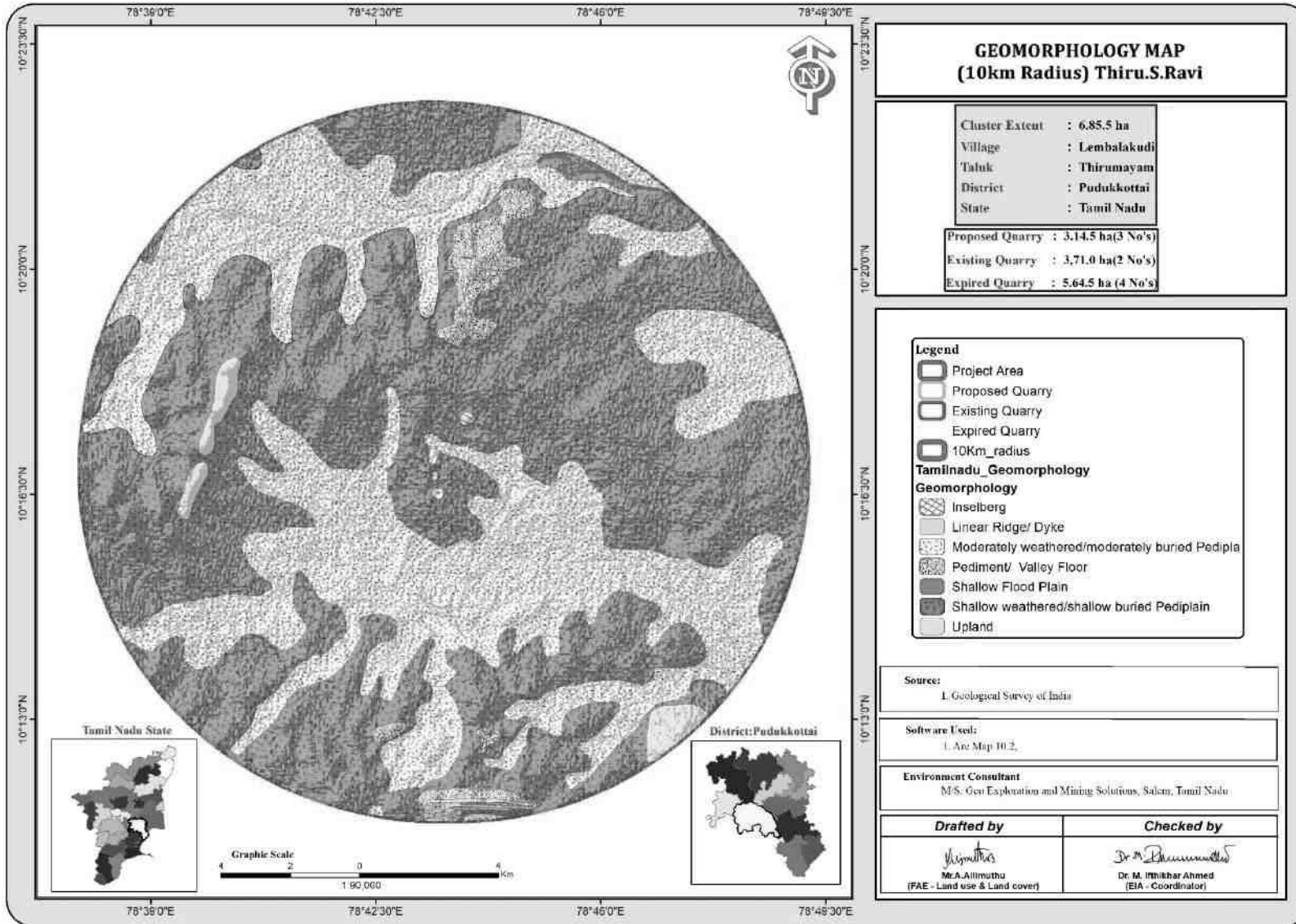
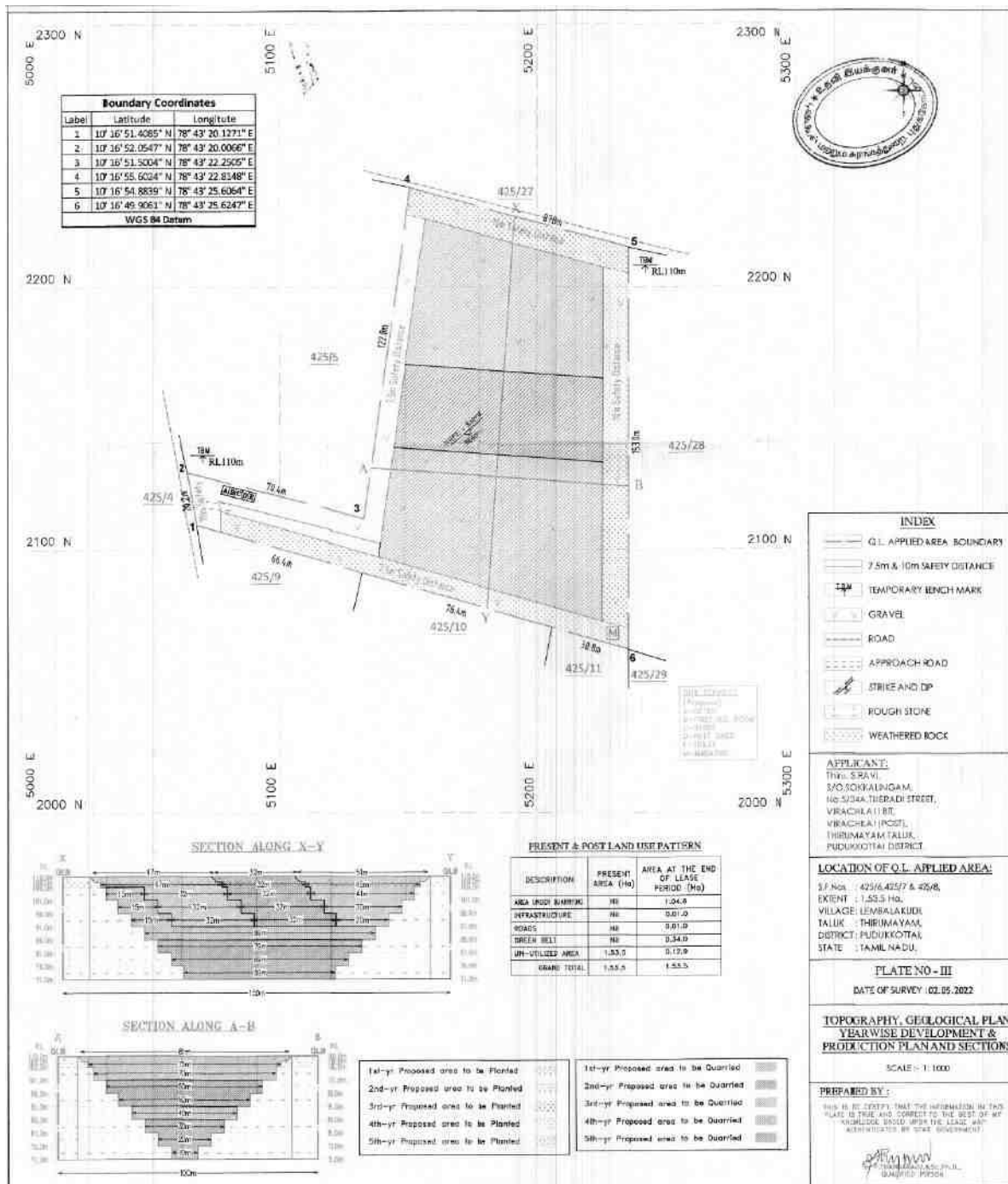
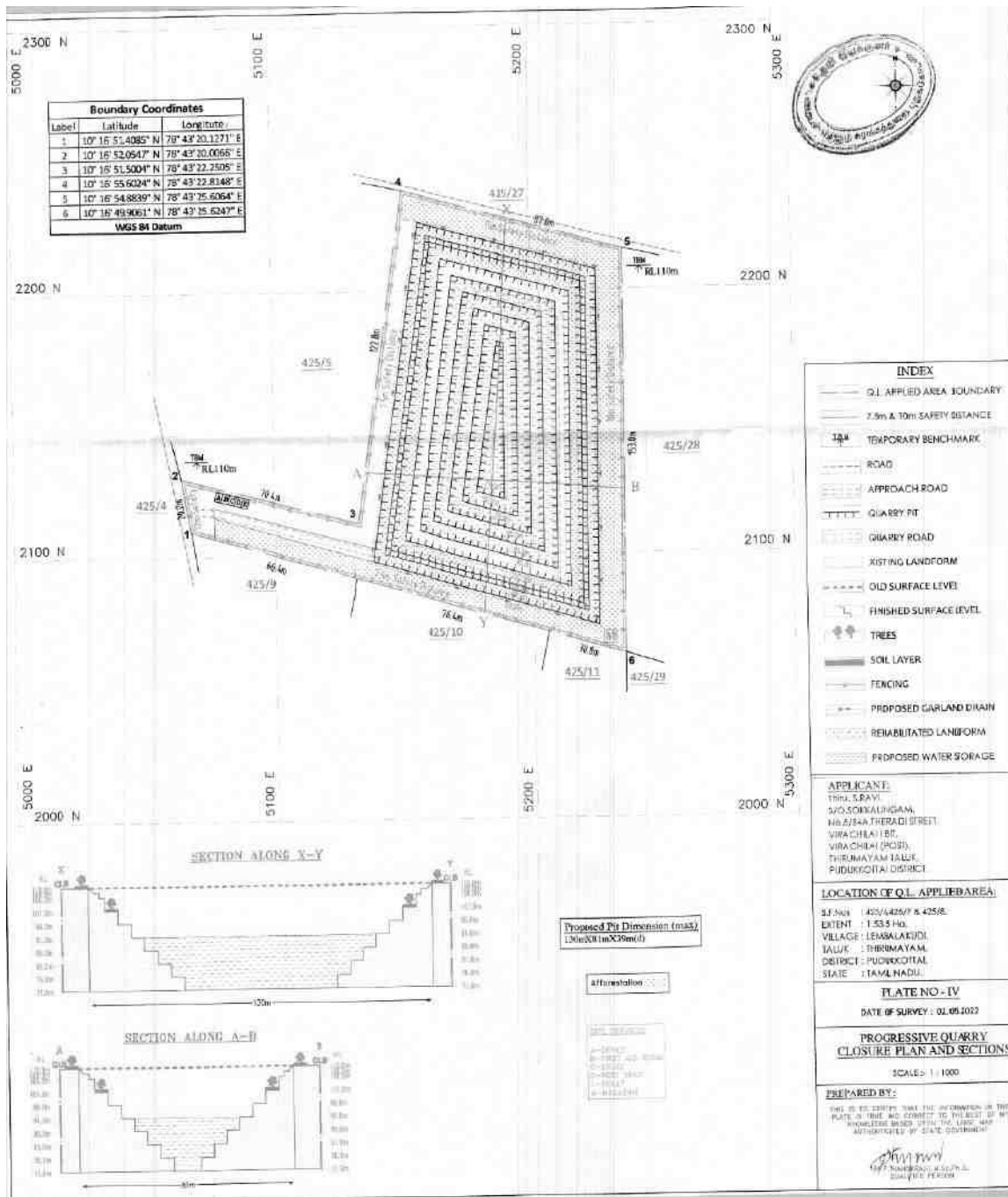


FIGURE 2.9: TOPOGRAPHY, GEOLOGICAL, YEAR-WISE DEVELOPMENT PRODUCTION PLAN AND SECTIONS



Source: Approved Mining Plan

FIGURE 2.10: 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 for all the proposed projects.

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 7.5m & 10m 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 all the proposed projects.

TABLE 2.6: AVAILABLE GEOLOGICAL RESOURCES OF PROPOSED PROJECT

Description	Rough Stone	Weathered rock	Gravel
Geological Resource in m ³	5,37,250	30,700	30,700
Mineable Resource in m ³	1,38,950	18,600	21,060

Source: Approved Mining Plan

TABLE 2.7: YEAR-WISE PRODUCTION PLAN

YEAR	ROUGH STONE (m ³)	WEATHERED ROCK (m ³)	GRAVEL (m ³)
I	28,350	6,750	8,262
II	28,800	4,800	5,184
III	28,800	7,050	7,614
IV	31,300	-	-
V	18,750	-	-
TOTAL	1,36,000	18,600	21,060

Source: Approved Mining Plan

Disposal of Waste

There is no waste anticipated in these Rough Stone and Gravel quarrying operation. The entire quarried out materials will be utilized (100%). Top layer of Gravel formation will be removed and will be sold in open market.

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

Length (Max) (m)	Width (Max) (m)	Depth (Max)
130	81	39m 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.

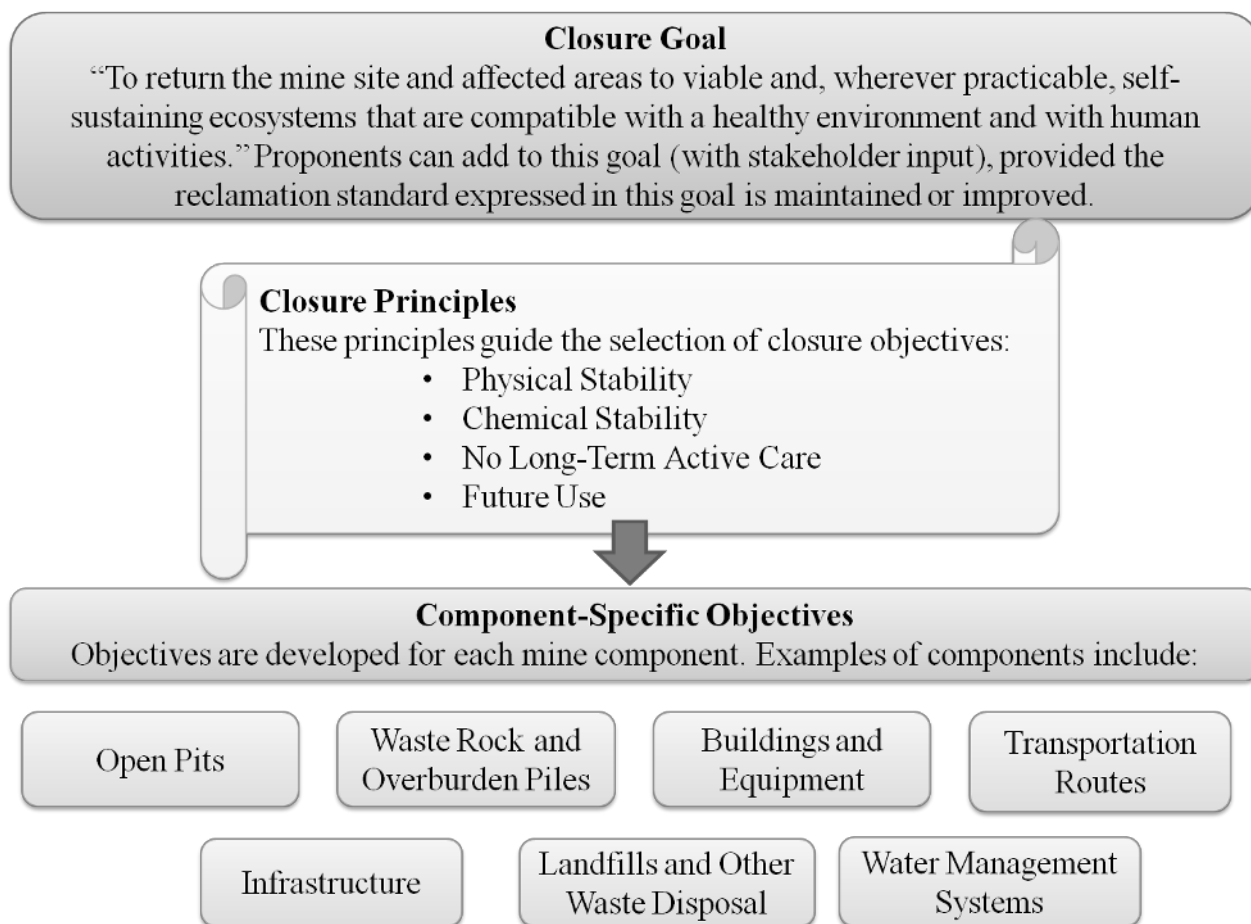
Closure Objectives –

- 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	150	150	150	150	150	@ 100 Rs/ Saplings	Rs 75,000
Plantation cost	15000	15000	15000	15000	15000		
Plantation in the around the approach road and panchayat roads	75	75	75	75	75		Rs 37,500
Renovation of Wire Fencing (620 meters)	1,86,000					@ 300Rs per meter	Rs 1,86,000
Renovation of Garland Drain (430 meters)	1,29,000					@ 300Rs per meter	Rs 1,29,000
TOTAL							Rs 4,27,500

Source: Proposed by FAE's and EC

2.5 METHOD OF MINING

Proposed Method of Mining is common for the Proposed Project – The method of mining is Opencast Mechanized Mining Method is being proposed by formation of 7.0-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 respective project proponents have 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	4	1.2m to 2.0m	Compressed air
2	Compressor	1	400psi	Diesel Drive
3	Excavator with Bucket / Rock Breaker	1	300 HP	Diesel Drive
4	Trucks	2	20 Tonnes	Diesel Drive

Source: Approved Mining Plans

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 in all the proposed quarries.

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 Lakshmipuram to Nallipatti -Viilage Road

Traffic density measurements were performed at two locations

1. Lakshmipuram to Nallipatti -Viilage Road
2. Panayapatti to Tirumayam - 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	Lakshmipuram to Nallipatti	1.0 km - SE	VILLAGE ROAD
TS2	Panayapatti to Tirumayam	2.50 km - SE	MAJOR DISTRICT ROAD

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	80	240	150	155	256	128	523
TS2	120	360	210	220	376	183	763

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 per day		
Capacity of trucks	No. of Trips per day Cumulatively	Volume in PCU
12 tonnes	8	8

Source: Data analysed from Approved Mining Plan

FIGURE.2.11: MINERAL TRANSPORTATION ROUTE MAP

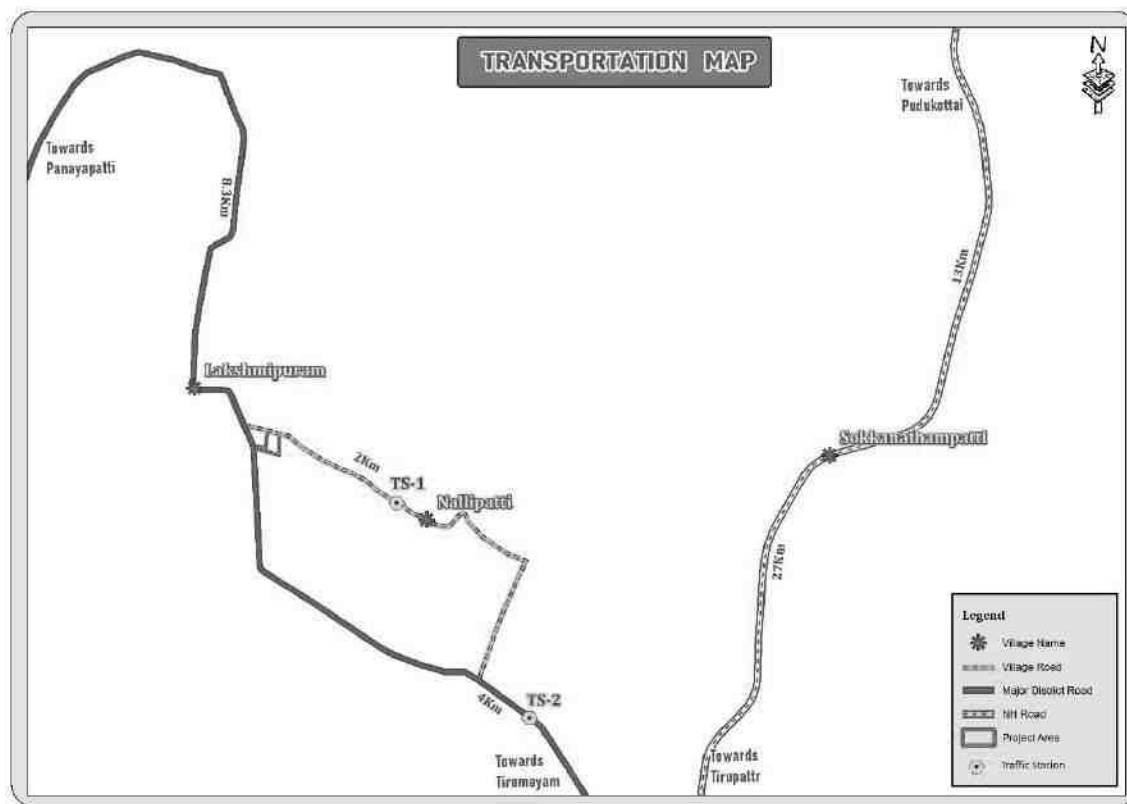


TABLE 2.14: SUMMARY OF TRAFFIC VOLUME

Route	Existing Traffic volume in PCU	Incremental traffic due to the project	Total traffic volume	Hourly Capacity in PCU as per IRC – 1960 guidelines
Lakshmiapuram to Nallipatti	523	8	531	1200
Panayapatti to Tirumayam	763	8	771	1500

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 District Road can handle 1200 PCU in hour in hour & village road 500 PCU 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

*Purpose	Quantity	Source
Dust Suppression	1.0 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Green Belt development	0.4 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Domestic purpose	0.6 KLD	Water Tankers
Total	2.0 KLD	

Source: Prefeasibility report

* Drinking water will be sourced from Approved Water Vendors

2.7.2 Power and Other Infrastructure Requirement

No 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 = 300 Liters of HSD / day per proposed project.

2.7.4 Project Cost

TABLE 2.16: PROJECT COST OF PROPOSED PROJECT

Project Cost	Rs.35,87,000/-
--------------	----------------

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

PROPOSAL	
Mines Manager/Mines Foreman	1
Mate/Blaster	1
Jack hammer Operator	8
Excavator Operator	1
Tipper Drivers	2
Helper	2
Co-operator and Cleaner	3
Security	1
Total	19

Source: Approved Mining Plans of respective Project

2.9 PROJECT IMPLEMENTATION SCHEDULE

The commercial operation will commence after the grant of Environmental Clearance. CTO 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
		1 st	2 nd	3 rd	4 th	5 th	
1	Environmental Clearance						
2	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 2022 with CPCB guidelines. Environmental data has been collected with reference to cluster quarries by Chennai Mettex lab private Limited– Approved by AAI, AGMARK, APEDA, BIS, [IC, FSSAI, GAFTA, IOPEPC, MOEF & TEA BOARD, 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 Pre-monsoon season i.e., October to December 2022.

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
- A 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, PM₁₀ and SO₂, 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 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	PM10 PM2.5 SO2 NOX Fugitive Dust	24 hourly twice a week (March – May 2019)	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 Quadrante & 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 Chennai Mettex Lab Private Limited in association with GEMS

* All monitoring and testing has 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

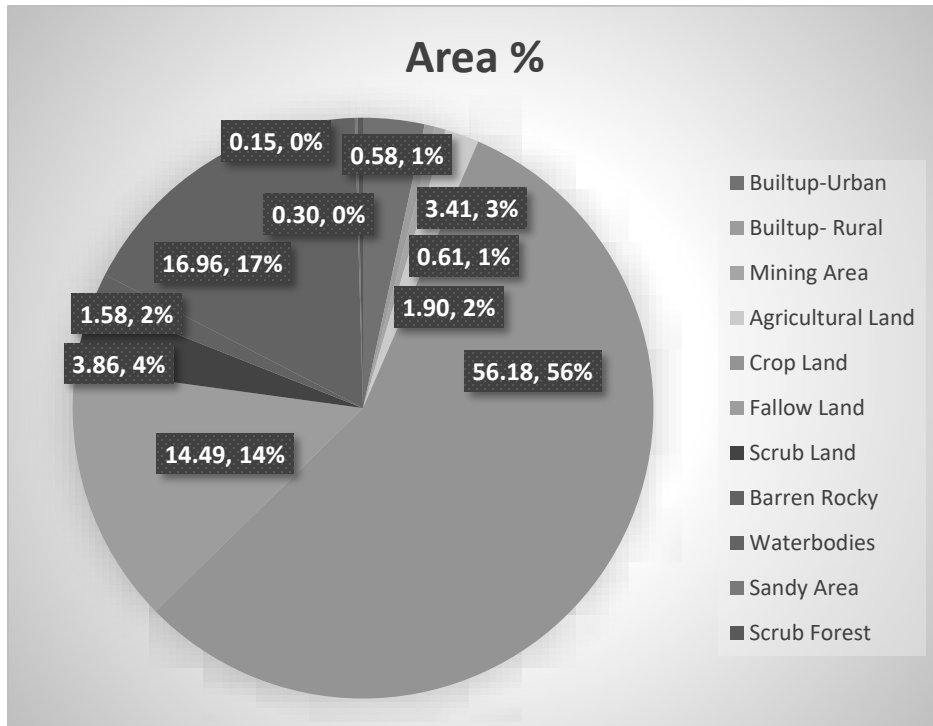
A visual interpretation technique has been adopted for land use classification based on the keys suggested in the chapter – V of the guidelines issued by NNRMS Bangalore & Level III classification with 1:50,000 scale for the preparation of land use mapping. Land use pattern of the area was studied through 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	1159.889886	3.411652285
2	Builtup- Rural	196.959752	0.579329293
3	Mining Area	206.821634	0.608336626
AGRICULTURAL LAND			
4	Agricultural Land	644.472204	1.895623968
5	Crop Land	19098.446	56.17538157
6	Fallow Land	4925.516061	14.48770985
BARREN/WASTELANDS			
7	Scrub Land	1311.200929	3.856712348
8	Barren Rocky	536.212943	1.577194641
WATERBODIES			
9	Waterbodies	5766.949643	16.96266789
10	Sandy Area	49.895468	0.146760472
FOREST			
11	Scrub Forest	101.528264	0.298631049
		33997.89278	100

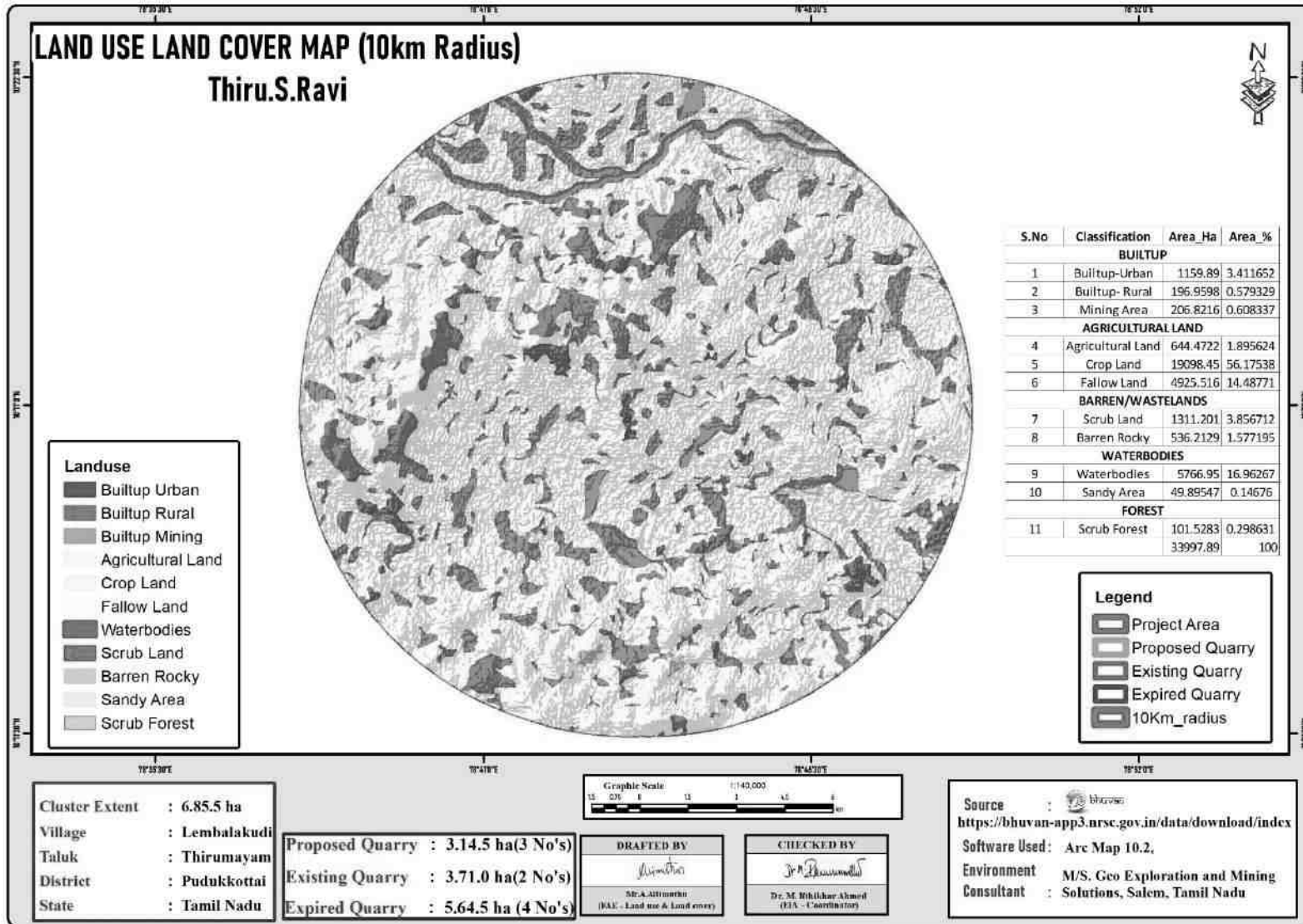
Source: Survey of India Toposheet and Landsat Satellite Imagery

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



Source: Table 3.1

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 land and fallow land) 72.56% followed by Built-up Lands (includes Urban & Rural) 3.99%, Barren Land/Waste Lands (includes Scrub land & barren rocky) 5.43%; Water bodies 17.11%; Forest 0.30% and Mining – 0.61%.

The total mining area within the study area is 206.82 ha i.e., 0.61%. The cluster area of 6.85.5 ha contributes about 3.31% 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 proposed project area is plain terrain, covered with Gravel formation of 2m thickness and weathered rock of 2m thickness; Massive Charnockite formation is found after 2m Gravel formation and 2m weathered rock formation which is clearly inferred from the existing quarry pits.

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 III, 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	None	Mallangudi RF 4.1km NE Vellar RF 8.5km NE
3	Lakes/Reservoir/ Dams/Stream/Rivers	None	Vellar River – 7km – North Senthamangalam Dam–9km – North Thulaiyanur Lake – 4km – South Tank – 840m – East Pond – 480m – North Tank – 100m – North East
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/	None	Nil within 10km Radius

	Thermal Power Plants		
10	Defence Installation	None	Nil within 10km Radius

Source: Survey of India Toposheet

TABLE 3.4: NEARBY WATER BODIES FROM THE PROPOSED PROJECT SITE

No	Name	Distance & Direction
1	Vellar River	7Km & North
2	Senthamangalam Dam	9Km & North
3	Thulaiyanur Lake	4Km & South
4	Tank	840m & East
5	Pond	480m & North
6	Tank	100m & North East

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 3.6 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	Project area	10°16'53.50"N 78°43'25.25"E
2	S-2	Arumanthapatti	2.8km SW	10°16'13.54"N 78°41'55.07"E
3	S-3	Thirumayam	4.5km SE	10°14'34.73"N 78°44'16.56"E
4	S-4	Embanakutti	3km NE	10°17'44.87"N 78°44'46.59"E
5	S-5	Ponnanur	4.7km NW	10°18'53.80"N 78°41'49.57"E
6	S-6	Thiruvapuram	5.8km SW	10°14'15.76"N 78°41'27.96"E

Source: On-site monitoring/sampling by Chennai Mettex Lab Private Limited 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 Chennai Mettex Lab Private Limited 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

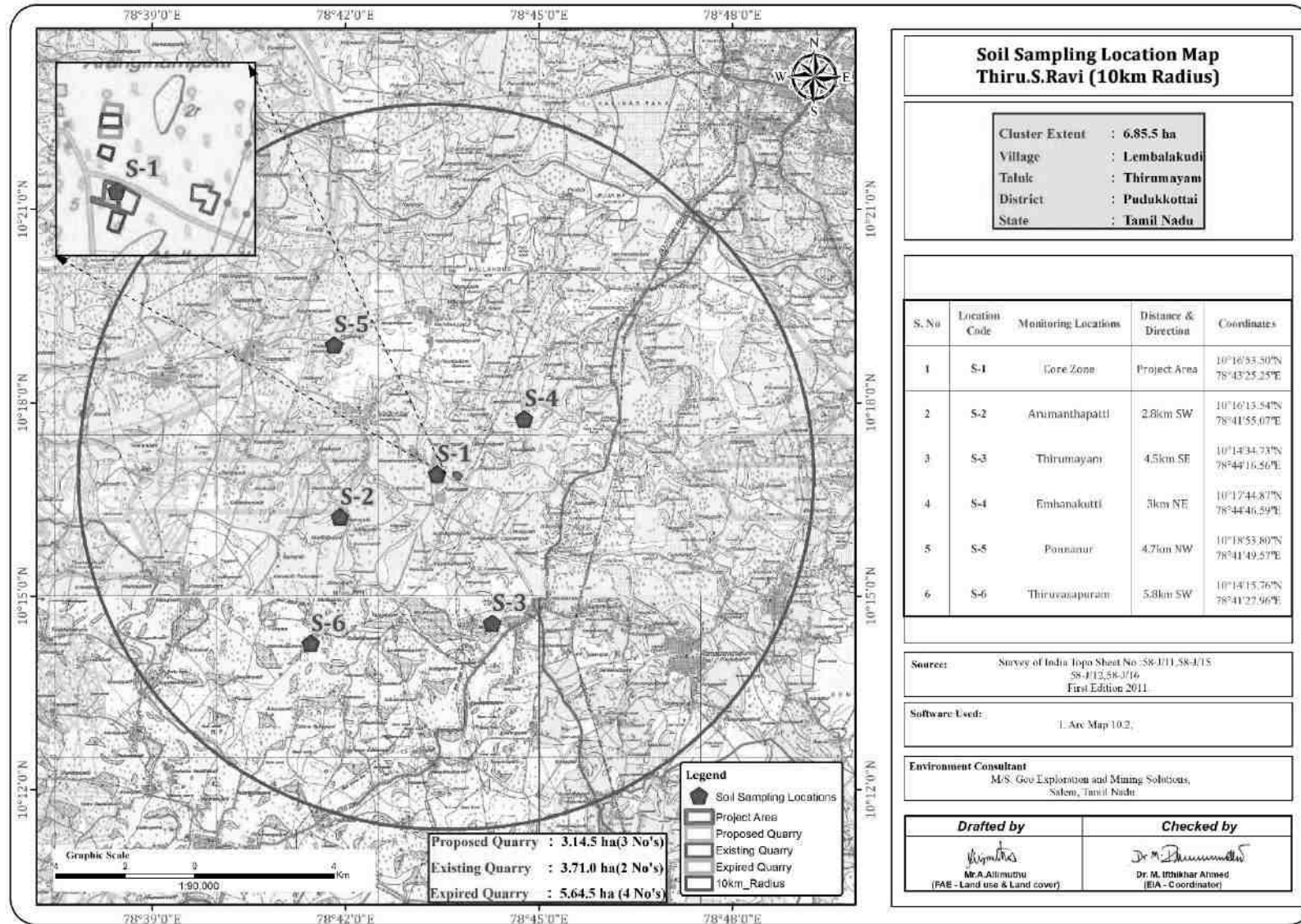


FIGURE 3.4: SOIL MAP

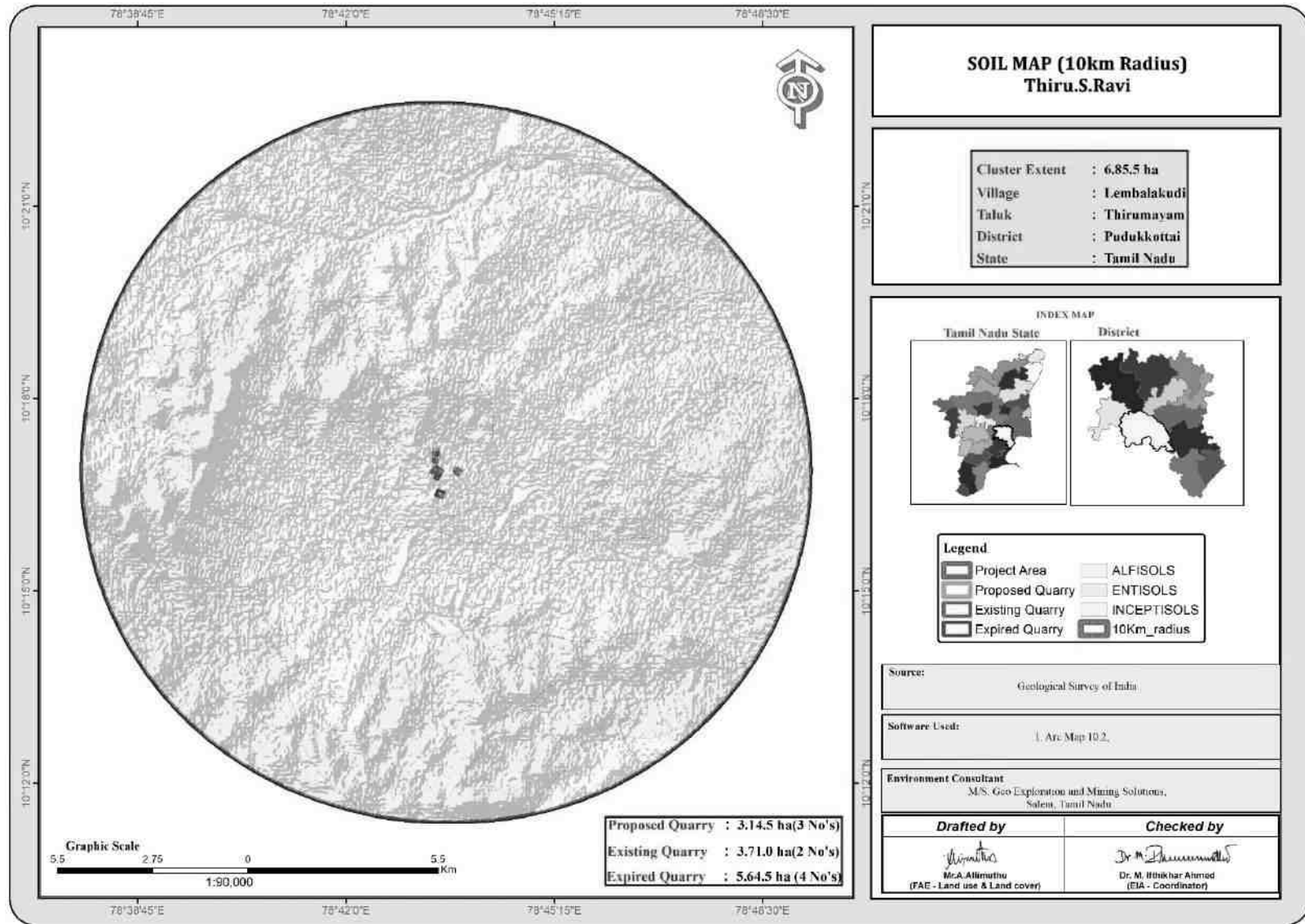


TABLE 3.7: SOIL QUALITY OF THE STUDY AREA

Parameter		Unit	S-1 Project Area	S-2 Arumanthapatti	S-3 Thirumayam	S-4 Embanakutti	S-5 Ponnanur	S-6 Thiruvapuram	
1	pHat27C	-	8.38	8.18	8.32	8.20	8.38	8.30	
2	Electrical Conductivity at 25C	µs/cm	582	586	596	604	586	620	
3	Texture	-	Clay Loam						
4	Clay	%	41.6	30	32.4	35.8	38.4	36.2	
5	Sand	%	46.4	48	43.8	46.8	45.4	44.6	
6	Silt	%	12.0	22	23.8	17.4	16.2	19.2	
7	Water Holding Capacity	%	43.1	46.2	46.2	43.2	45.6	43.2	
8	Bulk Density	g/cc	1.32	1.44	1.34	1.38	1.24	1.28	
9	Porosity	%	43.6	37.8	42.4	42.4	36.8	42.4	
10	Exchangeable Calcium(asCa)	mg/Kg	204	198	204	218	212	214	
11	Exchangeable Magnesium(asMg)	mg/Kg	120	132	96	120	138	110	
12	Exchangeable Manganese(asMn)	mg/Kg	21.6	22.6	16.8	18.4	18.6	18.2	
13	Exchangeable Zinc as Zn	mg/Kg	0.98	1.20	1.40	1.10	1.20	0.98	
14	Available Boron (as B)	mg/Kg	1.42	1.68	1.68	1.42	1.2	1.60	
15	Soluble Chloride(as Cl)	mg/Kg	202	224	204	176	178	184	
16	Soluble Sulphate(as S04)	%	0.018	0.018	0.18	0.018	0.020	0.30	
17	Available Potassium(as K)	mg/Kg	36.2	34.6	32.6	32.8	32.8	35.4	
18	Available Phosphorous(as P)	Kg/hect	1.42	1.40	1.38	1.22	1.62	1.48	
19	Available Nitrogen(as N)	Kg/hect	182	164	180	164	184	178	
20	Cadmium (as Cd)	mg/Kg	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	
21	Chromium (as Cr)	mg/Kg	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	
22	Copper(as Cu)	mg/Kg	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	
23	Lead (as Pb)	mg/Kg	0.26	0.30	0.32	0.28	0.26	0.40	
24	Total Iron	mg/Kg	1.46	1.8	1.12	2.8	1.4	3.2	
25	Organic Matter	%	4.8	4.5	3.6	4.2	3.8	4.4	
26	Organic Carbon	%	2.6	2.6	2.0	2.4	2.2	2.5	
27	CEC	meq/100g	36.8	38.4	35.8	38.2	37.2	35.8	

Source: Sampling Results by Chennai Mettlex Lab Private Limited

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 Loam Soil and Bulk Density of Soils in the study area varied between 1.24 - 1.44 g/cc. The Water Holding Capacity and Porosity of the soil samples is found to be medium i.e. ranging from 43.1 – 46.2%.

Chemical Characteristics –

- The nature of soil is slightly alkaline to strongly alkaline with pH range 8.18 to 8.38
- The available Nitrogen content range between 164 to 184 kg/ha
- The available Phosphorus content range between 1.22 to 1.62 kg/ha
- The available Potassium range between 32.6 to 36.2 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:

There is no major surface water body in the study area and the rainfall over the area is moderate, the rainwater storage in open wells and trenches are in practice over the area and the stored water acts as source of drinking water for few months after rainy season.

