DRAFT ENVIRONMENTAL IMPACT ASSESSMENT
&
ENVIRONMENT MANAGEMENT PLAN

B1" CATEGORY – MINOR MINERAL -PATTA LAND

THIRU.V. CHANDRAN ROUGH STONE AND GRAVEL QUARRY

At

Pakkam Village, Maduranthagam Taluk, Chengalpattu District, Tamil Nadu State

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

IN CLUSTER OVER AN EXTENT OF 9.34.50 Ha

Project Proponent	Proposed Project	Extent
Thiru.V. Chandran, S/o, V. Venkatesan, No.5/68, VLS Office, Thalapathi Nagar, Venjambakkam, SP Koil, Chengelpet.	480/1A, 1B,2,3,484/3, 490/1A,1B,2B, 491/1A,3A,3B,3C,4D Pakkam Village, Maduranthagam Taluk, Chengalpattu District.	3.76.0 ha
ToR obtained vide **Lr.No. SEIAA-TN/F.No.9519/SEAC/ToR-1357/2023 Dated:09.02.2023**		

Environmental Consultant
GEO EXPLORATION AND MINING SOLUTIONS
Old No. 260-B, New No. 17,
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ENVIRONMENTAL LAB
EHS 360 LABS PRIVATE LIMITED,
10/2 Ground floor, 50th street, 7th Avenue,
Ashok Nagar, Chennai – 600 083.

Baseline Monitoring Season – Dec 2022 to Feb 2023

MAY 2023

For the easy representation the proposed, existing, abandoned and expired quarries are designated as below –

PROPOSED QUARRY				
CODE	**Name of the Proponent and Address**	**S.F. Nos, Village & Taluk**	**Extent in Ha**	**Status**
P1	**Thiru.V.Chandran**, S/O.V.Venkatesan, No.5/68, VLS Office, Thalapathi Nagar,Venjambakkam, SP Koil, Chengelpet.	480/1A, 1B,2,3,484/3, 490/1A,1B,2B, 491/1A,3A,3B,3C,4D of Pakkam Village, Maduranthagam Tk	**3.76.0**	Obtained ToR vide, Lr.No. SEIAA-TN/F.No.9519/SEAC/ToR-1357/2023 Dated:09.02.2023
EXISTING QUARRIES				
CODE	**Name of the Proponent and Address**	**S.F.Nos , Village & Taluk**	**Extent in Ha**	**Lease Period**
E1	**Thiru.V. Chandran**, S/O.V.Venketesan, No.5/68, VLS Office, Thalapathi Nagar, Venjambakkam, SP Koil, Chengelpet.	491/6A, 482/2A, 483/2A,2B, 482/2B, 480/4C2, 4E, 481/2, 491/6D, 6B Pakkam Village, Maduranthagam Tk	3.23.0	17.10.2018 to 16.10.2023
E2	Thiru.R. Anugraha Prasath S/O.Ramadoss, No.7, Thirumanjana Veethi, Seerkazhi, Nagapattinam District.	491/2,495/1,495/2,494/1 Pakkam Village, Maduranthagam Tk	2.35.50	08.11.2018 to 07.11.2023
		Total	**5.58.5 Ha**	
ABANDONED QURRIES				
CODE	**Name of the Proponent and Address**	**S.F. Nos, Village & Taluk**	**Extent in Ha**	**Lease Period**
A-1	**Thiru.A. Tikkaraman,** Melavalampattu Village, Karunkuzhi Post, Madurantakam Tk.	486/1,2, 487/1A Pakkam Village, Maduranthagam Tk	**1.21.5**	30.10.2002 to 29.10.2007
A-2	**Thiru.S. Sugumar,** No.47, Meenakshiamman Koil street, Madurantakam Tk.	479/1,2A,2B, Pakkam Village, Maduranthagam Tk	**0.66.5**	23.11.2004 to 22.11.2009
A-3	**Thiru.T.Ravi,** No.135, Marapakkam Village & Post, Madurantakam Tk.	508(P),Q.No.2, Pakkam Village, Maduranthagam Tk	**3.00.0**	05.01.2005 to 04.01.2010
A-4	**Thiru.S A.Gopinathan**, No.22, Amman Koil Street, Kadaperi, Chennai-45	511/1A, 2A, 1B, Pakkam Village, Maduranthagam Tk	**1.88.5**	03.10.2005 to 02.10.2010
A-5	**Thiru.S.Sugumar,** No.47, Meenakshiamman Koil street, Madurantakam Tk.	479/1A,2A,2B, Pakkam Village, Maduranthagam Tk	**0.66.5**	08.07.2010 to 07.7.2015
A-6	**Thiru.V.Chandran**, S/O.V.Venketesan, No.5/68, VLS Office, Thalapathi Nagar,Venjambakkam, SP Koil, Chengelpet.	509,510,511/1A,1B,2A, Pakkam Village, Maduranthagam Tk	**2.45.0**	09.08.2010 to 08.08.2017
A-7	**Thiru.J.Saravanan,** S/o.Jeevanantham, Old No.12, New No.27, Sampanthan St, Bharathipuram, chrompet, Chennai-44	480/4A, Pakkam Village, Maduranthagam Tk	**1.87.5**	01.09.2012 to 31.08.2017
A-8	**Thiru.V.Chandran**, S/O.V.Venketesan, No.5/68, VLS Office, Thalapathi Nagar,Venjambakkam, SP Koil, Chengelpet.	511/2B,512,514,515, Pakkam Village, Maduranthagam Tk	**3.25.0**	01.09.2012 to 31.08.2017
A-9	**Thiru.P.Thiruvengadam,** S/O.Parthasarathy, No.5/70, Istasithi Vinayagar Koil St, Venkateswara Nagar, Pozhichalur, Chennai-74	496/1A, 1B,2,3,4,5, 497, 506,507/1,2, Pakkam Village, Maduranthagam Tk	**3.23.0**	01.09.2012 to 31.08.2017
A-10	**Thiru.C.Kanniappan,** S/O.K.Sokkalingam, No.66/74, Senkazhaniyamman Koil St, Puzuthivakkam, Chennai-91	483/1B,1C,490/3B, Pakkam Village, Maduranthagam Tk	**0.94.5**	30.07.2013 to 29.07.2018
A-11	**Thiru.S.Surendiran S/o.Sugumar No.47, Meenatchiamman Koil St, Madurantakam**	489,491/1B, 4A,4C,4E,4F,5A,5B,5C,5D, Pakkam Village, Maduranthagam Tk	**1.68.0**	03.03.2014 to 02.03.2019
TOTAL CLUSTER EXTENT			**9.34.50**	

