

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 = 11.16.0 ha

**THIRU.R.R. SENTHILKUMAR RAJU ROUGH STONE AND GRAVEL QUARRY
at**

Sundakottai Village, Aruppukottai Taluk, Virudhunagar District, Tamil Nadu State

Project Proponent	Proposed Project	Extent
Thiru.R.R. Senthilkumar Raju, S/o. Raju, No. 33, Guru Illam, V.T.Pandian Nagar, Kariapatti Taluk, Virudhunagar District – 626 106.	S.F. No 52/8B2, 52/8B3, 53/10, 53/11, 53/12, 53/5B, 53/6, 53/7, 53/8, 53/9, 54/1B2 & 54/1C Sundakottai Village, Aruppukottai Taluk, Virudhunagar District, Tamil Nadu.	3.56.0 ha
ToR obtained vide Lr No. SEIAA-TN/F.No.9901/ToR-1434/2023 Dated:24.04.2023.		

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 Category 'A' & 31,38 Category 'B'
Certificate No: NABET/EIA/2225/RA0276**



Phone: 0427-2431989,

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

Web: www.gemssalem.com

Baseline Monitoring Period - March to May 2023

ENVIRONMENTAL LAB

**EHS 360 LABS PRIVATE LIMITED,
10/2 Ground floor, 50th street, 7th Avenue,
Ashok Nagar, Chennai – 600 083.**

JUNE- 2023

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

PROPOSED QUARRY				
Code	Name of the Owner	S.F. Nos	Extent	Status
P1	Thiru.R.R. Senthilkumar Raju, S/o. Raju, No. 33, Guru Illam, V.T. Pandian Nagar, Kariapatti Taluk, Virudhunagar District – 626 106.	52/8B2, 52/8B3, 53/10, 53/11, 53/12, 53/5B, 53/6, 53/7, 53/8, 53/9, 54/1B2 & 54/1C	3.56.0 ha	TOR Obtained: Lr No. SEIAA- TN/F.No.9901/ToR- 1434/2023 Dated:24.04.2023.
Nearby Proposed Quarry				
P2	Tmt. R. Subashini, W/o. Rajkumar, No.54, South Car Street, Vellaikkottai, Aruppukottai & Taluk, Virudhunagar District – 626 101.	54/2, 54/3 of Sundakottai 70/5A1, 70/4, 70/5A2, 70/5B, 70/6, 70/7 and 70/8 Aladipatti Village	3.11.0 Ha	EC GRANTED
TOTAL			6.67.0 ha	
EXISTING QUARRY				
Code	Name of the Owner	S.F. No	Extent	Status
E1	Thiru.T.R.Varadharajan	48/12, 48/13, 48/14 etc.,	2.22.50 ha	17.05.2022 To 16.05.2027
E2	Thiru.S.Balasubramani	72/1, 72/2, 72/4A, etc.,	2.26.50	14.02.2019 To 13.02.2024
TOTAL			4.49.0ha	
ABANDONED QUARRY				
Code	Name of the Owner	S.F. No	Extent	Status
A1	Thiru. R.R.Senthilkumar Raju	61/4. 63/5 etc.,	1.15.50	07.11.2017 To 06.11.2022
A2	Thiru.V.Thaveethuraja	54/1B	0.55.50	16.09.2014 To 15.09.2019
A3	Thiru.T.R.Varadharajan	53/4, 53/5A	1.40.5	18.01.2018 To 17.01.2023
A4	Thiru.M.Jesumuthu	52/3, 52/5	1.25.0	14.06.2016 To 13.06.2019
Total			4.36.50	
TOTAL CLUSTER EXTENT			11.16.0 ha	

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

As per above notification S.O.2269(E) dated : 01.07.2016 in para (b) in Appendix XI,- (ii)(5): The lease not operative for three years or more and leases which have got environmental clearance as on 15th January, 2016 shall not be counted for calculating the area of cluster, but shall be included in the Environment Management Plan and the Regional Environmental Management Plan”

TERMS OF REFERENCE (ToR) COMPLIANCE

Thiru.R.R.Senthilkumar Raju,

“ToR issued vide Lr No. SEIAA-TN/F.No.9901/ToR-1434/2023 Dated:24.04.2023”

SPECIFIC CONDITIONS		
1	The Proponent shall carry out the cumulative & comprehensive impact study due to mining operations carried out in the quarry cluster specifically with reference to the environment in terms of air pollution, water pollution & health impacts, 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.
2	Certified EC compliance report shall be included in the EIA report	Not Applicable
3	<p>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,</p> <p>a) What was the period of the operation and stoppage of the earlier mines with last work permit issued by the AD/DD mines?</p> <p>b) Quantity of minerals mined out.</p> <p>c) Highest production achieved in any one year</p> <p>d) Derail of approved depth of mining.</p> <p>e) Actual depth of the mining achieved earlier.</p> <p>t) Name of the person already mined in that leases area.</p> <p>g) If EC and CTO already obtained, the copy of the same shall be submitted.</p> <p>h) Whether the mining was carried out as per the approved mine plan (or EC if issued) with stipulated benches.</p>	The Quarry lease was previously granted to M.Samuvel Mariakumar, extent: 2.02.5 ha in patta land of S.F.Nos.53/5B,53/6,53/7,53/8,53/9,53/10,53/11& 53/12 of sundakottai village, Aruppukottai taluk , viruthunagar District. Period : 14.06.2016 to 13.06.2019.
4	All corner coordinates of the mine lease area, superimposed on a high-resolution Imagery/Toposheet, 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 area).	Satellite imagery of the project area along with boundary coordinates is given in the Chapter No 1 Figure No .1.1 Page No.2 Geomorphology of the area is given in Chapter No 2 Figure No 2.8. Page No.21 Land use pattern of the project area is tabulated in the Chapter No.2. Table No.2.3 Page No.17 Land use pattern of the Study area is tabulated in the Chapter No.3 Table No 3.3 Page No.36.
5	The PP shall carry out Drone video survey covering the cluster, Green belt , fencing etc	Drone video covering the cluster area clearly stating the extent of the operation is submitted in the final EIA report
6	The proponent shall furnish photographs of adequate fencing, green belt along the periphery including	Fencing erected around the boundary barrier.

	replantation of existing trees & safety distance between the adjacent quarries & water bodies nearby provided as per the approved mining plan.	
7	The Project proponent shall provide the details of mineral reserves and mineable reserves, planned production capacity, proposed working methodology justifications, with the anticipated impacts of the mining operations on the surrounding environment and the remedial measures for the same.	Total Mineable Reserves, Proposed production and working methodology given in the Chapter No.2
8	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.	Organization chart indicating Proposal for the appointment of Statutory officials is given in the Chapter No.7 Figure No. 7.2
9	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. No of Ground water pumping wells, Open wells within radius of 1km along with Contour map is given in the Chapter No.3 Page No.46-48 Table No. 3.11 & 3.12. Figure No. 3.6 & 3.7.
10	The proponent shall furnish the baseline data for the environmental and ecological parameters with regard to surface water/ground water quantity' air quality' soil quality & flora/fauna including traffic/vehicular movement study	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 to assess the cumulative impact of the proposed project on the environment is prepared as a Draft EIA EMP and will be finalized after public consultation and will be submitted as Final EIA /EMP Report.
11	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.
12	A detailed mine closure plan for the proposed project shall be included in EIA/EMP report which should be site-specific'	Noted & agreed. Detailed under Chapter 4

13	The Public hearing advertisement shall be published in one major National daily and one most circulated vernacular daily.	Noted and agreed
14	The PP shall produce/display the EIA report' Executive summery and other related with respect to public hearing should in Tamil Language also'	Noted and agreed
15	The recommendation for the issue of "'Terms of Reference" is subjected to the outcome of the Hon'ble NCT, Principal Bench' New Delhi in O'A No 186 of 2016 (M.A.No.350/2016) and O A' No'200/2016 and O A No 580/2016 (M.A.No.1182/2016) and O A'No 10212017 and OANo404/2016 (M.A.No' 758/2016, M.A.No.9202016, MA'No 11222016' MANo12/2017 & MA No' 843/2017) and O.A.No405/2016 and OANo520 of 2016 (M.A.No 981/2016' M.A.No.982/2016 & M.A.No 384/2017)'	Noted and agreed
16	The purpose of Green belt 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 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 2140 nos of trees in the 7.5m safety barrier and approach roads
17	Taller/one year old Saplings raised in appropriate size of bags, preferably ecofriendly bags should be planted in proper espacement as per the advice of local forest authorities/botanist/Horticulturist with regard to site specific choices. 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	Noted and agreed
18	A disaster Management plan shall be prepared and included in the EIA/EMP report.	Detailed under Chapter 7, Page No 131
19	A Risk Assessment and management plan shall be prepared and included In the EIA/EMP Report.	Detailed under Chapter 7, Page No 129
20	A specific flora and fauna studies shall be carry out with the help of local school/college students and the same shall be EIA/EMP Report.	Noted and agreed
21	The Socio-ecooomic 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 propone.t should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	Details in chapter 3
22	If any quarrying operations were caried out in the	Details in Chapter 4.8

	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 duly be certified by MoEF&CC, Regional Office, Chennai (or) the concerned DEE/TNPCB.	
23	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 Reference besides attracting penal provisions in the Environment (Protection) Act, 1986.	Noted and agreed
ADDITIONAL CONDITIONS		
1	Detailed study shall be carried out regard to impact of mining around the proposed mine lease area on the nearby villages, waterbodies/Rivers and any ecological fragile areas.	Noted and agreed
2	The project proponent shall furnish VAO certificate with reference to 300m radius regard to approved habitations, schools, Archaeological structures etc.	Noted and agreed
3	As per the MoEF&CC office memorandum F.No.22_620 7-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, all the concerns raised during the public hearing will be addressed along with mitigation measures in the Final EIA.
4	The Environmental Impact Assessment shall study in detail on 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.	Carbon emission due to this project and mitigation measures is discussed in the Chapter No 7.
5	The Environmental Impact Assessment should study the biodiversity' the natural ecosystem, the soil micro flora fauna and soil seed bank and suggest measures to maintain the natural Ecosystem	Noted & agreed. Detailed under Chapter 3.
6	Action should specifically suggest for sustainable management of the area and restoration of ecosystem for flow of goods and services	The Eco System of the area will be retained during the mining operation by the way of planting trees in the boundary barrier and un utilized areas. After completion of mining operation, the quarried-out pit will be facilitated to collect the rainwater to pit act as temporary reservoir
7	The project proponent shall study impact on fish habitats and the food WEB/ food chain in the nearby \ water body and Reservoir.	No proposal for the disposal of pit water to the nearby water bodies hence this project will not create impact to the food chain in the water body. After completion of quarry operation, the pit will act as temporary reservoir and pisciculture activities will be involved. Details of Nearest water bodies from the project site is given in Chapter No. 3,
8	The terms of reference should specifically study impact on soil health, soil erosion, the soil physical.	There is no Top soil in the project area, the overburden in the form of Gravel formation.

	Chemical components and microbial components.	Details of impact on soil environment is detailed in Chapter No.4
9	The Environmental Impact Assessment should study impact on forest, vegetation, endemic, vulnerable and endangered indigenous flora and fauna.	Noted & agreed. Details of flora and fauna studies given in the Chapter No.3.
10	The Environmental Impact Assessment should study on standing trees and the existing trees should be numbered and action suggested for production.	The entire area is a broken land, No major trees within the project area.
11	The Environmental Impact Assessment should study on wetlands' water bodies' rivers streams, lakes and farmer sites.	Nearest agriculture activity is coconut plantation located South West side of the project area. Proponent erected fencing in the previous lease period. The project area is bounded mostly by Crusher and Quarries.
12	The Environmental Impact Assessment should hold detailed study on EMP with budget for green belt development and mine closure plan including disaster management plan.	Budgetary allocation is given in the Chapter No. 4.
13	The Environmental Impact Assessment should study impact on climate change' temperature rise, pollution and above soil & below soil carbon stock'	The project will not cause significant impact on climatic change. Description about the project and climatic changes is described in Chapter No.4.
14	The Environmental Impact Assessment should study impact on protected areas, reserve forests, National parks, Corridors and wild pathways, near project site.	Anticipated Environment Impact and Mitigation measures are detailed in Chapter No.4.
15	The project proponent shall study and furnish the impact of project on plantations in adjoin patta lands, Horticultue, Agriculture and livestock	The project area is bounded by Existing quarries and crushers no agriculture activities adjacent to the project site.
16	The project proponent shall study and furnish the details on potential fragmentation impact of natural environment' by the activities.	Details are given in the Chapter No 4.
17	The project proponent shall study and furnish the impact on aquatic plants and animals in waterbodies and possible scars on the landscape, damage to nearby caves, heritage site and archaeological sites possible landforms changes visual and aesthetic impacts.	There is No Archaeological sites in the vicinity of the project area. Details are given in the Chapter No 3. Details of water bodies given in the Chapter No 3
18	The project proponent sha, study and furnish the possible pollution due to microplastic on the environment. The ecological risks and impacts of microplastics on aquatic environment and fresh water systems due to contemplated during mining may be investigated and reported.	Plastic waste management in the project area detailed in Chapter No.7.
19	The project proponent shall study on impact of mining on Reserve wildlife. plastic and plastic & activities, forests free ranging	There is no Reserve Forest within 1km radius from the project area. The mining operation will not cause any significant impact to the Reserve Forest and Wild life Sanctuaries
20	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	Details of Soil health is given in Chapter No 3 and biodiversity is given in Chapter No 3, The project will not cause any significant changes in the climate Climatic changes and GHG are described in Chapter No 4,

	<p>a) Soil health & biodiversity</p> <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 and 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>	<p>Details of water contamination and impact on aquatic ecosystem is given in Chapter No 4</p> <p>Hydrothermal/ Geothermal effects due to destruction in the environment, Bio geochemical process and sed</p>
21	<p>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) 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.</p>	<p>Detailed discussed in the chapter 3.</p>
22	<p>To furnish disaster management plan and disaster mitigation measures in regard to all aspects to avoid/reduce vulnerability to hazards & to cope with disaster/unfavorable accidents in & around the proposed mine lease area due to the proposed method of mining activity & its related activities covering the entire mine lease period as per precise area communication order issued.</p>	<p>Detailed discussed in the chapter 7.</p>
23	<p>To furnish risk assessment and management plan including anticipated vulnerabilities during operational and post operational phases of Mining.</p>	<p>Detailed discussed in the chapter 7.</p>
24	<p>Detailed Mine Closure Plan covering the entire mine lease period as per precise area communication order issued'</p>	<p>Detailed discussed in the chapter 4.</p>
25	<p>The detailed environment Management plan along with adaptation, mitigation and remedial strategies covering the entire mine lease period as per precise area communication order issued.</p>	<p>Detailed discussed in the chapter 10.</p>

STANDARD TERMS OF REFERENCE

1	<p>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</p>	<p>Not applicable.</p> <p>This is Not a violation category project.</p> <p>This proposal falls under B1 Category (Cluster</p>
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	force, w.r.t. the highest production achieved prior to 1994.	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).	Satellite imagery of the project area along with boundary coordinates is given in the Chapter No 1 Figure No .1.1 Page No.2 Geomorphology of the area is given in Chapter No 2 Figure No 2.8. Page No.21 Land use pattern of the project area is tabulated in the Chapter No.2. Table No.2.3 Page No.17 Land use pattern of the Study area is tabulated in the Chapter No.3 Table No 3.3 Page No.36.
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 Company and/or shareholders or stakeholders at large, may also be detailed in the EIA Report.	The proponent has framed their Environmental Policy and the same is discussed in the Chapter No 10.1.
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	It is an opencast quarrying operation proposed to operate in Mechanized method. The rough stone formation is a hard, compact and homogeneous body.

	should also be provided.	<p>The height and width of the bench will be maintained as 5m with 90⁰ bench angles.</p> <p>Quarrying activities will be carried out under the supervision of Competent Persons like Mines Manager, Mines Foreman and Mining Mate.</p> <p>Necessary permissions will be obtained from DGMS after obtaining Environmental Clearance.</p>
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.	<p>Noted & agreed.</p> <p>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.</p>
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.	<p>Land use and land cover of the study area is discussed in Chapter No. 3.</p> <p>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.</p>
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	<p>Not Applicable.</p> <p>There is no waste anticipated during this quarry operation. The entire quarried out rough stone will be transported to the needy customers.</p> <p>No Dumps is proposed outside the lease area.</p>
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.	<p>Not Applicable.</p> <p>There is no Forest Land involved in the proposed project area. The proposed project area is a patta land.</p> <p>Approved Mining Plan is enclosed as Annexure Volume 1.</p>
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.	<p>Not Applicable.</p> <p>The proposed project area does not involve any Forest Land.</p>
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.	<p>Not Applicable.</p> <p>The project doesn't attract Recognition of Forest Rights Act, 2006.</p>
15	The vegetation in the RF / PF areas in the study area,	No Reserve Forest within the Study Area.

	with necessary details, should be given.	
16	A study shall be got done to ascertain the impact of the Mining Project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the surrounding and any other protected area and accordingly, detailed mitigative measures required, should be worked out with cost implications and submitted.	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 &	Not Applicable. There are no approved habitations within a

	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.	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 predominant downwind direction and location of sensitive receptors. There should be at least one monitoring station within 500 m of the mine lease in the predominant downwind direction. The mineralogical composition of PM10, particularly for free silica, should be given.	Baseline Data were collected for One Season (Summer) March - May 2023 as per CPCB Notification and MoEF & CC Guidelines. Details in Chapter No. 3.
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 predominant 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 2.13.
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 40m. This proposal of 40m 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 70m AMSL. Ultimate depth of the mine is 40m 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 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.	Greenbelt Development Plan is discussed under Chapter 4.

32	Impact on local transport infrastructure due to the Project should be indicated. Projected increase in truck traffic as a result of the Project in the present road network (including those outside the Project area) should be worked out, indicating whether it is capable of handling the incremental load. Arrangement for improving the infrastructure, if contemplated (including action to be taken by other agencies such as State 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, with direction /order passed by any Court of Law against the Project should be given.	No litigation is pending in any court against 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.70,48,000/- 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	<u>Enclosed as separate booklet.</u>
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)	Not Applicable.

	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.	
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.

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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 & Gravel is the major requirements for construction industry. This EIA report is prepared by considering Cumulative load of proposed & existing quarries of Thiru.R. RSenthilkumar Raju Rough Stone & Gravel Quarry consisting of two Proposed and two Existing Quarry with total extent of Cluster of 11.16.0 ha in Sundakottai Village, Aruppukottai Taluk, Virudhunagar District, Tamil Nadu, cluster area calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016.

This EIA Report is prepared in compliance with ToR obtained vide –

Code	Name of the Owner	Extent	ToR Status
P1	Thiru.R.R. Senthilkumar Raju	3.56.0 Ha	Lr.No.SEIAA- TN/F.No.9901/ToR-1434/2023 Dated:24.04.2023.

The Baseline Monitoring study has been carried out during the period of **March 2023-May 2023** and this EIA and EMP report is prepared for considering cumulative impacts arising out of these projects, 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

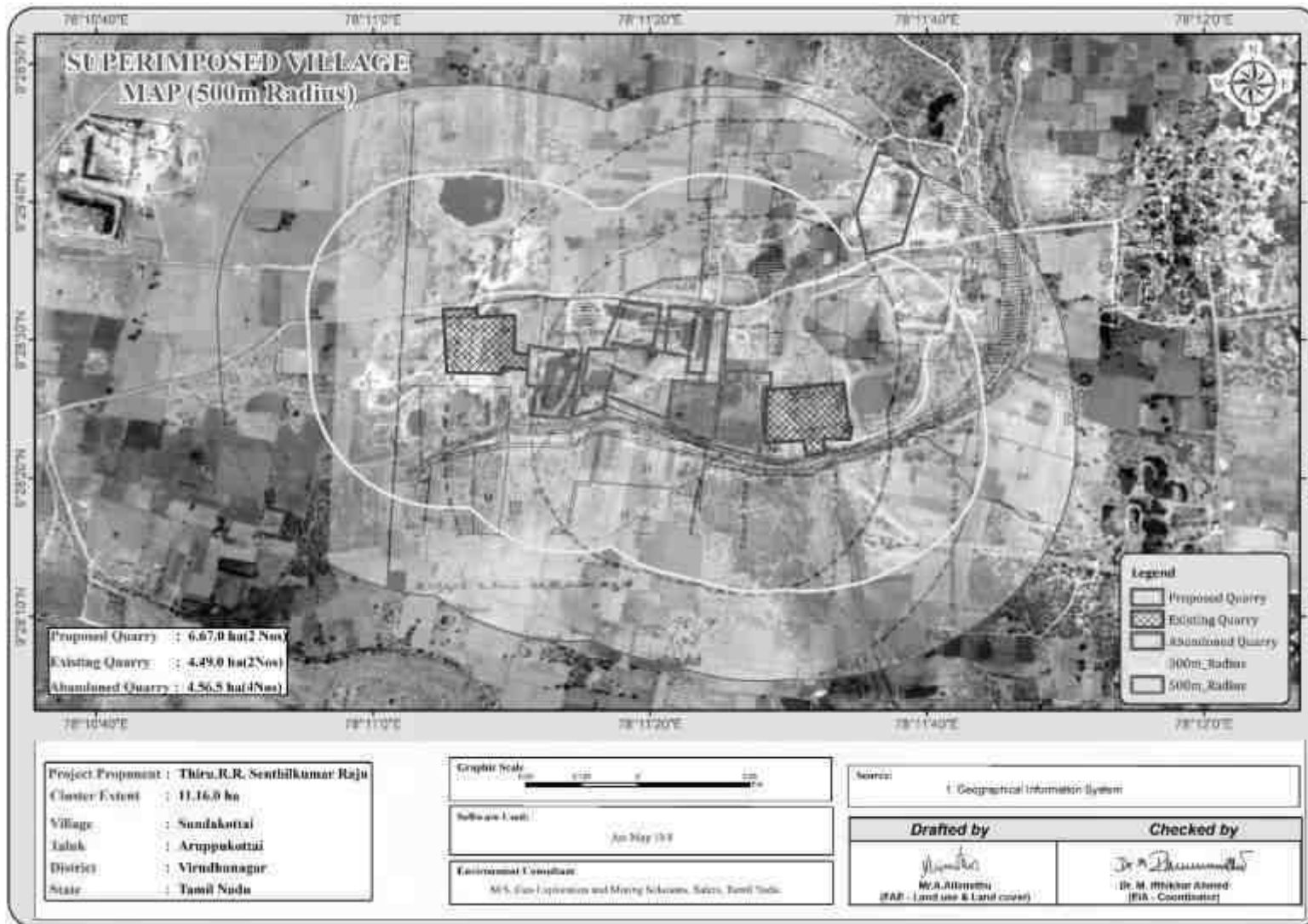
The Ministry of Environment and Forests, Govt. of India, through its EIA notification S.O. 1533(E) of 14thSeptember 2006 and its subsequent amendments as per Gazette Notification S.O. 3977 (E) of 14th August 2018, Mining Projects are classified under two categories i.e., A (> 100 Ha) and B (\leq 100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

P1	
Name of the Project	Thiru.R.R.Senthilkumar Raju Rough stone and Gravel Quarry
S.F. No.	52/8B2, 52/8B3, 53/10, 53/11, 53/12, 53/5B, 53/6, 53/7, 53/8, 53/9, 54/1B2 & 54/1C
Extent	3.56.0 ha
Land Type	Patta Land
Village Taluk and District	Sundakottai Village, Aruppukottai Taluk, Virudhunagar District, Tamil Nadu State

Source: Approved Mining Plan.

1.2.2 Identification of Project Proponent

TABLE 1.2: DETAILS OF PROJECT PROPONENT

P1	
Name of the Company	Thiru.R.R.Senthilkumar Raju
Address	S/o. Raju, No. 33, Guru Illam, V.T.Pandian Nagar, Kariapatti Taluk, Virudhunagar District – 626 106.
Mobile	+91 94878 73305
Aadhaar No	2294 2722 9039
Status	Proprietor

Source: Approved Mining Plan.

1.3 BRIEF DESCRIPTION OF THE PROJECT

1.3.1 Nature and Size of the Project

The quarrying operation is proposed to be carried out by Opencast Mechanized Mining method 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 -P1

Name of the Quarry	Thiru.R.R. Senthilkumar Raju, Rough Stone & Gravel Quarry Project
S.F. No.	52/8B2, 52/8B3, 53/10, 53/11, 53/12, 53/5B, 53/6, 53/7, 53/8, 53/9, 54/1B2 & 54/1C
Extent	3.56.0 ha
Village and Taluk	Sundakottai Village, Aruppukottai Taluk
Land Type	Patta Land
Land Ownership	It is a Patta land, registered in the name of B.Ananya. The applicant has obtained consent from the pattadhar.
Toposheet No	58 - K/03
Latitude between	09°28'24.15"N to 09°28'32.14"N
Longitude between	78°11'14.34"E to 78°11'25.63"E
Highest Elevation	70m AMSL

- ♣ Proposed quarry projects fall in Sundakottai Village, Aruppukottai Taluk, Virudhunagar District, Tamil Nadu State.
- ♣ The entire quarry lease area falls in the Patta land, the lease applied area exhibits flat terrain.
- ♣ The Altitude of the area is **70-72m** (Maximum) above MSL.
- ♣ The area is mentioned in GSI Topo sheet No. **58 – K/03**

FIGURE: 1.2 KEY MAP SHOWING THE LOCATION KEY MAP

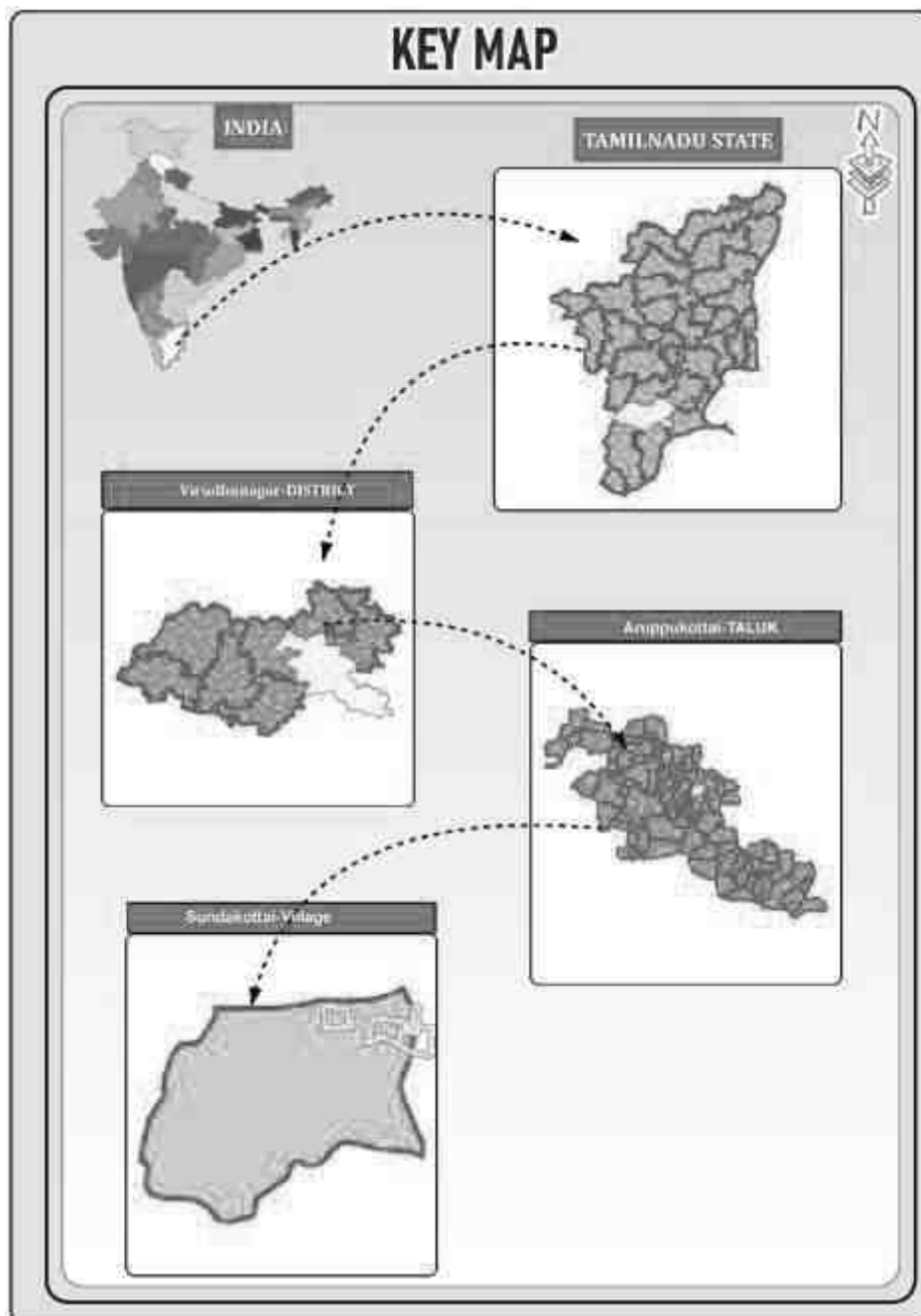


FIGURE 1.3: TOPOSHEET MAP OF THE STUDY AREA 10 KM RADIUS

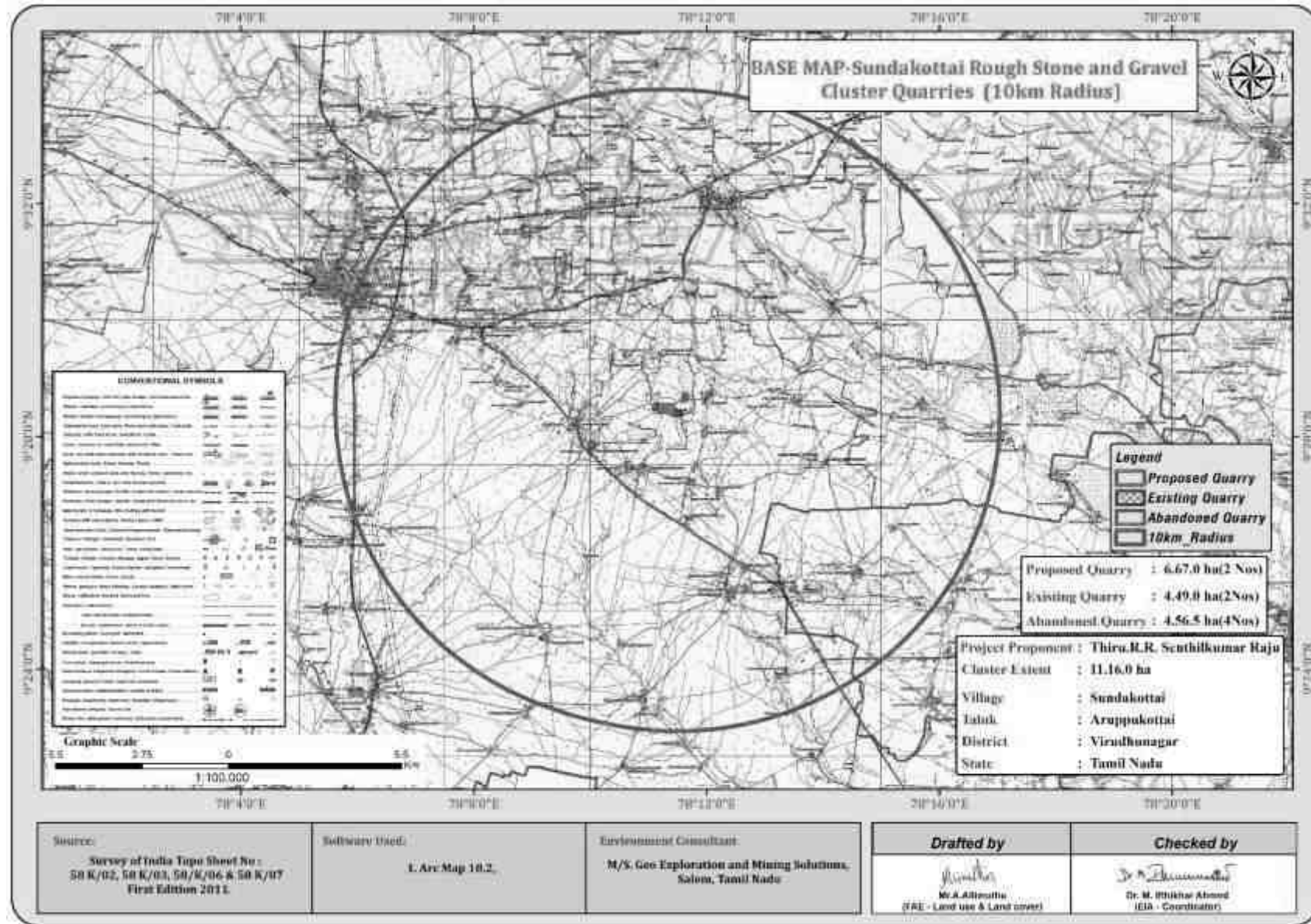
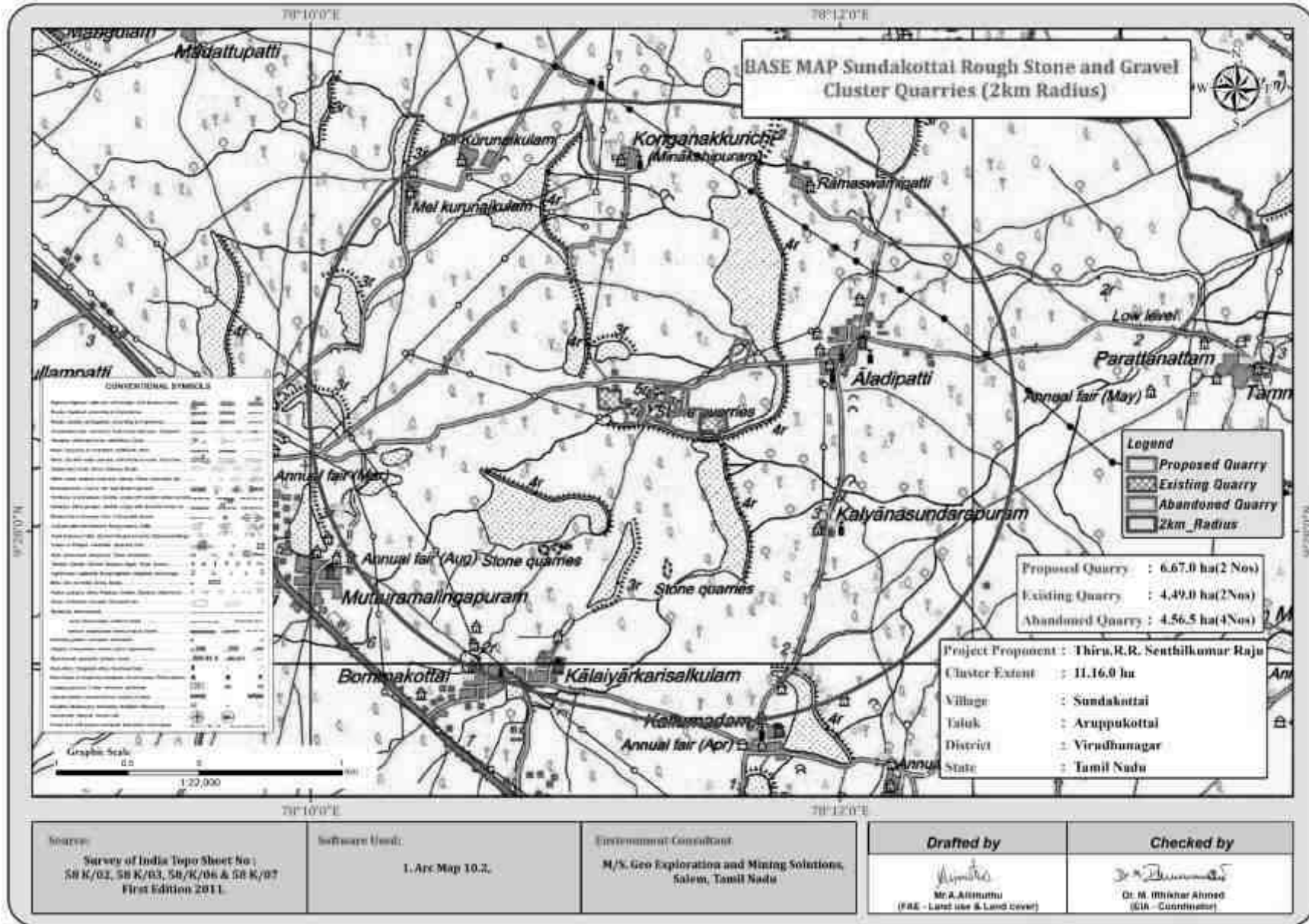


FIGURE 1.4: TOPOSHEET MAP OF THE STUDY AREA 2 KM



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 –P1

- The proponent applied for Rough Stone and Gravel Quarry Lease Dated: **06.01.2022**
- Precise Area Communication Letter was issued by the District Collector, Virudhunagar **Rc.No.KV1/1554/2022-Mines, Dated: 24.01.2023**
- The Mining Plan was prepared by Recognized Qualified Person and approved by Deputy Director, Geology and Mining, Virudhunagar District, Rc.No.KV1/1554/2022-Mines, Dated: 15.02.2023.
- 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 Environmental Clearance vide online Proposal No. SIA/TN/MIN/421586/2023, Dated: 10.03.2023.

SCOPING -P1

- The proposal was placed in 367th SEAC meeting held on 31.03.2023 and the committee recommended for issue of ToR.
- The proposal was considered in 614th SEIAA meeting held on 24.04.2023 and issued ToR vide Lr No. SEIAA-TN/F.No.9901/ToR-1434/2023 Dated:24.04.2023.

PUBLIC CONSULTATION –

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

APPRAISAL

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

The report has been prepared using the following references:

- Guidance Manual of Environmental Impact Assessment for Mining of Minerals, Ministry of Environment and Forests, February, 2010
- EIA Notification, 14thSeptember, 2006
- Lr No. SEIAA-TN/F.No.9901/ToR-1434/2023 Dated:24.04.2023-P1
- Approved Mining Plan.

1.5 TERMS OF REFERENCE (ToR)

Compliance to ToR issued vide –

- Lr No. SEIAA-TN/F.No.9901/ToR-1434/2023 Dated:24.04.2023-P1

Are detailed in Page No. I – XLIX.

1.6 POST ENVIRONMENT CLEARANCE MONITORING

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

1.7 GENERIC STRUCTURE OF EIA DOCUMENT

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

1.8 THE SCOPE OF THE STUDY

The main scope of the EIA study is to quantify the cumulative impact in the study area due to cluster quarries and formulate the effective mitigation measures for 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 2023) 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	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂	Continuous 24-hourly samples twice a week for three months at 9 locations (2 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)	9 locations (2 Core & 7 Buffer) – data monitored once for 24 hours during EIA study
6	Soil Characteristics	Physical and Chemical Parameters	Once at 6 locations during study period
7	Land use	Existing land use for different categories	Based on Survey of India topographical sheet and satellite imagery and primary survey.
8	Socio-Economic Aspects	Socio-economic and demographic characteristics, worker characteristics	Based on primary survey and secondary sources data like census of India 2011.
9	Hydrology	Drainage pattern of the area, nature of streams, aquifer characteristics, recharge and discharge areas	Based on data collected from secondary sources as well as hydro-geology study report prepared.
10	Risk assessment and Disaster Management Plan	Identify areas where disaster can occur by fires and explosions and release of toxic substances	Based on the findings of Risk analysis done for the risk associated with mining.

Source: Onsite Monitoring Data/Sampling by Laboratories, the data has been collected as per the requirement of the ToR issued by SEIAA – TN.

1.8.1 Regulatory Compliance & Applicable Laws/Regulations for Proposed Quarry

- 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.
- Lr No.SEIAA-TN/F.No.9901/ToR-1434/2023 Dated:24.04.2023-P1

2. PROJECT DESCRIPTION

2.0 GENERAL

The Proposed Rough Stone and Gravel Quarry require Environmental Clearance. There are two (2) proposed and two (2) existing quarries forming a cluster; calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016 and the total extent of cluster is 11.16.0 ha.

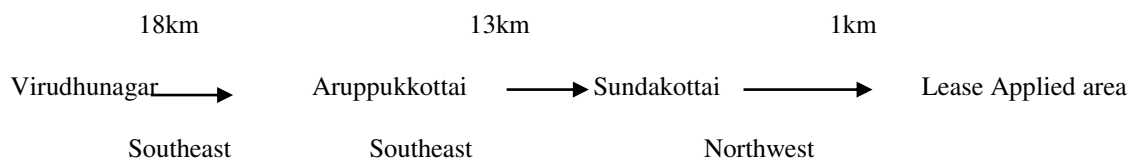
As the extent of cluster are more than 5 ha, the proposal falls under B1 Category as per the Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green Tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No, 186 of 2016 and MoEF & CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: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

2.1 DESCRIPTION OF THE PROJECT

The proposed projects are site specific and there is no additional area required for the 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 and gravel are 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 pit head to the needy crushers and rock breakers to avoid secondary blasting.

2.2 LOCATION OF THE PROJECT

The lease applied area is located about 28km Southeast of Virudhunagar, 11km Southeast of Aruppukkottai and 1km Northwest side of Sundakottai Village.



- ♣ Proposed quarry projects fall in Sundakottai Village, Aruppukkottai Taluk, Virudhunagar District, Tamil Nadu State.
- ♣ The entire quarry lease area falls in the Patta land, the lease applied area is exhibits flat terrain.
- ♣ The Altitude of the area is **70-72m** (Maximum) above MSL.
- ♣ The area is mentioned in GSI Topo sheet No. **58 – K/03**

TABLE 2.1: SITE CONNECTIVITY

Nearest Roadway	NH38-Vellore to Thoothukudi – 9.0km-NW SH47- Parthibanur to Aruppukkottai – 3.0km-SW
Nearest Village	Aladipatti – 900m - NE
Nearest Town	Aruppukkottai – 11.0km-NW
Nearest Railway	Tiruchuli– 7.0 km- NE
Nearest Airport	Madurai - 42Km – NW
Seaport	Thoothukudi-79km – S
Interstate Boundary	Tamilnadu-Kerala -86km-W

Source: Survey of India Toposheet

TABLE 2.2: BOUNDARY CO-ORDINATES OF PROPOSED PROJECT-P1

Boundary Pillar No.	Latitude	Longitude
1	09° 28' 24.34"N	78° 11' 14.34"E
2	09° 28' 25.59"N	78° 11' 14.69"E
3	09° 28' 25.94"N	78° 11' 15.05"E
4	09° 28' 27.32"N	78° 11' 15.18"E
5	09° 28' 28.02"N	78° 11' 15.37"E
6	09° 28' 29.30"N	78° 11' 15.56"E
7	09° 28' 29.17"N	78° 11' 17.58"E
8	09° 28' 29.23"N	78° 11' 17.60"E
9	09° 28' 29.40"N	78° 11' 17.26"E
10	09° 28' 29.71"N	78° 11' 17.35"E
11	09° 28' 28.70"N	78° 11' 22.79"E
12	09° 28' 27.56"N	78° 11' 22.64"E
13	09° 28' 27.47"N	78° 11' 23.92"E
14	09° 28' 32.14"N	78° 11' 24.51"E
15	09° 28' 32.02"N	78° 11' 25.63"E
16	09° 28' 26.60"N	78° 11' 25.10"E
17	09° 28' 26.98"N	78° 11' 21.61"E
18	09° 28' 24.15"N	78° 11' 21.32"E
19	09° 28' 25.96"N	78° 11' 16.74"E
20	09° 28' 25.10"N	78° 11' 16.82"E