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 8 to 11 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	Location code	Monitoring Locations	Distance & Direction	Coordinates
1	SW-1	Tank near Anaipatti	2.5km SE	10°16'27.15"N 78°44'45.33"E
2	SW-2	Tank near Chettiapatti	5km NE	10°18'38.22"N 78°45'29.68"E
3	WW-1	Arangirampatti	730m North	10°17'19.13"N 78°43'27.03"E
4	WW-2	Thirumayam	4.5km SE	10°14'39.27"N 78°44'21.10"E
5	BW-1	Near Project Area	480m NW	10°17'06.59"N 78°43'11.66"E
6	BW-2	Anaipatti	3.3km SE	10°16'11.38"N 78°45'09.02"E

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

FIGURE 3.5: WATER SAMPLING LOCATIONS AROUND 10 KM RADIUS

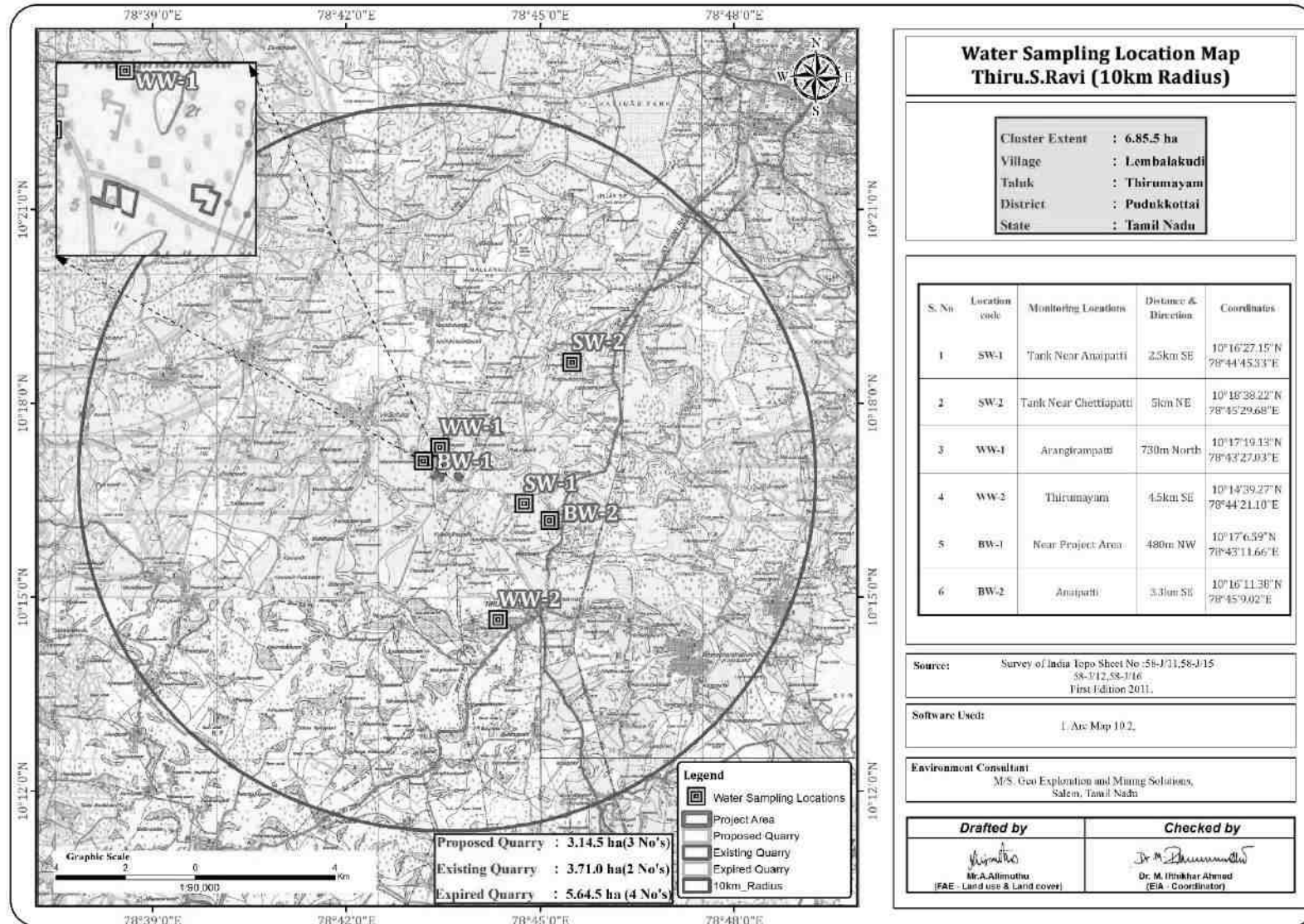


TABLE 3.9: GROUND WATER SAMPLING RESULTS

S.No	Parameters	Units	RESULTS				Standards as Per IS 10500: 2012	
			WW1	WW2	BW1	BW2	Acceptable limit	Permissible limit
1	Color	Hazen	< 5	6	5	4	5	5
2	Odour	-	Agreeable				Agreeable	Agreeable
3	Taste	-	Agreeable				Agreeable	Agreeable
4	pH@ 25°C	-	7.70	7.58	7.62	7.62	6.5-8.5	6.5-8.5
5	Electrical Conductivity @ 25°C	µs/cm	846	888	916	894	Not specified	Not specified
6	Turbidity	NTU	2.4	2.2	2.1	3.2	1	1
7	TDS	mg /l	507	532	549	536	500	500
8	Total Hardness	mg/l	172	148	172	154	200	200
9	Calcium as Ca	mg/l	54	44	48	48	75	75
10	Magnesium as Mg	mg/l	9.0	9.2	12.6	8.2	30	30
11	Total Alkalinity	mg/l	196	196	184	232	200	200
12	Chloride as Cl-	mg/l	168	158	138	156	250	250
13	Sulphate as SO4-	mg/l	48	48	38	26	200	200
14	Iron as Fe	mg/l	0.30	0.26	0.32	0.22	0.3	0.3
15	Free Residual Cl	mg/l	BDL(DL:0.01)	BDL(DL:0.1)	BDL(DL:0.1)	BDL (DL:0.1)	0.2	0.2
16	Fluoride as F	mg/l	0.24	0.32	0.30	0.28	1.0	1.0
17	Nitrates as NO3	mg/l	8.6	20.4	18.6	14.2	45	45
18	Copper as Cu	mg/l	BDL (DL:0.01)				0.05	0.05
19	Manganese as Mn	mg/l	BDL (DL:0.02)				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:0.001)				0.003	0.003
22	Selenium as Se	mg/l	BDL (DL:0.005)				0.01	0.01
23	Aluminium as Al	mg/l	BDL (DL:0.005)				0.03	0.03
24	Lead as Pb	mg/l	BDL (DL:0.005)				0.01	0.01
25	Zinc as Zn	mg/l	BDL(DL : 0.05)				5	5
26	Total Chromium	mg/l	BDL(DL : 0.02)				0.05	0.05
27	Boron as B	mg/l	BDL(DL : 0.05)				0.5	0.5
28	Mineral Oil	mg/l	BDL(DL : 0.01)				0.5	0.5
29	Phenolic Compounds	mg/l	BDL (DL:0.0005)				0.001	0.001
30	Anionic Detergents	mg/l	BDL (DL:0.01)				0.2	0.2
31	Cyanide as CN	mg/l	BDL (DL:0.01 l)				0.05	0.05
32	Barium as Ba	mg/l	BDL(DL:0.05)					
33	Ammonia	mg/l	BDL (DL:0.01)					
34	Sulphide as H ₂ S	mg/l	BDL (DL:0.01)					
35	Molybdenum	mg/l	BDL (DL:0.02)					
36	Total Arsenic	mg/l	BDL (DL:0.005)					
37	Total Suspended Solids	mg/l	4.0	6	6	8		
38	Total Coliform	MPN/	170	110	210	120	Shall not be detectable in any100 ml	Shall not be detectable in any100 ml
39	E-Coli	100ml	< 1.8	< 1.8	< 1.8	< 1.8		

* 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	12	5	300
2	Odour	-	Agreeable	Agreeable	Not specified
3	Taste	-	Agreeable	Agreeable	Not specified
4	pH@ 25°C	-	7.64	7.86	6.5 – 8.5
5	Electrical Conductivity @ 25°C	µs/cm	1022	912	
6	Turbidity	NTU	2.6	3.2	Not specified
7	Total Dissolved Solids	mg/l	613	547	1500
8	Total Hardness as CaCO ₃	mg/l	154	130	Not specified
9	Calcium as Ca	mg/l	44	30	Not specified
10	Magnesium as Mg	mg/l	10.6	13.3	Not specified
11	Total Alkalinity as CaCO ₃	mg/l	212	212	Not specified
12	Chloride as Cl ⁻	mg/l	126	124	600
13	Sulphate as SO ₄ ⁻	mg/l	48	38	400
14	Iron as Fe	mg/l	0.18	0.32	50
15	Free Residual Chlorine	mg/l	BDL (DL:0.1)	BDL (DL:0.1)	400
16	Fluoride as F	mg/l	0.31	0.34	1.5
17	Nitrates as NO ₃	mg/l	22.4	18.6	50
18	Copper as Cu	mg/l	BDL (DL:0.01)	BDL (DL:0.01)	1.5
19	Manganese as Mn	mg/l	BDL (DL:0.02)	BDL (DL:0.02)	Not specified
20	Mercury as Hg	mg/l	BDL (DL:0.0005)	BDL (DL:0.0005)	Not specified
21	Cadmium as Cd	mg/l	BDL (DL:0.001)	BDL (DL:0.001)	0.01
22	Selenium as Se	mg/l	BDL (DL:0.005)	BDL (DL:0.005)	Not specified
23	Aluminium as Al	mg/l	BDL (DL:0.005)	BDL (DL:0.005)	Not specified
24	Lead as Pb	mg/l	BDL (DL:0.005)	BDL (DL:0.005)	0.1
25	Zinc as Zn	mg/l	BDL(DL : 0.05)	BDL(DL : 0.05)	15
26	Total Chromium	mg/l	BDL(DL : 0.02)	BDL(DL : 0.02)	0.05
27	Boron as B	mg/l	BDL(DL : 0.05)	BDL(DL : 0.05)	Not specified
28	Mineral Oil	mg/l	BDL(DL : 0.01)	BDL(DL : 0.01)	Not specified
29	Phenolic Compounds as C ₆ H ₅ OH	mg/l	BDL (DL:0.0005)	BDL (DL:0.0005)	0.005
30	Anionic Detergents as MBAS	mg/l	BDL (DL:0.01)	BDL (DL:0.01)	Not specified
31	Cyanide as CN	mg/l	BDL (DL:0.01)	BDL (DL:0.01)	0.05
32	Biological Oxygen Demand, 3 days @ 27°C	mg/l	BDL(DL:2.0)	BDL(DL:2.0)	3
33	Chemical Oxygen Demand	mg/l	12	6	Not specified
34	Dissolved Oxygen	mg/l	5.4	5.2	4
35	Barium as Ba	mg/l	BDL(DL:0.05)	BDL(DL:0.05)	
36	Ammonia (as Total Ammonia-N)	mg/l	BDL (DL:0.01)	BDL (DL:0.01)	
37	Sulphide as H ₂ S	mg/l	BDL (DL:0.01)	BDL (DL:0.01)	
38	Molybdenum as Mo	mg/l	BDL (DL:0.02)	BDL (DL:0.02)	
39	Total Arsenic as As	mg/l	BDL (DL:0.005)	BDL (DL:0.005)	
40	Total Suspended Solids	mg/l	22	18	
41	Total Coliform		920	920	
42	E-Coli	MPN/ 100ml	110	70	

3.2.4 Interpretation & Conclusion

Surface Water

pH:

The pH varied from 7.64 to 7.86 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 varied from 547 to 613 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 124 to 126 mg/l. Nitrates varied from 18.6 to 22.4 mg/l, while sulphates varied from 38 to 48 mg/l.

Ground Water

The pH of the water samples collected ranged from 7.58 to 7.70 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 507 - 549 mg/l in all samples. The Total hardness varied between 148 – 172 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 **60 - 65m**. The maximum depth proposed out of proposed projects is **34m 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 these proposed projects.

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: PRE-MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS

S.No	LABEL	LATITUDE	LONGITUDE	Oct	Nov	Dec
1	OW1	10° 17' 18.37"N	78° 43' 17.17"E	10.1	10.7	11.4
2	OW2	10° 17' 10.27"N	78° 43' 26.55"E	11.2	11.8	12.4
3	OW3	10° 17' 05.96"N	78° 43' 39.23"E	10.4	11	11.6
4	OW4	10° 17' 16.82"N	78° 43' 51.93"E	10.5	11.1	11.7
5	OW5	10° 16' 57.91"N	78° 44' 09.88"E	11.3	11.9	12.5
6	OW6	10° 16' 28.14"N	78° 43' 50.94"E	11.7	12.3	12.9
7	OW7	10° 16' 23.80"N	78° 43' 29.81"E	10.8	11.4	12
8	OW8	10° 16' 31.58"N	78° 42' 57.95"E	11.1	11.7	12.3
9	OW9	10° 16' 41.25"N	78° 43' 03.60"E	10.3	10.9	11.5
10	OW10	10° 16' 57.06"N	78° 43' 12.59"E	10.7	11.2	11.8
11	OW11	10° 17' 35.86"N	78° 43' 20.23"E	10.8	11.4	12

Source: Onsite monitoring data

TABLE 3.12: PRE-MONSOON WATER LEVEL OF BOREWELLS 1 KM RADIUS

S.No	Name	LATITUDE	LONGITUDE	Oct	Nov	Dec
1	BW1	10° 16' 54.27"N	78° 43' 19.08"E	62.1	62.7	63.3
2	BW2	10° 17' 04.28"N	78° 43' 03.83"E	61.6	62.2	62.8
3	BW3	10° 17' 17.57"N	78° 43' 00.45"E	59.4	60	60.6
4	BW4	10° 17' 43.50"N	78° 43' 15.28"E	60.3	60.9	61.4
5	BW5	10° 17' 24.61"N	78° 43' 30.79"E	59.8	60.4	61
6	BW6	10° 17' 19.55"N	78° 44' 00.29"E	60.2	60.6	61.2
7	BW7	10° 16' 46.82"N	78° 43' 55.43"E	61.5	62.1	62.6
8	BW8	10° 16' 33.86"N	78° 43' 59.73"E	62.6	63.2	63.7
9	BW9	10° 16' 30.44"N	78° 43' 44.48"E	60.5	61.1	61.6
10	BW10	10° 16' 17.90"N	78° 43' 24.40"E	59.2	59.8	60.4
11	BW11	10° 16' 25.70"N	78° 43' 22.83"E	61.8	62.4	63
12	BW12	10° 16' 38.96"N	78° 42' 58.16"E	62.3	62.9	63.5

Source: Onsite monitoring data

FIGURE 3.6: DRAINAGE MAP AROUND 10 KM RADIUS FROM PROJECT SITE

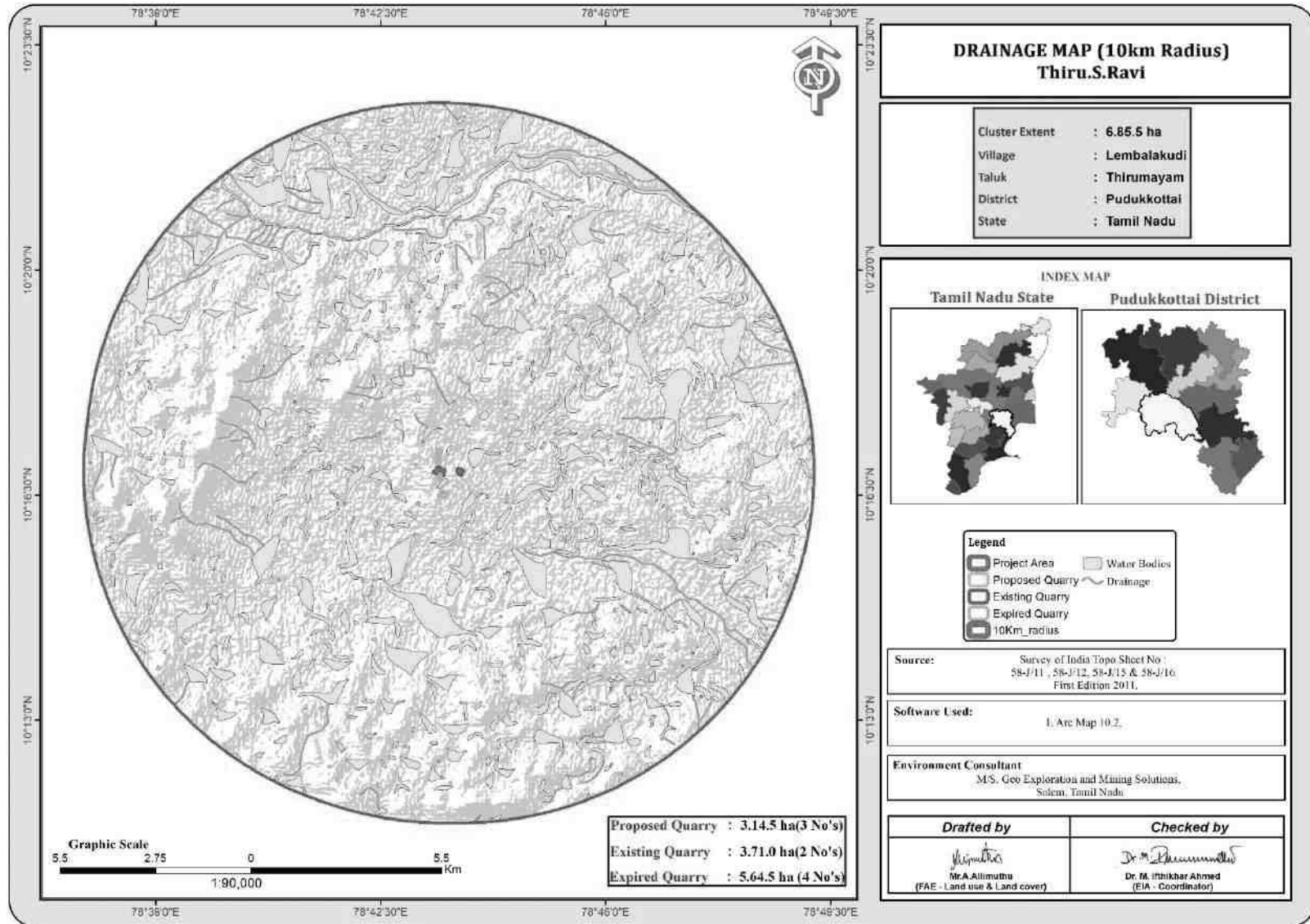
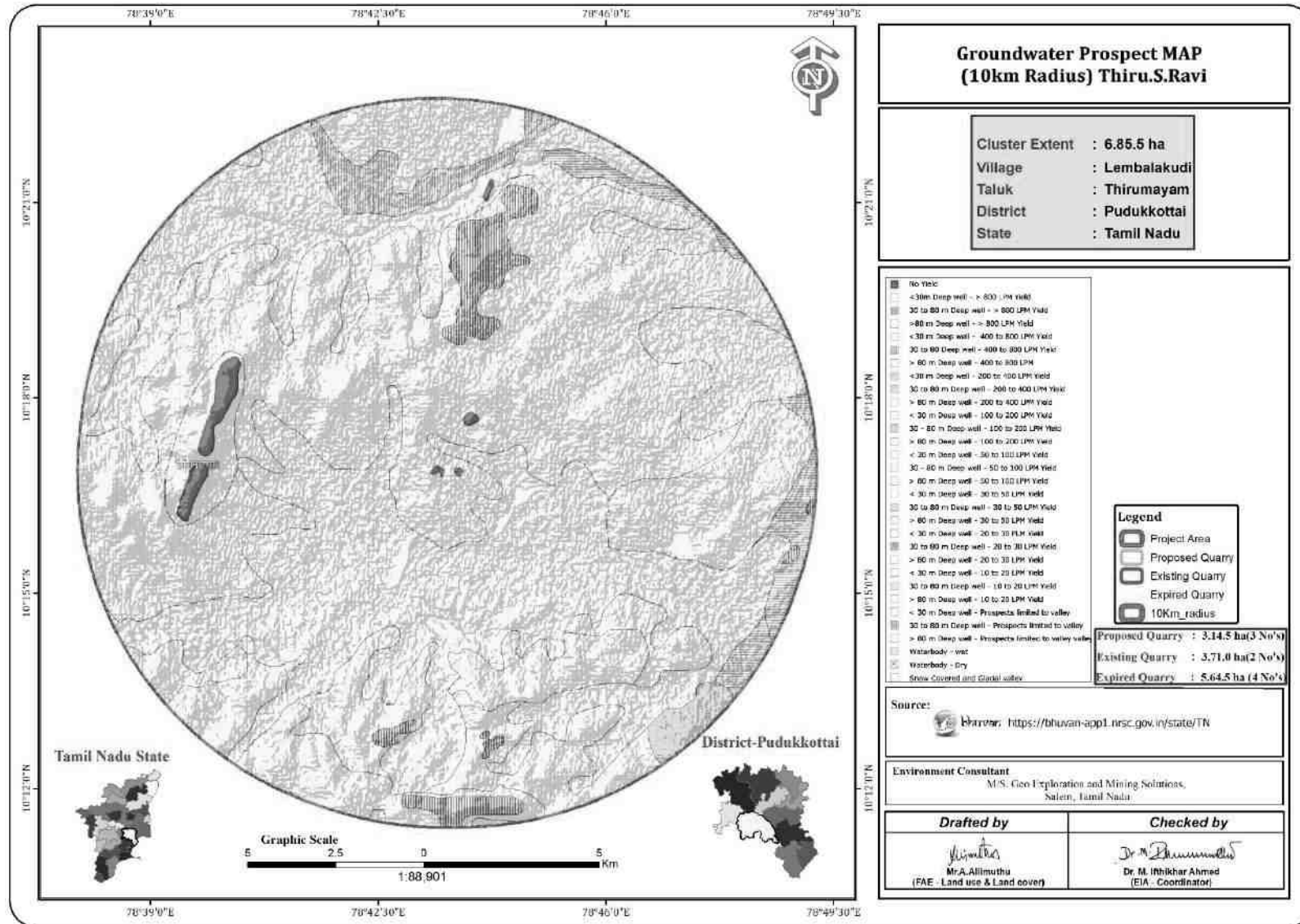


FIGURE 3.7: GROUND WATER PROSPECT MAP



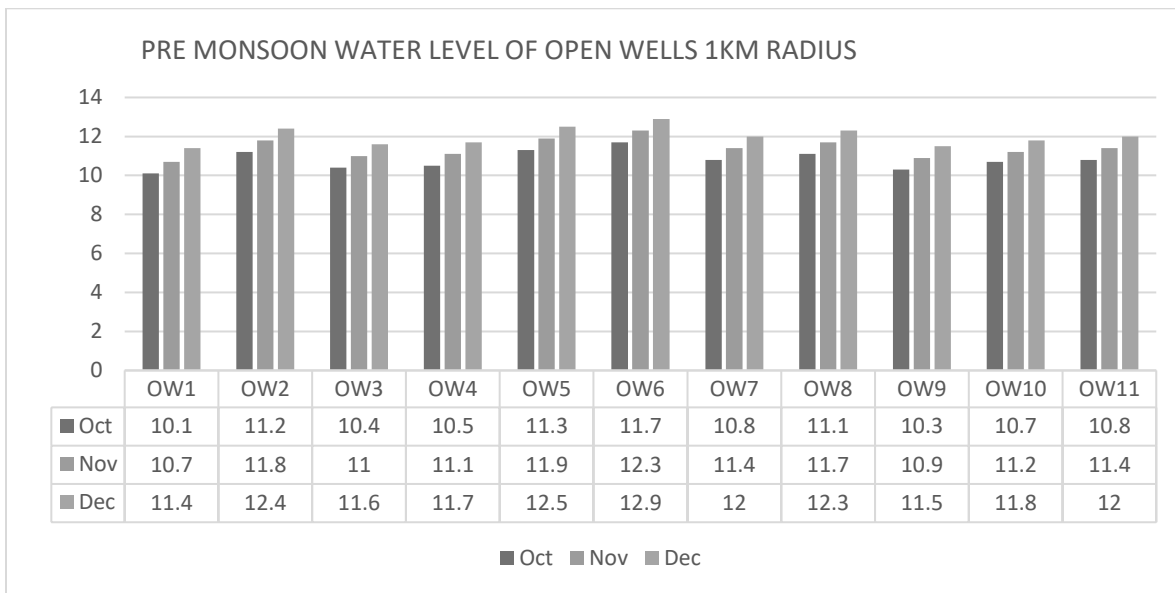
Source : Bhuvan

TABLE 3.13: PRE-MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS

S.No	LABEL	LATITUDE	LONGITUDE	Oct	Nov	Dec
1	OW1	10° 17' 18.37"N	78° 43' 17.17"E	10.1	10.7	11.4
2	OW2	10° 17' 10.27"N	78° 43' 26.55"E	11.2	11.8	12.4
3	OW3	10° 17' 05.96"N	78° 43' 39.23"E	10.4	11	11.6
4	OW4	10° 17' 16.82"N	78° 43' 51.93"E	10.5	11.1	11.7
5	OW5	10° 16' 57.91"N	78° 44' 09.88"E	11.3	11.9	12.5
6	OW6	10° 16' 28.14"N	78° 43' 50.94"E	11.7	12.3	12.9
7	OW7	10° 16' 23.80"N	78° 43' 29.81"E	10.8	11.4	12
8	OW8	10° 16' 31.58"N	78° 42' 57.95"E	11.1	11.7	12.3
9	OW9	10° 16' 41.25"N	78° 43' 03.60"E	10.3	10.9	11.5
10	OW10	10° 16' 57.06"N	78° 43' 12.59"E	10.7	11.2	11.8
11	OW11	10° 17' 35.86"N	78° 43' 20.23"E	10.8	11.4	12

Source: Field Monitoring Data

FIGURE 3.14: BAR CHART OF PRE-MONSOON WATER LEVEL OF BORE WELLS 1 KM



Source: Table No. 3.13

FIGURE 3.11: PRE-MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS – OCT 2022

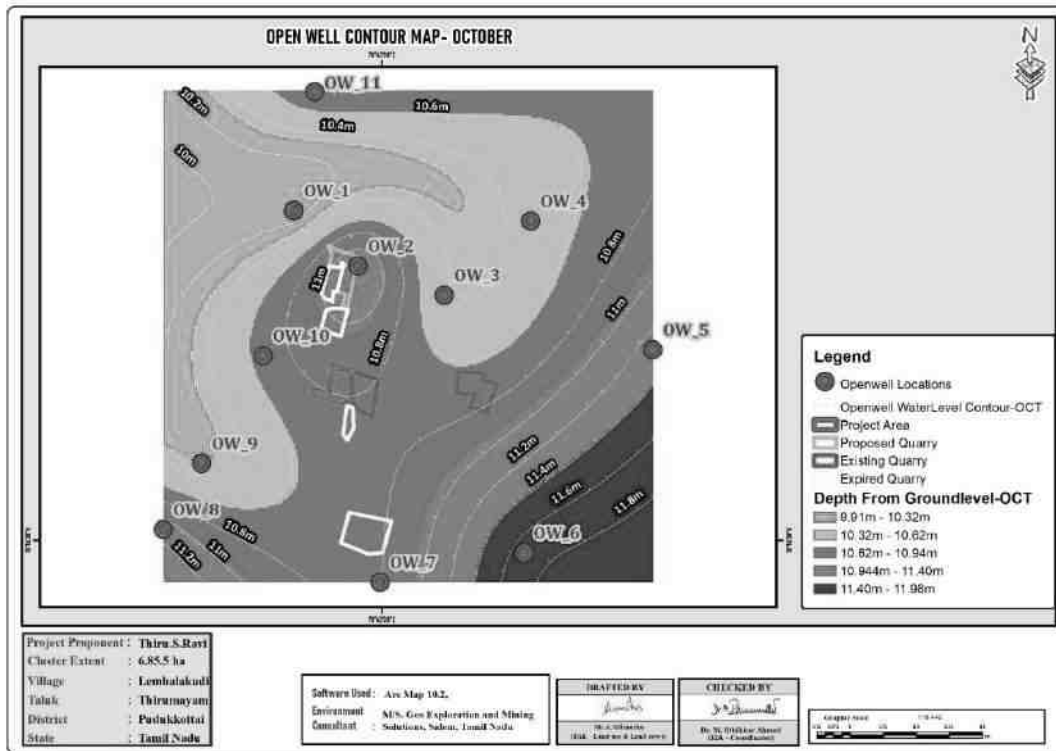


FIGURE 3.12: PRE-MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS – NOV 2022

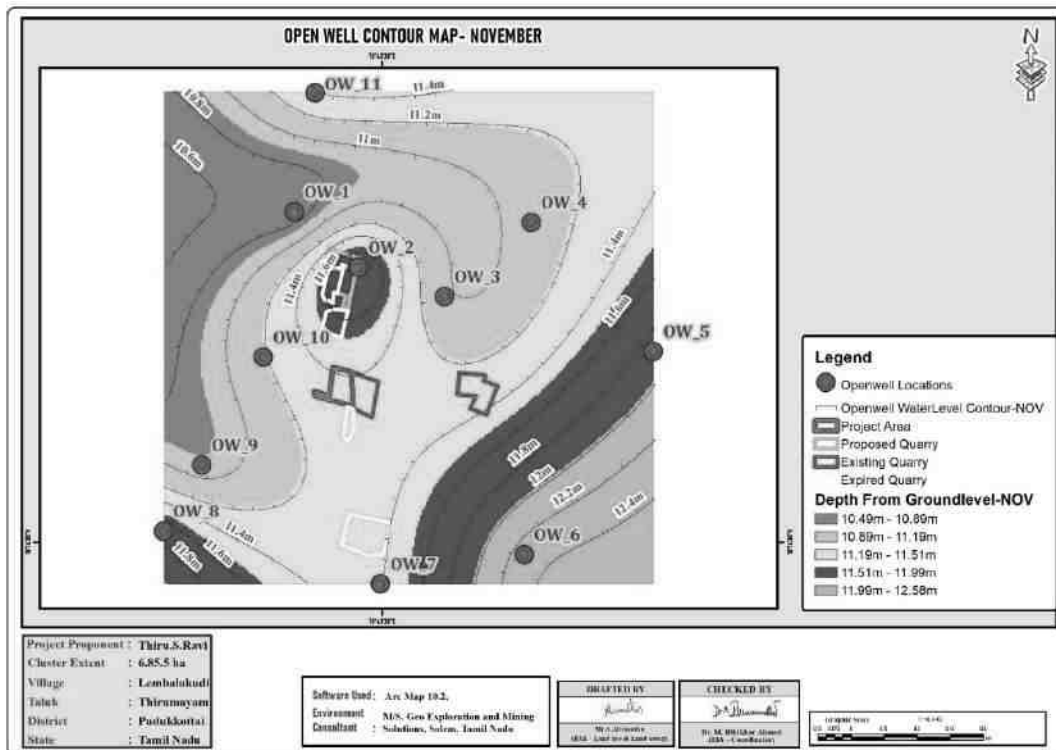


FIGURE 3.13: PRE-MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS – DEC 2022

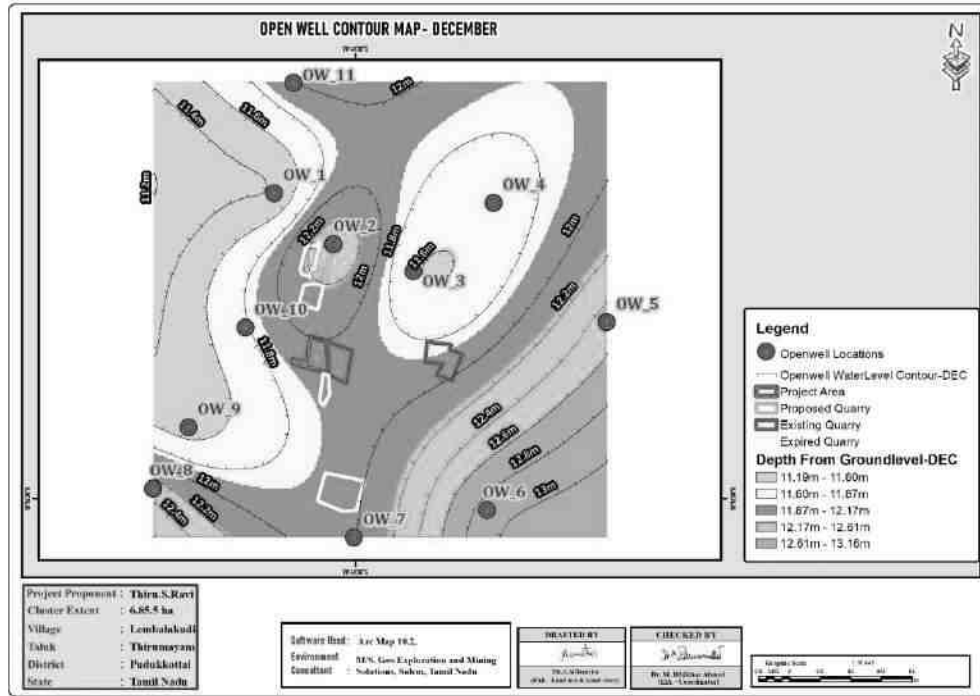
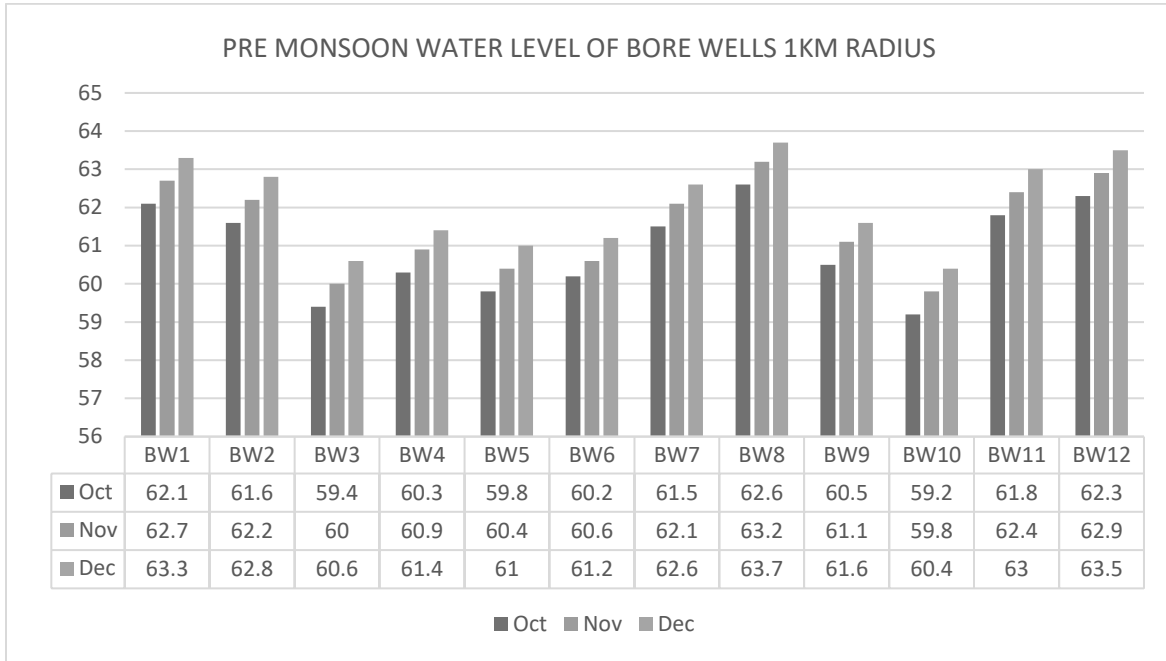


TABLE 3.14: PRE-MONSOON WATER LEVEL OF BORE WELLS 1 KM RADIUS

S.No	Name	LATITUDE	LONGITUDE	Oct	Nov	Dec
1	BW1	10° 16' 54.27"N	78° 43' 19.08"E	62.1	62.7	63.3
2	BW2	10° 17' 04.28"N	78° 43' 03.83"E	61.6	62.2	62.8
3	BW3	10° 17' 17.57"N	78° 43' 00.45"E	59.4	60	60.6
4	BW4	10° 17' 43.50"N	78° 43' 15.28"E	60.3	60.9	61.4
5	BW5	10° 17' 24.61"N	78° 43' 30.79"E	59.8	60.4	61
6	BW6	10° 17' 19.55"N	78° 44' 00.29"E	60.2	60.6	61.2
7	BW7	10° 16' 46.82"N	78° 43' 55.43"E	61.5	62.1	62.6
8	BW8	10° 16' 33.86"N	78° 43' 59.73"E	62.6	63.2	63.7
9	BW9	10° 16' 30.44"N	78° 43' 44.48"E	60.5	61.1	61.6
10	BW10	10° 16' 17.90"N	78° 43' 24.40"E	59.2	59.8	60.4
11	BW11	10° 16' 25.70"N	78° 43' 22.83"E	61.8	62.4	63
12	BW12	10° 16' 38.96"N	78° 42' 58.16"E	62.3	62.9	63.5

Source: Field Monitoring Data

FIGURE 3.14: BAR CHART OF PRE-MONSOON WATER LEVEL OF BORE WELLS 1 KM



Source: Table 3.14

FIGURE 3.15: PRE-MONSOON WATER LEVEL OF BORE WELLS 1 KM RADIUS – OCT 2022

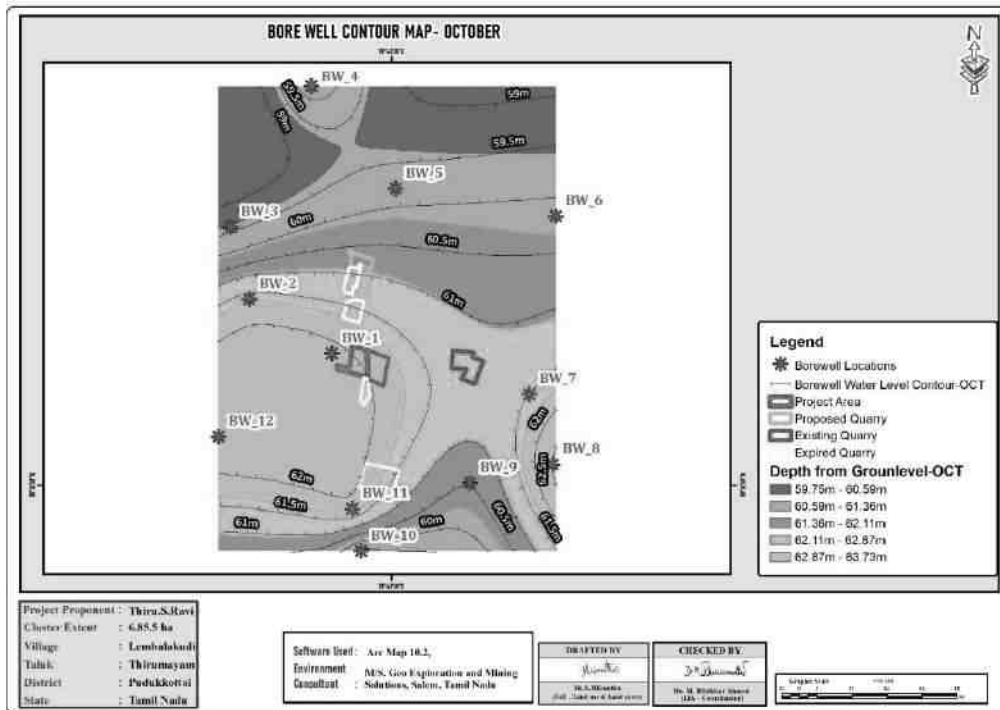


FIGURE 3.16: PRE-MONSOON WATER LEVEL OF BORE WELLS 1 KM RADIUS–NOV 2022

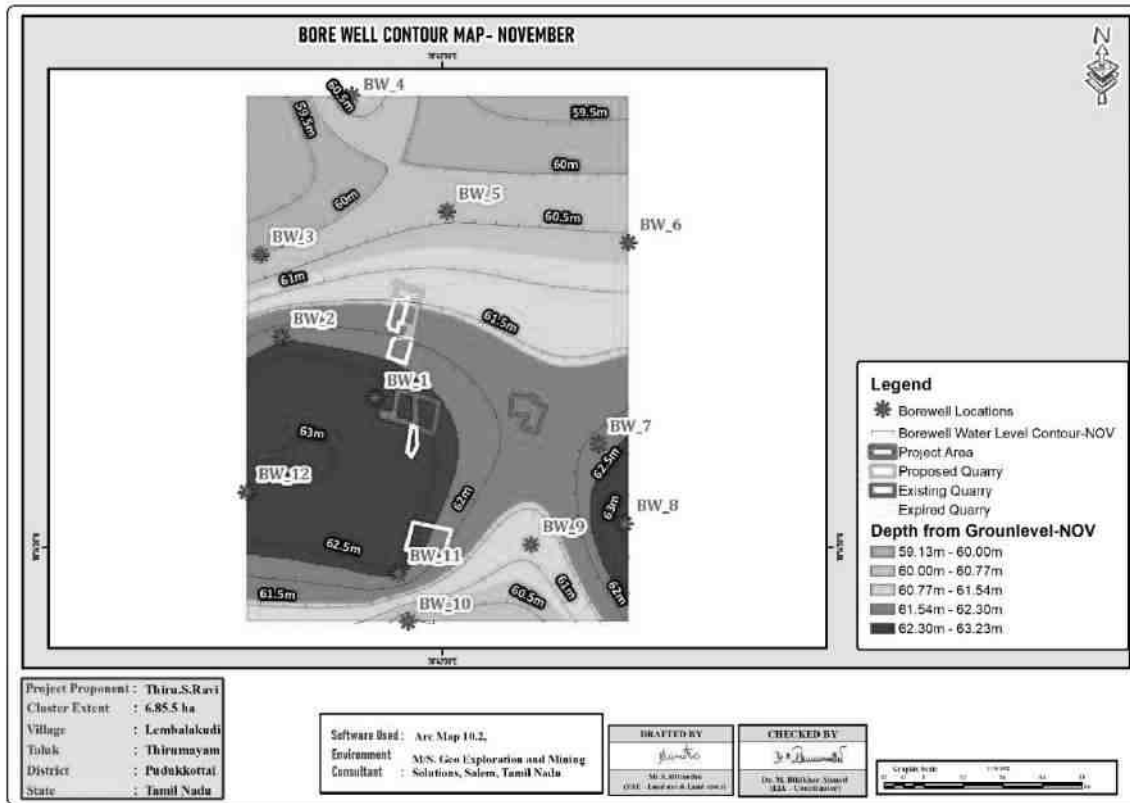
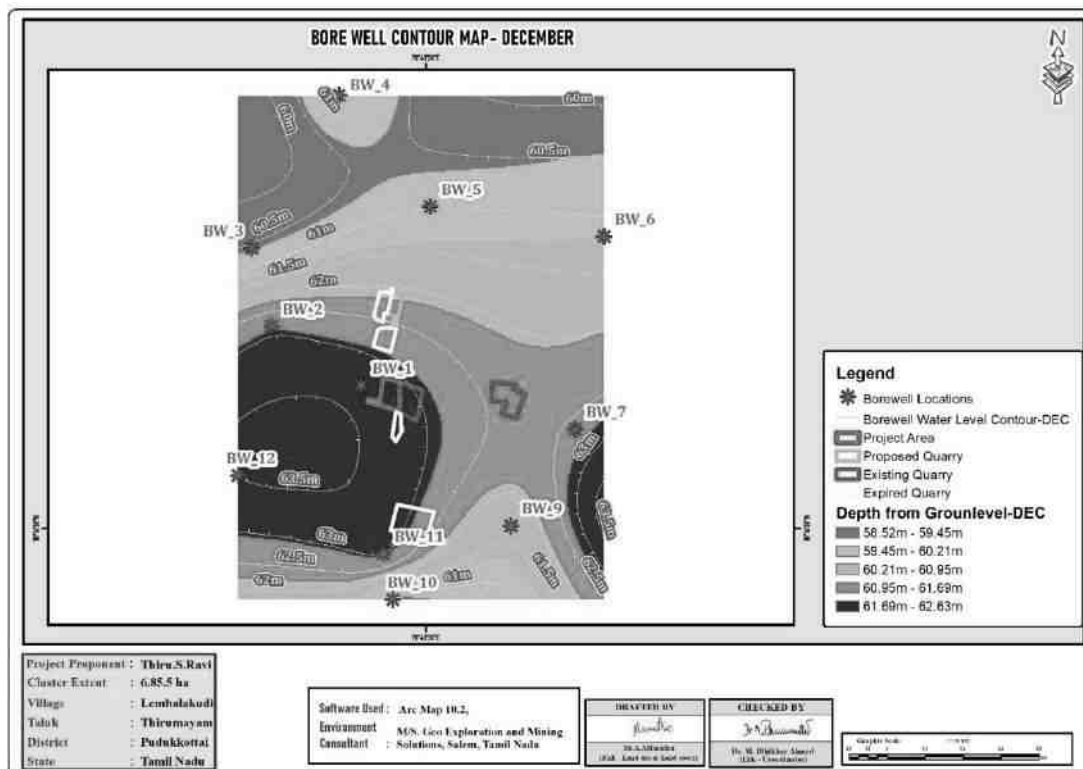


FIGURE 3.17: PRE-MONSOON WATER LEVEL OF BORE WELLS 1 KM RADIUS – DEC 2022



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 inhomogeneities 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 form 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 inhomogeneities that is consistent with the measured data.