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

P1- Thiru.V. Chandran,

Lr.No. SEIAA-TN/F.No.9519/SEAC/ToR-1357/2023 Dated:09.02.2023

SPECIFIC CONDITIONS		
1	Since Vedanthangal Birds Sanctuary is situated near the project site, the PP shall obtain NBWL clearance vide, MoEF&CC office Memorandem no. FC-11/119/2020-FC dated 17th May 2022.	Noted and agreed
2	The committee noted that the proposal contains two non-contiguous lands. PP shall furnish documentary evidence showing that the land in between the two sites also belongs to him. Also, the proponent can either revise the proposal for either of the two lands since non-contiguous lands can be dealt in one application or he shall necessary letter obtained from the competent authority indicating the justification on the ground in which the permission has been granted for working in the mining lease area which is not compact.	Noted and agreed
3	The structures within the radius i)100 m, ii)200m and iii)300m shall be enumerated with details such as dwelling houses with number of occupants, places of worship, industries, factories, sheds, etc.,	Noted and agreed
4	In the case of proposed lease in an existing (or old) quarry where the benches are not formed (or) partially formed as per the approved Mining Plan, the Project Proponent (PP) shall prepare and submit an 'Action Plan' for carrying out the realignment of the benches in the proposed quarry lease after it is approved by the concerned Asst. Director of Geology and Mining during the time of appraisal for obtaining the EC.	Noted and agreed
5	The Proponent shall submit a conceptual 'Slope Stability Plan' for the proposed quarry during the appraisal while obtaining the EC, when the depth of the working is extended beyond 30 m below ground level.	Noted and agreed
6	The PP shall furnish the affidavit stating that the blasting operationin the proposed quarry is carried out by the statutory competent person as per the MMR 1961 such as blaster, mining mate, mine foreman, II/lst Class mines manager appointed by the proponent	Noted and agreed
7	The PP shall present a conceptual design for carrying out only controlled blasting operation involving line drilling and muffle blasting in the proposed quarry such that the blast-induced ground vibrations are controlled as well as no fly rock travel beyond 30 m from the blast site.	Noted and agreed
8	The EIA Coordinators shall obtain and fumish the details of quarry/quarries operated by the proponent ill the past, either in the same location or else wherc in the State with video and photographic evidences.	Noted and agreed

9	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, a. What was the period of the operation and stoppage of the earlier mines with last work permit issued by the AD/DD mines? b. Quantity of minerals mined out c. Highest production achieved in any one year d. Detail of approved depth of mining e. Actual depth of the mining achieved earlier f. Name of the person already mined in that leases area g. If EC and CTO already obtained, the copy of the same shall be submitted. h. whether the mining was carried out as per the approved mine plan (or EC if issued) with stipulated benches.	Noted and agreed It is a fresh Lease application
10	All corner coordinates of the mine lease area, superimposed on a High-Resolution Imagery/Topo sheet, topographic sheet, geomorphology, lithology and geology of the mining lease area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).	Satellite imagery of the project area along with boundary coordinates is given in the Chapter No 1 Geomorphology of the area is given in Chapter No 2 Land use pattern of the project area is tabulated in the Chapter No.2. Land use pattern of the Study area is tabulated in the Chapter No.3
11	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 will be submitted in the final EIA report
12	The proponent shall furnish revised manpower including the statutory and competent persons as requires under the provisions of the MMR 1961 for the proposed quarry based on the volume of the rock handled and area excavation.	Noted and agreed
13	The proponent shall fumish photographs of adequate fencing, green belt along the periphery including replantation of existing trees & safety distance between the adjacent quarries & water bodies nearby provided as per the approved mining plan.	Noted and agreed
14	The Project Proponent shall provide the details of mineral reserves and mineable reserves, planned production capacity, proposed working methodology with justifications, the anticipated impacts of the mining operations on the surrounding environment and the remedial measures for the same	Details of Geological Resources and Proposed reserves are discussed under Chapter No. 2.
15	The Project Proponent shall provide the organization chart indicating the appointment of various statutory officials and other competent	Organization chart indicating Proposal for the appointment of Statutory officials is given in the Chapter No.7