Source:Approved Mining Plans

Datum: UTM-WGS84 Zone 44N

FIGURE 2.1: GOOGLE IMAGE OF THE PROJECT-P1



FIGURE 2.2: QUARRY LEASE PLAN / SURFACE PLAN

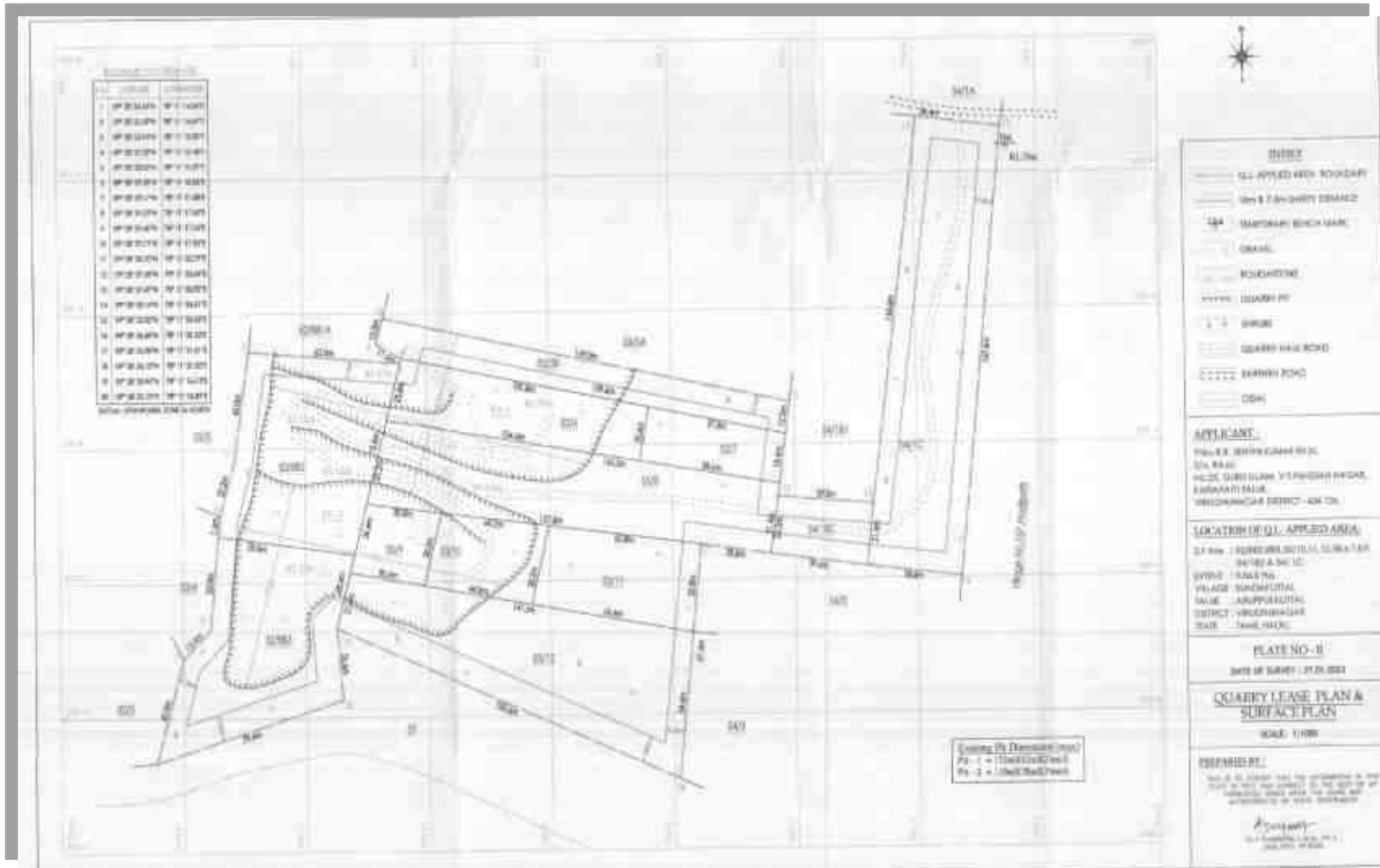


FIGURE 2.3: GOOGLE EARTH IMAGE SHOWING AROUND 500M RADIUS

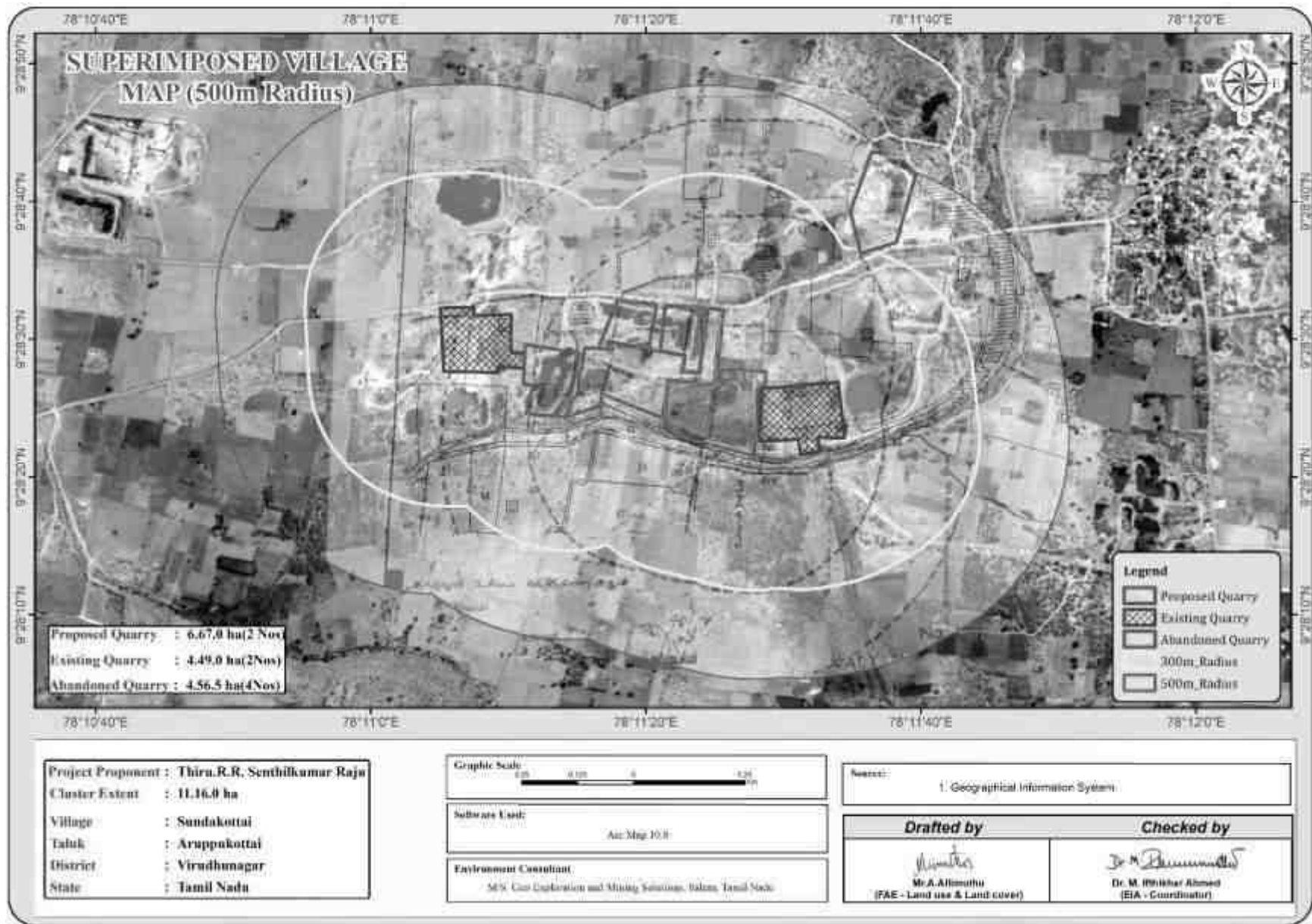


FIGURE 2.4: IMAGE SHOWING SURFACE FEATURES AROUND 10 KM RADIUS

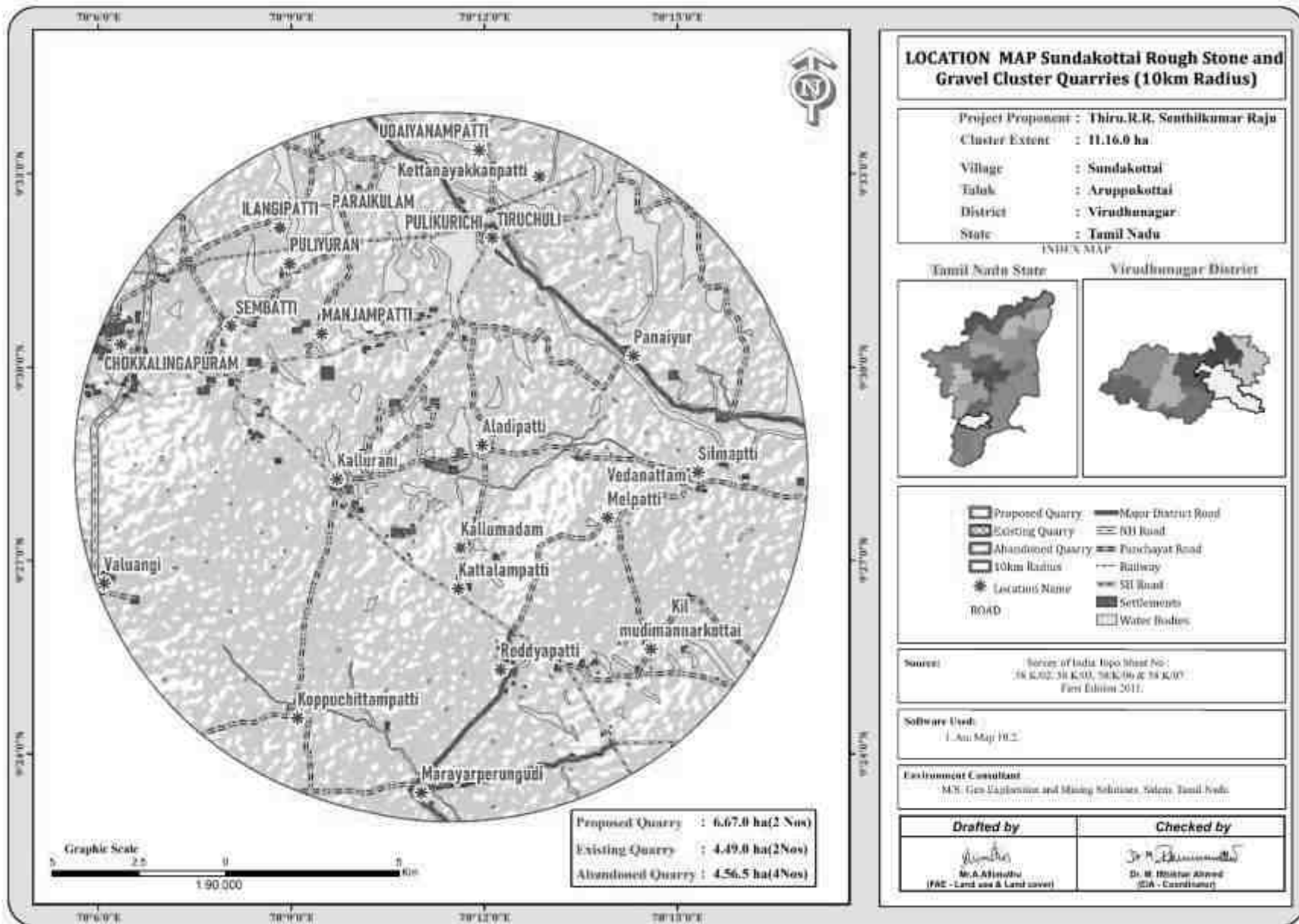


FIGURE 2.5: IMAGE SHOWING SURFACE FEATURES AROUND 5KM RADIUS

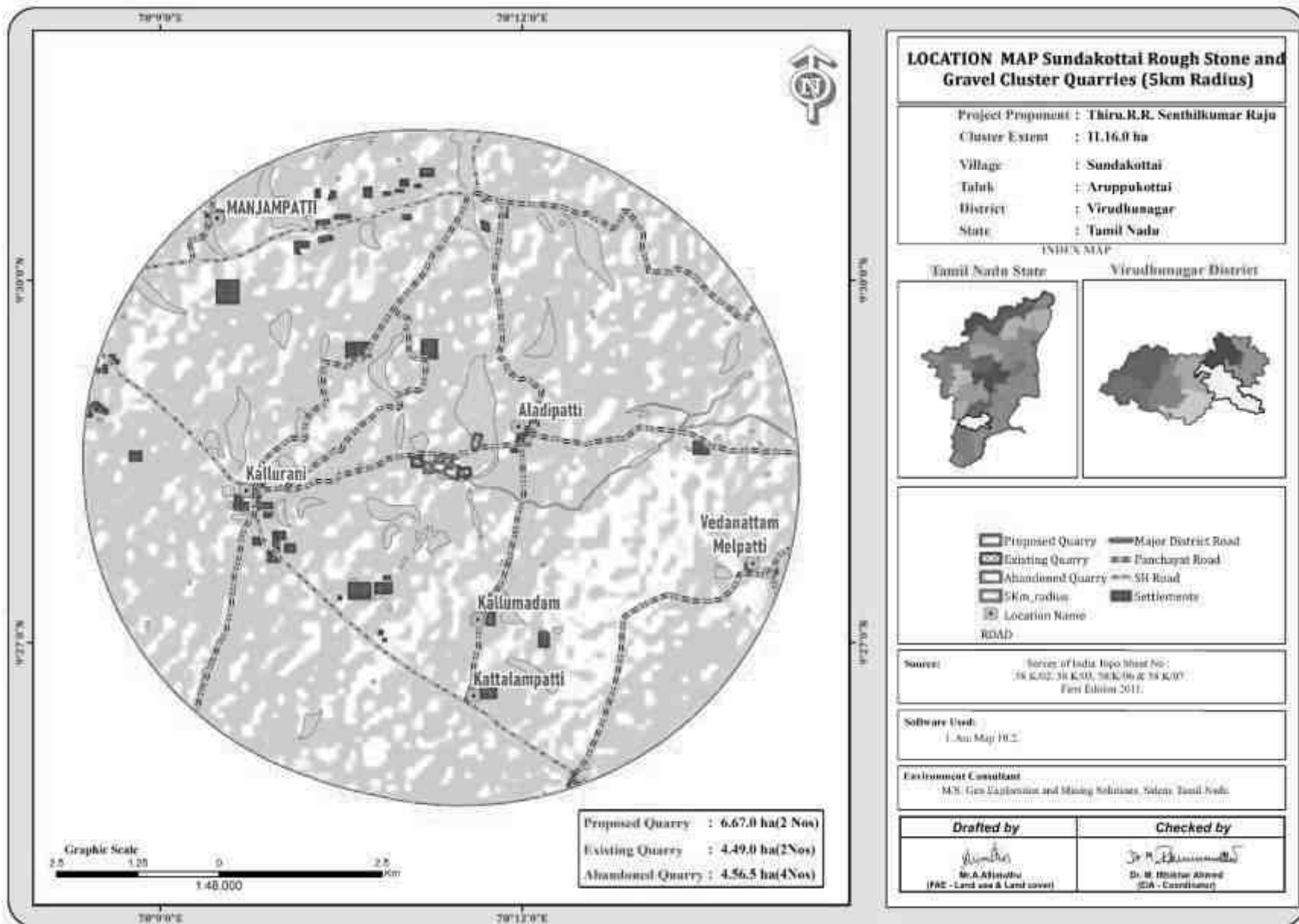
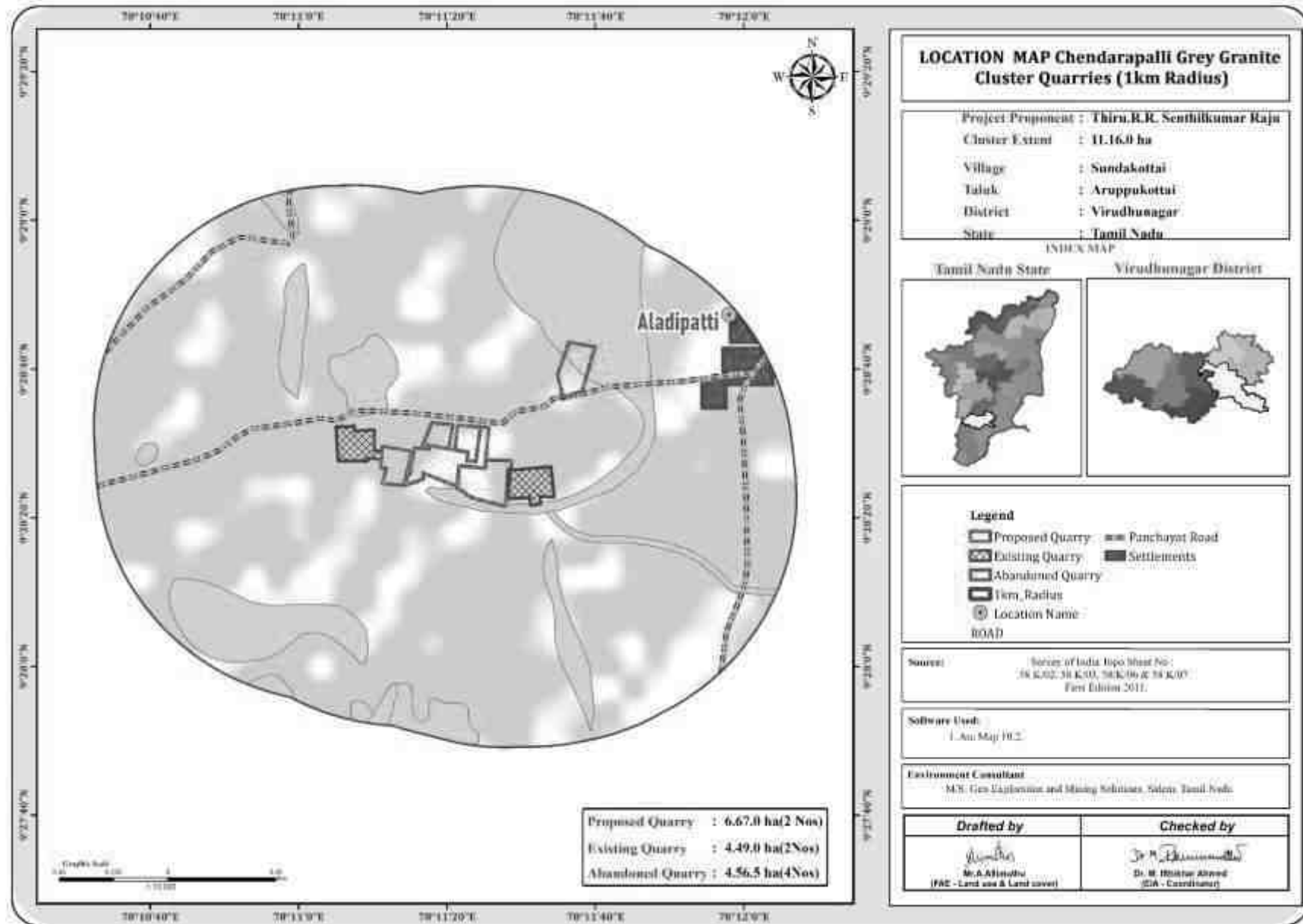


FIGURE 2.6: IMAGE SHOWING SURFACE FEATURES AROUND 1 KM RADIUS



2.2.1 Project Area

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

TABLE 2.3: LAND USE PATTERN OF THE PROPOSED PROJECT -P1

Description	Present area (Ha)	Area at the end of this quarrying period (Ha)
Area under quarrying	1.25.0	2.58.0
Infrastructure	Nil	0.01.0
Roads	0.02.0	0.02.0
Green Belt	Nil	0.27.0
Unutilized Area	2.29.0	0.68.0
Grand Total	3.56.0	3.56.0

Source: Approved Mining Plan

2.2.2 Size or Magnitude of Operation**TABLE 2.4: OPERATIONAL DETAILS FOR PROPOSED PROJECT-P1**

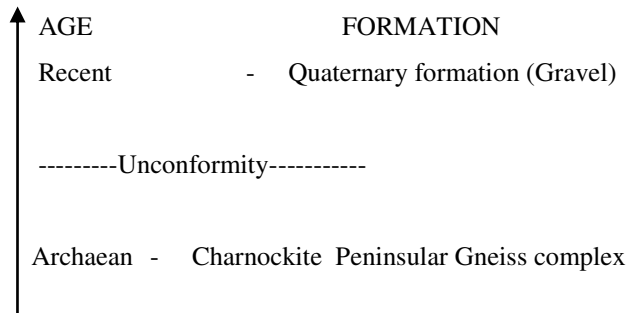
PARTICULARS	DETAILS		
	Rough Stone (5Year Plan period)	Weathered Rock (3 Years Plan period)	Gravel (3 Years Plan period)
Geological Resources in m ³	8,36,460	52,857	35,238
Mineable Reserves in m ³	2,67,915	29,634	23,120
Yearwise reserves in m ³	2,67,915	29,634	23,120
Mining Plan Period	5 Years		
Number of Working Days	300 Days		
Production per day in m ³	179	33	26
No of Lorry loads (6m ³ per load)	30	5	4
Total Depth of Mining	40m (2m Gravel + 3m Weathered Rock + 35m Rough Stone) Bgl.		

Source: Approved Mining Plan

2.3 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 – S40°W with dipping towards SE70°.

Regional stratigraphic sequence:



Geomorphology

Virudhunagar district is bordered by Western Ghats (Ridge and valley complex) in the West. Vally fill area is observed in Watrap block. A major part of the district constitutes a plain terrain with a gentle slope toward East and Southeast, except for the hilly terrain in the west. The prominent geomorphic units identified in the district through interpretation of Satellite imagery are; 1. Flood Plain, 2. Bazada, 3. Pediment, 4. Shallow & deep buried Pediments and 6. Structural Hills.

Source: http://cgwb.gov.in/District_Profile/TamilNadu/Virudhunagar.pdf

The district is divisible into three geomorphological units viz the western most hill ranges (denudational hills of Western Ghats), uplands (pediments) and the plains (pediplains). The hill ranges rise upto 2019 meters above mean sea level at Kottaimalai. The other notable hill is Andipatti hill with a NE-SW trend, in the northwestern part of the district. The Vaippar and Gundar rivers which flow to the east are ephemeral streams. The drainage pattern is subdendritic.

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. The lease applied area is exhibits flat terrain. The area has gentle

sloping towards southeastern side. The maximum altitude of the area is 72m above Mean Sea level. The area is covered by the Gravel which is maximum thickness of 2m depth. Massive Charnockite is found after 2m (Gravel formation) which is clearly inferred from the existing quarry pits in the cluster.

2.3.3 Hydrogeology

Virudhunagar district is underlain entirely by Archaean Crystalline formations with Recent alluvial deposits occurring along the river and streams courses. Weathered, fissured and fractured crystalline rock sand there centalluvial deposits constitute the important aquifer systems in the district. The hard consolidated crystalline rocks of Archaean age represent weathered, fissured and fractured formations of gneisses, granites, charnockites and other associated rocks. The Specific capacity of large diameter wells tested in crystalline rocks from 31 to 200 lpm / m. of drawdown. The yield characteristics of wells vary considerably depending on the topographic set-up, lithology and the degree of weathering.

Source: <https://Virudhunagar.nic.in/departments/geology-mining/>



FIGURE 2.7: REGIONAL GEOLOGY MAP

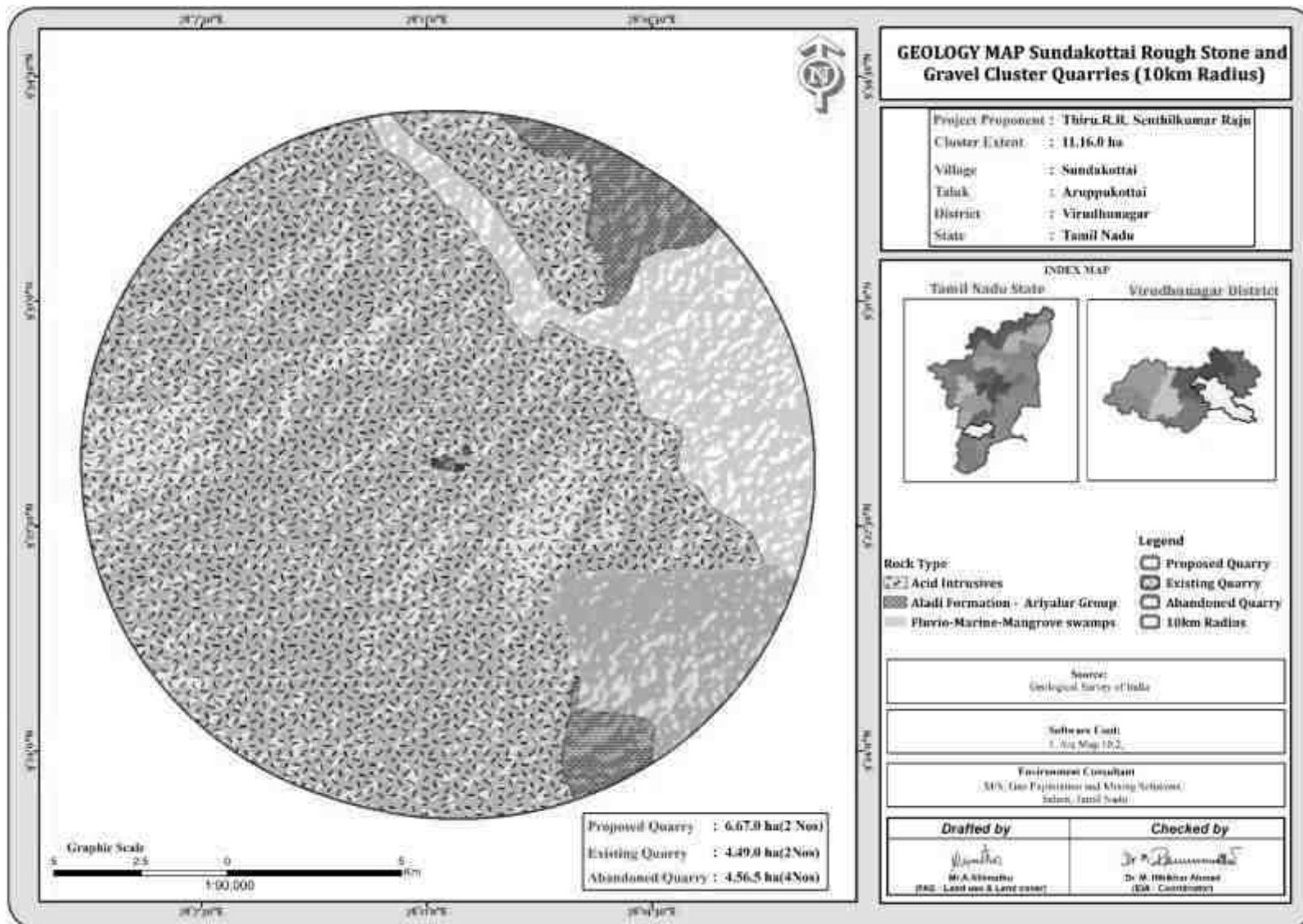
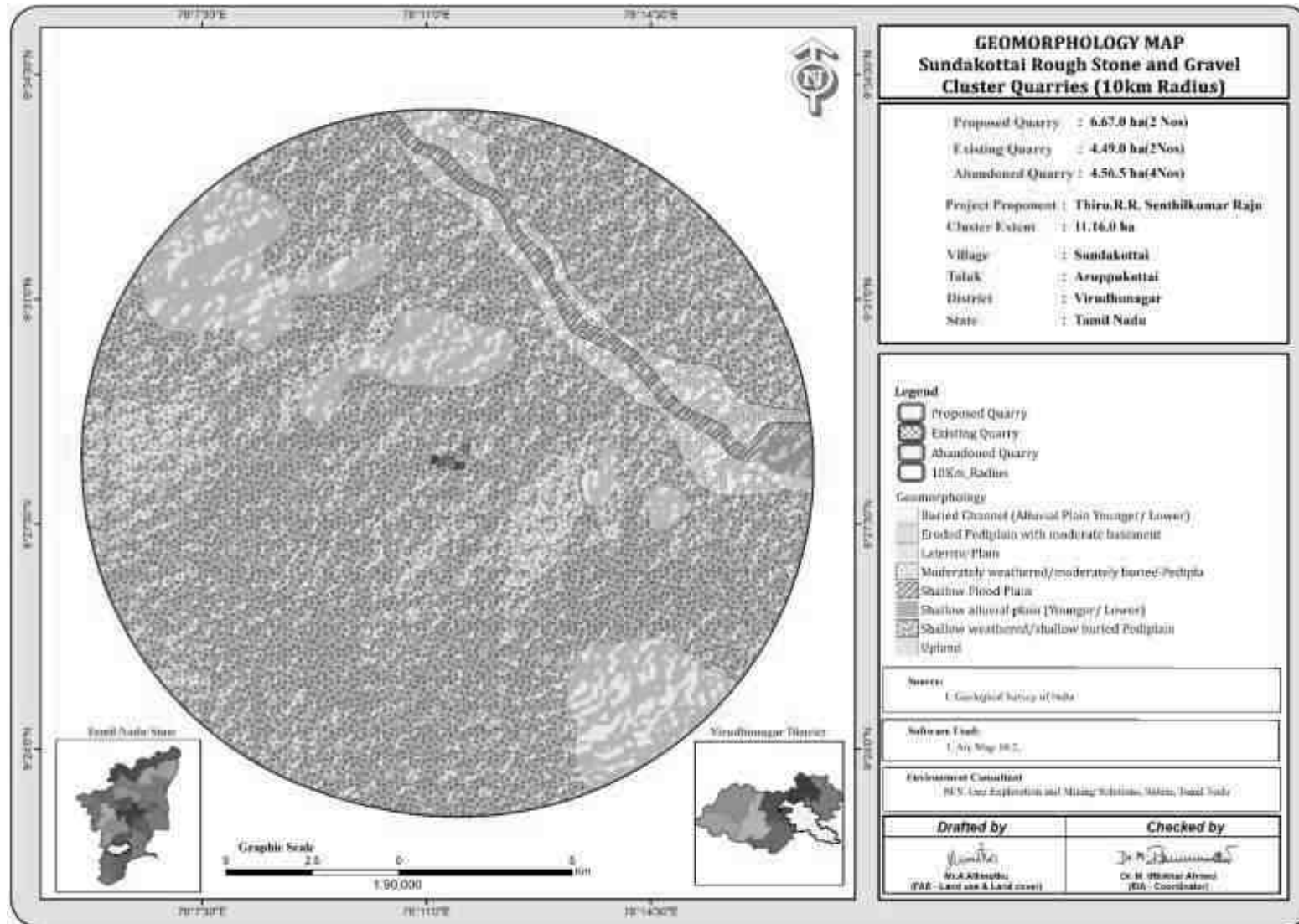


FIGURE 2.8: GEOMORPHOLOGY MAP



2.4 RESOURCES AND RESERVES

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

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

TABLE 2.5: AVAILABLE GEOLOGICAL RESOURCES OF PROPOSED PROJECT-P1

Description	Rough Stone in m ³	Weathered Rock in m ³	Gravel in m ³
Geological Resource in m ³	8,36,460	52,857	35,238
Mineable Resource in m ³	2,67,915	29,634	23,120

Source: Approved Mining Plan

TABLE 2.6: YEAR-WISE PRODUCTION PLAN-P1

Year	Rough Stone in m ³	Weathered Rock in m ³	Gravel in m ³
1 st	49525	7995	5984
2 nd	43675	15549	11096
3 rd	53025	6090	6040
4 th	51340	-	-
5 th	70350	-	-
Total	267915	29634	23120

Source: Approved Mining Plan

Disposal of Waste

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

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.

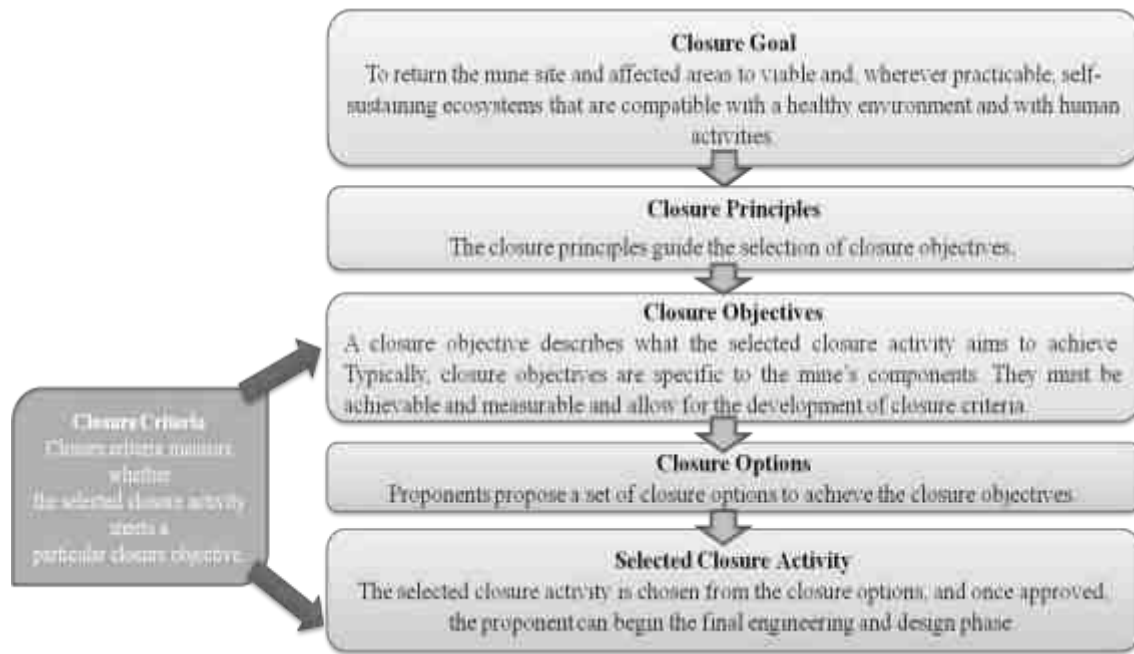
TABLE 2.7 ULTIMATE PIT DIMENSION -P1

Pit	Length (Max) (m)	Width (Max) (m)	Depth (Max)
Pit1	122	204	40m bgl
Pit 2	153	22	5m 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.



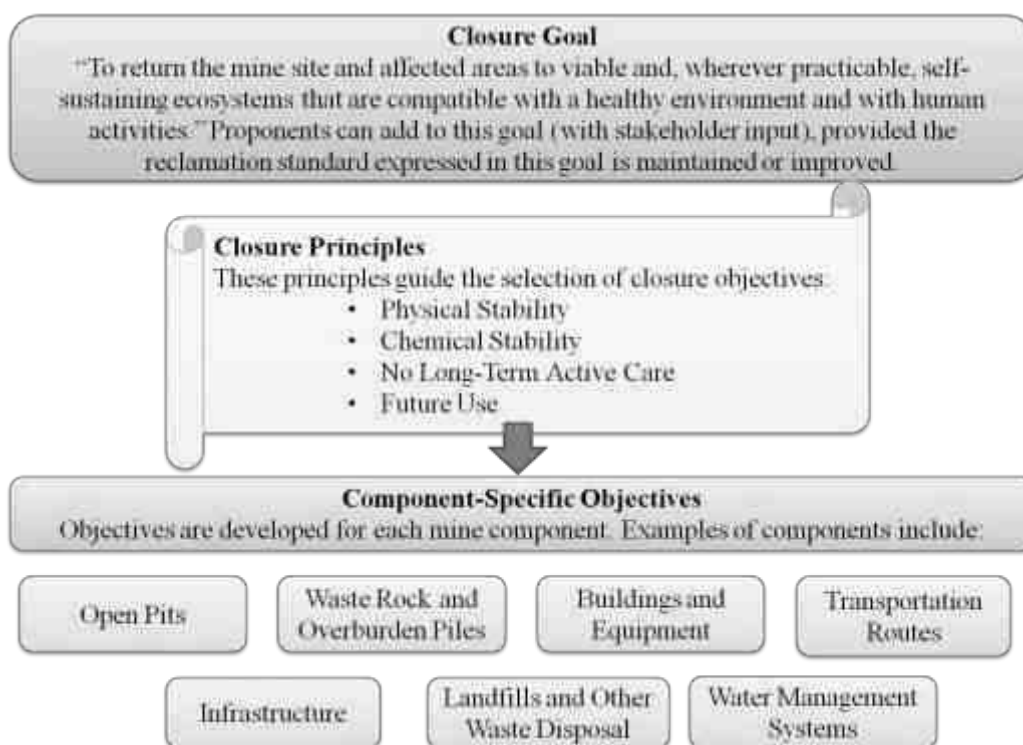
Closure Objectives –

- 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

- 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 2.8: MINE CLOSURE BUDGET-P1

ACTIVITY		YEAR					RATE	AMOUNT (INR)
		I	II	III	IV	V		
Plantation under safety zone	Nos.	60	60	60	60	60		Rs.30,000/-
	Cost	6000	6000	6000	6000	6000		
Plantation cost in the quarried out top benches, approach road and panchayat road	Nos.	100	100	100	100	100	@ 100 Rs Per sapling	Rs.50,000/-
	Cost	10000	10000	10000	10000	10000		
Wire Fencing (In Mtrs) 1260		3,78,000	-	-	-	-	@ 300 Rs Per Meter	Rs.3,78,000/-
Garland drain (In Mtrs) 1180		3,54,000	-	-	-	-	@ 300 Rs Per Meter	Rs.3,54,000/-
TOTAL								Rs.8,12,000/-

Source: Proposed by FAE's and EC

2.5 METHOD OF MINING

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

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

2.5.1 Drilling & Blasting Parameters

Diameter of hole – 32 mm 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

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 2.9 PROPOSED MACHINERY DEPLOYMENT-P1

S.NO.	TYPE	NOS	SIZE/CAPACITY	MOTIVE POWER
1	Jack hammers	7	1.2m to 2.0m	Compressed air
2	Compressor	2	400psi	Diesel Drive
3	Excavator with Bucket / Rock Breaker	2	300 HP	Diesel Drive
4	Tipplers	3	20 Tonnes	Diesel Drive

Source: Approved Mining Plan

2.6 GENERAL FEATURES

2.6.1 Existing Infrastructures

Infrastructures like Mine office, Temporary Rest shelters for workers, Latrine and Urinal Facilities will be constructed as per the Mine Rule after the grant of quarry lease 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 Panchayat Road. - Sundakottai to Kuppampalayam Road on Southwest Side of the Cluster and Major District road - K. Paramathi to Athipalayam Road on North East Side.

Traffic density measurements were performed at two locations

1. Kamudi to Aruppukottai Road -West side
2. Tamilpadi to Kalayarkarisalkulam Road – North East side

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.2.10: TRAFFIC SURVEY LOCATIONS

Station Code	Road Name	Distance and Direction	Type of Road
TS1	Kamudi-Aruppukotta & SH Road	3.5km West	SH Road
TS2	Tamilpadi-Kalayarkarisalkulam & Panchayat Road	1.5 km North East	Panchayat Road

Source: On-site monitoring by GEMS FAE & TM

TABLE 2.11: EXISTING TRAFFIC VOLUME

Station code	HMV		LMV		2/3 Wheelers		Total PCU
	No	PCU	No	PCU	No	PCU	
TS1	140	420	120	120	280	140	680
TS2	60	240	80	80	190	95	415

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 & GRAVEL HOURLY TRANSPORTATION REQUIREMENT

Transportation of Rough Stone & Gravel per day		
Capacity of trucks	No. of Trips per day Cumulatively	Volume in PCU
10 tonnes	15	15

Source: Data analysed from Approved Mining Plan

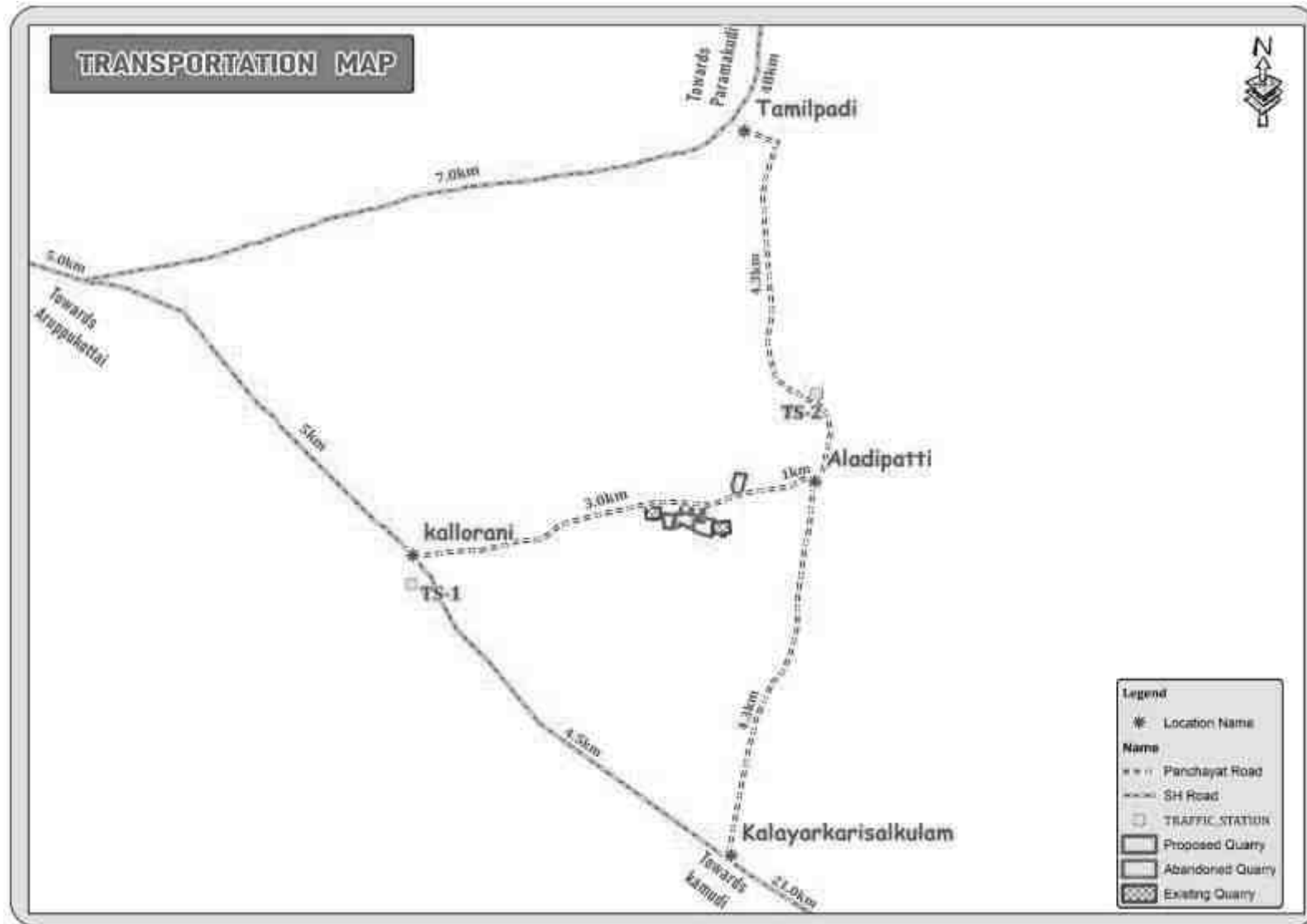
TABLE 2.12: SUMMARY OF TRAFFIC VOLUME

Route	Existing Traffic volume in PCU	Incremental traffic due to the project	Total traffic volume	Hourly Capacity in PCU as per (IRC – 1960 Guidelines)
Kamudi-Aruppukotta	680	14	694	1800
Tamilpadi-Kalayarkarisalkulam	415	14	429	1200

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

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

FIGURE.2.11: MINERAL TRANSPORTATION ROUTE MAP



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 2.13: WATER REQUIREMENT FOR THE PROJECT-P1

*Purpose	Quantity	Source
Dust Suppression	0.4 KLD	From Existing bore wells from nearby area
Green Belt development	1.0 KLD	From Existing bore wells from nearby area
Domestic purpose	0.6 KLD	From existing, bore wells and drinking water will be sourced from Approved water vendors.
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 projects require 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 for -P1

High speed Diesel (HSD) will be used for quarrying machineries. Diesel will be brought from nearby Fuel Stations.

1.Gravel:

Per hour Excavator will consume	=	10 liters / hour
Per hour Excavator will excavate	=	60m ³ of Gravel
Gravel quantity	=	23,120/60 = 385hours
Diesel consume	=	385hours x 10 liters
Total diesel consumption	=	3850Liters of HSD will be utilized for Gravel

2.Weathered rock:

Per hour Excavator will consume	=	10 liters / hour
Per hour Excavator will excavate	=	60m ³ of Gravel
Weathered rock quantity	=	29,634/60 = 494hours
Diesel consume	=	494hours x 10 liters
Total diesel consumption	=	4940Liters of HSD will be utilized for Weathered rock

3. Rough stone:

Per hour Excavator will consume	=	16 liters / hour
Per hour Excavator will excavate	=	20m ³ of Rough stone

Rough stone quantity	= 2,67,915/20 = 13,396hours
Diesel consume	= 13,396hours x 16 liters
Total diesel consumption	= 2,14,336 Liters of HSD will be utilized for Rough stone
Total diesel consumption	= 2,23,126 Liters of HSD will be utilized for entire project life.

2.7.4 Project Cost

TABLE 2.14 PROJECT COST OF PROPOSED PROJECTS-P1

Project Cost	Rs.66,68,000/-
---------------------	----------------

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 2.15: PROPOSED MANPOWER DEPLOYMENT -P1

Sno	Employment	No.of persons
1	Mines Manager/Mines Foreman	1
2	Mate/Blaster	1
3	Jack hammer operator	14
4	Excavator Operator & Driver	2+3
5	Security	1
6	Labour & Helper	3
7	Cleaner & Co-operator	5
	Total	30

Source: Approved Mining Plans of respective Project

2.9 PROJECT IMPLEMENTATION SCHEDULE

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

TABLE 2.16: 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 Establish						Project Establishment Period
3	Consent to Operate						Production Start Period
Time line may vary; subjected to rules and regulations /& other unforeseen circumstances							

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

3. DESCRIPTION OF ENVIRONMENT

3.0 GENERAL

This chapter presents a regional background to the baseline data at the very onset, which will help in better appreciation of micro-level field data, generated on several environmental and ecological attributes of the study area. The baseline status of the project environment is described section wise for better understanding of the broad-spectrum conditions. The baseline environment quality represents the background environmental scenario of various environmental components such as Land, Water, Air, Noise, Biological and Socio-economic status of the study area. Field monitoring studies to evaluate the base line status of the project site were carried out covering **March, April and May 2023** with CPCB guidelines. Environmental data has been collected with reference to cluster quarries by **EHS 360 Labs Private Limited**, – An accredited by ISO/IEC 17025:2017 (NABL) Laboratory, for the below attributes –

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

Study Area

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

Study Period

The baseline study was conducted during the Summer season i.e., March to May 2023

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 NRSC-Bhuvan, Hyderabad.
- 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's from census handbook 2011 and from the satellite imagery	Study Area	Satellite Imagery Primary Survey
*Soil	Physio-Chemical Characteristics	Once during the study period	6 (1 core & 5 buffer zone)	IS 2720 Agriculture Handbook - Indian Council of Agriculture Research, New Delhi
*Water Quality	Physical, Chemical and Bacteriological Parameters	Once during the study period	6 (1 surface water & 5 ground water)	IS 10500& CPCB Standards
Meteorology	Wind Speed Wind Direction Temperature Cloud cover Dry bulb temperature Rainfall	1 Hourly Continuous Mechanical/Automatic Weather Station	1	Site specific primary data& Secondary Data from IMD Station
*Ambient Air Quality	PM ₁₀ PM _{2.5} SO ₂ NO _x Fugitive Dust	24 hourly twice a week (Mar to May 2023)	9 (2core & 7 buffer)	IS 5182 Part 1-23 National Ambient Air Quality Standards, CPCB
*Noise Levels	Ambient Noise	Hourly observation for 24 Hours per location	9 (2 core & 7 buffer zone)	IS 9989 As per CPCB Guidelines
Ecology	Existing Flora and Fauna	Through field visit during the study period	Study Area	Primary Survey by Quadrate & Transect Study Secondary Data – Forest Working Plan
Socio Economic Aspects	Socio–Economic Characteristics, Population Statistics and Existing Infrastructure in the study area	Site Visit & Census Handbook, 2011	Study Area	Primary Survey, census handbook & need based assessments.

Source: On-site monitoring/sampling by **EHS 360 Labs Private** Limited, in association with GEMS

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

3.1 LAND ENVIRONMENT

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

3.1.1 LAND USE/ LAND COVER

To study the land use pattern of the core as well as a buffer zone, land use/land cover details have been identified/ maps have been prepared in accordance with the **Standard ToR point no. 4 & 10 Stating:**

Point No. 4 All corner coordinates of the mine lease area, superimposed on a High-Resolution Imagery/ 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).

Point No. 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.

Current vintage data of Indian Remote Sensing Satellite ResourceSat-2A L4FMX (False Color Composite) has been used for Land Use / Land Cover study. Satellite image has been procured from National Remote Sensing Centre, Hyderabad.

3.1.2 OBJECTIVE

The objectives of the LULC study are as follow:

- ☞ To develop the Land use & Land cover map using land coordinates of the Quarry area (Core Zone) and 10 km radius from the quarry area (Buffer area).
- ☞ To Identify and mark the important Land use and Land cover features using the primary and secondary data collected.
- ☞ To evaluate the impacts on existing land use/cover features of the buffer area by the Proposed Project activities.
- ☞ To identify the mitigative measures for the sustainable use of land and to protect the buffer zone from the adverse impacts.

Technical specification of Satellite imagery Data Used:

Current vintage data of Indian Remote Sensing Satellite RESOURCESAT1 (LISS-III) digital FCC (False Color Composite) has been used for preparation of Land use/ Land cover thematic map of study area. Satellite image has been procured from National Remote Sensing Centre, Hyderabad. Survey of India Toposheet as a reference map on 1:50,000 scale has been used for preparation of base layer data like road, rail network; village for geo-referencing of satellite image.

- ☞ Satellite Image - Resourcesat1-LISSIII, 23.5m Resolution
- ☞ Satellite Data Source - NRSC, Hyderabad
- ☞ Satellite Vintage - 14st July 2020, Swath 141km wide.
- ☞ SOI Toposheet No - 57 F/13
- ☞ Software Used - ArcGIS 10.8

The satellite image (FCC color 3,2,1) of the buffer zone is given in 3.1

The spatial resolution and the spectral bands in which the sensor collects the remotely sensed data are two important parameters for any land use survey. Resourcesat1-LISSIII, 23m Resolution of 23.5m and a 141 km wide swath of the earth in 23.5m resolution covering wide areas the data is collected in 4 visible bands namely band number and Resolution.

TABLE 3.2: Resourcesat1-LISSIII SENSOR characteristics

Band Number	Description	Wavelength	Resolution
Band 1	Green	0.52-0.59 μm	23.5 meters
Band 2	Red	0.62-0.68 μm	23.5meters
Band 3	NIR	0.77-0.86 μm	23.5meters
Band 4	SWIR	1.55-1.70 μm	70meters

Source: NRSC, Hyderabad

3.1.3 METHODOLOGY

The land use / land cover map is prepared by adopting the interpretation techniques of the Satellite image in combination with collateral data such as Survey of India topographical maps. Image classification is done by using visual interpretation techniques and digital classification using any of the image processing software. The various activities for preparation of LULC include preprocessing, rectification, image enhancements and classifying the satellite data for assessing the change in land use land cover due to proposed developmental activities.

- ☞ Preliminary/primary data collection of the study area
- ☞ Satellite data procurement from NRSC
- ☞ Secondary data collection from authorized bodies
- ☞ Survey of India Toposheet (SOI)
- ☞ Mine Layout
- ☞ Cadastral / Khasra map
- ☞ GPS Coordinates of Lease Boundary
- ☞ Processing of satellite data using ArcGIS 10.8 and preparing the Land Use & Land cover maps (e.g. Plant/Mine area, Existing Quarries, Settlements, Agriculture land, Non agriculture land, water bodies, etc.) by Digital Image Processing (DIP) technique.
- ☞ Geo-Referencing of the Survey of India Toposheet
- ☞ Geo-Referencing of satellite Imagery with the help of Geo-Referenced Toposheets
- ☞ Enhancement of the Satellite Imagery
- ☞ Base Map layer creation (Roads, Railway, Village Names, and other Secondary data, etc.)

- ∞ Data analysis and Classification using Digital interpretation techniques.
- ∞ Ground truth studies or field Verification.
- ∞ Error fixing / Reclassification
- ∞ Final Map Generation.

The land use/Land cover Map of the buffer zone is given in 3.4(b).

Land Use Pattern of the Buffer Zone (Study area),

Details of the same are given in Table - 3.3 and the map is shown in Figure - 3.2

TABLE: 3.3 LAND USE / LAND COVER DETAILS OF STUDY AREA

S.No	CLASSIFICATION	AREA_HA	AREA_%
BUILTUP			
1	URBAN	822.13	2.45
2	RURAL	361.39	1.08
3	MINING	175.22	0.52
AGRICULTURAL LAND			
4	CROP LAND	18024.19	53.80
5	PLANTATION	1028.99	3.07
6	FALLOW LAND	10310.15	30.78
BARREN/WASTE LANDS			
7	SCRUB LAND	365.52	1.09
	SALT AFFECTED AREA	677.97	2.02
	SANDY AREA	34.20	0.10
WETLANDS/ WATER BODIES			
8	WATER BODIES/LAKE/RIVER	1700.03	5.07
TOTAL		33499.79	100.00

Source: Bhuvan, NRSC.