For a Schlumberger among the Apparent resistivity can be calculated as follows

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

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,

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

ρ_r = Resistivity of Rocks

ρ_w = Resistivity of water in pores of rock

F = Formation Factor

\emptyset = Fractional pore volume

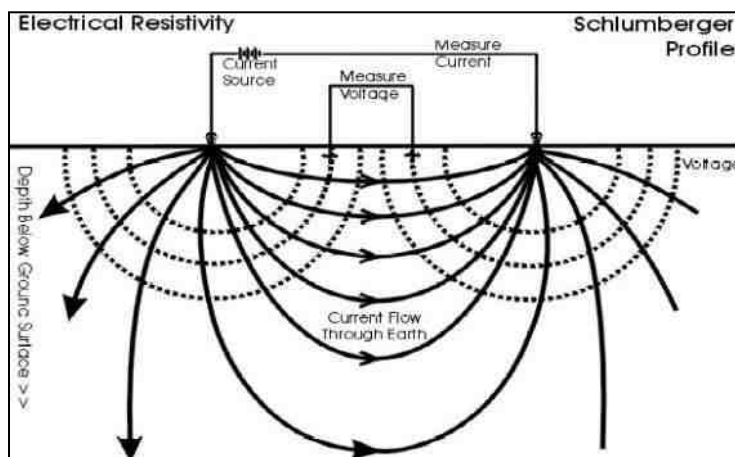
A = Constants with values ranging from 0.5 to 2.5

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 noise ration can be enhanced by \sqrt{N} where N is the number of stacked readings. This SSR meter in which running averages of measurements $[1, (1+2)/2, (1+2+3)/3 \dots (1+2\dots+16/16)]$ 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 (C₁& C₂) and measuring the resulting potential by two other electrodes called potential electrode (P₁& P₂). 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.

TABLE 3.15: GPS CO-ORDINATES OF VES LOCATION

No of station	Co-ordinates	Vertical Electrical Sounding depth in (m)
Satation-1	10°16'54.81"N 78°43'24.18"E	100m
Satation-2	10°16'50.32"N 78°43'25.10"E	100m
Satation-3	10°16'51.52"N 78°43'20.42"E	100m

Source: Field Data

3.2.5.3 Data Presentation

TABLE 3.16: VES RESULTS OF STATION – 1

STATION-1					
S.No	Ab/2	Mn/2	K	R	Rho
1	2	1	4.71	16.21	76.30
2	4	1	23.55	5.86	138.00
3	6	1	54.95	2.93	160.45
4	8	1	98.91	1.92	189.91
5	10	1	155.45	1.40	217.63
6	10	5	23.55	10.20	240.21
7	15	5	62.80	4.30	270.04
8	20	5	117.75	2.55	300.26
9	30	5	274.75	1.22	335.20
10	40	5	494.55	0.73	365.97
11	50	5	777.15	0.51	396.35
12	60	5	1122.55	0.39	437.79
13	70	5	1530.75	0.31	474.53
14	80	5	2001.75	0.25	522.46
15	90	5	2535.55	0.22	557.82
16	100	5	3132.15	0.19	595.11

Source: Field Data

FIGURE 3.19: INVERSE SLOP METHOD GRAPHS OF STATION – 1

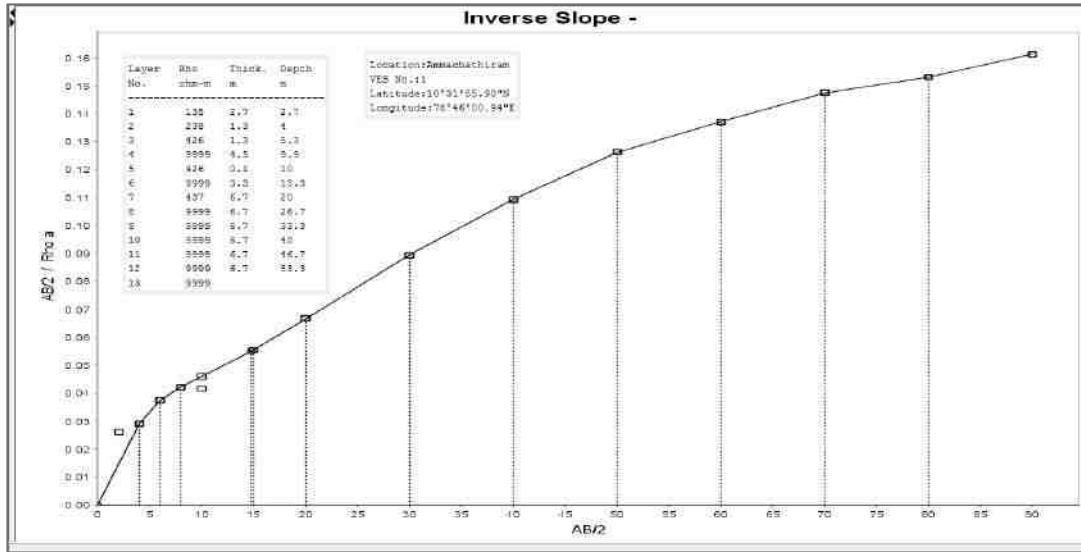


TABLE 3.17: VES RESULTS OF STATION – 2

STATION-2					
S.No	Ab/2	Mn/2	K	R	Rho
1	2	1	4.71	14.15	66.69
2	4	1	23.55	4.02	94.67
3	6	1	54.95	2.80	153.86
4	8	1	98.91	2.02	199.80
5	10	1	155.45	1.58	245.61
6	10	5	23.55	12.05	284.01
7	15	5	62.80	5.12	321.54
8	20	5	117.75	3.06	360.32
9	30	5	274.75	1.44	395.64
10	40	5	494.55	0.87	430.26
11	50	5	777.15	0.60	466.29
12	60	5	1122.55	0.46	505.15
13	70	5	1530.75	0.35	535.76
14	80	5	2001.75	0.28	560.49
15	90	5	2535.55	0.22	583.18
16	100	5	3132.15	0.20	626.43

Source: Field Data

FIGURE 3.20: INVERSE SLOP METHOD GRAPHS OF STATION – 2

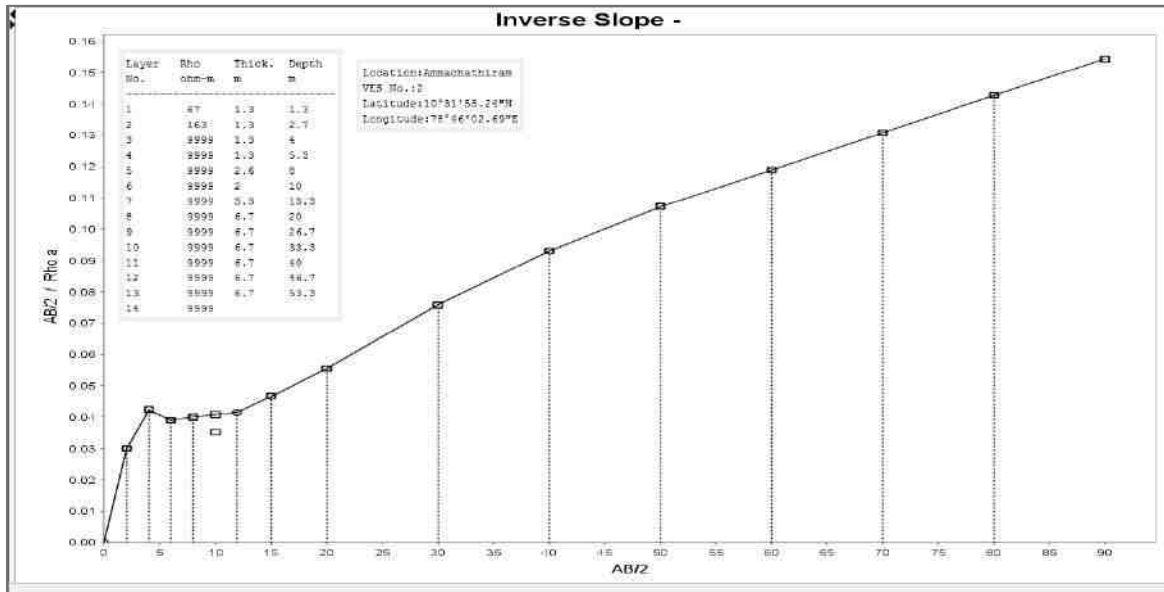
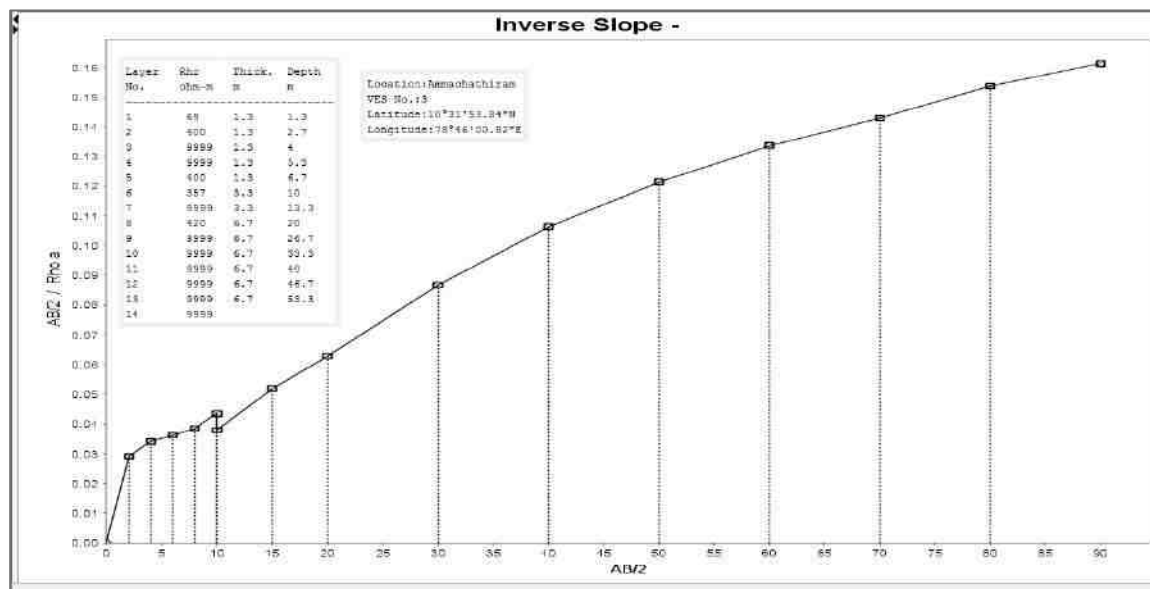


TABLE 3.18: VES RESULTS OF STATION – 3

STATION-3					
S.No	Ab/2	Mn/2	K	R	Rho
1	2	1	4.71	14.61	68.77
2	4	1	23.55	4.98	117.28
3	6	1	54.95	3.01	165.95
4	8	1	98.91	2.10	207.71
5	10	1	155.45	1.48	230.07
6	10	5	23.55	11.20	263.76
7	15	5	62.80	4.60	288.88
8	20	5	117.75	2.70	317.93
9	30	5	274.75	1.26	346.19
10	40	5	494.55	0.76	375.86
11	50	5	777.15	0.53	411.89
12	60	5	1122.55	0.41	449.02
13	70	5	1530.75	0.32	489.84
14	80	5	2001.75	0.27	520.46
15	90	5	2535.55	0.22	557.82
16	100	5	3132.15	0.18	563.79

Source: Field Data

FIGURE 3.21: INVERSE SLOP METHOD GRAPHS OF STATION – 3

3.2.5.4 Geophysical Data Interpretation

The geophysical data's 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 project 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

- Pudukkottai are in the middle and the summers are that easy to define.
- The best time to visit are January, February, October, November, December.
- The month with the highest relative humidity is November (78.25 %). The month with the lowest relative humidity is July (55.68 %).
- The month with the highest number of rainy days is October (19.20 days). The month with the lowest number of rainy days is February (3.23 days).
- Pudukkottai has a tropical climate. The summers here have a good deal of rainfall, while the winters have very little. This location is classified as Aw by Köppen and Geiger. The average temperature in Pudukkottai is 28.0 °C | 82.4 °F. Precipitation here is about 925 mm | 36.4 inch per year.
- The driest month is February, with 15 mm | 0.6 inches of rainfall. Most of the precipitation here falls in November, averaging 203 mm | 8.0 inches.
- The warmest month of the year is May, with an average temperature of 31.0 °C | 87.8 °F. January is the coldest month, with temperatures averaging 24.4 °C | 76.0 °F.

<https://en.climate-data.org/asia/india/tamil-nadu/pudukkottai-24013/>

Rainfall

TABLE 3.19: RAINFALL DATA

Actual Rainfall in mm					Normal Rainfall in mm
2017	2018	2019	2020	2021	
724.4	692.1	876.2	947.6	1188.7	985

Source: <https://www.twadboard.tn.gov.in/content/pudukkottai>

TABLE 3.20: METEOROLOGICAL DATA RECORDED AT SITE

S.No	Parameters		Oct – 2022	Nov – 2022	Dec – 2022
1	Temperature (°C)	Max	27.4	25.8	25.56
		Min	25.09	23.05	21.69
		Avg	26.245	24.425	23.625
2	Relative Humidity (%)	Avg	83.15	86.75	87.28
3	Wind Speed (m/s)	Max	4.34	5.58	5.46
		Min	1.66	1.73	1.66
		Avg	3	3.655	3.56
4	Cloud Cover (OKTAS)		0-8	0-8	0-8
5	Wind Direction		WSW, S	NE, ENE	NE, ENE

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

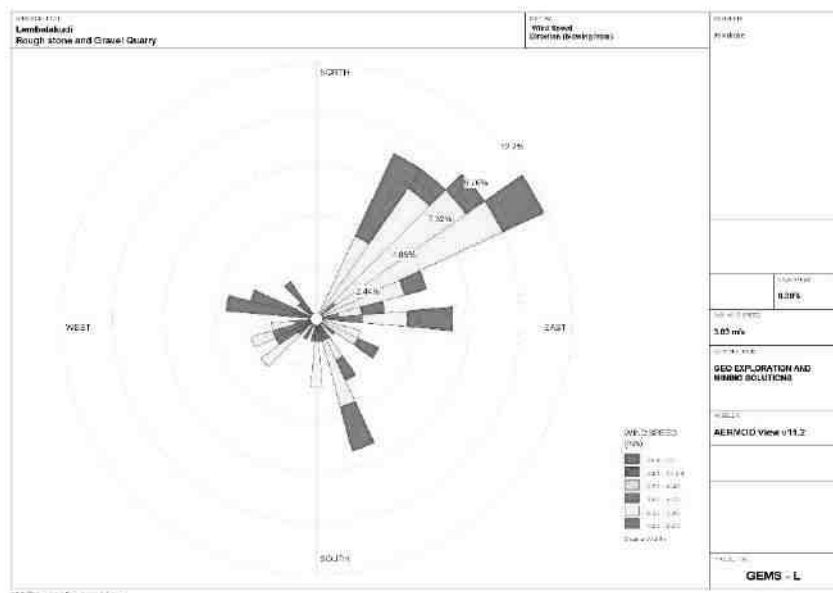
Correlation between Secondary and Primary Data

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

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

Wind rose diagram of the study site is depicted in Figure. 3.8. Predominant downwind direction of the area during study season is South-West to North-East.

FIGURE 3.22: 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.3.22 during the monitoring period in the study area

- Predominant winds were from SW-NE.
- Wind velocity readings were recorded between 0.50 to 5.70 m/s
- Calm conditions prevail of about 0.00 % of the monitoring period
- Temperature readings ranging from 23.05 to 27.4 °C
- Relative humidity ranging from 83.15 to 87.28 %
- 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 3.21: METHODOLOGY AND INSTRUMENT USED FOR AAQ ANALYSIS

Parameter	Method	Instrument
PM2.5	Gravimetric Method Beta attenuation Method	Fine Particulate Sampler Make – Thermo Environmental Instruments – TEI 121
PM10	Gravimetric Method Beta attenuation Method	Respirable Dust Sampler Make –Thermo Environmental Instruments – TEI 108
SO2	IS-5182 Part II (Improved West & Gaeke method)	Respirable Dust Sampler with gaseous attachment
NOx	IS-5182 Part II (Jacob & Hochheiser modified method)	Respirable Dust Sampler with gaseous attachment
Free Silica	NIOSH – 7601	Visible Spectrophotometry

Source: Sampling Methodology followed by Chennai Mettex Laboratories & CPCB Notification

TABLE 3.22: 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 ($\mu\text{g}/\text{m}^3$)	Annual Avg.* 24 hours**	50.0 80.0	20.0 80.0
2	Nitrogen Dioxide ($\mu\text{g}/\text{m}^3$)	Annual Avg. 24 hours	40.0 80.0	30.0 80.0
3	Particulate matter (size less than $10\mu\text{m}$) PM10 ($\mu\text{g}/\text{m}^3$)	Annual Avg. 24 hours	60.0 100.0	60.0 100.0
4	Particulate matter (size less than $2.5\mu\text{m}$) PM2.5 ($\mu\text{g}/\text{m}^3$)	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 values 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 October to December, 2022. The baseline data of ambient air has been generated for PM₁₀, PM_{2.5}, Sulphur Dioxide (SO₂) & Nitrogen Dioxide (NO₂) 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 3.6.1 for assessment of the existing ambient air quality. Details of the sampling locations are as per given below.

TABLE 3.23: AMBIENT AIR QUALITY (AAQ) MONITORING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	AAQ-1	Project area	Center Side	10°16'52.58"N 78°43'23.58"E
2	AAQ-2	Arangirampatti	900m North	10°17'23.91"N 78°43'29.24"E
3	AAQ-3	Arumanthapatti	2.8km SW	10°16'17.08"N 78°41'52.25"E
4	AAQ-4	Thirumayam	4.5km SE	10°14'35.08"N 78°44'21.72"E
5	AAQ-5	Embanakutti	3km NE	10°17'47.10"N 78°44'45.95"E
6	AAQ-6	Ponnanur	4.7km NW	10°18'54.87"N 78°41'45.24"E
7	AAQ-7	Anaipatti	3.3km SE	10°16'13.82"N 78°45'08.98"E
8	AAQ-8	Thiruvapuram	5.8km SW	10°14'16.59"N 78°41'28.17"E

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

FIGURE 3.23: AMBIENT AIR QUALITY LOCATIONS AROUND 10 KM RADIUS

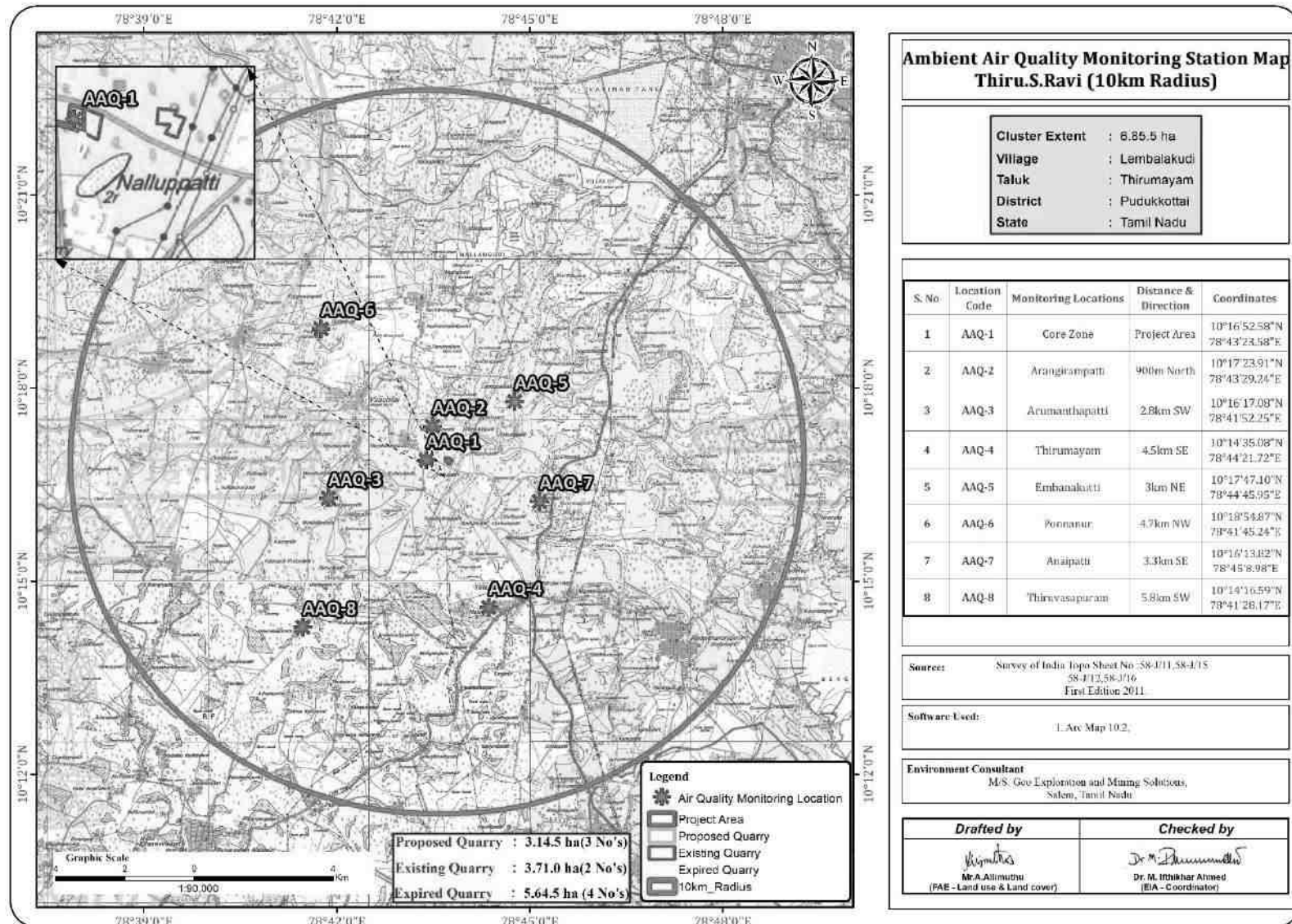


TABLE 3.24: AMBIENT AIR QUALITY DATA LOCATION AAQ1

Period: October – December - 2022

Location: AAQ1- Core Zone

Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM ₁₀	PM _{2.5}	SO ₂	NO ₂	NH ₃	O ₃	CO	Pb	Ni	As	C ₆ H ₆	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	mg/m ³	µg/m ³	ng/m ³	ng/m ³	µg/m ³	ng/m ³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
03.10.2022	7:00-7:00	102	59.8	23.4	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.10.2022	7:15-7:15	128	61.6	30.2	9.3	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.10.2022	7:00-7:00	134	58.5	35.5	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.10.2022	7:15-7:15	113	52.2	38.8	10.3	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.10.2022	7:00-7:00	125	54.8	24.3	9.3	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.10.2022	7:15-7:15	108	68.5	20.7	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.10.2022	7:00-7:00	112	65.4	21.2	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.10.2022	7:15-7:15	101	52.5	32.9	9.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.10.2022	7:00-7:00	127	54.8	25.5	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.10.2022	7:15-7:15	109	58.2	38.6	10.3	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.10.2022	7:00-7:00	135	65.0	25.8	9.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.10.2022	7:15-7:15	102	56.1	32.4	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.10.2022	7:00-7:00	127	62.2	20.3	8.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.11.2022	7:15-7:15	129	51.4	21.0	9.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.11.2022	7:00-7:00	112	54.8	34.2	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.11.2022	7:15-7:15	101	55.5	37.8	7.5	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.11.2022	7:00-7:00	104	68.6	38.9	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.11.2022	7:15-7:15	117	67.5	22.4	9.3	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.11.2022	7:00-7:00	110	66.2	29.2	10.3	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.11.2022	7:15-7:15	125	53.0	25.0	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.11.2022	7:00-7:00	122	55.1	32.2	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.11.2022	7:15-7:15	131	68.5	20.5	9.3	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.12.2022	7:00-7:00	116	51.8	21.4	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	104	60.7	22.6	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	115	52.5	35.3	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	128	68.2	37.0	9.3	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	102	54.0	39.5	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	137	60.3	25.8	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;DL: Detection Limit ; NH₃: BDL (DL:20); O₃: BDL (DL:20); CO: BDL (DL:1.0); Pb: BDL (DL:0.1); Ni: BDL (DL:1.0); As: BDL (DL:1.0); C₆H₆: BDL (DL:1.0); BaP: BDL (DL:0.1)

Remarks: The values observed for the pollutants given above are within the CPCB standards.

TABLE 3.25: AMBIENT AIR QUALITY DATA LOCATION AAQ2

Period: October – December - 2022

Location: AAQ2- Arangirampatti

Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM ₁₀	PM _{2.5}	SO ₂	NO ₂	NH ₃	O ₃	CO	Pb	Ni	As	C ₆ H ₆	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	mg/m ³	µg/m ³	ng/m ³	ng/m ³	µg/m ³	ng/m ³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
03.10.2022	7:00-7:00	106	53.4	26.5	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.10.2022	7:15-7:15	122	68.6	35.3	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.10.2022	7:00-7:00	115	65.8	22.6	9.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.10.2022	7:15-7:15	108	66.2	23.9	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.10.2022	7:00-7:00	127	59.1	25.8	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.10.2022	7:15-7:15	104	58.4	39.5	8.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.10.2022	7:00-7:00	111	54.7	38.4	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.10.2022	7:15-7:15	102	50.8	37.2	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.10.2022	7:00-7:00	125	61.6	20.5	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.10.2022	7:15-7:15	109	64.3	34.4	7.5	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.10.2022	7:00-7:00	116	67.2	21.1	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.10.2022	7:15-7:15	103	59.1	32.5	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.10.2022	7:00-7:00	102	55.4	25.2	9.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.11.2022	7:15-7:15	115	52.5	38.6	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.11.2022	7:00-7:00	118	60.8	22.2	7.5	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.11.2022	7:15-7:15	120	51.2	23.8	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.11.2022	7:00-7:00	103	68.8	20.5	8.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.11.2022	7:15-7:15	122	54.4	31.3	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.11.2022	7:00-7:00	105	66.7	34.2	8.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.11.2022	7:15-7:15	111	53.3	35.0	9.3	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.11.2022	7:00-7:00	105	62.9	28.1	8.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.11.2022	7:15-7:15	119	50.6	27.4	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.12.2022	7:00-7:00	108	65.5	26.5	8.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	124	58.2	32.8	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	105	69.9	20.7	9.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	112	54.5	25.5	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	101	67.8	38.2	7.5	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	114	52.7	24.9	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;DL: Detection Limit ; NH₃: BDL (DL:20); O₃: BDL (DL:20); CO: BDL (DL:1.0); Pb: BDL (DL:0.1); Ni: BDL (DL:1.0); As: BDL (DL:1.0); C₆H₆: BDL (DL:1.0); BaP: BDL (DL:0.1)

Remarks: The values observed for the pollutants given above are within the CPCB standards.

TABLE 3.26: AMBIENT AIR QUALITY DATA LOCATION AAQ3

Period: October – December - 2022

: AAQ3- Arumanthapatti

Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM ₁₀	PM _{2.5}	SO ₂	NO ₂	NH ₃	O ₃	CO	Pb	Ni	As	C ₆ H ₆	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	mg/m ³	µg/m ³	ng/m ³	ng/m ³	µg/m ³	ng/m ³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
03.10.2022	7:00-7:00	103	58.6	23.1	7.5	20.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.10.2022	7:15-7:15	125	64.0	37.4	8.4	22.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.10.2022	7:00-7:00	102	56.5	29.7	9.3	20.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.10.2022	7:15-7:15	118	53.2	25.8	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.10.2022	7:00-7:00	105	55.1	22.6	7.5	20.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.10.2022	7:15-7:15	122	65.3	31.3	8.4	20.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.10.2022	7:00-7:00	106	68.5	36.5	9.3	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.10.2022	7:15-7:15	123	55.8	38.9	8.4	20.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.10.2022	7:00-7:00	102	63.9	25.2	8.4	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.10.2022	7:15-7:15	121	66.6	24.8	7.5	22.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.10.2022	7:00-7:00	105	59.3	26.4	7.5	20.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.10.2022	7:15-7:15	114	58.2	33.9	7.5	22.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.10.2022	7:00-7:00	117	55.5	21.2	9.3	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.11.2022	7:15-7:15	109	52.8	35.0	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.11.2022	7:00-7:00	129	61.4	29.2	7.5	22.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.11.2022	7:15-7:15	124	58.6	35.5	8.4	20.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.11.2022	7:00-7:00	106	65.5	21.6	9.3	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.11.2022	7:15-7:15	108	52.7	36.4	8.4	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.11.2022	7:00-7:00	117	63.1	29.6	7.5	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.11.2022	7:15-7:15	108	55.0	33.8	8.4	20.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.11.2022	7:00-7:00	105	62.5	25.3	9.3	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.11.2022	7:15-7:15	112	51.3	32.8	8.4	23.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.12.2022	7:00-7:00	100	54.5	21.1	7.5	20.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	121	57.8	37.5	8.4	22.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	122	65.3	30.0	9.3	21.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	114	60.5	29.8	8.4	20.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	105	62.0	35.4	7.5	22.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	115	61.9	22.5	7.5	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;DL: Detection Limit ; NH₃: BDL (DL:20); O₃: BDL (DL:20); CO: BDL (DL:1.0); Pb: BDL (DL:0.1); Ni: BDL (DL:1.0); As: BDL (DL:1.0); C₆H₆: BDL (DL:1.0); BaP: BDL (DL:0.1)

Remarks: The values observed for the pollutants given above are within the CPCB standards.

TABLE 3.27: AMBIENT AIR QUALITY DATA LOCATION AAQ4

Period: October – December - 2022

Location: AAQ4 - Thirumayam

Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM ₁₀	PM _{2.5}	SO ₂	NO ₂	NH ₃	O ₃	CO	Pb	Ni	As	C ₆ H ₆	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	mg/m ³	µg/m ³	ng/m ³	ng/m ³	µg/m ³	ng/m ³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
03.10.2022	7:00-7:00	126	56.6	26.6	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.10.2022	7:15-7:15	103	63.1	33.2	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.10.2022	7:00-7:00	125	52.9	38.3	8.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.10.2022	7:15-7:15	102	55.8	35.5	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.10.2022	7:00-7:00	114	51.2	22.4	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.10.2022	7:15-7:15	117	65.3	24.8	9.3	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.10.2022	7:00-7:00	124	62.6	28.5	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.10.2022	7:15-7:15	114	68.4	29.4	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.10.2022	7:00-7:00	105	56.8	26.0	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.10.2022	7:15-7:15	129	55.0	33.2	9.3	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.10.2022	7:00-7:00	107	52.2	25.1	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.10.2022	7:15-7:15	110	58.8	32.3	9.3	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.10.2022	7:00-7:00	104	62.6	28.0	9.3	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.11.2022	7:15-7:15	124	67.3	24.2	9.3	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.11.2022	7:00-7:00	101	64.0	25.6	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.11.2022	7:15-7:15	112	55.1	36.9	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.11.2022	7:00-7:00	105	58.8	32.7	7.5	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.11.2022	7:15-7:15	124	69.5	30.4	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.11.2022	7:00-7:00	105	50.6	21.5	9.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.11.2022	7:15-7:15	116	67.4	27.2	9.3	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.11.2022	7:00-7:00	125	54.7	28.1	8.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.11.2022	7:15-7:15	124	65.8	27.0	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.12.2022	7:00-7:00	122	58.2	34.2	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	111	59.0	31.3	9.3	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	115	52.1	33.5	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	118	67.3	39.4	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	104	65.4	27.9	8.4	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	102	53.9	25.7	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;DL: Detection Limit ; NH₃: BDL (DL:20); O₃: BDL (DL:20); CO: BDL (DL:1.0); Pb: BDL (DL:0.1); Ni: BDL (DL:1.0); As: BDL (DL:1.0); C₆H₆: BDL (DL:1.0); BaP: BDL (DL:0.1)

Remarks: The values observed for the pollutants given above are within the CPCB standards.

TABLE 3.28: AMBIENT AIR QUALITY DATA LOCATION AAQ5

Period: October – December - 2022

AAQ5- Embanakutti

Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM ₁₀	PM _{2.5}	SO ₂	NO ₂	NH ₃	O ₃	CO	Pb	Ni	As	C ₆ H ₆	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	mg/m ³	µg/m ³	ng/m ³	ng/m ³	µg/m ³	ng/m ³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
03.10.2022	7:00-7:00	104	52.2	25.9	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.10.2022	7:15-7:15	123	65.8	22.1	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.10.2022	7:00-7:00	102	58.5	28.5	7.5	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.10.2022	7:15-7:15	125	56.2	39.2	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.10.2022	7:00-7:00	101	53.1	36.8	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.10.2022	7:15-7:15	102	61.4	33.4	8.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.10.2022	7:00-7:00	125	64.5	21.3	9.3	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.10.2022	7:15-7:15	108	66.2	34.6	8.4	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.10.2022	7:00-7:00	129	55.0	27.5	9.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.10.2022	7:15-7:15	106	52.1	38.2	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.10.2022	7:00-7:00	123	50.6	25.8	7.5	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.10.2022	7:15-7:15	125	68.9	32.5	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.10.2022	7:00-7:00	128	60.8	23.8	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.11.2022	7:15-7:15	115	69.3	34.6	9.3	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.11.2022	7:00-7:00	102	60.4	26.9	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.11.2022	7:15-7:15	125	54.8	31.3	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.11.2022	7:00-7:00	108	57.5	39.6	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.11.2022	7:15-7:15	117	55.2	31.2	9.3	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.11.2022	7:00-7:00	104	62.7	22.5	8.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.11.2022	7:15-7:15	122	50.5	20.4	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.11.2022	7:00-7:00	105	51.6	22.1	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.11.2022	7:15-7:15	116	60.4	35.4	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.12.2022	7:00-7:00	103	53.2	24.1	9.3	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	122	60.8	39.2	9.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	105	52.7	26.0	9.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	111	61.2	33.2	8.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	125	52.1	22.1	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	108	65.4	35.5	7.5	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;DL: Detection Limit ; NH₃: BDL (DL:20); O₃: BDL (DL:20); CO: BDL (DL:1.0); Pb: BDL (DL:0.1); Ni: BDL (DL:1.0); As: BDL (DL:1.0); C₆H₆: BDL (DL:1.0); BaP: BDL (DL:0.1)

Remarks: The values observed for the pollutants given above are within the CPCB standards.

TABLE 3.29: AMBIENT AIR QUALITY DATA LOCATION AAQ6

Period: October – December - 2022

Location: AAQ6 – Ponnanur

Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM ₁₀	PM _{2.5}	SO ₂	NO ₂	NH ₃	O ₃	CO	Pb	Ni	As	C ₆ H ₆	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	mg/m ³	µg/m ³	ng/m ³	ng/m ³	µg/m ³	ng/m ³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
03.10.2022	7:00-7:00	126	56.2	26.4	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.10.2022	7:15-7:15	102	65.5	32.6	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.10.2022	7:00-7:00	121	62.8	35.3	9.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.10.2022	7:15-7:15	105	63.4	39.0	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.10.2022	7:00-7:00	118	55.1	25.1	9.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.10.2022	7:15-7:15	104	59.2	24.2	8.4	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.10.2022	7:00-7:00	115	55.3	25.5	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.10.2022	7:15-7:15	122	51.6	32.8	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.10.2022	7:00-7:00	106	60.5	33.5	7.5	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.10.2022	7:15-7:15	129	62.2	26.2	8.4	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.10.2022	7:00-7:00	118	58.9	25.0	9.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.10.2022	7:15-7:15	105	56.5	21.1	9.3	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.10.2022	7:00-7:00	122	53.1	35.6	8.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.11.2022	7:15-7:15	101	50.5	39.5	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.11.2022	7:00-7:00	124	61.6	38.8	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.11.2022	7:15-7:15	108	64.3	36.4	8.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.11.2022	7:00-7:00	115	58.2	23.0	9.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.11.2022	7:15-7:15	102	65.5	25.9	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.11.2022	7:00-7:00	124	67.4	32.5	9.3	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.11.2022	7:15-7:15	109	52.2	21.0	9.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.11.2022	7:00-7:00	118	61.1	34.2	9.3	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.11.2022	7:15-7:15	115	50.4	29.4	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.12.2022	7:00-7:00	124	62.5	35.8	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	122	51.2	22.5	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	100	62.9	33.2	7.5	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	111	65.5	26.0	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	102	54.4	38.6	9.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	124	68.0	25.4	8.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;DL: Detection Limit ; NH₃: BDL (DL:20); O₃: BDL (DL:20); CO: BDL (DL:1.0); Pb: BDL (DL:0.1); Ni: BDL (DL:1.0); As: BDL (DL:1.0); C₆H₆: BDL (DL:1.0); BaP: BDL (DL:0.1)

Remarks: The values observed for the pollutants given above are within the CPCB standards.

TABLE 3.30: AMBIENT AIR QUALITY DATA LOCATION AAQ7

Period: October – December - 2022

Location: AAQ7– Anaipatti

Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM ₁₀	PM _{2.5}	SO ₂	NO ₂	NH ₃	O ₃	CO	Pb	Ni	As	C ₆ H ₆	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	mg/m ³	µg/m ³	ng/m ³	ng/m ³	µg/m ³	ng/m ³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
03.10.2022	7:00-7:00	106	52.6	25.9	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.10.2022	7:15-7:15	122	61.2	32.6	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.10.2022	7:00-7:00	115	65.5	31.3	9.3	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.10.2022	7:15-7:15	108	68.8	35.5	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.10.2022	7:00-7:00	114	59.4	28.8	9.3	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.10.2022	7:15-7:15	102	56.6	24.4	8.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.10.2022	7:00-7:00	102	63.3	39.2	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.10.2022	7:15-7:15	110	55.5	25.6	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.10.2022	7:00-7:00	115	54.1	32.5	9.3	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.10.2022	7:15-7:15	126	61.0	24.1	8.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.10.2022	7:00-7:00	128	55.2	23.8	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.10.2022	7:15-7:15	105	69.5	39.9	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.10.2022	7:00-7:00	124	56.4	28.6	9.3	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.11.2022	7:15-7:15	102	63.5	25.3	9.3	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.11.2022	7:00-7:00	1101	52.9	36.5	9.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.11.2022	7:15-7:15	103	55.8	24.4	7.5	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.11.2022	7:00-7:00	120	67.6	32.2	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.11.2022	7:15-7:15	105	64.3	21.1	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.11.2022	7:00-7:00	108	61.5	30.0	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.11.2022	7:15-7:15	114	55.4	22.2	9.3	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.11.2022	7:00-7:00	106	59.2	21.9	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.11.2022	7:15-7:15	123	55.1	22.8	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.12.2022	7:00-7:00	100	62.5	35.4	7.5	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	115	50.9	24.3	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	108	61.5	35.6	9.3	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	127	52.4	28.8	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	114	54.3	20.5	7.5	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	101	68.0	25.7	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;DL: Detection Limit ; NH₃: BDL (DL:20); O₃: BDL (DL:20); CO: BDL (DL:1.0); Pb: BDL (DL:0.1); Ni: BDL (DL:1.0); As: BDL (DL:1.0); C₆H₆: BDL (DL:1.0); BaP: BDL (DL:0.1)

Remarks: The values observed for the pollutants given above are within the CPCB standards.