	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	
16	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 1km (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 is 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.
17	The proponent shall furnish the baseline data for the environmental and ecological parameters with regard to surface water/ground water quality, air quality, soil quality & Flora/fauna including traffic/vehicular movement study.	Baseline Data were collected for One Season (Winter season) Dec 2022 to Feb 2023 as per CPCB Notification and MoEF & CC Guidelines. Details in Chapter No. 3.
18	The Proponent shall carry out the Cumulative impact study due to mining operations: carried out in the quarry specifically with reference to the specific environment in terms of 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.
19	Rain water harvesting management with recharging details along with water balance (both) monsoon & non-monsoon) be submitted.	Detailed discussed in chapter 3
20	Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the 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	Detailes discussion Land environment in chapter 3 & Land use pattern of the study area discussed in chapter 3.
21	Details of the land for storage of Overburden/Waste Dumps (or) Rejects outside the mine lease, such as extent of land area, distance from mine lease, its land use. R&R issues, if any. should be provided	No overburden waste dump present in this quarry
22	Proximity to Areas declared as 'Critically Polluted' (or) the Project areas which attracts the court restrictions for mining operations, should also be indicated and where so required. clearance certifications from the prescribed Authorities, such as the TNPCB (or) Dept of Geology and Mining should be secured and furnished to the effect that the proposed mining activities could be considered	Noted and agreed

23	Description of water conservation measures proposed to be adopted in the Project should be given. Details of rainwater harvesting proposed in the Project, if any, should be provided	Detailed discussed in chapter 4.
24	Impact on local transport infrastructure due to the Project should be indicated.	Detailed discussed in chapter 2.
25	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.
26	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
27	Public Hearing points raised and commitments of the Project Proponent on the same along with time bound Action Plan with budgetary provisions to implement the same should be provided and also incorporated in the final EIA/EMP Report of the Project and to be submitted to SEIAA/SEAC with regard to the Office Memorandum of MoEF& CC accordingly.	Noted & agreed. Details will be provided in Final EIA/EMP report after the completion of public hearing
28	The Public hearing advertisement shall be published in one major National daily and one most circulated vernacular daily.	Public hearing advertisement will be made as per the ToR Recommendations
29	The PP shall produce/display the EIA report, Executive summery and other related information with respect to public hearing in Tamil Language also.	Noted & agreed.
30	As a part of the study of flora and fauna around the vicinity of the proposed site, the EIA coordinator shall strive to educate the local students on the importance of preserving local flora and fauna by involving them in the study, wherever possible.	Noted & agreed.
31	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-I in consultation with the DFO. State Agriculture University and local school/college authorities. The plant species with dense/moderate canopy of native origin should be chosen. Species of small/medium/tall trees alternating with shrubs should be planted in a mixed manner	Noted & agreed. It is proposed to plant 1880 nos of trees in the 7.5m safety barrier and approach roads
32	Taller/one year old Saplings raised in appropriate size of bags preferably eco-friendly bags should be planted as per the advice of local forest authorities/botanist/Horticulturist with regard to	Noted & agreed.

	site specific choices. The proponent shall earmark the greenbelt area with GPS coordinates all along the boundary of the project site with at least 3 meters wide and in between blocks in an organized manner	
33	A Disaster management Plan shall be prepared and included in the EIA/EMP Report for the complete life of the proposed quarry (or) till the end of the lease period.	Detailed under Chapter 7,
34	A Risk Assessment and management Plan shall be prepared and included in the ELA/EMP Report for the complete life of the proposed quarry (or) till the end of the lease period.	Detailed under Chapter 7,
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.	Detailed discussed in the 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.	Detailed discussed in the chapter 10.
37	The Socio-economic studies should be carried out within a 5 km buffer zone from the mining activity. Measures of socio-economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	Socio Economic study has been carried out the details are given in the Chapter No.3.
38	Details of litigation pending against the project, if any, with direction /Order passed by any Court of Law against the Project should be given.	No litigation pending cases
39	Benefits of the Project if the Project is implemented should be spelt out. The benefits of the Project shall clearly indicate environmental, social, economic, employment potential, etc.	Detailed discussed in the chapter 8.
40	If any quarrying operations were carried out in the proposed quarrying site for which now the EC is sought, the Project Proponent shall furnish the detailed compliance to EC conditions given in the previous EC with the site photographs which shall duly be certified by MoEF&CC. Regional Office, Chennai (or) the concerned DEE/TNPCB.	Noted & and the compliance report will be submitted along with Final EIA report.
41	The PP shall prepare the EMP for the entire life of mine and also furnish the sworn affidavit stating to abide the EMP for the entire life of mine	Detail discussed in chapter 10.
42	Concealing any factual information or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this Terms of Conditions besides	Noted & agreed

	attracting penal provisions in the Environment (Protection) Act, 1986.	
ADDITIONAL CONDITIONS		
Annexure -B Cluster Management Committee		
1	Cluster Management Committee, which must include all the proponents in the cluster as members including the existing as well as proposed quarry.	Details in chapter 7 salient features of quarry with existing quarry.
2	The members must coordinate among themselves for the effective implementation of EMP as committed including Green Belt Development, Water sprinkling, tree plantation, blasting etc.,	Noted & agreed
3	The List of members of the committee formed shall be submitted to AD/Mines before the execution of mining lease and the same shall be updated every year to the AD/Mines.	Noted & agreed
4	Detailed Operational Plan must be submitted which must include the blasting frequency with respect to the nearby quarry situated in the cluster, the usage of haul roads by the individual quarry in the form of route map and network.	Transport details in chapter-2
5	The committee shall deliberate on risk management plan pertaining to the cluster in a holistic manner especially during natural calamities like intense rain and the mitigation measures considering the inundation of the cluster and evacuation plan.	Noted & agreed
6	The Cluster Management Committee shall from Environmental Policy to practice sustainable mining in scientific and systematic manner in accordance with the law. The role played by the committee in implementing the environmental policy devised shall be given in detail.	Noted & agreed
7	The committee shall furnish action plan regarding the restoration strategy with respect to the individual quarry falling under the cluster in a holistic manner.	Noted & agreed
8	The committee shall furnish the Emergency Management plan within the cluster.	Details discussed in chapter 7.
9	The committee shall deliberate on the health of the workers/staff involved in the mining as well as the health of the public.	Details discussed in chapter 10.
10	The committee shall furnish an action plan to achieve sustainable development goals with inference to water, sanitation & safety.	Noted & agreed
11	The committee shall furnish the fire safely and evacuation plan in the case of fire accidents	Detailed discussed in chapter 7.
Impact study of mining		
12	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 precise area communication order issued from reputed search institutions on the following. a) Soil health and soil biological, physical land chemical features.	Noted & agreed