FIGURE 3.1: CHART SHOWING LANDUSE/LANDCOVER ANALYSIS USING LISS III DATA

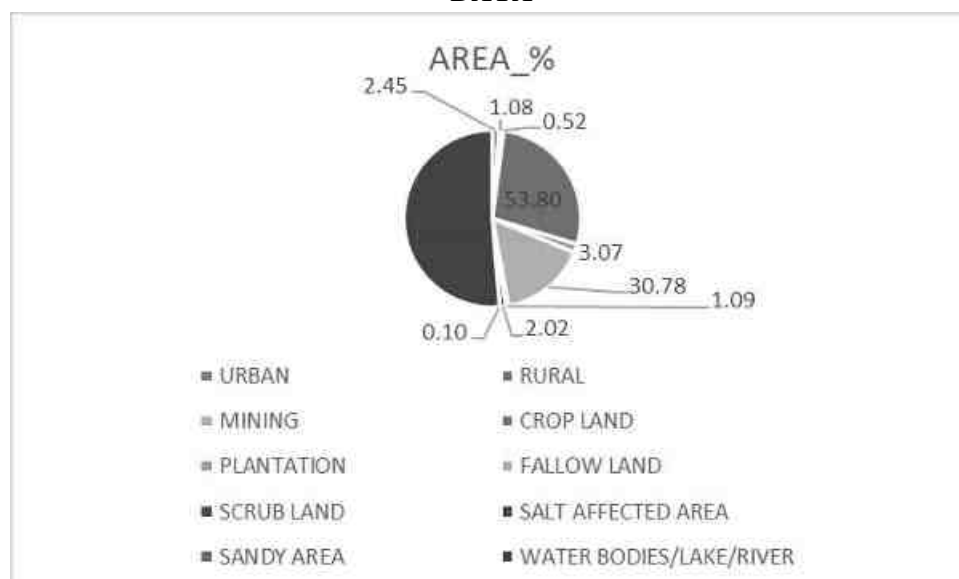


FIGURE 3.2: MAP SHOWING FALSE COLOR COMPOSITE (3,2,1) SATELLITE IMAGERY OF THE STUDY AREA

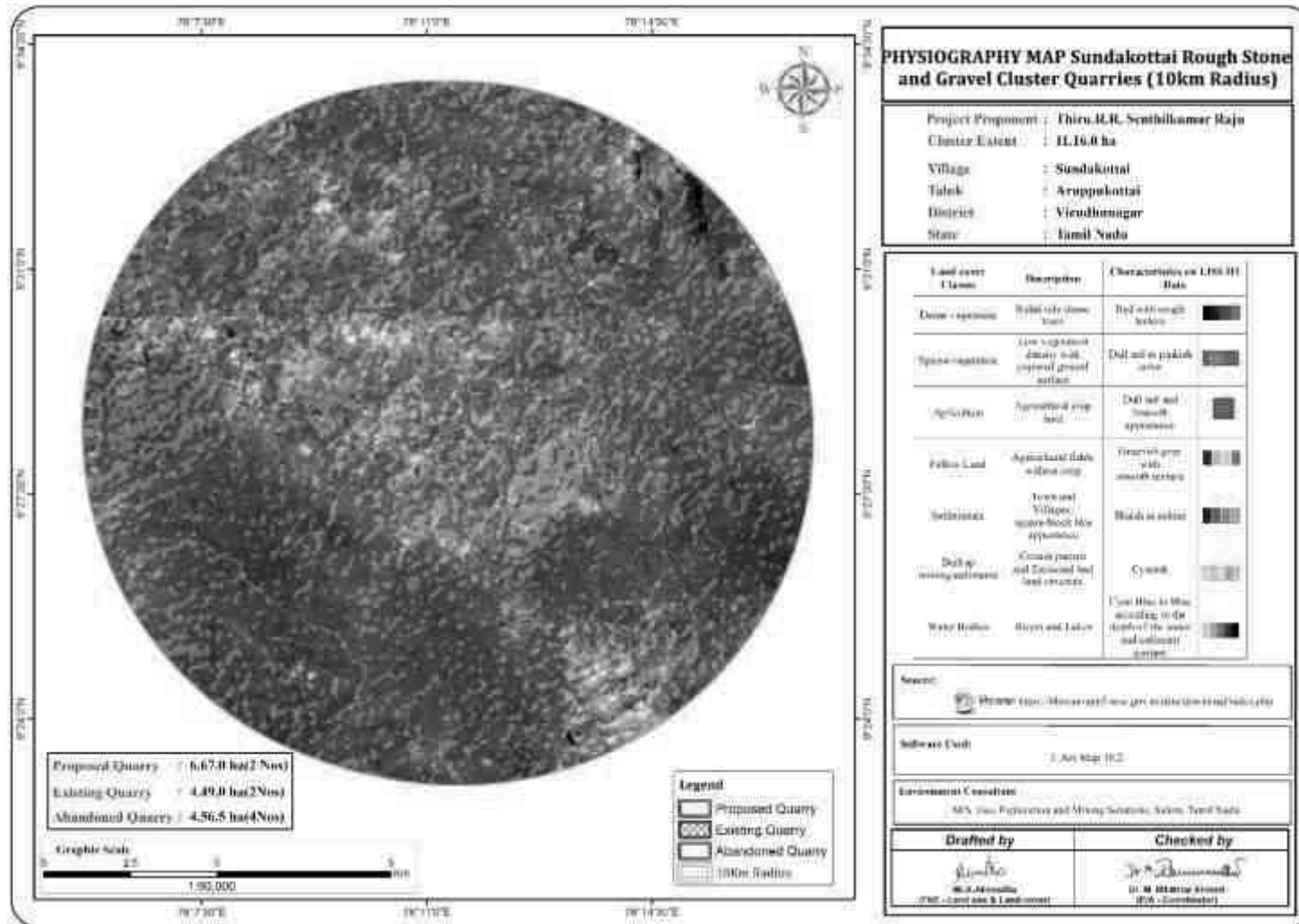
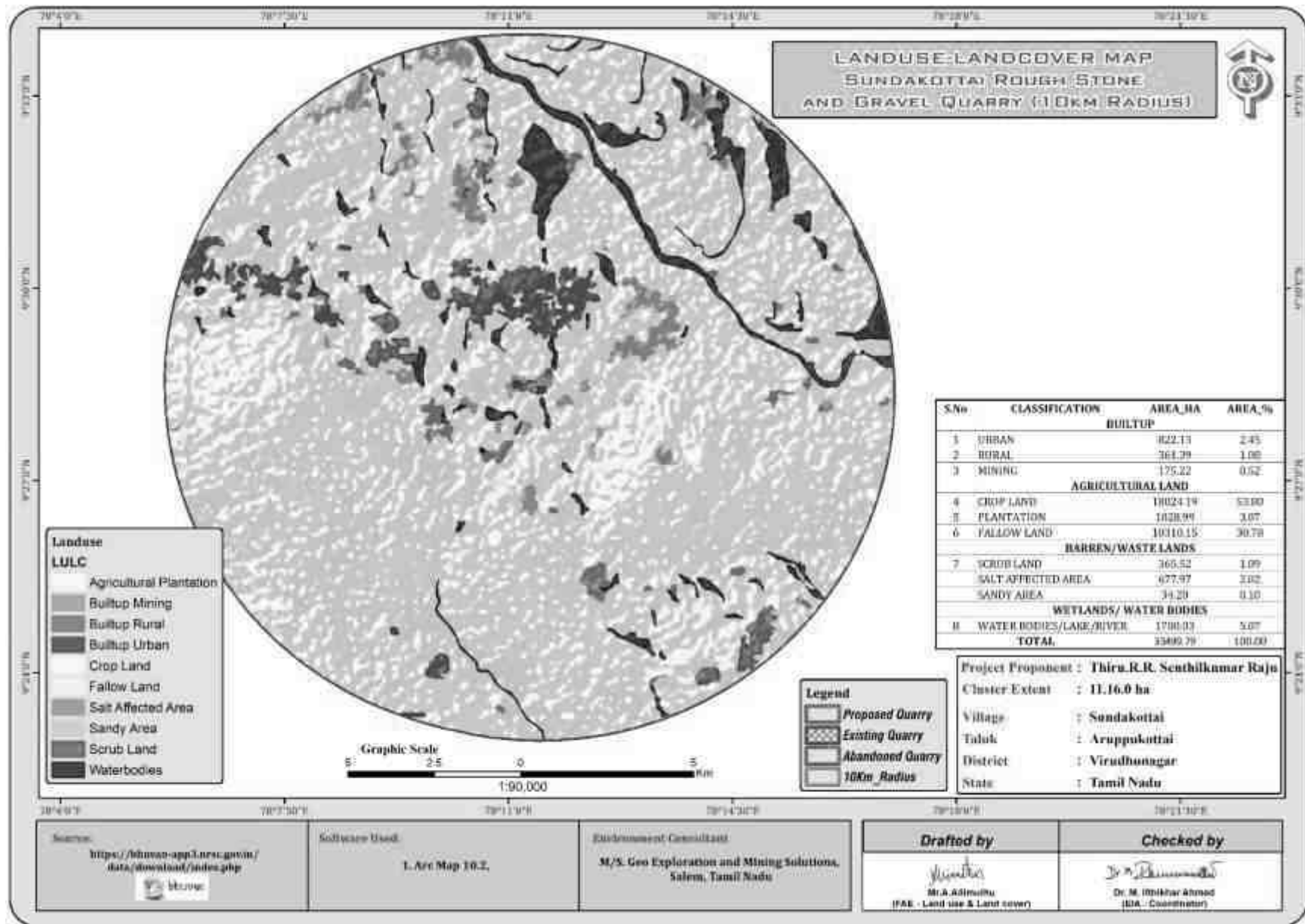


FIGURE 3.3: LAND USE LAND COVER MAP 10KM RADIUS



3.1.4 Interpretation

- ☞ The 10 km radius study area mainly comprises of crop land & Agriculture Plantation land accounting of 40.52% & 0.27% of the total study area. The study area also consists of fallow land of 44.33%.
- ☞ The buffer zone studied has no ecological sensitive area (National Park, Wildlife Sanctuary, Biosphere Reserve/ etc.).
- ☞ Water Bodies such as ponds/ lakes comprises of 0.57% of the total buffer area. The two seasonal rivers such as Noyyal river at 5 Km in NW direction, Canal 1km in NE and Aathupalayam dam at 9.5km in NW direction of the total study area.
- ☞ The Scrub land accounts of 1.04%. As per the primary survey, it was observed the scrub land is mainly occupied by the stony waste and left-over domestic waste generated by the nearby areas.
- ☞ 2.39% of the total study area is occupied by mines. The area occupied by Mainly Roughstone and gravel of the total buffer area. As also observed within the primary survey, the 10 km buffer area is also occupied by the medium scaled granite and small Brick kiln industries also located in the study area.
- ☞ 7% of the area is covered under the Builtup Land. The nearest village within the 3 km radius from the project site boundary is observed to be villages Sundakottai, Kuppampalayam, K. Paramathi etc.,

3.1.5 Cropping Pattern of the Buffer Zone

The principal crops of the district are paddy, millets, pulses, oilseeds, sugarcane and banana. The major paddy area is in Kulithalai and Krishnarayapuram taluks. Pulses are grown in rice fallow areas. In uplands millets like sorghum, pearl millet pulses such as red gram, horse gram oilseeds such as groundnut, gingelly and sunflower are grown both under irrigated and rain fed conditions.

Horticultural area of the Virudhunagar district was 16000.00 Ha. In general, Virudhunagar district has specifically known for Moringa and Banana cultivation and other prominent crops under cultivation are Tapioca, Gloriosa, Betelvine, Jasmine, Ixora, Coconut and other vegetable crops. Thanthoni, Aravakurichi, Kadavur and K. Paramathy were major vegetable growing region and Thogamalai, Krishnarayapuram, Kulithalai were major Banana growing region and Virudhunagar block was major Coconut growing region. State Horticulture Farms was located on Mudalaipatti, Thogamalai block where Quality Planting materials are produced. Source: <https://Virudhunagar.nic.in/departments/department-of-horticulture-and-plantation-crops/>

3.1.6 Interpretation and Conclusion

- ☞ Sundakottai village Roughstone and gravel quarry has proposed Project. It is a government poramboke land.
- ☞ Total project area is 32501.38 ha around 10km radius.
- ☞ As new Proposed mine is coming in the area, percentage of human settlement will be increased in surrounding of project site and Infrastructure facilities also will be developed on the basis of requirement.
- ☞ The 10 km study area mostly covers of crop land 40.52%. As per current study area is occupied by scrub land 1.04%, Barren rocky land 0.40% in 10 km radius from the study area land use into quarrie purpose for this proposed project.
- ☞ The project site falls under the Roughstone and gravel region. Therefore, the area is appropriate for developing Road development and building etc., it shows that the region has good prospects in the future. Due

to proposed Roughstone in this region, economic condition of locals is expected to be improved directly & indirectly. Hence project will prove to be the best economic proposal for the coming times.

3.1.7 TOPOGRAPHY

The lease applied area exhibits flat terrain. The area has gentle sloping towards Northwestern side from Virudhunagar district. The altitude of the area is 177m AMSL. The area is covered by 2m thickness of Topsoil formation. Massive Charnockite which is clearly inferred from the proposed quarry pits.

3.1.7 DIGITAL ELEVATION MODEL

Digital Elevation Model (DEM) has been prepared for the project at Sundakottai Village, Aruppukottai Taluk, Virudhunagar District for a 10 km radius study area.

Data Used

- ☞ DEM Data : SRTM (DEM) -1ArcSecond-90m Resolution
- ☞ Data Source : <https://urs.earthdata.nasa.gov/>
- ☞ Software Used : Arc GIS 10.8

Methodology

SRTM (DEM) data has been used for the creation of the Digital Elevation Model of the study area. IRS Satellite-derived DEM with 30m or coarser posting shall be made available as a free download. IRS Satellite-derived DEM less than 30m and more than 10m postings may be made available at par with the base price for all categories of users.

Source: <https://urs.earthdata.nasa.gov/>

1st Stage:

The first processing stage involves importing and merging the 7.5' x 7.5' tiles into continuous elevation surfaces in DEM format.

2nd Stage:

Re-sampling the data at 15 m is done and a contour interval of 10 m through the usual process of interpolation is created.

3rd Stage:

DEM data is converted in grid format through Arc GIS 10.8 to obtain elevation information of the study area. Contours are then generated at 10 m intervals through spatial analysis of Arc GIS and with SRTM DEM data.

4th Stage:

Integration of DEM with contour map showing spatial analyst is done.

The Digital Elevation Model (DEM) of the Study Area with Contour Map DEM is given in Figure - 3.3.

Slope

The slope map was derived from SRTM DEM data of the study area. The slope of the study area was classified into four classes: less than 1Percent/degree Flat to almost flat, and no meaningful denudation process. 1 to 3 percent/degree gentle low speed ground motion, sheet erosion and soil rosion in the 3⁰ to 10⁰ more gentle the

same as above but with a higher magnitude and slightly steep, a lot of ground movement and erosion especially landslides that are flat. Slope zone 5 class divide $0-07^\circ$, $0.7-1.2^\circ$, $1.2-3.6^\circ$, $3.6-9.9^\circ$, and above- 10° (Fig.3.5)

Slope Class	Nature, Process and Natural Conditions
$0^\circ-2^\circ$ (0-2%)	Flat to almost flat, no meaningful denudation process
$2^\circ - 4^\circ$ (2-7%)	Gentle, low-speed ground motion, sheet erosion and soil erosion (sheet & rill erosion), erosion swamps.
$4^\circ - 8^\circ$ (7-15%)	More Gentle, the same as above, but with a higher magnitude.
$8^\circ - 16^\circ$ (15-30%)	Slightly steep, a lot of ground movement and erosion, especially landslides that are flat.
$16^\circ - 35^\circ$ (30-70%)	Steep, intensive denudation processes and ground movements are common.
$35^\circ - 55^\circ$ (70-140%)	Very steep, rocks generally begin to unfold, a very intensive denudational process, have begun to produce rework material.
$> 55^\circ$ >140%	Very steep, exposed rocks, a very strong denudational process and prone to falling rocks, rarely grown plants (limited)

Source: Calculation of this slope using van zuidam classification, 1985

Interpretation & Conclusion

It is very clear from the DEM that the elevation varies from 126m to 237m in the whole study area, thus having an elevation difference of 111m. The areas in the Northern, Wester portion have higher elevation which is covered by plain land while the low-lying areas are generally used for agricultural purpose with builtup land. The contour over the DEM shows that the project site is 850-860m in the elevation range of 10 m interval present on the flat land in the study area.

3.1.2 Topography

The project area is almost plain terrain with gentle gradient towards North – Southeastern, Eastern side, maximum elevation of the area is 170-220m above Mean Sea level there are no hilly regions in and around the area.

3.1.6 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.

3.1.8 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.

3.1.9 Environmental Features in the Study Area

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

TABLE 3.4: 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	Vellode Bird Sanctuary - 39.8km-NW
2	Reserved Forest	None	Nil within 10km Radius
3	Tiger Reserve/ Elephant Reserve/ Biosphere Reserve	None	Nil within 10Km Radius
4	Critically Polluted Areas	None	Nil within 10Km Radius
5	Mangroves	None	Nil within 10km Radius
6	Mountains/Hills	None	Nil within 10km Radius
7	Notified Archaeological Sites	None	Nil within 10km Radius
8	Industries/ Thermal Power Plants	None	Nil within 10km Radius
9	Defence Installation	None	Nil within 10km Radius

Source: Survey of India Toposheet

TABLE 3.5: NEARBY WATER BODIES FROM THE PROPOSED PROJECT SITE

S.No	LABEL	DISTANCE & DIRECTION
1	Canal	1Km_NE
2	Noyyal River	5Km_NW
3	Odai	6Km_South
4	Aathpalayam Dam	9.5Km_NW

Source: Village Cadastral Map and Field Survey

3.1.10 Soil Environment

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

The objective of the soil sampling is -

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

TABLE 3.6: SOIL SAMPLING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	S-1	Aladipatti	880m NE	9°28'37.81"N 78°11'53.26"E
2	S-2	Kallorani	2.5km SW	9°28'17.10"N 78° 9'56.47"E
3	S-3	Muthuramalingapuram	2.5km SW	9°27'43.70"N 78°10'10.10"E
4	S-4	Bommakottai	1.8km South	9°27'23.77"N 78°10'59.20"E
5	S-5	Kalayarkarisalkulam	3.4km South	9°26'36.12"N 78°11'33.37"E
6	S-6	Kallumadam	3km SE	9°26'57.23"N 78°12'13.47"E

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

Methodology –

For studying soil quality, sampling locations were selected to assess the existing soil conditions in and around the project site representing various land use conditions. The samples were collected by auger boring into the soil up to 90-cm depth. Six (6) locations were selected for soil sampling on the basis of soil types, vegetative cover, industrial & residential activities including infrastructure facilities, which would accord an overall idea of the soil characteristics. The samples were analysed for physical and chemical characteristics. The samples were sent to laboratory for analysis. The samples were filled in Polythene bags, coded and sent to laboratory for analysis and the details of methodology in respect are given in below Table 3.6.

TABLE 3.7: 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 Laboratories in association with GEMS

Soil Testing Result –

The samples were analysed as per the standard methods prescribed in “Soil Chemical Analysis (M.L. Jackson, 1967) & Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India”. The important properties analysed for soil are bulk density, porosity, infiltration rate, pH and Organic matter, 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 3.4: SOIL SAMPLING LOCATIONS AROUND 10 KM RADIUS

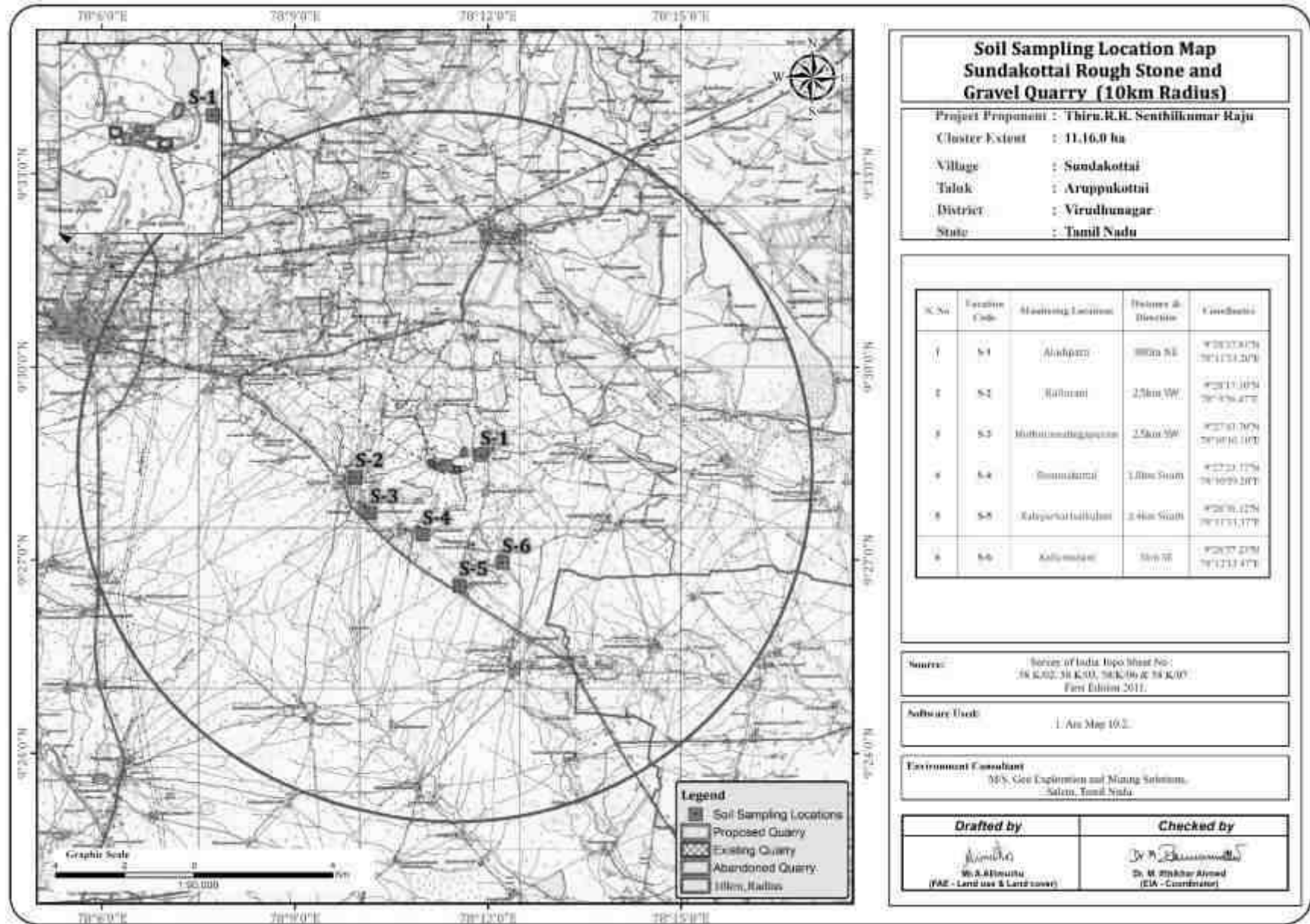


FIGURE 3.5: SOIL MAP

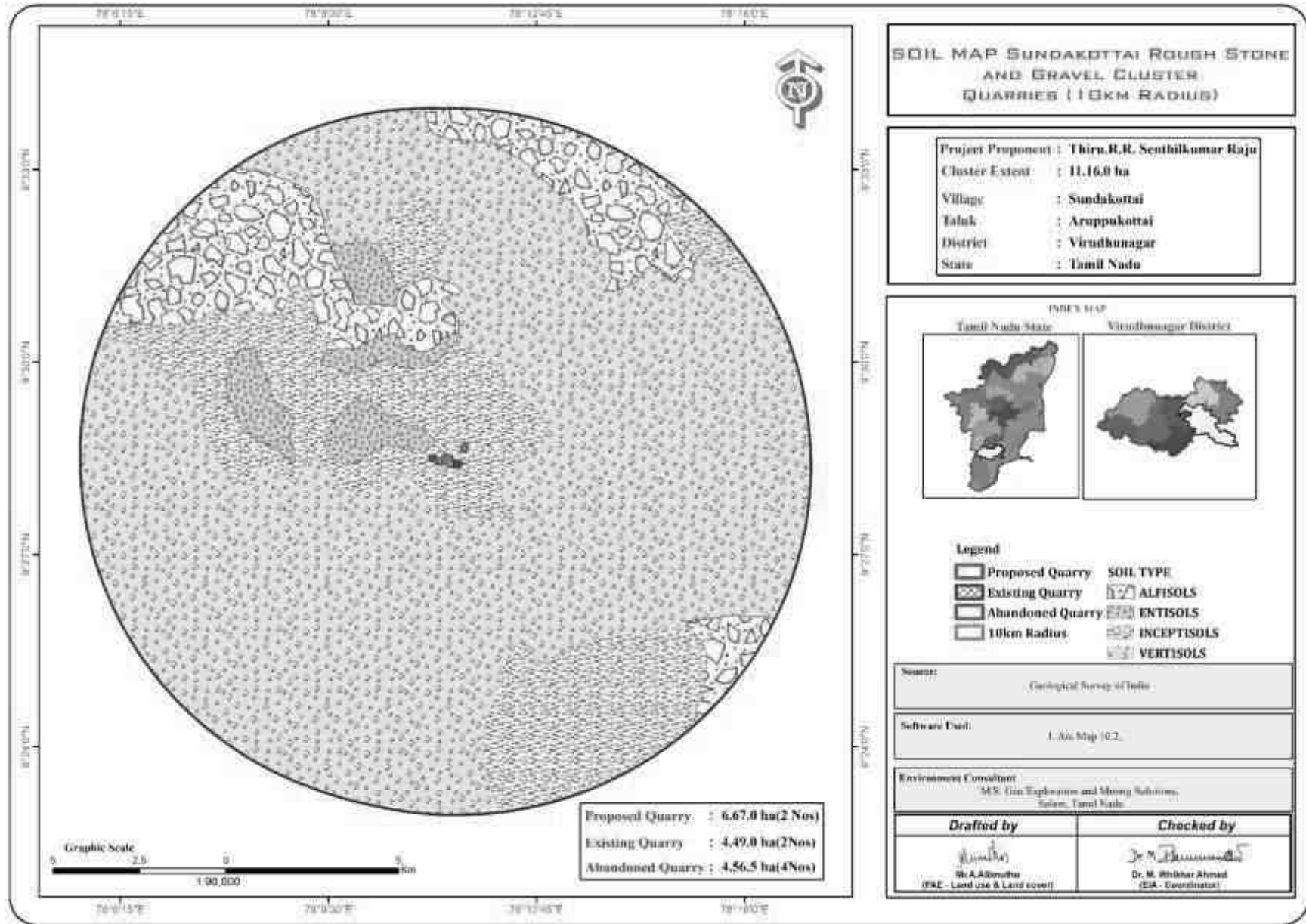


TABLE 3.8: SOIL QUALITY OF THE STUDY AREA

S. No.	Test Parameter	Unit	S1 Results	S2 Results	S3 Results	S4 Results	S5 Results	S6 Results	Test Method
1	pH	...	7.86	8.01	7.70	8.26	7.79	8.55	IS 2720 (Part-26)
2	Electrical Conductivity (EC)	µs/cm	456	505	458	254	345	432	IS 14767
3	Texture	...	Clay Loam	Clay Loam	Clay Loam	Clay Loam	Clay Loam	Loam	IS 2720 (Part-4)
4	Sand	%	37.6	36.8	35.1	34.1	38.7	50.2	IS 2720 (Part-4)
5	Silt	%	35.1	34.4	38.5	39.9	36.6	39.7	IS 2720 (Part-4)
6	Clay	%	27.3	28.8	26.4	26.0	24.7	10.1	IS 2720 (Part-4)
7	Water Holding Capacity (WHC)	%	48.6	46.8	46.5	45.5	46.8	47.8	IS 2720 (Part-2)
8	Bulk Density	g/cm ³	1.01	1.05	1.10	1.25	1.12	0.98	IS 2386 (Part-4)
9	Porosity	%	28.9	29.7	31.1	33.8	32.1	36.8	IS 13030
10	Calcium,(Ca)	mg/kg	140	156	147.3	155	131	123.2	IS 2720 (Part-23)
11	Magnesium,(Mg)	mg/kg	30.1	21.7	28	24.1	40.8	20.5	ETS/STP/SOIL-08
12	Manganese,(Mn)	mg/kg	30.5	25.4	21.4	33.5	26.8	24.7	ETS/STP/SOIL-18
13	Zinc,(Zn)	mg/kg	0.86	0.71	1.05	1.21	1.55	0.79	ETS/STP/SOIL-18
14	Boron (as B)	mg/kg	0.7	0.82	0.67	0.78	1.5	0.76	ETS/STP/SOIL-18
15	Chloride,(Cl)	mg/kg	150	165.7	133	140.7	138	200	BS 1377 -3
16	Total Soluble Sulphate	%	124	111.2	124.4	139	168	100	IS 2720 (Part-27)
17	Potassium (K)	mg/kg	42	44.5	48.2	39.4	31	22.1	ETS/STP/SOIL-18
18	Phosphorus (PO4)	mg/kg	0.76	1.55	0.96	1.22	1.17	0.93	ETS/STP/SOIL-19
19	Total Nitrogen (N)	mg/kg	200	189.6	180	186.6	124.6	179.5	ETS/STP/SOIL-15
20	Cadmium,(Cd)	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	ETS/STP/SOIL-18
21	Chromium,(Cr)	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	ETS/STP/SOIL-18
22	Copper,(Cu)	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	ETS/STP/SOIL-18
23	Lead,(Pb)	mg/kg	0.8	0.79	0.75	1.69	1.71	0.36	ETS/STP/SOIL-18
24	Iron,(Fe)	mg/kg	1.98	2.06	1.87	2.11	2.36	2.58	ETS/STP/SOIL-18
25	Organic Matter,(OM)	%	1.67	2.46	1.77	2.19	1.48	1.34	IS 2720 (Part-22)
26	Organic Carbon,(OC)	%	0.97	1.43	1.03	1.27	0.86	0.78	BS 1377 -3
27	Cation Exchange Capacity (CEC)	meq/100g	35.7	36.5	36.6	40.5	42	40.1	IS 2720 (Part-24)

Source: Sampling Results by Laboratories

Interpretation & Conclusion

Physical Characteristics –

The physical properties of the soil samples were examined for texture, bulk density, porosity and water holding capacity. The soil texture found in the study area is Clay Loam Soil between 10.11-28.8% and Bulk Density of Soils in the study area varied between 0.98– 1.25 g/cm³. The Water Holding Capacity 45.5-48.6% and Porosity of the soil samples is found to be medium i.e. ranging from 28.9 – 36.8%.

Chemical Characteristics –

- The nature of soil is slightly alkaline to strongly alkaline with pH range 7.70 to 8.55
- The available Nitrogen content range between 124.6 to 200 kg/ha
- The available Phosphorus content range between 0.76 to 1.55 kg/ha
- The available Potassium range between 22.1 to 48.2 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:

The study area is studded with few tanks that serve as the source of drinking water and also their surplus feeds adjoining tanks. 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 freshwater for couple of months after rainy season.

S.No	LABEL	DISTANCE & DIRECTION
1	Odai	10m safety South
2	Tank	300m SE
3	Tank	520m East
4	Tank	520m NW
5	Tank	630m SW
6	Tank Near Tiruchuli	5km NW
7	Gundar River	5.2km NE

3.2.2 Ground Water Resources:

In view of the comparatively high level of ground water development in the major part of the district and the quality problems due to lithogenic and anthropogenic factors, it is necessary to exercise caution while planning further development of available ground water resources in the district. The development of ground water for irrigation in the district is mainly through dug wells tapping the weathered residuum. The yields of dug wells are improved at favorable locations by construction of extension bores, which are 50 to 100m. deep. Bore wells have

also become popular as the source for irrigation in the district in recent years. Dug wells with extension bores wherever necessary is ideal for hard rock areas whereas large diameter dug wells with radial well is suitable for alluvial areas.

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

One (1) surface water and Five (5) 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 3.8 and shown as Figure 3.6.

TABLE 3.9: WATER SAMPLING LOCATIONS

S. No	Location code	Monitoring Locations	Distance & Direction	Coordinates
1	SW-1	Seasonal Pond in Muthuramalingapuram	2.3km SW	9°28'0.13"N 78°10'2.46"E
2	GW-1	Aladipatti	930m NE	9°28'36.21"N 78°11'55.79"E
3	GW-2	Kallorani	2.5km SW	9°28'17.16"N 78° 9'51.87"E
4	GW-3	Muthuramalingapuram	2.5km SW	9°27'43.81"N 78°10'9.54"E
5	GW-4	Bommakottai	1.8km South	9°27'34.12"N 78°10'52.25"E
6	GW-5	Kalayarkarisalkulam	3.4km South	9°26'36.18"N 78°11'34.71"E

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

FIGURE 3.6: WATER SAMPLING LOCATIONS AROUND 10 KM RADIUS

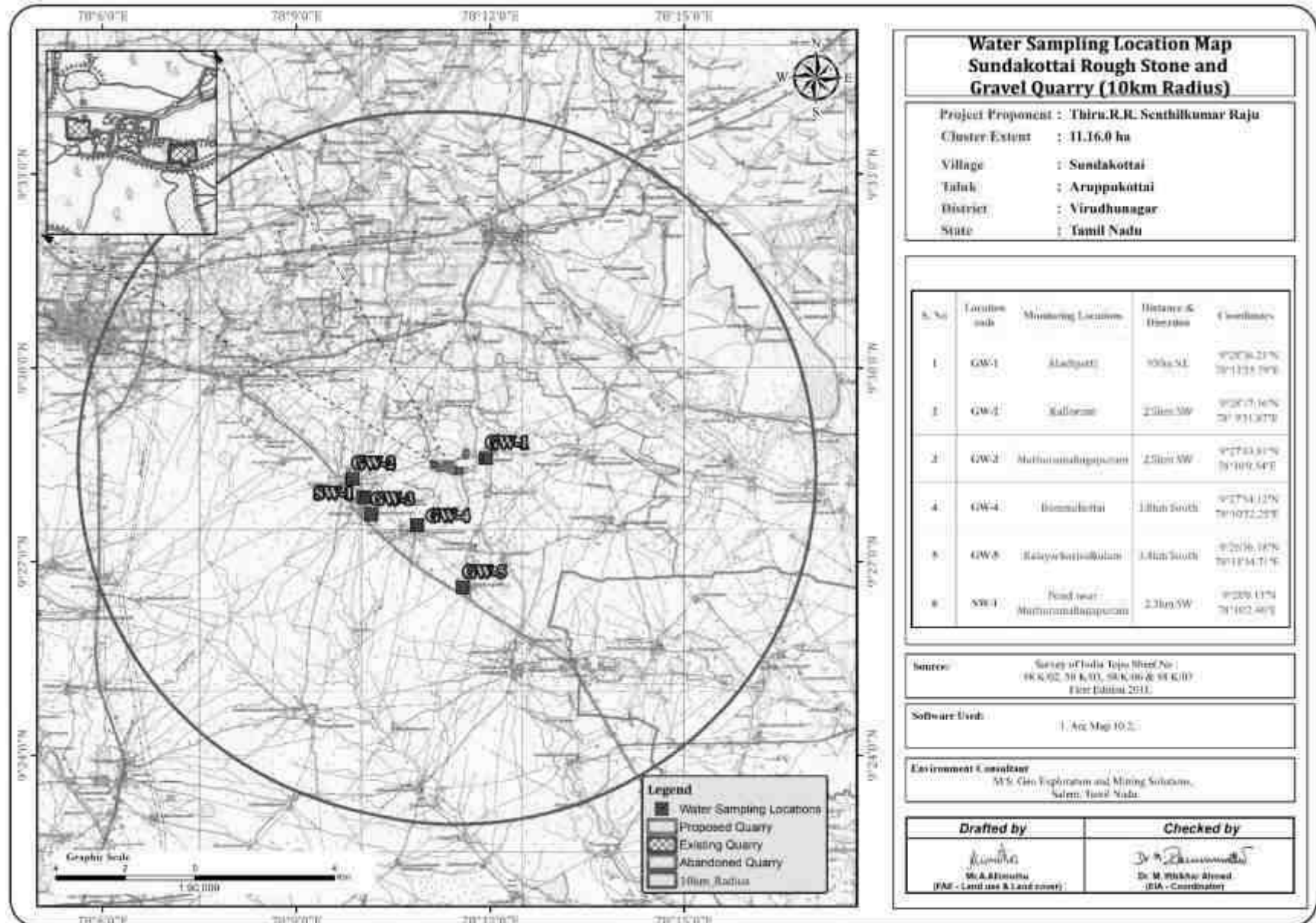


TABLE:3.10 GROUND WATER SAMPLING RESULTS

S. No.	Test Parameter	Unit	GW 1 Result	GW 2 Result	GW 3 Result	GW 4 Result	GW 5 Result	Specification/Limit (As per IS:10500: 2012)		Test Method
								Desirable	Permissible	
1	Colour	Hazen	< 5	< 5	< 5	< 5	< 5	5	15	APHA 2120-B
2	Odour	...	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	APHA 2150-B
3	pH	...	6.59	7.15	7.21	7.55	7.46	6.5 - 8.5	No Relaxation	APHA 4500-H+
4	Conductivity	µs/cm	552	653	593	608	634	Not Specified	Not Specified	APHA 2510-B
5	Turbidity	NTU	< 1	< 1	< 1	< 1	< 1	1	5	APHA 2130-B
6	Total Dissolved Solids,(TDS)	mg/L	326	385	350	359	374	500	2000	APHA 2540-C
7	Total Hardness, (CaCO ₃)	mg/L	109.62	143.8	133.75	129.14	101.35	200	600	APHA 2340-C
8	Calcium, (Ca)	mg/L	20.7	27.8	25.1	24.9	19.2	75	200	APHA 3500:(Ca)-B
9	Magnesium (Mg)	mg/L	14.1	18.1	17.3	16.3	13.0	30	100	APHA 3500:(Mg)-B
10	Total Alkalinity (CaCO ₃)	mg/L	154.3	172	147.5	152	180	200	600	APHA 2320-B
11	Chloride, (Cl)	mg/L	68.7	88.8	76.8	80.5	75.5	250	1000	APHA 4500:(Cl-)-B
12	Sulphate,(SO ₄)	mg/L	18	20.7	19.7	22.2	23.3	200	400	APHA 4500:(SO ₄)-E
13	Iron,(Fe)	mg/L	0.19	0.25	0.16	0.15	0.18	0.3	No Relaxation	APHA-3120B
14	Chlorine (Residual)	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	1	APHA 4500:(Cl)-B
15	Fluoride, (F)	mg/L	0.19	0.19	0.18	0.31	0.22	1	1.5	APHA 4500:(F-)-D
16	Nitrate, (NO ₃)	mg/L	12.5	13.3	20.4	10.1	12	45	No Relaxation	APHA 4500:(NO ₃)-B
17	Copper, (Cu)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	0.05	1.5	APHA 3120B
18	Manganese, (Mn)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	0.1	0.3	APHA-3120B
19	Mercury, (Hg)	ug/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	No Relaxation	APHA-3114C
20	Cadmium,(Cd)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	No Relaxation	APHA 3120B
21	Selenium,(Se)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	0.01	No Relaxation	APHA-3120B
22	Aluminium, (Al)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	0.2	APHA-3120B
23	Lead,(Pb)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	0.01	No Relaxation	APHA-3120B
24	Zinc,(Zn)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	5	15	APHA-3120B
25	Total Chromium,(Cr)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	Not Specified	Not Specified	APHA-3120B
26	Boron,(B)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.5	1	APHA 4500:(B)-C

S. No.	Test Parameter	Unit	GW 1 Result	GW 2 Result	GW 3 Result	GW 4 Result	GW 5 Result	Specification/Limit (As per IS:10500: 2012)		Test Method
								Desirable	Permissible	
27	Mineral Oil	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.5	No Relaxation	IS 3025 (Part-39)
28	Phenolic Compound, (C ₆ H ₅ OH)	mg/L	Absent	Absent	Absent	Absent	Absent	0.001	0.002	APHA 5530-C
29	Anionic Detergent(MBAS)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	1	APHA 5540-C
30	Cyanide, (CN)*	mg/L	Absent	Absent	Absent	Absent	Absent	0.05	No Relaxation	APHA 4500:(CN-)-D
31	Total Coliform Count	MPN/100 mL	< 2	< 2	< 2	< 2	< 2	Shall Not Be Detectable		IS 1622
32	Escherichia coli	MPN/100 mL	< 2	< 2	< 2	< 2	< 2	Shall Not Be Detectable		IS 1622
33	Barium, (Ba)	mg/L	<0.005	<0.005	<0.005	< 2	< 2	0.7	No Relaxation	APHA 3120B
34	Ammonia(as Total NH ₃ -N)*	mg/L	<0.05	<0.05	<0.05	<0.005	<0.005	0.5	No Relaxation	APHA 4500:(NH3)-C
35	Sulphide,(H ₂ S)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	No Relaxation	APHA 4500:(S ₂)-D
36	Molybdenum,(Mo)	mg/L	<0.005	<0.005	<0.005	<0.05	<0.05	0.07	No Relaxation	APHA-3120B
37	Arsenic, (As)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	0.01	0.05	APHA 3120B
38	(TSS)	mg/L	<2.0	<2.0	<2.0	<0.005	<0.005	Not Specified	Not Specified	APHA 2540-D

* 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: 3.101SURFACE WATER SAMPLING RESULTS

S. No.	Test Parameter	Unit	SW 1 Result	Test Method
1	Colour	Hazen	5	IS:3025 (Pt-4)
2	Odour	Agreeable	Agreeable	IS:3025 (Pt-5)
3	pH	---	7.29	IS:3025 (Pt-11)
4	Conductivity (25 °C)	us/Cm	708	APHA-2510
5	Turbidity	NTU	7.1	IS:3025 (Pt-10)
6	Total Dissolve Solid (TDS)	mg/L	417	IS:3025 (Pt-16)
7	Total Hardness(CaCO3)	mg/L	189.02	IS:3025 (Pt-21)
8	Calcium (Ca)	mg/L	34.4	IS:3025 (Pt-40)
9	Magnesium (Mg)	mg/L	25.1	IS:3025 (Pt-45)
10	Total Alkalinity (CaCO3)	mg/L	170	IS:3025 (Pt-23)
11	Chloride (Cl)	mg/L	83.5	IS:3025 (Pt-32)
12	Sulphate (SO ₄)	mg/L	30	IS:3025 (Pt-24)
13	Iron (Fe)	mg/L	0.17	IS:3025 (Pt-53)
14	Chlorine (Residual)	mg/L	< 0.02	APHA 4500:(Cl)-B
15	Fluoride (F)	mg/L	0.22	IS:3025 (Pt-60)
16	Nitrate,(NO ₃)	mg/L	14.5	APHA 4500:(NO ₃ -)-B
17	Copper(Cu)	mg/L	<0.1	APHA-3111(B)
18	Manganese,(Mn)	mg/L	< 0.01	APHA-3120B
19	Mercury,(Hg)	ug/L	<0.001	APHA-3114C
20	Cadmium(Cd)	mg/L	<0.001	APHA-3111 (B)
21	Selenium,(Se)	mg/L	< 0.01	APHA-3120B
22	Aluminium,(Al)	mg/L	<0.01	APHA-3120B
23	Lead(Pb)	mg/L	<0.001	APHA-3111 (B)
24	Zinc(Zn)	mg/L	<0.01	APHA-3111 (B)
25	Chromium,(Cr)	mg/L	< 0.01	APHA-3120B
26	Boron,(B)	mg/L	< 0.01	APHA 4500:(B)-C
27	Mineral Oil	mg/L	<0.001	IS 3025 (Part-39)
28	Phenolic Compound (C6H5OH)	mg/L	<0.001	APHA-5530
29	Anionic Detergent,(MBAS)	mg/L	<0.01	APHA 5540-C
30	Cyanide,(CN)	mg/L	<0.05.	APHA 4500:(CN-)-D
31	Biological Oxygen Demand (BOD at 27°C for 3 day)	mg/L	9.2	APHA-5220 (B)
32	Chemical Oxygen Demand (COD)	mg/L	30	APHA-5220 (B)
33	Dissolved Oxygen(DO)	mg/L	5.6	APHA 4500:(O)-C
34	Total Coliform	MPN/100ml	130	IS:1622-1981
35	E. Coli	Coli/100ml	100	IS:1622-1981
36	Barium,(Ba)	mg/L	< 0.01	APHA 3120B
37	Ammonia, (as Total NH ₃ -N)	mg/L	2.4	APHA 4500:(NH3)-C
38	Sulphide,(H ₂ S)	mg/L	< 0.5	APHA 4500:(S ₂ -)-D
39	Molybdenum,(Mo)	mg/L	< 0.01	APHA-3120B
40	Arsenic,(As)	mg/L	< 0.01	APHA 3120B
41	Total Suspended Solids,(TSS)	mg/L	24.6	APHA 2540-D

3.2.4 Interpretation & Conclusion

Surface Water

Ph:

The pH 7.29 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 Solid 417 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 83.5 mg/l. Nitrates 14.5 mg/l, while sulphate 30 mg/l.