TABLE 3.31: AMBIENT AIR QUALITY DATA LOCATION AAQ8

Period: October – December - 2022

Location: AAQ8– Thiruvapuram

Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM ₁₀	PM _{2.5}	SO ₂	NO ₂	NH ₃	O ₃	CO	Pb	Ni	As	C ₆ H ₆	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	mg/m ³	µg/m ³	ng/m ³	ng/m ³	µg/m ³	ng/m ³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
03.10.2022	7:00-7:00	126	56.9	26.8	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.10.2022	7:15-7:15	105	61.5	32.2	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.10.2022	7:00-7:00	122	55.6	29.1	9.3	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.10.2022	7:15-7:15	104	52.5	25.4	8.4	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.10.2022	7:00-7:00	106	65.2	33.8	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.10.2022	7:15-7:15	112	64.1	25.9	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.10.2022	7:00-7:00	123	68.4	37.5	9.3	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.10.2022	7:15-7:15	104	59.8	24.4	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.10.2022	7:00-7:00	108	56.5	28.6	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.10.2022	7:15-7:15	115	53.6	39.3	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.10.2022	7:00-7:00	101	55.3	35.7	7.5	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.10.2022	7:15-7:15	122	62.2	34.8	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.10.2022	7:00-7:00	103	69.5	25.5	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.11.2022	7:15-7:15	125	65.8	26.4	8.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.11.2022	7:00-7:00	109	51.4	22.6	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.11.2022	7:15-7:15	128	54.0	35.5	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.11.2022	7:00-7:00	115	68.2	29.2	9.3	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.11.2022	7:15-7:15	122	55.8	35.6	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.11.2022	7:00-7:00	121	52.6	21.5	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.11.2022	7:15-7:15	104	66.0	34.7	8.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.11.2022	7:00-7:00	129	55.2	29.4	9.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.11.2022	7:15-7:15	115	68.4	38.1	8.4	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.12.2022	7:00-7:00	101	54.9	35.2	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	102	62.5	23.5	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	123	51.0	32.4	9.3	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	125	55.2	21.6	8.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	114	69.4	35.9	7.5	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	118	53.8	26.7	7.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Note: BDL: Below Detection Limit ;DL: Detection Limit ; NH ₃ : BDL (DL:20); O ₃ : BDL (DL:20); CO: BDL (DL:1.0);														Pb:
BDL (DL:0.1); Ni: BDL (DL:1.0); As: BDL (DL:1.0); C ₆ H ₆ : BDL (DL:1.0); BaP: BDL (DL:0.1)														
Remarks: The values observed for the pollutants given above are within the CPCB standards.														

Legend: **PM2.5**-Particulate Matter size less than 2.5 µm; **PM10**-Respirable Particulate Matter size less than 10 µm; **SO₂**-Sulphur dioxide; **NO_x**-Oxides of Nitrogen; **NH₃**-Ammonia; **O₃**-Ozone; **CO**-Carbon monoxide; **Pb**-Particulate Lead; **As**-Particulate Arsenic; **Ni**-Particulate Nickel; **C₆H₆**-Benzene & **BaP**- Benzo (a) pyrene inparticulate phase **NAAQ Norms**-National Ambient Air Quality Norms-Revised as per **GSR 826(E) dated 16.11.2009** for Industrial, Residential, Rural and other Area.

TABLE 3.32: SUMMARY OF AAQ – 1 to AAQ – 8

Particulate matter PM_{2.5}			
Station ID	Max	Min	Mean
AAQ-1	39.5	20.3	29.0
AAQ-2	39.5	20.5	29.1
AAQ-3	38.9	21.1	29.7
AAQ-4	39.4	21.5	29.6
AAQ-5	39.6	20.4	29.8
AAQ-6	39.5	21.0	30.2
AAQ-7	39.9	20.5	28.5
AAQ-8	39.3	21.5	30.3
Particulate matter PM₁₀			
Station ID	Max	Min	Mean
AAQ-1	68.6	51.4	59.2
AAQ-2	69.9	50.6	59.6
AAQ-3	68.5	51.3	59.5
AAQ-4	69.5	50.6	59.7
AAQ-5	69.3	50.5	58.3
AAQ-6	68.0	50.4	59.1
AAQ-7	69.5	50.9	59.4
AAQ-8	69.5	51.0	59.5
Sulphur Di-oxide as SO₂			
Station ID	Max	Min	Mean
AAQ-1	10.3	7.5	8.6
AAQ-2	9.3	7.5	8.2
AAQ-3	9.3	7.5	8.3
AAQ-4	9.3	7.5	8.4
AAQ-5	9.3	7.5	8.3
AAQ-6	9.3	7.5	8.5
AAQ-7	9.3	7.5	8.4
AAQ-8	9.3	7.5	8.2
Oxide of Nitrogen as NO₂			
Station ID	Max	Min	Mean
AAQ-1	23.2	20.7	21.6
AAQ-2	23.2	20.7	21.9
AAQ-3	23.5	20.0	21.7
AAQ-4	23.2	20.7	21.8
AAQ-5	23.2	20.7	21.7
AAQ-6	23.2	20.7	21.8
AAQ-7	23.2	20.7	22.0
AAQ-8	23.2	20.7	21.7

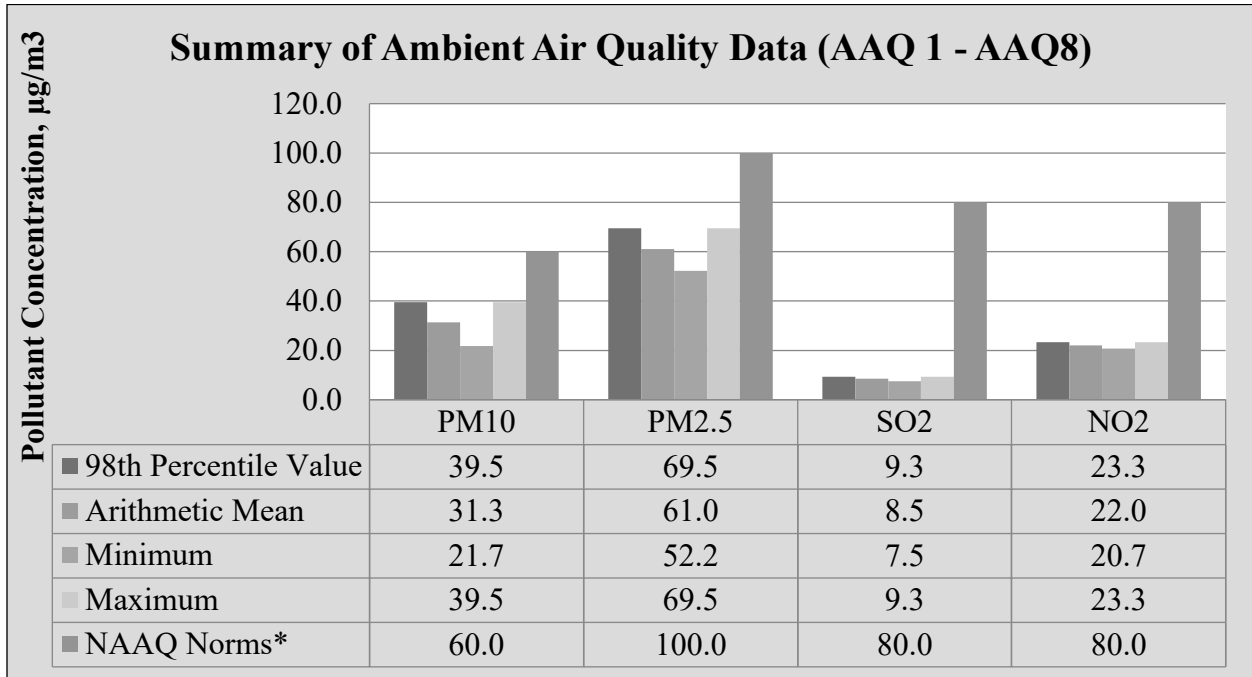
TABLE 3.26: ABSTRACT OF AMBIENT AIR QUALITY DATA

Sl. No.	Parameter	Pollutant Concentration, $\mu\text{g}/\text{m}^3$			
		PM _{2.5}	PM ₁₀	SO ₂	NO ₂
1	No. of Observations	260	260	260	260
2	10th Percentile Value	21.7	52.2	7.5	20.7
3	20th Percentile Value	23.8	53.3	7.5	20.7
4	30th Percentile Value	25.4	55.1	7.5	20.7
5	40th Percentile Value	26.4	56.2	8.4	21.5
6	50th Percentile Value	28.8	58.9	8.4	22.1
7	60th Percentile Value	32.2	61.4	8.4	22.3
8	70th Percentile Value	33.8	63.0	8.4	22.3
9	80th Percentile Value	35.5	65.5	9.3	22.5
10	90th Percentile Value	38.2	67.8	9.3	23.2
11	95th Percentile Value	39.2	68.6	9.3	23.2
12	98th Percentile Value	39.5	69.5	9.3	23.3
13	Arithmetic Mean	31.3	61.0	8.5	22.0
14	Geometric Mean	30.7	60.7	8.5	22.0
15	Standard Deviation	6.4	6.3	0.7	1.0
16	NAAQ Norms*	100.0	60.0	80.0	80.0
17	% Values exceeding Norms*	0.0	0.0	0.0	0.0

Legend: PM_{2.5}-Particulate Matter size less than 2.5 μm ; PM₁₀-Respirable Particulate Matter size less than 10 μm ; SO₂-Sulphur dioxide; NO_x-Oxides of Nitrogen; CO-Carbon monoxide; O₃-Ozone; NH₃-Ammonia; Pb-Particulate Lead; As-Particulate Arsenic; Ni-Particulate Nickel; C₆H₆-Benzene & BaP- Benzo (a) pyrene in particulate phase levels were monitored below their respective detectable limits

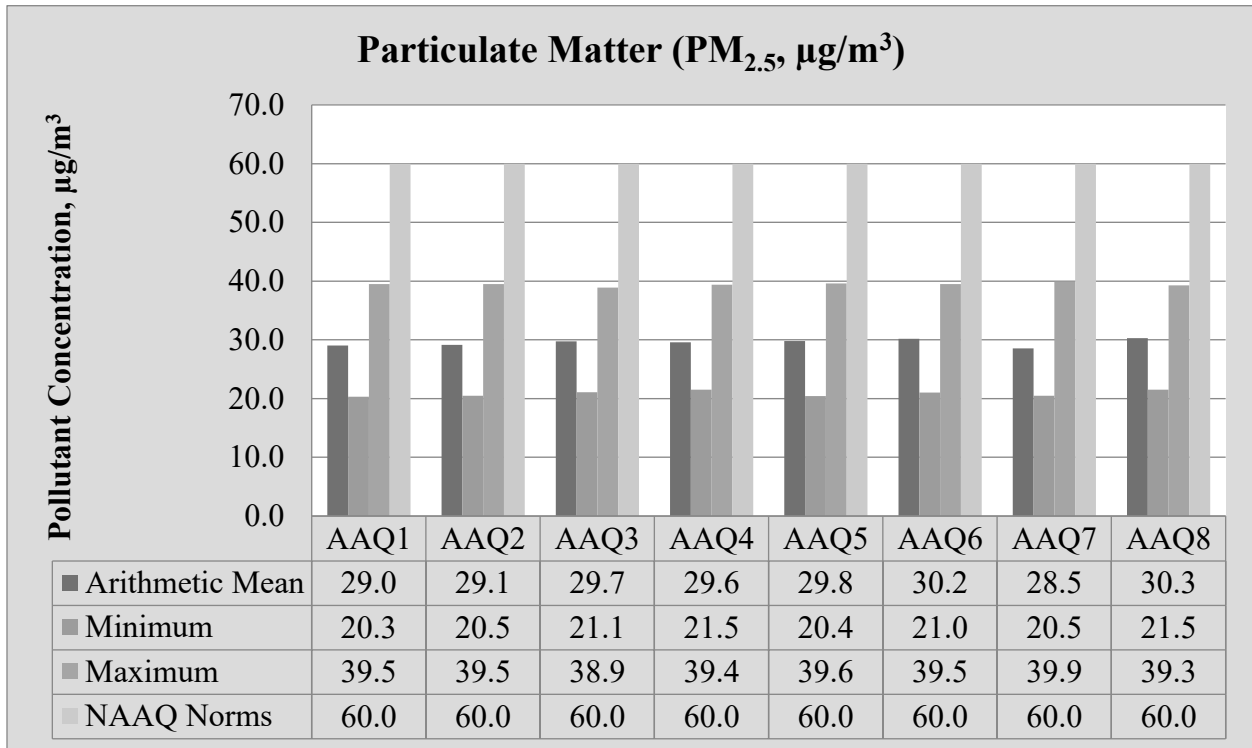
* NAAQ Norms-National Ambient Air Quality Norms-Revised as per GSR 826(E) dated 16.11.2009 for Industrial, Residential, Rural and other Areas.

FIGURE 3.24: BAR DIAGRAM OF SUMMARY OF AAQ 1 – AAQ 8



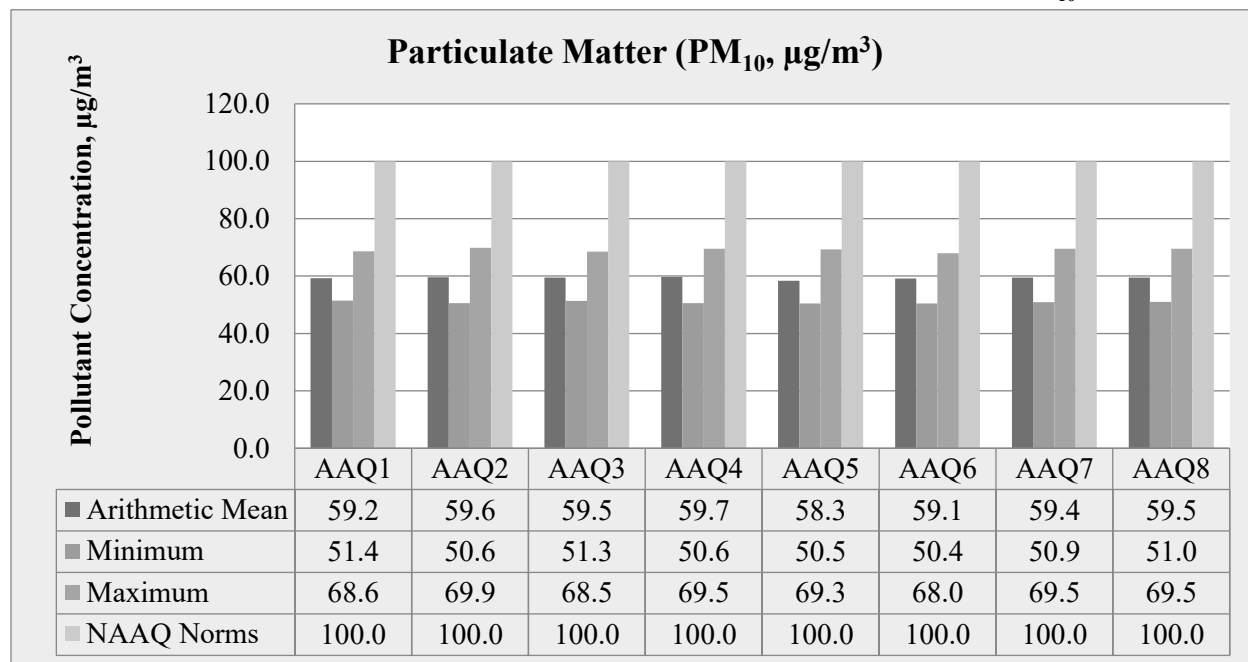
Source: Table 3.17 to 3.27

FIGURE 3.25: BAR DIAGRAM OF PARTICULATE MATTER $\text{PM}_{2.5}$



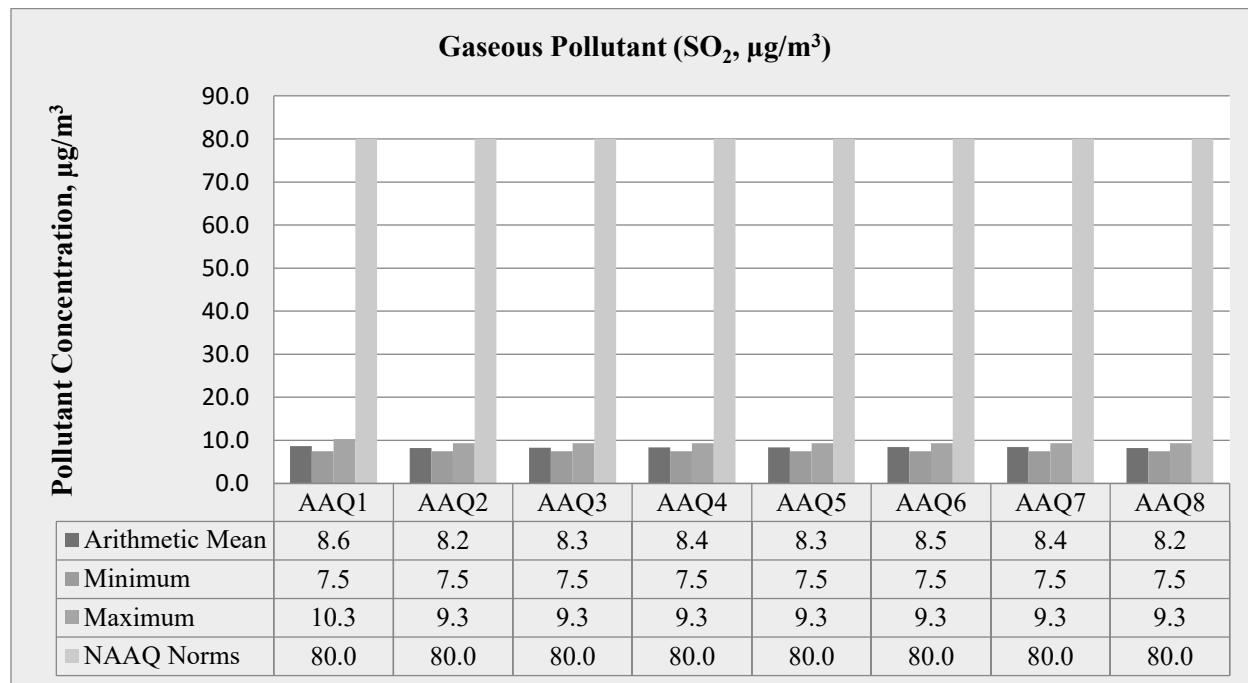
Source: Table 3.17 to 3.27

FIGURE 3.26: BAR DIAGRAM OF PARTICULATE MATTER PM₁₀



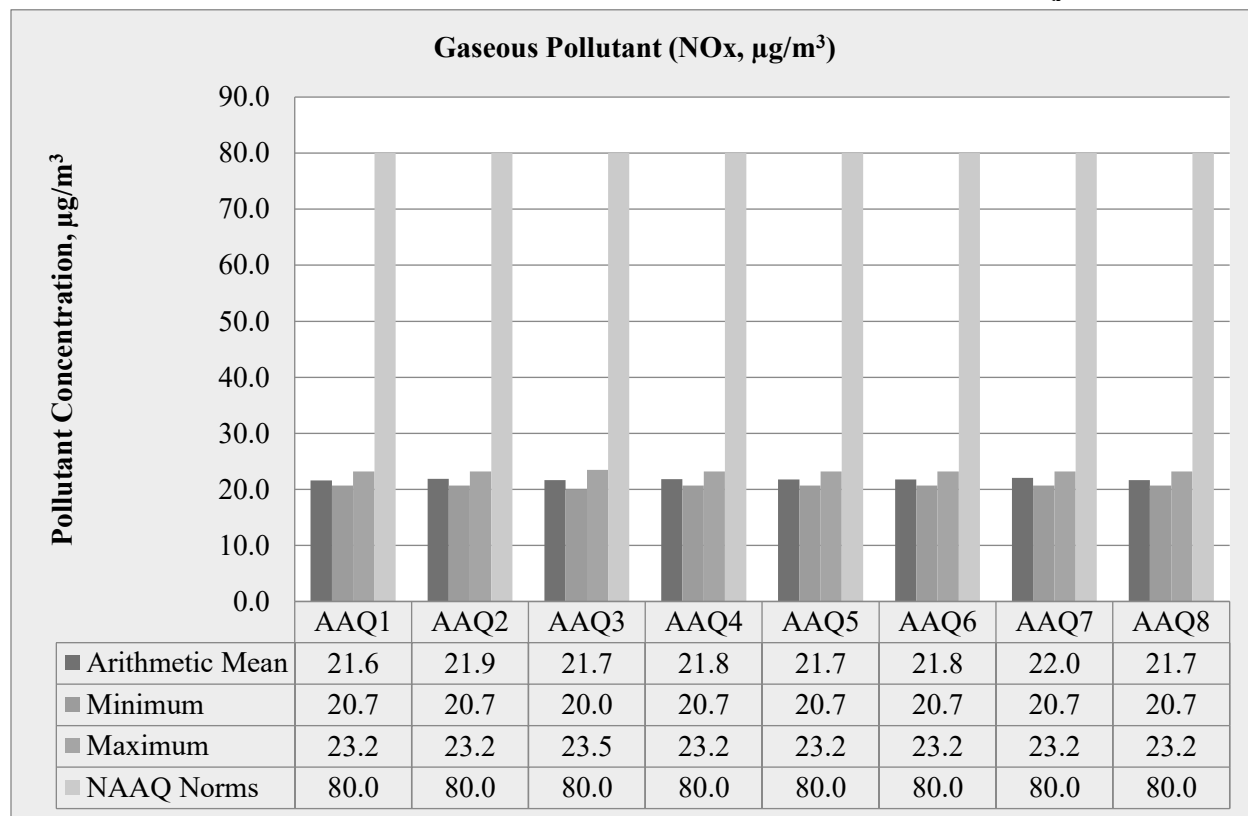
Source: Table 3.17 to 3.27

FIGURE 3.27: BAR DIAGRAM OF GASEOUS POLLUTANT SO₂



Source: Table 3.17 to 3.27

FIGURE 3.28: BAR DIAGRAM OF GASEOUS POLLUTANT NO_x



Source: Table 3.17 to 3.27

3.3.6 Interpretations & Conclusion

As per monitoring data, PM₁₀ ranges from 50.4 µg/m³ to 69.9 µg/m³, PM_{2.5} data ranges from 20.3 µg/m³ to 39.9 µg/m³, SO₂ ranges from 7.5 µg/m³ to 10.3 µg/m³ and NO₂ data ranges from 20.0 µg/m³ to 23.5 µg/m³. 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

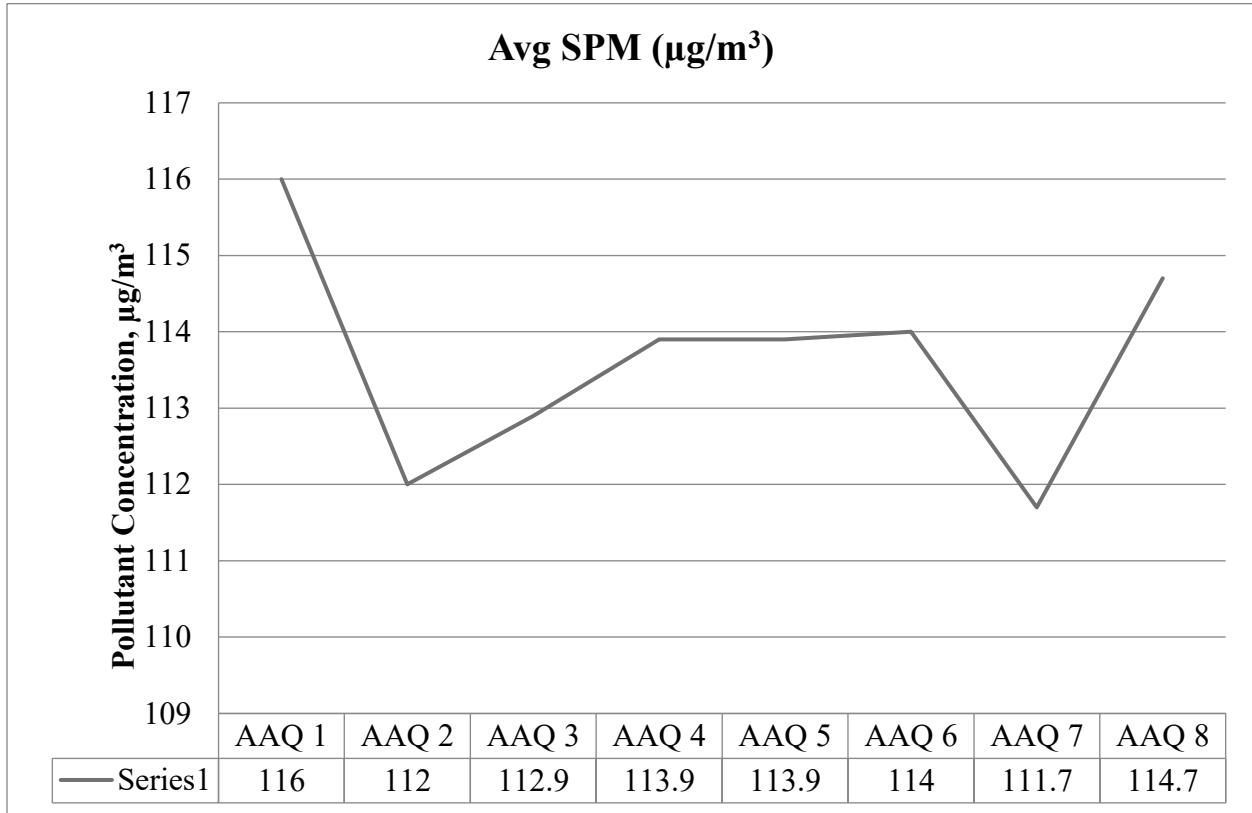
Fugitive dust was recorded at 8 AAQ monitoring stations for 30 days average during the study period.

TABLE 3.34: AVERAGE FUGITIVE DUST SAMPLE VALUES

AAQ Locations	Avg SPM (µg/m ³)
AAQ 1	116
AAQ 2	112
AAQ 3	112.9
AAQ 4	113.9
AAQ 5	113.9
AAQ 6	114.0
AAQ 7	111.7
AAQ 8	114.7

Source: Onsite monitoring/ sampling by Chennai Mettex Laboratories

FIGURE 3.29: LINE DIAGRAM OF AVERAGE SPM VALUES

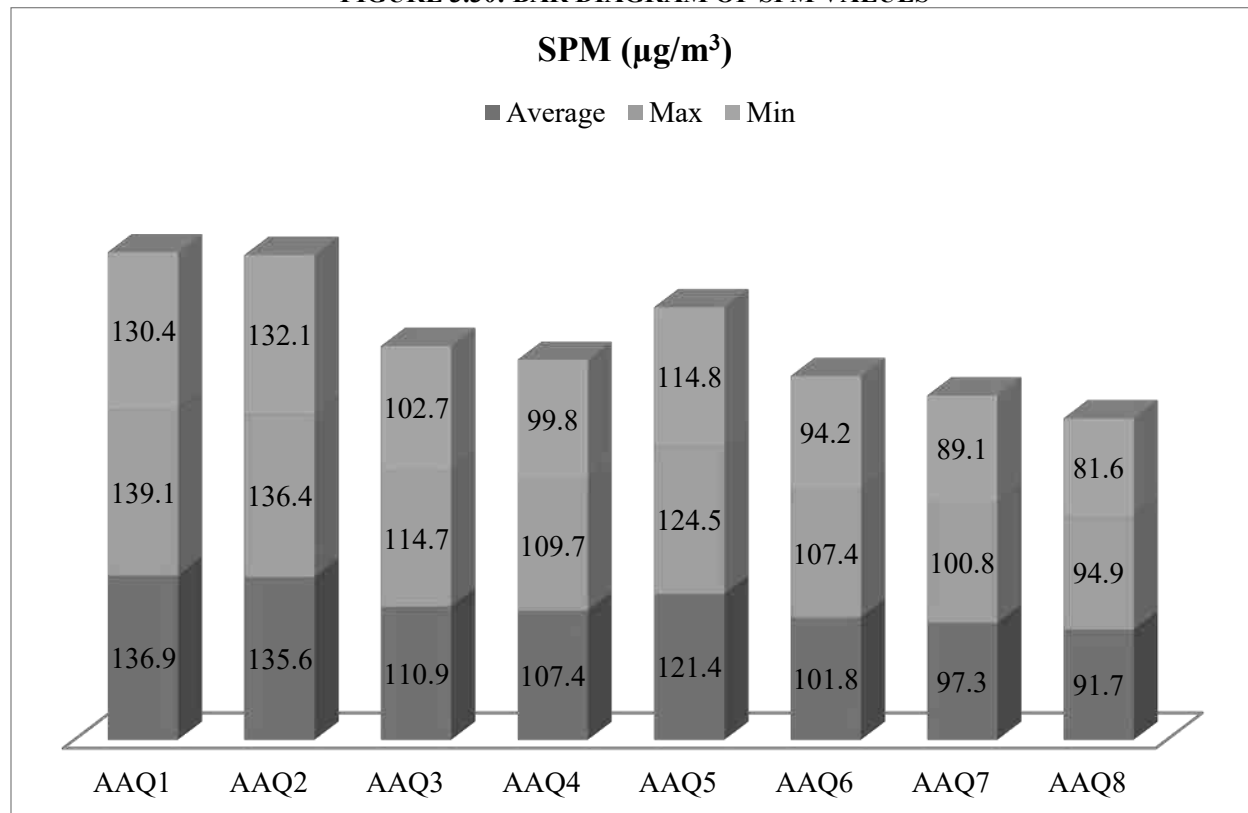


Source: Table 3.28

TABLE 3.35: FUGITIVE DUST SAMPLE VALUES IN µg/m³

SPM (µg/m3)	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Average	116	112	112.9	113.9	113.9	114.0	111.7	114.7
Min	107	101	100	101	101	100	100	101
Max	137	127	129	129	129	129	128	129

Source: Calculations from Lab Analysis Reports

FIGURE 3.30: 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 3.36: DETAILS OF SURFACE NOISE MONITORING LOCATIONS

S. No	Location code	Monitoring Locations	Distance & Direction	Coordinates
1	N-1	Core Zone	South East Corner	10°16'50.66"N 78°43'25.02"E
2	N-2	Arangirampatti	900m North	10°17'23.56"N 78°43'28.91"E
3	N-3	Arumanthapatti	2.8km SW	10°16'14.88"N 78°41'54.05"E
4	N-4	Thirumayam	4.5km SE	10°14'35.06"N 78°44'22.53"E
5	N-5	Embanakutti	3km NE	10°17'46.80"N 78°44'46.24"E

6	N-6	Ponnanur	4.7km NW	10°18'54.68"N 78°41'47.74"E
7	N-7	Anaipatti	3.3km SE	10°16'13.22"N 78°45'09.05"E
8	N-8	Thiruvapuram	5.8km SW	10°14'16.51"N 78°41'27.58"E

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

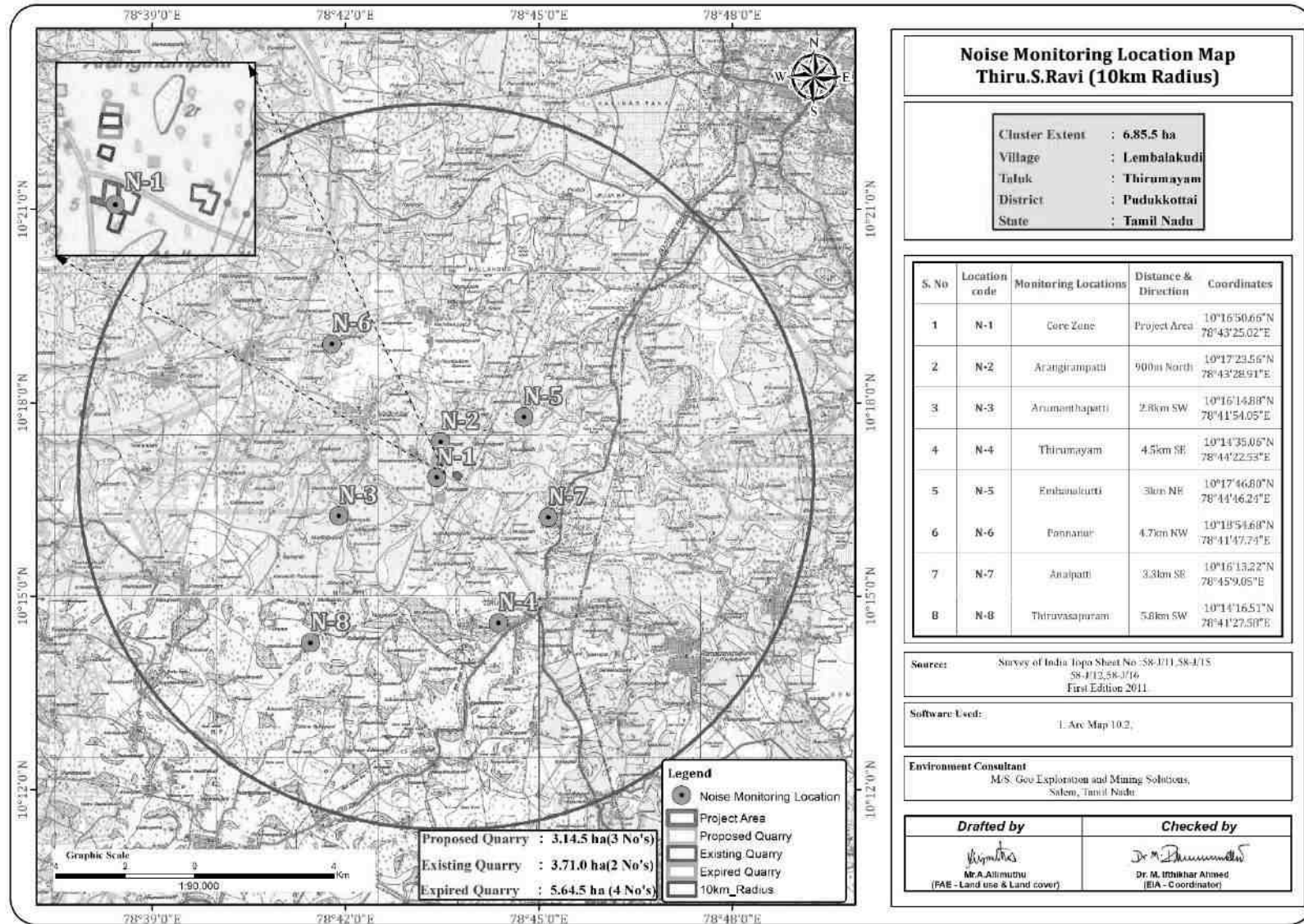
Measured noise levels, displayed as a function of time, is useful for describing the acoustical climate of the community. Noise levels recorded at each station with a time interval of about 60 minutes are computed for equivalent noise levels. Equivalent noise level is a single number descriptor for describing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

$$Leq = 10 \text{ Log } L / T \sum (10L_n/10)$$

Where L = Sound pressure level at function of time dB (A)

T = Time interval of observation

FIGURE 3.31: NOISE MONITORING STATIONS AROUND 10 KM RADIUS



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 3.37: AMBIENT NOISE QUALITY RESULT

S. No	Locations	Noise level (dB (A) Leq)		Ambient Noise Standards
		Day Time	Night Time	
1	Core Zone	64.1	56.5	Industrial Day Time- 75 dB (A) Night Time- 70 dB (A)
2	Arangirampatti	48.7	39.8	
3	Arumanthapatti	48.2	40.0	
4	Thirumayam	48.1	39.9	
5	Embanakutti	47.5	40.3	Residential Day Time- 55 dB (A) Night Time- 45 dB (A)
6	Ponnanur	48.4	39.4	
7	Anaipatti	48.0	39.5	
8	Thiruvapuram	48.5	39.1	

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

FIGURE 3.32: DAY TIME NOISE LEVELS IN CORE AND BUFFER ZONE

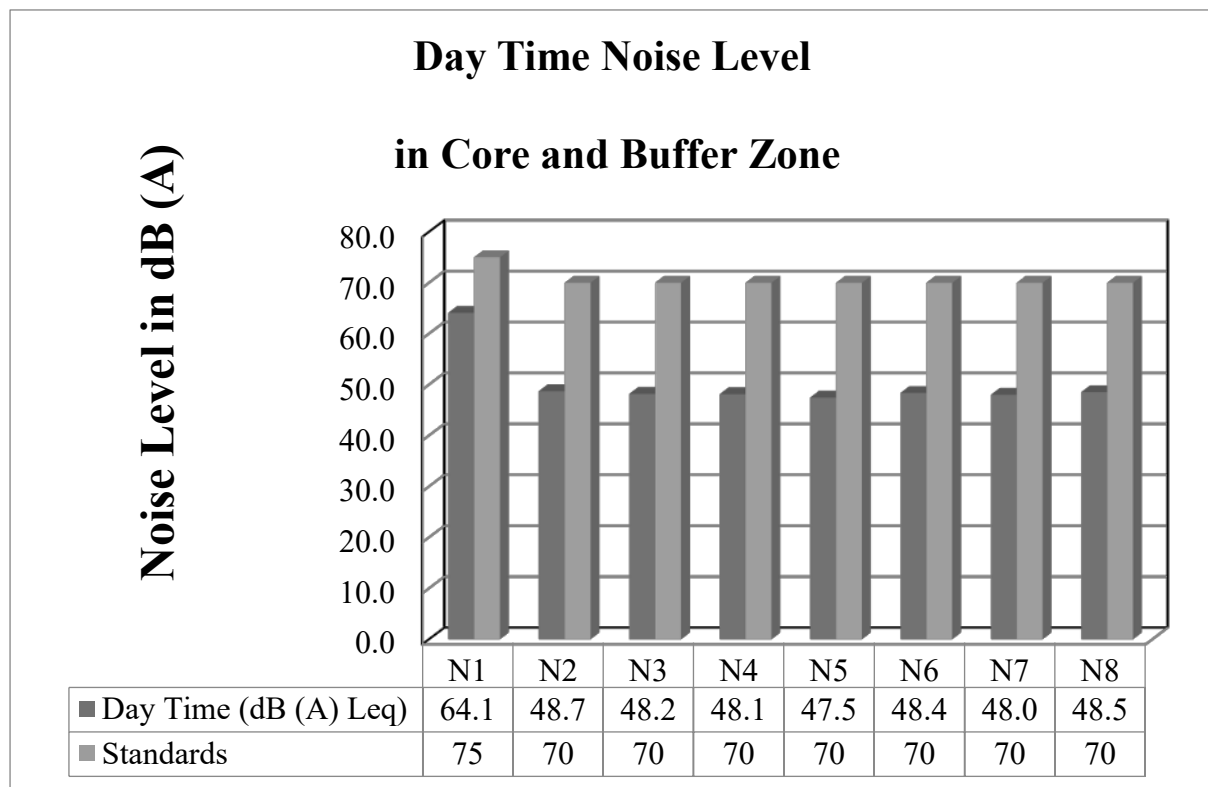
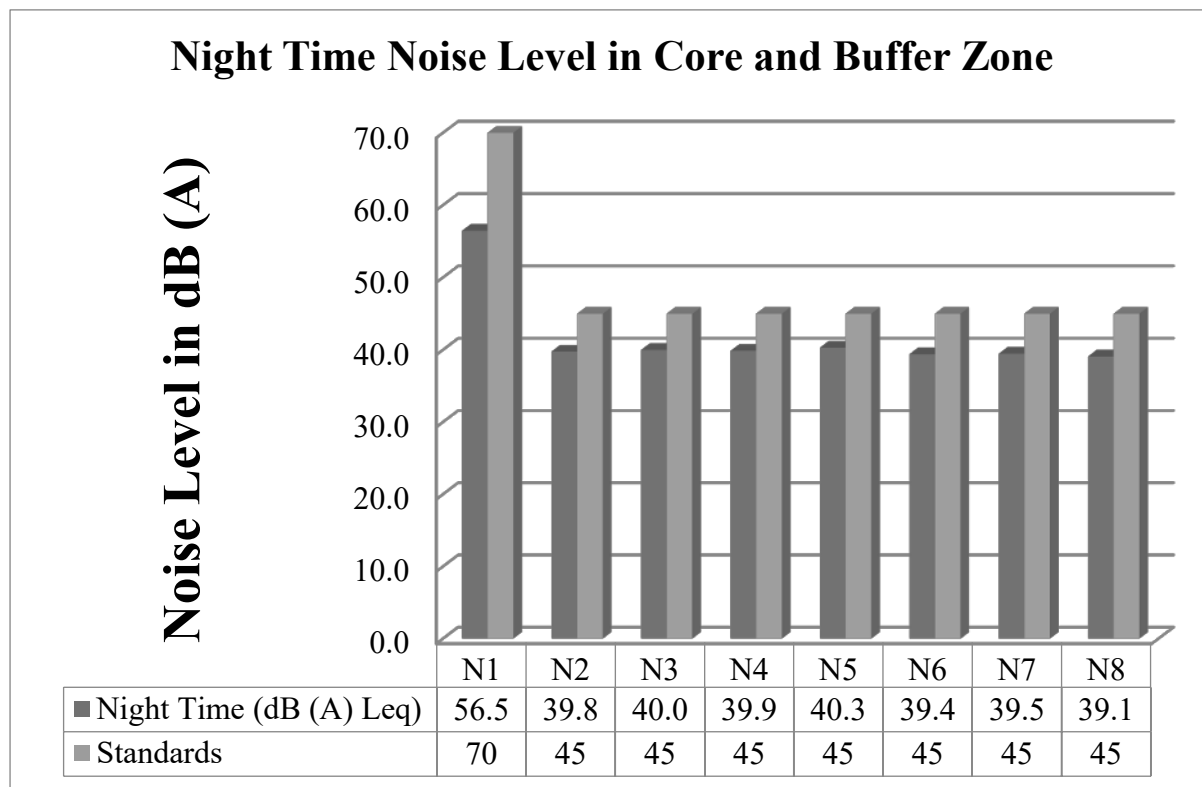


FIGURE 3.33: NIGHT TIME NOISE LEVELS IN CORE AND BUFFER ZONE



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 were from 64.1 dB (A) Leq and during night time were from 56.5dB (A) Leq. Noise levels recorded in buffer zone during day time were from 47.5to 48.7 dB (A) Leq and during night time were from 39.1 to 40.3 dB (A) Leq.

Thus, the noise level for Industrial and Residential area meets the requirements of CPCB.

3.5 BIOLOGICAL ENVIRONMENT

3.5.1. Study area Ecology

The core area extent of 1.53.5 Ha of Rough stone and Gravel quarry has an impact on diversity of flora and fauna of the surrounding area. But present work was carried out on detailed study of the impacts of Rough stone and Gravel quarry on the ecology and biodiversity of the core lease area with the proper mitigation and sustainable management plan. The Core mining area is situated with exhibit plain topography. whereas in buffer zone some places agricultural land is dominated. The following methods were applied during the baseline study of flora, fauna and diversity assessment.