	b) Climate change leading to droughts, floods etc. c) Pollution leading to release of greenhouse gases (GHG), rise in temperature and Livelihood of the local people. d) Possibilities of water contamination and impact on aquatic ecosystem health. e) Agriculture, forestry and traditional practices. f) Hydrothermal/Geothermal effect due to destruction in the environment. g) Bio-geochemical processes and its foot prints including environmental strees. h) Sediment geochemistry in the surface streams.	
Agriculture and Agro-Biodiversity		
13	Impact on surrounding agricultural fields around the proposed mining Area.	Detailed discussed in chapter 4.
14	lmpact on soil flora & Vegetation around the project site.	Detailed discussed in chapter 4.
15	Details of type of vegetation including no. of trees & Shrubs within the proposed mining area and. If so, transplantation of such vegetations all along the boundary of the proposed mining area shall committed mentioned in EMP.	Details in Chapter 2,3 and 7
16	The EIA should study the biodiversity, the natural ecosystem, the soil micro flora, fauna and soil seed banks and suggest measures to maintain the natural ecosystem.	Details in Chapter 3
17	Action should specifically suggest for sustainable management of the area and restoration of ecosystem for flow of goods and services.	Noted & agreed
18	The project proponent shall study and furnish the impact of project on adjoining Patta lands, Horticulture, Agriculture and livestock.	The project area is bounded by Existing quarries on the East, South and west side and crusher located on North side. Nearest Coconut agriculture land is situated South side of the area. Proponent proposed to erect green mesh along with fencing on the South side besides, Budgetary allocation given in the Chapter No. 10.
Forests		
19	The project proponent shall detail study on Impact of mining on Reserve forests free ranging wildlife.	Noted and agreed, there is no reserve forest and wildlife in the buffer zone.
20	The Environmental Impact assessment should study impact on forests, vegetation, endemic, vulenerable and endangered indigeneous flora and fauna.	Anticipated impact and mitigation measures on biodiversity, vegetation, endemic, vulnerable and endangered indigenous flora and fauna and detailed in the Chapter No. 4, the Draft EIA report furnished by the Project proponent.
21	The Environmental Impact Assessment should study impact on standing trees and the existing trees should be numbered and action suggested for production.	Noted & agreed
22	The Environmental Impact Assessment should study impact on protected areas, RF, National Park, Corridors and wildlife pathways, near project site.	Anticipated Environment Impact and Mitigation measures are detailed in Chapter No.4
Water Enviornment		
23	Hydro-geological study considering the contour map of the water table detailing the number of	Detailed discussed in the chapter 3.

	ground water pumping & open wells, and surface water bodies such as rivers, tanks, canals, ponds etc. within km (radius) so as to assess the impacts on the nearby water bodies 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.	
24	Erosion Control Measures.	Noted & agreed
25	Detailed study shall be carried out in regard to impact of mining aroud the proposed mine lease area on the nearby villages, waterbodies/Rivers and any ecological fragile areas.	Details in Chapter 2
26	The project proponent shall study impact on fish habitats and the food WEB/food chain in the waterbody and Reservoir.	Details in Chapter 2 and 4 impact of bio diversity.
27	The project proponent shall study and furnish the details on potential fragmentation impact on natural environment by the activities.	Noted & agreed
28	The project proponent shall study and furnish the impact on aquatic plants and animals in water bodies and possible scars on the landscape, damages to nearby caves, heritage site, and archaeological sites possible land form changes visual and aesthetic impacts.	Noted & agreed. Detailed under Chapter 3.
29	The terms of Reference should specifically study impact on soil health, Soil Erosion, the soil physical, chemical components and microbial components.	Details in Chapter 3 soil environment.
30	The Environmental Impact Assessment should study on wetlands, water bodies, rivers streams, lakes and farmer sites.	Nearest agriculture activity is coconut plantation located North side of the project area. Proponent erected fencing in the previous lease period. The same will be reconstructed around the quarry pits
Energy		
31	The measure taken control Noise, Air, water, dust control and steps adopted to efficiently utilize the energy shall be furnished.	Details in Chapter 3 environmental monitoring details.
Climate changes		
32	The Environmental Impact Assessment shall study in detail the carbon emission and also suggest to measures to mitigate carbon emission including development of catbon sinks and temperature reduction including control of other emission and climate mitigation activities.	Details of carbon emission and mitigation activities are given int the Chapter No.4
33	The Environmental Impact Assessment should study impact on climate change, temperature rise, pollution and soil and below soil carbon stock.	Details in Chapter-3 for metorological and climate/weather data representation of graphs.
Mine Closure Plan		
34	Detailed mine closure plan covering the entire mine lease period as per precise area communication order issued.	Details in Chapter 2 mine closure plan
EMP		
35	Detailed environment management plan along with adaptation, mitigation and remedial strategies	Details in EMP in chapter 10