Ground Water

The pH of the water samples collected ranged from 6.59 to 7.55 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 326- 385 mg/l in all samples. The Total hardness varied between 101.35- 143.8 -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 65-60m. The maximum depth proposed out of proposed project is 40m 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 3.12: WATER LEVEL OF OPEN WELLS 1 KM RADIUS

S.No	LABEL	LATITUDE	LONGITUDE	Mar-23	Apr-23	May-23
1	OW1	78° 11' 02.10"E	09° 28' 34.48"N	12.5	13.1	13.7
2	OW2	78° 10' 55.83"E	09° 28' 45.62"N	12.8	13.4	14
3	OW3	78° 11' 02.45"E	09° 28' 53.47"N	12.6	13.2	13.8
4	OW4	78° 11' 19.90"E	09° 28' 42.12"N	13.6	14.2	14.8
5	OW5	78° 11' 49.07"E	09° 28' 49.19"N	13	13.6	14.2
6	OW6	78° 11' 41.25"E	09° 28' 14.58"N	12	12.6	13.2
7	OW7	78° 12' 05.85"E	09° 28' 15.51"N	13	13.6	14.2
8	OW8	78° 11' 02.77"E	09° 27' 54.89"N	12.6	13.2	13.8
9	OW9	78° 10' 34.41"E	09° 28' 19.81"N	12.6	13.2	13.8

Source: Onsite monitoring data

TABLE 3.13: WATER LEVEL OF BOREWELLS 1 KM RADIUS

S.No	Name	LATITUDE	LONGITUDE	Mar-23	Apr-23	May-23
1	BW1	78° 11' 04.39"E	9° 28' 33.279"N	62.4	63	63.6
2	BW2	78° 11' 02.88"E	9° 28' 53.494"N	63	63.6	64.2
3	BW3	78° 11' 38.76"E	9° 28' 31.746"N	61	61.6	62.2
4	BW4	78° 11' 25.57"E	9° 28' 53.601"N	61.5	62.1	62.7
5	BW5	78° 11' 59.89"E	9° 28' 35.957"N	62	62.6	63.2
6	BW6	78° 11' 56.64"E	9° 28' 01.426"N	62.6	63.2	63.8
7	BW7	78° 11' 16.81"E	9° 28' 08.987"N	63	63.6	64.2
8	BW8	78° 10' 34.16"E	9° 28' 24.485"N	62.8	63.4	64

Source: Onsite monitoring data

FIGURE 3.7: WATER LEVEL CONTOUR MAP OF OPEN WELLS 1 KM RADIUS – MARCH 2023

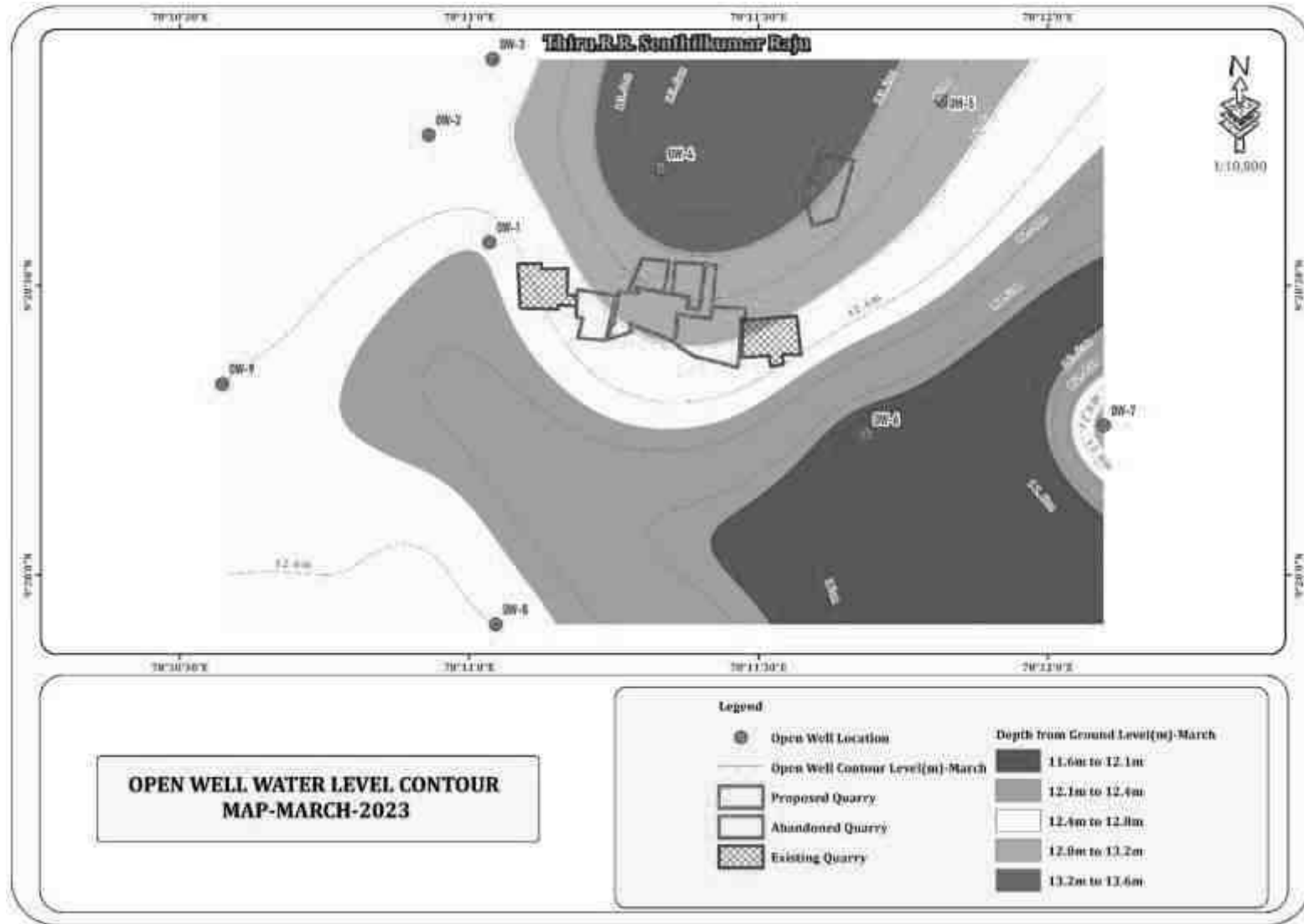


FIGURE 3.8: WATER LEVEL CONTOUR MAP OF OPEN WELLS 1 KM RADIUS – APRIL 2023

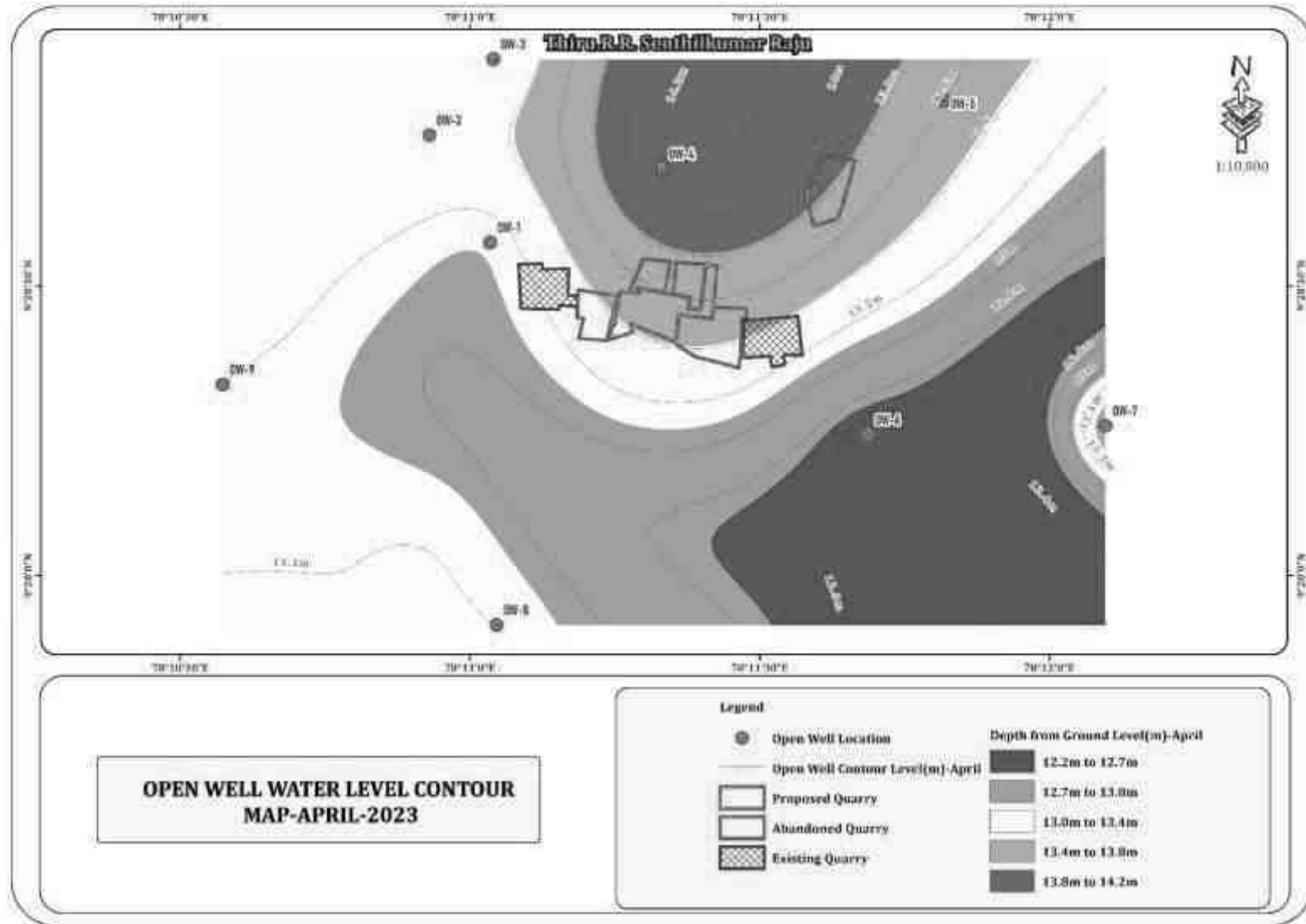


FIGURE 3.9: WATER LEVEL CONTOUR MAP OF OPEN WELLS 1 KM RADIUS – MAY 2023

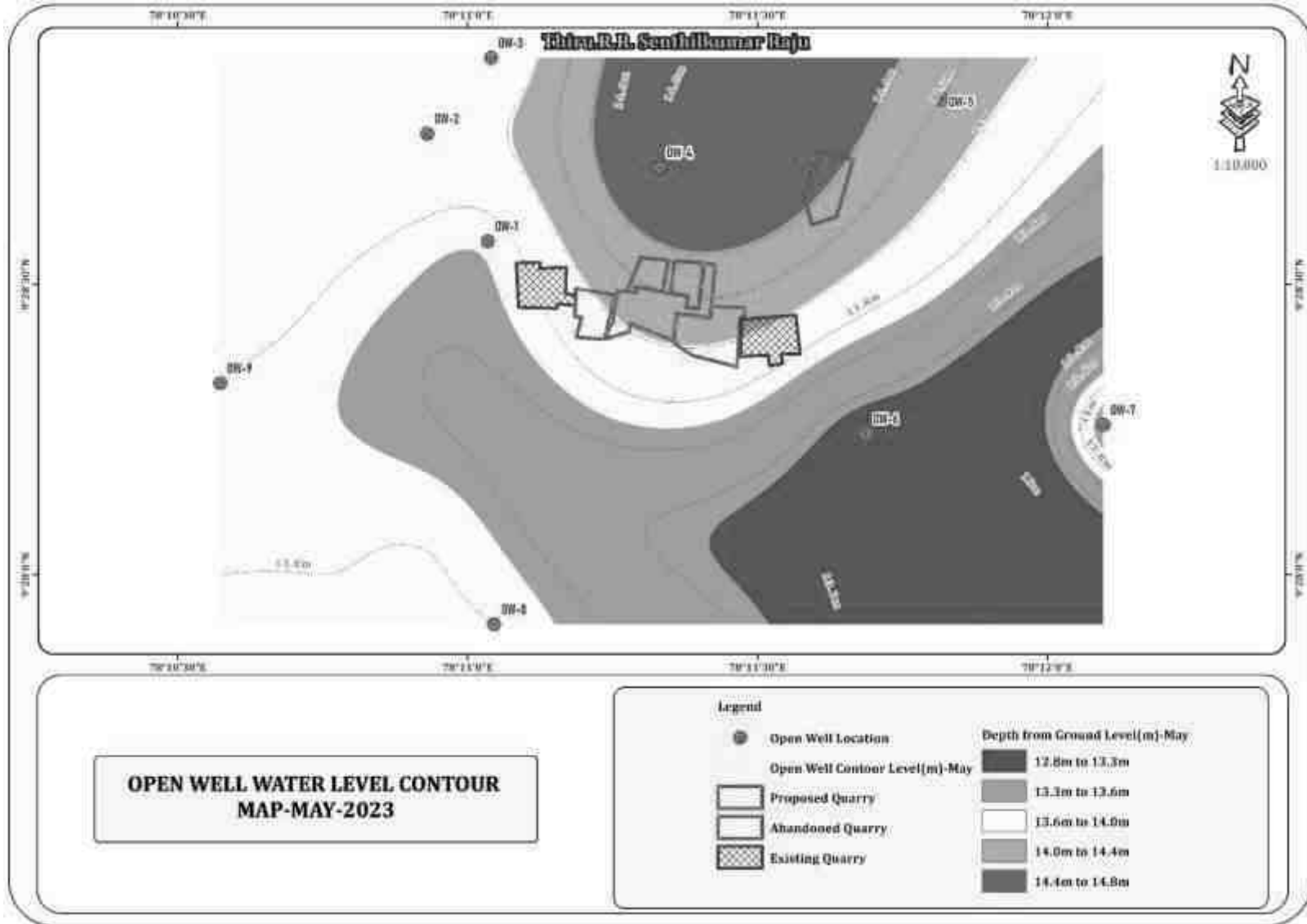


FIGURE 3.10: WATER LEVEL CONTOUR MAP OF BORE WELLS 1 KM RADIUS – MARCH 2023

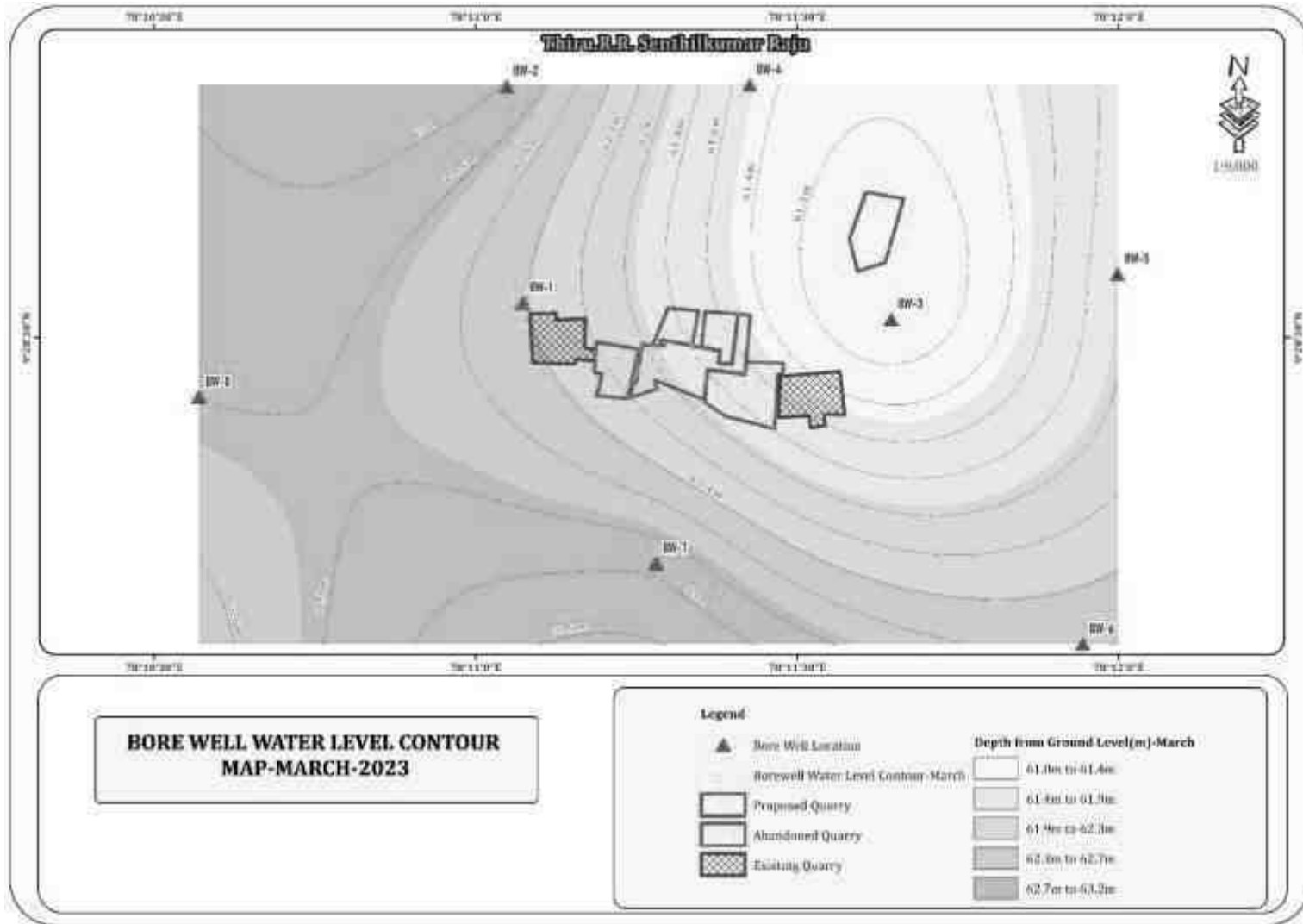


FIGURE 3.11: WATER LEVEL CONTOUR MAP OF BORE WELLS 1 KM RADIUS – APRIL 2023

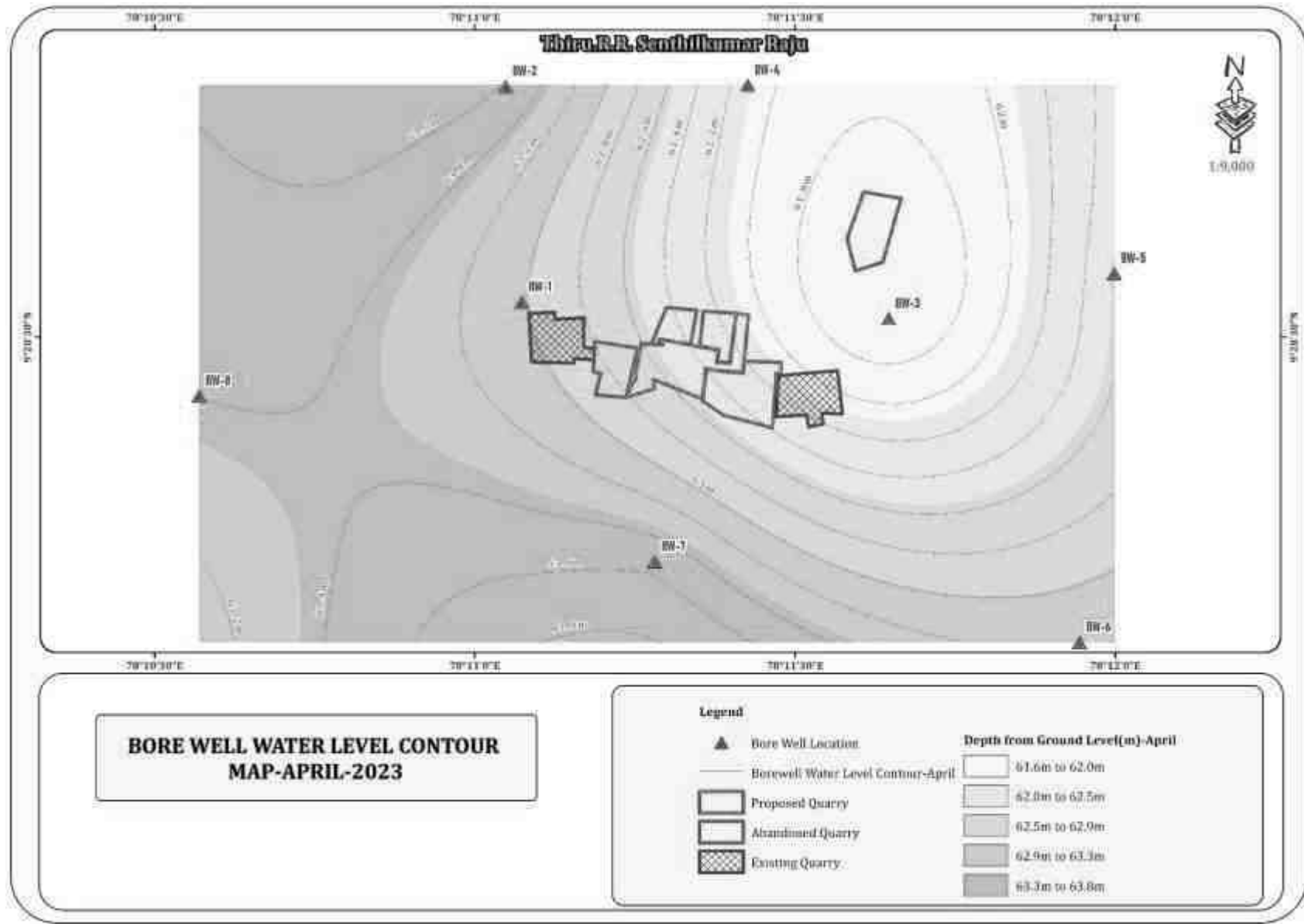


FIGURE 3.12: WATER LEVEL CONTOUR MAP OF BORE WELLS 1 KM RADIUS – MAY 2023

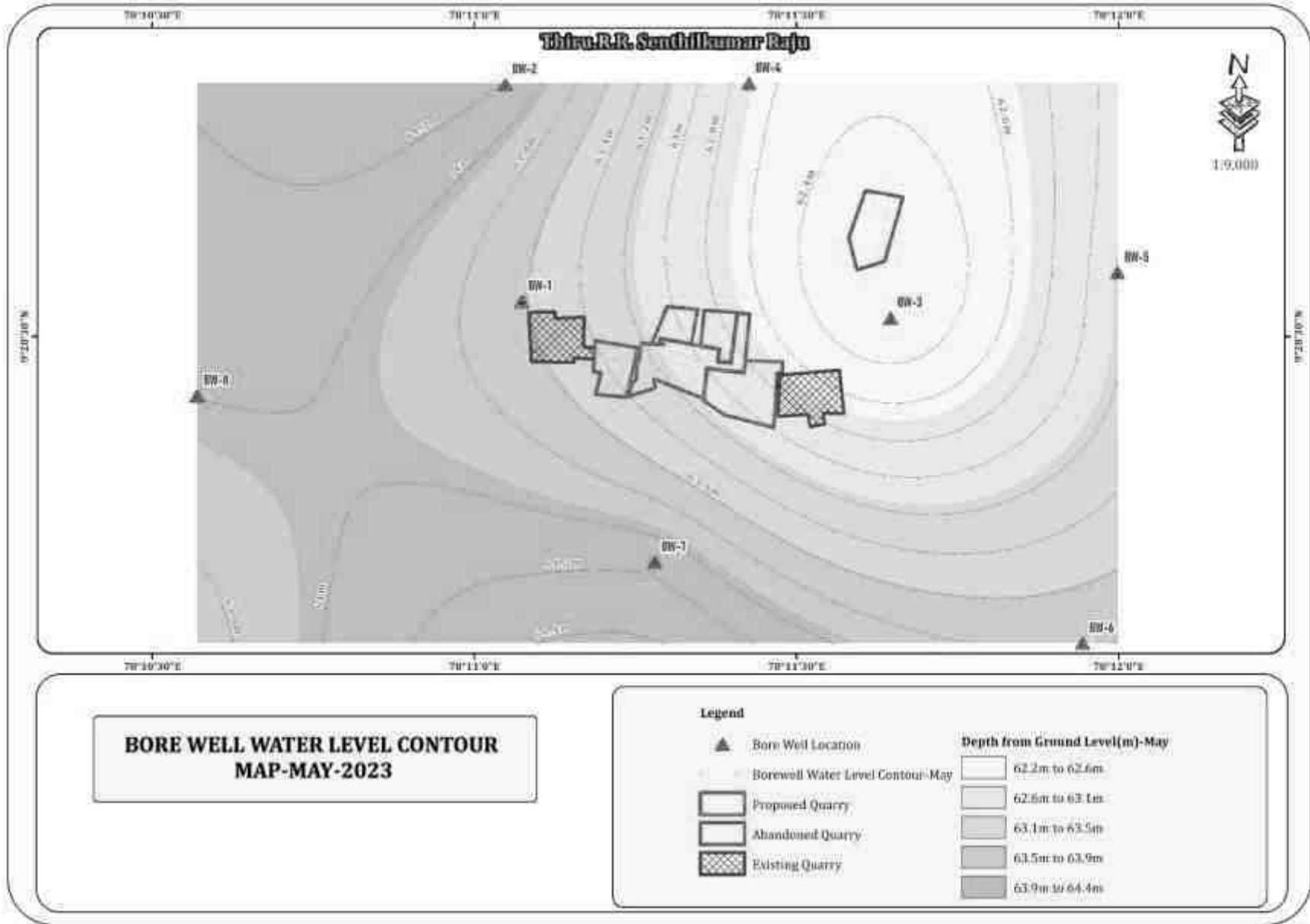


FIGURE 3.13: DRAINAGE MAP AROUND 10 KM RADIUS FROM PROJECT SITE

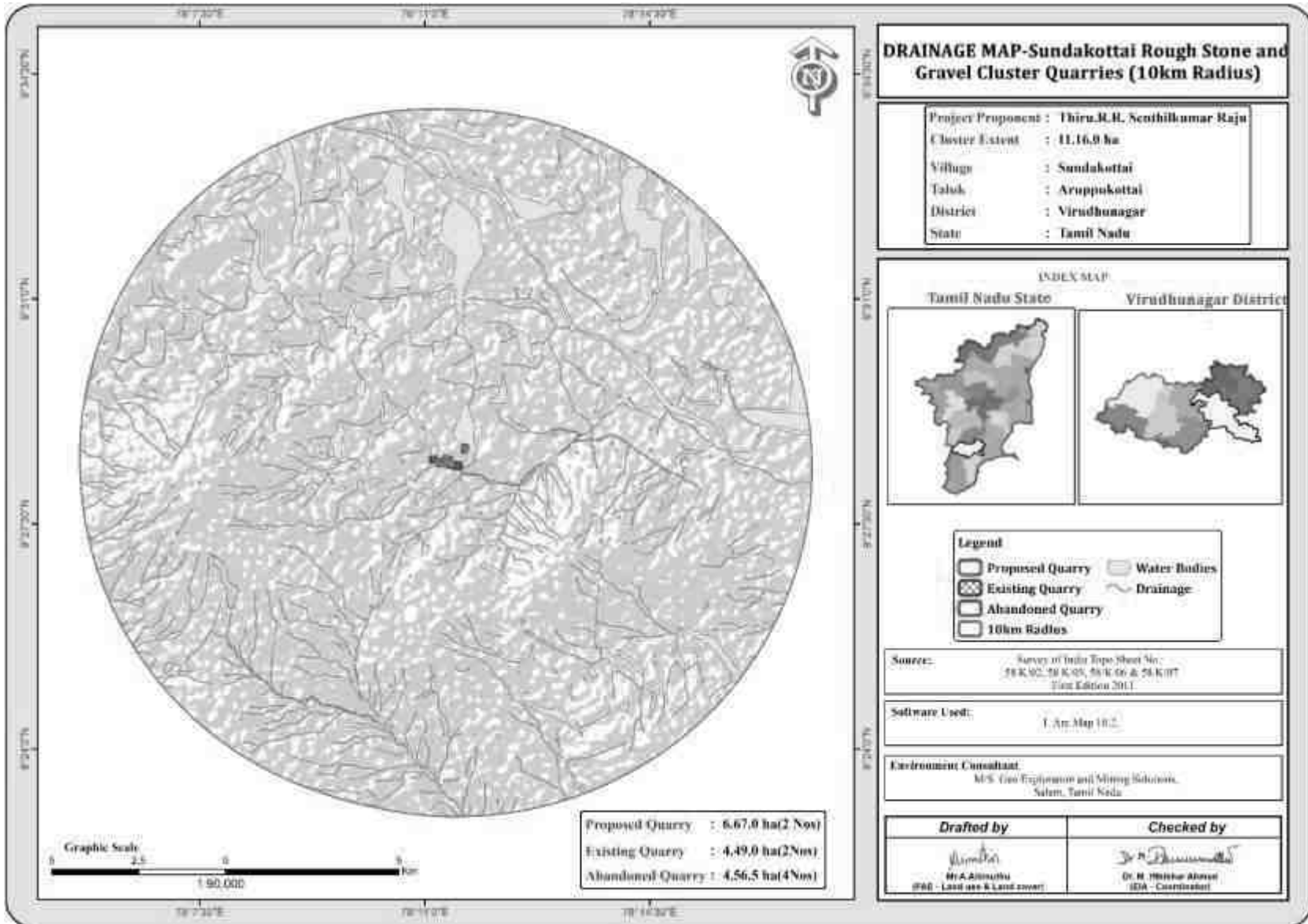
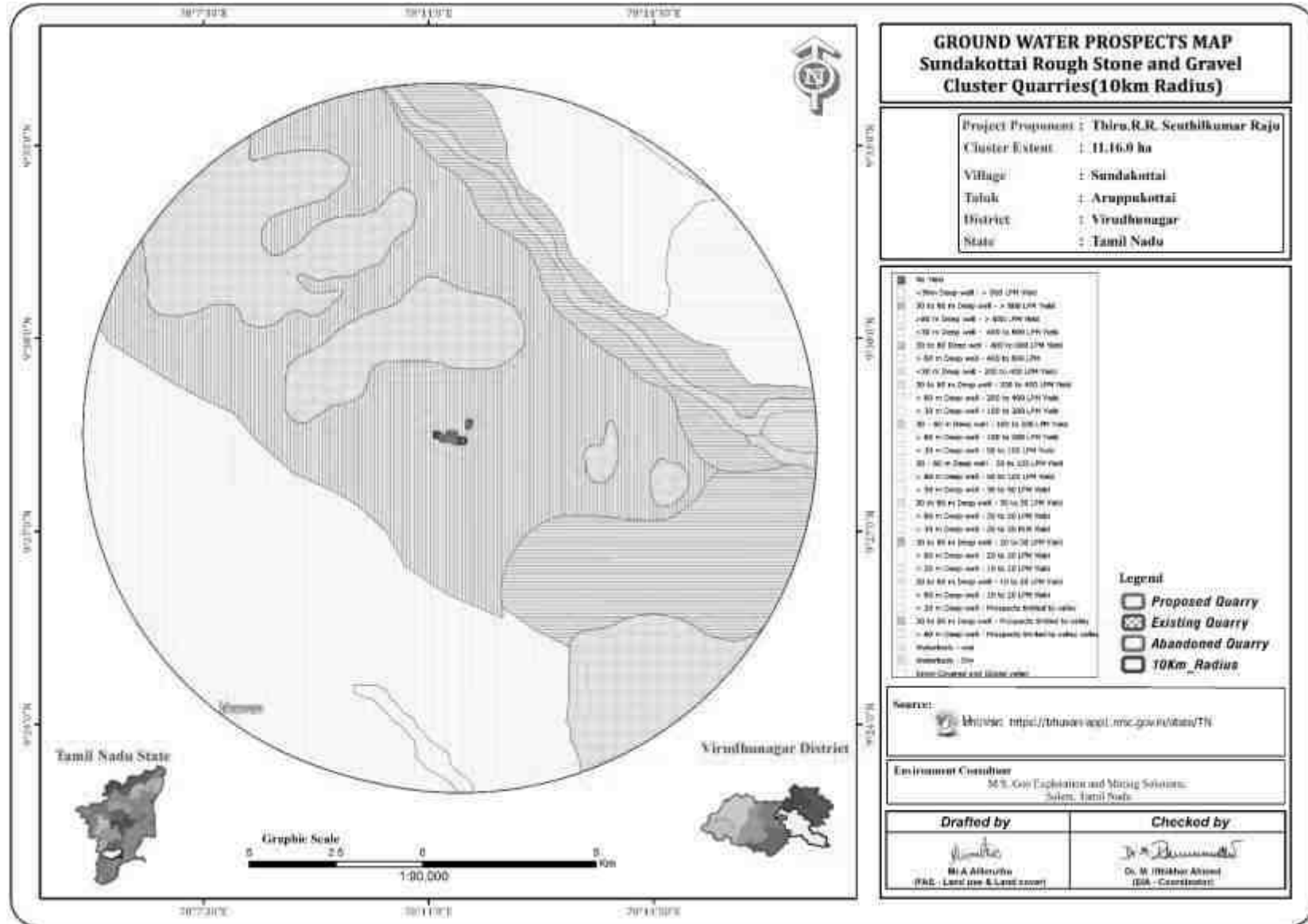


FIGURE 3.14: GROUND WATER PROSPECT MAP



3.2.5.1 Methodology and Data Acquisition

Electric Resistivity Method is well established for delineating lateral as well vertical discontinuities in the resistive structure of the Earth's subsurface. The present study makes use of vertical electric sounding (VES) to delineate the Vertical Resistivity structure at depth. Schlumberger electrode set up was employed for making sounding measurements. Since it is least influenced by lateral 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

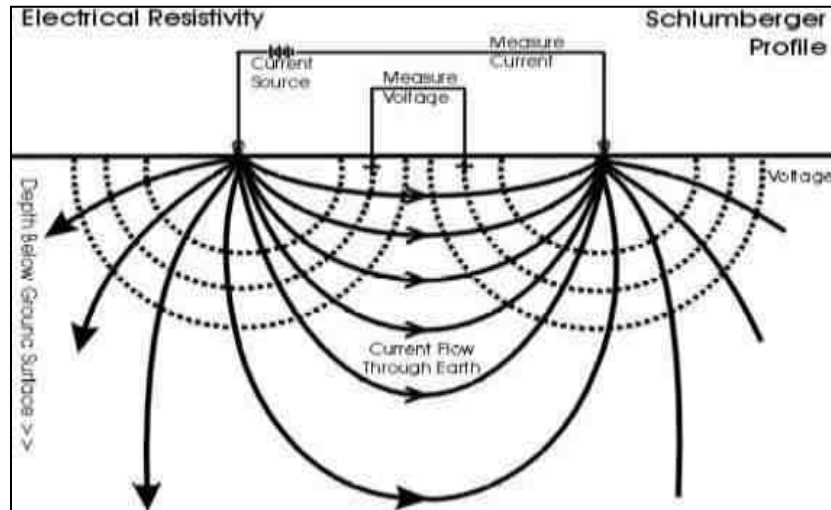
3.2.5.2 Survey Layout

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 (C_1 & C_2) and measuring the resulting potential by two other electrodes called potential electrode (P_1 & P_2). The amount of current required to be sent into the ground depends on the contact resistance at the current electrode, the ground resistivity and the depth of interest.

3.2.5.3 Data Presentation

It was inferred that the low resistance encountered at the depth between 65-70m. The maximum depth proposed out of proposed projects is 42m BGL. Hence there is no possibilities of water table intersection during the entire mine life period besides it is also inferred topographically that there are no major water bodies intersecting the project area.

3.2.5.4 Geophysical Data Interpretation

The geophysical data'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 projects in cluster.

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

3.3.1 Meteorology & Climate

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

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

Climate

- The Virudhunagar lies on 102m above sea level the climate here is considered to be a local steppe climate. The average annual temperature is 28.6 °C | 83.4 °F.
- The precipitation here is around 829 mm | 32.6 inch per year. The driest month is May, with 9 mm | 0.4inch. The greatest amount of precipitation occurs in October, with an average of 144 mm | 5.6 inch.
- The warmest month of the year is October, with an average temperature of 32.2°C | 89.9 °F.
- The lowest average temperatures in the year occur in December, when it is around 22°C | 71.6°F.
- The difference in precipitation between the driest month and the wettest month is 107mm | 7inch. The variation in temperatures throughout the year is 3.4°C | 38.1 °F.

Source: <https://en.climate-data.org/asia/india/tamil-nadu/virudhunagar>

TABLE 3.14: RAINFALL DATA

Actual Rainfall in mm					Normal Rainfall in mm
2017	2018	2019	2020	2021	
715.3	468.4	524.5	684.2	919.8	628.9

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

TABLE 3.15: METEOROLOGICAL DATA RECORDED AT SITE

S.No	Parameters		Mar-2023	Apr- 2023	May- 2023
1	Temperature (°C)	Max	32.75	33.78	30.4
		Min	27.54	29.12	26.42
		Avg	30.14	31.45	28.41
2	Relative Humidity (%)	Avg	55.69	62.12	80.28
3	Wind Speed (m/s)	Max	5.2	4.55	4.92
		Min	2.27	1.95	1.54
		Avg	3.73	3.25	3.23
4	Cloud Cover (OKTAS)		0-8	0-8	0-8
5	Wind Direction		NE,ENE	SSE,S	SW,WSW

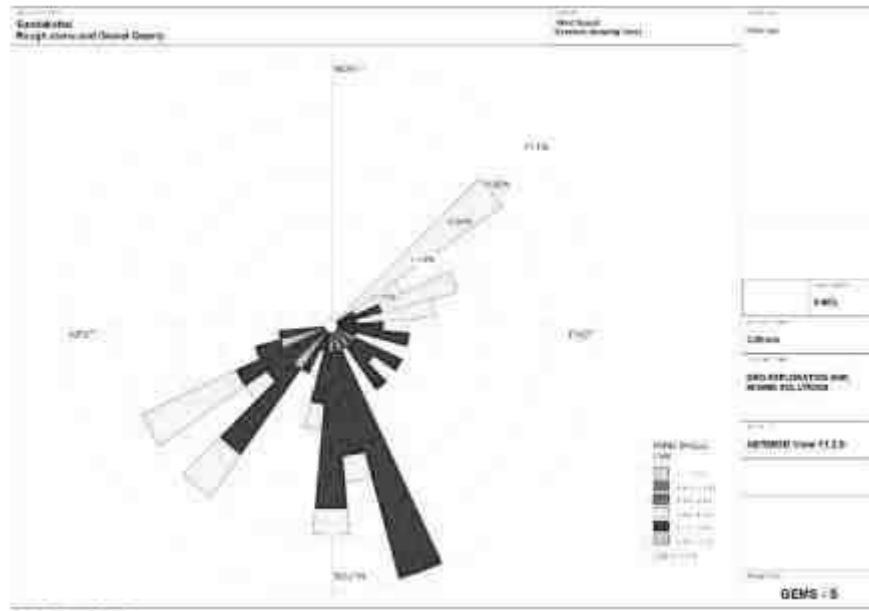
Source: On-site monitoring/sampling by **EHS 360 Labs Private** Limited, association with GEMS

Correlation between Secondary and Primary Data

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

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

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

FIGURE 3.15: 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.3.15 during the monitoring period in the study area

- Predominant winds were from NE, ENE,SSE,S SW,WSW
- Wind velocity readings were recorded between 0.00 to 5.70 m/s
- Calm conditions prevail of about 0.00 % of the monitoring period
- Temperature readings ranging from 26.4 to 33.78C
- Relative humidity ranging from 55.69 to 80.28 %
- 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 3.16: METHODOLOGY AND INSTRUMENT USED FOR AAQ MONITORING

Parameter	Method	Instrument
PM _{2.5}	Gravimetric Method Beta attenuation Method	Fine Particulate Sampler Make – Thermo Environmental Instruments – TEI 121
PM ₁₀	Gravimetric Method Beta attenuation Method	Respirable Dust Sampler Make –Thermo Environmental Instruments – TEI 108
SO ₂	IS-5182 Part II (Improved West & Gaeke method)	Respirable Dust Sampler with gaseous attachment
NO _x	IS-5182 Part II (Jacob & Hochheiser modifiedmethod)	Respirable Dust Sampler with gaseous attachment
Free Silica	NIOSH – 7601	Visible Spectrophotometry

Source: Sampling Methodology followed by Laboratories & CPCB Notification

TABLE 3.17: 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.*	50.0	20.0
		24 hours**	80.0	80.0
2	Nitrogen Dioxide ($\mu\text{g}/\text{m}^3$)	Annual Avg.	40.0	30.0
		24 hours	80.0	80.0
3	Particulate matter (size less than $10\mu\text{m}$) PM ₁₀ ($\mu\text{g}/\text{m}^3$)	Annual Avg.	60.0	60.0
		24 hours	100.0	100.0
4	Particulate matter (size less than $2.5\mu\text{m}$) PM _{2.5} ($\mu\text{g}/\text{m}^3$)	Annual Avg.	40.0	40.0
		24 hours	60.0	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 March to May, 2023. 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 $3 \pm 0.5\text{m}$ 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

Nine (9) 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 3.18: AMBIENT AIR QUALITY (AAQ) MONITORING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance	Direction	Coordinates
1	AAQ1	Core Zone Project Area	-	Project Area	9°28'27.39"N 78°11'24.62"E
2	AAQ 2	Near Proposed Quarry	-	140m SE	9°28'22.45"N 78°11'27.40"E
3	AAQ 3	Aladipatti	0.85 Km	900m NE	9°28'38.90"N 78°11'54.80"E
4	AAQ 4	Kallorani	2.72 Km	2.5km SW	9°28'11.24"N 78° 9'53.74"E
5	AAQ 5	Muthuramalingapuram	2.34 Km	2.5km SW	9°27'43.39"N 78°10'6.69"E
6	AAQ 6	Bommakottai	1.21 Km	1.8km South	9°27'26.20"N 78°10'57.52"E
7	AAQ 7	Kalayarkarisalkulam	1.62 km	3.4km South	9°26'34.09"N 78°11'33.95"E
8	AAQ 8	Kallumadam	2.7 Km	3km SE	9°26'57.58"N 78°12'13.71"E
9	AAQ9	Konganakurichi	1.74 Km	1.6km North	9°29'20.78"N 78°11'16.55"E

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

FIGURE 3.16: AMBIENT AIR QUALITY LOCATIONS AROUND 10 KM RADIUS

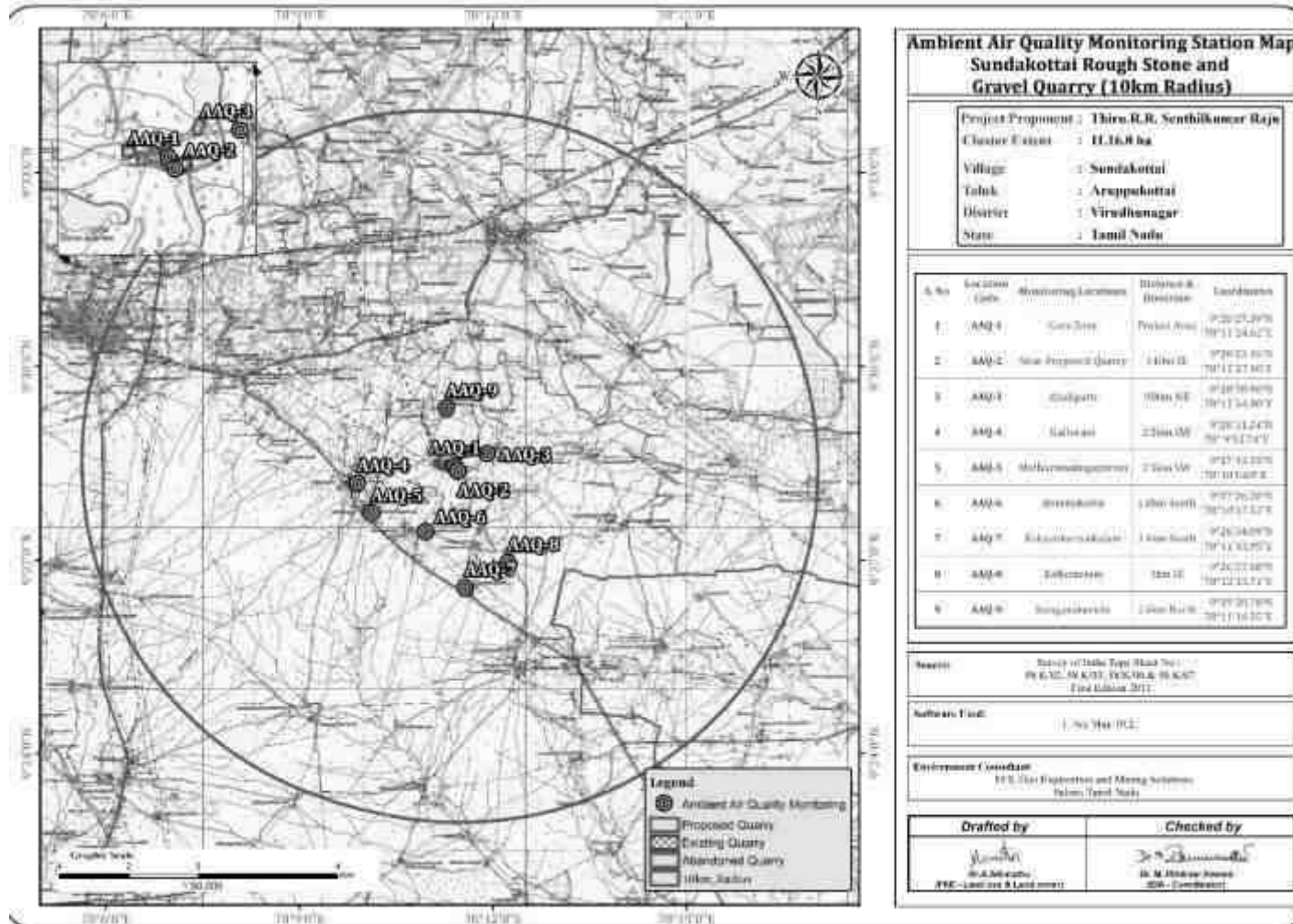


TABLE 3.19 AMBIENT AIR QUALITY DATA LOCATION AAQ1

Period: Mar – May-2023

Location: AAQ1- Core Zone

Sampling Time: 24-hourly

Monitoring		Particulates, $\mu\text{g}/\text{m}^3$			Gaseous Pollutants, $\mu\text{g}/\text{m}^3$					Other Pollutants (Particulate Phase), $\mu\text{g}/\text{m}^3$				
Date	Period, hrs.	SPM	PM _{2.5}	PM ₁₀	SO ₂	NO ₂	NH ₃	O ₃ (8-hly Avg.)	CO (8-hly Avg.)	Pb, $\mu\text{g}/\text{m}^3$	As, ng/m^3	Ni, ng/m^3	C ₆ H ₆ , ng/m^3	BaP, ng/m^3
NAAQ Norms*		(24 hrs.)	60(24 hrs.)	100 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
01.03.2023	07.00-07.00	60.2	20.8	44.7	7.6	22.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
02.03.2023	07.15-07.15	62.3	19.3	43.5	7.1	23.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
08.03.2023	07.00-07.00	64.2	20.3	44.6	7.6	22.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.03.2023	07.15-07.15	61.8	19.3	45.4	6.4	21.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
15.03.2023	07.00-07.00	64.9	20.3	44.3	6.6	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.03.2023	07.15-07.15	62.7	20.7	44.3	8.8	23.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
22.03.2023	07.00-07.00	63.2	20.2	44.4	7.1	22.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.03.2023	07.15-07.15	63.4	21.4	44.7	7.5	22.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
29.03.2023	07.00-07.00	63.1	21.6	43.8	6.6	23.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
30.03.2023	07.15-07.15	62.1	21.7	42.3	6.8	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.04.2023	07.00-07.00	63.5	20.6	43.9	6.8	24.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.04.2023	07.15-07.15	64.8	21.5	43.1	7.9	23.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.04.2023	07.00-07.00	60.8	21.7	44.5	7.6	21.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.04.2023	07.15-07.15	60.9	20.4	42.7	7.7	23.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
19.04.2023	07.00-07.00	61.7	20.6	42.3	6.6	22.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.04.2023	07.15-07.15	62.4	20.3	43.1	6.2	20.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
26.04.2023	07.00-07.00	61.5	21.7	43.8	6.3	21.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
27.04.2023	07.15-07.15	61.3	21.6	42.5	7.1	23.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.05.2023	07.00-07.00	61.8	20.1	43.6	7.4	22.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
04.05.2023	07.15-07.15	62.7	21.5	43.1	7.5	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.05.2023	07.00-07.00	64.2	20.4	44.7	7.7	21.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.05.2023	07.15-07.15	60.3	20.9	43.8	6.3	22.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.05.2023	07.00-07.00	62.1	20.2	44.5	6.7	20.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
18.05.2023	07.15-07.15	60.8	20.6	44.9	6.6	22.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.05.2023	07.00-07.00	60.7	21.2	43.5	7.1	22.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
25.05.2023	07.15-07.15	60.4	21.9	43.9	6.3	22.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.20 AMBIENT AIR QUALITY DATA LOCATION AAQ2

Period: Mar – May-2023

Location: AAQ2- Core Zone

Sampling Time: 24-hourly

Monitoring		Particulates, $\mu\text{g}/\text{m}^3$			Gaseous Pollutants, $\mu\text{g}/\text{m}^3$					Other Pollutants (Particulate Phase) , $\mu\text{g}/\text{m}^3$				
Date	Period, hrs.	SPM	PM2.5	PM10	SO ₂	NO ₂	NH ₃	O ₃ (8-hly Avg.)	CO (8-hly Avg.)	Pb, $\mu\text{g}/\text{m}^3$	As, ng/m^3	Ni, ng/m^3	C ₆ H ₆ , ng/m^3	BaP, ng/m^3
NAAQ Norms*		(24 hrs.)	60(24 hrs.)	100 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
01.03.2023	07.15-07.15	67.7	19.6	43.9	8.3	21.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
02.03.2023	07.30-07:30	66.2	20.9	41.8	8.9	20.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
08.03.2023	07.15-07.15	67.4	18.7	42.7	8.4	21.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.03.2023	07.30-07:30	65.1	20.3	40.4	8.2	22.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
15.03.2023	07.15-07.15	64.3	20.4	40.6	8.3	23.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.03.2023	07.30-07:30	66.3	20.5	41.9	8.6	21.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
22.03.2023	07.15-07.15	66.6	20.1	40.3	9.3	23.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.03.2023	07.30-07:30	68.4	20.6	42.4	9.7	21.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
29.03.2023	07.15-07.15	66.2	21.8	43.1	9.5	23.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
30.03.2023	07.30-07:30	64.1	20.7	41.8	8.3	20.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.04.2023	07.15-07.15	65.6	20.6	42.6	8.5	21.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.04.2023	07.30-07:30	65.3	21.5	42.8	8.1	22.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.04.2023	07.15-07.15	65.8	21.8	42.5	9.2	20.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.04.2023	07.15-07.15	64.3	20.3	43.4	9.4	26.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
19.04.2023	07.00-07.00	64.7	20.5	42.6	7.3	24.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.04.2023	07.15-07.15	64.2	21.2	43.4	7.6	21.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
26.04.2023	07.00-07.00	66.3	19.7	42.9	7.8	22.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
27.04.2023	07.15-07.15	66.7	20.3	43.6	8.1	23.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.05.2023	07.00-07.00	56.2	21.4	42.5	8.8	21.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
04.05.2023	07.15-07.15	67.1	21.6	42.7	7.3	22.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.05.2023	07.00-07.00	67.9	20.5	43.3	8.6	23.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.05.2023	07.15-07.15	66.3	21.3	42.9	8.1	21.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.05.2023	07.00-07.00	66.2	21.6	41.6	7.6	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
18.05.2023	07.15-07.15	66.1	21.8	42.5	7.9	22.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.05.2023	07.00-07.00	67.8	20.9	41.9	7.4	21.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
25.05.2023	07.15-07.15	67.6	20.5	42.8	7.1	21.0	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

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TABLE 3.21 AMBIENT AIR QUALITY DATA LOCATION AAQ3

Period: Mar – May-2023

AAQ3- Aladipatti

Sampling Time: 24-hourly

Monitoring		Particulates, $\mu\text{g}/\text{m}^3$			Gaseous Pollutants, $\mu\text{g}/\text{m}^3$					Other Pollutants (Particulate Phase) , $\mu\text{g}/\text{m}^3$				
Date	Period, hrs.	SPM	PM2.5	PM10	SO ₂	NO ₂	NH ₃	O ₃ (8-hly Avg.)	CO (8-hly Avg.)	Pb, $\mu\text{g}/\text{m}^3$	As, ng/m^3	Ni, ng/m^3	C ₆ H ₆ , ng/m^3	BaP, ng/m^3
NAAQ Norms*		(24 hrs.)	60 (24 hrs.)	100 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
01.03.2023	07.15-07.15	65.6	19.7	43.2	5.3	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
02.03.2023	07.30-07:30	65.5	19.6	41.8	5.7	23.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
08.03.2023	07.15-07.15	65.9	18.4	42.6	5.9	23.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.03.2023	07.30-07:30	65.1	21.6	43.5	6.3	23.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
15.03.2023	07.15-07.15	66.3	19.6	40.9	6.8	22.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.03.2023	07.30-07:30	66.7	20.4	41.6	6.4	22.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
22.03.2023	07.15-07.15	66.2	21.6	40.1	6.9	22.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.03.2023	07.30-07:30	67.1	18.6	41.7	6.8	23.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
29.03.2023	07.15-07.15	66.3	18.5	42.5	6.7	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
30.03.2023	07.30-07:30	66.2	19.7	41.8	6.2	23.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.04.2023	07.15-07.15	65.1	20.5	41.9	7.3	22.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.04.2023	07.30-07:30	66.7	21.6	42.4	7.5	22.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.04.2023	07.15-07.15	64.3	21.8	40.6	7.6	24.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.04.2023	07.15-07.15	64.7	19.6	40.3	7.9	24.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
19.04.2023	07.00-07.00	65.0	19.7	40.7	7.1	23.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.04.2023	07.15-07.15	63.6	21.5	41.8	6.6	23.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
26.04.2023	07.00-07.00	64.6	20.4	42.2	6.8	22.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
27.04.2023	07.15-07.15	64.2	18.8	42.4	6.9	22.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.05.2023	07.00-07.00	65.9	19.7	41.6	6.1	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
04.05.2023	07.15-07.15	66.1	21.5	41.8	6.7	23.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.05.2023	07.00-07.00	66.7	20.9	40.7	5.9	22.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.05.2023	07.15-07.15	66.3	22.1	43.3	6.8	23.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.05.2023	07.00-07.00	66.1	21.7	42.7	7.3	24.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
18.05.2023	07.15-07.15	65.8	20.8	40.8	7.5	24.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.05.2023	07.00-07.00	67.9	19.9	40.3	7.8	23.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
25.05.2023	07.15-07.15	67.1	19.7	40.6	6.9	23.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.22 AMBIENT AIR QUALITY DATA LOCATION AAQ4