3.5.2. Objectives of Biological Studies

- a) To study the likely impact of the proposed mining project on the local biodiversity and to suggest mitigation measures, if required, for vulnerable biota.
- b) To assess the nature and distribution of vegetation Terrestrial in and around the mining activity.
- c) To identify the impacts of mining on agricultural lands and how it affects.
- d) Proper collection of information about wildlife Sanctuaries/ national parks/ biosphere reserves of the project area.
- e) Devise management & conservation measures for biodiversity.

3.5.3. Methodology of Sampling

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

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). Each of the quartiles have been examined for representative flora on randomly sampled quadrats for trees (10x10-m), shrubs (5x5-m) and herbs (1x1-m) depending upon prevailing geographical conditions and bio-diversity aspects of the study area.

3.5.4. Floral analysis:

The vegetation structure of the region was randomly checked at selected habitats and sampling was done study area. Most of the buffer zone area is under cultivation and hence sampling near pond side and road side are restricted to dense covered regions.

Quadrats of 10 × 10-m were laid down randomly within the core and 5-km buffer area; each quadrat was laid to assess the trees (>5 cm GBH) and one, 5 × 5-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 areas, trees in agricultural bunds, tank bunds, farm forestry plantations, wildlife areas, and natural forest area, avenue plantations, house backyards, etc. In each quadrat individuals belonging to tree (10 × 10-m) and shrub (5 × 5-m) were recorded separately and have been identified on the field. Only photographs were taken during the field survey and no damage is created to flora and fauna during the sampling. The plants were identified using floras by Gamble (1915-36), Saxena and Brahmam (1994-96), Nair and Henry (1983), Henry et al. (1987), Henry et al. (1989) and also by using updated check list from www.theplantlist.org.

3.5.5. Flora Composition in the Core Zone

Taxonomically a total of 18 species belonging to 15 families have been recorded from the core mining lease area. The lease applied area is exhibit plain topography. The area has gentle sloping towards Eastern side. Based on the habitat classification of the enumerated plants the majority of species were Herbs 8 (44%) followed by Trees 4 (22%), Shrubs 4 (22%), Creeper 1 (6%), Grass 1 (6%). Details of flora with the scientific name were mentioned in Table No. 3.1. The result of the core zone of flora studies shows that Fabaceae and Lamiaceae are the main dominating species in the study area mentioned in Table No.3.1 and the details of the diversity of flora family's patterns are given in Fig No.3.3.

Table No: 3.1. Flora in the Core zone

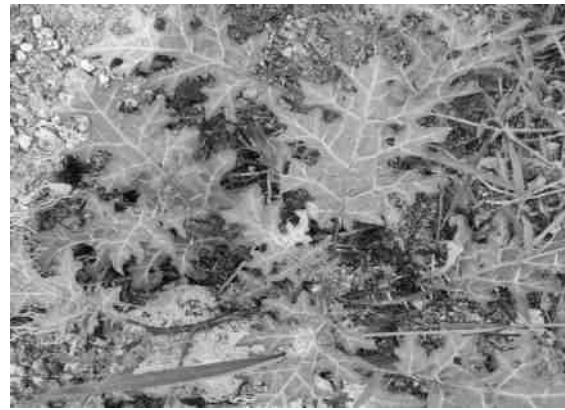
SI. No	English Name	Vernacular Name	Scientific Name	Family Name
Trees				
1.	Neem	Vembu	<i>Azadirachta indica</i>	Meliaceae
2.	Mesquite	Mullu maram	<i>Prosopis juliflora</i>	Fabaceae
3.	Asian Palmyra palm	Panai maram	<i>Borassus flabellifer</i>	Arecaceae
4.	Banyan tree	Alamaram	<i>Ficus benghalensis</i>	Moraceae
Shrubs				
1.	Milk Weed	Erukku	<i>Calotropis gigantea</i>	Apocynaceae
2.	Tanner's cassia	Avaram	<i>Senna auriculata</i>	Fabaceae
3.	Lantana	Unni chedi	<i>Lantana camara</i>	Verbenaceae
4.	Night shade plan	Sundaika	<i>Solanum torvum</i>	Solanaceae
Herbs				
1.	Common leucas	Thumbai	<i>Leucas aspera</i>	Lamiaceae
2.	Indian doab	Arugampul	<i>Cynodon dactylon</i>	Poaceae

3.	Coat buttons	Thatha poo	<i>Tridax procumbens</i>	Asteraceae
4.	Bindii	Nerunji mullu	<i>Tribulus terrestris</i>	Zygophyllaceae
5.	Dog Mustard	Nai kadugu plant	<i>Cleome viscosa</i>	Cleomaceae
6.	Prickly chaff flower	Nayuruv	<i>Achyranthes aspera</i>	Amaranthaceae
7.	Holy basil	Thulasi	<i>Ocimum tenuiflorum</i>	Lamiaceae
8.	Ban Tulsi	Melakai poondu	<i>Croton bonplandianus</i>	Euphorbiaceae
Creeper				
1.	Nut grass	Korai	<i>Cyperus rotandus</i>	Poaceae
Grass				
1.	Eragrostis	Pullu	<i>Eragrostis ferruginea</i>	Poaceae

(Sources: Species observation in the field study)



a. *Calotropis gigantea*



b. *Solanum Xanthocarpum*



c. *Tridax procumbens*



d. *Cyperus rotandus*



e. *Cynodon dactylon*



f. *Borassus flabellifer*



g. *Ficus benghalensis*



h. *Senna auriculata*



i. *Azadirachta indica*



j. *Prosopis juliflora*

Fig No: 3.1. Species observation in the field study (Core Zone)

3.5.6. Flora Composition in the Buffer Zone

A similar type of environment is also in the buffer area but with more flora diversity compared to the core zone area because of the vegetation in all the directions. The lease applied area is exhibit plain topography. It contains a total of 82 species belonging to 36 families that have been recorded from the buffer zone. The floral (82) varieties among them Thirty Trees 30 (37%) twenty-five herbs 25 (30%) and Thirteen shrubs 13 (16%) and eight Climbers 8 (10%), four Grasses 4 (5%), one Creepers 1 (1%) and one Cactus 1 (1%) were identified. The result of the buffer zone of flora studies shows that Fabaceae and Solanaceae, Euphorbiaceae is the main dominating species in the study area mentioned in Table No.3.2. There are no impacts due to this mining activity.

There are no Rare, Endangered, and Threatened Flora species in the mining area and their surrounding study area. Details of flora with the scientific name were mentioned in Table No.3.2. The diversity of flora families is given in Fig No.3.5.

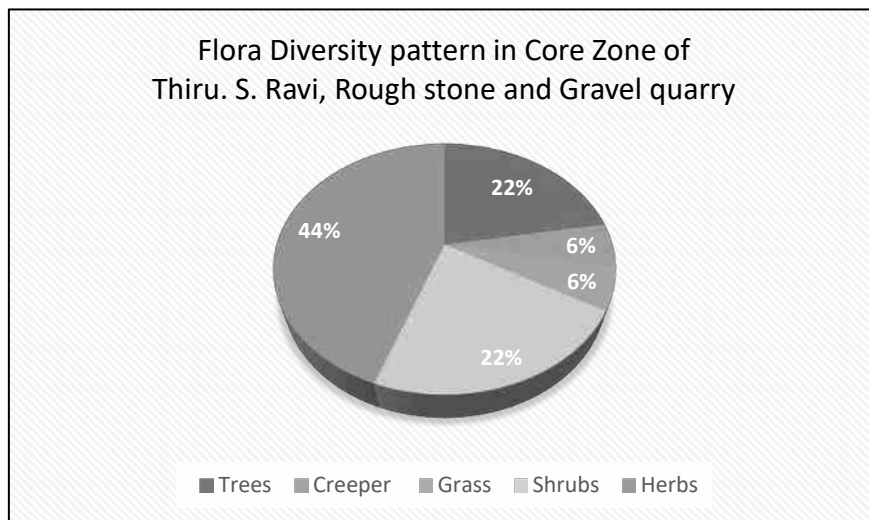


Fig No: 3.2. Flora Diversity pattern in Core Zone

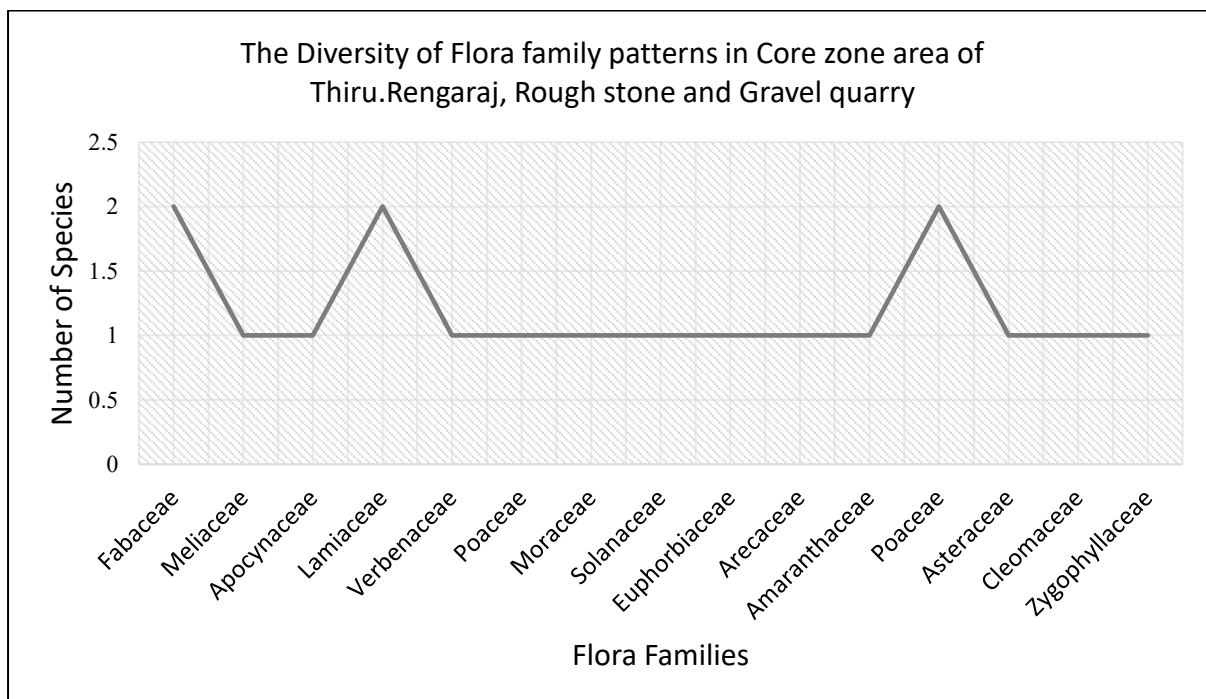


Fig No: 3.3. The Diversity of Flora family patterns in Core zone area

Table No: 3.2. Flora in Buffer Zone of Thiru.C.Rengaraj, Rough Stone and Gravel quarry

S.No.	English Name	Vernacular Name	Scientific Name	Family Name	Resource use type *(E,M,EM)
Trees					
1.	Mango	Manga	<i>Mangifera indica</i>	Anacardiaceae	E
2.	Blue gum	Thayala maram	<i>Eucalyptus</i>	Myrtaceae	M
3.	Indian ash tree	Odiya maram	<i>Lannea coromandelica</i>	Anacardiaceae	E
4.	Neem	Vembu	<i>Azadirachta indica</i>	Meliaceae	M
5.	Tamarind	Puliyamaram	<i>Tamarindus indica</i>	Legumes	EM
6.	Asian Palmyra palm	Panai maram	<i>Borassus flabellifer</i>	Arecaceae	E
7.	Bamboo	Moonghil	<i>Bambusa bambo</i>	Poaceae	E
8.	Indian almond	Padam maram	<i>Terminalia catappa</i>	Combretaceae	EM
9.	Indian ash tree	Odiya maram	<i>Lannea coromandelica</i>	Anacardiaceae	E
10.	Curry leaves	Karuveppali	<i>Murraya koenigii</i>	Rutaceae	EM
11.	Lemon	Ezhumuchaipalam	<i>Citrus lemon</i>	Rutaceae	EM
12.	Bidi leaf tree	Thiruvathi Plant	<i>Bauhinia racemosa</i>	Fabaceae	EM
13.	Peepal	Arasanmaram	<i>Ficus religiosa</i>	Moraceae	M
14.	Custard apple	Seethapazham	<i>Annona reticulata</i>	Annonaceae	E
15.	Flamboyant	Cemmayir-konrai	<i>Delonix regia</i>	Fabaceae	E
16.	Teak	Thekku	<i>Tectona grandis</i>	Verbenaceae	E
17.	Indian gooseberry	Nelli	<i>Emblica officinalis</i>	Phyllanthaceae	EM
18.	Henna	Marudaani	<i>Lawsonia inermis</i>	Lythraceae	EM
19.	Pomegranate	Mathulai	<i>Punica granatum</i>	Lythraceae	EM
20.	Banyan tree	Alamaram	<i>Ficus benghalensis</i>	Moraceae	E
21.	Chinese chaste tree	Nochi	<i>Vitex negundo</i>	Verbenaceae	E
22.	Millettia pinnata	Pongam oiltree	<i>Pongamia pinnata</i>	Fabaceae	E
23.	Coconut	Thennai maram	<i>Cocos nucifera</i>	Arecaceae	EM
24.	Guava	Koyya	<i>Psidium guajava</i>	Myrtaceae	EM
25.	River tamarind	Savundal maram	<i>leucaena leucocephala</i>	Fabaceae	E
26.	Portia tree	Poovarasan	<i>Thespesia populnea</i>	Malvaceae	E
27.	Drumstick tree	Murunga maram	<i>Moringa oleifera</i>	Moringaceae	EM
28.	Mesquite	Mullu maram	<i>Prosopis juliflora</i>	Fabaceae	M
29.	Papaya	Pappali maram	<i>Carica papaya L</i>	Caricaceae	EM
30.	White Bark Acacia	Vela maram	<i>Vachellia leucophloea</i>	Fabaceae	
Shrubs					
1.	Tanner's cassia	Avaram	<i>Senna auriculata</i>	Fabaceae	M
2.	Milk Weed	Erukku	<i>Calotropis gigantea</i>	Apocynaceae	M

3.	Lantana	Unni chedi	<i>Lantana camara</i>	Verbenaceae	M
4.	Triangular spruce	Chaturakalli	<i>Euphorbia antiquorum</i>	Euphorbiaceae	NE
5.	Night shade plan	Sundaika	<i>Solanum torvum</i>	Solanaceae	EM
6.	Indian Oleander	Arali	<i>Nerium indicum</i>	Apocynaceae	M
7.	Shoe flower	Chemparuthi	<i>Hibiscu rosa-sinensis</i>	Malvaceae	EM
8.	Yellow elder	Manjarali	<i>Tecoma stans</i>	Bignoniaceae	M
9.	Puriging nut	Kattamanakku	<i>Jatropha curcas</i>	Euphorbiaceae	EM
10.	Touch-me-not	Thottalchinungi	<i>Mimosa pudica</i>	Mimosaceae	
11.	Thorn apple	Oomathai	<i>Datura stramonium</i>	Solanaceae	E
12.	Castor oil plant	Amanakku	<i>Ricinus communis</i>	Euphorbiaceae	EM
13.	Flame of the Woods	Idlipoo	<i>Xoracoc cinea</i>	Rubiaceae	M
Herbs					
1.	Eggplant	Kathrikkai	<i>Solanum melongena</i>	Solanaceae	EM
2.	Aloe barbadensis	Katrzhai	<i>Aloe vera</i>	Asphodelaceae	EM
3.	Commelina benghalensis	Kanavazha	<i>Commelina benghalensis</i>	Commelinaceae	M
4.	Coat buttons	Thatha poo	<i>Tridax procumbens</i>	Asteraceae	M
5.	Indian doab	Arugampul	<i>Cynodon dactylon</i>	Poaceae	E
6.	Chilli	Milakai	<i>Capsicum annum</i>	Solanaceae	EM
7.	Indian Copperleaf	Kuppaimeni	<i>Acalypha indica</i>	Euphorbiaceae	M
8.	Asthma-plant	Amman pacharisi	<i>Euphorbia hirta</i>	Euphorbiaceae	M
9.	Tomato	Thakkali	<i>Solanum lycopersicum</i>	Solanaceae	EM
10.	Cleome viscosa	Nai kadugu	<i>Celome viscosa</i>	Capparidaceae	M
11.	Bindii	Nerunji mullu	<i>Tribulus terrestris</i>	Zygophyllaceae	M
12.	Prickly chaff flower	Nayuruv	<i>Achyranthes aspera</i>	Amaranthaceae	M
13.	Field beans	Avarai	<i>Hyacinth Beans</i>	Fabaceae	EM
14.	Common leucas	Thumbai	<i>Leucas aspera</i>	Lamiaceae	M
15.	Spiny amaranth	Mullu keerai	<i>Amaranthus spinosus</i>	Amaranthaceae	M
16.	Holy basil	Thulasi	<i>Ocimum tenuiflorum</i>	Lamiaceae	M
17.	Ban Tulsi	Melakai poondu	<i>Croton bonplandianus</i>	Euphorbiaceae	M
18.	Tomato	Thakkali	<i>Solanum lycopersicum</i>	Solanaceae	EM
19.	Europeanblack nightshade	Manathakkali	<i>Solanumnigrum</i>	Solanaceae	EM
20.	ladies' fingers	Vendakkai	<i>Abelmoschus esculentus</i>	Malvaceae	EM
21.	Vigna mungo	Ulunthu	<i>Vigna mungo</i>	Fabaceae	EM
22.	Bright eyes	Nithiyakalyani	<i>Catharanthus roseus</i>	Apocynaceae	EM
23.	Carrot grass	Parttiniyam	<i>Parthenium hysterophorus</i>	Asteraceae	NE
24.	Indian mint	Karpura valli	<i>Coleus amboinicus</i>	Lamiaceae	EM
25.	Native gooseberry	Sodakku thakkali	<i>Physalis minima</i>	Solanaceae	M

Climber					
1.	Stemmed vine	Perandai	<i>Cissus quadrangularis</i>	Vitaceae	M
2.	Wild jasmine	Malli	<i>Jasminum augustifolium</i>	Oleaceae	EM
3.	Betel	Vettilai	<i>Piper betle</i>	Piperaceae	EM
4.	Pointed gourd	Kovakkai	<i>Trichosanthes dioica</i>	Cucurbitaceae	EM
5.	Wild bitter	Pavarkai	<i>Momordica charantia</i>	Cucurbitaceae	EM
6.	Bottle Guard	Sorakkai	<i>Lagenaria siceraria</i>	Cucurbitaceae	EM
7.	White pumpkin	Poosanaikkaai	<i>Cucurbitaceae</i>	Cucurbitaceae	EM
8.	Rosary Pea	Gundumani	<i>Abrus precatorius</i>	Fabaceae	M
Creeper					
1.	Nut grass	Korai	<i>Cyperus rotandus</i>	Poaceae	M
Grass					
1.	Eragrostis	Pullu	<i>Eragrostis ferruginea</i>	Poaceae	E
2.	Windmill grass	Chevvarakupul	<i>Chloris barbata</i>	Amaranthaceae	NE
3.	Sugarcane	Karumbu	<i>Saccharum</i>	Poaceae	E
4.	Paddy	Nellu	<i>Oryza sativa</i>	Grasses	E
Cactus					
1.	Prickly pear	Nagathali	<i>Opuntia dillenii</i>	Cactaceae	M

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

(Sources: Species observation in the field study)

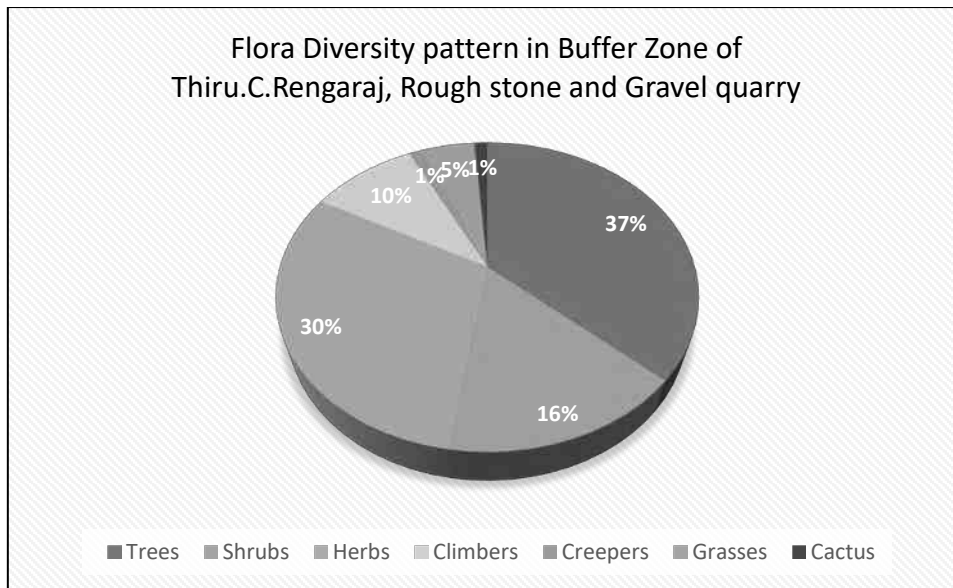


Fig No: 3.4. Flora Diversity pattern in Buffer Zone

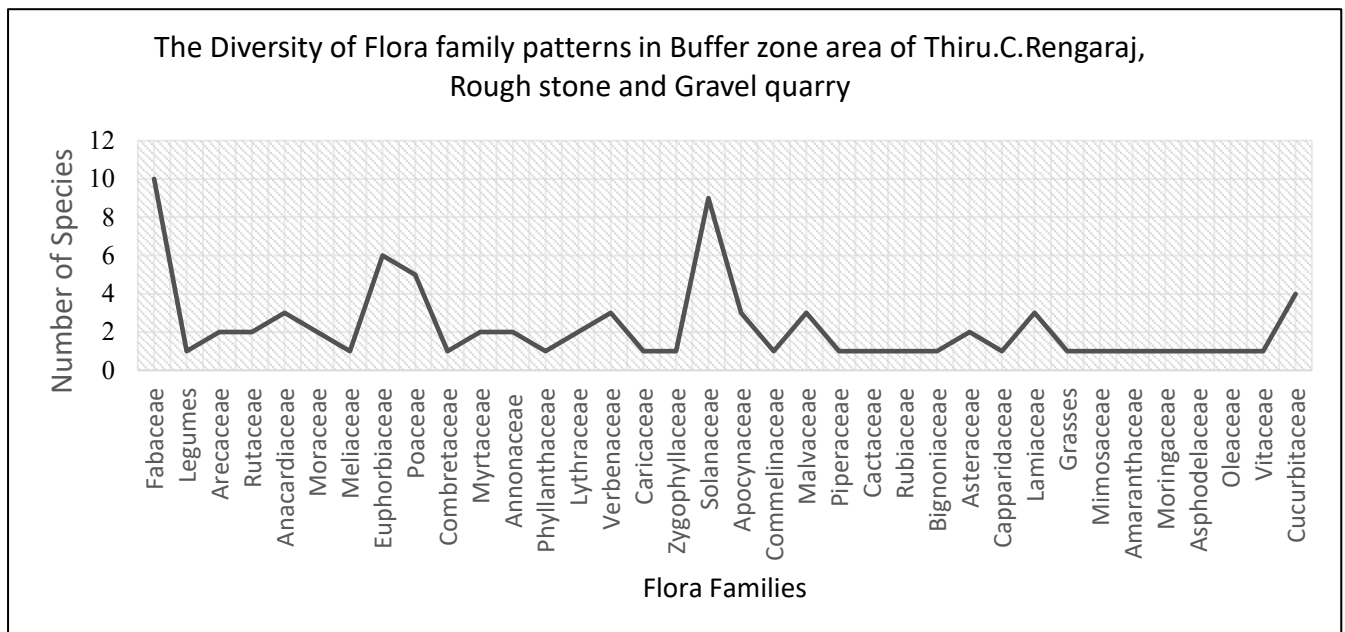


Fig No: 3.5. The Diversity of Flora family patterns in Buffer zone area

3.5.8. Faunal analysis:

The faunal survey has been carried out as per the methodology cited and listed out Mammals, birds, Reptiles, Amphibians, and Butterflies collected by trekking inhabiting areas, along the road, nearby village areas and agricultural fields. An inventory of the animals has been prepared separately for mammals, reptiles, and birds. The faunal species are reported as Common quail, Monitor Lizard, Common myna, Parakeet, House Crow, Rock Pigeon, Green Bee eater and Indian hare. 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 the core area.

Table No: 3.3. Methodology applied during the survey of fauna

S. No	Taxa	Method of Sampling	References
1	Insects	Random walk, Opportunistic observations	Pollard (1977); Kunte (2000)
2	Reptiles	Visual encounter survey (Direct Search)	Daniel J.C (2002)
3	Amphibians	Visual encounter survey (Direct Search)	
4	Mammals	Tracks and Signs	Menon V (2014)
5	Avian	Random walk, Opportunistic observations	Grimmett R (2011); Ali S (1941)

3.5.8.1. Faunal survey

A random survey for mammals were conducted by in all major habitats and recorded the species through direct and indirect evidence. Species were identified using “A pictorial guide to the Mammals of the India” by Vivek menon (2014), Prater (1997).

For Birds, random based observation followed with point count method was applied near water bodies. Birds seen or heard 50 m radius from has been recorded during survey period. Bird surveys were carried out in dawn and dusk of the field visit days. A special note on migratory status of birds were also recorded through secondary data. Birds sighted at the study area were identified using “A field guide to the birds of the Indian Sub-Continent” by Grimmett R (2011).

Reptiles were identified by direct or indirect evidence and literature gathered from the working plans of the forest department and other publications. The directly observed species are identified using the field book on Indian Reptiles and Amphibians by J.C. Daniel (2002). Snakes of India by Whitaker (2016).

Amphibians are surveyed both at aquatic and terrestrial systems searching under the logs and stones, digging through litter and soil, searching short bushes and tree hollows and under fallen barks. The books referred are Amphibians of Peninsular India by Ranjit Daniel (2004). Invertebrates such as Butterflies, Dragonflies and spiders sighted during the survey period were identified by species-specific field guides. Bugs, Beetles and other insect data were gathered from publications working plan data.

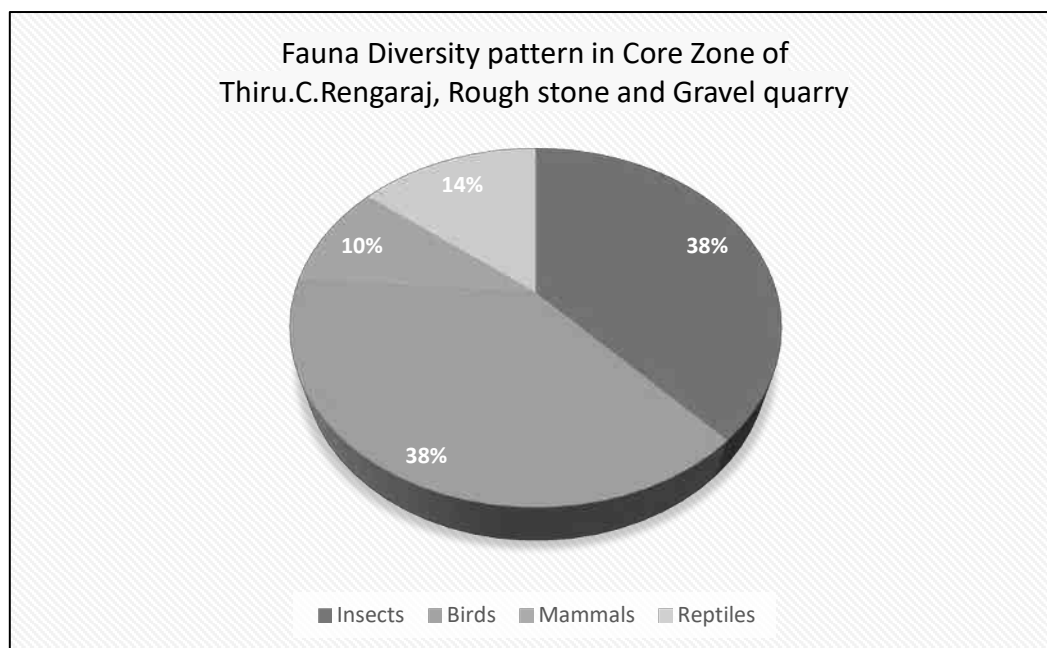
3.5.8.2. Fauna Composition in the Core Zone

A total of 21 varieties of species were observed in the Core zone of Lembalakudi Village, Rough stone and Gravel quarry (Table No.3.7) among them numbers of Insects 8 (38%), Reptiles 3 (14%), Mammals 2 (10%) and Avian 8 (38%). A total of 21 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 the Indian wildlife Act 1972. A total of 8 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 the core zone with the scientific name were mentioned in Table No. 3.4.

Table No: 3.4. Fauna in the Core zone

Sl. No	Common name/English Name	Family Name	Scientific Name	Schedule list wildlife Protection act 1972	IUCN Red List data
Insects					
1	Striped tiger	Nymphalidae	<i>Danaus plexippus</i>	Schedule IV	LC
2	Colotis danae	Pieridae	<i>Colotis danae</i>	NL	LC
3	Grasshopper	Acrididae	<i>Hieroglyphus sp</i>	NL	LC
4	Chocolate pansy	Nymphalidae	<i>Junonia iphita</i>	NL	LC
5	Common Tiger	Nymphalidae	<i>Danaus genutia</i>	NL	NL
6	Termite	Blattodea	<i>Hamitermes silvestri</i>	NE	LC
7	Red-veined darter	Libellulidae	<i>Sympetrum fonscolombii</i>	NL	LC
8	Tawny coster	Nymphalidae	<i>Danaus chrysippus</i>	Schedule IV	LC
Reptiles					
1	Garden lizard	Agamidae	<i>Calotes versicolor</i>	NL	LC
2	Common skink	Scincidae	<i>Mabuya carinatus</i>	NL	LC
3	Green vine snake	Colubridae	<i>Ahaetulla nasuta</i>	Schedule IV	NL
Mammals					
1	Indian Field Mouse	Muridae	<i>Mus booduga</i>	Schedule IV	NL
2	Asian Small Mongoose	Herpestidae	<i>Herpestes javanicus</i>	Schedule (Part II)	LC
Aves					
1	Common myna	Sturnidae	<i>Acridotheres tristis</i>	NL	LC
2	House crow	Corvidae	<i>Corvus splendens</i>	NL	LC
3	Koel	Cuculidae	<i>Eudynamys</i>	Schedule IV	LC
4	Asian green bee-eater	Meropidae	<i>Merops orientalis</i>	NL	LC
5	Rose-ringed parakeet	Psittaculidae	<i>Psittacula krameri</i>	NL	LC
6	Common quail	Phasianidae	<i>Coturnix coturnix</i>	Schedule IV	LC
7	Black drongo	Dicruridae	<i>Dicrurus macrocercus</i>	Schedule IV	LC
8	Cattle egret	Ardeidae	<i>Bubulcus ibis</i>	NE	LC

*NL- Not listed, LC- Least Concern

**Fig No: 3.6. Fauna Diversity pattern in Core Zone of Thiru.S. Ravi**

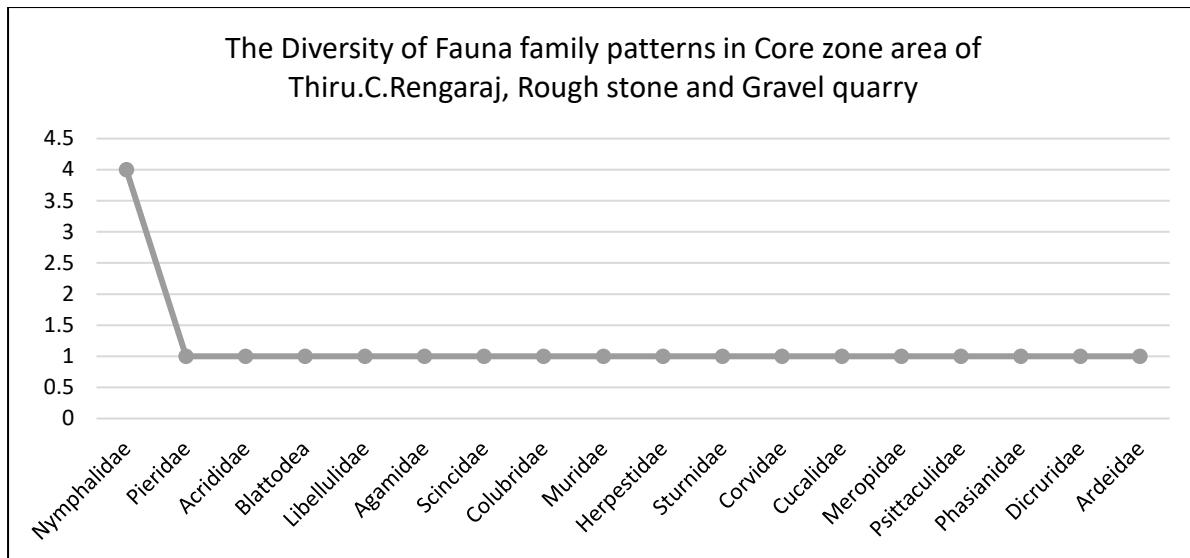


Fig No: 3.7. The Diversity of Fauna family patterns in Core zone area of Thiru.S. Ravi

3.5.8.3. Fauna Composition in the Buffer Zone:

As the animals, especially vertebrates move from place to place in search of food, shelter, mate or other biological needs, separate lists for core and buffer areas are not feasible however, a separate list of fauna pertaining to core and buffer zone are listed separately. Though there are no reserved forest in the buffer zone. As such there are no chances of occurrence of any rare or endangered or endemic or threatened (REET) species within the core or buffer area.

There are no Sanctuaries, National Parks, Tiger Reserve or Biosphere Reserve or Elephant Corridor or other protected areas within 10 km radius from core area. It is evident from the available records, reports, and circumstantial evidence that the entire study area including the core and buffer areas were free from any endangered animals. There were no resident birds other than common bird species such as, green bee eaters, Indian rollers, Rose-ringed parakeet, Common Mynas, Black drangos, Crows, Grey Francolin.

The list of bird species recorded during field survey and literature from the study area are given in Table 3.6. The list of reptilian species recorded during field survey and literature from the study area are given in Table 3.7. The list of insect’s species recorded during field survey and literature from the study area are given in Table 3.8. The list of Amphibian species recorded during field survey and literature from the study area are given in Table 3.9. It is apparent from the list that none of the species either spotted or reported is included in Schedule I of the Wildlife Protection Act. Similarly, none of them comes under the REET category.

Taxonomically a total of 46 species belonging to 36 families have been recorded from the buffer zone area. Based on habitat classification the majority of species were Insect 15 (33%), followed by birds 14 (30%), Reptiles 10 (22%), Mammals 5 (11%), and amphibians 2 (5%). There are six Schedule II species, and twenty-four species are under schedule IV according to the Indian wildlife Act 1972. A total of 14 species of bird were sighted in the study area. There are no critically endangered, endangered, vulnerable, and endemic species were observed. There are no impacts on nearby fauna species.

Dominant species are mostly birds and insects, and two amphibian was observed during the extensive field visit *Sphaerotheca breviceps*, *Euphlyctis hexadactylus*. The result of Buffer zone of fauna studies shows that Nymphalidae, Colubridae, and Scincidae are the main dominating species in the study area. There is no schedule I Species in the study area. A detail of fauna diversity of family’s pattern is given in Fig No.3.10. There are no critically endangered, endangered, vulnerable, and endemic species were observed.

Table 3.5. List of Fauna & Their Conservation Status, Mammals: (*directly sighted animals & Secondary data)

SI. No	Common Name/English Name	Family Name	Scientific Name	Schedule list wildlife Protection act 1972	IUCN Red List data
1	Indian palm squirrel	Sciuridae	<i>Funambulus palmarum</i>	Schedule IV	LC
2	Indian Field Mouse	Muridae	<i>Mus booduga</i>	Schedule IV	LC
3	Asian Small Mongoose	Herpestidae	<i>Herpestes javanicus</i>	Schedule (Part II)	LC
4	Indian hare	Leporidae	<i>Lepus nigricollis</i>	Schedule (Part II)	LC
5	Brown rat	Muridae	<i>Rattus norvegicus</i>	Schedule IV	LC

Status assigned by the IUCN, where – CR – Critically Endangered; EN – Endangered; LC – Least Concern; NT – Near Threatened; VU – Vulnerable, DA – Data Deficient, NE – Not Evaluated

Table 3.6. listed birds

SI. No	Common Name/English Name	Family Name	Scientific Name	Schedule list wildlife Protection act 1972	IUCN Red List data
1	Koel	Cuculidae	<i>Eudynamis</i>	Schedule IV	LC
2	Cattle egret	Ardeidae	<i>Bubulcus ibis</i>	NL	LC
3	Common myna	Sturnidae	<i>Acridotheres tristis</i>	NL	LC
4	House crow	Corvidae	<i>Corvus splendens</i>	NL	LC
5	Asian green bee-eater	Meropidae	<i>Merops orientalis</i>	NL	LC
6	Small blue Kingfisher	Alcedinidae	<i>Alcedo atthis</i>	Schedule IV	LC
7	Rose-ringed parakeet	Psittaculidae	<i>Psittacula krameri</i>	NL	LC
8	Common quail	Phasianidae	<i>Coturnix coturnix</i>	Schedule IV	LC
9	Small Sunbird	Nectariniidae	<i>Nectarinia asiatica</i>	Schedule IV	LC
10	Black drongo	Dicruridae	<i>Dicrurus macrocercus</i>	Schedule IV	LC
11	Woodpecker bird	Picidae	<i>Picidae</i>	Schedule IV	LC
12	Two-tailed Sparrow	Dicruridae	<i>Dicrurus macrocercus</i>	Schedule IV	LC
13	Grey Francolin	Phasianidae	<i>Francolinus pondicerianus</i>	Schedule IV	LC
14	Common Coot	Rallidae	<i>Fulica atra</i>	Schedule IV	LC

*Status assigned by the IUCN, where – CR – Critically Endangered; EN – Endangered; LC – Least Concern; NT – Near Threatened; VU – Vulnerable, DA – Data Deficient, NE – Not Evaluated

**Table 3.7. List of Reptiles either spotted or reported from the study area.
(*indicates Direct observations & Secondary data)**

1	Garden lizard	Agamidae	<i>Calotes versicolor</i>	NL	LC
2	Chameleon	Chamaeleonidae	<i>Chameleon zeylanicus</i>	Sch II (Part II)	LC
3	Fan-Throated Lizard	Agamidae	<i>Sitanaponticeriana</i>	NL	LC
4	Indian wall lizard	Gekkonidae	<i>Hemidactylus flaviviridis</i>	Schedule IV	NL
5	Green vine snake	Colubridae	<i>Ahaetulla nasuta</i>	Schedule IV	NL
6	Rat snake	Colubridae	<i>Ptyas mucosa</i>	Sch II (Part II)	LC
7	Common krait	Elapid snakes	<i>Bungarus caeruleus</i>	Schedule IV	NL
8	Indian cobra	Elapid snakes	<i>Naja naja</i>	Sch II (Part II)	LC
9	Russell's viper	Viperidae	<i>Vipera russelli</i>	Sch II (Part II)	LC
10	Common skink	Scincidae	<i>Mabuya carinatus</i>	NL	LC

Table 3.8. List of insects either spotted or reported from the study area

SI. No	Common Name/English Name	Family Name	Scientific Name	Schedule list wildlife Protection act 1972	IUCN Red List data
1	Indian honey bee	Apidae	<i>Apis cerana</i>	Schedule IV	LC
2	Striped tiger	Nymphalidae	<i>Danaus plexippus</i>	Schedule IV	LC
3	Termite	Blattodea	<i>Hamitermes silvestri</i>	NE	LC
4	Crimson tip	Pieridae	<i>Colotis danae</i>	NL	LC
5	Tawny coaster	Nymphalidae	<i>Danaus chrysippus</i>	Schedule IV	LC
6	Grasshopper	Acrididae	<i>Hieroglyphus sp</i>	NL	LC
7	Red-veined darter	Libellulidae	<i>Sympetrum fonscolombii</i>	NL	LC
8	Chocolate pansy	Nymphalidae	<i>Junonia iphita</i>	NL	LC
9	Ant	Formicidae	<i>Camponotus Vicinus</i>	NL	NL
10	Common Tiger	Nymphalidae	<i>Danaus genutia</i>	Schedule IV	LC
11	Dragonfly	Gomphidae	<i>Ceratogomphus pictus</i>	Schedule IV	LC
12	Milkweed butterfly	Nymphalidae	<i>Danainae</i>	NL	LC
13	Grass yellow	Pieridae	<i>Eurema hecabe</i>	NL	LC
14	Common Indian crow	Nymphalidae	<i>Euploea core</i>	Schedule IV	LC
15	Lesser grass blue	Lycaenidae	<i>Zizina Otis indica</i>	Schedule IV	LC

Table 3.9. List of Amphibians either spotted or reported from the study area

SI. No	Common Name/English Name	Family Name	Scientific Name	Schedule list wildlife Protection act 1972	IUCN Red List data
1	Indian Burrowing frog	Dicroglossidae	<i>Sphaerotheca breviceps</i>	Schedule IV	LC
2	Green pond frog	Dicroglossidae	<i>Euphyctis hexadactylus</i>	Schedule IV	LC

*Status assigned by the IUCN, where – CR – Critically Endangered; EN – Endangered; LC – Least Concern; NT – Near Threatened; VU – Vulnerable, DA – Data Deficient, NE – Not Evaluated



a. *Colotis danae*



b. *Zizina Otis indica*



c. *Acridotheres tristis*



d. *Catopsilia pyranthe*



e. *Blattodea*



f. *Xylocopa*



g. *Chocolate pansy*



h. *Eurema hecabe*



i. *Dicrurus macrocercus*



j. *Calotes versicolor*



k. *Corvus splendens*



l. *Acraea terpsicore*

Fig No: 3.8. Species observation in the field study (Core Zone & Buffer zone)

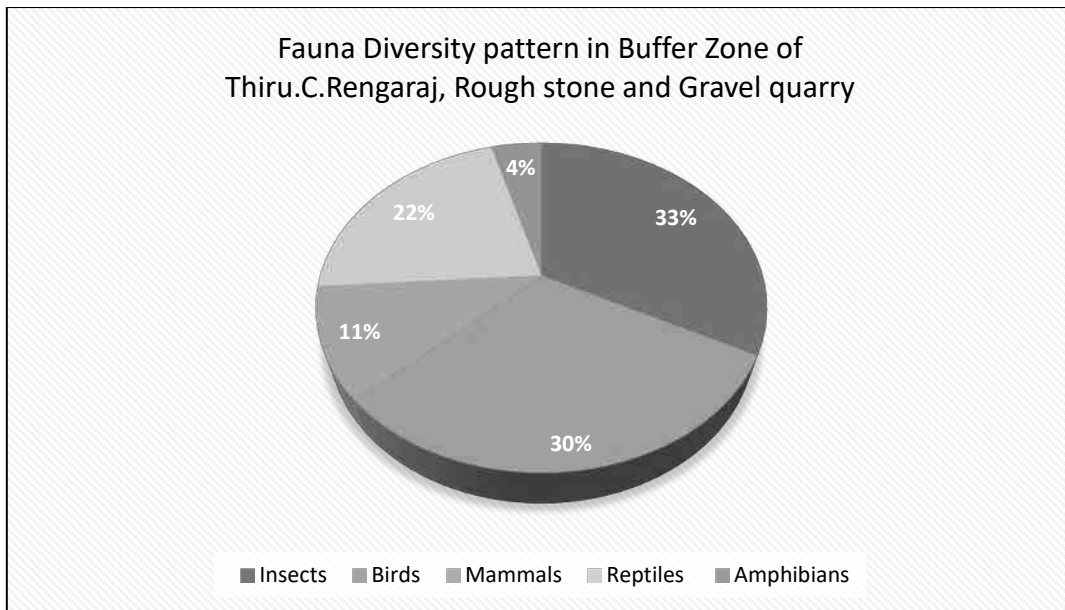


Fig No: 3.9. Fauna Diversity pattern in Buffer Zone

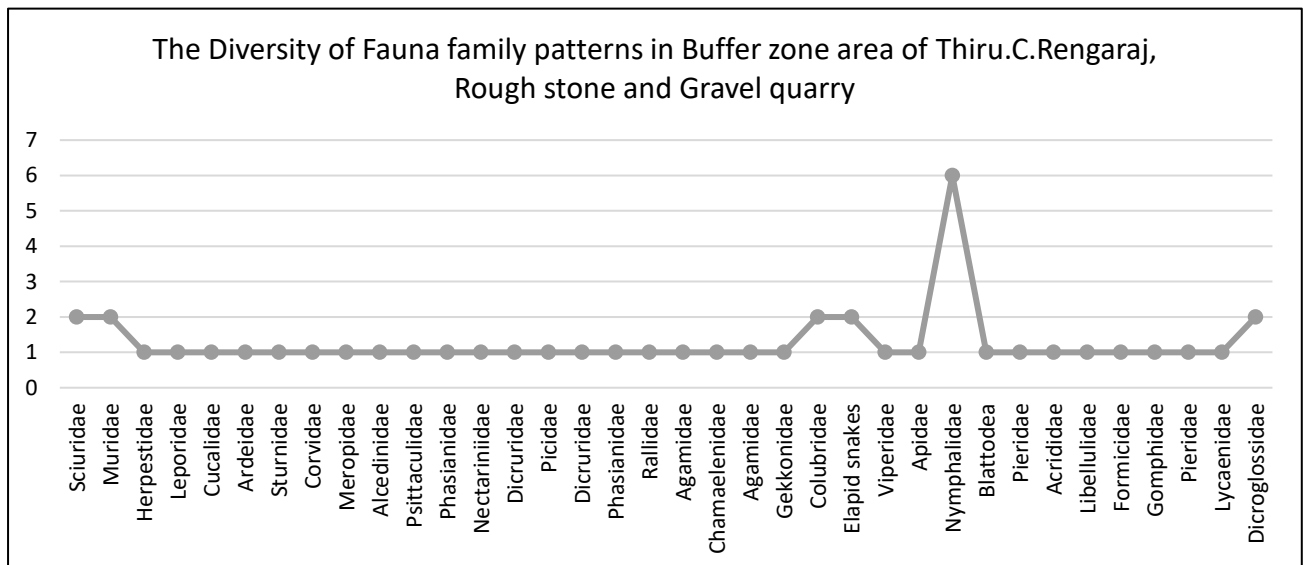


Fig No: 3.10. The Diversity of Fauna family patterns in Buffer zone area

3.5.9. Effect on Migratory corridors, Nesting and Breeding sites.

There are no migratory corridors, nesting and breeding sites within the proposed site or in the core area and study area. No need to take any mitigation measures in this connection.