	covering the entire mine lease period as per precise area communication order issued.	
36	The Environmental Impact Assessment should hold detailed study on EMP with budget for green belt development and mine closure plan including disaster management plan.	Details in Green belt development in chapter 7
Risk Assessment		
37	To furnish risk assessment and management plan including anticipated vulnerabilities during operational and post operational phases of Mining.	A Risk Assessment and management Plan Chapter-7
Disaster management plan		
38	To furnish disaster management plan and disaster mitigation measures in regard to all aspects to avoid/reduce vulnerability to hazards & to cope with disaster/untoward accidents in & around the proposed mine lease area due to the proposed method of mining activity & its related activities covering the entire mine lease period as per precise area communication order issued.	Disaster management Plan details in Chapter-7
Others		
39	The project proponent shall furnish VAO certificate with reference to 300m radius regard to approved habitations. Schools, Archaeological sited, structures, railway lines, roads, water bodies such as streams, odai, vaari, canal, channel, river, lake pond, tank etc.,	Details in chapter-2 with attached annexure
40	As per the MoEF &CC office memorandum F.No.22-65/2017-IA.III dated:30.09.2020 and 20.10.2020 the proponent shall address the concerns raised during the public consultation and all the activities proposed shall be part of the Environment Management plan.	Noted and agreed, to be furnished public hearing
41	The project proponent shall study and furnish the possible pollution due to plastic and microplastic on the environment. The ecological risks and impacts of plastics & Microplastics on aquatic environment and fresh water systems due to activities, contemplated during mining may be investigated and reported.	Details of carbon emission and mitigation activities are given int the Chapter No.4
STANDARD TERMS OF REFERENCE		
1	Year-wise production details since 1994 should be given, clearly stating the highest production achieved in any one year prior to 1994. It may also be categorically informed whether there had been any increase in production after the EIA Notification 1994 came into force, w.r.t. the highest production achieved prior to 1994.	**Not applicable.** The projects are not a violation category. This proposal falls under B1 Category (Cluster situation)
2	A copy of the document in support of the fact that the Proponent is the rightful lessee of the mine should be given.	Document is enclosed along with Approved Mining Plan as Annexure Volume 1 for the respective projects.
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 co-ordinates is given in the Chapter No 1 Figure No .1.1 Geomorphology of the area is given in Chapter No 2 Figure No 2.10. Land use pattern of the project area is tabulated in the Chapter No.2. Table No.2.3 Land use pattern of the Study area is tabulated in the Chapter No.3 Table No 3.2.
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. 2.11, Geomorphology of the area is given in Chapter No 2 Figure No 2.10.
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 should also be provided.	It is an opencast quarrying operation proposed to operate in Mechanized method. The rough stone formation is a hard, compact and homogeneous body. The height and width of the bench will be maintained as 5m with 90^0 bench angles. Quarrying activities will be carried out under the supervision of Competent Persons like Mines Manager, Mines Foreman and Mining Mate. Necessary permissions will be obtained from DGMS after obtaining Environmental Clearance.
9	The study area will comprise of 10 km zone around the mine lease from lease periphery and the data contained in the EIA such as waste generation etc., should be for the life of the mine / lease period.	**Noted & agreed.** The study area considered for this study is 10 km radius and all data contained in the EIA report such as waste generation etc., is for the Life of the Mine / lease period.

10	Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given.	Land use and land cover of the study area is discussed in Chapter No. 3, Page No. 54. Land use plan of the project area showing pre-operational, operational and post-operational phases are discussed in Chapter No. 2, Table No 2.3.
11	Details of the land for any Over Burden Dumps outside the mine lease, such as extent of land area, distance from mine lease, its land use, R&R issues, if any, should be given	**Not Applicable.** There is no waste anticipated during this quarry operation. The entire quarried out Rough stone will be transported to the needy customers. No Dumps is proposed outside the lease area.
12	A Certificate from the Competent Authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area. In the event of any contrary claim by the Project Proponent regarding the status of forests, the site may be inspected by the State Forest Department along with the Regional Office of the Ministry to ascertain the status of forests, based on which, the Certificate in this regard as mentioned above be issued. In all such cases, it would be desirable for representative of the State Forest Department to assist the Expert Appraisal Committees.	**Not Applicable.** There is no Forest Land involved in the proposed project area. The proposed project area is a government land. Approved Mining Plan is enclosed as Annexure Volume 1.
13	Status of forestry clearance for the brake up area and virgin forestland involved in the Project including deposition of net present value (NPV) and compensatory afforestation (CA) should be indicated. A copy of the forestry clearance should also be furnished.	**Not Applicable.** The proposed project area does not involve any Forest Land.
14	Implementation status of recognition of forest rights under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 should be indicated.	**Not Applicable.** The project doesn't attract Recognition of Forest Rights Act, 2006.
15	The vegetation in the RF / PF areas in the study area, with necessary details, should be given.	Gudalura Reserve Forest 0.22km-NW in the Study Area.
16	A study shall be got done to ascertain the impact of the Mining Project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the surrounding and any other protected area and accordingly, detailed 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	**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. Vedanthangal Bird Sanctuary -7km-N