Period: Mar – May-2023

Location: AAQ4 – Kallorani

Sampling Time: 24-hourly

Monitoring		Particulates, $\mu\text{g}/\text{m}^3$			Gaseous Pollutants, $\mu\text{g}/\text{m}^3$					Other Pollutants (Particulate Phase), $\mu\text{g}/\text{m}^3$				
Date	Period, hrs.	SPM	PM2.5	PM10	SO ₂	NO ₂	NH ₃	O ₃ (8-hly Avg.)	CO (8-hly Avg.)	Pb, $\mu\text{g}/\text{m}^3$	As, ng/m^3	Ni, ng/m^3	C ₆ H ₆ , ng/m^3	BaP, ng/m^3
NAAQ Norms*		(24 hrs.)	60(24 hrs.)	100 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
01.03.2023	07.00-07.00	62.3	18.7	41.3	5.6	21.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
02.03.2023	07.15-07:15	62.6	18.5	40.8	5.9	23.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
08.03.2023	07.00-07.00	63.4	15.8	42.5	6.8	22.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.03.2023	07.15-07:15	63.7	19.5	40.6	6.4	20.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
15.03.2023	07.00-07.00	64.6	19.5	39.8	7.5	22.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.03.2023	07.15-07:15	64.2	20.6	38.9	7.9	23.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
22.03.2023	07.00-07.00	64.6	21.5	40.5	6.6	23.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.03.2023	07.15-07:15	64.6	16.8	39.5	6.8	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
29.03.2023	07.00-07.00	63.3	21.6	42.4	5.4	23.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
30.03.2023	07.15-07:15	63.7	22.7	43.2	5.3	23.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.04.2023	07.00-07.00	63.8	18.8	38.9	5.9	22.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.04.2023	07.15-07:15	64.1	17.9	41.5	5.6	24.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.04.2023	07.00-07.00	64.8	18.9	39.5	6.2	24.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.04.2023	07.15-07.15	64.3	19.4	43.2	6.5	24.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
19.04.2023	07.00-07.00	63.7	20.3	41.6	6.1	23.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.04.2023	07.15-07.15	63.9	20.1	42.8	6.8	22.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
26.04.2023	07.00-07.00	63.8	21.7	43.8	6.6	23.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
27.04.2023	07.15-07.15	62.1	22.8	41.9	7.7	23.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.05.2023	07.00-07.00	62.7	19.8	43.9	6.9	23.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
04.05.2023	07.15-07.15	62.6	20.5	40.8	5.3	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.05.2023	07.00-07.00	62.8	21.7	41.8	5.1	23.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.05.2023	07.15-07.15	64.1	18.7	42.6	6.8	23.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.05.2023	07.00-07.00	63.7	18.8	40.3	5.5	22.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
18.05.2023	07.15-07.15	63.6	17.2	41.5	5.7	22.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.05.2023	07.00-07.00	63.1	18.3	40.3	5.3	23.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
25.05.2023	07.15-07.15	63.4	18.9	40.7	6.1	23.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.23 AMBIENT AIR QUALITY DATA LOCATION AAQ5

Period: Mar – May-2023

AAQ5- Muthuramalingapuram

Sampling Time: 24-hourly

Monitoring		Particulates, $\mu\text{g}/\text{m}^3$			Gaseous Pollutants, $\mu\text{g}/\text{m}^3$					Other Pollutants (Particulate Phase) , $\mu\text{g}/\text{m}^3$				
Date	Period, hrs.	SPM	PM2.5	PM10	SO ₂	NO ₂	NH ₃	O ₃ (8-hly Avg.)	CO (8-hly Avg.)	Pb, $\mu\text{g}/\text{m}^3$	As, ng/m^3	Ni, ng/m^3	C ₆ H ₆ , ng/m^3	BaP, ng/m^3
NAAQ Norms*		(24 hrs.)	60(24 hrs.)	100 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
01.03.2023	07:30-07:30	62.3	19.6	40.5	6.3	21.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
02.03.2023	07:45-07:45	62.6	18.9	39.2	6.5	21.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
08.03.2023	07:30-07:30	62.4	18.5	40.6	5.6	21.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.03.2023	07:45-07:45	62.7	18.2	41.0	5.8	21.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
15.03.2023	07:30-07:30	62.9	18.1	40.8	6.1	22.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.03.2023	07:45-07:45	63.6	18.9	41.5	6.9	22.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
22.03.2023	07:30-07:30	63.7	19.1	40.1	5.3	22.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.03.2023	07:45-07:45	63.8	19.5	41.7	5.2	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
29.03.2023	07:30-07:30	63.6	19.8	41.0	5.2	23.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
30.03.2023	07:45-07:45	63.4	19.5	41.1	5.8	22.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.04.2023	07:30-07:30	62.8	18.3	40.9	6.2	21.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.04.2023	07:45-07:45	62.7	18.8	40.4	6.4	21.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.04.2023	07:30-07:30	62.1	19.6	41.6	6.6	21.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.04.2023	07.15-07.15	62.5	18.1	41.9	5.4	20.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
19.04.2023	07.00-07.00	61.3	19.9	41.2	5.3	20.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.04.2023	07.15-07.15	61.7	18.5	42.7	5.1	20.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
26.04.2023	07.00-07.00	61.9	18.3	40.1	6.8	22.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
27.04.2023	07.15-07.15	64.3	18.8	41.6	6.6	22.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.05.2023	07.00-07.00	64.6	19.2	41.5	6.1	22.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
04.05.2023	07.15-07.15	64.1	18.5	40.8	6.5	23.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.05.2023	07.00-07.00	63.2	19.8	41.1	5.6	21.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.05.2023	07.15-07.15	63.9	19.6	41.5	5.4	23.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.05.2023	07.00-07.00	63.4	19.2	40.3	5.2	23.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
18.05.2023	07.15-07.15	63.7	18.6	40.9	5.7	24.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.05.2023	07.00-07.00	63.5	19.2	40.3	6.2	23.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
25.05.2023	07.15-07.15	64.6	18.2	40.2	5.4	23.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.24 AMBIENT AIR QUALITY DATA LOCATION AAQ6

Period: Mar – May-2023

Location: AAQ6 – Bommakottai

Sampling Time: 24-hourly

Monitoring		Particulates, $\mu\text{g}/\text{m}^3$			Gaseous Pollutants, $\mu\text{g}/\text{m}^3$					Other Pollutants (Particulate Phase), $\mu\text{g}/\text{m}^3$				
Date	Period, hrs.	SPM	PM2.5	PM10	SO ₂	NO ₂	NH ₃	O ₃ (8-hly Avg.)	CO (8-hly Avg.)	Pb, $\mu\text{g}/\text{m}^3$	As, ng/m^3	Ni, ng/m^3	C ₆ H ₆ , ng/m^3	BaP, ng/m^3
NAAQ Norms*		(24 hrs.)	60(24 hrs.)	100 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
01.03.2023	08:00-08:00	67.8	21.3	43.7	6.3	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
02.03.2023	08:15-08:15	68.6	22.7	40.6	6.4	24.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
08.03.2023	08:00-08:00	67.6	23.3	41.2	6.5	24.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.03.2023	08:15-08:15	67.3	21.5	43.7	6.7	24.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
15.03.2023	08:00-08:00	68.3	23.6	42.9	6.8	25.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.03.2023	08:15-08:15	67.6	23.4	41.5	7.3	25.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
22.03.2023	08:00-08:00	68.3	21.8	43.6	7.8	25.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.03.2023	08:15-08:15	68.1	23.9	42.7	7.6	24.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
29.03.2023	08:00-08:00	68.9	24.4	41.3	7.9	24.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
30.03.2023	08:15-08:15	67.3	23.8	42.4	7.1	24.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.04.2023	08:00-08:00	67.6	21.2	45.7	7.3	23.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.04.2023	08:15-08:15	67.1	22.6	43.6	7.5	23.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.04.2023	08:00-08:00	67.2	23.4	42.5	8.3	23.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.04.2023	07:15-07:15	66.4	22.5	43.4	8.5	22.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
19.04.2023	07:00-07:00	66.8	23.7	41.9	8.6	22.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.04.2023	07:15-07:15	65.2	22.9	43.8	8.7	23.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
26.04.2023	07:00-07:00	66.1	23.5	43.2	6.8	23.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
27.04.2023	07:15-07:15	66.7	21.6	42.6	6.1	23.0	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.05.2023	07:00-07:00	65.3	23.4	42.8	6.4	23.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
04.05.2023	07:15-07:15	66.8	23.6	41.7	6.8	22.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.05.2023	07:00-07:00	66.4	21.3	42.4	6.7	22.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.05.2023	07:15-07:15	64.8	20.6	41.5	7.2	22.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.05.2023	07:00-07:00	64.6	21.2	42.3	7.8	23.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
18.05.2023	07:15-07:15	64.9	23.7	43.7	7.5	23.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.05.2023	07:00-07:00	64.5	23.4	41.6	7.8	24.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
25.05.2023	07:15-07:15	63.4	23.1	41.5	7.1	24.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.25 AMBIENT AIR QUALITY DATA LOCATION AAQ7

Period: Mar – May-2023

Location: AAQ7– Kalayarkarisalkulam

Sampling Time: 24-hourly

Monitoring		Particulates, $\mu\text{g}/\text{m}^3$			Gaseous Pollutants, $\mu\text{g}/\text{m}^3$					Other Pollutants (Particulate Phase), $\mu\text{g}/\text{m}^3$				
Date	Period, hrs.	SPM	PM2.5	PM10	SO ₂	NO ₂	NH ₃	O ₃ (8-hly Avg.)	CO (8-hly Avg.)	Pb, $\mu\text{g}/\text{m}^3$	As, ng/m^3	Ni, ng/m^3	C ₆ H ₆ , ng/m^3	BaP, ng/m^3
NAAQ Norms*		(24 hrs.)	60(24 hrs.)	100 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
01.03.2023	08:00-08:00	63.6	21.3	40.8	6.3	24.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
02.03.2023	08:15-08:15	63.9	20.7	41.2	6.2	22.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
08.03.2023	08:00-08:00	64.8	22.9	42.7	6.4	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.03.2023	08:15-08:15	64.6	20.4	41.3	6.7	22.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
15.03.2023	08:00-08:00	64.7	21.6	42.8	5.9	23.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.03.2023	08:15-08:15	64.3	22.3	41.5	5.8	23.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
22.03.2023	08:00-08:00	66.2	20.7	40.3	5.9	24.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.03.2023	08:15-08:15	66.1	21.3	42.4	6.4	22.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
29.03.2023	08:00-08:00	66.8	20.8	41.9	6.7	23.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
30.03.2023	08:15-08:15	65.7	21.9	43.4	6.3	22.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.04.2023	08:00-08:00	65.3	22.3	42.7	6.8	21.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.04.2023	08:15-08:15	65.8	21.7	40.1	6.1	23.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.04.2023	08:00-08:00	65.7	23.4	43.4	7.3	22.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.04.2023	07:15-07:15	66.4	21.8	42.8	7.9	21.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
19.04.2023	07:00-07:00	66.2	21.9	41.9	7.5	22.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.04.2023	07:15-07:15	66.1	20.5	42.3	7.6	22.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
26.04.2023	07:00-07:00	64.3	20.3	42.1	6.4	23.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
27.04.2023	07:15-07:15	63.2	21.7	42.6	6.1	22.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.05.2023	07:00-07:00	63.1	21.5	43.5	6.4	24.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
04.05.2023	07:15-07:15	63.6	22.3	43.1	6.7	23.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.05.2023	07:00-07:00	63.7	20.7	42.7	6.2	22.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.05.2023	07:15-07:15	63.4	21.8	41.6	5.3	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.05.2023	07:00-07:00	63.1	21.4	42.8	5.1	22.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
18.05.2023	07:15-07:15	62.3	22.6	40.6	5.8	23.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.05.2023	07:00-07:00	64.7	21.0	41.6	6.3	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
25.05.2023	07:15-07:15	62.6	21.1	41.2	6.1	24.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.26 AMBIENT AIR QUALITY DATA LOCATION AAQ8

Period: Mar – May-2023

Location: AAQ8– Kallumadam

Sampling Time: 24-hourly

Monitoring		Particulates, µg/m ³			Gaseous Pollutants, µg/m ³					Other Pollutants (Particulate Phase) , µg/m ³				
Date	Period, hrs.	SPM	PM _{2.5}	PM ₁₀	SO ₂	NO ₂	NH ₃	O ₃ (8-hly Avg.)	CO (8-hly Avg.)	Pb, µg/m ³	As, ng/m ³	Ni, ng/m ³	C ₆ H ₆ , ng/m ³	BaP, ng/m ³
NAAQ Norms*		(24 hrs.)	60(24 hrs.)	100 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
01.03.2023	08:00-08:00	66.3	20.7	45.3	8.3	23.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
02.03.2023	08:15-08:15	66.4	20.4	45.4	8.5	22.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
08.03.2023	08:00-08:00	65.2	21.5	45.8	8.7	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.03.2023	08:15-08:15	65.8	20.9	42.4	8.1	24.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
15.03.2023	08:00-08:00	63.2	20.5	44.3	8.6	24.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.03.2023	08:15-08:15	63.7	21.9	43.7	8.7	22.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
22.03.2023	08:00-08:00	64.6	21.7	40.6	7.3	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.03.2023	08:15-08:15	64.8	21.5	42.5	8.5	24.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
29.03.2023	08:00-08:00	64.2	20.6	43.6	7.2	23.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
30.03.2023	08:15-08:15	64.3	20.8	42.7	7.1	24.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.04.2023	08:00-08:00	64.7	20.4	41.6	7.6	23.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.04.2023	08:15-08:15	63.2	21.3	42.9	7.8	22.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.04.2023	08:00-08:00	63.8	20.8	46.8	7.1	24.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.04.2023	07.15-07.15	64.6	21.7	46.5	7.8	23.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
19.04.2023	07.00-07.00	64.8	21.6	47.9	6.6	24.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.04.2023	07.15-07.15	64.1	22.8	47.3	6.3	25.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
26.04.2023	07.00-07.00	63.2	21.2	42.7	6.1	23.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
27.04.2023	07.15-07.15	63.7	21.3	41.3	6.5	24.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.05.2023	07.00-07.00	63.1	20.5	43.6	6.8	23.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
04.05.2023	07.15-07.15	64.3	20.3	46.5	6.5	24.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.05.2023	07.00-07.00	64.8	21.7	46.8	7.6	23.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.05.2023	07.15-07.15	63.7	21.3	42.5	7.1	23.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.05.2023	07.00-07.00	63.1	20.8	45.3	7.8	22.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
18.05.2023	07.15-07.15	65.5	21.5	47.7	7.1	24.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.05.2023	07.00-07.00	65.1	21.1	41.5	5.6	24.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
25.05.2023	07.15-07.15	65.9	21.9	41.9	5.9	24.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.27 AMBIENT AIR QUALITY DATA LOCATION AAQ9

Period: Mar – May-2023

Location: AAQ9– Konganakurichi

Sampling Time: 24-hourly

Monitoring		Particulates, µg/m ³			Gaseous Pollutants, µg/m ³					Other Pollutants (Particulate Phase) , µg/m ³				
Date	Period, hrs.	SPM	PM2.5	PM10	SO2	NO2	NH3	O3 (8-hly Avg.)	CO (8-hly Avg.)	Pb, µg/m ³	As, ng/m ³	Ni, ng/m ³	C6H6, ng/m ³	BaP, ng/m ³
NAAQ Norms*		(24 hrs.)	60(24 hrs.)	100 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
01.03.2023	08:00-08:00	63.7	21.9	43.2	6.3	24.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
02.03.2023	08:15-08:15	61.8	22.7	42.5	5.9	23.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
08.03.2023	08:00-08:00	62.6	23.4	43.9	5.4	25.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.03.2023	08:15-08:15	63.4	22.9	41.5	7.8	23.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
15.03.2023	08:00-08:00	62.5	23.6	42.7	5.9	25.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.03.2023	08:15-08:15	63.9	22.3	43.3	5.8	25.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
22.03.2023	08:00-08:00	62.5	25.9	44.5	5.1	23.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.03.2023	08:15-08:15	63.3	24.4	42.7	7.3	25.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
29.03.2023	08:00-08:00	65.4	23.9	43.4	6.3	25.1	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
30.03.2023	08:15-08:15	61.8	25.7	42.9	5.8	26.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.04.2023	08:00-08:00	62.2	24.3	44.6	7.9	25.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.04.2023	08:15-08:15	63.9	23.9	42.5	6.3	26.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.04.2023	08:00-08:00	62.7	25.7	44.7	8.5	25.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.04.2023	07.15-07.15	62.5	24.4	43.3	5.9	26.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
19.04.2023	07.00-07.00	63.4	23.3	42.5	6.9	25.6	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.04.2023	07.15-07.15	62.8	25.7	41.8	8.7	26.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
26.04.2023	07.00-07.00	64.3	26.6	42.7	5.3	25.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
27.04.2023	07.15-07.15	64.1	25.8	42.5	6.9	25.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.05.2023	07.00-07.00	62.9	24.3	43.6	5.8	25.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
04.05.2023	07.15-07.15	63.7	25.7	42.5	6.3	25.3	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.05.2023	07.00-07.00	65.3	24.4	44.9	5.9	26.4	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.05.2023	07.15-07.15	64.8	23.9	44.1	7.4	24.9	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.05.2023	07.00-07.00	63.5	22.3	43.7	6.2	25.2	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
18.05.2023	07.15-07.15	62.5	22.7	43.5	5.6	24.5	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.05.2023	07.00-07.00	62.4	22.3	42.2	7.2	24.8	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
25.05.2023	07.15-07.15	62.8	23.5	42.9	6.9	23.7	<5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.28: 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	234	234	234	234
2	10th Percentile Value	18.80	40.60	5.60	21.60
3	20th Percentile Value	19.60	41.16	5.90	22.40
4	30th Percentile Value	20.30	41.60	6.30	22.70
5	40th Percentile Value	20.60	41.90	6.50	23.10
6	50th Percentile Value	21.05	42.50	6.80	23.50
7	60th Percentile Value	21.50	42.70	7.10	23.60
8	70th Percentile Value	21.70	43.20	7.40	23.80
9	80th Percentile Value	22.30	43.60	7.80	24.30
10	90th Percentile Value	23.50	44.47	8.30	24.90
11	95th Percentile Value	24.30	45.30	8.64	25.60
12	98th Percentile Value	25.70	46.60	9.00	26.33
13	Arithmetic Mean	21.76	43.06	7.21	23.80
14	Geometric Mean	21.67	43.02	7.13	23.77
15	Standard Deviation	2.07	1.83	1.12	1.41
16	NAAQ Norms*	60	100	80	80
17	% Values exceeding Norms*	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

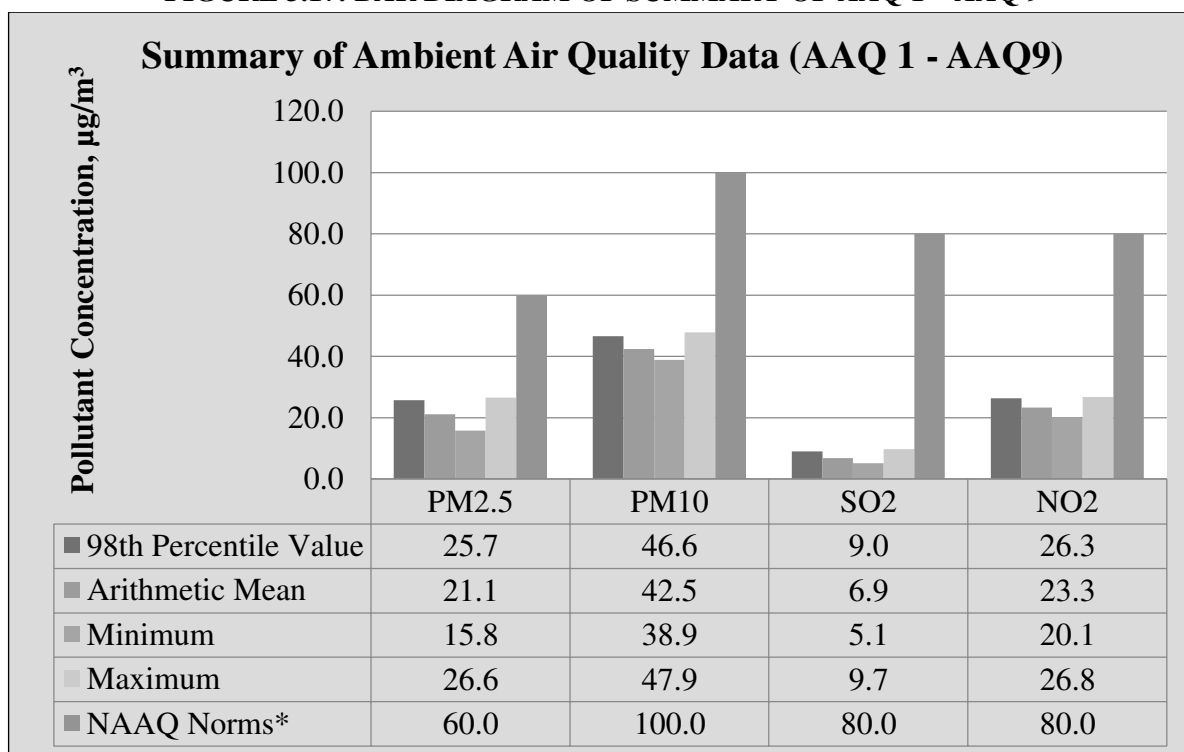
* NAAQ Norms-National Ambient Air Quality Norms-Revised as per GSR 826(E) dated 16.11.2009 for Industrial, Residential, Rural and other Areas.

TABLE 3.29: SUMMARY OF AMBIENT AIR QUALITY DATA

Particulate matter PM _{2.5}					
Station ID	Max	Min	Mean	98 Percentile Value	STDEV
AAQ-1	21.9	19.3	20.8	21.7	0.73
AAQ-2	21.8	18.7	20.7	21.7	0.76
AAQ-3	22.1	18.4	20.3	21.65	1.12
AAQ-4	22.8	15.8	19.6	21.7	1.75
AAQ-5	19.9	18.1	19.0	19.7	0.59
AAQ-6	24.4	20.6	22.7	23.75	1.07
AAQ-7	23.4	20.3	21.5	22.45	0.80
AAQ-8	22.8	20.3	21.2	21.8	0.60
AAQ-9	26.6	21.9	24.1	25.75	1.34
Particulate matter PM ₁₀					
Station ID	Max	Min	Mean	98 Percentile Value	STDEV
AAQ-1	45.4	42.3	43.8	44.7	0.84
AAQ-2	43.9	40.3	42.4	43.4	0.93
AAQ-3	43.5	40.1	41.7	43.0	0.98
AAQ-4	43.9	38.9	41.3	43.2	1.44
AAQ-5	42.7	39.2	40.9	41.7	0.72
AAQ-6	45.7	40.6	42.6	43.7	1.12
AAQ-7	43.5	40.1	42.1	43.3	0.97

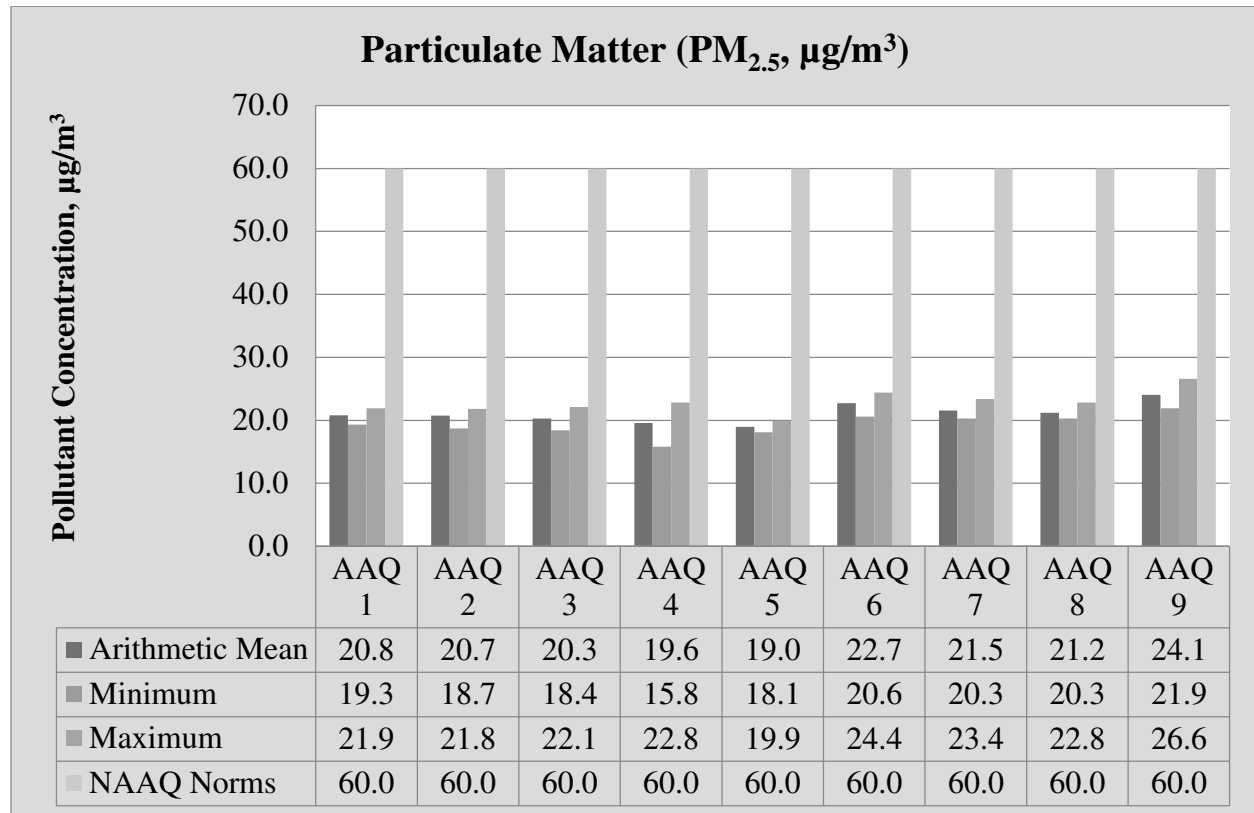
AAQ-8	47.9	40.6	44.2	47.1	2.22
AAQ-9	44.9	41.5	43.2	44.6	0.89
Sulphur Di-oxide as SO₂					
Station ID	Max	Min	Mean	98 Percentile Value	STDEV
AAQ-1	8.8	6.2	7.1	7.7	0.63
AAQ-2	9.7	7.1	8.3	9.4	0.72
AAQ-3	7.9	5.3	6.8	7.6	0.66
AAQ-4	7.9	5.1	6.2	7.2	0.78
AAQ-5	6.9	5.1	5.9	6.6	0.57
AAQ-6	8.7	6.1	7.3	8.4	0.74
AAQ-7	7.9	5.1	6.4	7.4	0.65
AAQ-8	8.7	5.6	7.4	8.6	0.90
AAQ-9	8.7	5.1	6.5	7.9	0.97
Oxide of Nitrogen as NO₂					
Station ID	Max	Min	Mean	98 Percentile Value	STDEV
AAQ-1	24.4	20.5	22.7	23.6	1.00
AAQ-2	26.7	20.1	22.4	23.9	1.46
AAQ-3	24.9	22.1	23.4	24.2	0.70
AAQ-4	24.7	20.8	23.2	24.1	0.87
AAQ-5	24.1	20.1	22.3	23.7	1.14
AAQ-6	25.7	22.1	23.8	25.0	0.99
AAQ-7	24.6	21.4	23.2	24.1	0.76
AAQ-8	25.2	22.2	23.9	24.8	0.79
AAQ-9	26.8	23.7	25.3	26.4	0.90

FIGURE 3.17: BAR DIAGRAM OF SUMMARY OF AAQ 1 – AAQ 9



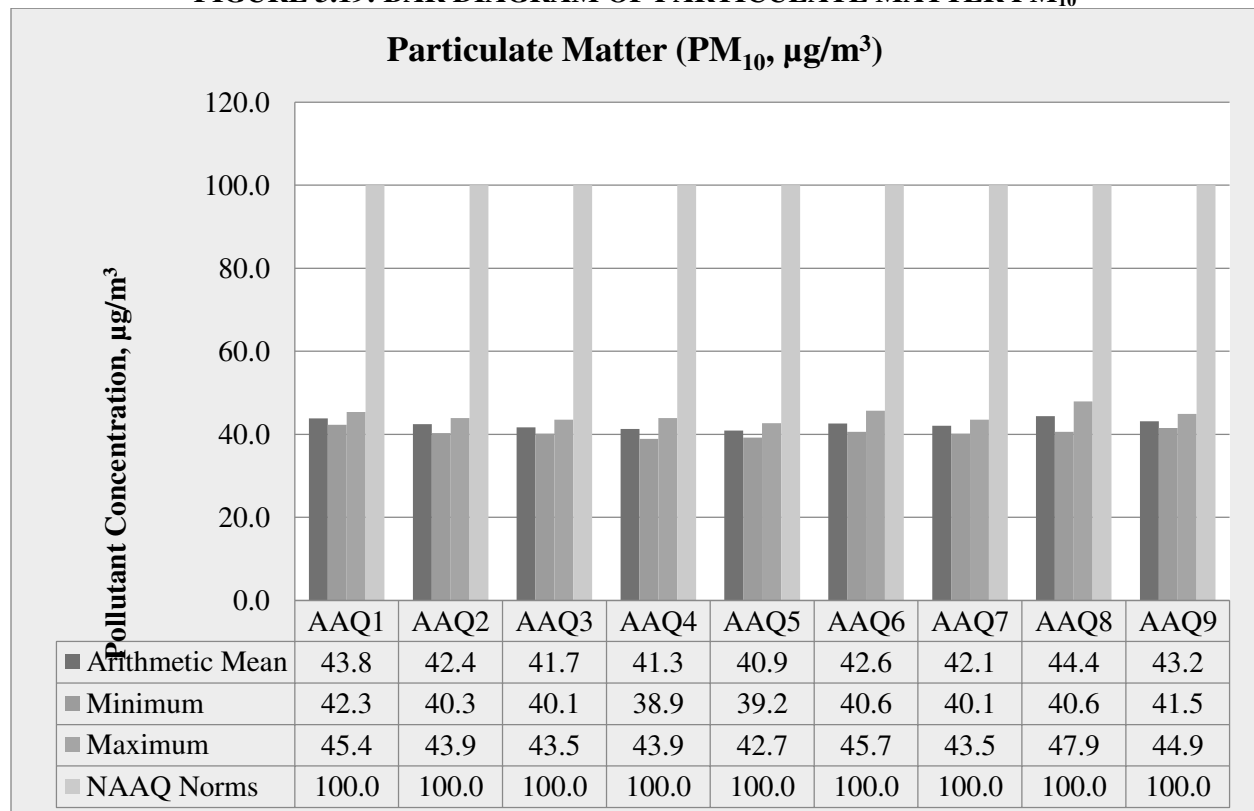
Source: Table 3.17 to 3.27

FIGURE 3.18: BAR DIAGRAM OF PARTICULATE MATTER PM_{2.5}



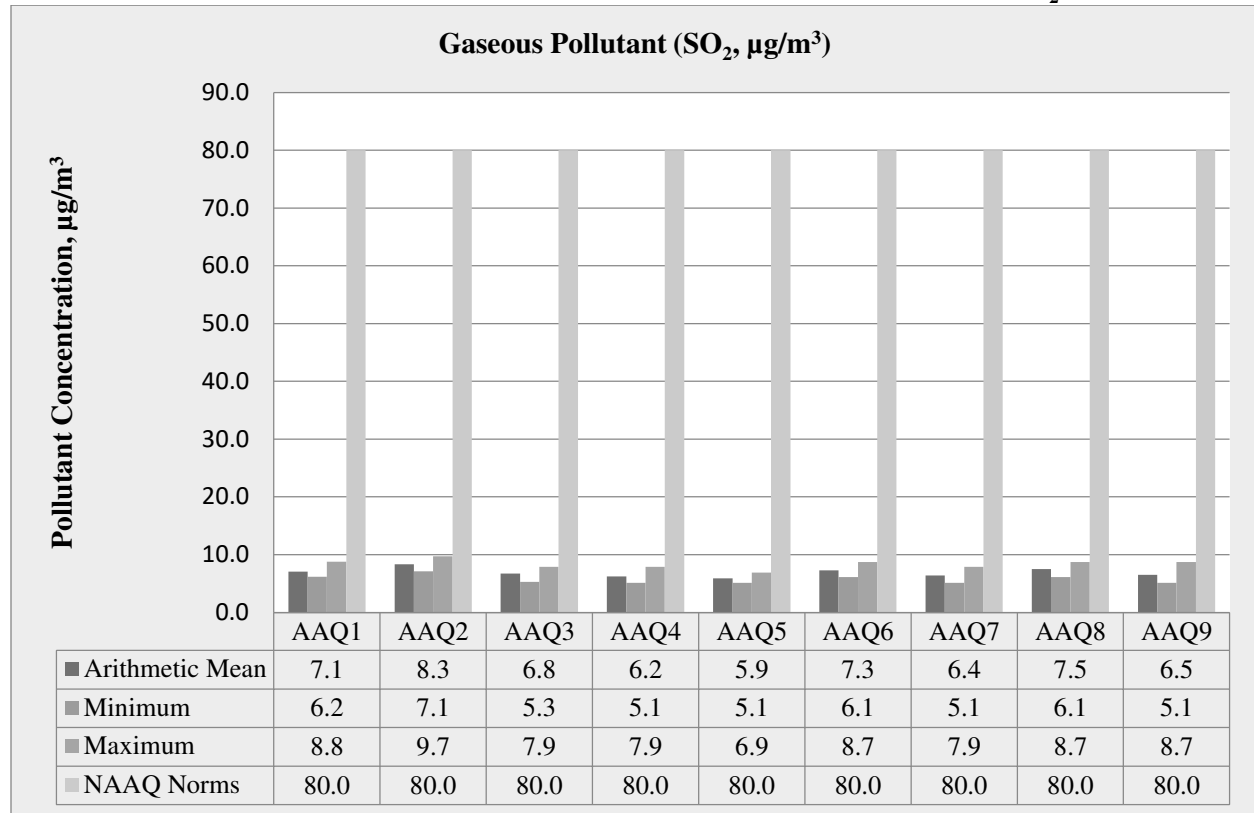
Source: Table 3.17 to 3.27

FIGURE 3.19: BAR DIAGRAM OF PARTICULATE MATTER PM₁₀



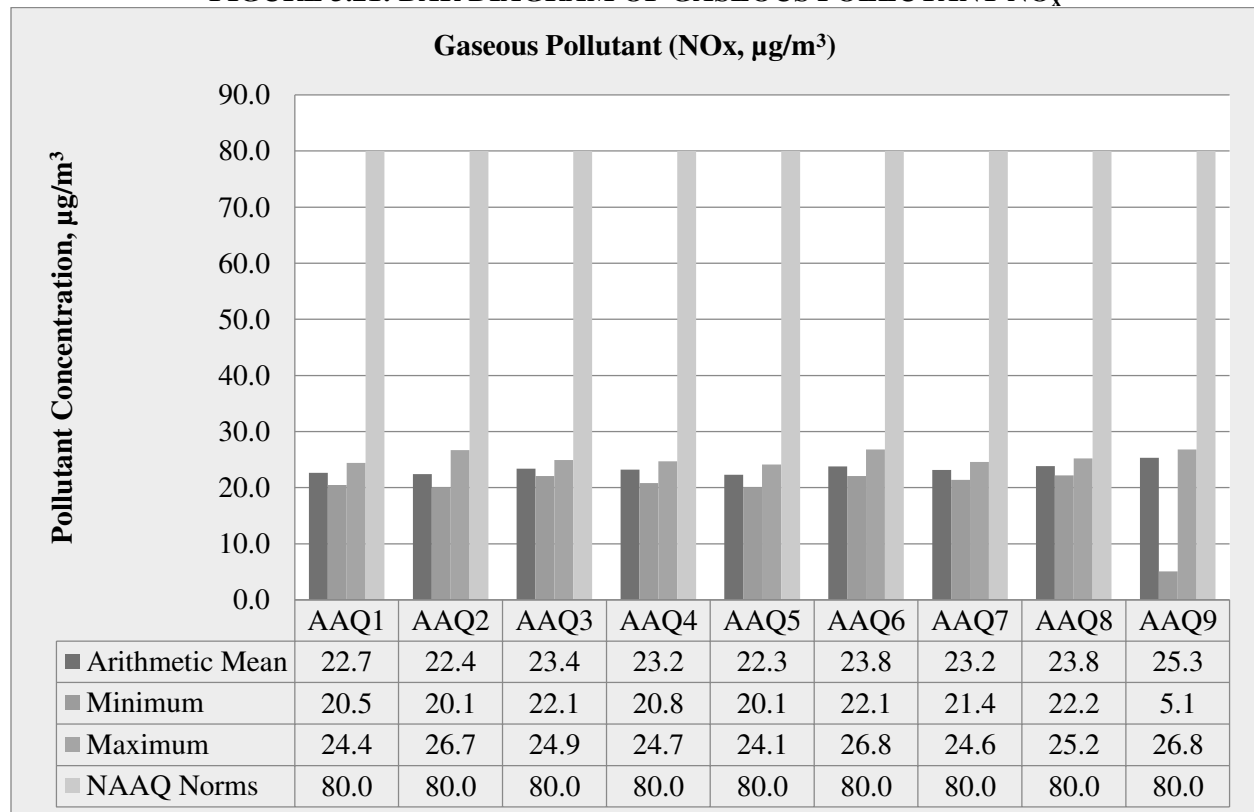
Source: Table 3.17 to 3.27

FIGURE 3.20: BAR DIAGRAM OF GASEOUS POLLUTANT SO₂



Source: Table 3.17 to 3.27

FIGURE 3.21: 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 44.2 µg/m³ to 47 µg/m³, PM_{2.5} data ranges from 23.6 µg/m³ to 25.5 µg/m³, SO₂ ranges from 6.3 µg/m³ to 7.3 µg/m³ and NO₂ data ranges from 20.4µg/m³ to 22.9 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 –

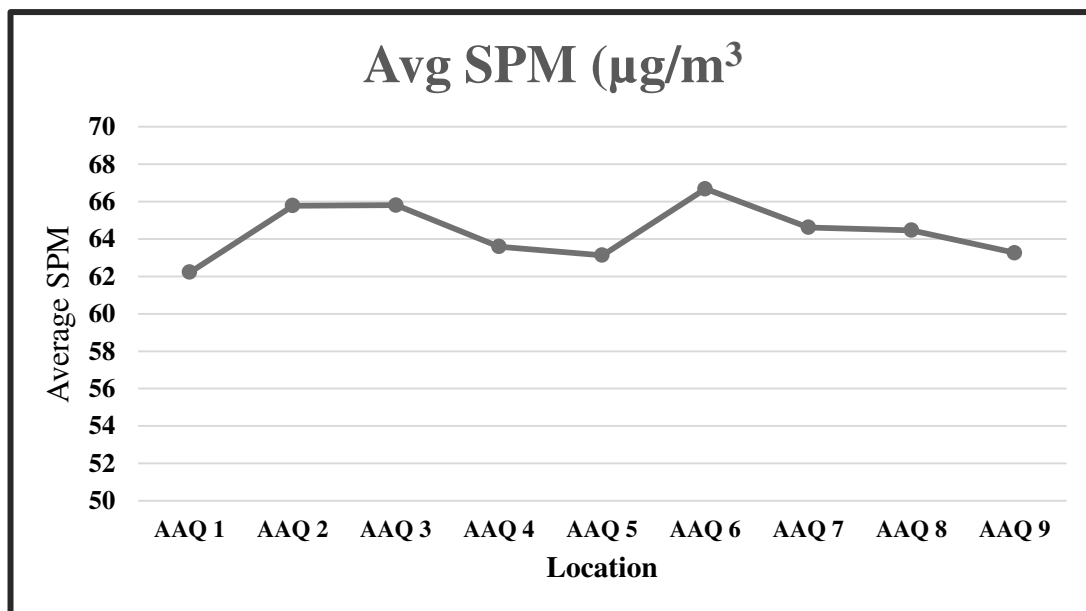
Fugitive dust was recorded at AAQ monitoring stations for 30 days average during the study period.

TABLE 3.30: AVERAGE FUGITIVE DUST SAMPLE VALUES

AAQ Locations	Avg SPM (µg/m3)
AAQ 1	62.22
AAQ 2	65.78
AAQ 3	65.81
AAQ 4	63.60
AAQ 5	63.13
AAQ 6	66.68
AAQ 7	64.62
AAQ 8	64.47
AAQ 9	63.26

Source: Onsite monitoring/ sampling by Chennai Mettex Lab pvt Ltd

FIGURE 3.22: LINE DIAGRAM OF AVERAGE SPM VALUES

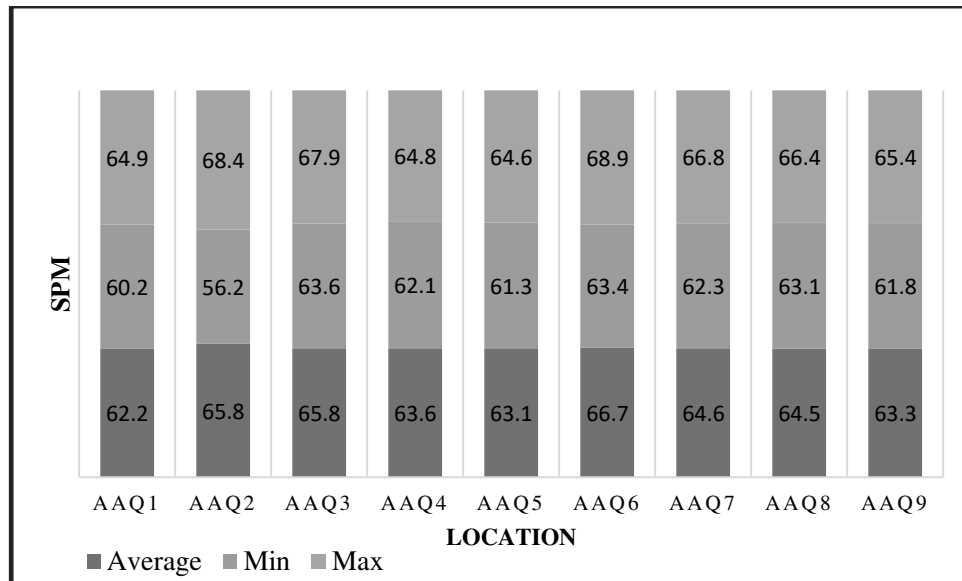


Source: Table 3.27

TABLE 3.31: FUGITIVE DUST SAMPLE VALUES IN $\mu\text{g}/\text{m}^3$

SPM	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8	AAQ9
Arithmetic Mean	62.2	65.8	65.8	63.6	63.1	66.7	64.6	64.5	63.3
Minimum	60.2	56.2	63.6	62.1	61.3	63.4	62.3	63.1	61.8
Maximum	64.9	68.4	67.9	64.8	64.6	68.9	66.8	66.4	65.4
NAAQ Norms	62.2	65.8	65.8	63.6	63.1	66.7	64.6	64.5	63.3

Source: Calculations from Lab Analysis Reports

FIGURE 3.23: BAR DIAGRAM OF SPM VALUES

Source: Table 3.28

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 Nine (9) 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 3.32 DETAILS OF SURFACE NOISE MONITORING LOCATIONS

S. No	Location code	Monitoring Locations	Distance & Direction	Direction	Coordinates
1	N-1	Core Zone Project Area	-	Project Area	9°28'24.77"N 78°11'21.12"E
2	N-2	Near Proposed Quarry	-	140m SE	9°28'24.42"N 78°11'27.28"E
3	N-3	Aladipatti	0.85 Km	900m NE	9°28'37.98"N 78°11'54.62"E
4	N-4	Kallorani	2.72 Km	2.5km SW	9°28'10.99"N 78° 9'53.59"E
5	N-5	Muthuramalingapuram	2.34 Km	2.5km SW	9°27'41.60"N 78°10'5.57"E
6	N-6	Bommakottai	1.21 Km	1.8km South	9°27'26.87"N 78°10'57.90"E
7	N-7	Kalayarkarisalkulam	1.62 km	3.4km South	9°26'34.88"N 78°11'34.90"E
8	N-8	Kallumadam	2.7 Km	3km SE	9°26'57.69"N 78°12'14.03"E
9	N-9	Konganakurichi	1.74 Km	1.6km North	9°29'20.73"N 78°11'14.04"E

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

3.4.2 Method of Monitoring

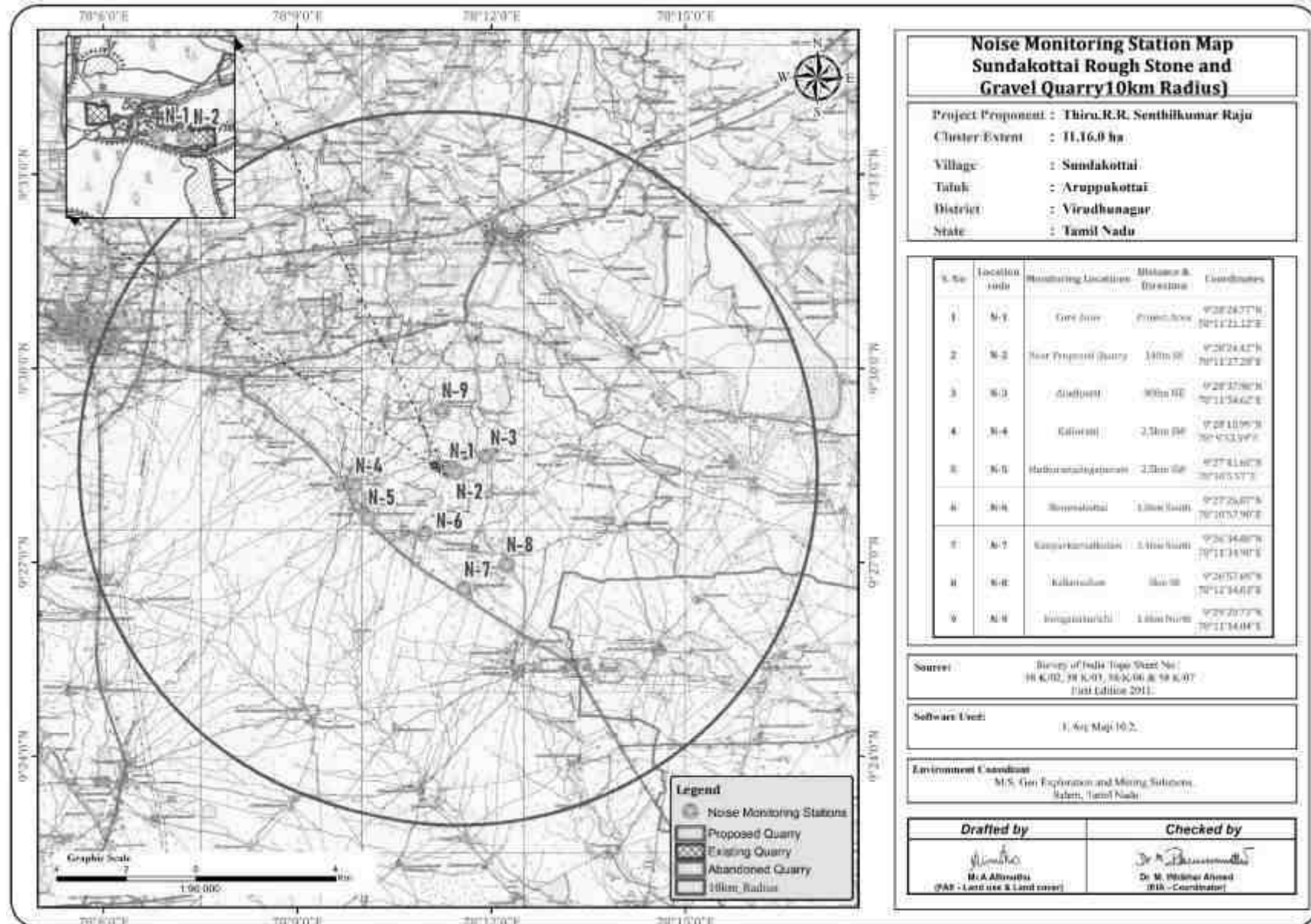
Digital Sound Level Meter was used for the study. All reading was taken on the 'A-Weighting' frequency network, at a height of 1.5 meters from ground level. The sound level meter does not give a steady and consistent reading and it is quite difficult to assess the actual sound level over the entire monitoring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

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

$$Leq = 10 \log L / T \sum (10L_n/10)$$

Where L = Sound pressure level at function of time dB (A) T = Time interval of observation

FIGURE 3.24: 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 3.30

Day time: 6:00 hours to 22.00 hours.

Night time: 22:00 hours to 6.00 hours.