3.5.9.1. Effect on REET species

From the list, no Rare or Endangered or Endemic or Threatened (REET) species or any species listed in Schedule I of the Wildlife (Protection) Act. Hence, species specific and habitat specific mitigation measures are not needed in this connection. The project site does not overlap with any of the recognized Ramsar sites.

3.5.10. 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 No 3.10.

Table No: 3.10. List of aquatic plants observed in the study area

Sl. No	Scientific name	Common Name	Vernacular Name (Tamil)	IUCN Red List of Threatened Species
1	<i>Nymphaea nauchali</i>	Blue lotus	Alli	LC
2	<i>Cyperus exaltatus</i>	Tall Flat Sedge	Koraikizhangu	LC
3	<i>Aponogeton natans</i>	Floating laceplant	Kottikizhnagu	NA
4	<i>Colocassia esculenta</i>	Taro	Seppakizhangu	LC
5	<i>Carex cruciata</i>	Cross Grass	Koraipullu	NA
6	<i>Cynodon dactylon</i>	Scutch grass	Arugampul	LC
7	<i>Eichornia crassipe</i>	Water hyacinth	Agayatamarai	NA
8	<i>Nymphaea nouchali</i>	Blue waterlily	Nellambal	LC

*LC- Least Concern, NA-Not yet assessed

3.5.11. Conclusion

The observations and assessment of the overall ecological scenario involve details such as classification of Biogeographic zone, eco-region, habitat types and land cover, distances from natural habitats, vegetation/forest types, and sensitive ecological habitats such as Wetlands sites, Important Bird areas, migration corridors of important wildlife etc. Such baseline information provides better understanding of the situation and overall ecological importance of the area. This baseline information viewed against proposed project activities help in predicting their impacts on the wildlife and their habitats in the region. Data collected and information gathered from secondary literature on flora, fauna, protected area, natural habitats, and wildlife species etc., and consulted and discussed with local people, from the villages, herders and farmers who inhabit close to the proposed project area.

3.6 SOCIO ECONOMIC ENVIRONMENT

The major developmental activities in mining /Industrial sector are required for economic development as well as creation of employment opportunities (direct and indirect) and to meet the basic/modern needs of the society, which ultimately results in overall improvement of the quality of life through upliftment of social, economic, health, education and nutritional status in the project region, state as well as the country. In this manner all developmental projects have direct as well as indirect relationships with socioeconomic aspects, which also include public acceptability for new developmental projects. Thus, the study of socioeconomic component incorporating various facets related to prevailing social and cultural conditions and economic status of the Roughstone and Gravel quarry project region is an important part of EIA study. The study of these parameters helps in identification, prediction and evaluation of the likely impacts on the socio economics and parameters of human interest due to the project.

3.6.1 Objectives of the Study

The objectives of the socio-economic impact assessment are as follows:

- To study the socio-economic status of the people living in the study area of the project.

- b) To identify the basic needs of the nearby villages within the study area.
- c) To assess the impact on socio-economic environment due to the project.
- d) To provide the employment and improved living standards.
- e) To study the socio-economic status of the people living in the study area Roughstone and Gravel quarry project region
- f) To assess the impact on socio-economic environment due to Roughstone and Gravel quarry project region
- g) To analysis of impact of socio economic and Environmental Infrastructure facilities and road accessibility.

3.6.2 Scope of Work

- To study the Socio-economic Environment of area from the secondary sources
- Data Collection and Analysis
- Identification of impacts due to the mining projects
- Mitigation Measures

3.6.3 Methodology

The methodology adopted for the socio-economic impact assessment is as follows:

- a) The details of the activities and population structure have been obtained from Census 2001 and 2011 and analyzed.
- b) Based on the above data, impacts due to plant operation on the community have been assessed and recommendations for further improvement have been made.

3.6.4 Sources of Information and Data Base

To achieve the above objectives, the information has been collected from both primary and secondary sources. Both primary data and secondary data have been analyzed by means of suitable statistical techniques for the purpose of verifying the above selected hypotheses concerned with the surrounding area.

3.6.5 Primary Survey

The primary data collection includes the collection of data through a structured interview schedule by direct observation method. The questionnaire survey includes both open and closed methods. The sample size is limited respondents, who were selected on the basis of simple random sampling from Lembalakudi Village, Thirumayam Taluk, Pudukkottai District, Tamil Nadu State, in the field survey has been divided into three major segments namely Primary Zone (0 - 3 km), Secondary Zone (3 - 7 km) and tertiary Zone (7 - 10 km).

The questionnaires were designed to suit the subjects considering their rural background enabling to furnish correct information and data as far as possible. Data were collected at village level and household level by questionnaires and focused group discussions.

The study area for the field survey has been divided into three major segments namely Primary Zone (0 - 3 km), Secondary Zone (3 - 7 km) and Outer Zone (7 - 10 km).

3.6.6 Collection of Data from Secondary Sources

Data from secondary sources were collected on following aspects:

- Demographic profile of the area
- Economic profile of the area

Table 3.6.1 Type of Information and Sources

Information	Source
Demography	District Census Handbook, Govt. of India
Economic profile of the area	Census of India, Tamil Nadu State

b) Data Presentation and Analysis

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

3.7 Background Information of the Area

Tamil Nadu is the 11th largest states in India in terms of area. The state is the seventh most populous state in the country and its main language Tamil has origins that date back to 500 BC. Chennai is the capital of Tamil Nadu and lies on the eastern coast line of India. Tamil Nadu is famous for its wonderful temples and monuments that have been built 1000s of years ago and has places that have been marked as heritage sites by the United Nations. In a 180 degree paradigm shift, this state with a rich historical importance is also one of the fastest developing centre for technology and trade.

The State can be divided broadly into two natural divisions (a) the Coastal plains of South India and (b) the hilly western area. Parallel to the coast and gradually rising from it is the broad strip of plain country. It can further be subdivided into coromandal plains comprising the districts of Kancheepuram, Pudukkottai, Cuddalore and Vellore. The alluvial plains of the Cauvery Delta extending over Thanjavur and part of Tiruchirapally districts and dry southern plains in Madurai, Dindigul, Ramanathapuram, Sivaganga, Virudhnagar, Tirunelveli and Tuticorin districts. It extends a little beyond Western Ghats in Kanyakumari District. The Cauvery Delta presents some extremely distinctive physical and human

features, its power being a main factor in the remarkable growth, the towns of Tamilnadu have witnessed.

3.8 Geography of the Area

Tamil Nadu is one of the 28 states of India, located in the southernmost part of the country. It extends from 8°4'N to 13°35'N latitudes and from 76°18'E to 80°20'E longitudes. Its extremities are

- in eastern - Point Calimere
- in western - hills of Anaimalai
- in northern - Pulicat lake
- in southern - Cape Comorin

It covers an area of 1,30,058 sq.km and 11th largest state in India. It covers 4% of the area of our country. Tamil Nadu is bounded by the Bay of Bengal in the east, Kerala in the west, Andhra Pradesh in the north, Tamil Nadu in the northwest and Indian Ocean in the south. Gulf of Mannar and Palk Strait separate Tamil Nadu from the Island of Sri Lanka, which lies to the southeast of India.

Already we have learnt that the state of Tamil Nadu had only 13 districts at the time of its formation. After that, the state was reorganised several times for the administrative convenience. At present there are 37 districts in Tamil Nadu, including the newly created districts such as Kallakurichi, Tenkasi, Chengalpet, Ranipet and Tirupathur.

3.9 Population Growth Rate

In 1991, there were only 21 districts in the State of Tamil Nadu. In 2001, eight new districts were created by reorganising the territorial jurisdiction. The nine districts are – Pudukkottai, Namakkal, Pudukkottai, Perambalur, Viluppuram, Thiruvavur, Nagapattinam, and Theni. The population and its growth trend are important economic factors in a developing economy.

Year	Tamil Nadu	India
1941	11.91	14.22
1951	14.66	13.31
1961	11.85	21.51
1971	22.30	24.80
1981	17.50	24.66
1991	15.39	23.86
2001	11.19	21.34
2011	15.61	5.96
2021	5.96	1.0

3.10 Pudukkottai District

Pudukkottai district as one of the princely states of Tamilnadu holds rich cultural heritage with Fortresses, Palaces, Temples, Cave Paintings and many other historical monuments. Pudukkottai district is well endowed with natural resources of land and sea bounded by the marine hedge of Bay of Bengal in the east conjoined by the southern districts viz, Trichy, Sivaganga, Ramanathapuram and Thanjavur. The Palaces, Fortress, Canals and Tanks built during the reign of ancient Tamil Kings are the place of interest. Besides, Temple in Avudayarkovil, Kudumiyanmalai, Chitthannavasal are very much prominent. Peacock sanctuary at Viralimalai, cave temples, temples built on the mountains are major tourism destination.

Pudukkottai Division of Tiruchirappalli district with some additions from Thanjavur district. At present, this district is composed of three Revenue Divisions, namely, Pudukkottai ,Aranthangi and Illuppur and twelve Taluks, namely, Kulathur, Illuppur, Alangudi, Pudukkottai, Gandarvakottai, Thirumayam, Aranthangi, Avudaiyrakoil , Manamelkudi, Ponnamaravathi, Karambakkudi and Viralimalai. There are 763 Revenue Villages. The area of the district is 4663 Sq.Kms. Source: <https://pudukkottai.nic.in/about-district/>

3.11 Study Area

Detailed socio-economic survey was conducted in the study area (Core and buffer zone) within 10 km radius of the area at Lembalakudi Village, Thirumayam Taluk, Pudukkottai District, Tamil Nadu State. In order to determine the impact of the proposed project on nature and inhabitant. To get an overview of the villagers and their perspectives about this proposed activity, different demographic parameters and social aspects such population density, sex ratio, literacy rate, worker ratio etc. has been identified, analyzed, studied together. These impacts may be beneficial or disadvantageous. If disadvantageous anticipated suggestions measures are advocated in order to have collective development.

3.12 Demographic pattern of 10km study area characteristics a comparative analysis

Table 3.12.1 shows the socio-economic profile of the study area as compared to district, state and national level socio-economic profile

Particular	India	Tamil Nadu	Pudukkottai District	Study Area (10km Radius)
Area (in sq. km.)	3,287,263	130058	4663	320
Population Density/ sq. Km.	368	554	347	212
No. of Households	249454252	13357027	387679	16731

Particular	India	Tamil Nadu	Pudukkottai District	Study Area (10km Radius)
Population	1210569573	72147030	1618345	67866
Male	623121843	36137975	803188	33870
Female	587447730	36009055	815157	33996
Scheduled Tribes	104281034	794697	1283	63
Scheduled Castes	201378086	14438445	284804	14820
Literacy Rate	72.99%	80%	68.62%	75.53%
Sex Ratio (Females per 1000 Males)	943	996	1015	1004

Source: Census of India, 2011

Table no 3.12.1 show demographic pattern of India, Tamil Nadu, Pudukkottai District & Study area (10km Radius). In India had total area of 3.2sqkm, State of Tamil Nadu area was 130058 sqkm, District of Pudukkottai area was 4663 sqkm and study area is about 320 sqkm. Population density is total population per sqkm. So, India population density was 368sqkm, state of Tamil Nadu density was 554 sqkm, District had density about 347 sqkm and study area density is about 212sqkm. As per Census 2011, about 5.96percent of population in the state lives in areas. Pudukkottai had comparing state wise 2.90 percent of population lives in the district. In study area has 3.09 % around 10km radius. State, District and study area. In Tamil Nadu state SC categories people had about 20.02 %, District of Pudukkottai about 17.59 % it has increasing to Study area about 23.30% increasing in the total population Similarly ST population is about 1.10%, 0.07% and 6% of the total population in the study area. State level Literacy rate is 80%, district level is 68.62% but study area has almost decreased about 69.73%. There is literacy rate is study area decrease comparing district level decrease in the study area. Sex ratio female per thousand males about state level is 996, District level is 1015 and study area is 1004

The study area has population density 212 persons per sq.km of total population about 48656 as per census 2011. There were about 49.25 percent male and 50.75% female population. Study area has literate rate is about69.7%. District had about 75.60% of literate rate as per census 2011.

3.13 Population Projection of the Study Area

A population projection is an estimation of the number of people expected to be alive at a future date that is made based on assumptions of population structure, fertility, mortality and migration. It is an essential to assess the need for new jobs, schools, doctors and nurses, planning urban housing, foods, clothing and

requirements of energy and resources. It is also needed for policy discourse i.e., helps to the policy-makers to understand the existing problems and finally supports to develop the suitable solutions.

Table 3.13.1 Total Population of Study Area

SI No.	Population in 2001	Population in 2011
1	62338	67866

Source: <https://censusindia.gov.in/census.website/>

Table 3.13.2 Population Projection of Study Area

S. No	Year	Projected Population (Approximately)
1.	2021	73394
2.	2031	78922
3.	2041	84450
4.	2051	89978

Source: Calculated by SPSS v29, 2022.

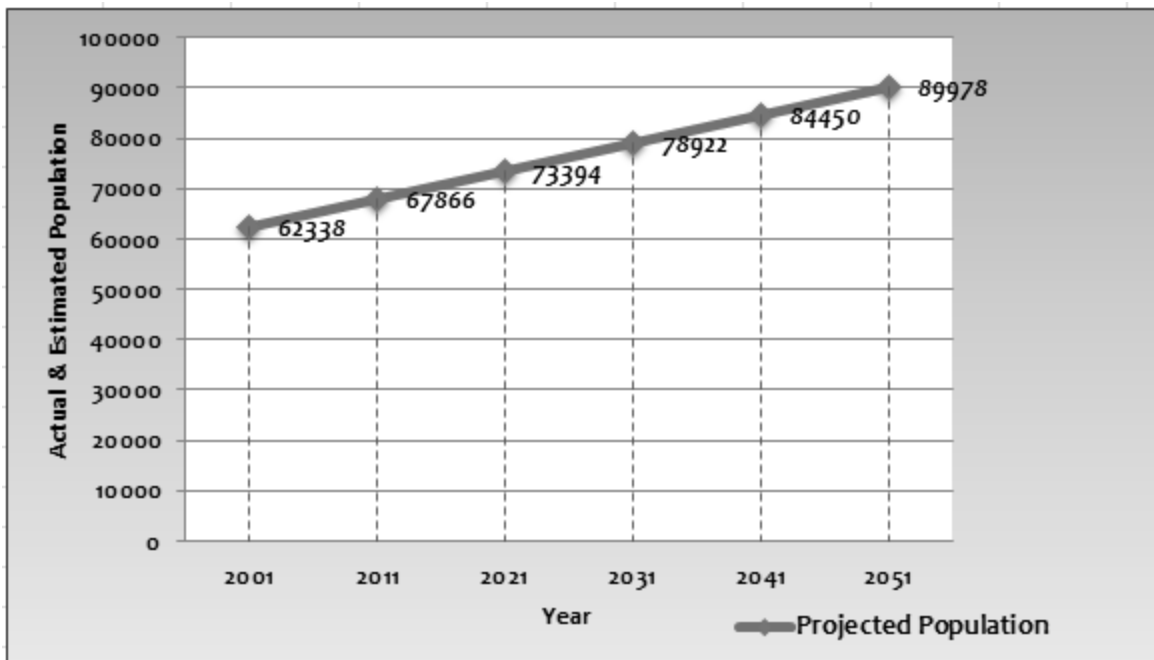


Fig 3.13.3 Graph Showing Population Projection

Following formula has been used for the projection of population.

$$Y=a+bt$$

Where: Y= Dependent variable (Population)

a=Intercept

b=Slope

t=Interdependent variables (Time)

Above formula is applied to project population for the years (2021, 2031, 2041, and 2051). Due to avoid the errors in manual calculation the statistical software SPSS (demo version 29) is used to calculate the intercept and the slope.

Due to the shortage of data on population the results show same value of growth for the years (2021,2031, 2041, 2051). If the researcher gets enough the data on population for earlier years the data projection will be accurate.

- Ref: Indian Economic survey, the SLR (Simple Linear Regression) techniques are used by statistical department, Government of India to project population.
- Source: <https://www.ibm.com/in-en/analytics/spss-statistics-software>

3.14 Population Growth of the Study Area

Table 3.14.1 Population Growth rate in Study area

Year	Actual Population	Growth Rate %
2001	62338	
2011	67866	10.89
2021	73394	10.81
2031	78922	10.75
2041	84450	10.70
2051	89978	10.65

Source: Compiled by Author-2022

Above table no 3.14.1 is showing the growth rate of population since 2001, as per census in 2001 the population of study area was 62338 and 2011 it was 67866 if the population growth rate is 10.89%, it will approximately 73394 in year 2021 and 89978 in the year of 2051. It has approximately population growth rate decline will be 10.65%.

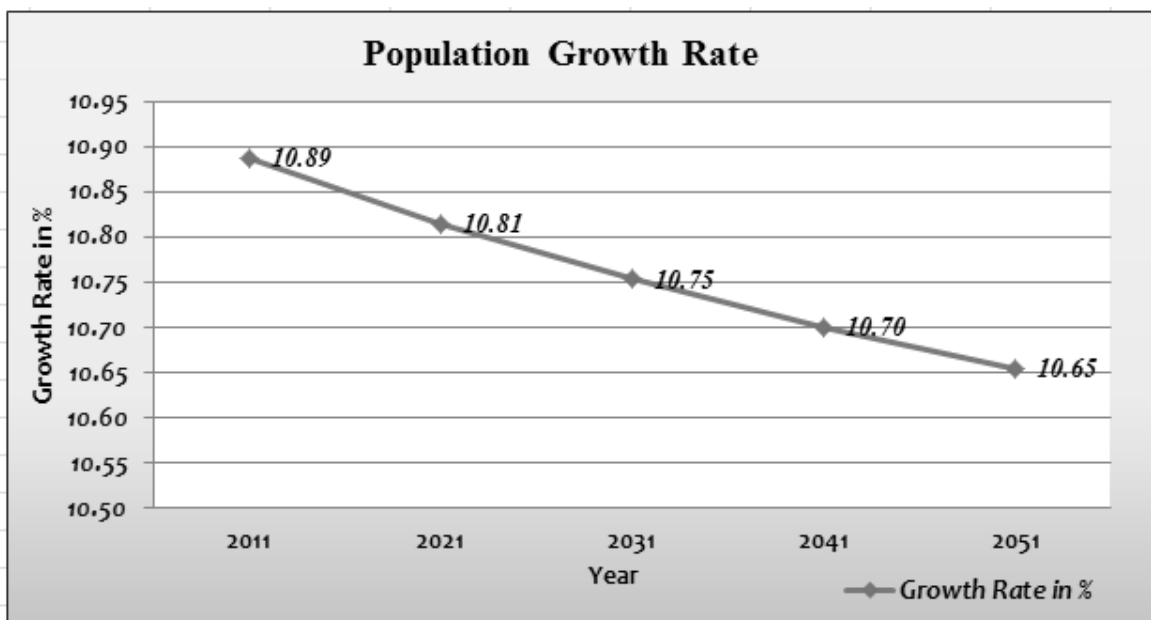


Fig.3.14.2 Graph Showing Population Growth Rate

Planning Analysis:

Calculating Growth Rates

The percent change from one period to another is calculated from the formula:

Where:

$$PR = \frac{(V_{Present} - V_{Past})}{V_{Past}} \times 100$$

PR=Percent Rate

V_{Present} =Present or Future Value

V_{Past} = Past or Present Value

The *annual* percentage growth rate is simply the percent growth divided by N, the number of years.

Source: <https://pages.uoregon.edu/rgp/PPPM613/class8a.htm>

3.15 Population Distribution and Composition of Study Area

The population as per 2011 Census records is 67866 (for 10 km radius buffer zone). Total no. of household is 2782, 9254, 4695 respectively, in primary, secondary and tertiary zone. Sex ratio is 996, 1001 and 1015 (females per 1000 males) observed in primary, secondary and tertiary zone respectively. SC population distribution is 2075, 8924 and 3821 respectively in primary, secondary and tertiary zone.

ST population distribution is 24,33 and 6 respectively in primary, secondary and tertiary. Average household size is 4. Zone wise Demographic profile of study area is given in the table 3.15.1 below:

Source: <https://censusindia.gov.in/census.website/data/census-tables>

Table 3.15.1 Zone wise Demographic Profile of Study Area

Zone	No. of Villages	Total Household	Total Population	Male Population	%	Female Population	%
Primary Zone (0 - 3 Km)	3	2782	11666	5844	50.09	5822	49.91
Secondary Zone (3 - 7 Km)	14	9254	37549	18769	49.99	18780	50.01
Tertiary Zone (7 - 10 km)	13	4695	18651	9257	49.63	9394	50.37
Study Area (0-10 km)	30	16731	67866	33870	49.91	33996	50.09

Source: Census of India, 2011



Figure 3.15.2 Population of study area

Table 3.15.3 Village wise Demographic Profile of the Study Area (Core and Buffer Zone)

0-3km																														
Sno	Name	No.of Households	Total population	Total Male	Total Female	Sex Ratio	Population below 6	Male below 6	Female below 6	Child Sex Ratio	SC population	SC Male	SC Female	ST population	ST Male	ST Female	Literate population	Male Literate	Female Literate	Total Lite.rate (%)	Male Lite rate (%)	Female Lite.rate (%)	Total workers	Total Workers Rate (%)	Main workers	MainWorkers Rate (%)	Marginal workers	Marginal Workers Rate (%)	Nonworkers	Non Workers Rate (%)
1	Virachilai I Bit	1660	7006	3528	3478	986	699	362	337	931	1277	654	623	8	6	2	4578	2596	1982	72.59	82.00	63.10	3185	45.46	2415	34.47	770	10.99	3821	54.54
2	Lembalakudi	1090	4539	2257	2282	1011	518	268	250	933	678	335	343	15	8	7	3013	1681	1332	74.93	84.51	65.55	1843	40.60	1296	28.55	547	12.05	2696	59.40
3	Perendurai	32	121	59	62	1051	10	4	6	1500	120	59	61	1	0	1	62	33	29	55.86	60.00	51.79	73	60.33	73	60.33	0	0.00	48	39.67
Total		2782	11666	5844	5822	996	1217	630	587	932	1955	989	966	23	14	9	7591	4277	3314	72.65	82.03	63.30	5101	43.73	3784	32.44	1317	11.29	6565	56.27
3-7km																														
Sno	Name	No.of Households	Total population	Total Male	Total Female	Sex Ratio	Population below 6	Male below 6	Female below 6	Child Sex Ratio	SC population	SC Male	SC Female	ST population	ST Male	ST Female	Literate population	Male Literate	Female Literate	Total Lite.rate (%)	Male Lite rate (%)	Female Lite.rate (%)	Total workers	Total Workers Rate (%)	Main workers	MainWorkers Rate (%)	Marginal workers	Marginal Workers Rate (%)	Nonworkers	Non Workers Rate (%)
1	Chettipatti	539	2411	1193	1218	1021	295	141	154	1092	91	45	46	0	0	0	1370	746	624	64.74	70.91	58.65	1520	63.04	1178	48.86	342	14.18	891	36.96
2	Vellaipillayarpatti	87	386	206	180	874	33	19	14	737	55	28	27	0	0	0	206	125	81	58.36	66.84	48.80	244	63.21	241	62.44	3	0.78	142	36.79
3	Sokkanathapatti	254	1092	547	545	996	133	72	61	847	284	147	137	0	0	0	672	404	268	70.07	85.05	55.37	607	55.59	148	13.55	459	42.03	485	44.41
4	Kummangudi	145	590	306	284	928	57	34	23	676	143	78	65	0	0	0	391	224	167	73.36	82.35	63.98	368	62.37	361	61.19	7	1.19	222	37.63
5	Kottur	1097	4269	2134	2135	1000	452	222	230	1036	626	316	310	3	2	1	2914	1636	1278	76.34	85.56	67.09	1898	44.46	1734	40.62	164	3.84	2371	55.54
6	Kulamangalam	553	2305	1124	1181	1051	217	103	114	1107	633	311	322	8	1	7	1466	833	633	70.21	81.59	59.33	1118	48.50	1013	43.95	105	4.56	1187	51.50
7	Melappanaiyur	1216	4885	2466	2419	981	505	270	235	870	1284	653	631	3	2	1	3290	1873	1417	75.11	85.29	64.88	2547	52.14	2329	47.68	218	4.46	2338	47.86
8	Thekkattur	1932	7632	3845	3787	985	823	417	406	974	867	463	404	1	0	1	5329	3019	2310	78.26	88.07	68.32	3221	42.20	2063	27.03	1158	15.17	4411	57.80
9	Sokkanathapatti	63	274	132	142	1076	30	18	12	667	119	56	63	0	0	0	159	84	75	65.16	73.68	57.69	167	60.95	40	14.60	127	46.35	107	39.05
10	Ennapatti	109	490	260	230	885	45	22	23	1045	207	110	97	0	0	0	351	209	142	78.88	87.82	68.60	179	36.53	178	36.33	1	0.20	311	63.47
11	Thiruvapuram	200	908	469	439	936	101	50	51	1020	125	63	62	2	1	1	537	332	205	66.54	79.24	52.84	576	63.44	358	39.43	218	24.01	332	36.56
12	Melur	751	2992	1466	1526	1041	301	146	155	1062	1387	673	714	8	4	4	2020	1126	894	75.07	85.30	65.21	1322	44.18	1033	34.53	289	9.66	1670	55.82
13	Alavayal	83	327	176	151	858	29	19	10	526	108	55	53	0	0	0	269	154	115	90.27	98.09	81.56	117	35.78	36	11.01	81	24.77	210	64.22
14	Tirumayam	2225	8988	4445	4543	1022	996	481	515	1071	2995	1470	1525	8	2	6	6590	3564	3026	82.46	89.91	75.12	3515	39.11	2830	31.49	685	7.62	5473	60.89
Total		9254	37549	18769	18780	1001	4017	2014	2003	995	8924	4468	4456	33	12	21	25564	14329	11235	76.24	85.52	66.97	17399	46.34	9107	24.25	3857	10.27	14677	39.09
7-10km																														
Sno	Name	No.of Households	Total population	Total Male	Total Female	Sex Ratio	Population below 6	Male below 6	Female below 6	Child Sex Ratio	SC population	SC Male	SC Female	ST population	ST Male	ST Female	Literate population	Male Literate	Female Literate	Total Lite.rate (%)	Male Lite rate (%)	Female Lite.rate (%)	Total workers	Total Workers Rate (%)	Main workers	MainWorkers Rate (%)	Marginal workers	Marginal Workers Rate (%)	Nonworkers	Non Workers Rate (%)
1	Mallangudi	76	324	154	170	1104	26	13	13	1000	24	8	16	0	0	0	191	107	84	64.09	75.89	53.50	145	44.75	40	12.35	105	32.41	179	55.25
2	Arasandampatti	106	466	226	240	1062	46	18	28	1556	134	64	70	0	0	0	328	175	153	78.10	84.13	72.17	222	47.64	103	22.10	119	25.54	244	52.36
3	Kulipirai	894	3323	1626	1697	1044	321	170	151	888	668	329	339	1	0	1	2425	1293	1132	80.78	88.80	73.22	1433	43.12	1352	40.69	81	2.44	1890	56.88
4	Athur	162	791	413	378	915	76	47	29	617	42	22	20	0	0	0	534	314	220	74.69	85.79	63.04	492	62.20	491	62.07	1	0.13	299	37.80
5	Valayampatti	110	490	257	233	907	47	25	22	880	0	0	0	0	0	0	323	200	123	72.91	86.21	58.29	209	42.65	206	42.04	3	0.61	281	57.35
6	Poovampatti	75	311	160	151	944	35	17	18	1059	148	75	73	0	0	0	254	139	115	92.03	97.20	86.47	178	57.23	173	55.63	5	1.61	133	42.77

7	Kottaiyur	550	2273	1109	1164	1050	218	100	118	1180	949	451	498	2	1	1	1542	829	713	75.04	82.16	68.16	1086	47.78	926	40.74	160	7.04	1187	52.22
8	Kannanoor I Bit	283	1188	579	609	1052	99	52	47	904	313	150	163	1	0	1	796	459	337	73.09	87.10	59.96	762	64.14	717	60.35	45	3.79	426	35.86
9	Rangiyam	1215	4622	2324	2298	989	443	231	212	918	531	271	260	1	0	1	3146	1788	1358	75.28	85.43	65.10	2169	46.93	1501	32.48	668	14.45	2453	53.07
10	Samudram	410	1681	831	850	1023	158	82	76	927	476	240	236	0	0	0	1192	668	524	78.27	89.19	67.70	768	45.69	422	25.10	346	20.58	913	54.31
11	Kunnathupatti	36	153	83	70	843	16	7	9	1286	0	0	0	0	0	0	87	55	32	63.50	72.37	52.46	71	46.41	70	45.75	1	0.65	82	53.59
12	Adhanur	666	2546	1255	1291	1029	302	147	155	1054	223	115	108	1	0	1	1588	874	714	70.77	78.88	62.85	1088	42.73	1055	41.44	33	1.30	1458	57.27
13	Kulathupatti	112	483	240	243	1013	47	18	29	1611	313	158	155	0	0	0	289	162	127	66.28	72.97	59.35	174	36.02	171	35.40	3	0.62	309	63.98
Total		4695	18651	9257	9394	1015	1834	927	907	978	3821	1883	1938	6	1	5	12695	7063	5632	75.49	84.79	66.36	6696	35.90	7227	38.75	1570	8.42	9854	52.83
Grand total		16731	67866	33870	33996	1004	7068	3571	3497	979	14700	7340	7360	62	27	35	45850	25669	20181	75.41	84.72	66.17	29196	43.02	20118	29.64	6744	9.94	31096	45.82

Source: Village Wise Demographic Profile of the Study Area, *Census of India, 2011*

- ✓ Above table identifies the presence of villages and their subsequent population divided under three zones from plant boundary (i.e., Primary, secondary and tertiary zone)
- ✓ Primary zone has 3 villages where as much as 2782 households with 11666 populations are located. Mostly lying on Built-up land for their livelihood and substance.
- ✓ Secondary and tertiary zone both comprise of 14 and 13 villages having a total population of 37549 and 18651 respectively.

3.16 Gender and Sex Ratio

Sex ratio is used to describe the number of females per 1000 of males. Sex ratio is a valuable source for finding the population of women in India and what is the ratio of women to that of men in India. In the Population Census of 2011, it was revealed that the population ratio in India 2011 is 940 females per 1000 of males. The study area has 1004 females per 1000 males. Gender and sex ratio determine the Human Development Index (HDI) of an area thereby understanding the status of women in that region. Following table entails information about sex ratio of 30 villages lying in study area (buffer zone) as primary, secondary and tertiary zone.

Table 3.16.1 Sex ratio of the study area

S. No.	Buffer Zone	Sex Ratio of Study area Female/ 1000 Male
1	Primary Zone (0-3 km)	996
2	Secondary zone (3-7 km)	1001
3	Tertiary Zone (7-10 km)	1015

Source: Census of India, 2011

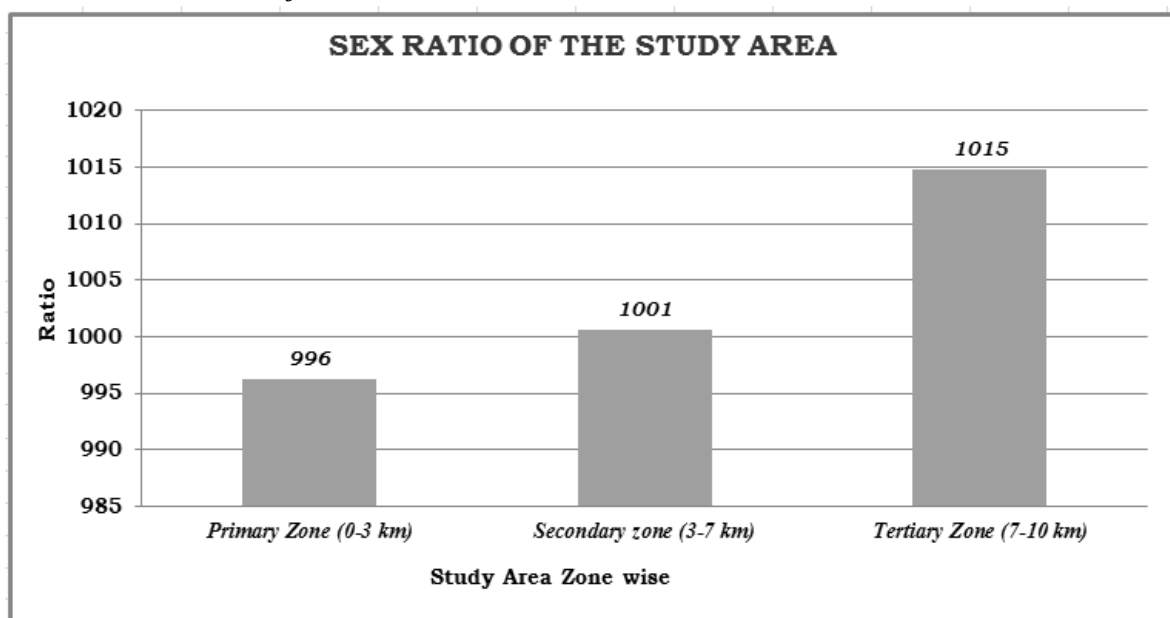


Figure 3.16.2 Sex Ratio within 10 Km study area

3.17 Literacy Rate in Study Area

Literacy Rate is the percentage of people in a country with the ability to read and write. The analysis of the literacy levels is done in the study area. The 10 km radius of study area demonstrates a literacy rate of 75.53% as per census data 2011. The male literacy rate in the study area indicates 84.84% whereas the female literacy rate, which is an important indicator for social change, is observed to be 66.28% as per the census data 2011. This needs to focus on the region and enhance further development focusing on education. (Table no 3.17.1).

Table 3.17.1 Literacy Rate of the Study Area

Zone	No. of Villages	Male Literacy Population	Male literacy Rate	Female Literacy Population	Female literacy Rate	Total Literacy	Total Literacy Rate
Primary Zone (0 - 3 Km)	3	4310	82.73	3343	63.93	7653	73.31
Secondary Zone (3 - 7 Km)	14	14329	85.52	11235	66.97	25564	76.24
Tertiary Zone (7 - 10 Km)	13	7063	84.79	5632	66.36	12695	75.49
Study Area (0-10km)	30	25702	84.84	20210	66.28	45912	75.53

Source: Census of India, 2011

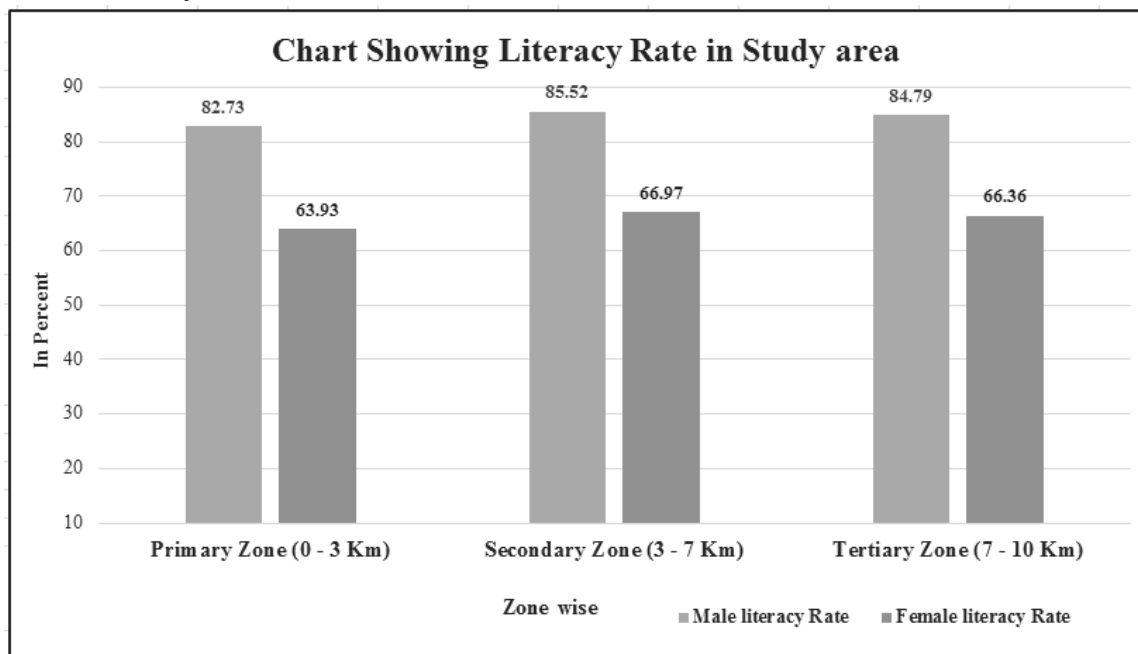


Figure 3.17.2 Gender wise Literacy Rate in the study area

3.18 Family Size

Size of family also describes about family functioning, resource consumption, total income generated and their expenditure pattern. Census 2011 data suggests that most of these households have a family size of up to 4 members, knowing the size of family also give fair understanding of relating how much resource consumption is being incurred, and annual income being generated and spent.

3.19 Vulnerable Group

While developing an action plan, it is very important to identify the population who fall under the marginalized and vulnerable groups and special attention has to be given towards these groups while making action plans. Special provisions should be made for them. In the observed villages schedule caste (SC) population is 21.84% and Schedule Tribe population 0.09%, Other Population is 78.07% in total study area.