	Standing Committee of National Board of Wildlife and copy furnished	
18	A detailed biological study of the study area [core zone and buffer zone (10 KM radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET Species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the Schedule of the fauna present. In case of any scheduled-I fauna found in the study area, the necessary plan 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. Detailed in Chapter No. 3.
19	Proximity to Areas declared as 'Critically Polluted' or the Project areas likely to come under the 'Aravalli Range', (attracting court restrictions for mining operations), should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the SPCB or State Mining Department should be secured and furnished to the effect that the proposed mining activities could be considered.	**Not Applicable.** Project area / Study area is not declared in 'Critically Polluted' Area and does not come under 'Aravalli Range.
20	Similarly, for coastal Projects, A CRZ map duly authenticated by one of the authorized agencies demarcating LTL. HTL, CRZ area, location of the mine lease w.r.t CRZ, coastal features such as mangroves, if any, should be furnished. (Note: The Mining Projects falling under CRZ would also need to obtain approval of the concerned Coastal Zone Management Authority).	**Not Applicable.** The project doesn't attract The C. R. Z. Notification, 2018.
21	R&R Plan/compensation details for the Project Affected People (PAP) should be furnished. While preparing the R&R Plan, the relevant State/National Rehabilitation & Resettlement Policy should be kept in view. In respect of SCs /STs and other weaker sections of the society in the study area, a need based sample survey, family-wise, should be undertaken to assess their requirements, and action programmes prepared and submitted accordingly, integrating the sectoral programmes of line departments of the State Government. It may be clearly brought out whether the village(s) located in the mine lease area will be shifted or not. The issues relating to shifting of village(s) including their R&R and socio-economic aspects should be discussed in the Report.	**Not Applicable.** There are no approved habitations within a radius of 300 meters. Therefore, R&R Plan / Compensation details for the Project Affected People (PAP) is not anticipated and Not Applicable for this project.
22	One season (non-monsoon) [i.e. March-May (Summer Season); October-December (post monsoon season); December-February (winter season)]primary baseline data on ambient air quality as per CPCB Notification of 2009, water quality, noise level, soil and flora and fauna shall be collected and the AAQ and other data so compiled presented date-	Baseline Data were collected for One Season (Dec-Feb 2023 (Winter Season) as per CPCB Notification and MoEF & CC Guidelines. Details in Chapter No. 3.

	wise in the EIA and EMP Report. Site-specific meteorological data should also be collected. The location of the monitoring stations should be such as to represent whole of the study area and justified keeping in view the pre-dominant downwind direction and location of sensitive receptors. There should be at least one monitoring station within 500 m of the mine lease in the pre-dominant downwind direction. The mineralogical composition of PM10, particularly for free silica, should be given.	
23	Air quality modelling should be carried out for prediction of impact of the project on the air quality of the area. It should also take into account the impact of movement of vehicles for transportation of mineral. The details of the model used and input parameters used for modelling should be provided. The air quality contours may be shown on a location map clearly indicating the location of the site, location of sensitive receptors, if any, and the habitation. The wind roses showing pre-dominant wind direction may also be indicated on the map.	Air Quality Modelling for prediction of incremental GLC's of pollutant was carried out using AERMOD view 9.6.1 Model. Details in Chapter No. 4.
24	The water requirement for the Project, its availability and source should be furnished. A detailed water balance should also be provided. Fresh water requirement for the Project should be indicated.	Total Water Requirement for this project is given in the chapter No 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.	Water for dust suppression, greenbelt development and domestic use will be obtained from accumulated rainwater/seepage water in mine pits. Drinking water will be sourced from the approved water vendors, No 2, Table No 2.13,
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.	The rain water collected in the pits after spell of rain will be used for greenbelt development and dust suppression.
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 Quality discussed in Chapter No. 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.	The ground water table is at 70-65m below ground level. In these projects, ultimate depth is 43m Maximum from the general ground profile. It is inferred the quarrying activities in the Cumulative EIA project (Quarries) will not intersect the Ground water table.
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.	Highest elevation of the project area is 66m AMSL Ultimate depth of the mine is 43m AMSL Water level in the area is 70m BGL to 65m BGL
30	Information on site elevation, working depth, groundwater table etc. Should be provided both in	Progressive greenbelt development plan has been prepared and discussed along with Recommended

	AMSL and BGL. A schematic diagram may also be provided for the same.	Species details are given in the Chapter 4, Table No.4.12
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.	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 much significant impact due to the proposed transportation from the project area. Details in Chapter 2.
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.	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.
33	Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.	Discussed in 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.	Details in Chapter 10.
35	Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	Occupational health impact and details of the medical examination to the workers given in the Details in Chapter 10.
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.	Details in Chapter No. 4
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.	Details of Socio Economic is given in the Chapter No 3.