TABLE 3.33: AMBIENT NOISE QUALITY RESULT

S. No	Locations	Noise level (dB (A) Leq)		Ambient Noise Standards
		Day Time	Night Time	
1	Core Zone Project Area	42.5	37.9	Industrial Day Time- 75 dB (A) Night Time- 70 dB (A)
2	Near Proposed Quarry	38.4	35.2	
3	Aladipatti	40.3	35.0	Residential Day Time- 55 dB (A) Night Time- 45 dB (A)
4	Kallorani	40.7	35.3	
5	Muthuramalingapuram	38.0	35.5	
6	Bommakottai	39.7	34.0	
7	Kalayarkarisalkulam	37.9	35.1	
8	Kallumadam	38.4	35.5	
9	Konganakurichi	38.3	35.2	

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

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

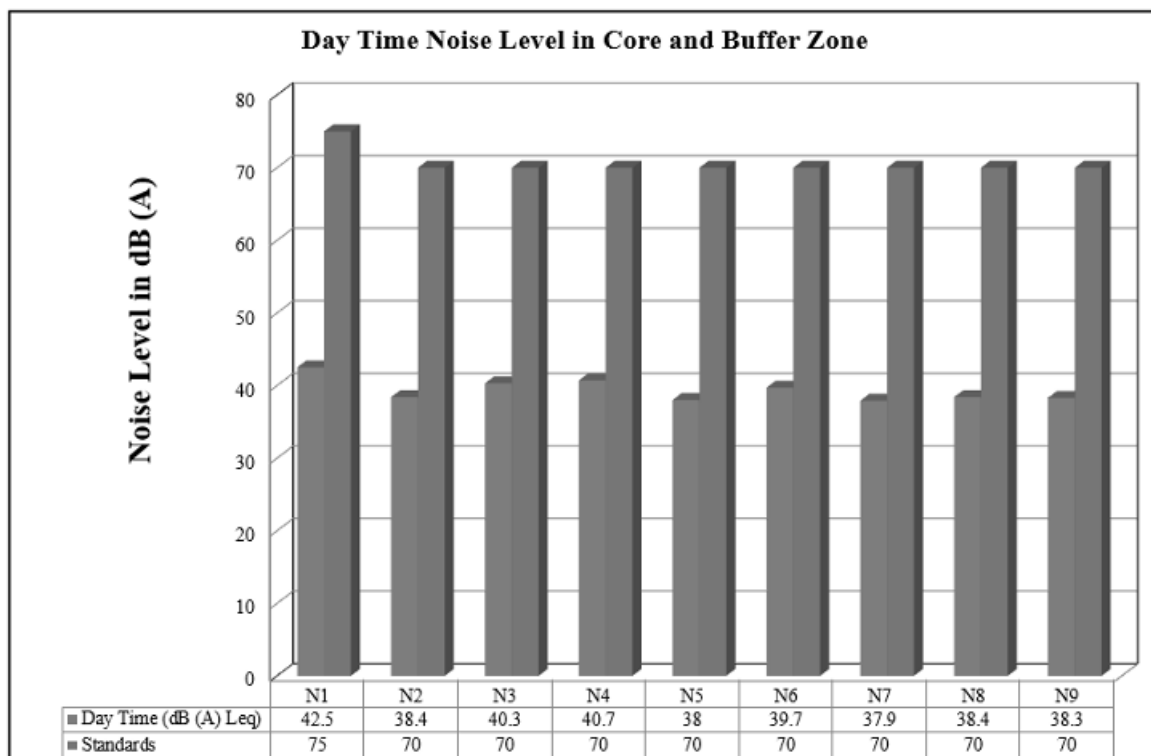
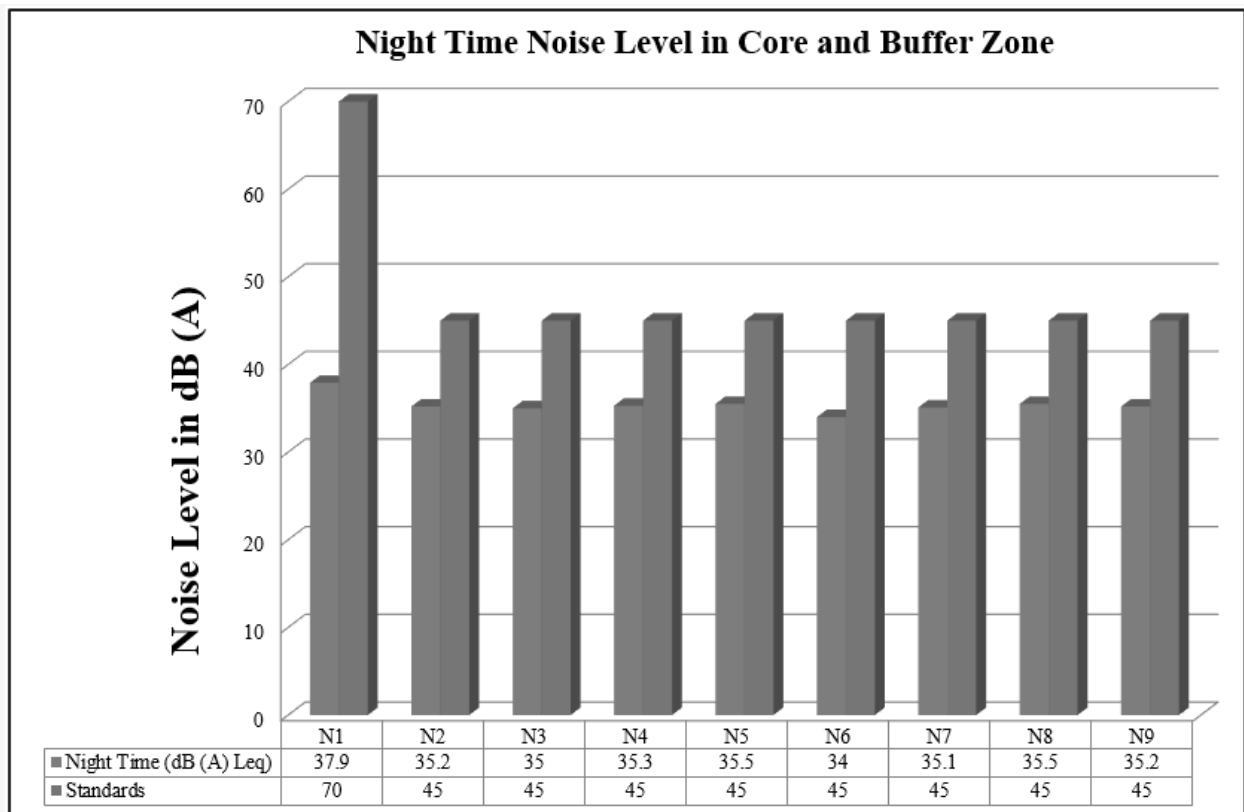


FIGURE 3.26: NIGHT TIME NOISE LEVELS IN CORE AND BUFFER ZONE



3.4.4 Interpretation & Conclusion:

Ambient noise levels were measured at 9 (Nine) locations around the proposed project area. Noise levels recorded in core zone during day time were from 42.5 dB (A) Leq and during night time were is 37.9dB (A) Leq. Noise levels recorded in buffer zone during day time were from 37.9to 40.3 dB (A) Leq and during night time were from 34.0 to 35.5 dB (A) Leq.

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

3.5 ECOLOGICAL ENVIRONMENT

3.5.1. Study area Ecology

Ecology is a branch of science that deals with the relationship and interactions between organisms and their environment. An ecological survey of the study area was performed, particularly with reference to the listing of species and assessment of the existing baseline ecological conditions in the study area. The main objective of the biological study is to collect the baseline data regarding flora and fauna in the study area. Data has been collected through extensive surveys of the area with reference to flora and fauna. Information is also collected from different sources i.e. government departments such as the District Forest Office, Government of Tamil Nadu.

3.5.2. Objectives of Biological Studies

- a) Undertake an intensive field survey to assess the status of floral & faunal component in different habitats in the core and buffer areas of the project site.
- b) Identification and listing of flora and fauna which are important as per the Wildlife (Protection) Act 1972.
- c) Suggest Wildlife conservation (species specific/habitat specific) and management plan for the threatened (critically endangered & endangered species - schedule I) faunal species if any reported within the study area.
- d) To identify the impacts of mining on agricultural lands and how it affects.
- e) Proper collection of information about wildlife Sanctuaries/ national parks/ biosphere reserves of the project area.
- f) Devise management & conservation measures for biodiversity.

3.5.3. Methodology of Sampling

Identification of vegetation in relation to the natural flora and crops was conducted through reconnaissance field surveys and onsite observations in core and buffer zone. The plant species identification was done based on the reference materials and also by examining the morphological characteristics and reproductive materials i.e. flowers, fruits and seeds. Land use pattern in relation to agriculture crop varieties were identified through physical verification of land and interaction with local villagers.

The faunal elements (animal species) of core and buffer zone were identified by direct sightings or indirect evidences viz. pug marks, skeletal remains, scats and droppings etc. (Jayson and Easa 2004). Standard binocular was used for the observations. The authenticity of faunal elements occurrence was confirmed by interaction with the local people. Avifauna identification was done with pictorial descriptions of published literature. Information pertaining to existence of any migratory corridors and paths were obtained from local inhabitants. The status of each faunal element was determined and the Wildlife schedule category was ascertained as per the IUCN-Red Data Book and Indian wildlife (Protection) Act, 1972.

Plot method is used in the floral documentation in the core and buffer zone. For trees (10x10-m), shrubs (5x5-m) and herbs (1x1-m) plots were taken. Birds and butterflies were mainly focused during faunal assessment, transect method was employed for birds and butterflies. Transect is a path along which one counts and records

the occurrence of an individual for study. A straight-line walk covering desired distance, within a time span of one hour to 30 minutes was carried out in the proposed region. Bird species were recorded during the hours of peak activity. 0700 to 1100 Hrs and 1430 to 1730 Hrs (Bibby et al. 2000).

Direct observations and bird calls were used for bird documentation. Same transects were used for counting butterflies. Opportunistic observations were made for Amphibians, reptiles and ordinates. Presence of mammals was recorded by direct and indirect signs. All possible transects were taken for birds and butterflies. Birds and butterflies were classified into species level. Recorded bird species were identified to species level using standard books (Ali & Ripley 1987, Grimmett et al., 2016).

A. Sampling

A stratified simple random sampling procedure was employed to obtain a sample from study area. The study area was further stratified in different land use/ecosystems.

B. Sampling Size

Keeping in mind both random sampling technique and covering all land use patterns for the study following sampling locations were chosen depending up on the area of the proposed site.

C. Timing of Study

The study was carried out during morning and evening hours, to cover the different activity phases for important species such as time resting, feeding, hunting, and daily movements.

D. Observations from Sampling

The various observations relating to flora and fauna species are discussed in detail below, in separate sections.

E. Equipment/ References

- Canon Mark III Camera with 50-500mm lens– Snap shots taken
- Leica Binoculars (8x 20) to spot/identify species
- IUCN Red Data Book – <https://www.iucnredlist.org/species>

Ornithological/Entomological/Herpetological/Mammalian catalogues and pictorial descriptions from various authors and websites are followed for species identification.

3.5.4. Part I Field Sampling Techniques

3.5.4.1 Transect walk – Birds

Six no transect lines with varying length (100m-300m) and fixed width (2m) were laid which cuts through the core and buffer areas of proposed site. The transect surveys were conducted from 0700 to 1100Hrs and 1430 to 1730Hrs (Bibby et al. 2000). All avifauna found along these transects were recorded for analysing the data. Counts were conducted while there is no heavy rain, mist or strong wind.

3.5.4.2 Modified Pollard Walk – for Butterflies

The Modified Pollard Walk (Pollard 1977, 1993, Walpole 1999) using fixed width transect walk method were employed to investigate butterfly spatial distribution, diversity and abundance at the different survey sites.

3.5.4.3 Visual Encounter Survey (VES) - reptiles and Amphibians

VES is a time-constrained sampling technique (Campbell and Christman, 1982; Corn and Bury, 1990). It needs a systematic search through an area or habitat for a prescribed time period (Campbell and Christman, 1982). The result of VES is measured against the time spent on search. VES technique is one of the simplest methods, and an appropriate technique for both inventory and monitoring Herpetofauna (Heyer et al. 1994).

3.5.4.4 Observational methods- Mammals

For the purpose of recording mammals, we used two different observational techniques: (1) direct observations, and (2) recording of occurrences like holes, markings, scats, hairs, and spines (Menon 2003). For identification confirmations, photographs with a scale reference were used, and locations were recorded using a portable GPS device. Indigenous knowledge particularly that of the locals, was occasionally employed to compile a preliminary list of species and/or aid in the recognition of indicators.

3.5.4.5 Multiple Stage Quadrat – Vegetation

A variety of habitat or vegetation structure variables were measured using the Multiple Stage Quadrat sampling protocol (Sykes and Horrill 1977). All of those areas were sampled, and the major corners were temporarily delineated with colored ribbons. Each site was identified in the field using a compass and clinometer, and the plot's latitude, longitude, and elevation were recorded using a handheld Global Positioning System (Garmin 12XL).

3.5.4.5 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.

3.5.4.6 Flora Composition in the Core Zone

Taxonomically a total of 25 species belonging to 18 families have been recorded from the core mining lease area. The lease-applied area is exhibit flat terrain. Based on the habitat classification of the enumerated plants the majority of species were herbs 11 followed by trees 4, Shrubs 5, Grass 3, Creeper 2. 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 Poaceae are the main dominating species in the study area mentioned in Table No.3.1.

Table No: 3.5.5.1 Flora in the Core Zone of Rough stone and gravel quarry

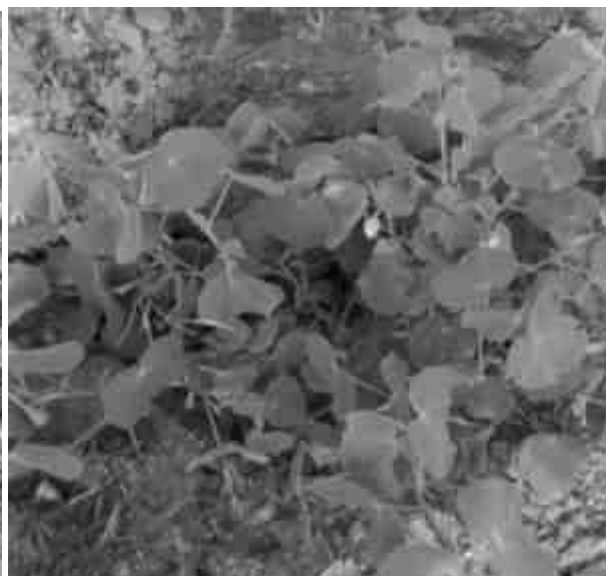
SI. No	English Name	Vernacular Name	Scientific Name	Family Name
Trees				
1.	Neem	Vembu	<i>Azadirachta indica</i>	Meliaceae
2.	Mesquite	Mullu maram	<i>Prosopis juliflora</i>	Fabaceae
3.	Indian mulberry	Nuna maram	<i>Morinda tinctoria</i>	Rubiaceae
4.	Millettia pinnata	Pongam oiltree	<i>Pongamia pinnata</i>	Fabaceae
Shrubs				
1.	Tanner's cassia	Avaram	<i>Senna auriculata</i>	Fabaceae
2.	Jujube Trees	Elantha Pazham	<i>Ziziphus Mauritiana</i>	Rhamnaceae
3.	Black-Honey	Inki pazham	<i>Phyllanthus reticulatus</i>	Euphorbiaceae
4.	Puriging nut	Kattamanakku	<i>Jatropha curcas</i>	Euphorbiaceae
5.	Milk Weed	Erukku	<i>Calotropis gigantea</i>	Apocynaceae
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.	Indian mallow	Thuthi	<i>Abutilon indicum</i>	Meliaceae
5.	Bindii	Nerunji mullu	<i>Tribulus terrestris</i>	Zygophyllaceae
6.	Dog Mustard	Nai kadugu plant	<i>Cleome viscosa</i>	Cleomaceae
7.	Prickly chaff flower	Nayuruv	<i>Achyranthes aspera</i>	Amaranthaceae
8.	Holy basil	Thulasi	<i>Ocimum tenuiflorum</i>	Lamiaceae
9.	Ban Tulsi	Melakai poondu	<i>Croton bonplandianus</i>	Euphorbiaceae
10.	Touch-me-not	Thottalchinungi	<i>Mimosa pudica</i>	Mimosaceae
11.	Blue agave	Neela katrazhai	<i>Agave tequilana</i>	Asparagaceae
Creeper				
1.	Nut grass	Korai	<i>Cyperus rotandus</i>	Poaceae
2.	Stinking passionflower	Ponai puduku chedi	<i>Passiflora foetida L</i>	Passifloraceae
Grass				
1.	Eragrostis	Pullu	<i>Eragrostis ferruginea</i>	Poaceae
2.	Narrowleaf cattail	Sambu	<i>Typha angustifolia</i>	Typhaceae
3.	Great brome	Thodappam	<i>Bromus diandrus</i>	Poaceae



a.Morinda tinctoria



b.Ocimum tenuiflorum



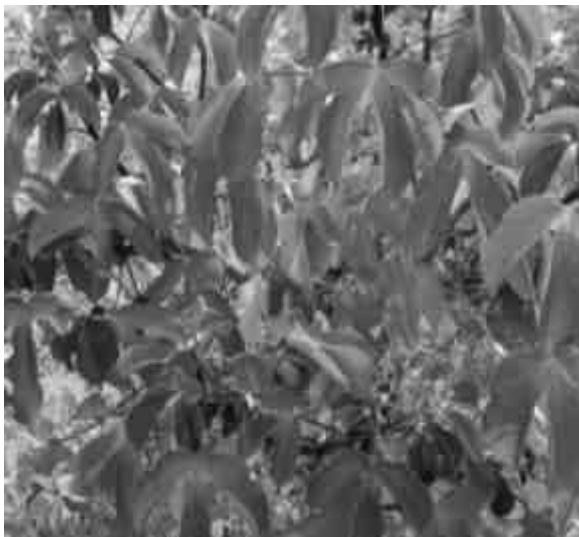
c. *Tridax procumbens*



d. *Abutilon indicum*



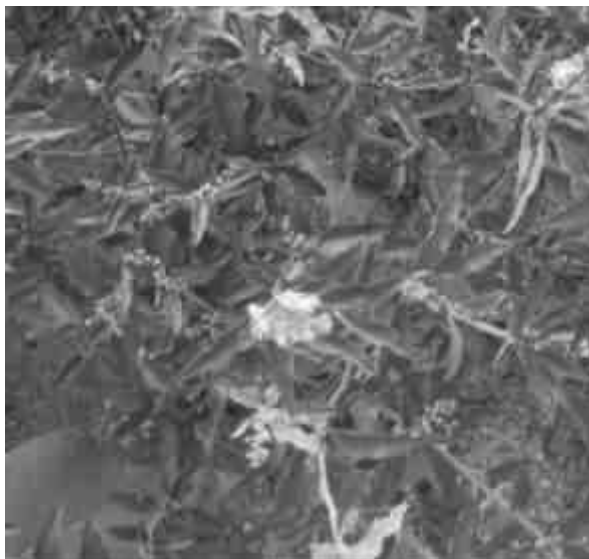
e. *Senna auriculata*



f. *Azadirachta indica*



g. *Jatropha curcas*



h. *Calotropis gigan*



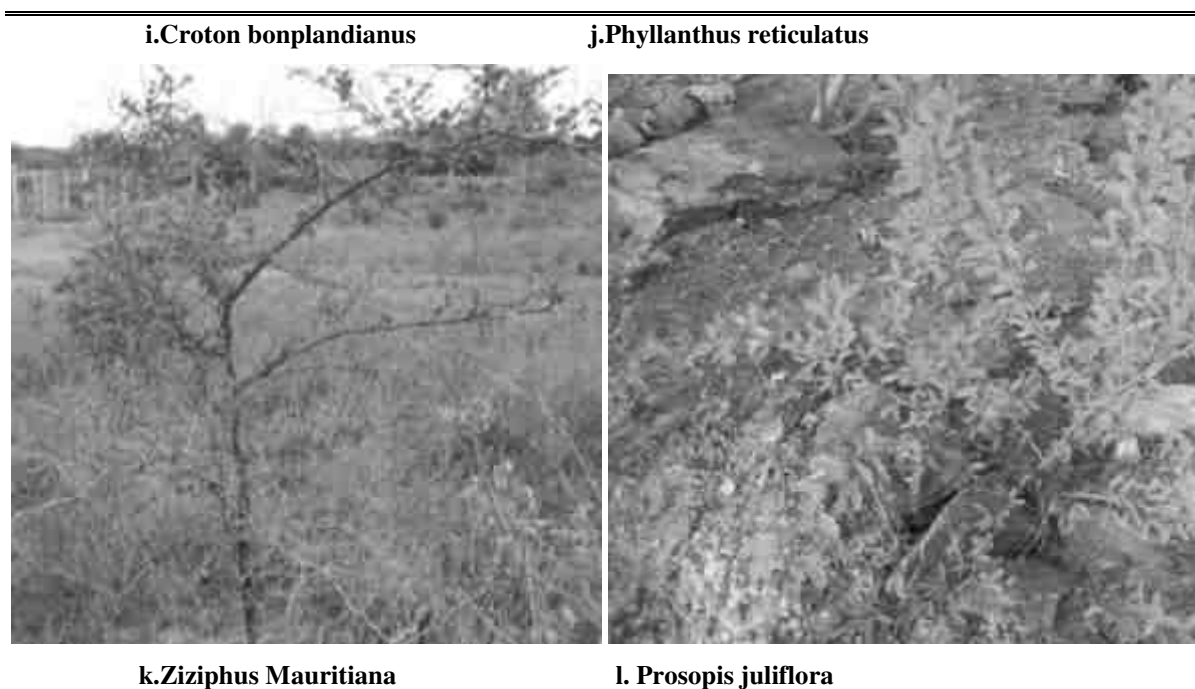


Fig No: 3.1. Flora species observation in the Core zone area

3.5.5.2 Flora Composition in the Buffer Zone

Similar habitats may be found in the buffer area as well, although there is a wider variety of plants there than in the core zone area. The proposed project site and there are 109 species in the buffer zone study area in total, based on records. The floral (109) varieties among them Trees 45, herbs 28, shrubs 24, Climbers 6, Grasses 3, Creepers 2, and Cactus 1 were identified. The result of the buffer zone of flora studies shows that Fabaceae and Poaceae, Euphorbiaceae is the main dominating species in the study area mentioned in Table No.3.3. 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. Apart from the proposed project area, there is agricultural land. Horticulture and agricultural land are untouched. There are no Rare, Endangered, and Threatened Flora species in the mining area and their surrounding study area. A list of floral species has been prepared based on a primary survey (site observations) and discussion with local people (Secondary data). The total number of different plant life forms under trees, shrubs, herbs, and climbers is shown in Table 3.2 and their % distribution is shown in Figure 3.2.

Table 3.2: Number of floral life forms in the Study Area

S. No	Plant Life Form	Number of Species
1	Trees	45
2	Shrubs	24
3	Herbs	28
4	Climber	6
5	Creepers	3
6	Grassess	2

7	Cactus	1
Total No. of Species		109

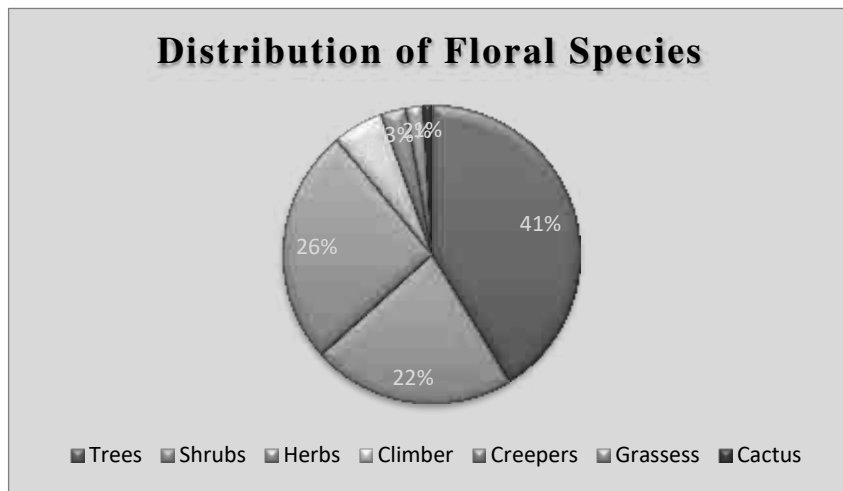


Fig No. 3.2: Pie diagram showing % distribution of floral life forms

Table No: 3.5.5.2 Flora in the Buffer zone of study area.

SI.No	English Name	Vernacular Name	Scientific Name	Family Name	Resource use type *(E,M,EM)
Trees					
1.	Neem or Indian lilac	Vembu	<i>Azadirachta indica</i>	Meliaceae	M
2.	Frywood	Vaagai	<i>Albizia lebbbeck (L.) Willd</i>	Mimosaceae	M
3.	Mango	Manga	<i>Mangifera indica</i>	Anacardiaceae	E
4.	Chinaberry	Malai vembu	<i>Melia azedarach L.</i>	Meliaceae	M
5.	Burflower-tree	Kadamba	<i>Neolamarckiacadamba</i>	Rubiaceae	E
6.	Wild Date Palm	Icham	<i>Phoenix sylvestris</i>	Arecaceae	M
7.	Chinaberry	Malai vembu	<i>Melia azedarach L</i>	Meliaceae	M
8.	Velvet mesquite	Mullu maram	<i>Prosopis juliflora</i>	Fabaceae	M
9.	Madras thorn	Kudukapuli	<i>Pithecellobium dulce</i>	Fabaceae	EM
10.	Sacred Tree	Porasu	<i>Butea monosperma</i>	Fabaceae	E
11.	Monkey pod tree	Thungumoonchi	<i>Samanea saman</i>	Fabaceae	E
12.	Portia tree	Poovarasam	<i>Thespesia Populnea</i>	Malvaceae	E
13.	Golden shower	Sarakkondrai	<i>Cassia fistula L.</i>	Caesalpinaceae	E
14.	Jack fruit	Bala maram	<i>Artocarpusintegrifolia</i>	Moraceae	E
15.	Lemon	Ezhumuchaipalam	<i>Citrus lemon</i>	Rutaceae	EM
16.	Jamun Fruit Plant	Naval maram	<i>Syzygium cumini</i>	Myrtaceae	EM
17.	Gum arabic tree	Karuvelam	<i>Vachellia nilotica</i>	Fabaceae	E
18.	Gulmohar	Neruppu Kondrai	<i>Royal poinciana</i>	Fabaceae	EM
19.	Chinese chaste tree	Nochi	<i>Vitex negundo</i>	Verbenaceae	E
20.	Indian coral tree	Kalyana Murungai	<i>Erythrina variegata L.</i>	Fabaceae	M
21.	Asian Palmyra palm	Panai maram	<i>Borassus flabellifer</i>	Arecaceae	E
22.	Curry tree Plant	Karuveppilai	<i>Murraya koenigii</i>	Rutaceae	M
23.	Bamboo	Moongil	<i>Bambusoideae</i>	Poaceae	E
24.	Teak	Thekku	<i>Tectona grandis</i>	Verbenaceae	E
25.	Indian mulberry	Nuna maram	<i>Morinda tinctoria</i>	Rubiaceae	E
26.	Coconut	Thennai maram	<i>Cocos nucifera</i>	Arecaceae	EM
27.	Horsetail She-oak	Savukku maram	<i>Casuarina equisetifolia</i>	Casuarinaceae	E
28.	Indian-almond	Inguti	<i>Terminalia catappa</i>	Combretaceae	EM
29.	Eucalyptus	Thailam maram	<i>Eucalyptus tereticornis</i>	Myrtaceae	M
30.	Yellow flame tree	Perunkondrai	<i>Peltophorum pterocarpum</i>	Fabaceae	E
31.	Pongamia pinnata	Pongam	<i>Millettia pinnata</i>	Fabaceae	M

32.	Agati	Agathi keerai	<i>Sesbania grandiflora</i>	Fabaceae	EM
33.	Banyan tree	Alamaram	<i>Ficus benghalensis</i>	Moraceae	E
34.	Indian gooseberry	Nelli	<i>Phyllanthus emblica</i>	Phyllanthaceae	EM
35.	Guava	Koyya	<i>Psidium guajava</i>	Myrtaceae	EM
36.	Tamarind	Puliyamaram	<i>Tamarindus indica</i>	Legumes	EM
37.	Drumstick tree	Murunga maram	<i>Moringa oleifera</i>	Moringaceae	EM
38.	Henna	Marudaani	<i>Lawsonia inermis</i>	Lythraceae	EM
39.	Papaya	Pappali maram	<i>Carica papaya L</i>	Caricaceae	EM
40.	Banana tree	Vazhaimaram	<i>Musa acuminata</i>	Musaceae	EM
41.	Jack fruit	Palamaram	<i>Artocarpus heterophyllus</i>	Moraceae	E
42.	Custard apple	Seethapazham	<i>Annona reticulata</i>	Annonaceae	E
43.	Manilkara zapota	Sapota	<i>Manilkara zapota</i>	Sapotaceae	E
44.	java olive tree	Kutiraippitukku	<i>Sterculia foetida</i>	Malvaceae	E
45.	Malayan Cherry	Ten Pazham	<i>Muntingia calabura</i>	Muntingiaceae	M
Shrubs					
1.	Broom creeper	Kattukodi	<i>Cocculus hirsutus</i>	Menispermaceae	M
2.	Solanum pubescens	Malaisundai	<i>Solanum pubescens Willd</i>	Solanaceae	M
3.	Devil's trumpet	Umathai	<i>Datura metel</i>	Solanaceae	EM
4.	Avaram	Avarai	<i>Senna auriculata</i>	Fabaceae	M
5.	Wild jasmine	Kattumalli	<i>Jasminum trichotomum</i>	Oleaceae	M
6.	Bush Morning Glory	Neiveli Kattamani	<i>Ipomoea carnea</i>	Convolvulaceae	E
7.	Castor bean	Amanakku	<i>Ricinus communis</i>	Euphorbiaceae	M
8.	Jungle geranium	Idly Poo	<i>Ixora coccinea</i>	Rubiaceae	M
9.	Shoe flower	Chemparuthi	<i>Hibiscu rosa-sinensis</i>	Malvaceae	EM
10.	Milk Weed	Erukku	<i>Calotropis gigantea</i>	Apocynaceae	M
11.	Jackal jujube	Suraimullu	<i>Ziziphus oenoplia</i>	Rhamnaceae	M
12.	Malabar nut	Adathodai	<i>Justicia adhatoda L</i>	Acanthaceae	M
13.	Puriging nut	Kattamanakku	<i>Jatropha curcas</i>	Euphorbiaceae	EM
14.	Malabar catmint	Pei veratti	<i>Anisomeles malabarica</i>	Lamiaceae	M
15.	Chinese chaste tree	Nalla nochi	<i>Vitex negundo L</i>	Verbinaceae	M
16.	Touch-me-not	Thottalchinungi	<i>Mimosa pudica</i>	Mimosaceae	M
17.	Black-Honey	Inki pazham	<i>Phyllanthus reticulatus</i>	Euphorbiaceae	M
18.	Indian mallow	Thuthi	<i>Abutilon indicum</i>	Meliaceae	M
19.	Night shade plan	Sundaika	<i>Solanum torvum</i>	Solanaceae	EM
20.	Rough cocklebur	Marlumuttu	<i>Xanthium indicum</i>	Asteraceae	M
21.	Mexican prickly poppy	Bramathndu	<i>Argemone mexicana</i>	Papaveraceae	M

22.	Rosary pea	Kundumani	<i>Abrus precatorius</i>	Fabaceae	M
23.	Indian Oleander	Arali	<i>Nerium indicum</i>	Apocynaceae	M
24.	West Indian Lantana	Unni chedi	<i>Lantana camara</i>	Verbenaceae	E
Herbs					
1.	Chamber bitter	Malai Kizhanelli	<i>Phyllanthus urinaria L.</i>	Euphorbiaceae	M
2.	Carrot grass	Partiniyam	<i>Parthenium hysterophorus</i>	Asteraceae	NE
3.	Punarnava	Mookarattai	<i>Boerhavia diffusa L.</i>	Nyctaginaceae	EN
4.	Spiny amaranth	Mullu keerai	<i>Amaranthus spinosus</i>	Amaranthaceae	M
5.	Billygoat weed	Pumpillu	<i>Ageratum conyzoides</i>	Asteraceae	M
6.	Aloe barbadensis	Katrazhai	<i>Aloe vera</i>	Asphodelaceae	EM
7.	Madagascar Periwinkle	Nithyakalyani	<i>Catharanthus roseus</i>	Apocynaceae	M
8.	Thorn apple	Seemai Oomatthai	<i>Datura stramonium L</i>	Solanaceae	M
9.	Indian Mercury	Kuppamani	<i>Acalypha indica</i>	Euphorbiaceae	EM
10.	White dammar	Mookutipoondu	<i>Vicoa indica</i>	Asteraceae	M
11.	Indian nettle	Nayuruvi	<i>Achyranthes aspera</i>	Amaranthaceae	M
12.	Mountain knotgrass	Ciru-pulai	<i>Aervalanata</i>	Amaranthaceae	M
13.	Ban Tulsi	Melakai poondu	<i>Croton bonplandianus</i>	Euphorbiaceae	M
14.	Sand Herbage	Manal keerai	<i>Gisekia pharnaceoides</i>	Gisekiaceae	M
15.	Fish poison	Kollukaivelai	<i>Tephrosia purpureae</i>	Papilionaceae	M
16.	Indian doab	Arugampul	<i>Cynodon dactylon</i>	Poaceae	E
17.	Large Caltrops	Yanai nerunji	<i>Pedaliium murex L.</i>	Pedaliaceae	E
18.	Cleome viscosa	Nai kadugu	<i>Celome viscosa</i>	Capparidaceae	M
19.	Common leucas	Thumbai	<i>Leucas aspera</i>	Lamiaceae	M
20.	Commelina benghalensis	Kanavazha	<i>Commelina benghalensis</i>	Commelinaceae	M
21.	Asthma-plant	Amman pacharisi	<i>Euphorbia hirta</i>	Euphorbiaceae	M
22.	Poor land flatsedg	Kunnakora	<i>Cyperus compressus</i>	Cyperaceae	NE
23.	Holy basil	Thulasi	<i>Ocimum tenuiflorum</i>	Lamiaceae	M
24.	Red Hogweed	Mukurattai	<i>Boerhavia diffusa</i>	Nyctaginaceae	M
25.	Tridax daisy	Thatha poo	<i>Tridax procumbens</i>	Asteraceae	M
26.	Gale of the wind	Keelaneeli	<i>Phyllanthus niruri</i>	Phyllanthaceae	EM
27.	Eggplant	kathirikai	<i>Solanum melongena</i>	Solanaceae	M
28.	European black nightshade	Manathakkali	<i>Solanum nigrum</i>	Solanaceae	EM
Climber					

1.	Ivy gourd	Kovai	<i>Coccinia grandis</i>	Cucurbitaceae	M
2.	Bitter apple	Peikkumatti	<i>Citrullus colocynthis</i>	Cucurbitaceae	M
3.	Butterfly pea	Sangu poo	<i>Clitoria ternatea</i>	Fabaceae	M
4.	Wild water lemon	Poonai puduku chedi	<i>Passiflora foetida</i>	Passifloraceae	M
5.	Stemmed vine	Perandai	<i>Cissus quadrangularis</i>	Vitaceae	M
6.	Bottle Guard	Sorakkai	<i>Lagenaria siceraria</i>	Cucurbitaceae	EM
Creeper					
1.	Nut grass	Korai	<i>Cyperus rotandus</i>	Poaceae	M
2.	Cucumis maderaspatanus	Musumusukkai	<i>Mukia maderaspatana</i>	Cucurbitaceae	M
3.	Grona triflora	Siru puladi	<i>Desmodium triflorum</i>	Fabaceae	EM
Grass					
1.	Eragrostis	Pullu	<i>Eragrostis ferruginea</i>	Poaceae	E
2.	Windmill grass	Chevvarakupul	<i>Chloris barbata</i>	Amaranthaceae	NE
Cactus					
1.	Indian fig opuntia	Sapathikalli	<i>Opuntia ficus-indica</i>	Cactaceae	M

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

3.5.6 The vegetation in the RF / PF areas, ecologically sensitive areas

There are neither reserved (RF) nor protected (PF) forests either in the mine lease area or in the buffer zone. Thus, no forest land is involved in any manner. Hence, no certificate from the Forest department is required. There are no protected or ecologically sensitive areas such as National parks or Important Bird Areas (IBAs), or Wetlands or migratory routes of fauna or water bodies or human settlements within the proposed mine lease area. There are no Biosphere reserves or wildlife sanctuaries or National parks or Important Bird Areas (IBAs), or migratory routes of fauna. Thus, the area under study (Mine lease area and the 10 Km buffer zone) is not ecologically sensitive. It is away from the proposed project site.

Thus, no forest land is involved in any manner. Hence, no certificate from the Forest department is required. There are no impacts due to this mining activity. There are neither forests nor forest dwellers nor forest-dependent communities in the mine lease area. There shall be no forest-impacted families (PF) or people (PP). Thus, the rights of Traditional Forest Dwellers will not be compromised on account of the project.

3.5.7 Fauna

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

3.5.8. Fauna Composition in the Core Zone

A total of 23 varieties of species were observed in the Core zone of Sundakottai Village Rough stone and gravel quarry (Table No.3.4) among them numbers Insects 6, Reptiles 3, Mammals 2, and Avians 12. A total of 23

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 eleven species are under Schedule IV according to the Indian Wildlife Act 1972. A total of 12 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: 3.5.8.1 Fauna in the Core zone of Rough stone and gravel quarry

SI. No	Common Name	Scientific Name	Schedule list WLPC 1972
Insects			
1.	House fly	<i>Musca domestica</i>	-
2.	Common Tiger	<i>Danaus genutia</i>	NL
3.	Striped tiger	<i>Danaus plexippus</i>	Schedule IV
4.	Tawny coster	<i>Danaus chrysippus</i>	Schedule IV
5.	Dragonfly	<i>Agriansp</i>	-
Reptiles			
1.	Indian forest skink	<i>Sphenomorphus indicus</i>	NL
2.	Green vine snake	<i>Ahaetulla nasuta</i>	LC
3.	Oriental garden lizard	<i>Calotes versicolor</i>	NL
4.	Rat snake	<i>Ptyas mucosa</i>	NA
5.	House lizards	<i>Hemidactylus flaviviridis</i>	Schedule IV
6.	Common krait	<i>Bungarus caeruleus</i>	LC
Mammals			
1.	Squirrel	<i>Funambulus palmarum</i>	Schedule IV
2.	Asian Small Mongoose	<i>Herpestes javanicus</i>	Schedule (Part II)
3.	Indian Field Mouse	<i>Mus booduga</i>	Schedule IV
Aves			
1.	Rose-ringed parakeet	<i>Psittacula krameri</i>	Schedule IV
2.	Black drongo	<i>Dicrurus macrocerus</i>	Schedule IV
3.	Asian koel	<i>Eudynamysscolopacea</i>	Schedule IV
4.	Koel	<i>Eudynamys</i>	Schedule IV
5.	Asian green bee-eater	<i>Meropsorientalis</i>	NL
6.	House crow	<i>Corvus splendens</i>	NL
7.	Cattle egret	<i>Bubulcus ibis</i>	NE
8.	Common myna	<i>Acridotheres tristis</i>	NL

*NL- Not listed, LC- Least Concern (Sources: Species observation in the field study)

3.5.9 Fauna Composition in the Buffer Zone

As 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 the 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 blue robin, Common Mynas, Black drangos, Crows, etc.

The list of bird species recorded during the field survey and literature from the study area is given in Table 3.5.8.1 The list of reptilian species recorded during the field survey and literature from the study area are given in Table 3.7. The list of insect species recorded during the field survey and literature from the study area are given in Table 3.8. The list of Amphibian species recorded during the field survey and literature from the study area are given in Table 3.11 and List of Butterflies identified from the project site and their conservation status is given in Table No.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 69 species were identified from the project site. Based on habitat classification the majority of species were Insects 4, followed by birds 30, Reptiles 10, Mammals 5, amphibians 5, and Butterflies 15. A total of 30 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 buffer flies, and five Amphibians were observed during the extensive field visit *Duttaphrynus melanostictus*, *Rana tiger*, *Euphlyctis hexadactylus* and, *Hoplobatrachus tigerinus*. There is no schedule I Species in the study area. There are no critically endangered, endangered, vulnerable, and endemic species were observed.

**Table 3.5.8.2 List of Fauna & Their Conservation Status,
Mammals: (*directly sighted animals & Secondary data)**

SI. No	Common Name	Scientific Name	Schedule WLPA 1972	IUCN Red List data
1	Indian palm squirrel	<i>Funambulus palmarum</i>	Schedule IV	LC
2	Indian Field Mouse	<i>Mus booduga</i>	Schedule IV	LC
3	Asian Small Mongoose	<i>Herpestes javanicus</i>	Schedule (Part II)	LC
4	Indian hare	<i>Lepus nigricollis</i>	Schedule (Part II)	LC

5	Brown rat	<i>Rattus norvegicus</i>	Schedule IV	LC
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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 3.5.8.3 Listed birds

SI. No	Common Name	Scientific Name	Schedule list WLPA 1972	IUCN Red List data
1.	Koel	<i>Eudynamys</i>	Schedule IV	LC
2.	Cattle egret	<i>Bubulcus ibis</i>	NL	LC
3.	Common myna	<i>Acridotheres tristis</i>	NL	LC
4.	Paddy Bird	<i>Ardea grayii grayii</i>	Schedule IV	LC
5.	House crow	<i>Corvus splendens</i>	NL	LC
6.	Asian green bee-eater	<i>Merops orientalis</i>	NL	LC
7.	Small blue Kingfisher	<i>Alcedo atthis</i>	Schedule IV	LC
8.	Rose-ringed parakeet	<i>Psittacula krameri</i>	NL	LC
9.	Common quail	<i>Coturnix coturnix</i>	Schedule IV	LC
10.	Small Sunbird	<i>Nectarinia asiatica</i>	Schedule IV	LC
11.	Black drongo	<i>Dicrurus macrocercus</i>	Schedule IV	LC
12.	Indian Robin	<i>Saxicoloides fulvicata</i>	Schedule IV	LC
13.	Woodpecker bird	<i>Picidae</i>	Schedule IV	LC
14.	Two-tailed Sparrow	<i>Dicrurus macrocercus</i>	Schedule IV	LC
15.	Grey Francolin	<i>Francolinus pondicerianus</i>	Schedule IV	LC
16.	Pond Heron	<i>Ardeola grayii</i>	Schedule IV	LC
17.	Common Coot	<i>Fulica atra</i>	Schedule IV	LC
18.	House sparrow	<i>Passer domesticus</i>	Schedule IV	LC
19.	Indian Robin	<i>Saxicoloides fulvicatus</i>	Schedule IV	LC
20.	Indian Roller	<i>Coracias benghalensis</i>	Schedule IV	LC
21.	Cuckoo	<i>Cuculus canorus</i>	Schedule IV	LC
22.	House Sparrow	<i>Passer domesticus</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

SI. No	Common Name	Scientific Name	Schedule list WLPA 1972	IUCN Red List data
1.	Garden lizard	<i>Calotes versicolor</i>	NL	LC
2.	Fan-Throated Lizard	<i>Sitanaponticeriana</i>	NL	LC
3.	Indian wall lizard	<i>Hemidactylus flaviviridis</i>	Schedule IV	NL
4.	Green vine snake	<i>Ahaetulla nasuta</i>	Schedule IV	NL
5.	Rat snake	<i>Ptyas mucosa</i>	Sch II (Part II)	LC
6.	Common krait	<i>Bungarus caeruleus</i>	Schedule IV	NL
7.	Indian cobra	<i>Naja naja</i>	Sch II (Part II)	LC
8.	Russell's viper	<i>Vipera russelli</i>	Sch II (Part II)	LC
9.	Common skink	<i>Mabuya carinatus</i>	NL	LC

Table 3.5.8.4 List of Reptiles either spotted or reported from the study area.

Table.3.5.8.6 List of Butterflies identified from the project site and their conservation status

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

3.5.10 Aquatic Ecology

The study area has small water bodies located on the north and east side it is away from the proposed project site. But no major drainage system can be found within the study area. No Aquatic diversity is noticed in the core zone area. Aquatic weeds are found to be growing everywhere in 10 km radius area, in every water bog, pond, etc. *Typha angustata* can be found growing all along the drains of villages, small water-logged depressions, and agricultural fields lacking water but containing enough moisture to support its growth. And where water is present, *Eichhornia crassipes* has taken its roots and covers the entire water surface by its sprawl and invasion.

3.5.10.1 Objectives of Aquatic Studies

- ✓ Generating data through actual field collection in these locations over the study period.
- ✓ Impacts on aquatic fauna/flora
- ✓ Consulted with locals to obtain knowledge about aquatic flora and animals.

3.5.10.2 Macrophytes

The macrophytes observed within the study area are tabulated in Table 3.5.10.1

Table No.3.5.10.1 Description of Macrophytes

Sl. No	Scientific name	Common Name	Vernacular Name (Tamil)	IUCN Red List of Threatened Species
1	<i>Nymphaea nauchali</i>	Blue lotus	Alli	LC
	<i>Eichornia crassipe</i>	Water hyacinth	Agayatamarai	NA
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
8	<i>Nymphaea nouchali</i>	Blue waterlily	Nellambal	LC

3.5.10.3 Aquatic Faunal Diversity

Amphibian species like the common Indian Burrowing frog, and Indian Pond Frog, Indian Toad, Indian Bull Frog, Common Tree Frog were sighted near the water bodies located in the study area.

Table no. 3.5.10.2 Amphibians Observed/Recorded from the Study Area

Sl. No	Common Name	Zoological Name	WLPA, 1972	IUCN Red List data
1.	Indian Pond Frog	<i>Euphlyctis hexadactylus</i>	Schedule IV	LC

2.	Indian Toad	<i>Bufo melanostictus</i>	Schedule IV	LC
3.	Indian Skipper Frog	<i>Euphlyctis cyanophlyctis</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

3.5.10.4 Other Aquatic species

There are also a few canals and ponds in the study region. The presence of a few common/local fish species, as well as a broad range of plankton, has been documented in ponds in the communities listed below.

3.5.10.5 Phytoplanktons: Nitzschia, Microcystis, Oscillatoria, Navicula and Pediastrum sps.

3.5.10.6 Zooplanktons: These consist of microscopic organisms from groups Protozoa, Rotifers, Cladocera and Copepoda etc. Some common species of zooplanktons are; Deflandre, Arcella vulgaris, Centropyxis spinosa Arcella discoides, Arcella hemispherica, Centropyxis aculeate, Trigonopyxis arcula, Brachionus calyciflorus, Lecane curvicornis, Brachionus angularis, Polyarthra vulgaris, Filinia longiseta.

3.5.10.7 Fishes

The fish species were seen during the primary field investigation near the study's area. Table 3.11 lists fish species such as Rohu, Catla, Catfish, and others.

Table 3.5.10.3 Based on Actual Sighting, based on inputs from locals and Perused from Secondary Data

S.No	Common name	Scientific name	Family
1.	Ponthia	<i>Puntius sophore</i>	Cyprinidae
	Rohu	<i>Labeo rohita</i>	Cyprinidae
2.	-	<i>Cyprinus carpio</i>	Cyprinidae
3.	Catla	<i>Catla Catla</i>	Cyprinidae
5.	Catfish	<i>Siluriformes</i>	-
6.	Snakehead murrel	<i>Channa striata</i>	-

3.5.10.8 Findings/Results

The assessment was carried out during the Summer season. The inspection day was quite alright with respectable weather. The details of the flora and fauna observed are given below.

Records of threatened species in the area

No threatened species were observed

Endangered Species as per Wildlife (Protection) Act

No Endangered fauna was recorded in the project area.

Endemic Species of the Project areas

No endemic species were observed in the project area.

Migratory species of the Project areas

No migratory fauna observed in project area.

Migratory corridors and Flight paths

No migratory corridors and Flight paths were observed in project area.

3.5.10.9 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 rough stone 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:

- a) 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.

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- e) To study the socio-economic status of the people living in the study area rough stone and gravel quarry project region.
 - f) To assess the impact on socio-economic environment due to rough stone 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 analysed.
- 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 Sundakottai Village, Aruppukottai Taluk, Virudhunagar 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 centres 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, Thoothukudi, Cuddalore and Vellore. The alluvial plains of the Cauvery Delta extending over Thanjavur and part of Tiruchirappalli districts and dry southern plains in Madurai, Dindigul, Ramanathapuram, Sivaganga, Virudhunagar, 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 Tamil Nādu 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 – Thoothukudi, Namakkal, Perambalur, Viluppuram, Thiruvarur, 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 Virudhunagar District

Virudhunagar District was formerly called Karmavirer Kamarajar District. The district is situated in the southern portion of Tamil Nadu State. The Virudhunagar district is bounded on north by Madurai and Sivagangai district, south by Tirunelveli and Tuticorin district, east by Ramanathapuram, west by Kerala state and northwest by Theni district. The administrative headquarters of Virudhunagar district is located at Virudhunagar town. Virudhunagar district consists of 3 Revenue divisions, 9 Taluks, 39 Firkas and 600 Revenue Villages.

Virudhunagar District consists of three Revenue Divisions viz., Aruppukottai, Sivakasi and Sattur, Ten Taluks viz., Rajapalayam, Srivilliputtur, Sattur, Sivakasi, Virudhunagar, Aruppukottai, Tiruchuli, Kariapatti, Vembakottai and Watrap (Vembakottai Taluk is formed as per G.O.(Ms) No. 321 Revenue Department dated : 31-08-2015) comprising of 600 Revenue Villages. The District has one Corporation, five Municipalities, nine Town Panchayats, eleven blocks and 450 Village Panchayats.

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 Sundakottai Village, Aruppukottai Taluk, Virudhunagar 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	Virudhunagar District	Study Area (10km Radius)
Area (in sq. km.)	3,287,263	130058	4,288	315
Population Density/ sq. Km.	368	554	453	191
No. of Households	249454252	13357027	537748	15636
Population	1210569573	72147030	1942288	60046
Male	623121843	36137975	967709	30134
Female	587447730	36009055	974579	29912
Scheduled Tribes	104281034	794697	2294	11
Scheduled Castes	201378086	14438445	399831	5459
Literacy Rate	72.99%	80%	72%	80%
Sex Ratio (Females per 1000 Males)	943	996	1007	993

Source: Census of India, 2011

Table no 3.12.1 show demographic pattern of India, Tamil Nadu, Virudhunagar District & Study area (10km Radius). In India had total area of 3.2 sqkm, State of Tamil Nadu area was 130058 sqkm, District of Virudhunagar area was 4,288 sqkm and study area is about 315 sqkm. Population density is total population per sqkm. So, India population density was 368 sqkm, state of Tamil Nadu density was 554 sqkm, District had density about 453 sqkm and study area density is about 191 sqkm. As per Census 2011, about 5.96percent of population in the state lives in areas. Virudhunagar had comparing state wise 2.69 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 19 %,

district of Virudhunagar about 21% it has increasing to Study area about 9.09% increasing in the total population Similarly ST population is about 1.10%, 0.11% and 0.02% of the total population in the study area. State level Literacy rate is 80%, district level is 72% but study area has increased about 80%. There is literacy rate is study area is an increase comparing district level decreased. Sex ratio female per thousand males about state level is 996, District level is 1007 and study area is 993.

The study area has population density 191 persons per sq.km of total population about 60046 as per census 2011. There were about 50.18 percent male and 49.82% female population. Study area has literate rate is about 80%, District had about 72% of literate rate as per census 2011.

3.13 Population Projection of the Study Area

Virudhunagar Population 2011 – 2030

The last census of Thoothukkudi was done in 2011 and next census of 2021 has been postponed or cancelled. But we can do projection of future Thoothukkudi 2023 Population on the basis likely Population Growth Rate.