Table 3.19.1 Vulnerable groups of the study area

Zone	No. of Villages	Vulnerable Groups					
		SC Population	%	ST Population	%	Other Population	%
Primary Zone (0 - 3 Km)	3	2075	17.79	24	0.21	9567	82.01
Secondary Zone (3 - 7 Km)	14	8924	23.77	33	0.09	28592	76.15
Tertiary Zone (7 - 10 Km)	13	3821	20.49	6	0.03	14824	79.48
Total area (10km)	30	14820	21.84	63	0.09	52983	78.07

Source: Census of India, 2011

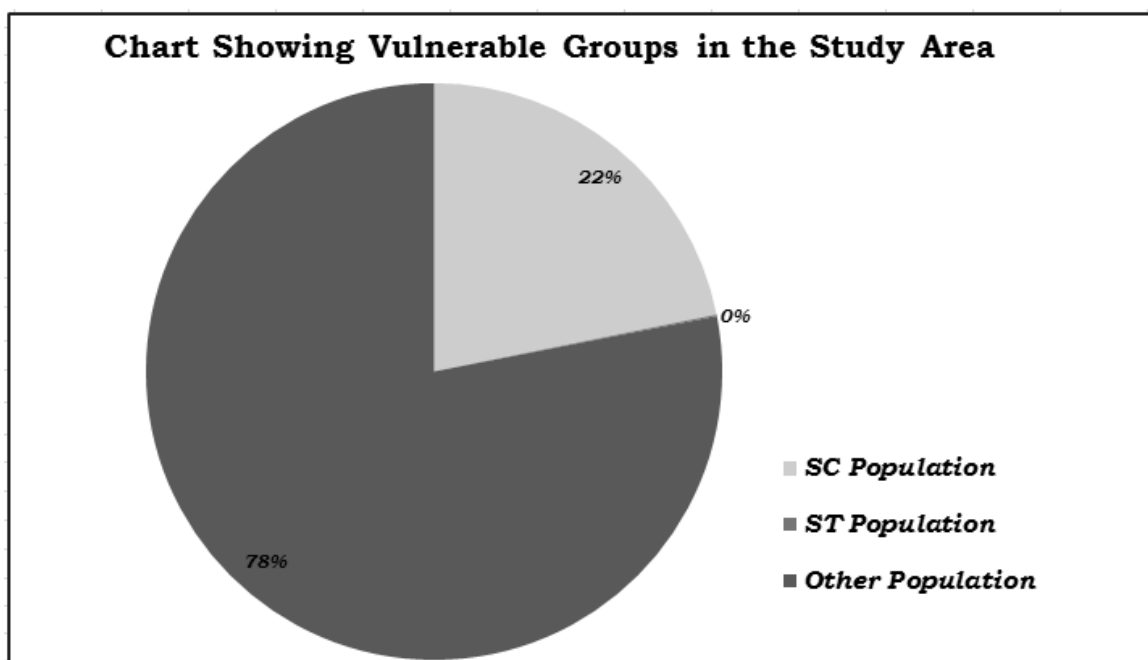


Figure 3.19.2 vulnerable groups

3.20 Economic Activities

The economy of an area is defined by the occupational pattern and income level of the people in the area. The occupational structure of residents in the study area is studied with reference to work category. The population is divided occupation wise into three categories, viz., Total workers, Main workers and non-workers. The main workers include cultivators, agricultural laborers, those engaged in household industry and other services. The non-workers include those engaged in unpaid household duties like, students, retired persons, dependents, beggars, wanderers etc. besides Institutional intimates or all other non-workers who do not fall under the above categories.

Table 3.20.1 shows the work force of the study area

Zone	No. of Villages	Total Workers	%	Main Workers	%	Marginal Workers	%	Non-Workers	%
Primary Zone (0 - 3 Km)	3	5101	43.73	3784	32.44	1317	11.29	6565	56.27
Secondary Zone (3 - 7 Km)	14	17399	46.34	13542	36.06	3857	10.27	20150	53.66
Tertiary Zone (7 - 10 Km)	13	8797	47.17	7227	38.75	1570	8.42	9854	52.83
Study Area (10 Km)	30	31297	46.12	24553	36.18	6744	9.94	36569	53.88

Source: Census of India, 2011

The above table shows that out of the total working population, the percentage of main workers is 36.18 % while 9.94% are marginal workers. Number of working populations is 46.12% and non-working population is 53.88% in the study area. As per the data obtained from the survey (as mentioned previously in occupational structure) most of these people are employed for major period of the year. Also, to mention the natural environment also restricts the people in finding stable business is performed for only certain months. Thus, proposed project will act as possible exposure for them to get enroll and earn sustain livelihood.



Figure 3.20.2. Working population in the study area

3.21 Infrastructure Base

A better network of physical infrastructure facilities (built up and roads, irrigation, power and social infrastructure support, viz. health and Education, water and sanitation are essential for the development of the rural economy.

A review of infrastructural facilities available in the area has been done based on the information from baseline survey & census data of the study area. Infrastructural facilities available in the area are described in the subsequent sections.

- Administrative offices are located in Tamil Nadu, Pudukkottai district (14km-NE) from site which by local transport.
- Lake, Pond etc., around 10 km radius from mine lease boundary.
- Availability of Government Primary school Paranikudippatti Village (5km-N), Government school, Enapatti Village (3.5km-E), Government school Purakaraipatti Village (8.5km-NW), Government Higher school, Tirumayam Village (5.0km-SW), Pudukkottai district many schools, colleges and Training institute found in study area.
- Health facilities covered in the Buffer zone area like Government Hospital Nachandupati (4.0km-N), Government Hospital Tirumayam (5.0km-SE), Government Hospital Kadiapatti Village (8.0km-SE), Panayapatti PHC, (6.0km-NW),

Table 3.21.1 Educational Facilities in the Surveyed Area

Sno	Village Name	Govt Primary School (Numbers)	Private Primary School (Numbers)	Govt Middle School (Numbers)	Private Middle School (Numbers)	Govt Secondary School (Numbers)	Private Secondary School (Numbers)	Govt Senior Secondary School (Numbers)	Private Senior Secondary School (Numbers)	Govt Arts and Science Degree College (Numbers)
0-3km										
1	Virachilai I Bit	5	1	2	1	0	0	0	0	0
2	Lembalakudi	5	1	1	0	1	0	0	0	0
3	Perendurai	1	0	1	0	0	0	0	0	0
	Total	11	2	4	1	1	0	0	0	0
3-7km										
1	Chettipatti	4	0	0	0	0	0	0	0	0
2	Vellaipillayarpatti	1	0	0	0	0	0	0	0	0
3	Sokkanathapatti	1	0	0	0	0	0	0	0	0
4	Kummangudi	6	0	1	0	0	0	0	0	0
5	Kottur	5	0	0	1	0	1	0	1	0
6	Kulamangalam	3	0	0	0	0	0	0	0	0
7	Melappanaiyur	4	0	1	0	1	0	0	0	0
8	Thekkattur	7	1	3	1	1	1	0	1	0
9	Sokkanathapatti	0	0	0	0	0	0	0	0	0
10	Ennapatti	1	0	0	0	0	0	0	0	0
11	Thiruvapuram	1	0	0	0	0	0	0	0	0
12	Melur	4	0	1	0	0	0	0	0	0
13	Alavayal	2	1	1	0	1	0	1	0	0
14	Tirumayam	6	3	2	1	2	0	2	0	0
	Total	45	5	9	3	5	2	3	2	0
7-10km										
1	Samudram	3	0	1	0	1	0	0	0	0
2	Kunnathupatti	1	0	0	0	0	0	0	0	0
3	Adhanur	4	0	1	0	0	0	0	0	0
4	Kulathupatti	1	0	1	0	0	0	0	0	0
5	Mallangudi	1	0	0	0	0	0	0	0	0
6	Arasandampatti	2	0	0	0	0	0	0	0	0
7	Kulipirai	0	2	0	2	0	1	0	1	0
8	Athur	1	0	0	0	0	0	0	0	0
9	Valayampatti	1	0	0	0	0	0	0	0	0
10	Poovampatti	0	0	0	0	0	0	0	0	0
11	Kottaiyur	3	0	1	0	0	0	0	0	0
12	Kannanoor I Bit	3	0	1	0	0	0	0	0	0
13	Rangiyam	4	1	0	1	0	1	0	0	0
	Total	24	3	5	3	1	2	0	1	0
	G.total	80	10	18	7	7	4	3	3	0

Source: *DCHB Census 2011, Tamil Nadu.*

Table 3.21.2 Health/ Medical Facilities in the Surveyed Area

S No	Village Name	Community Health Centre (Numbers)	Primary Health Centre (Numbers)	Primary Health Sub Centre (Numbers)	Maternity And Child Welfare Centre (Numbers)	Hospital Allopathic (Numbers)	Dispensary (Numbers)	Veterinary Hospital (Numbers)	Family Welfare Centre (Numbers)	Non Government Medical facilities Medicine Shop (Numbers)
0-3km										
1	Virachilai I Bit	0	0	1	0	0	0	1	0	1
2	Lembalakudi	0	0	1	0	0	0	0	0	0
3	Perendurai	0	0	0	0	0	0	0	0	0
	Total	0	0	1	0	0	0	1	0	1
3-7km										
1	Chettipatti	0	0	0	0	0	0	0	0	0
2	Vellaipillayarpatti	0	0	0	0	0	0	0	0	0
3	Sokkanathapatti	0	0	0	0	0	0	0	0	0
4	Kummangudi	0	0	0	0	0	0	0	0	0
5	Kottur	0	1	1	1	0	1	1	1	0
6	Kulamangalam	0	0	0	0	0	0	0	0	0
7	Melappanaiyur	0	1	1	1	0	1	1	1	0
8	Thekkattur	0	0	3	0	0	0	0	0	2
9	Sokkanathapatti	0	0	0	0	0	0	0	0	0
10	Ennapatti	0	0	0	0	0	0	0	0	0
11	Thiruvapuram	0	0	0	0	0	0	0	0	0
12	Melur	0	0	1	0	0	0	0	0	0
13	Alavayal	0	0	0	0	0	0	0	0	0
14	Tirumayam	0	0	1	1	0	0	1	0	2
	Total	0	2	5	2	0	2	2	2	2
7-10km										
1	Samudram	0	0	0	0	0	0	1	0	0
2	Kunnathupatti	0	0	0	0	0	0	0	0	0
3	Adhanur	0	0	1	0	0	0	0	0	0
4	Kulathupatti	0	0	0	0	0	0	0	0	0
5	Mallangudi	0	0	0	0	0	0	0	0	0
6	Arasandampatti	0	0	0	0	0	0	0	0	0
7	Kulipirai	0	0	1	1	0	0	1	0	0
8	Athur	0	0	1	0	0	0	1	0	0
9	Valayampatti	0	0	0	0	0	0	0	0	0
10	Poovampatti	0	0	0	0	0	0	0	0	0
11	Kottaiyur	0	0	0	0	0	0	0	0	0
12	Kannanoor I Bit	0	0	1	0	0	0	0	0	0
13	Rangiyam	0	1	1	1	0	1	1	1	0
	Total	0	1	5	2	0	1	4	1	0
	G.Total	0	3	11	4	0	3	7	3	5

Source: DCHB Census 2011, Tamil Nadu.

Table 3.21.3 Water & Drainage Facilities in the Surveyed Area

Sno	Village Name	Tap Water-Treated (Status A(1)/NA(2))	Tap Water Untreated (Status A(1)/NA(2))	Covered Well (Status A(1)/NA(2))	Uncovered Well (Status A(1)/NA(2))	Hand Pump (Status A(1)/NA(2))	Tube Wells/Borehole (Status A(1)/NA(2))	Spring (Status A(1)/NA(2))	River/Canal (Status A(1)/NA(2))	Tank/Pond/Lake (Status A(1)/NA(2))	Closed Drainage (Status A(1)/NA(2))	Open Drainage (Status A(1)/NA(2))	No Drainage (Status A(1)/NA(2))
0-3km													
1	Virachilai I Bit	1	1	1	1	1	1	2	1	1	1	1	1
2	Lembalakudi	1	1	1	1	1	1	1	2	1	1	1	1
3	Perendurai	1	2	2	2	2	2	2	2	2	2	2	1
	Total	3	2	2	2	2	2	1	1	2	2	2	3
3-7km													
1	Chettipatti	1	1	2	2	1	2	2	2	2	1	1	1
2	Vellaipillayarpatti	2	1	2	2	2	1	2	2	2	2	2	1
3	Sokkanathapatti	1	1	2	2	2	2	2	2	2	1	2	1
4	Kummangudi	1	1	2	2	2	1	2	2	1	1	2	1
5	Kottur	1	1	1	1	1	1	1	2	1	1	1	1
6	Kulamangalam	1	1	2	1	1	1	2	2	1	1	1	1
7	Melappanaiyur	1	1	1	1	1	1	2	2	1	1	1	1
8	Thekkattur	1	1	1	1	1	1	2	2	1	1	1	1
9	Sokkanathapatti	2	1	2	2	2	2	2	2	2	1	2	1
10	Ennapatti	2	1	2	2	2	2	2	2	2	1	1	1
11	Thiruvapuram	1	1	2	1	1	1	2	2	2	1	1	1
12	Melur	1	1	1	1	1	1	2	1	1	1	1	1
13	Alavayal	2	1	2	2	1	1	2	2	1	1	1	1
14	Tirumayam	1	1	1	1	1	1	2	1	1	1	1	1
	Total	10	14	4	7	9	10	1	2	8	13	10	14
7-10km													
1	Samudram	1	2	2	2	2	2	2	2	1	1	1	1
2	Kunnathupatti	1	2	2	2	2	1	2	2	2	2	2	1
3	Adhanur	1	1	2	1	1	1	1	2	1	1	1	1
4	Kulathupatti	1	2	2	2	2	2	2	2	1	1	1	1
5	Mallangudi	2	2	2	2	1	2	1	2	2	1	2	1
6	Arasandampatti	1	1	2	2	1	1	2	2	2	1	2	1
7	Kulipirai	1	1	1	1	1	1	1	1	1	1	1	1
8	Athur	1	1	2	2	2	2	2	2	1	2	1	1
9	Valayampatti	1	1	2	1	2	2	2	2	1	2	1	1
10	Poovampatti	2	1	2	2	2	2	2	2	2	1	1	1
11	Kottaiyur	1	1	2	2	1	1	2	2	1	1	1	1
12	Kannanoor I Bit	1	1	2	1	1	1	1	2	1	2	2	1
13	Rangiyam	1	1	1	1	1	1	2	2	1	1	1	1
	Total	11	9	2	5	7	7	4	1	9	9	9	13
	G.Total	24	25	8	14	18	19	6	4	5	24	21	30

Source: DCHB Census 2011, Tamil Nadu.

3.21.4 Transport and Other Infrastructure Facilities in the Surveyed Area

Sno	Village Name	Post Office (Status A(1)/NA(2))	Sub Post Office (Status A(1)/NA(2))	Post And Telegraph Office (Status A(1)/NA(2))	Telephone (landlines) (Status A(1)/NA(2))	Private Courier Facility (Status A(1)/NA(2))	Public Bus Service (Status A(1)/NA(2))	Private Bus Service (Status A(1)/NA(2))	Railway Station (Status A(1)/NA(2))	Auto/Modified Autos (Status A(1)/NA(2))	Taxi (Status A(1)/NA(2))	Vans (Status A(1)/NA(2))	Tractors (Status A(1)/NA(2))	Cycle-pulled Rickshaws (manual driven) (Status A(1)/NA(2))	Cycle-pulled Rickshaws (machine driven) (Status A(1)/NA(2))	Carts Driven by Animals (Status A(1)/NA(2))	Sea/River/Ferry Service (Status A(1)/NA(2))	National Highway (Status A(1)/NA(2))	State Highway (Status A(1)/NA(2))	Major District Road (Status A(1)/NA(2))	Other District Road (Status A(1)/NA(2))
0-3km																					
1	Virachilai I Bit	1	2	1	1	1	1	1	2	1	1	1	2	2	2	2	2	2	2	1	1
2	Lembalakudi	2	1	2	1	2	2	1	2	2	2	2	2	2	2	2	2	1	2	1	1
3	Perendurai	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	Total	1	1	1	2	1	2	2	0	1	1	1	1	0	0	0	0	1	0	2	2
3-7km																					
1	Chetipatti	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1
2	Vellaipillayarpati	2	1	1	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2
3	Sokkanathapatti	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	1
4	Kummangudi	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	1	1
5	Kottur	1	1	1	1	2	1	1	2	1	1	1	2	2	2	2	2	2	2	1	1
6	Kulamangalam	2	1	2	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	1	1
7	Melappanaiyur	2	1	2	1	1	1	1	2	1	1	1	2	2	2	2	2	2	2	1	1
8	Thekkattur	1	2	1	1	2	1	1	2	2	2	2	2	2	2	2	2	1	2	1	1
9	Sokkanathapatti	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1
10	Ennapatti	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2	2	1	2	1	1
11	Thiruvapuram	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2
12	Melur	2	1	2	1	2	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2
13	Alavayal	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
14	Tirumayam	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	1	2	1	1
	Total	3	6	4	14	2	10	9	1	4	3	4	0	0	0	0	0	3	5	9	10
7-10km																					
1	Samudram	2	2	2	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	1	1
2	Kunnathupatti	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	Adhanur	2	1	2	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2
4	Kulathupatti	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2
5	Mallangudi	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	1	1
6	Arasandampatti	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	1	1
7	Kulipirai	2	1	1	1	1	1	1	2	1	1	1	2	2	2	2	2	2	2	1	1
8	Athur	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2
9	Valayampatti	2	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2
10	Poovampatti	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
11	Kottaiyur	2	1	2	1	2	1	1	2	2	2	1	2	2	2	2	2	2	2	2	2
12	Kannanoor I Bit	2	1	2	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2
13	Rangiyam	2	1	2	1	1	1	1	2	1	1	1	2	2	2	2	2	2	2	1	1
	Total	0	5	1	11	3	11	10	8	2	2	3	8	0	0	0	0	1	2	5	5
	G.Total	4	12	6	27	6	23	21	9	7	6	8	9	0	0	0	0	5	7	16	7

Source: DCHB Census 2011, Tamil Nadu.

3.22. Other Issues in the Study Area

1. Deforestation of Land (Cutting Trees or Plant etc.)
2. Agriculture Land decreases
3. Lack of awareness among vulnerable groups for their welfare
4. Medical/Clinic facilities and PHC need for the Core and Buffer zone area
5. Environmental clean with solid wastage pin each village.
6. Functioning of Hospital facilities with Sub Health care centers.
7. Need proper drainage system with public toilet men and women separately.

3.23 Interpretation

Based on the data, following inferences could be drawn:

- Total literacy rate in the study area is 75.53%.
- The study area had average educational facilities. The overall status depicts that the education is limited to primary and middle level.
- The schedule tribe community forms 0.09% and Scheduled Caste forms 21.84% of the total population of study area.
- The Other Population forms 78.07% of the total population of study area.
- The study area is well connected by District/Village Road.
- The study area not well health facilities of primary level.
- Considering the above facts, the proposed project will boost the socio-economic development activities in the area and hence will leave positive impact.
- The study area has mobile connectivity.

3.24 Recommendation and Suggestions

The village development plans are made in consultation with the community through Gram Sabha; these appear to address the needs of the community. However, it may be noted that at the implementation stage these plans often are fraught with problem of inadequate funds, lack of proper planning, corruption, vested interests and political agendas. Hence while ascertaining the scope for convergence with the government activities, care must be taken to ascertain realistic possibilities for implementation.

- **Women empowerment**– Home based income generation activities, vocational training programs and common education centre for increasing the literacy rate.
- **Education** – Free uniform, construction of common rooms and library, computer education and physical education, additional schools for girls, furniture and equipment in schools, up-gradation of existing school infrastructure.
- **Agriculture/livestock** – Infrastructure such as agricultural practices, electricity connections, assistance with buying improved tools and equipment, capacity building, supply and/or knowledge of better variety of seeds, pasture land development and trainings on animal husbandry& facility of veterinary doctor.

-
- **Health** – Improvements in sanitary conditions of villages, assistance with construction of latrines, improvement in drainage system, health camps and awareness campaigns for diseases like Covid-19, malaria, typhoid, tuberculosis, yellow fever and pneumonia. Repairing of PHCs and Anganwadi centers.
 - **People with disability** – Establishment of center for special education, sensitization of the community towards disabled and awareness on Government schemes.
 - 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.
 - **Connectivity** –Road network and transport connectivity to easiness accessibility to the region.

3.25 Conclusion

To evaluate the impacts of proposed quarry project on the surrounding area, it is vital to assess the baseline status of the environmental quality in the locality of the site. Hence it can be concluded that the present environment status of the study area will not be affected by the project as **Thiru. S. Ravi** will adopt adequate control measures to protect the surrounding environment and will contribute in development of the study areas.

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 Impact

- 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 Common 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 Gravel formation and the average thickness is about 2 m, the excavated Gravel will be dumped sold to needy customers in open market.

4.1.4 Impact 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 Common 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 and Gravel quarrying operation. The entire quarried out materials will be utilized (100%).

4.2 WATER ENVIRONMENT

4.2.1 Anticipated Impact

- 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 REQUIREMENTS

*Purpose	Quantity	Source
Dust Suppression	1.0 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Green Belt development	0.6 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Domestic purpose	0.4 KLD	Water Tankers
Total	2.0 KLD	

* Water for drinking purpose will be brought from approved water vendors

Source: Approved Mining Plan Pre-Feasibility Report

4.2.2 Common 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 judiciously 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 Impact

- 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 PM₁₀ & PM_{2.5} and emissions of Sulphur dioxide (SO₂) & Oxides of Nitrogen (NO_x) 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 (SO₂), Oxides of Nitrogen (NO_x) 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 (PM₁₀) affecting Ambient Air of the area. Prediction of impacts on air environment has been carried out taking into consideration cumulative production three 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.

TABLE 4.2: ESTIMATED EMISSION RATE FOR PM₁₀

Activity	Source type	Value	Unit
Drilling	Point Source	0.075415507	g/s
Blasting	Point Source	0.000590089	g/s
Mineral Loading	Point Source	0.046831468	g/s
Haul Road	Line Source	0.002508699	g/s/m
Overall Mine	Area Source	0.049207696	g/s

TABLE 4.3: ESTIMATED EMISSION RATE FOR SO₂

Activity	Source type	Value	Unit
Overall Mine	Area Source	0.001467732	g/s

TABLE 4.4: ESTIMATED EMISSION RATE FOR NO_x

Activity	Source type	Value	Unit
Overall Mine	Area Source	0.000054338	g/s

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 PM₁₀ was observed close to the source due to low to moderate wind speeds. Incremental value of PM₁₀ was superimposed on the base line data monitored at the proposed site to predict total GLC of PM₁₀ due to combined impacts

FIGURE 4.1: AERMOD TERRAIN MAP

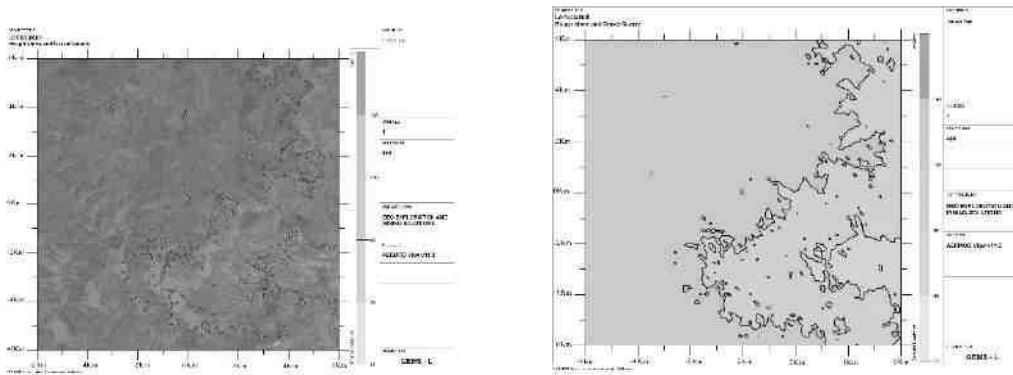


FIGURE 4.2: PREDICTED INCREMENTAL CONCENTRATION OF PM₁₀

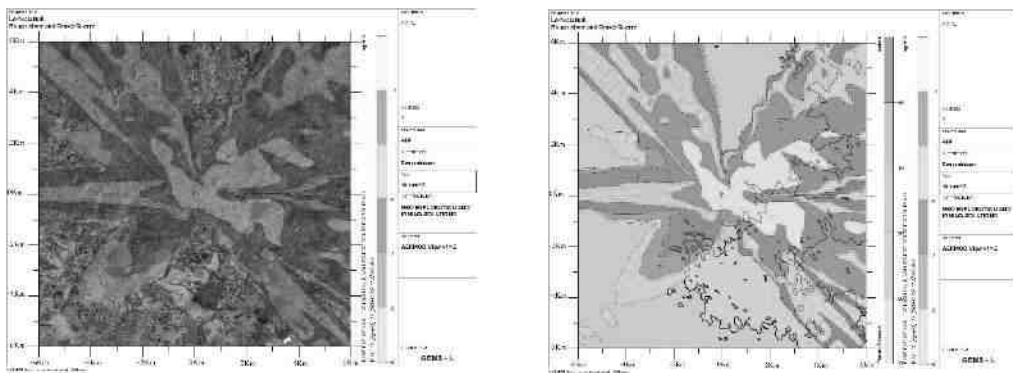


FIGURE 4.3: PREDICTED INCREMENTAL CONCENTRATION OF SO₂

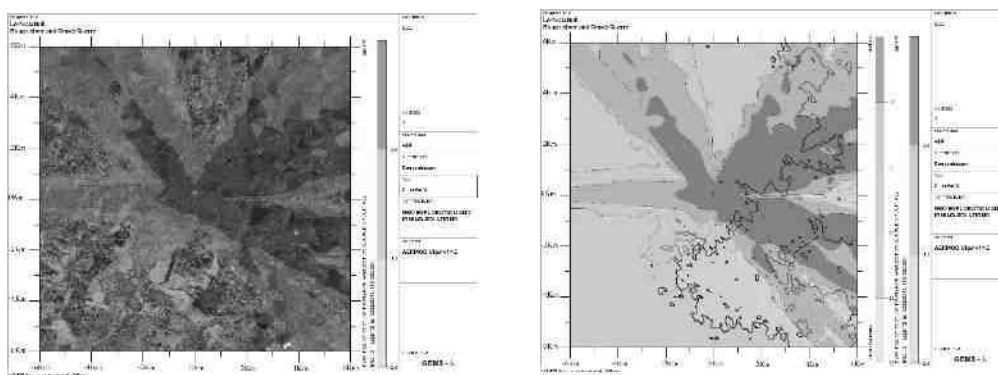


FIGURE 4.4: PREDICTED INCREMENTAL CONCENTRATION OF NO_x

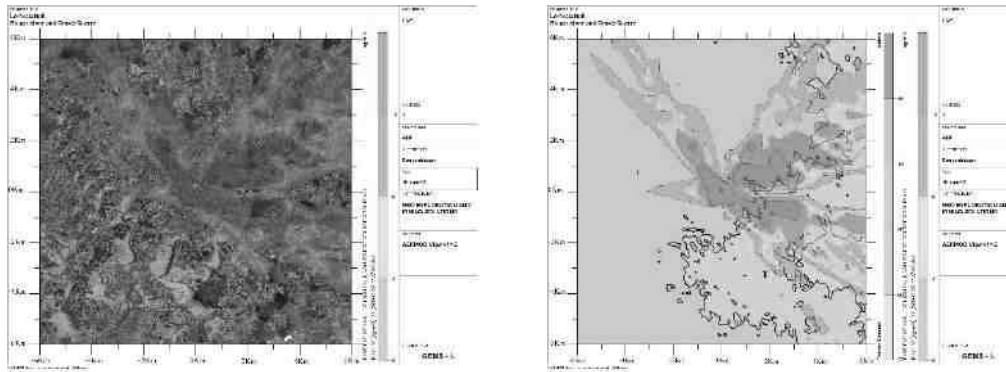
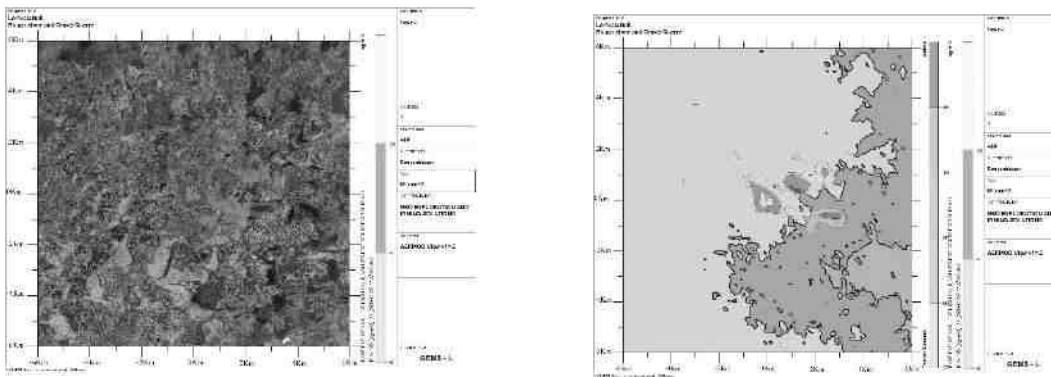


FIGURE 4.5: PREDICTED INCREMENTAL CONCENTRATION OF FUGITIVE DUST



4.3.2.1 Model Results

The post project Resultant Concentrations of PM₁₀, PM_{2.5}, SO₂& NO_x (GLC) is given in Table below:

TABLE 4.5: INCREMENTAL & RESULTANT GLC OF PM₁₀

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline PM ₁₀ (µg/m ³)	Incremental value of PM ₁₀ due to mining (µg/m ³)	Total PM ₁₀ (µg/m ³) (5+6)
AAQ1	10°16'52.58"N 78°43'23.58"E	-16	-17	59.2	14.56	73.76
AAQ2	10°18'49.55"N 78°43'18.95"E	-89	3602	59.6	0	59.6
AAQ3	10°17'16.83"N 78°41'29.16"E	-3518	734	59.5	6.47	65.97
AAQ4	10°14'41.55"N 78°44'45.90"E	2506	-4069	59.7	1.04	60.74
AAQ5	10°17'47.10"N 78°44'45.95"E	2505	1672	58.3	13.00	71.3
AAQ6	10°18'54.87"N 78°41'45.24"E	-3023	3765	59.1	9.99	69.09
AAQ7	10°16'2.01"N 78°45'32.14"E	3921	-1580	59.4	11.35	70.75
AAQ8	10°15'8.58"N 78°42'1.76"E	-2518	-3236	59.5	3.87	63.37

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

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline PM _{2.5} (µg/m ³)	Incremental value of PM _{2.5} due to mining (µg/m ³)	Total PM _{2.5} (µg/m ³) (5+6)
AAQ1	10°16'52.58"N 78°43'23.58"E	-16	-17	29.0	7.89	36.89
AAQ2	10°18'49.55"N 78°43'18.95"E	-89	3602	29.1	0.46	29.56
AAQ3	10°17'16.83"N 78°41'29.16"E	-3518	734	29.7	3.58	33.28
AAQ4	10°14'41.55"N 78°44'45.90"E	2506	-4069	29.6	1.61	31.21
AAQ5	10°17'47.10"N 78°44'45.95"E	2505	1672	29.8	7.10	36.9
AAQ6	10°18'54.87"N 78°41'45.24"E	-3023	3765	30.2	4.72	34.92
AAQ7	10°16'2.01"N 78°45'32.14"E	3921	-1580	28.5	6.38	34.88
AAQ8	10°15'8.58"N 78°42'1.76"E	-2518	-3236	30.3	2.50	32.8

TABLE 4.7: INCREMENTAL & RESULTANT GLC OF SO₂

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline SO ₂ (µg/m ³)	Incremental value of SO ₂ due to mining (µg/m ³)	Total SO ₂ (µg/m ³) (5+6)
AAQ1	10°16'52.58"N 78°43'23.58"E	-16	-17	8.6	3.49	12.09
AAQ2	10°18'49.55"N 78°43'18.95"E	-89	3602	8.2	0	8.2
AAQ3	10°17'16.83"N 78°41'29.16"E	-3518	734	8.3	1.05	9.35
AAQ4	10°14'41.55"N 78°44'45.90"E	2506	-4069	8.4	0	8.4
AAQ5	10°17'47.10"N 78°44'45.95"E	2505	1672	8.3	3.22	11.52
AAQ6	10°18'54.87"N 78°41'45.24"E	-3023	3765	8.5	2.41	10.91
AAQ7	10°16'2.01"N 78°45'32.14"E	3921	-1580	8.4	3.0	11.4
AAQ8	10°15'8.58"N 78°42'1.76"E	-2518	-3236	8.2	0	8.2

TABLE 4.8: INCREMENTAL & RESULTANT GLC OF NO_x

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline NO _x (µg/m ³)	Incremental value of NO _x due to mining (µg/m ³)	Total NO _x (µg/m ³) (5+6)
AAQ1	10°16'52.58"N 78°43'23.58"E	-16	-17	21.6	10.40	32
AAQ2	10°18'49.55"N 78°43'18.95"E	-89	3602	21.9	0	21.9
AAQ3	10°17'16.83"N 78°41'29.16"E	-3518	734	21.7	0	21.7
AAQ4	10°14'41.55"N 78°44'45.90"E	2506	-4069	21.8	0	21.8
AAQ5	10°17'47.10"N 78°44'45.95"E	2505	1672	21.7	8.49	30.19
AAQ6	10°18'54.87"N 78°41'45.24"E	-3023	3765	21.8	0	21.8
AAQ7	10°16'2.01"N 78°45'32.14"E	3921	-1580	22.0	5.00	27
AAQ8	10°15'8.58"N 78°42'1.76"E	-2518	-3236	21.7	0	21.7

TABLE 4.9: INCREMENTAL & RESULTANT GLC OF FUGITIVE DUST

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline Fugitive ($\mu\text{g}/\text{m}^3$)	Incremental value of Fugitive due to mining ($\mu\text{g}/\text{m}^3$)	Total Fugitive ($\mu\text{g}/\text{m}^3$) (5+6)
AAQ1	10°16'52.58"N 78°43'23.58"E	-16	-17	116	82	198
AAQ2	10°18'49.55"N 78°43'18.95"E	-89	3602	112	0	112
AAQ3	10°17'16.83"N 78°41'29.16"E	-3518	734	112.9	0	112.9
AAQ4	10°14'41.55"N 78°44'45.90"E	2506	-4069	113.9	0	113.9
AAQ5	10°17'47.10"N 78°44'45.95"E	2505	1672	113.9	0	113.9
AAQ6	10°18'54.87"N 78°41'45.24"E	-3023	3765	114.0	0	114.0
AAQ7	10°16'2.01"N 78°45'32.14"E	3921	-1580	111.7	0	111.7
AAQ8	10°15'8.58"N 78°42'1.76"E	-2518	-3236	114.7	0	114.7

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 $\mu\text{g}/\text{m}^3$ for PM10, SO₂ & NO_x respectively. By adopting suitable mitigation measures, the pollutant levels in the atmosphere can be further being controlled.

4.3.4. Common 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 tarpaulin
- 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.

$$L_{p2} = L_{p1} - 20 \log (r_2/r_1) - Ae_{1,2}$$

Where:

L_{p1} & L_{p2} 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.

$$L_{p \text{ total}} = 10 \log \{ 10^{(L_{p1}/10)} + 10^{(L_{p2}/10)} + 10^{(L_{p3}/10)} + \dots \}$$

4.4.1 Anticipated Impact

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 noise 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)	78.3	58.5	59.4	58.1	59.2	58.6	59.5	59.4
Incremental Value dB(A)	60.1	41.2	30.6	27.2	30.6	26.8	29.4	24.7
Total Predicted Noise level dB(A)	78.4	58.6	59.4	58.1	59.2	58.6	59.5	54.6

The incremental noise level is found within the range of 60.1 dB (A) in Core Zone and 24.7 to 41.2 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 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 Common 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 through 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 areas are 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

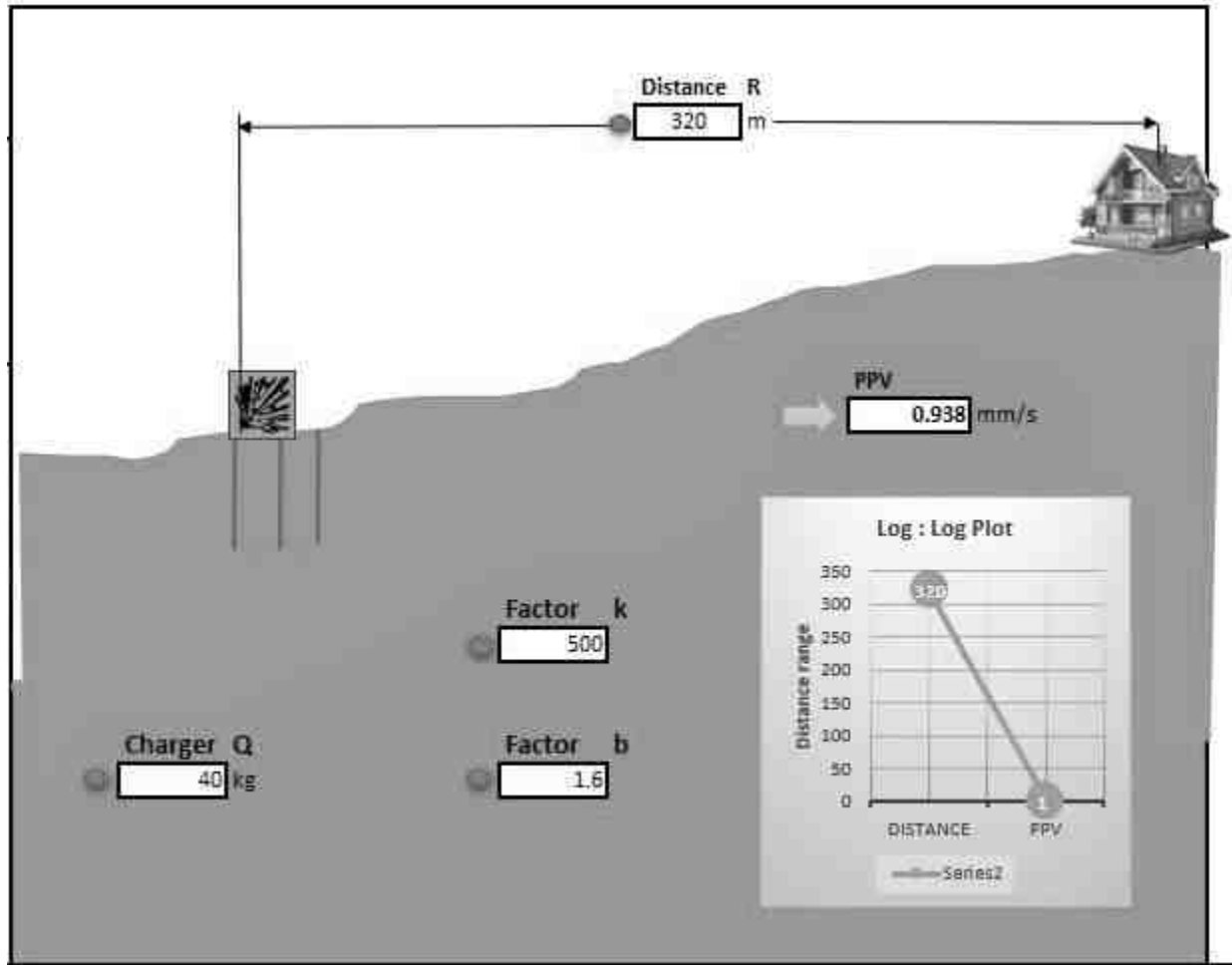
Q = maximum instantaneous charge (kg)

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 mm/s
Thiru. S. Ravi	40	320	0.938

FIGURE 4.6: GROUND VIBRATION PREDICTION

From the above graph, the charge per blast of 40 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 all the project proponents ensure that the charge per blast shall be less than 13 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 Common Mitigation

- 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 mm/s.
 - Vibration monitoring will be carried out every 6 months to check the efficacy of blasting practices.

4.5 Biological Environment

Methodology of Sampling Flora and fauna studies were carried out during the **Summer season** 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. None of the specimens were collected as voucher specimens for the herbarium. It is basically done through field observations only.

4.5.1. Anticipated Impact on Flora

- There is no Eco Sensitive zone/ Critically polluted area/ HACA/CRZ located within 10 km radius of the area. (Kindly refer the Plate No 1A in the approved Mining plan). It is away from the proposed project site. There are no impacts due to this mining activity.
- None of the plants will be cut during the operational phase of the mine.
- 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.
- Most of the land in the buffer area is undulating terrain with croplands, grass patches, and small shrubs. Hence, there will be no effect on the flora of the region.

4.5.2 Mitigation Measures

4.5.2.1. General Guidelines for Green Belt Development

The project site should have land to develop a greenbelt in and around the limits of the mine, along roads and another vacant area. The main objective of the green belt is to provide a barrier between the source of pollution and the surrounding areas. Although the project will not lead to any tree cutting, it is proposed to improve the greenery of the locality through plantation services. To avoid dust emissions, the mined materials will be covered with tarpaulin during transportation.

- Plants that grow fast will be preferred.
 - Preference for high canopy covers plants with local varieties.
 - Perennial and evergreen plants will be preferred.
 - The development of the Green Belt is an important aspect for any plant because:
 - a. It improves the ambient air quality by controlling Suspended Particulate Matter (SPM) in the air.
 - b. It helps in noise abatement for the surrounding area.
 - c. It helps in the settlement of new birds and insects within itself.
 - d. It maintains the ecological balance.
 - e. It increases the aesthetic value of the site.
-

4.5.2.2. Environmental Management Plan - Flora and Fauna

a. Afforestation

More number of trees has been observed along the approach road in the lease area, which is developed by the lease owner. The 7.5m Safety distance along the boundary has been identified to be utilized for subsequent Afforestation. However, afforestation should always be carried out in a systematic and scientific manner. Regional tree saplings in eco-friendly bags like Neem, Pongamia, Pinnata, and Casuarina will be planted along the Lease boundary and avenues as well as over non-active dumps with intervals 3m in between with the GPS Coordinates. A retaining wall will be constructed around the dumping yard. The rate of survival is expected to be 80% in this area. The preparation of green belt details is given in the approved mining plan.

4.5.2.2. Species Recommendation for Plantation granted in the district.

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

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

Table No 4.1. List of plant species proposed for Greenbelt development

S. No	Name of the plant (Botanical)	Family Name	Common Name	Habit
1	<i>Borassus flabellifer</i>	Arecaceae	Panai	T
2	<i>Morinda pubescens</i>	Rubiaceae	Nuna	T
3	<i>Pongamia pinnata</i>	Fabaceae	Pungam	T
4	<i>Thespesia Populnea</i>	Malvaceae	Puvarasu	T
5	<i>Syrygium cumini</i>	Myrtaceae	Naval	T
6	<i>Saraca asoca</i>	Fabaceae	Asoca	T
7	<i>Limonia acidissima</i>	Rutaceae	Odham	T
8	<i>Lannea coromandelica</i>	Anacardiaceae	Vila maram	T
9	<i>Cassia roxburghii</i>	Fabaceae	Sengondrai	T
10	<i>Pterocarpus marsupium</i>	Fabaceae	Vengai	T

4.5.3. Anticipated Impact on Fauna

- No rare, endemic & endangered species are reported in the buffer zone. However, during the course of mining, the management will practice the scientific method of mining with a proper Environmental Management Plan including pollution control measures especially for air and noise, to avoid any adverse impact on the surrounding wildlife.
- Fencing around the mine lease area 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

- Topsoil has a large number of seeds of native plant species in the mining area. Topsoil will be used for restoration and suitable surfaces for planted seedlings.