38	Detailed environmental management plan (EMP) to mitigate the environmental impacts which, should inter-alia include the impacts of change of land use, loss of agricultural and grazing land, if any, occupational health impacts besides other impacts specific to the proposed Project.	Environment Management Plan 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.	Public hearing points and commitment of the project proponent will be updated in the final EIA & EMP 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 given in the Chpater No 2, Table No 2.15.
42	A Disaster management Plan shall be prepared and included in the EIA/EMP Report.	Detailed under 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.	Total Water Requirement for this project is given in the chapter No 2, Table No 2.13.
44	**Besides the above, the below mentioned general points are also to be followed: -**	
A	Executive Summary of the EIA/EMP Report	Encloses as separate volume
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 given properly.
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	Copy of Baseline monitoring reports are enclosed with this draft as annexure
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.	Questionnaire of the project will be submitted in final EIA report after complying the public hearing points.
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.	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)	There are no changes in Form-I, Mining plan and Pre-feasibility report for all the projects.

	will entail conducting the PH again with the revised documentation	
I	As per the circular no. J-11011/618/2010-IA. II(I) Dated: 30.5.2012, certified report of the status of compliance of the conditions stipulated in the environment clearance for the existing operations of the project, should be obtained from the Regional Office of Ministry of Environment, Forest and Climate Change, as may be applicable.	Not applicable.
J	The EIA report should also include (i) surface plan of the area indicating contours of main topographic features, drainage and mining area, (ii) geological maps and sections and (iii) sections of the mine pit and external dumps, if any, clearly showing the land features of the adjoining area.	Satellite imagery of the project area along with boundary coordinates is given in the Chapter No 1 Figure No .1.1 Geomorphology of the area is given in Chapter No 2 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.V. Chandran, Rough Stone & Gravel Quarry consisting of one Proposed and two Existing Quarry with total extent of Cluster of 9.34.50 ha in Pakkam Village, Maduranthagam Taluk, Chengalpattu District and Tamil Nadu State, cluster area calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016.

Baseline Monitoring study has been carried out during the period of December 2022-February 2023 and this EIA and EMP report is prepared for considering cumulative impacts arising out of this project, the Cumulative Environmental Impact Assessment study is undertaken, which is followed by preparation of a detailed Environmental Management Plan (EMP) individually to minimize those adverse impacts.

1.1 PURPOSE OF THE REPORT

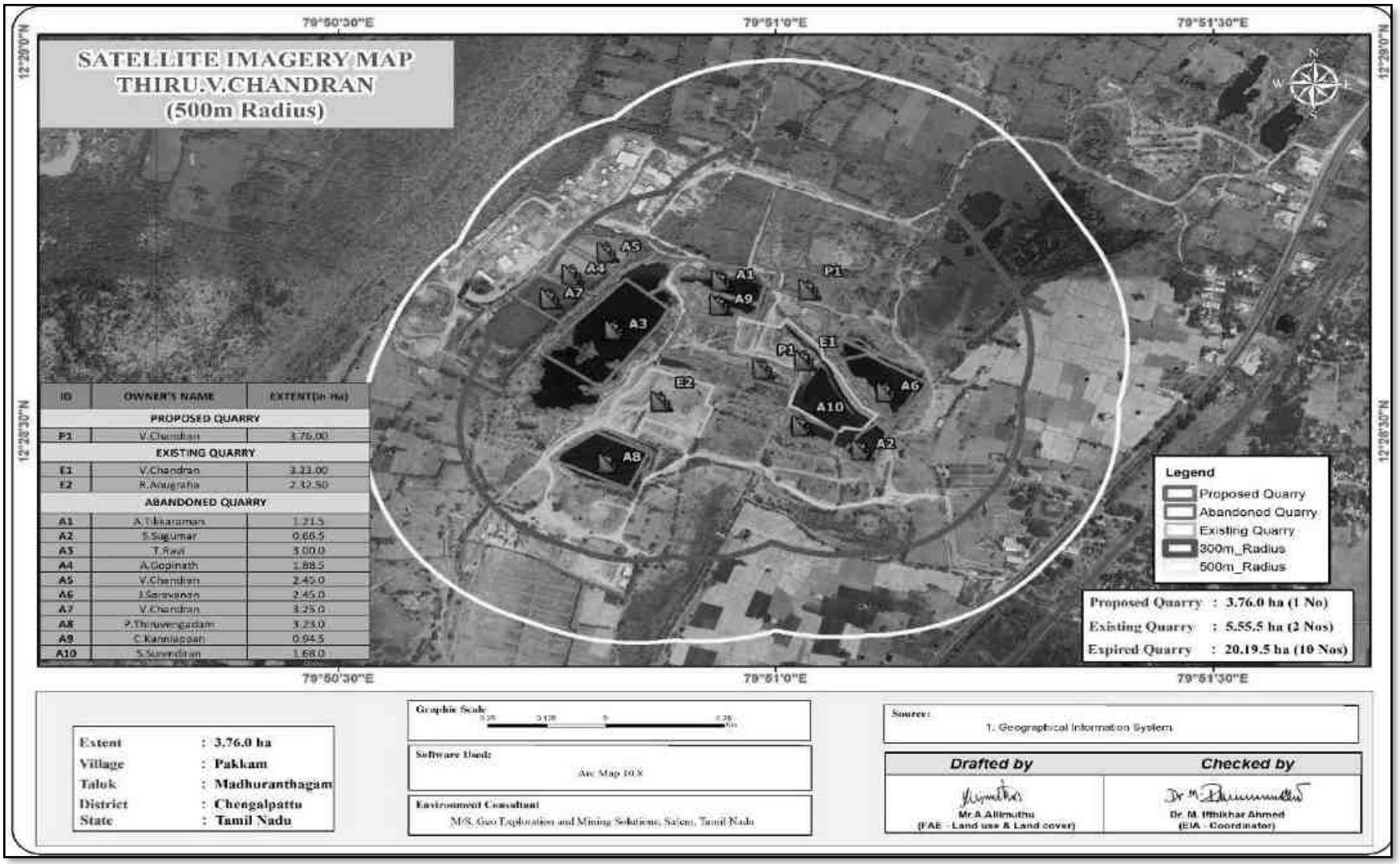
The Ministry of Environment and Forests, Govt. of India, through its EIA notification S.O. 1533(E) of 14thSeptember 2006 and its subsequent amendments as per Gazette Notification S.O. 3977 (E) of 14thAugust 2018, Mining Projects are classified under two categories i.e. A (> 100 Ha) and B (≤ 100 Ha),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