Year	Projected Population
2011	1,942,288
2021	2,120,000
2022	2,130,000
2023	2,150,000
2024	2,160,000
2025	2,170,000
2026	2,180,000
2027	2,190,000
2028	2,190,000
2029	2,200,000
2030	2,200,000

Source: <https://www.census2011.co.in/census/district/47-virudhunagar.html>

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.

A population projection gives a picture of what the future size and structure of the population by sex and age might look like. It is based on knowledge of the past trends, and, for the future, on assumptions made for three components: fertility, mortality and migration.

Table 3.13.1 Total Population of Study Area

Sl No.	Population in 2001	Population in 2011
1	52373	60046

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

Table 3.13.2 Population Projection of Study Area

S. No	Year	Projected Population (Approximately)
1.	2021	67719
2.	2031	75392
3.	2041	83065
4.	2051	90738

Source: Calculated by SPSS 23

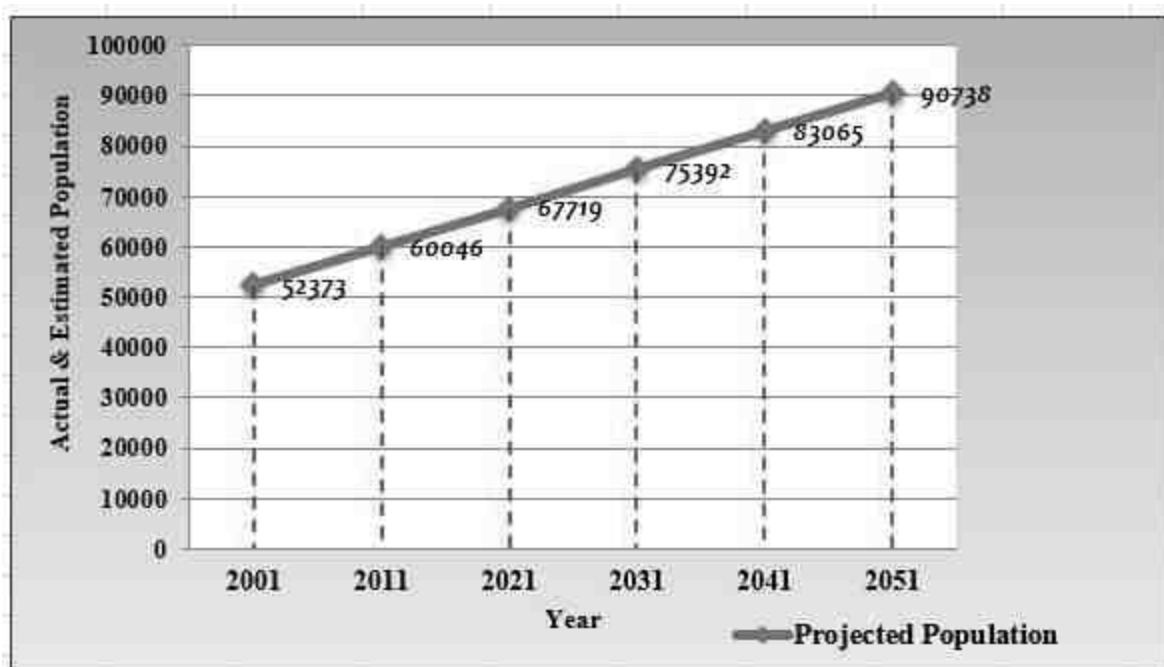


Fig 3.13.3 Graph Showing Population Projection

Following formula has been used for the projection of population.

$$Y=a+b_t$$

Where: Y= Dependent variable (Population)

a=Intercept

b=Slope

t=Interdependent variables (Time)

Above formula is applied to project population for the years (2021, 2031,2041,2051). Due to avoid the errors in manual calculation the statistical software SPSS (demo version 23) 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	52373	-
2011	60046	11.47
2021	67719	11.28
2031	75392	11.13
2041	83065	11.02
2051	90738	10.92

Source: Compiled by Author-2023

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 52373 and 2011 it was 60046 if the population growth rate is 11.47%, it will approximately gradually an increase about 67719 in year 2021 and 90738 in the year of 2051. It has approximately population growth rate decline will be 10.92%.

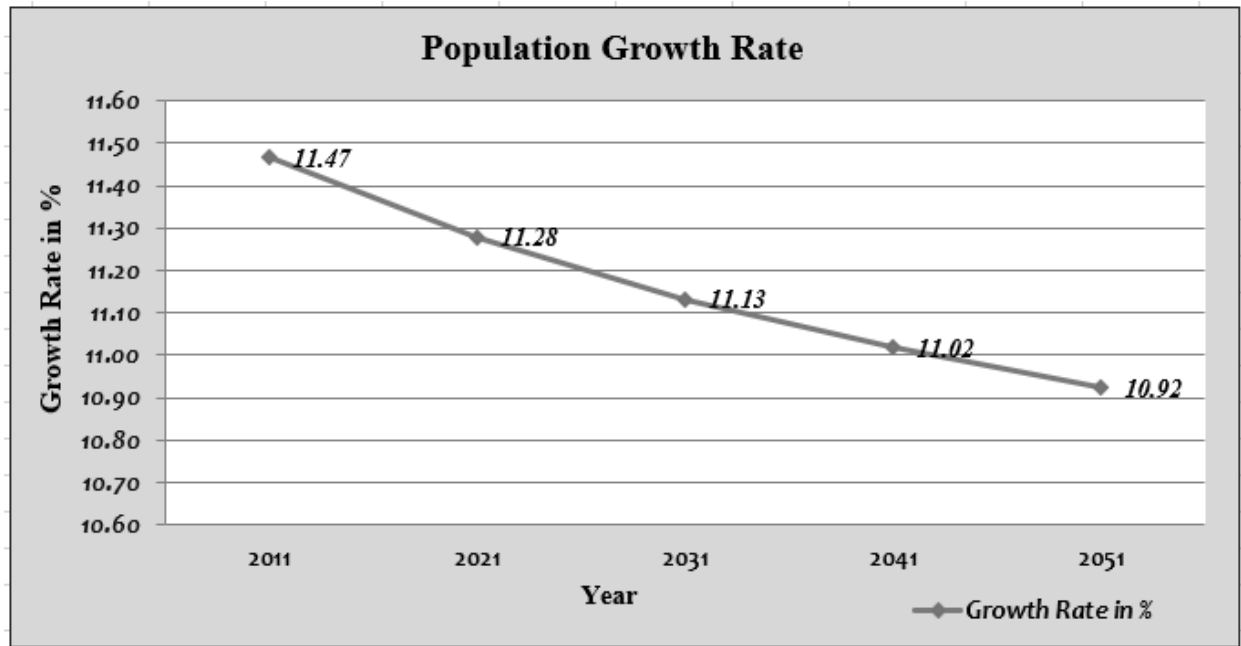


Fig.3.14.2 Graph Showing Population Growth Rate

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 60046 (for 10 km radius buffer zone). Total no. of household is 2985, 7473 and 5178 respectively, in primary, secondary and tertiary zone. Sex ratio is 984,995 and 994 (females per 1000 males) observed in primary, secondary and tertiary zone respectively. SC population distribution is 1289, 2840 and 1330 respectively in primary, secondary and tertiary zone. ST population distribution is very less 0,11 and 0 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)	9	2985	10507	5296	50.40	5211	49.60
Secondary Zone (3 - 7 Km)	15	7473	28878	14474	50.12	14404	49.88
Tertiary Zone (7 - 10 km)	14	5178	20661	10364	50.16	10297	49.84
Study Area (0-10 km)	38	15636	60046	30134	50.18	29912	49.82

Source: Census of India, 2011

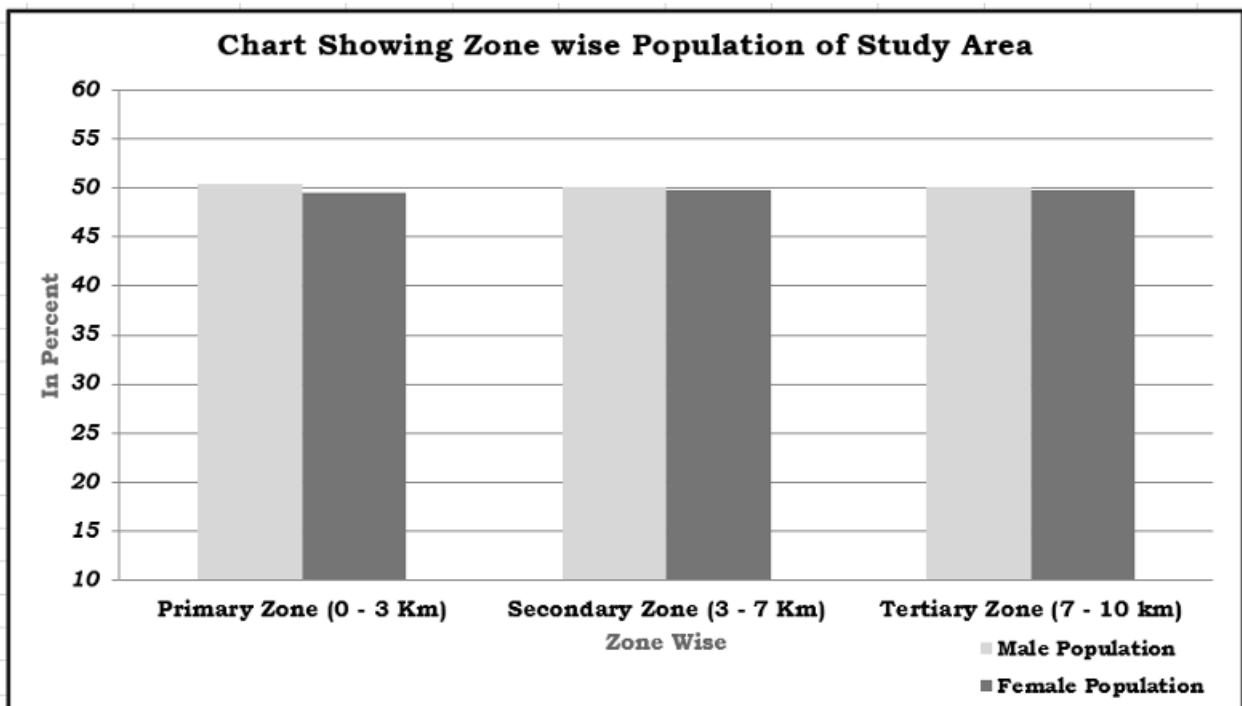


Figure 3.15.2 Population of study area

- ✓ 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 9 villages where as much as 2985 households with 5296 population are located. Mostly lying on Built-up land for their livelihood and substance.
- ✓ Secondary and tertiary zone both comprise of 15 and 14 villages having a total population of 28878 and 20661 respectively.

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

Sno	Name	TRU	No Household	Total Population	Male Population	Female Population	Person 0-6 yrs	Male 0-6 yrs	Female 0-6yrs	SC Persons	ST Person	Literate Person	Male Literate	Female Literate	Total Workers	Main Workers	Marginal workers	Non Workers
0-3m																		
1	Kurunaikulam	Rural	185	641	329	312	60	37	23	221	0	442	247	195	357	338	19	284
2	Konganakurichi	Rural	174	575	282	293	44	26	18	107	0	414	222	192	358	340	18	217
3	Aladipatti	Rural	708	2811	1433	1378	323	175	148	40	0	1913	1085	828	1582	1412	170	1229
4	Bommakottai	Rural	252	815	399	416	71	40	31	17	0	642	322	320	432	430	2	383
5	Kallorani	Rural	865	2798	1416	1382	270	141	129	427	0	2225	1203	1022	1395	1357	38	1403
6	Muthuramalingapuram	Rural	458	1591	820	771	118	53	65	2	0	1412	745	667	926	885	41	665
7	Narthampatti	Rural	280	1036	509	527	98	48	50	475	0	816	414	402	515	370	145	521
8	Sundakottai	Rural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Kalyanasundarapuram	Rural	63	240	108	132	33	18	15	0	0	166	79	87	116	105	11	124
	Total		2985	10507	5296	5211	1017	538	479	1289	0	8030	4317	3713	5681	5237	444	4826
3-7km																		
1	Tiruchuli	Rural	2438	9665	4863	4802	1134	589	545	1556	8	6882	3761	3121	4477	3575	902	5188
2	Panaiyur	Rural	368	1305	652	653	158	77	81	29	0	868	504	364	589	572	17	716
3	Chittalakundu	Rural	288	1132	583	549	145	69	76	0	0	684	425	259	525	250	275	607
4	Pillaiyar natham	Rural	93	327	158	169	27	11	16	2	0	236	126	110	252	68	184	75
5	Kulasekaranallur	Rural	729	2820	1408	1412	289	139	150	326	0	1890	1086	804	1489	1411	78	1331
6	Melakandamangalam	Rural	544	2111	1098	1013	314	159	155	256	0	1542	855	687	939	917	22	1172
7	Kullampatti	Rural	196	855	431	424	88	43	45	11	0	676	369	307	448	433	15	407
8	Kalayarkarisalkulam	Rural	603	1971	947	1024	164	83	81	299	0	1537	792	745	1229	1150	79	742
9	Kallumadam	Rural	338	1934	987	947	218	102	116	47	0	1430	799	631	1129	1105	24	805
10	Erasinnampatti	Rural	98	373	176	197	34	18	16	1	0	276	141	135	133	70	63	240
11	Parattanatham	Rural	23	93	41	52	7	2	5	0	0	61	31	30	49	33	16	44
12	Thammanaickenpatti	Rural	100	404	211	193	30	18	12	12	0	257	156	101	252	236	16	152
13	Vedanatham	Rural	171	681	352	329	64	27	37	9	0	503	296	207	411	144	267	270
14	Silukkapatti	Rural	126	516	254	262	56	36	20	283	0	329	180	149	326	326	0	190
15	Mandapasalai	Rural	1358	4691	2313	2378	425	213	212	9	3	3764	1977	1787	2442	2275	167	2249
	Total		7473	28878	14474	14404	3153	1586	1567	2840	11	20935	11498	9437	14690	10290	2125	14188
7-10km																		
1	Pillaiyarhottaiyankulam	Rural	406	1586	777	809	183	86	97	43	0	1039	617	422	871	868	3	715
2	Manavarayanendal	Rural	94	371	189	182	31	11	20	1	0	171	101	70	217	216	1	154
3	Pulikurichi	Rural	219	1089	552	537	172	99	73	66	0	630	337	293	541	458	83	548
4	Kadalpatchi	Rural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Sethupuram	Rural	205	948	494	454	103	56	47	128	0	651	378	273	474	468	6	474
6	Velanoorani	Rural	838	3401	1729	1672	325	172	153	21	0	2471	1382	1089	2240	1483	757	1161

7	Poyyankulam	Rural	312	1234	596	638	167	81	86	0	0	708	396	312	674	350	324	560
8	Kurunjakulam	Rural	351	1267	629	638	129	66	63	0	0	805	484	321	750	717	33	517
9	Puliyuran	Rural	664	2534	1291	1243	318	168	150	984	0	1619	940	679	1320	819	501	1214
10	Sembatti	Rural	1033	3880	1936	1944	454	230	224	33	0	2465	1436	1029	2225	1753	472	1655
11	Mettuthottiyangulam	Rural	294	1087	536	551	124	63	61	0	0	737	395	342	662	656	6	425
12	Maravarperungudi	Rural	430	1971	988	983	210	100	110	46	0	1395	807	588	1236	1226	10	735
13	Vadakkukoppuchithampatti	Rural	107	456	231	225	42	18	24	0	0	362	210	152	271	267	4	185
14	T.Koppuchithampatti	Rural	225	837	416	421	83	44	39	8	0	699	365	334	357	350	7	480
	Total		5178	20661	10364	10297	2341	1194	1147	1330	0	13752	7848	5904	11838	9631	2207	8823
	G.Total		15636	60046	30134	29912	6511	3318	3193	5459	11	42717	23663	19054	32209	25158	4776	27837

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

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 989 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 27 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)	984
2	Secondary zone (3-7 km)	995
3	Tertiary Zone (7-10 km)	994

Source: Census of India, 2011

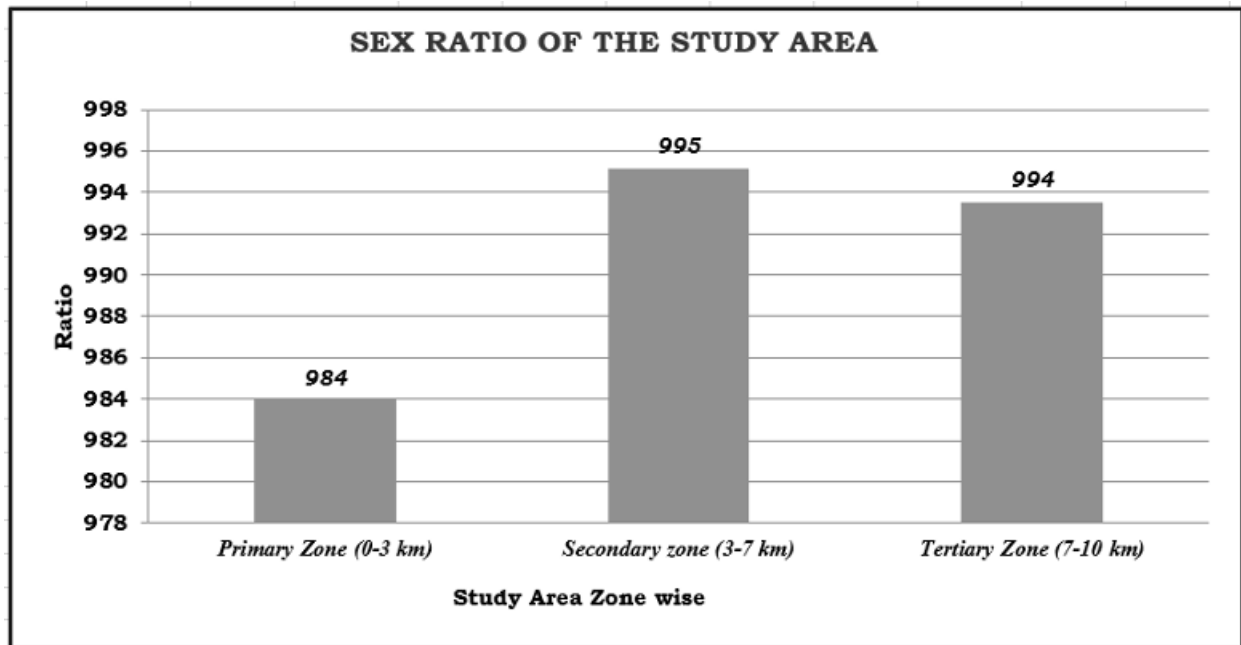
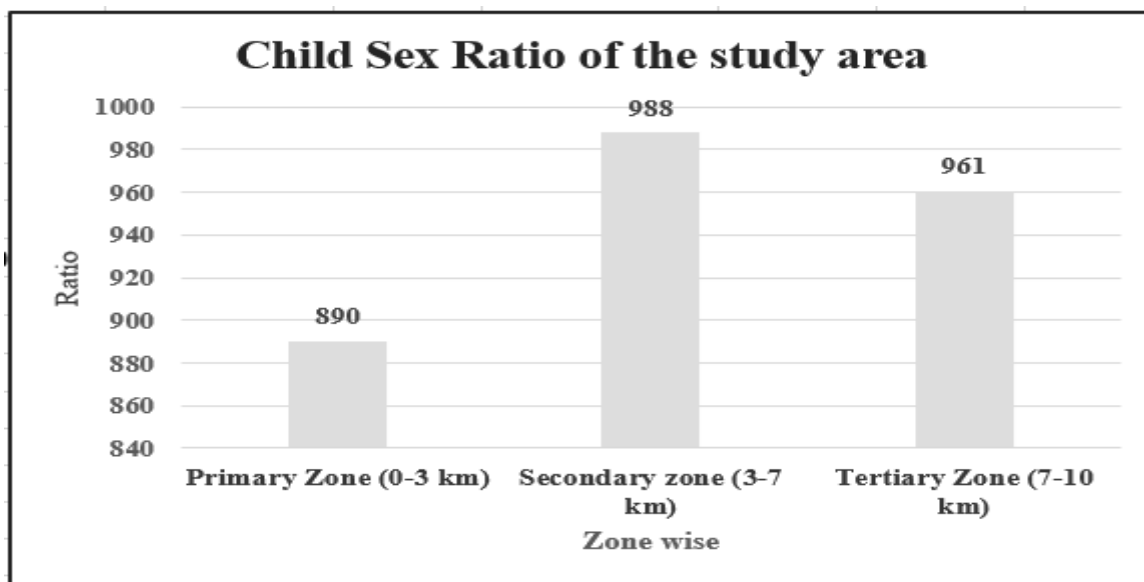


Figure 3.16.2 Sex Ratio within 10 Km study area

Table 3.16.1-b Child Sex ratio of the study area

S. No.	Buffer Zone	Sex Ratio of Study area Female/ 1000 Male
1	Primary Zone (0-3 km)	890
2	Secondary zone (3-7 km)	988
3	Tertiary Zone (7-10 km)	961

**Figure 3.16.2-b Child 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 80% as per census data 2011. The male literacy rate in the study area indicates 88% whereas the female literacy rate, which is an important indicator for social change, is observed to be 71% as per the census data 2011. This needs to focus on the study area 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)	9	4317	90.73	3713	78.47	8030	84.62
Secondary Zone (3 - 7 Km)	15	11498	89.21	9437	73.51	20935	81.38

Tertiary Zone (7 - 10 Km)	14	7848	85.58	5904	64.52	13752	75.07
Study Area (0-10km)	38	23663	88.24	19054	71.31	42717	79.79

Source: Census of India, 2011

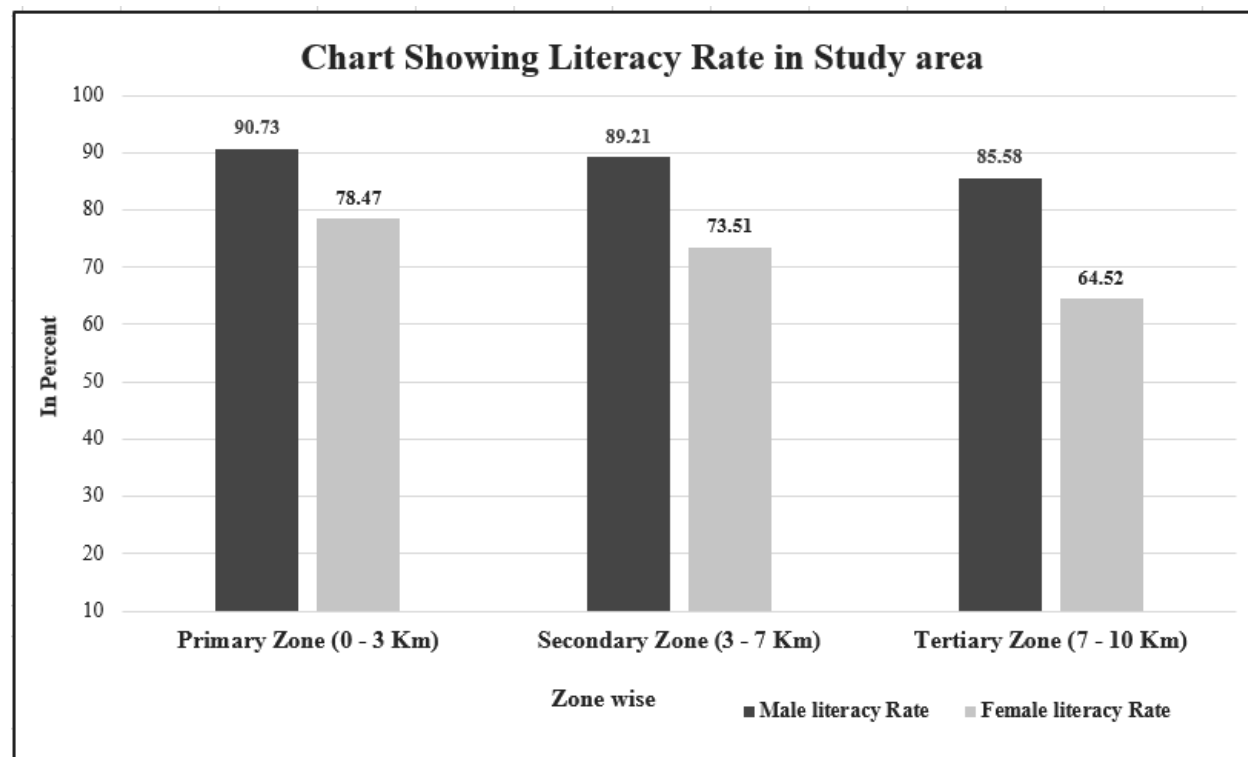


Figure 3.17.2 Gender wise Literacy Rate in the study area

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.

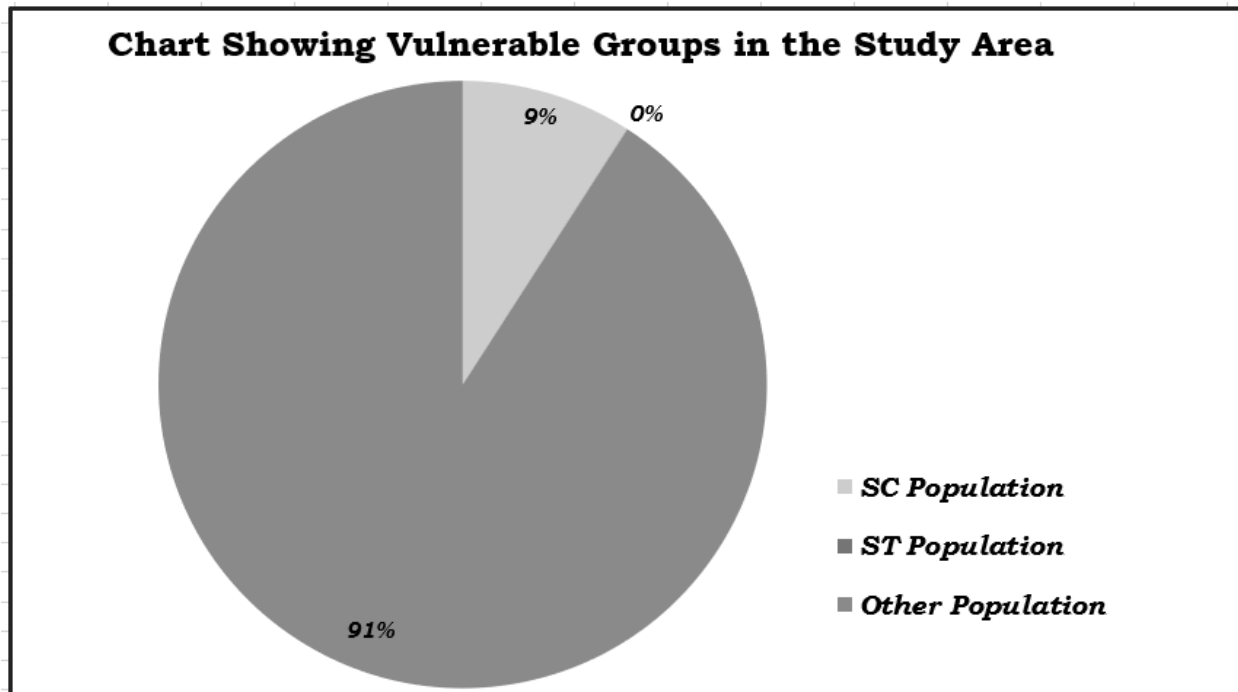
3.19 Vulnerable Group

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 9.09% and Schedule Tribe population 0.02 %, Other Population is 91% 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)	9	1289	12.27	0	0.00	9218	87.73
Secondary Zone (3 - 7 Km)	15	2840	9.83	11	0.04	26027	90.13
Tertiary Zone (7 - 10 Km)	14	1330	6.44	0	0.00	19331	93.56
Total area (10km)	38	5459	9.09	11	0.02	54576	90.89

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, vagrants 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)	9	5681	54.07	5237	49.84	444	4.23	4826	45.93
Secondary Zone (3 - 7 Km)	15	14690	50.87	10290	35.63	2125	7.36	14188	49.13
Tertiary Zone (7 - 10 Km)	14	11838	57.30	9631	46.61	2207	10.68	8823	42.70
Study Area (10 Km)	38	32209	53.64	25158	41.90	4776	7.95	27837	46.36

Source: Census of India, 2011

The above table shows that out of the total working population, the percentage of main workers is 42% while 8% are marginal workers. Number of working populations is 54% and non-working population is 46% 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 enrol and earn sustain livelihood.

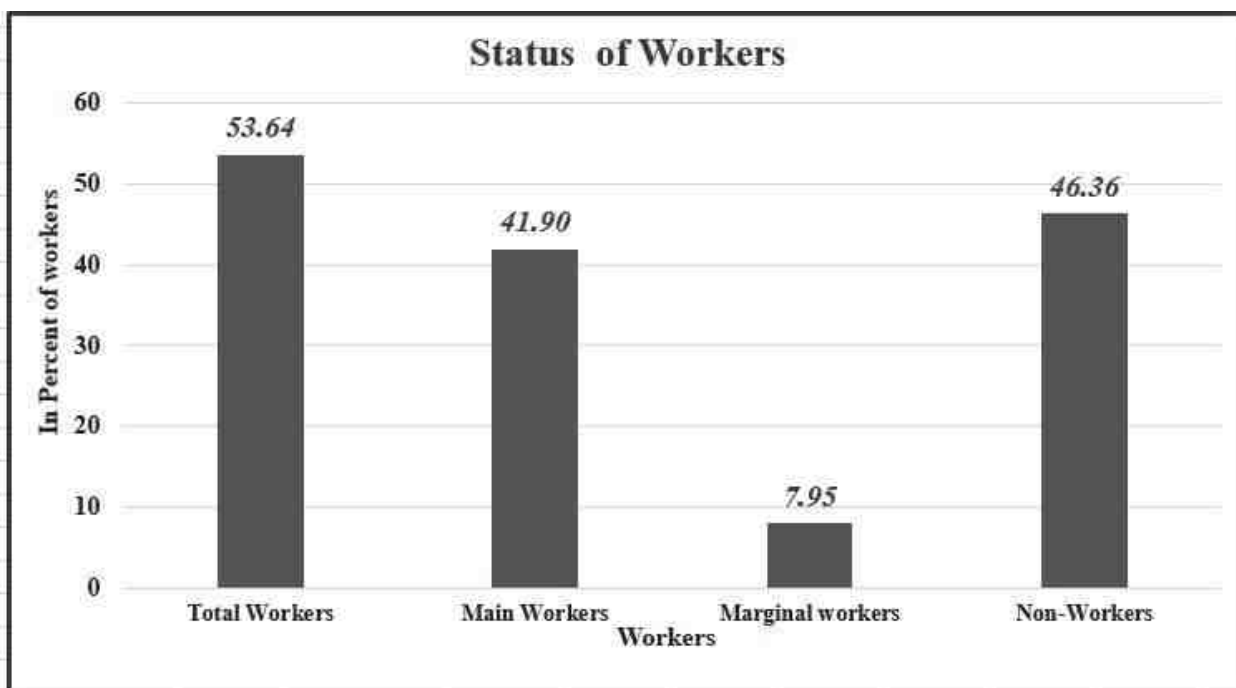


Figure 3.20.2. Working population in the study area

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.

The significant features of these important parameters for each study area are discussed as follows:

- (a) **Education Facilities:** In the study area, education is available from Primary School to Degree collage. Higher education facilities including colleges and other diploma courses are available at Tiruchuli & Aruppukkottai a distance of 20-22 km respectively from the project site.
- (b) **Medical Facilities:** There are only 20 villages had health facilities e.g. Community Health Centre, PHC, sub health centers, Maternity and Child Welfare Centre within the study area. Hospitals and other better medical facilities were available at Tiruchuli & Aruppukkottai city.
- (c) **Drinking Water:** The main water supply in the surveyed villages is through tap water, hand pump, well and tube well is the main sources of drinking water in the region.
- (d) **Power Supply:** All villages are accessed with electricity supply.
- (e) **Transportation:** For transportation purpose Government bus Auto and Taxi Service are available in the study area. Transportation facilities were not frequently available in the region. Private vehicles like Bicycles and Motor Cycles were mostly used by villagers for transportation purpose.
- (f) **Communication Facilities:** For communication purpose mainly Sub Post Office, Telephone, Mobile phones and newspaper are available in most of the villages.
- (g) **Agriculture:** Most of the respondents are engaged in labour work, agriculture, and livestock activities.; a few respondents service in government sectors. Most of the respondents are labours and others are trying to migrate towards other city places.
- (h) **Houses:** Most of the houses are pakka and Semi pakka with good construction in the study area.
- (i) **Employment:** : Main occupations of the people in the study area are labour work and agriculture. The labours were getting daily wage in the range of Rs. 500-600, depending on the type of work involved
- (j) **Fuel:** The primary source of cooking fuel is LPG and wood. Kerosene is also been as per the requirement.
- (k) **Main Crops:** The principal crops grown in agricultural farm are paddy, corn, chili, cotton etc.
- (l) **Language:** The official language of Tamil Nadu is Tamil. The most widely spoken language within the study area is Tamil and English
- (m) **Migration:** During survey it was found that local population were migrating maximum towards the Virudhunagar city as a purpose of employment and some to other states.
- (n) **Sanitation:** Systems of individual and combined septic tanks are in use at some places of this Study area. Toilet facility is one of the most basic facilities required in a house. Most of the households were having toilet facilities in their houses. There was no proper drainage line in the villages
- (o) **Road Connectivity:** Most of the roads are tar and connects to the villages. Both tar and gravel roads were commonly seen in the villages.

- (p) **Market Facility:** Study area was predominantly semi urban type. In villages, small shops were available for daily needs. Weekly market facility was available in some villages. Wholesale markets were available at town place. Tiruchuli & Aruppukkottai is main center for all type of facilities in the area.
- (q) **Recreation:** Temples, Samaj Bhawan, Television are the main recreation facilities in the study area. Newspaper/Magazine is also used by the villagers.

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 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.
8. Avoid Road damage during carriage by mine vehicles (tipper Lorry).
9. Use sprinkler water when loading mine materials, to avoid water pollution during dust emission.
10. Water bodies like Arno river, Lake, pond avoid dust emission.

3.23 Interpretation

Based on the data, following inferences could be drawn:

- Total literacy rate in the study area is 80%.
- 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 0.02% and Scheduled Caste forms 9.09% of the total population of study area.
- The Other Population forms 91% of the total population of study area.
- The study area is well connected by Taluk/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 Conclusion

The socio-economic study of surveyed villages gives a clear picture of its population, average household size, literacy rate and sex ratio etc. It is also found that a part of population is suffering from lack of permanent job to run their day-to-day life. Their expectation is to earn some income for their sustainability on a long-term basis. The proposed project will aim to provide preferential employment to the local people there by improving the employment opportunity in the area and in turn the social standards will improve. The nearby villages within 5kms radius have PHC, Anganwadi school, post office, telegram, Government and Private school, bus connectivity besides. Hence it can be concluded that the present baseline environment status of the study area will not be affected by the proposed project.

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.

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 from Proposed Project

- 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

4.1.3 Common Mitigation Measures for Proposed Project

- 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.

4.1.4 Soil Environment

The proposed project area is covered by thin layer of gravel formation and the average thickness is about 2 m – 3 m, the excavated gravel will be dumped sold to needy customers in open market.

4.1.5 Impact on Soil Environment from Proposed Project

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).

4.1.6 Common Mitigation Measures for Proposed Project

- 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

4.1.7 Waste Dump Management

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

4.2 WATER ENVIRONMENT

4.2.1 Anticipated Impact from Proposed Project

- 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	0.4 KLD	From Existing bore wells from nearby area
Green Belt development	1.0 KLD	From Existing bore wells from nearby area
Domestic purpose	0.6 KLD	From existing, bore wells and drinking water will be sourced from Approved water vendors.
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 for Proposed Project

- 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 from Proposed Project

- 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.

4.3.2 Modelling of Incremental Concentration from Proposed Project

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.

4.3.3 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	0.085688452	g/s
Blasting	Point Source	0.001117444	g/s
Mineral Loading	Point Source	0.042264393	g/s
Haul Road	Line Source	0.002491671	g/s/m
Overall Mine	Area Source	0.065571234	g/s

TABLE 4.3: ESTIMATED EMISSION RATE FOR SO₂

Activity	Source type	Value	Unit
Overall Mine	Area Source	0.000685317	g/s

TABLE 4.4: ESTIMATED EMISSION RATE FOR NO_x

Activity	Source type	Value	Unit
Overall Mine	Area Source	0.000052359	g/s

4.3.4 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

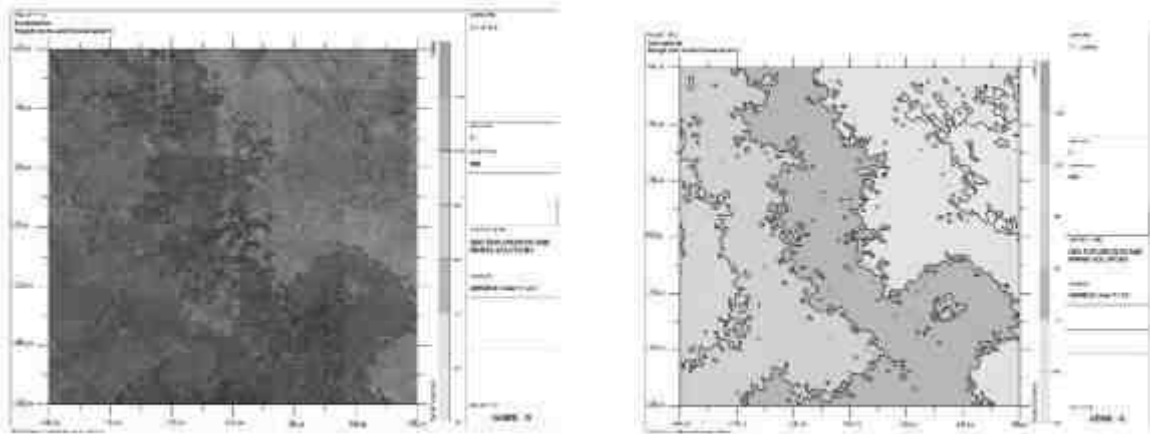


FIGURE 4.2: PREDICTED INCREMENTAL CONCENTRATION OF PM₁₀

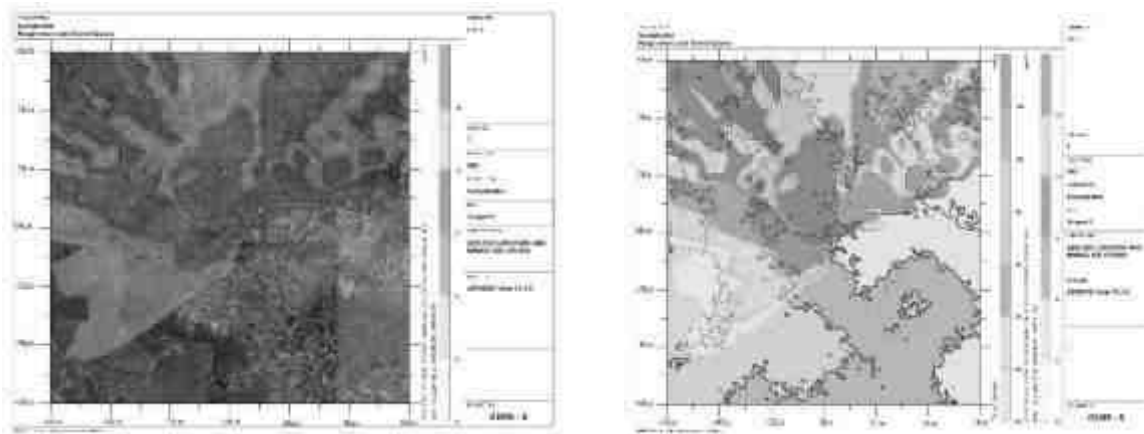


FIGURE 4.3: PREDICTED INCREMENTAL CONCENTRATION OF SO₂

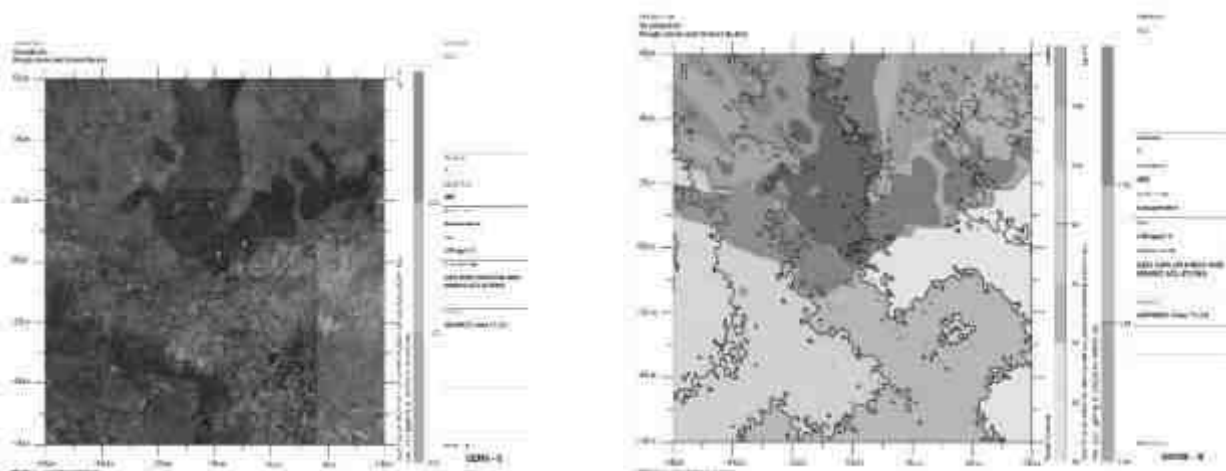


FIGURE 4.4: PREDICTED INCREMENTAL CONCENTRATION OF NO_x

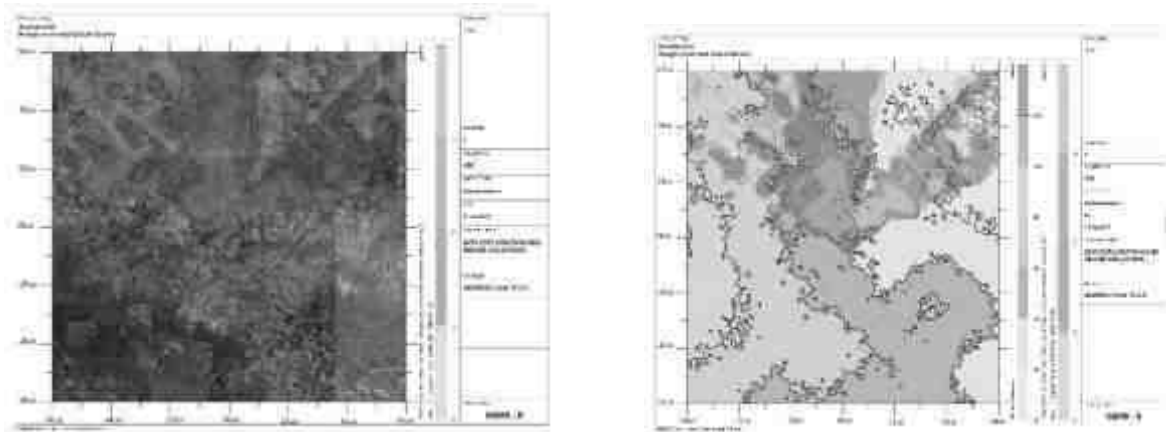
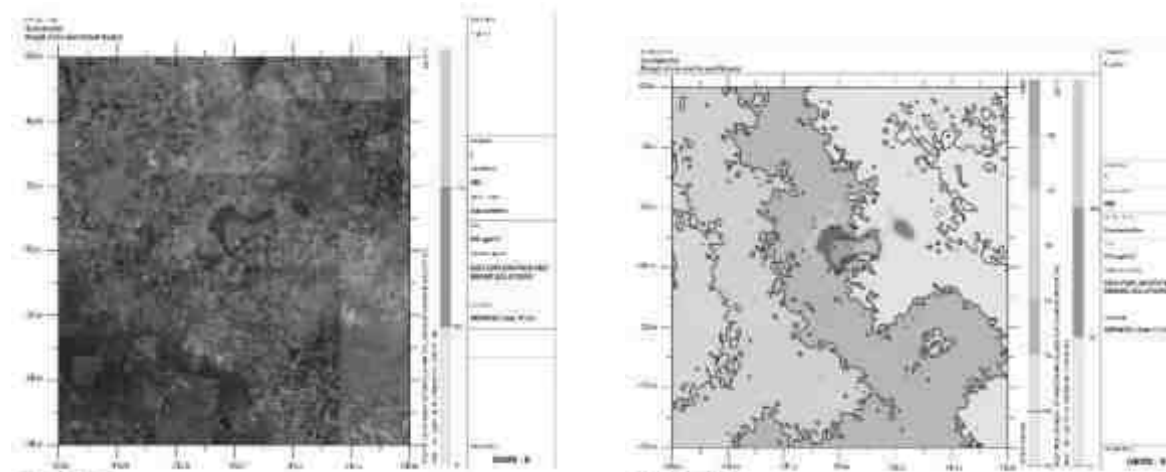


FIGURE 4.5: PREDICTED INCREMENTAL CONCENTRATION OF FUGITIVE DUST



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)
AAQ1	9°28'27.37"N 78°11'24.60"E	134	-12	43.8	16.89	60.7
AAQ2	9°28'4.62"N 78°11'29.96"E	298	-718	42.4	0	42.4
AAQ3	9°28'38.87"N 78°11'54.78"E	1060	342	41.7	14.00	55.7
AAQ4	9°28'51.14"N 78° 8'38.64"E	-4970	724	41.3	6.82	48.1
AAQ5	9°27'52.27"N 78° 9'42.26"E	-3014	-1099	40.9	5.10	46.0
AAQ6	9°27'26.17"N 78°10'57.52"E	-699	-1906	42.6	1.12	43.7
AAQ7	9°30'50.91"N 78° 9'33.45"E	-3281	4427	42.1	11.23	53.3
AAQ8	9°26'57.58"N 78°12'13.68"E	1644	-2791	44.2	0	44.2

AAQ9	9°29'20.75"N 78°11'16.53"E	-113	1634	43.2	16.00	59.2
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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	9°28'27.37"N 78°11'24.60"E	134	-12	20.8	8.79	29.6
AAQ2	9°28'4.62"N 78°11'29.96"E	298	-718	20.7	0.51	21.2
AAQ3	9°28'38.87"N 78°11'54.78"E	1060	342	20.3	7.00	27.3
AAQ4	9°28'51.14"N 78° 8'38.64"E	-4970	724	19.6	3.49	23.1
AAQ5	9°27'52.27"N 78° 9'42.26"E	-3014	-1099	19.0	2.80	21.8
AAQ6	9°27'26.17"N 78°10'57.52"E	-699	-1906	22.7	1.62	24.3
AAQ7	9°30'50.91"N 78° 9'33.45"E	-3281	4427	21.5	5.15	26.7
AAQ8	9°26'57.58"N 78°12'13.68"E	1644	-2791	21.2	0	21.2
AAQ9	9°29'20.75"N 78°11'16.53"E	-113	1634	24.1	8.11	32.2

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	9°28'27.37"N 78°11'24.60"E	134	-12	7.1	2.59	9.7
AAQ2	9°28'4.62"N 78°11'29.96"E	298	-718	8.3	0	8.3
AAQ3	9°28'38.87"N 78°11'54.78"E	1060	342	6.8	2.10	8.9
AAQ4	9°28'51.14"N 78° 8'38.64"E	-4970	724	6.2	0.46	6.7
AAQ5	9°27'52.27"N 78° 9'42.26"E	-3014	-1099	5.9	0	5.9
AAQ6	9°27'26.17"N 78°10'57.52"E	-699	-1906	7.3	0	7.3
AAQ7	9°30'50.91"N 78° 9'33.45"E	-3281	4427	6.4	0.72	7.1
AAQ8	9°26'57.58"N 78°12'13.68"E	1644	-2791	7.4	0	7.4
AAQ9	9°29'20.75"N 78°11'16.53"E	-113	1634	6.5	2.50	9.0

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	9°28'27.37"N 78°11'24.60"E	134	-12	22.7	11.70	34.4
AAQ2	9°28'4.62"N 78°11'29.96"E	298	-718	22.4	0	22.4
AAQ3	9°28'38.87"N 78°11'54.78"E	1060	342	23.4	1.19	24.6
AAQ4	9°28'51.14"N 78° 8'38.64"E	-4970	724	23.2	0	23.2

AAQ5	9°27'52.27"N 78° 9'42.26"E	-3014	-1099	22.3	0	22.3
AAQ6	9°27'26.17"N 78°10'57.52"E	-699	-1906	23.8	0	23.8
AAQ7	9°30'50.91"N 78° 9'33.45"E	-3281	4427	23.2	0	23.2
AAQ8	9°26'57.58"N 78°12'13.68"E	1644	-2791	23.9	0	23.9
AAQ9	9°29'20.75"N 78°11'16.53"E	-113	1634	25.3	11.05	36.4

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	9°28'27.37"N 78°11'24.60"E	134	-12	62.22	104	166.22
AAQ2	9°28'4.62"N 78°11'29.96"E	298	-718	65.78	0	65.78
AAQ3	9°28'38.87"N 78°11'54.78"E	1060	342	65.81	0	65.81
AAQ4	9°28'51.14"N 78° 8'38.64"E	-4970	724	63.60	0	63.60
AAQ5	9°27'52.27"N 78° 9'42.26"E	-3014	-1099	63.13	0	63.13
AAQ6	9°27'26.17"N 78°10'57.52"E	-699	-1906	66.68	0	66.68
AAQ7	9°30'50.91"N 78° 9'33.45"E	-3281	4427	64.62	0	64.62
AAQ8	9°26'57.58"N 78°12'13.68"E	1644	-2791	64.47	0	64.47
AAQ9	9°29'20.75"N 78°11'16.53"E	-113	1634	63.26	21	84.26

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 PM_{10} , SO_2 & NO_x respectively. By adopting suitable mitigation measures, the pollutant levels in the atmosphere can be further being controlled.