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

4.5.3.2. Mitigation Measures

- A suitable plan for the conservation of Schedule-I Species have been prepared and necessary fund for implementation for the same will be made.
- All the preventive measures will be taken for the growth & development of fauna.
- Creating and developing awareness for nature and wildlife in the adjoining 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 aquatic ecology as there is no effluent discharge proposed from the Rough stone and Gravel quarry. and There are few seasonal water bodies located away from the applied lease area. There is no natural perennial surface water body within the mine lease area, like wetlands, rivers streams, lakes, and farmer sites. There is no impact on fish habitats and the food WEB/ food chain in the water body and Reservoir. Aquatic biodiversity is observed in the study area.

4.5.5. Impact Assessment on Biological Environment

This chapter highlights the various impacts on ecology and biodiversity due to mining activity. The major adverse impacts due to pre-mining and mining phases are loss of habitat, biodiversity, rare flora and fauna, fisheries and other aquatic life, migration of wildlife, and overall disruption of the ecology of the area. During the post-mining phase after land restoration, ecology may effectively improve. A detail of impact and assessments was mentioned in Table No.4.2.

4.5.6. Anticipated Environmental Impacts and Mitigation Measures of Thiru.S. Ravi, Rough stone and Gravel quarry, Pudukottai District, Tamil Nadu.

Details anticipated issues for the next operation period were summarized with possible impacts and mitigation measures to meet the problem (Table No.4.2.).

Table No: 4.2. Anticipated impact of Ecology and Biodiversity in Thiru.S. Ravi, Rough stone and Gravel quarry

S. 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)	The site possesses Common floral (not tree) species. Clearance of these species will not result in loss of flora.	Less severe	No immediate action is required. However, a Greenbelt /plantation will be developed on the project site and in
		Site specific loss of associated	The site supports only common species, which		

		faunal diversity (Partial impact)	use a wide variety of habitats of the buffer zone reserve forest area. So, there is no threat of Faunal diversity		the periphery of the project boundary, which will improve the floral and faunal diversity of the project area.
		Loss of Habitat (Direct impact)	Site does not for 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 the generation of dust (Particulate matter) due to haul roads and emission of Sulphur Dioxide, Nitrogen Dioxide, Carbon monoxide, 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 is far from the core area.	Less severe	All vehicles will be certified for appropriate Emission levels. More plantations have been suggested Upgrade the vehicles with alternative fuels such biodiesel, methanol, and biofuel around the mining area.

Table No. 4.3. Overall Ecological impact assessments of Thiru.S. Ravi, Rough stone and Gravel quarry, Pudukottai District, Tamil Nadu.

S.No	Attributes	Assessment
1	Impact of mining activity on agricultural land nearby the proposed project site.	Agricultural land is located away from proposed project site. There are no impacts on the agricultural land & Horticulture. Kindly refer the conclusion.
	Activities of the project affect the breeding/nesting sites of birds and animals	No breeding and nesting site was identified in the mining lease site. The fauna sighted mostly migrated from the buffer area.
2	Located near an area populated by rare or endangered species	No Endangered, Critically Endangered, or vulnerable species were sighted in the core mining lease area.
3	Proximity to national park/wildlife sanctuary/reserve forest /mangroves/ coastline/estuary/sea	There is no Eco Sensitive zone/ Critically polluted area/ HACA/CRZ located within 10 km radius of the area.
4	The proposed project restricts access to waterholes for wildlife	'No '
5	Proposed mining project impact surface water quality that also provides water to wildlife	'No 'scheduled or threatened wildlife animals sighted regularly core in the core area.

6	Proposed mining project increase siltation that would affect nearby biodiversity areas.	Surface runoff management such as drains is constructed properly so there will be no siltation effect in the 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 the chances of water becoming polluted is low.
9	Mining projects affect the forest-based livelihood/ any specific forest product on which local livelihood depended.	'No'
10	The project likely to affect migration routes.	'No' migration route observed during the monitoring period.
11	The project is likely to affect the 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 is likely to affect wetlands, Fish breeding grounds, and marine ecology.	'No'. Wetland was not present in the near core Mining lease area. No breeding and nesting ground is present in the core mining area.

(*Source: EIA Guidance Manual-Mining and Minerals, 2010)

4.6 SOCIO ECONOMIC

4.6.1 Anticipated Impact

- 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 Common 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 any of the proposed quarries.

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

Thiru. S. Ravi Rough Stone and Gravel Quarry Project at Lembalakudi Village is a mining project for excavation of Rough Stone, which is site specific. 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 – III, 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 these projects. 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 Respective Project Proponents. A comprehensive monitoring mechanism has been devised for monitoring of impacts due to proposed projects; 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 quarries.

The responsibilities of this cell will be:

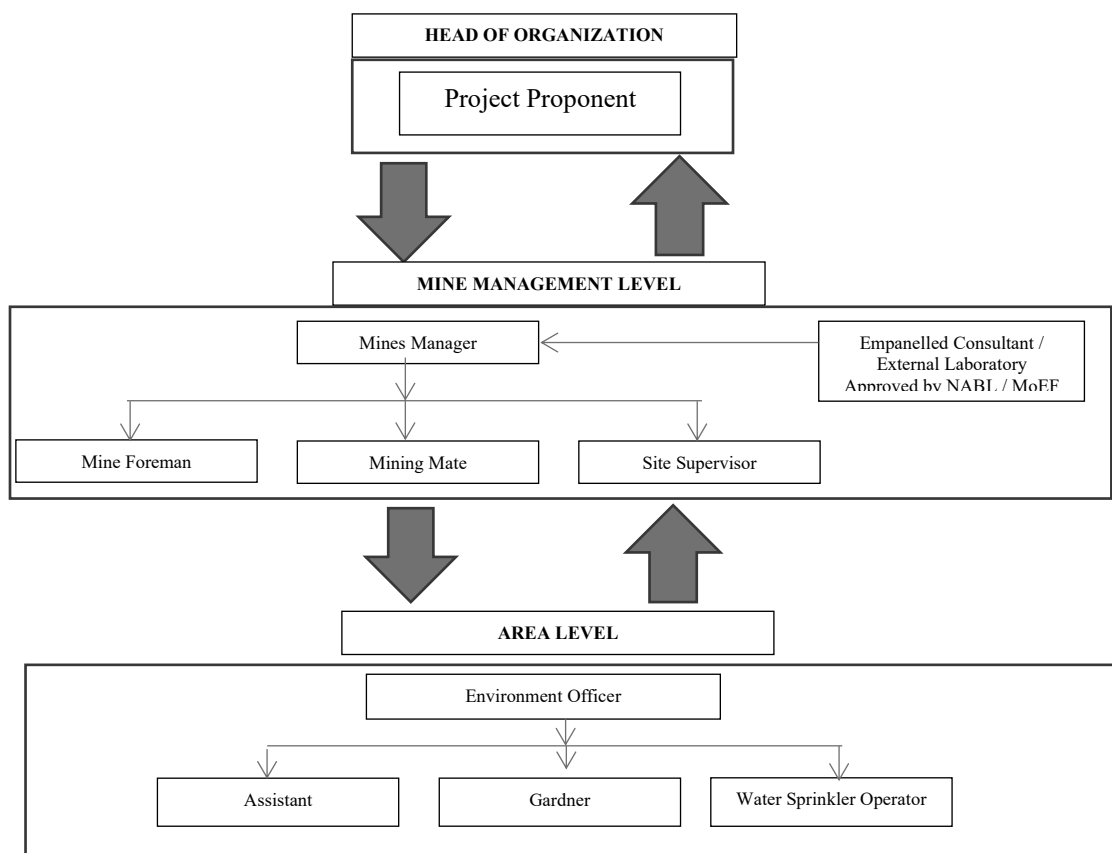
- Implementation of pollution control measures
- Monitoring programme implementation
- Post-plantation care
- To check the efficiency of pollution control measures taken
- Any other activity as may be related to environment
- Seeking expert's advice when needed.

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



* The Environmental Monitoring Cell will be formed in the proposed project

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 FOR PROPOSED PROJECT

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 is 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	8 Locations (1 Core & 7 Buffer)	24 hours	Once in 6 months	Fugitive Dust, PM2.5, PM10, SO2 and NOx.
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	6 Locations (2SW & 5 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	8 Locations (1 Core & 7 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	6 Locations (1 Core & 5 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 for each Proposed Project

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 Cluster 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

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 for all proposed projects. 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	<p>Improper and unsafe practices</p> <p>Due to high pressure of compressed air, hoses may burst</p> <p>Drill Rod may break</p>	<p>Safe operating procedure established for drilling (SOP) will be strictly followed.</p> <p>Only trained operators will be deployed.</p> <p>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,</p> <p>Drilling shall not be carried on simultaneously on the benches at places directly one above the other.</p> <p>Periodical preventive maintenance and replacement of worn-out accessories in the compressor and drill equipment as per operator manual.</p> <p>All drills unit shall be provided with wet drilling shall be maintained in efficient working in condition.</p> <p>Operator shall regularly use all the personal protective equipment.</p>
4	Blasting	<p>Fly rock, ground vibration, Noise and dust.</p> <p>Improper charging, stemming & Blasting/ fining of blast holes</p> <p>Vibration due to movement of vehicles</p>	<p>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.</p> <p>SOP for Charging, Stemming & Blasting/Firing of Blast Holes will be followed by blasting crew during initial stage of operation</p> <p>Shots are fired during daytime only.</p> <p>All holes charged on any one day shall be fired on the same day.</p> <p>The danger zone will be distinctly demarcated (by means of red flags)</p>
5	Transportation	<p>Potential hazards and unsafe workings contributing to accident and injuries</p> <p>Overloading of material</p> <p>While reversal & overtaking of vehicle</p> <p>Operator of truck leaving his cabin when it is loaded.</p>	<p>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.</p> <p>Not allow any unauthorized person to ride on the vehicle nor allow any unauthorized person to operate the vehicle.</p> <p>Concave mirrors should be kept at all corners</p> <p>All vehicles should be fitted with reverse horn with one spotter at every tipping point</p> <p>Loading according to the vehicle capacity</p> <p>Periodical maintenance of vehicles as per operator manual</p>
6	Natural calamities	Unexpected happenings	<p>Escape Routes will be provided to prevent inundation of storm water</p> <p>Fire Extinguishers & Sand Buckets</p>
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 III. The area is far away from the sea hence the disaster due to heavy floods and tsunamis are not anticipated

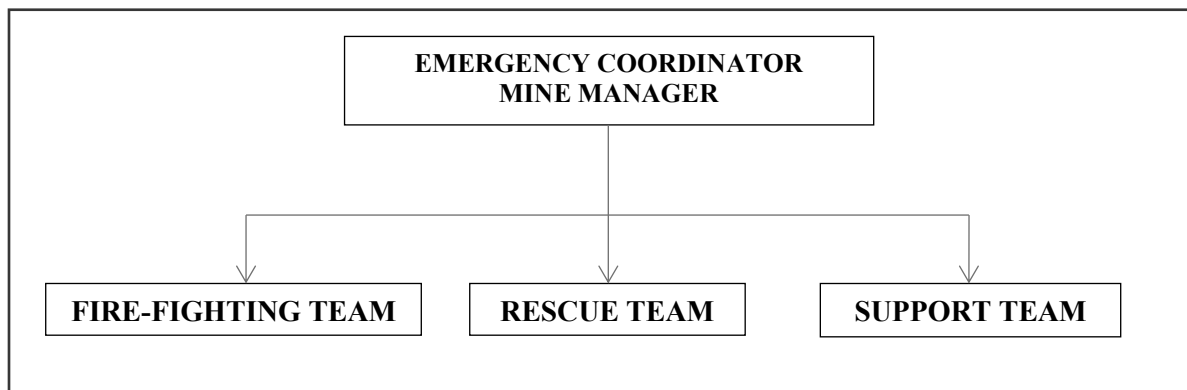
The Disaster Management Plan is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities.

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 mines manager. In his absence senior most people available at the mine shall be emergency coordinator till arrival of mines 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 for respective proposed quarries. 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.

LOCATION	TYPE
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	Thiru. S. Ravi, S/o. Sokkalingam, No.5/34A, Theradi Street, Virachilai I Bit, Virachilai (Post), Thirumayam Taluk, Pudukkottai District.	425/6, 425/7 & 425/8	1.53.5ha	ToR Obtained vide Lr.No. SEIAA- TN/F.No.9439/ToR- 1271/2022 Dated: 08.10.2022
P2	Thiru. R. Karuppiah, S/o. Ramathevar, No. 5/33G, Arasamarathu Veethi, Virachilai, Thirumayam Taluk, Pudukkottai (Dt)	995/1A	0.80.0	EC Granted vide Lr.No.SEIAA- TN/F.No.9027/EC.No:5315/2022 dated 20.09.2022
P3	Thiru. V. Nallaiya, S/o. Vellaisamy, No. 1/75, Vadakuthuru, V. Lakshmiapuram Post, Neikonam, Thirumayam Taluk, Pudukkottai District.	995/1B (Part)	0.81.0	EC Granted vide Lr.No.SEIAA- TN/F.No.9254/EC.No:5282/2022 dated 29.08.2022
TOTAL			3.14.5ha	
EXISTING QUARRIES				
CODE	Name of the Owner	S.F. Nos	Extent	Status
E1	Thiru. S. Ravi, S/o. Sokkalingam, No. 5/34A, Virachilai, Thirumayam Taluk, Pudukkottai District.	425/28	1.71.0	21.01.2019 to 20.01.2024
E2	Thiru. A.M.Xavier, S/o.Anthonymuthu, No. 10, Plot No. 78, MGR Street, Soodamanipuram Karaikudi, Sivangangai District.	454 (Part) and 455/2 (Part)	2.00.0	13.01.2020 to 12.01.2025
TOTAL			3.71.0ha	
EXPIRED QUARRIES				
CODE	Name of the Owner	S.F. No	Extent	Lease Period
EX1	Thiru. N. Murugan, S/o. V. Nallaiah,	995/1B	1.61.5	21.07.2014 to 20.07.2019

	Neikkunam, V.Lakshmipuram, Thirumayam Taluk, Pudukkottai District.			
EX2	Tmt. K. Subbulakshmi, W/o. Krishnan, 2/91, Maruthakudipatti, Virachilai (Post), Thirumayam Taluk,Pudukkottai.	425/11	1.81.5	17.06.2009 to 16.06.2014
EX3	Thiru. M.A. Murugappan, S/o. M.R. Manickam, 33, Charles Nagar,Pudukkottai	425/1 (Pt)	1.00.0	10.12.2010 to 09.12.2015
EX4	Thiru. S. Appaz, S/o. K. Shahul Hameed, Chola Real Estate, Annasaval Road,Pudukkottai.	421/4 (Pt)	1.21.5	28.03.2011 to 27.03.2016
EX5	Thiru. A.M. Zavier, 78, Soodamani Nagar, MGR Salai, Karaikudi,Pudukkottai	425/28 (Pt)	1.00.0	17.06.2012 to 16.06.2017
			6.64.5 ha	
TOTAL CLUSTER EXTENT			6.85.5 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	Thiru. S. Ravi Rough Stone and Gravel Quarry		
Toposheet No	58-J/11		
Latitude between	10°16'49.9061"N to 10°16'55.6024"N		
Longitude between	78°43'20.0066"E to 78°43'25.6247"E		
Highest Elevation	110 m AMSL		
Proposed Depth of Mining	34m bgl (2m Gravel + 2m Weathered rock + 30m Rough Stone)		
Geological Resources	Rough Stone in m ³	Weathered rock m ³	Gravel m ³
	5,37,250	30,700	30,700
Mineable Reserves	Rough Stone in m ³	Weathered rock m ³	Gravel m ³
	1,38,950	18,600	21,060
Year wise Production for 5 years as per TOR	Rough Stone in m ³	Weathered rock m ³	Gravel m ³
	1,36,000	18,600	21,060
Ultimate Pit Dimension	130m (L) x 81m (W) x 39m (D) bgl		
Water Level in the surrounds area	60 – 65m bgl		
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting		
Topography	The lease applied area is exhibits flat terrain. The area has gentle sloping towards eastern side. The altitude of the area is 110m (max) above mean sea level. The area is covered by 2m thickness of gravel and 2m weathered rock. Massive charnockite is found after 2m gravel and 2m weathered rock which is clearly inferred from the nearby existing quarrying pits.		
Machinery proposed	Jack Hammer	4 Nos	
	Compressor	1 No	
	Excavator with bucket and rock breaker	1 No	
	Trucks	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	19 Nos	
Project Cost	Rs. 35,87,000/-	
CER Cost @ 2% of Project Cost	Rs 5,00,000/-	
Nearby Water Bodies	Vellar River	7Km & North
	Senthamangalam Dam	9Km & North
	Thulaiyanur Lake	4Km & South
	Tank	840m & East
	Pond	480m & North
	Tank	100m & North East
Greenbelt Development Plan	Proposed to plant 750 trees in 3400Sq.m area in the Safety Zone and panchayat roads	
Proposed Water Requirement	2.0 KLD	
Nearest Habitation	320m Northwest	

TABLE 7.6: SALIENT FEATURES OF PROPOSAL “P2”

Name of the Quarry	Thiru. R. Karupiah Rough Stone and Gravel Quarry	
Toposheet No	58-J/11	
Latitude between	10°47'10.07"N to 10°47'13.76"N	
Longitude between	78°43'21.50"E to 78°43'25.65"E	
Proposed Depth of Mining	22 m bgl	
Proposed Production for 5 years	Rough Stone in m ³	Gravel m ³
	38,063	5,148
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Machinery proposed	Jack Hammer	2 Nos
	Compressor	1 Nos
	Hydraulic Excavator	1 Nos
	Tippers	1 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	16 Nos	
Project Cost	Rs. 41,14,800/-	
CER Cost @ 2% of Project Cost	Rs 5,00,000/-	

TABLE 7.8: SALIENT FEATURES OF PROPOSAL “P3”

Name of the Quarry	Thiru. V. Nallaiya Rough Stone and Gravel Quarry	
Toposheet No	58-J/11	
Latitude between	10°17'04.05"N to 10°17'10.47"N	
Longitude between	78°43'23.44"E to 78°43'26.20"E	
Proposed Depth of Mining	23 m bgl	
Geological Resources	Rough Stone in m ³	Gravel m ³
	4,78,010	22,062
Mineable Reserves	Rough Stone in m ³	Gravel m ³
	31,190	11,550
Proposed Production for 5 years	Rough Stone in m ³	Gravel m ³
	31,190	11,550
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Machinery proposed	Jack Hammer	2 Nos
	Compressor	1 Nos
	Hydraulic Excavator	1 Nos
	Tippers	1 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	18 Nos
Project Cost	Rs. 31,98,000/-
CER Cost @ 2% of Project Cost	Rs 5,00,000/-

TABLE 7.9: SALIENT FEATURES OF EXISTING QUARRY “E1”

Name of the Quarry	Thiru. S. Ravi Rough Stone Quarry	
Toposheet No	58-J/11	
Latitude between	10°16'48.31"N to 10°16'55.02"N	
Longitude between	78°43'24.73"E to 78°43'29.47"E	
Proposed Depth of Mining	41m bgl	
Geological Resources	Rough Stone in m ³	Topsoil m ³
	10,12,000	25,300
Mineable Reserves	Rough Stone in m ³	Topsoil m ³
	1,57,927	3,476
Year wise Production for 5 years	Rough Stone in m ³	Topsoil m ³
	1,57,927	3,476
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Machinery proposed	Jack Hammer	4 Nos
	Compressor	1 Nos
	Hydraulic Excavator	1 Nos
	Tipplers	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	23 Nos	
Project Cost	Rs. 89,40,000/-	
CER Cost @ 2% of Project Cost	Rs 5,00,000/-	

TABLE 7.9: SALIENT FEATURES OF EXISTING QUARRY “E2”

Name of the Quarry	Thiru. A.M.Xavier Rough Stone Quarry	
Toposheet No	58-J/11	
Latitude between	10°16'48.66"N to 10°16'54.80"N	
Longitude between	78°43'41.08"E to 78°43'46.95"E	
Proposed Depth of Mining	51m bgl	
Geological Resources	Rough Stone in m ³	Topsoil m ³
	13,44,350	19,205
Mineable Reserves	Rough Stone in m ³	Topsoil m ³
	2,81,370	14,551
Year wise Production for 5 years	Rough Stone in m ³	Topsoil m ³
	2,81,370	14,551
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Machinery proposed	Jack Hammer	2 Nos
	Compressor	1 Nos
	Hydraulic Excavator	2 Nos
	Tipplers	4 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	22 Nos
Project Cost	Rs. 42,10,000/-
CER Cost @ 2% of Project Cost	Rs 5,00,000/-

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 7.17& 7.18.

TABLE 7.7: 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	1,36,000	27,200	91	8
P2	38,063	7,613	25	2
P3	31,190	6,238	21	2
Total	2,05,253	41,051	137	12
E1	1,57,927	31,585	105	9
E2	2,81,370	56,274	188	16
Total	4,39,297	87,859	293	25
Grand Total	6,44,550	1,28,910	430	37

TABLE 7.8: CUMULATIVE PRODUCTION LOAD OF GRAVEL/WEATHERED GRAVEL

PROPOSED PRODUCTION DETAILS				
Quarry	3 Years in m ³	Per Year in m ³	Per Day in m ³	Number of Lorry Load Per Day
P1	39,660	13,220	44	4
P2	5,148	1,716	6	1
P3	11,550	3,850	13	1
Total	56,358	18,786	63	6
E1	-	-	-	-
E2	-	-	-	-
Total	-	-	-	-
Grand Total	56,358	18,786	63	6

On a cumulative basis considering the 3 Proposed quarries & 2 Existing Quarries it can be seen that the overall production of Rough Stone is 430 m³ per day and overall production of Gravel is 63 m³ per day with a capacity of 37 trips of Rough Stone per day and 6 Trips per day of Gravel from the cluster.

Note: Per day production of Rough Stone is calculated for 5 Years Lease Period and for Gravel production with 1, 2 or 3 or 5 years of production period. And the load of existing quarries is covered under existing environment of the cluster.

Based on the above production quantities the emissions due to various activities in all the 5 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 7.14.

TABLE 7.9: 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	0.075415507	g/s
	Blasting	Point Source	0.000590089	g/s
	Mineral Loading	Point Source	0.046831468	g/s
	Haul Road	Line Source	0.002508699	g/s
	Overall Mine	Area Source	0.049207696	g/s
	Estimated Emission Rate for SO ₂	Overall Mine	Area Source	0.001467732
Estimated Emission Rate for NO _x	Overall Mine	Area Source	0.000054338	g/s
EMISSION ESTIMATION FOR QUARRY "P2"				
	Activity	Source type	Value	Unit
Estimated Emission Rate for PM ₁₀	Drilling	Point Source	0.051786217	g/s
	Blasting	Point Source	0.000090092	g/s
	Mineral Loading	Point Source	0.041249385	g/s
	Haul Road	Line Source	0.002489618	g/s
	Overall Mine	Area Source	0.035668953	g/s
	Estimated Emission Rate for SO ₂	Overall Mine	Area Source	0.000402694
Estimated Emission Rate for NO _x	Overall Mine	Area Source	0.000007966	g/s
EMISSION ESTIMATION FOR QUARRY "P3"				
	Activity	Source type	Value	Unit
Estimated Emission Rate for PM ₁₀	Drilling	Point Source	0.045508047	g/s
	Blasting	Point Source	0.000047212	g/s
	Mineral Loading	Point Source	0.040258631	g/s
	Haul Road	Line Source	0.002488009	g/s
	Overall Mine	Area Source	0.035473297	g/s
	Estimated Emission Rate for SO ₂	Overall Mine	Area Source	0.000314237
Estimated Emission Rate for NO _x	Overall Mine	Area Source	0.000006194	g/s
EMISSION ESTIMATION FOR QUARRY "E1"				
	Activity	Source type	Value	Unit
Estimated Emission Rate for PM ₁₀	Drilling	Point Source	0.075415507	g/s
	Blasting	Point Source	0.000590089	g/s
	Mineral Loading	Point Source	0.047399882	g/s
	Haul Road	Line Source	0.002512102	g/s
	Overall Mine	Area Source	0.060699454	g/s
	Estimated Emission Rate for SO ₂	Overall Mine	Area Source	0.001719625
Estimated Emission Rate for NO _x	Overall Mine	Area Source	0.000100485	g/s
EMISSION ESTIMATION FOR QUARRY "E1"				
	Activity	Source type	Value	Unit
Estimated Emission Rate for PM ₁₀	Drilling	Point Source	0.092403710	g/s
	Blasting	Point Source	0.001629527	g/s
	Mineral Loading	Point Source	0.050312662	g/s
	Haul Road	Line Source	0.002536521	g/s
	Overall Mine	Area Source	0.059413271	g/s
	Estimated Emission Rate for SO ₂	Overall Mine	Area Source	0.00291399
Estimated Emission Rate for NO _x	Overall Mine	Area Source	0.000144742	g/s

Source: Emission Calculations

TABLE 7.10: INCREMENTAL & RESULTANT GLC WITHIN CLUSTER

PM₁₀ in µg/m³	
Location	Core
Background	59.2
Incremental	14.56
Resultant	73.76
NAAQ Norms	100 µg/m³
PM_{2.5} in µg/m³	
Location	Core

Background	29.0
Highest Incremental	7.89
Resultant	36.89
NAAQ Norms	60 µg/m³
SO₂ in µg/m³	
Location	Core
Background	8.6
Incremental	3.49
Resultant	12.09
NAAQ Norms	80 µg/m³
NO_x in µg/m³	
Location	Core
Background	21.6
Incremental	10.40
Resultant	32.0
NAAQ Norms	80 µg/m³

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.

$$L_{p2} = L_{p1} - 20 \log (r_2/r_1) - Ae_{1,2}$$

Where:

L_{p1} & L_{p2} 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.

$$L_{p \text{ total}} = 10 \log \{10^{(L_{p1}/10)} + 10^{(L_{p2}/10)} + 10^{(L_{p3}/10)} + \dots\}$$

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 7.11: PREDICTED NOISE INCREMENTAL VALUES FROM CLUSTER

Location ID	N1	N2	N3	N4	N5	N6	N7	N8
Maximum Monitored Value (Day) dB(A)	78.3	58.5	59.4	58.1	59.2	58.6	59.5	59.4
Incremental Value dB(A)	60.1	41.2	30.6	27.2	30.6	26.8	29.4	24.7
Total Predicted Noise level dB(A)	78.4	58.6	59.4	58.1	59.2	58.6	59.5	54.6

Source: Lab Monitoring Data

The incremental noise level is found within the range of 24.7 to 41.2dB (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 5 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 5 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.

Nearest Habitations from 2 mines respectively are as in below Table 7.22

TABLE 7.12: NEAREST HABITATION FROM EACH MINE

Location ID	Distance in Meters
Habitation Near P1	320
Habitation Near P2	335
Habitation Near P3	330
Habitation Near E1	460
Habitation Near E2	900

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 7.13: GROUND VIBRATIONS AT 5 MINES

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in m/ms
P1	40	320	0.938
P2	10	335	0.288
P3	9	330	0.295
E1	45	460	0.577
E2	81	900	0.315

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 5 mines shall contribute towards CER and the community shall develop.

TABLE 7.14: SOCIO ECONOMIC BENEFITS FROM 5 MINES

Location ID	Project Cost	CER @ 2%
P1	Rs. 35,87,000/-	Rs 5,00,000 /-

P2	Rs. 41,14,800/-	Rs 5,00,000 /-
P3	Rs. 31,98,000/-	Rs 5,00,000 /-
Total	Rs. 1,08,99,800/-	Rs 15,00,000 /-
E1	Rs. 89,40,000/-	Rs 1,78,000/-
E2	Rs. 42,10,000/-	Rs 84,200/-
Total	Rs. 1,31,50,000/-	Rs 2,62,200/-
Grand Total	Rs. 2,40,49,800/-	Rs. 17,26,200/-

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.

- Proposed project shall fund towards CER – **Rs 15,00,000/-**
- Existing project shall fund towards CER – **Rs 2,62,200/-**
- 5 Projects in Cluster shall fund towards CER – **Rs 17,26,200/-**

TABLE 7.15: EMPLOYMENT BENEFITS FROM 5 MINES

Location ID	Employment
P1	19
P2	16
P3	18
Total	53
E1	23
E2	22
Total	45
Grand Total	98

A total of 53 people will get employment due to 3 Proposed quarries in cluster and 45 people are already employed at existing mine.

TABLE 7.16: GREENBELT DEVELOPMENT BENEFITS FROM 5 MINES

CODE	No of Trees proposed to be planted	Survival %	Area Covered Sq.m	Name of the Species	No. of Trees expected to be grown
P1	750	80%	Near by safety distance ,panchayat road, village road	Neem, Casuarina	600
P2	500	80%		Neem, Casuarina	400
P3	500	80%		Neem, Casuarina	400
Total	1,750	80%		Neem, Casuarina	1,400
E1	1,250	80%		Neem, Casuarina	1000
E2	1,000	80%		Neem, Casuarina	800
Total	2,250	80%	Neem, Casuarina	1800	

Based on the Proposed Mining Plans it's anticipated that there shall growth of native species of Neem, Casuarina, etc in the Cluster at a rate of 1750 Trees Planted over a period of 5 Years with Survival Rate of 80% and expected growth is around 1400 Trees over an area of 15,750 Sq.m cumulative of proposed quarries and 2250 Trees Planted over a period of 5 Years with Survival Rate of 80% and expected growth is around 1800 Trees over an area of 20,250 Sq.m cumulative of existing quarry.

7.5 PLASTIC WASTE MANAGEMENT PLAN

All 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 7.17: 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

8. PROJECT BENEFITS

8.0 GENERAL

The Proposed Project for Quarrying Rough Stone at Thiru. S. Ravi aims to produce cumulatively **1,36,000** m³ 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 19 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 Lembalakudi Village, Thirumayam Taluk and Pudukkottai 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 Lembalakudi village mainly contributing to education, health, training of women self-help groups and contribution to infrastructure etc., CSR budget is allocated as 2.0% 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, Thiru. S. Ravi shall contribute 2% of Capital Investment towards CER as per directions of EAC/SEAC. Cumulative Capital cost is Rs. 35,87,000/-.

TABLE 8.1: CER – ACTION PLAN

Activity	Beneficiaries	Total
Avenue Plantation along the Government School Boundary & Renovation of existing toilets	Lembalakudi villagers	Rs.5,00,000/-
TOTAL		Rs.5,00,000/-

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 Thiru. S. Ravi 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 mines office.

The quarrying operation is proposed upto a depth of 30m BGL, the water table in the area is 60m – 65m below ground level, hence the proposed projects 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 shall be carried out in the project area and in surrounding villages to assess 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 and Gravel 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 750 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 FOR 5 YEAR PLAN PERIOD

Year	No. of trees proposed to be planted	Area to be covered	Name of the species	Survival rate expected	No. of trees expected to be grown
I	750	Along safety area, panchayat road and village road	Neem, Pongamia Pinnata, Casuarina etc.,	80%	600

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
2.	Tamarindus indica	Tamarind	Edible & Medicinal and other Uses
3.	Polyalthia longifolia	Nettilinkam	Tall and evergreen tree
4.	Borassus Flabellifer	Palmyra Palm	Tall Wind breaker tree and its fruits are edible

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 detail 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	1 st Year	2 nd Year	3 rd Year	4 th Year	5 th 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 Proponents 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

	Mitigation Measure	Provision for Implementation	Capital	Recurring
Air Environment	Compaction, gradation and drainage on both sides for Haulage Road	Rental Dozer & drainage construction on haul road @ Rs. 10,000/- per hectare; and yearly maintenance @ Rs. 10,000/- per hectare	15300	15300
	Fixed Water Sprinkling Arrangements + Water sprinkling by own water tankers	Fixed Sprinkler Installation and New Water Tanker Cost for Capital; and Water Sprinkling (thrice a day) Cost for recurring	800000	50000
	Muffle blasting – To control fly rocks during blasting	Blasting face will be covered with sand bags / steel mesh / old tyres / used conveyor belts	0	5000
	Wet drilling procedure / latest eco-friendly drill machine with separate dust extractor unit	Dust extractor @ Rs. 25,000/- per unit deployed as capital & @ Rs. 2500 per unit recurring cost for maintenance - 2 Units	50000	5000
	No overloading of trucks/tippers/tractors	Manual Monitoring through Security guard	0	5000
	Stone carrying trucks will be covered by tarpaulin	Monitoring if trucks will be covered by tarpaulin	0	10000
	Enforcing speed limits of 20 km/hr within ML area	Installation of Speed Governors @ Rs. 5000/- per Tipper/Dumper deployed - 1 Units	5000	250
	Regular monitoring of exhaust fumes as per RTO norms	Monitoring of Exhaust Fumes by Manual Labour	0	5000
	Regular sweeping and maintenance of approach roads for at least about 200 m from ML Area	Provision for 2 labours @ Rs.10,000/labour (Contractual) per Hectare	0	15300
	Installing wheel wash system near gate of quarry	Installation + Maintenance + Supervision	50000	20000
Noise Environment	Source of noise will be during operation of transportation vehicles, HEMM for this proper maintenance will be done at regular intervals.	Provision made in Operating Cost	0	0

	Oiling & greasing of Transport vehicles and HEMM at regular interval will be done	Provision made in Operating Cost	0	0
	Adequate silencers will be provided in all the diesel engines of vehicles.	Provision made in Operating Cost	0	0
	It will be ensured that all transportation vehicles carry a fitness certificate.	Provision made in Operating Cost	0	0
	Safety tools and implements that are required will be kept adequately near blasting site at the time of charging.	Provision made in OHS part	0	0
	Line Drilling all along the boundary to reduce the PPV from blasting activity and implementing controlled blasting.	Provision made in Operating Cost	0	0
	Proper warning system before blasting will be adopted and clearance of the area before blasting will be ensured.	Blowing Whistle by Mining Mate / Blaster / Compentent Person	0	0
	Provision for Portable blaster shed	Installation of Portable blasting shelter	50000	2000
	NONEL Blasting will be practiced to control Ground vibration and fly rocks	Rs. 30/- per 6 Tonnes of Blasted Material	0	110812
Water Environment	Water management	Provision for garland drain @ Rs. 10,000/- per Hectare with maintenance of Rs. 5,000/- per annum	15300	5000
Waste Management	Waste management (Spent Oil, Grease etc.,)	Provision for domestic waste collection and disposal through authorized agency	5000	20000
		Installation of dust bins	5000	2000
	Bio toilets will be made available outside mine lease on the land of owner itself	Provision made in Operating Cost	0	0

Green Belt Development	Green belt development - 500 trees per one hectare - Proposal for 750 Trees - (250 Inside Lease Area & 500 Outside Lease Area)	Site clearance, preparation of land, digging of pits / trenches, soil amendments, transplantation of saplings @ 200 per plant (capital) for plantation inside the lease area and @ 30 per plant maintenance (recurring)	150000	22,500
		Avenue Plantation @ 300 per plant (capital) for plantation outside the lease area and @ 30 per plant maintenance (recurring)	225000	22,500
Implementation of EC, Mining Plan & DGMS Condition	Size 6' X 5' with blue background and white letters as mentioned in MoM Appendix II by the SEAC TN	Fixed Display Board at the Quarry Entrance as permanent structure mentioning Environmental Conditions	10000	1000
	Air, Water, Noise and Soil Quality Sampling every 6 Months for Compliance Report of EC Conditions	Submission of 2 Half Yearly Compliance - Lab Monitoring Report as per CPCB norms	0	50000
	Workers will be provided with Personal Protective Equipment's	Provision of PPE @ Rs. 4000/- per employee with recurring based on wear and tear (say, @ Rs. 1000/- per employee) - 19 Employees	76000	19000
	Health check up for workers will be provisioned	IME & PME Health check up @ Rs. 1000/- per employee	0	19000
	First aid facility will be provided	Provision of 2 Kits per Hectare @ Rs. 2000/-	0	3060
	Mine will have safety precaution signages, boards.	Provision for signages and boards made	10000	2000

	Barbed Wire Fencing to quarry area will be provisioned.	Per Hectare fencing Cost @ Rs. 2,00,000/- with Maintenance of Rs 10,000/- per annum	306000	10000
	No parking will be provided on the transport routes. Separate provision on the south side of the hill will be made for vehicles /HEMMs. Flaggers will be deployed for traffic management	Parking area with shelter and flags @ Rs. 50,000/- per hectare project and Rs. 10,000/- as maintenance cost	76500	10000
	Installation of CCTV cameras in the mines and mine entrance	Camera 4 Nos, DVR, Monitor with internet facility	30000	5000
	Implementation as per Mining Plan and ensure safe quarry working	Mines Manager (1 st Class / 2 nd Class / Mine Foreman) under regulation 34 / 34 (6) of MMR, 1961 and Mining Mate under regulation 116 of MMR,1961 @ 40,000/- for Manager & @ 25,000/- for Foreman / Mate	0	780000
TOTAL			18,79,100	12,14,722

In order to implement the environmental protection measures, an amount of Rs.18.79 lakhs as capital cost and recurring cost as Rs. 12.15 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

Thiru. S. Ravi Rough Stone and Gravel Quarry (Extent – 1.53.5 ha) falls under “B” category as per MoEF & CC Notification (S.O. 3977 (E)).

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.

Environmental monitoring and audit mechanism have been recommended before and after commencement of the project, where necessary, to verify the accuracy of the EIA predictions and the effectiveness of recommended mitigation measures.

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 each individual leases. 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 months October to December 2022 for various environmental components so as to assess the anticipated impacts of the cluster quarry projects on the environment and suitable mitigation measures for likely adverse impacts due to the proposed project is suggested individually for the respective proposed project under Chapter 10.

The project proponent ensures to obtain necessary clearances and quarrying will be carried out as per rules and regulations. The Mining Activity will be carried out in a phased manner as per the approved mining plan after obtaining EC, CTO from TNPCB, execution of lease deed and obtaining DGMS Permission and working will be carried out under the supervision of Competent Persons employed.

Overall, the EIA report has predicted that the project will comply with all environment standards and legislation after commencement of the project and operational stage mitigation measures are implemented.

Mining operations has positive impact on environment and socio economy such as landscape improvement, water as by-product, economy development and better public services, providing and supply of Rough Stone as per market demand.

Sustainable and modern mining leads us to see positive impact of mining operation and providing consistent employment for nearly 19 people directly in the project and indirectly around 50 people.

As discussed, it is safe to say that the proposed quarry is not likely to cause any significant impact to the ecology of the area, as adequate preventive measures will be adopted to keep the various pollutants within the permissible limits. Green belt development around the area will also be taken up as an effective pollution mitigate technique, as well as to serve as biological indicators for the pollutants released from the Thiru. S. Ravi Rough Stone and Gravel Quarry (Extent – 1.53.5 ha).

12. DISCLOSURE OF CONSULTANT

Thiru. S. Ravi have 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 and Standard ToR Deemed Approved.

Name and address of the consultancy:

GEO EXPLORATION AND MINING SOLUTIONS

No 17, Advaita 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 for Thiru. S. Ravi Rough Stone & Gravel Quarry Project at S.F.No. 425/6, 425/7 and 425/8 over an Extent of 1.53.5 ha in Lembalakudi Village of Thirumayam Taluk, Pudukkottai 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:




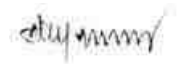

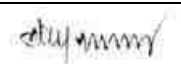














Period of Involvement: **March 2022 to till date**

Associated Team Member with EIA Coordinator:





1. Mr. S. Nagamani
2. Mr. P. Viswanathan
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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ Interpretation of ground water table and predict impact and propose mitigation measures. ▪ Analysis and description of aquifer Characteristics 	Dr. P. Thangaraju	
4	GEO	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ Revision in secondary data as per Census of India, 2011. ▪ Impact Assessment & Preventive Management Plan ▪ Corporate Environment Responsibility. 	Mrs. K. Anitha	
6	EB	<ul style="list-style-type: none"> ▪ Collection of Baseline data of Flora and Fauna. ▪ Identification of species labelled as Rare, Endangered and threatened as per IUCN list. 	Mrs. Amirtham	

		<ul style="list-style-type: none"> Impact of the project on flora and fauna. Suggesting species for greenbelt development. 	Mr. Alagappa Moses	
7	RH	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Identify impacts due to noise and vibrations Suggesting appropriate mitigation measures for EMP. 	Mr. A. Jagannathan	
10	AQ	<ul style="list-style-type: none"> Identifying different source of emissions and propose predictions of incremental GLC using AERMOD. Recommending mitigations measures for EMP 	Mr. N. Senthilkumar	
11	SC	<ul style="list-style-type: none"> Assessing the impact on soil environment and proposed mitigation measures for soil conservation 	Dr. M. Ifthikhar Ahmed	
12	SHW	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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. Viswanathan	AP; WP; LU	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Site Visit with FAE Provide inputs on Geological Aspects 	

			<ul style="list-style-type: none"> ▪ Assist in Resources & Reserve Calculation and preparation of Production Plan & Conceptual Plan 	
5	Mr. A. Allimuthu	SE	<ul style="list-style-type: none"> ▪ Site Visit with FAE ▪ Assist FAE with collection of data's ▪ Provide inputs by analysing primary and secondary data 	<i>A. Allimuthu</i>
6	Mr. S. Ilavarasan	LU; SC	<ul style="list-style-type: none"> ▪ Site Visit with FAE ▪ Assisting FAE in preparation of land use maps ▪ Provide inputs & Assisting FAE with soil conservation methods and identifying impacts 	<i>S. Ilavarasan</i>
7	Mr. E. Vadivel	HG	<ul style="list-style-type: none"> ▪ 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 	<i>E. Vadivel</i>
8	Mr. D. Dinesh	NV	<ul style="list-style-type: none"> ▪ 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 	<i>D. Dinesh</i>
9	Mr. Panneer Selvam	EB	<ul style="list-style-type: none"> ▪ Site Visit with FAE ▪ Assist FAE with collection of baseline data ▪ Provide inputs and assist with labelling of Flora and Fauna 	<i>P. Panneer Selvam</i>
10	Mrs. Nathiya	EB	<ul style="list-style-type: none"> ▪ Site Visit with FAE ▪ Assist FAE with collection of baseline data ▪ Provide inputs and assist with labelling of Flora and Fauna 	<i>T. Annappa</i>

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 Thiru. S. Ravi Rough Stone & Gravel Quarry Project over an Extent of 1.53.5 ha in Lembalakudi Village of Thirumayam Taluk, Pudukkottai 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:

Dr. M. Ifthikhar Ahmed

Name:

Dr. M. Ifthikhar Ahmed

Designation:

Managing Partner

Name of the EIA Consultant Organization:

M/s. Geo Exploration and Mining Solutions

NABET Certificate No & Issue Date:

NABET/EIA/1922/SA0139 Dated: 11-10-2021

Validity:

Valid till 29.04.2023