4.3.6 Common Mitigation Measures for Proposed Project

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.

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

Where:

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

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

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

4.4.1 Anticipated Impact from Proposed Project

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	N9
Maximum Monitored Value (Day) dB(A)	48.2	46.8	50.2	48.2	43.5	48.2	46.3	36.5	33.4
Incremental Value dB(A)	66.1	63.8	41.5	31.4	32.7	38.4	35.9	31.5	35.3
Total Predicted Noise level dB(A)	66.2	63.9	50.8	48.3	43.8	48.6	46.7	37.7	37.5

The incremental noise level is found within the range of 66.1 dB (A) in Core Zone and 31.4- 41.5 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 for Proposed Project

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 is listed in below table. The ground vibrations due to the blasting in the quarry are calculated using the empirical equation.

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

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

Where –

V = peak particle velocity (mm/s)

K = site and rock factor constant

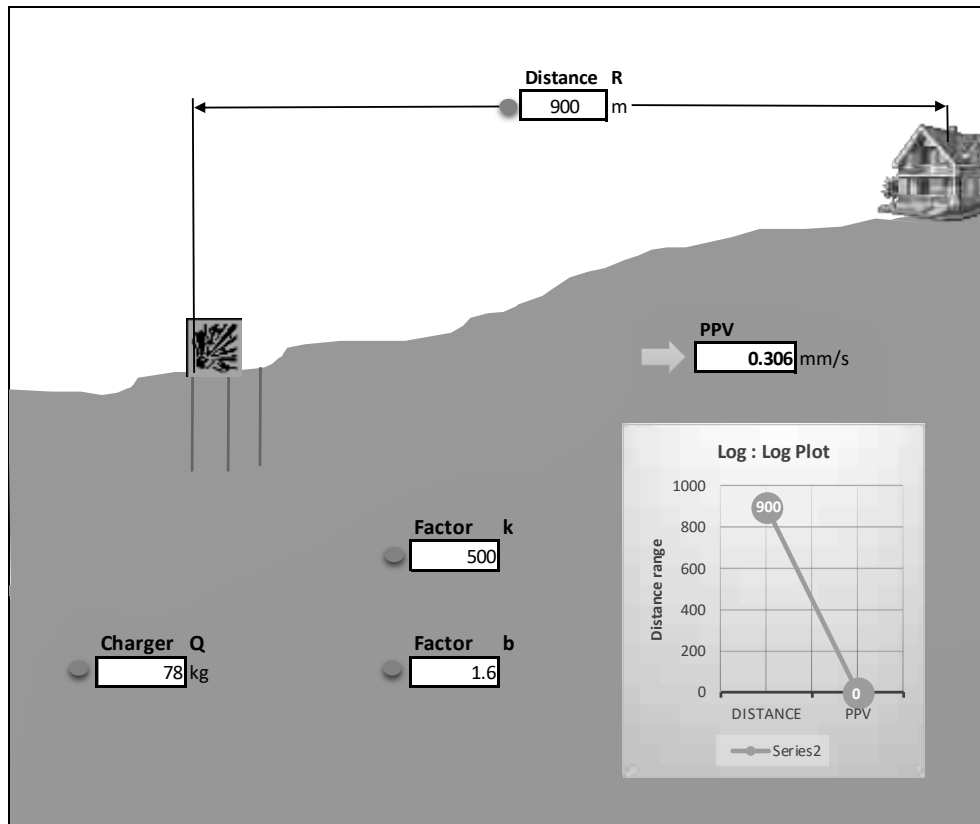
Q = maximum instantaneous charge (kg)

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

R = distance from charge (m)

TABLE 4.12: PREDICTED PPV VALUES DUE TO BLASTING

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in mm/s
P1	78	900	0.306

FIGURE 4.6: GROUND VIBRATION PREDICTION

From the above graph, the charge per blast of 78 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 154kg 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 Measures for Proposed Project

- 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 a greater number of delays will be used per blasts;
- During blasting, other activities in the immediate vicinity will be temporarily stopped;

- Drilling parameters like depth, diameter and spacing will be properly designed to give proper blast;
- A fully trained explosives blast man (Mining Mate, Mines Foreman, 2nd Class Mines Manager/ 1st Class Mines Manager) will be appointed.
- A set of shot firing rules will be drawn up and blasting shall commence outlining the detailed operating procedures that will be followed to ensure that shot firing operations on site take place without endangering the workforce or public.
- Sufficient angular stemming material will be used to confine the explosive force and minimise environmental disturbance caused by venting / misfire.
- The detonators will be connected in a predetermined sequence to ensure that only one charge is detonated at any one time and a NONEL or similar type initiation system will be used.
- The detonation delay sequence shall be designed so as to ensure that firing of the holes is in the direction of free faces so as to minimise vibration effects.
- Appropriate blasting techniques shall be adopted such that the predicted peak particle velocity shall not exceed 8 Hz.
- Vibration monitoring will be carried out every 6 months to check the efficacy of blasting practices

4.5 ECOLOGY AND BIODIVERSITY

Mining activities generally result in deforestation, land degradation, and water, air, and noise pollution which directly or indirectly affect the faunal and floral status of the mine area. However, the occurrence and magnitude of these impacts are entirely dependent upon the project location, mode of operation, and technology involved. Existing roads will be used; new roads will not be constructed to reduce the impact on flora. Wildlife is not commonly found in the lease area and its immediate environments because of the lack of vegetal cover and surface water.

4.5.1. Anticipated Impact on Flora

- 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 the loading of 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.

4.5.1.1. Mitigation Measures

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.

4.5.1.2. Selection of Plant Species for Green Belt Development

The selection of plant species for the green belt development depends on various factors such as climate, elevation, and soil. The plants should exhibit the following desirable characteristics in order to be selected for plantation.

- Native plant species will be preferred.
- The species should be wind-firm and deep-rooted.
- The species should form a dense canopy.
- Fast-growing plants will be planted
- Species tolerance to air pollution like SO₂ and NO₂ should be preferred.
- Plants having large leaf area index will be considered
- Soil improving plants (Nitrogen fixing rapidly decomposable leaf litter).
- Attractive appearance with good flowering and fruit-bearing.
- Birds and insects attract tree species.
- Roadsides will be planted with local vegetation.

Table No 4.13 List of plant species proposed for Greenbelt development

SI.No	Name of the plant (Botanical)	Family Name	Common Name	Habit
1	<i>Azadirachta indica</i>	<i>Meliaceae</i>	Neem, Vembu	Azadirachta indica
2	<i>Albiziafalcataria</i>	<i>Fabaceae</i>	Tamarind, Puliyamaram	Albiziafalcataria
3	<i>Polyalthialongifolia</i>	<i>Annonaceae</i>	Kattumaram	Polyalthialongifolia
4	<i>Borassus Flabellifer</i>	<i>Arecaceae</i>	Palmyra Palm	Borassus Flabellifer
5	<i>Cassi roxburghii</i>	Fabaceae	Sengondrai	Tree
6	<i>Terminalia bellerica</i>	Combretaceae	Thandri	Tree
7	<i>Syzygium cumini</i>	Myrtaceae	Naval	Tree

(*Source: Guidance for Developing Green belts Manual, CPCB 2000)

TABLE 4.14: GREENBELT DEVELOPMENT PLAN

Year	No. of trees proposed to be planted	Survival %	Area to be covered	Name of the species	No. of trees expected to be grown
I	2,140	80%	Safety zone, Approach Road and village road	Neem, Pongamia Pinnata, etc.,	1,780

TABLE 4.15: BUDGET FOR GREENBELT DEVELOPMENT PLAN

Activity	Year & No of Trees	Cost	Total Cost
Greenbelt development within the project area and nearby village roads	1 st year 2,140 Nos of trees	Site clearance, preparation of land, digging of pits / trenches, soil amendments, transplantation of	Rs 2,92,000/-

		saplings @ 200 per plant and maintenance	
Total no. of Trees	2,140 Trees	Total Budget	Rs 4,28,000/-

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

4.5.3. Anticipated Impact on Fauna

- 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

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

4.5.3.2. Mitigation Measures

- A suitable plan for the conservation of Schedule-I Species have been prepared and the 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.
- Topsoil has a large number of seeds of native plant species in the mining area.
- Checks and controls the movement of vehicles in and out of the mine.
- Undertaking mitigative measures for a conducive environment for the flora and fauna in consultation with Forest Department.
- A dust suppression system will be installed within the mine and periphery of the mine.

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. There is no natural perennial surface water body within the mine lease area, like wetlands, rivers streams, lakes, and farmer sites. Noyyal River is located about 5.5km on the north side. 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 Impacts on Bird Fauna:

The project does not involve any tree felling or removal of vegetation. Therefore, there may not be loss of nesting and roosting habitat of avian fauna.

4.5.6. Impacts on wildlife

There is no National Park, Wildlife Sanctuary, Biosphere Reserve, Wildlife corridors and Tiger/Elephant Reserve found within 10 km radius of the project site.

4.5.7. 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.4.16

4.5.7.1. Anticipated Environmental Impacts and Mitigation Measures of Sundakottai Village, Rough stone and Gravel quarry, Virudhunagar District, Tamil Nadu.

Details of anticipated issues for the next operation period were summarized with possible impacts and mitigation measures to meet the problem (Table No.4.16).

Table No: 4.16. Anticipated impact of Ecology and Biodiversity in Sundakottai Village, 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 on the periphery of the project boundary, which will improve the floral and faunal diversity of the project area.
		Site specific loss of associated faunal diversity (Partial impact)	The site supports only common species, which use a wide variety of habitats of the buffer zone reserve forest area. So, there is no threat of Faunal diversity		
		Loss of Habitat (Direct	Site does not for unique / critical habitat structure for		

		impact)	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. 4.17 Overall Ecological impact assessments of Sundakottai Village, Rough Stone and Gravel quarry, Virudhunagar 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 the proposed project site. There are no impacts on the agricultural land & Horticulture. Kindly refer to 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 National Park/ Wildlife Sanctuary/ Reserve Forest/ Mangroves and 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 are 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 was 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 IMPACT

4.6.1 Construction Phase

Anticipated Impacts:

♣ No. of people will get employment during the construction stage resulting in the ancillary development and growth. Nearby Local people will be given preference for employment on the basis of their skill and experience.

♣ Further due to proposed project, influx of working community will also generate an indirect employment through development of nearby market/ shops, trade centers, activities, transportation etc.

- ♣ Population influx during the construction phase can introduce various water and vector borne diseases which can lead to various unhygienic health problems in the area by disturbing the existing sanitation infrastructure.
- ♣ Rapid diverse population influx at the project site can create unusual behavioural activity such as worker-community conflicts, increase violence such as theft/stabbing and increased consumption of drugs/alcohol within the area.
- ♣ Impacts on the health of nearby villagers can be envisaged due to the transportation activities leading to short term exposure of fugitive dust, resulting in various acute diseases such as increased eye irritation, nausea, headache etc.

Mitigation measures:

- ♣ Deploying of mobile toilets or the construction of temporary toilets will be done near to the construction site with the adequate water supply.
- ♣ Awareness programme will be conducted before the monsoon season regarding the spread of water borne/ vector diseases.
- ♣ Mosquito repellents will be provided in the nearby villages and at construction site to avoid the spread of diseases.
- ♣ To overcome behavioural impact, proper site in charge with timely supervision will be done. In advance, facilities with equipped medical and safety services will be provided to take a control over the incident/violence if any caused.
- ♣ To overcome behavioural impact, supervision will be done by site in charge. In advance, emergency cell will be formed with fully equipped communication system, medical and safety services to take control over the incident/violence caused.

4.6.2 Operation Phase:

Anticipated Impacts:

- ♣ Long term exposure to the pollutants such as PM, SO₂ and NO₂ Cement dust have a potential to create health impacts such as risk of cardiovascular and respiratory disease, eye irritation, bronchitis, lung damage, increased heart ailments, etc.
- ♣ Other impacts, associated with the applied for rough stone and gravel quarry Project will create a positive impact as it will result in the overall development of the area in respect to the infrastructure development, educational growth, health facilities etc., as a part of the CSR activity.

Mitigation Measures:

- ♣ In order to mitigate the long-term health impacts, efficient Air Pollution Control Equipment (APCE) like Bag House / Bag Filter / ESP will be installed at all major stacks to keep the emissions within the permissible limits. To reduce the gaseous emission, Pyro-process itself acts as a long SO₂ scrubber and De - NO_x system will be installed for fuel burning along with calciner for low NO_x formation. To reduce fugitive emission from vehicles and machineries will be regularly monitored and maintained.
- ♣ For emergency, proposed to develop an occupational health centre for its employees and nearby villagers.

4.6.3 Impact Evaluation:

Table 4.6.3 Impact Evaluation Impact evaluation is given in table below.

Impact Evaluation Element	Impact on socio economics due to the applied for Sundakottai rough stone and Gravel cluster quarry over an extent of 4.85.0 ha of Patta lands of Sundakottai Village, Aruppukottai Taluk, Virudhunagar District, Tamil Nadu State.			
Potential Effect/ Concern	Proposed project will provide direct & indirect employment opportunities to the local residents, which will help to increase their earning and better living standard as well as further up-liftment of socio-economic status of the area.			
Characteristics of Impacts				
Nature	Positive		Negative	Neutral
	✓			
Type	Direct	Indirect	Cumulative	
			✓	
Extent	Project area	Local	Zonal	Regional
		✓		
Duration	Short time		Long term	
			✓	
Intensity	Low		Medium	High
			✓	
Frequency	Remote (R)	Occasional (O)	Periodic (P)	Continuous (C)
			✓	
Significance of Impact				
Significance	Insignificant	Minor	Moderate	Major
			✓	

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 quarry.

4.9 MINE CLOSURE

Mine closure plan is the most important environmental requirement in mining projects. The mine closure plan should cover technical, environmental, social, legal and financial aspects dealing with progressive and post closure activities. The closure operation is a continuous series of activities starting from the decommissioning of the project. Therefore, progressive mine closure plan should be specifically dealt with in the mining plan and is to be reviewed along with mining plan. As progressive mine closure is a continuous series of activities, it is obvious that the proposals of scientific mining have included most of the activities to be included in the closure plan. While formulating the closure

objectives for the site, it is important to consider the existing or the pre-mining land use of the site; and how the operation will affect this activity.

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

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

4.9.1 Mine Closure Criteria

The criteria involved in mine closure are discussed below:

4.9.1.1 Physical Stability

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

4.9.1.2 Chemical Stability

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

4.9.1.3 Biological Stability

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

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

- Where the nutrient level of spread topsoil is lower than material in-situ e.g. for development of social forestry

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

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

5. ANALYSIS OF ALTERNATIVES (TECHNOLOGY AND SITE)

5.1 INTRODUCTION

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

5.2 FACTORS BEHIND THE SELECTION OF PROJECT SITE

Thiru.T. Manojkumar Rough Stone & Gravel Quarry Project at Sundakottai Village is a mining project for excavation of Rough Stone and gravel, 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 and gravel in the area. the applied mining lease areas have following advantages

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

5.5 ANALYSIS OF ALTERNATIVE TECHNOLOGY

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

6. ENVIRONMENTAL MONITORING PROGRAMME

6.0 GENERAL

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

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

6.1 METHODOLOGY OF MONITORING MECHANISM

Implementation of EMP and periodic monitoring will be carried out by Project Proponent. 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.

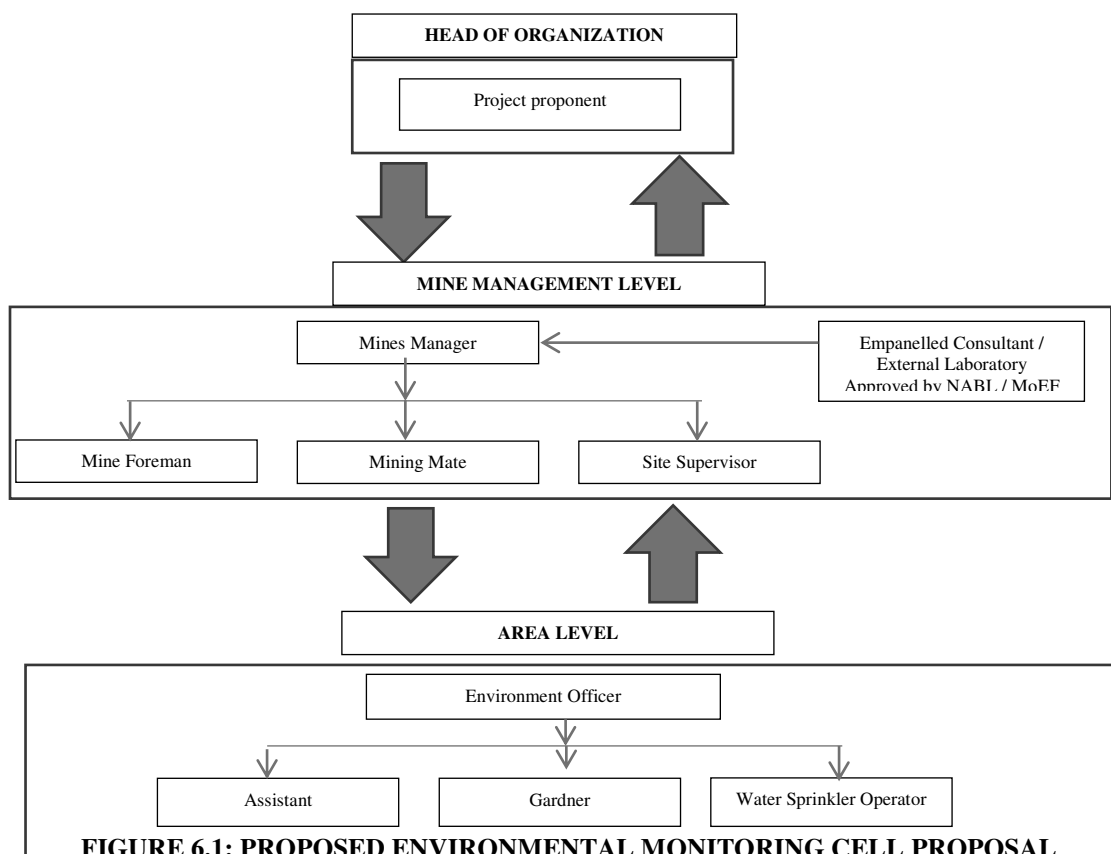
An Environment monitoring cell (EMC) will be constituted to monitor the implementation of EMP and other environmental protection measures in all the proposed quarries.

- ♣ 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).



* 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 PROJECTS

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

6.3 MONITORING SCHEDULE AND FREQUENCY

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

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

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

The details of monitoring are detailed in Table 6.2

TABLE 6.2: PROPOSED MONITORING SCHEDULE POST EC FOR MINES

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

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

6.4 BUDGETARY PROVISION FOR EMP

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

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

7.1 PUBLIC CONSULTATION

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

7.2 RISK ASSESSMENT

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

The whole quarry operation will be carried out under the direction of a Qualified Competent Mine Manager holding certificate of competency to manage a metalliferous mine granted by the DGMS, Dhanbad 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	<ul style="list-style-type: none"> ▪ 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;

			<ul style="list-style-type: none"> ▪ 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>	<ul style="list-style-type: none"> ▪ Safe operating procedure established for drilling (SOP) will be strictly followed. ▪ Only trained operators will be deployed. ▪ No drilling shall be commenced in an area where shots have been fired until the blaster/blasting foreman has made a thorough Examination of all places, ▪ Drilling shall not be carried on simultaneously on the benches at places directly one above the other. ▪ Periodical preventive maintenance and replacement of worn out accessories in the compressor and drill equipment as per operator manual. ▪ All drills unit shall be provided with wet drilling shall be maintained in efficient working in condition. ▪ Operator shall regularly use all the personal protective equipment.
4	Blasting	<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>	<ul style="list-style-type: none"> ▪ Restrict maximum charge per delay as per regulations and by optimum blast hole pattern, vibrations will be controlled within the permissible limit and blasting can be conducted safely. ▪ SOP for Charging, Stemming & Blasting/Firing of Blast Holes will be followed by blasting crew during initial stage of operation ▪ Shots are fired during daytime only. ▪ All holes charged on any one day shall be fired on the same day. ▪ The danger zone will be distinctly demarcated (by means of red flags)
5	Transportation	Potential hazards and unsafe workings contributing to accident and injuries	<ul style="list-style-type: none"> ▪ 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

		Overloading of material While reversal & overtaking of vehicle Operator of truck leaving his cabin when it is loaded.	<p>devices including automatically operated audio-visual reversing alarm, rear view mirrors, side indicator lights etc., are in good condition.</p> <ul style="list-style-type: none"> ▪ Not allow any unauthorized person to ride on the vehicle nor allow any unauthorized person to operate the vehicle. ▪ Concave mirrors should be kept at all corners ▪ All vehicles should be fitted with reverse horn with one spotter at every tipping point ▪ Loading according to the vehicle capacity ▪ Periodical maintenance of vehicles as per operator manual
6	Natural calamities	Unexpected happenings	<ul style="list-style-type: none"> ▪ Escape Routes will be provided to prevent inundation of storm water ▪ Fire Extinguishers & Sand Buckets
7	Failure of Mine Benches and Pit Slope	Slope geometry, Geological structure	<ul style="list-style-type: none"> ▪ 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

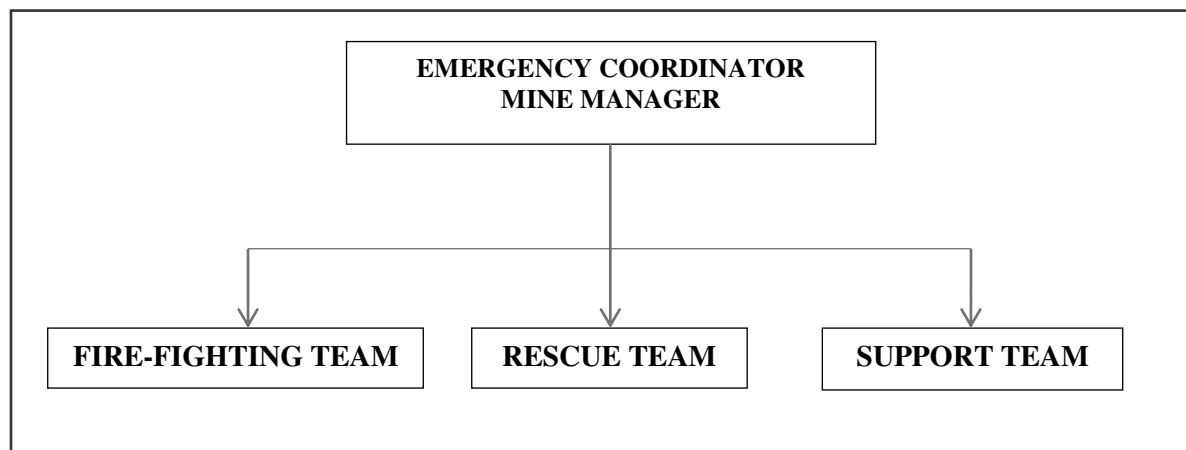
Natural disasters like Earthquake, Landslides have not been recorded in the past history as the terrain is categorized under seismic zone III. The area is far away from the sea hence the disaster due to heavy floods and tsunamis are not anticipated.

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

TABLE 7.2: PROPOSED TEAMS TO DEAL WITH EMERGENCY SITUATION

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

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

Roles and responsibilities of emergency team –

(a) Emergency coordinator (EC)

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

(b) Incident controller (IC)

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

(c) Communication and advisory team

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

(d) Roll call coordinator

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

(e) Search and rescue team

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

(f) Emergency security controller

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

Emergency control procedure –

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

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

Proposed fire extinguishers at different locations –

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

TABLE 7.3: PROPOSED FIRE EXTINGUISHERS AT DIFFERENT LOCATIONS

LOCATION	TYPE OF FIRE EXTINGUISHERS
Electrical Equipment's	CO ₂ type, foam type, dry chemical powder type
Fuel Storage Area	CO ₂ type, foam type, dry chemical powder type, Sand bucket
Office Area	Dry chemical type, foam type

Alarm system to be followed during disaster –

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

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

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

7.4 CUMULATIVE IMPACT STUDY

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

TABLE 7.4: LIST OF QUARRIES IN CLUSTER

PROPOSED QUARRY				
Code	Name of the Owner	S.F. Nos	Extent	Status
P1	Thiru.R.R. Senthilkumar Raju, S/o. Raju, No. 33, Guru Illam, V.T. Pandian Nagar, Kariapatti Taluk, Virudhunagar District – 626 106.	52/8B2, 52/8B3, 53/10, 53/11, 53/12, 53/5B, 53/6, 53/7, 53/8, 53/9, 54/1B2 & 54/1C	3.56.0 ha	TOR Obtained: Lr No. SEIAA- TN/F.No.9901/ToR- 1434/2023 Dated:24.04.2023.
Nearby Proposed Quarry				
P2	Tmt. R. Subashini, W/o. Rajkumar, No.54, South Car Street, Vellaikkottai, Aruppukottai & Taluk, Virudhunagar District – 626 101.	54/2, 54/3 of Sundakottai 70/5A1, 70/4, 70/5A2, 70/5B, 70/6, 70/7 and 70/8 Aladipatti Village	3.11.0 Ha	EC Granted.
TOTAL			6.67.0 ha	
EXISTING QUARRY				
Code	Name of the Owner	S.F. No	Extent	Status
E1	Thiru.T.R.Varadharajan	48/12, 48/13, 48/14 etc.,	2.22.50 ha	17.05.2022 To 16.05.2027
E2	Thiru.S.Balasubramani	72/1, 72/2, 72/4A, etc.,	2.26.50	14.02.2019 To 13.02.2024
TOTAL			4.49.0ha	
ABANDONED QUARRY				
Code	Name of the Owner	S.F. No	Extent	Status
A1	Thiru. R.R.Senthilkumar Raju	61/4. 63/5 etc.,	1.15.50	07.11.2017 To 06.11.2022
A2	Thiru.V.Thaveethuraja	54/1B	0.55.50	16.09.2014 To 15.09.2019
A3	Thiru.T.R.Varadharajan	53/4, 53/5A	1.40.5	18.01.2018 To 17.01.2023
A4	Thiru.M.Jesumuthu	52/3, 52/5	1.25.0	14.06.2016 To 13.06.2019
Total			4.36.50	
TOTAL CLUSTER EXTENT			11.16.0 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.R.R. Senthilkumar Raju, Rough Stone & Gravel Quarry Project		
S.F. No.	52/8B2, 52/8B3, 53/10, 53/11, 53/12, 53/5B, 53/6, 53/7, 53/8, 53/9, 54/1B2 & 54/1C		
Extent	3.56.0 ha		
Village and Taluk	Sundakottai and Aladipatti Village, Aruppukottai Taluk		
Land Type	Patta Land		
Land Ownership	It is a Patta land, registered in the name of B.Ananya. The applicant has obtained consent from the pattadhar.		
Toposheet No	58 - K/03		
Latitude between	09°28'24.15"N to 09°28'32.14"N		
Longitude between	78°11'14.34"E to 78°11'25.63"E		
Highest Elevation	70m AMSL		
Proposed Depth of Mining	40m (2m Gravel + 3m Weathered Rock + 35m Rough Stone) Bgl.		
Mining Plan Period	5 Years		
Geological Resources	Rough Stone in m ³	Weathered Rock in m ³	Gravel m ³
	8,36,460	52,857	35,238
Mineable Reserves	Rough Stone in m ³	Weathered Rock in m ³	Gravel m ³
	2,67,915	29,634	23,120
Proposed Quantity of Production for ten years	Rough Stone in m ³	Weathered Rock in m ³	Gravel m ³
	2,67,915	29,634	23,120
Ultimate Pit Dimension	Pit I- 122m (L) * 204 m (W) * 40m (D) Pit II- 153m (L) * 22 m (W) * 5m (D)		
Water Level in the surrounds area	The Water table is found at a depth of 65m in summer and at 60m in rainy seasons.		
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting		
Topography	The lease applied area is flat terrain. The area has gentle sloping towards South side and altitude of the area is 70m (max) above from Mean Sea level. The area is covered by 2m thickness of Gravel, 3m Weathered Rock and followed by Massive Charnockite which is clearly inferred from the existing quarry pits.		
Machinery proposed	Jack Hammer	7 Nos	
	Compressor	2 Nos	
	Excavator with Bucket and Rock Breaker	2 Nos	
	Tipplers	3 Nos	
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.		
Proposed Manpower Deployment	30 Nos		
Project Cost	Rs.66,68,000/-		
CER Cost	Rs.5,00,000/-		
Nearest water Bodies	Odai	10m-S, hence 10m safety distance has been provided.	
	Tank	300m- SE	
	Gunda River	5.0km- NE	
Greenbelt Development Plan	Proposed to plant 2,140 trees in Safety Zone, approach road and Panchayat roads		
Proposed Water Requirement	2.0 KLD		
Nearest Habitation	900m -North East		

Source: Approved Mining Plan

TABLE 7.5A: SALIENT FEATURES OF PROPOSAL -P2

Name of the Mine	M/s Tmt. R.Subashini	
Survey Nos	70/4, 70/5A1, 70/5A2, 70/5B, 70/6, 70/7 and 70/8 in Aladipatti, 54/2, 54/3 Sundakottai	
Land Type	Non-Forest Land / Patta Land	
Extent	3.11.0 ha	
Mining Plan/Lease Period	10 Years	
Latitude between	09°28'21.45"N-09°28'27.70"N	
Longitude between	78°11'21.10"E -78°11'28.71"E	
Highest Elevation	72m (Max) above Mean Sea Level	
Machinery Proposed	Jack Hammer	4
	Compressor	1
	Excavator bucket & Rock breaker attached	1
	Tippers (20 tonnes Capacity)	2
Proposed Blasting Method	Controlled Blasting Method	
Manpower Proposed	20 Nos	
Total Project Cost	Rs. 58,97,000/-	

TABLE 7.6: SALIENT FEATURES OF EXISTING QUARRY -E1

Name of the Quarry	Thiru.T.R. Varadharajan, Rough Stone & Gravel Quarry Project	
Toposheet No	58 - F/13	
Highest Elevation	77m AMSL	
Lease Period	10 Years	
Proposed Quantity of Production	Rough Stone in m ³	Gravel m ³
	1,65,015m ³	15,750 m ³
Ultimate Pit Dimension	First Five-year Proposed Pit -244m (L) * 172 m (W) * 22m (D) Ultimate Pit Dimension- 244m (L) * 172 m (W) * 42m (D)	
Water Level in the surrounds area	The Water table is found at a depth of 73m in summer and at 68m in rainy seasons.	
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Topography	The lease applied area is exhibits plain terrain. The area has gentle sloping towards Southern side. The altitude of the area is 77m (max) above Mean Sea level. The area is covered by 2m thickness of Gravel formation. Massive Charnockite is found after 2m (Gravel) which is clearly inferred from the nearby existing quarry pits.	
Machinery proposed	Jack Hammer	3 Nos
	Compressor	3 Nos
	Excavator with Bucket and Rock Breaker	1 No
	Tippers	6 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	15Nos
Project Cost	Rs.1,82,79,000/-
Proposed Water Requirement	2.0 KLD
Nearest Habitation	650m -North East

TABLE 7.7: SALIENT FEATURES OF EXISTING QUARRY -E2

Name of the Quarry	Thiru. S. Balasubramani, Rough Stone & Gravel Quarry Project		
Toposheet No	58 - K/13		
Latitude between	09°28'26.6"N to 09°28'24.80"N		
Longitude between	78°11'33.10"E to 78°11'28.30"E		
Highest Elevation	72m AMSL		
Proposed Depth of Mining	35m Bgl.		
Mining Plan Period	5 Years		
Geological Resources	Rough Stone in m ³	Topsoil m ³	Gravel m ³
	8,22,990m ³	-	-
Mineable Reserves	Rough Stone in m ³	Topsoil m ³	Gravel m ³
	2,15,530m ³	-	-
Proposed Quantity of Production	Rough Stone in m ³	Topsoil m ³	Gravel m ³
	1,48,540m ³	13,398m ³	53,592
Ultimate Pit Dimension	Pit I: 105m (L) * 77 m (W) * 35m (D) Pit II: 77m (L) * 69 m (W) * 35m (D)		
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting		
Topography	The lease applied area is exhibits plain terrain. The area has gentle sloping towards Southern side. The altitude of the area is 72m (max) above Mean Sea level. The area is covered by 2m thickness of Gravel formation. Massive Charnockite is found after 2m (Gravel) which is clearly inferred from the nearby existing quarry pits.		
Machinery proposed	Jack Hammer	2 Nos	
	Compressor	2 Nos	
	Excavator with Bucket and Rock Breaker	1 No	
	Tippers	8 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	17 Nos		
Project Cost	Rs.2,55,70,838/-		
Nearest water Bodies	Tank	22.0m S	
Greenbelt Development Plan	Proposed to plant 1,300 trees in Safety Zone, approach road and Village roads		
Proposed Water Requirement	2.0 KLD		
Nearest Habitation	780m -North East		

Air Environment –

Calculating the Cumulative Load of Mining within the cluster is as shown in table 7.17& 7.18.

TABLE 7.8: CUMULATIVE PRODUCTION LOAD OF ROUGH STONE

Quarry	PROPOSED PRODUCTION DETAILS			
	5 Years in m ³	Per Year in m ³	Per Day in m ³	Number of Lorry Load Per Day (12m ³ per load)
P1	2,67,915	53,583	179	15
P2	4,17,600	83,520	278	23
E1	1,65,015	33,003	110	10
E2	1,48,540	29,708	100	9
Total	9,99,070	1,99,814	667	57

TABLE 7.9: CUMULATIVE PRODUCTION LOAD OF GRAVEL

Quarry	PROPOSED PRODUCTION DETAILS			
	1 - 3 Years in m ³	Per Year in m ³	Per Day in m ³	Number of Lorry Load Per Day (12m ³ per load)
P1	23,120	7,706	26	3
P2	42,216	14,072	46	4
E1	15,750	5,240	17	2
E2	53,592	17,864	60	5
Total	1,34,678	44,882	149	14

TABLE 7.10: CUMULATIVE PRODUCTION LOAD OF WEATHERED ROCK

Quarry	PROPOSED PRODUCTION DETAILS			
	1 - 3 Years in m ³	Per Year in m ³	Per Day in m ³	Number of Lorry Load Per Day (12m ³ per load)
P1	29,634	9,878	33	3
E1	-	-	-	-
E2	-	-	-	-
Total	29,634	9,878	33	3

On a cumulative basis considering all the 4 quarries it can be seen that the overall production of Rough Stone is 667m³ per day and overall production of Gravel is 149 m³ per day with a capacity of 57 trips of Rough Stone per day and 14 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 4 mines includes various activities like ground preparation, excavation, handling and transport of ore. These activities have been analysed systematically basing on USEPA-Emission Estimation Technique Manual, for Mining AP-42, to arrive at possible emissions to the atmosphere and estimated emissions are given in Table 7.19.

TABLE 7.11: EMISSION ESTIMATION FROM QUARRIES WITHIN 500 METER RADIUS

EMISSION ESTIMATION FOR QUARRY "P1"				
Estimated Emission Rate for PM ₁₀	Activity	Source type	Value	Unit
	Drilling	Point Source	0.085688452	g/s
	Blasting	Point Source	0.001117444	g/s
	Mineral Loading	Point Source	0.042264393	g/s
	Haul Road	Line Source	0.002491671	g/s
	Overall Mine	Area Source	0.065571234	g/s
Estimated Emission Rate for SO ₂	Overall Mine	Area Source	0.000685317	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000052359	g/s
EMISSION ESTIMATION FOR QUARRY "P2"				
Estimated Emission Rate for PM ₁₀	Activity	Source type	Value	Unit
	Drilling	Point Source	0.080214841	g/s
	Blasting	Point Source	0.000803319	g/s
	Mineral Loading	Point Source	0.042485771	g/s
	Haul Road	Line Source	0.002492181	g/s
	Overall Mine	Area Source	0.017592839	g/s
Estimated Emission Rate for SO ₂	Overall Mine	Area Source	0.000497323	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000001968	g/s

EMISSION ESTIMATION FOR QUARRY "E1"				
Estimated Emission Rate for PM ₁₀	Activity	Source type	Value	Unit
	Drilling	Point Source	0.091461200	g/s
	Blasting	Point Source	0.001548100	g/s
	Mineral Loading	Point Source	0.042927438	g/s
	Haul Road	Line Source	0.002493273	g/s
	Overall Mine	Area Source	0.074194731	g/s
Estimated Emission Rate for SO ₂	Overall Mine	Area Source	0.000830369	g/s
Estimated Emission Rate for NO _x	Overall Mine	Area Source	0.000082906	g/s
EMISSION ESTIMATION FOR QUARRY "E2"				
Estimated Emission Rate for PM ₁₀	Activity	Source type	Value	Unit
	Drilling	Point Source	0.075828427	g/s
	Blasting	Point Source	0.000606422	g/s
	Mineral Loading	Point Source	0.041622360	g/s
	Haul Road	Line Source	0.002490321	g/s
	Overall Mine	Area Source	0.054374139	g/s
Estimated Emission Rate for SO ₂	Overall Mine	Area Source	0.000541658	g/s
Estimated Emission Rate for NO _x	Overall Mine	Area Source	0.000027433	g/s

Source: Emission Calculations

TABLE 7.12: INCREMENTAL & RESULTANT GLC WITHIN CLUSTER

PM ₁₀ in µg/m ³	
Background	43.8
Incremental	16.89
Resultant	60.70
NAAQ Norms	100 µg/m³
PM _{2.5} in µg/m ³	
Background	20.8
Incremental	8.79
Resultant	29.60
NAAQ Norms	100 µg/m³
SO ₂ in µg/m ³	
Background	7.1
Incremental	2.59
Resultant	9.7
NAAQ Norms	80 µg/m³
NO _x in µg/m ³	
Background	22.70
Incremental	11.70
Resultant	34.40
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.

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

Where:

Lp₁& Lp₂ are sound levels at points located at distances r₁& r₂ from the source.

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

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

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 7.13: PREDICTED NOISE INCREMENTAL VALUES FROM CLUSTER

Location ID	Background Value (Day) dB(A)	Incremental Value dB(A)	Total Predicted dB(A)	Residential Area Standards dB(A)
Habitation Near P1	43.1	49.2	51.7	55
Habitation Near P2	44.1	48.6	50.4	
Habitation Near E1	42.3	43.2	45.8	
Habitation Near E2	42.8	44.5	46.6	

Source: Lab Monitoring Data

The incremental noise level is found within the range of 43.2 – 51.7 dB (A) in Buffer zone. The noise level at different receptors in buffer zone is lower due to the distance involved and other topographical features adding to the noise attenuation. The resultant Noise level due to monitored values and calculated values at the receptors are based on the mathematical formula considering attenuation due to Green Belt as 4.9 dB (A) the barrier effect. From the above table, it can be seen that the ambient noise levels at all the locations 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), dated 19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment(Protection) Act, 1986.).

Ground Vibrations

Ground vibrations due to mining activities in all the 4 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 all the 4 mines is blasting. The major impact of the ground vibrations is observed on the domestic houses located in the villages nearby the mine lease area. The kuchha houses are more prone to cracks and damage due to the vibrations induced by blasting whereas RCC framed structures can withstand more ground vibrations. Apart from this, the ground vibrations may develop a fear factor in the nearby settlements. Another impact due to blasting activities is fly rocks. These may fall on the houses or agricultural fields nearby the mining areas and may cause injury to persons or damage to the structures. Nearest Habitations from 2 mines respectively are as in below Table 7.22

TABLE 7.14: NEAREST HABITATION FROM EACH MINE

Location ID	Distance in Meters
Habitation Near P1	900
Habitation Near P2	820
Habitation Near E1	1360
Habitation Near E2	700

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 7.15: GROUND VIBRATIONS AT 4 MINES

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in m/ms
P1	78	900	0.306
P2	120	850	0.473
E1	47	1360	0.223
E2	43	700	0.284

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

TABLE 7.16: SOCIO ECONOMIC BENEFITS FROM 4 MINES

Code	Project Cost	CER Cost
P1	Rs. 1,02,79,000/-	Rs.5,00,000/-
P2	Rs. 66,57,000	Rs.5,00,000/-
E1	Rs.1,82,79,000/-	Rs. 3,65,580/-
E2	Rs. 2,55,70,838/-	Rs.5,11,416/-
Total	Rs. 6,07,85,838/-	Rs 18,76,996/-

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.

- 1 Proposed project shall fund towards CER – **Rs 10,00,000/-**
- Existing project shall fund towards CER – **Rs 8,76,996/-**
- 2 Projects in Cluster shall fund towards CER – **Rs 18,76,996/-**

TABLE 7.17: EMPLOYMENT BENEFITS FROM 4 MINES

Quarry	Employment
P1	30
P2	20
E1	15
E2	17
Total	82

A total of 30 people will get employment due to 1 proposed mine in cluster and 52 people are already employed at existing mines.

TABLE 7.18: GREENBELT DEVELOPMENT BENEFITS FROM QUARRY

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	2140	80%	Safety zone, village roads	Neem, Pungam,etc.,	1780
P2	1500	80%		Neem, Pungam,etc.,	1200
E1	1340	80%		Neem, Pungam,etc.,	1110

E2	1360	80%		Neem, Pungam,etc.,	1130
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Based on the Proposed Mining Plans it's anticipated that there shall growth of native species of Neem, Casuarina, etc in the Entire Cluster at a rate of 6,340 Trees Planted over a period of 5 Years with Survival Rate of 80% and expected growth is around 5,140 Trees to planted safety zone and village roads.

In the proposed quarries, it is anticipated to plant 3640 Trees Planted over a period of 5 Years with Survival Rate of 80% and expected growth is around 2900 Trees to planted safety zone and village roads.

7.5 PLASTIC WASTE MANAGEMENT PLAN FOR PROPOAL

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 7.19: 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

Thiru.R.R. Senthilkumar Raju for Quarrying Rough Stone and Gravel at Sundakottai Village aims to produce cumulatively 2,67,915 m³ Rough Stone over a period of 5 Years, 29,634 m³ of Weathered Rock & 23,120 m³ of Gravel over a period of 3 Years. This will enhance the socio-economic activities in the adjoining areas and will result in the following benefits

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

8.1 EMPLOYMENT POTENTIAL

It is proposed to provide employment to about 30 persons for carrying out mining operations and give preference to the local people in providing employment in this cluster. 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 quarries are located in Sundakottai Village, Aruppukottai Taluk and Virudhunagar 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.,

8.6 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 proponents 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

8.7 CSR Cost Estimation

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

8.8 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 \leq 100 crores, the proposed project shall contribute 2% of capital investment towards CER as per directions of EAC/SEAC. However, the SEAC has suggested to allocate CER fund on the basis of the extent of the project. Therefore, Rs. 5,00,000 is allocated for CER. The proposed utilization of the budget of CER activities is given in Table 8.1.

TABLE 8.1: CER – ACTION PLAN

S. No.	Activity	Budget (Rs.in Lakh)
1	The applicant Indents to involve in corporate environment responsibilities (CER) activities such as renovation of existing toilet, plantation within the school premises, donating environment related books to the nearby school library, etc.	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. R.R. Senthilkumar Raju

Meet the requirements of all laws, acts, regulations, and standards relevant to its operations and activities

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

Description of the Administration and Technical Setup –

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

The said team will be responsible for:

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

10.2 LAND ENVIRONMENT MANAGEMENT

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

TABLE 10.1: PROPOSED CONTROLS FOR LAND ENVIRONMENT

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

Source: Proposed by FAE's & EIA Coordinator

10.3 SOIL MANAGEMENT

There is no overburden or waste anticipated from proposed project.

TABLE 10.2: PROPOSED CONTROLS FOR SOIL MANAGEMENT

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

Source: Proposed by FAE's & EIA Coordinator

10.4 WATER MANAGEMENT

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

The quarrying operation is proposed upto a depth of 40 m 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 2140 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	Survival %	Area to be covered	Name of the species	No. of trees expected to be grown
I	2140	80%	Safety zone, village roads	Neem, Pongamia, Pinnata, etc.,	1780

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

Activities	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	35600	35600
	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 - 7 Units	175000	17500
	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 - 3 Units	15000	750
	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	71200
	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	696579
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
Mine Closure	1. Progressive Closure Activity - Surface Runoff managent	Provision for garland drain @ Rs. 10,000/- per Hectare with maintenance of Rs. 5,000/- per annum	35600	5000

	2. Progressive Closure Activity 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	712000	10000
	3. Progressive Closure Activity Green belt development - 500 trees per one hectare - Proposal for 2140 Trees - (280 Inside Lease Area & 1860 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)	56000	8400
		Avenue Plantation @ 300 per plant (capital) for plantation outside the lease area and @ 30 per plant maintenance (recurring)	558000	55800
	4. Implementation of Final Mine Closure Activity as per Approved Mining Plan on Last Year	Few activities already covered as progressive closure activities as greenbelt development, wire fencing, garland drain. *For Final Closure Activities 15% of the proposed closure cost will be spent during the final mine closure stage - Last Year	121800	0
	5. Contribution towards Green Fund. As per TNMMCR 1959, Rule 35 A	The Contribution towards Green Funds @ 10% of Seigniorage fee are indicated as part of EMP Budge and not necessarily implemented in the Project Site	111639	0
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) - 30 Employees	120000	30000
	Health check up for workers will be provisioned	IME & PME Health check up @ Rs. 1000/- per employee	0	30000
	First aid facility will be provided	Provision of 2 Kits per Hectare @ Rs. 2000/-	0	7120
	Mine will have safety precaution signages, boards.	Provision for signages and boards made	10000	2000
	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	178000	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
CER	As per MoEF &CC OM 22-65/2017-IA.III Dated 25.02.2021	Detailed Description in following slides and Budget allocation is included as per MoeEF & CC OM	500000	0
TOTAL			3345200	1934949

Year wise Break Up Cost

Year	Total Cost
1 st	₹ 52,80,149/-
2 nd	₹ 20,31,696/-
3 rd	₹ 21,33,281/-
4 th	₹ 22,39,945/-
5 th	₹ 24,73,743/-
Total	Rs.142 Lakhs

Cost inflation 5% per annum

In order to implement the environmental protection measures, an amount of Rs.33.46 lakhs as capital cost and recurring cost as Rs. 19.35 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. R.R. Senthilkumar Raju Rough Stone & Gravel Cluster (Extent: 11.16.0 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.

A detailed Draft EIA EMP Report is prepared for public and other stakeholders' suggestions and a final EIA/EMP Report will be prepared based on the outcome of Public Consultation.

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 Mar to May 2023 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 & Gravel as per market demand.

Sustainable and modern mining leads us to see positive impact of mining operation and providing consistent employment for nearly 30 people directly in the cluster and indirectly around 15-20 people.

As discussed, it is safe to say that the proposed quarries are 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. R.R. Senthilkumar Raju Rough Stone & Gravel Cluster (Extent: 11.16.0 ha)

12. DISCLOSURE OF CONSULTANT

Thiru. R.R. Senthilkumar Raju 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.

Name and address of the consultancy:

GEO EXPLORATION AND MINING SOLUTIONS

No 17, Advaita Ashram Road,

Alagapuram, Salem – 636 004

Tamil Nadu, India

Email: info@geoexploration@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 38	A B	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	Mrs. Jisha parameswaran	In-house	-	-	SW	B
5	Mr. Govindasamy	In-house	-	-	WP	B
6	Mrs. K. Anitha	In-house	-	-	SE	A
7	Mrs. Amirtham	In-house	-	-	EB	B
8	Mr. A. Allimuthu	In-house	-	-	LU	B
9	Mr. N. Senthilkumar	Empanelled	38 28	B B	AQ WP RH	B B A
10	Mr. Alagappa Moses	Empanelled	-	-	EB	A
11	Mr. S. Pavel	Empanelled	-	-	RH	B
12	Mr. J. R. Vikram Krishna	Empanelled	1 38	A B	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. R.R. Senthilkumar Raju, Rough Stone & Gravel Quarry Project over an Extent of 3.56.0 ha in Sundakottai Village of Aruppukottai Taluk, Virudhunagar District of Tamil Nadu. It is also certified that information furnished in the above EIA study are true and correct to the best of our knowledge.

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

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

Designation: **EIA Coordinator**

Date & Signature:










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

Associated Team Member with EIA Coordinator:

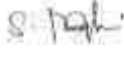
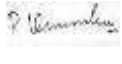

1. Mr. S. Nagamani
2. Mr. P. Viswanathan
3. Mr. M.Santhoshkumar
4. Mr. S. Ilavarasan

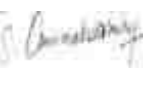

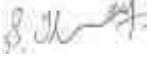
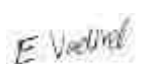

FUNCTIONAL AREA EXPERTS ENGAGED IN THE PROJECT

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	
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 local geology of the area. ▪ Preparation of mineral and geological maps. ▪ Geology and Geo morphological analysis/description and Stratigraphy/Lithology. 	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. 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. 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. 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. Viswathanan	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 ▪ 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 	
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 	
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 	
8	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 	

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. R.R. Senthilkumar Raju Rough Stone & Gravel Quarry Project over an Extent of 3.56.0 ha in Sundakottai Village of Aruppukottai Taluk, Virudhunagar District of Tamil Nadu. It is also certified that information furnished in the EIA study are true and correct to the best of our knowledge.

Signature& Date:



Name:

Dr. M. 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/2225/RA0276 Dated: 20.2.2023

Validity:

August 06, 2025