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

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

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

FIGURE.1.1 SATELLITE IMAGERY CLUSTER QUARRIES



ID	OWNER'S NAME	EXTENT(in Ha)
PROPOSED QUARRY		
P1	V.Chandran	3.76.00
EXISTING QUARRY		
E1	V.Chandran	3.23.00
E2	R.Anugraha	2.32.50
ABANDONED QUARRY		
A1	A.Ekaramam	1.21.5
A2	S.Sagumar	0.66.5
A3	T.Ravi	3.00.0
A4	A.Gopinath	1.88.5
A5	V.Chandran	2.45.0
A6	J.Saravanan	2.45.0
A7	V.Chandran	3.25.0
A8	P.Thiruvengadam	3.23.0
A9	C.Kannappan	0.94.5
A10	S.Surendran	1.68.0

1.2 IDENTIFICATION OF PROJECT AND PROJECT PROPONENT

1.2.1 Identification of Project

TABLE 1.1: SALIENT FEATURES OF THE PROPOSED PROJECT

Name of the Project	Thiru.V. Chandran Rough Stone & Gravel Quarry Project
S.F. No.	480/1A, 1B,2,3,484/3, 490/1A,1B,2B, 491/1A,3A,3B,3C,4D
Extent	3.76.0 ha
Land Type	Patta Land
Village Taluk and District	Pakkam Village, Maduranthagam Taluk, Chengalpattu District

Source: Approved Mining Plan.

1.2.2 Identification of Project Proponent

TABLE 1.2: DETAILS OF PROJECT PROPONENT

Name of the Company	Thiru.V. Chandran Rough Stone & Gravel Quarry Project
Address	S/O.V.Venkatesan, No.5/68, VLS Office, Thalapathi Nagar, Venjambakkam, SP Koil, Chengelpet-603 204
Mobile	+91 93400 26187
Status	Individual

Source: Approved Mining Plan.

1.3 BRIEF DESCRIPTION OF THE PROJECT

1.3.1 Nature and Size of the Project

Common Mining Methodology is proposed for one proposed mine.

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

TABLE 1.3: BRIEF DESCRIPTION OF THE PROJECT

Name of the Quarry	Thiru.V. Chandran Rough Stone & Gravel Quarry		
Toposheet No	57-P/15		
Latitude between	12°28'33.23"N to 12°28'43.08"N		
Longitude between	79°50'52.12"E to 79°51'07.58"E		
Highest Elevation	55m AMSL		
Proposed Depth of Mining	43m (1m Gravel + 2m Weathered Rock + 40m Rough stone) below ground level		
Lease Period (As per ToR)	10 Years		
Geological Resources	**Rough Stone in m^3**	**Weathered Rock m^3**	**Gravel m^3**
	15,04,000m^3	75,200m^3	37,600m^3

Mineable Reserves	**Rough Stone in m^3**	**Weathered Rock m^3**	**Gravel m^3**
	8,81,720m^3	57,846m^3	29,613m^3
Ultimate Pit Dimension	Pit-1 108m (L) x 100m (W) x 43m Pit-I1 148m (L) x 51m (W) x 43m Pit-1II 158m (L) x 71m (W) x 43m Pit-IV 36m (L) x 68m (W) x 18m		
Water Level in the surrounds area	70m Summer - 65m Rainy bgl		
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting		
Topography	The lease applied area is exhibits plain topography. The area has gentle sloping towards Northeast side. The altitude of the area is 66m (max) above Mean Sea level. The area is covered by 1m thickness of Gravel and 2m of Weathered Rock formation. Massive Charnockite is found after 3m (1m Gravel + 2m Weathered Rock) which is clearly inferred from the nearby existing quarry pits.		
Machinery proposed	Jack Hammer	11Nos	
	Compressor	3Nos	
	Excavator with bucket and rock breaker	2 Nos	
	Tipper	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	50 Nos		
Project Cost	Rs.1,50,54,000/-		
EMP Cost	Rs. 7,60,000/-		
Total	Rs.1,58,14,000/-		
CER Cost	Rs 5,00,000/-		
Nearby Water Bodies	Kiliyar River	4.5Km & NW	
	Edandhur Lake	6Km & SE	
	Madhuranthagam Lake	4.4Km & N	
	Tank	830m & SE	
	Tank	6.5Km & NE	
Greenbelt Development Plan	Proposed to plant 1880 trees in the 7.5m Safety Zone and panchayat roads.		
Proposed Water Requirement	3.0 KLD		

Nearest Habitation	Pakkam – 660m- NE

Source: Approved Mining Plan

1.3.2 Location of the Project

- The proposed quarry project falls in Pakkam Village, Madhuranthagam Taluk, Chengalpattu District.
- Thiru.V. Chandran, cluster is located about 5 km Southwestern side of Pakkam Village
- The Pakkam Village is located about 5 km Southwestern of Madhuranthagam Taluk.
- The area is marked in the Survey of India, Toposheet No. 57-P/15. The area lies between the Latitudes of 12°28'33.23"N to 12°28'43.08"N and Longitudes of 79°50'52.12"E to 79°51'07.58"E

FIGURE 1.1A KEY MAP SHOWING THE LOCATION OF THE PROJECT SITE

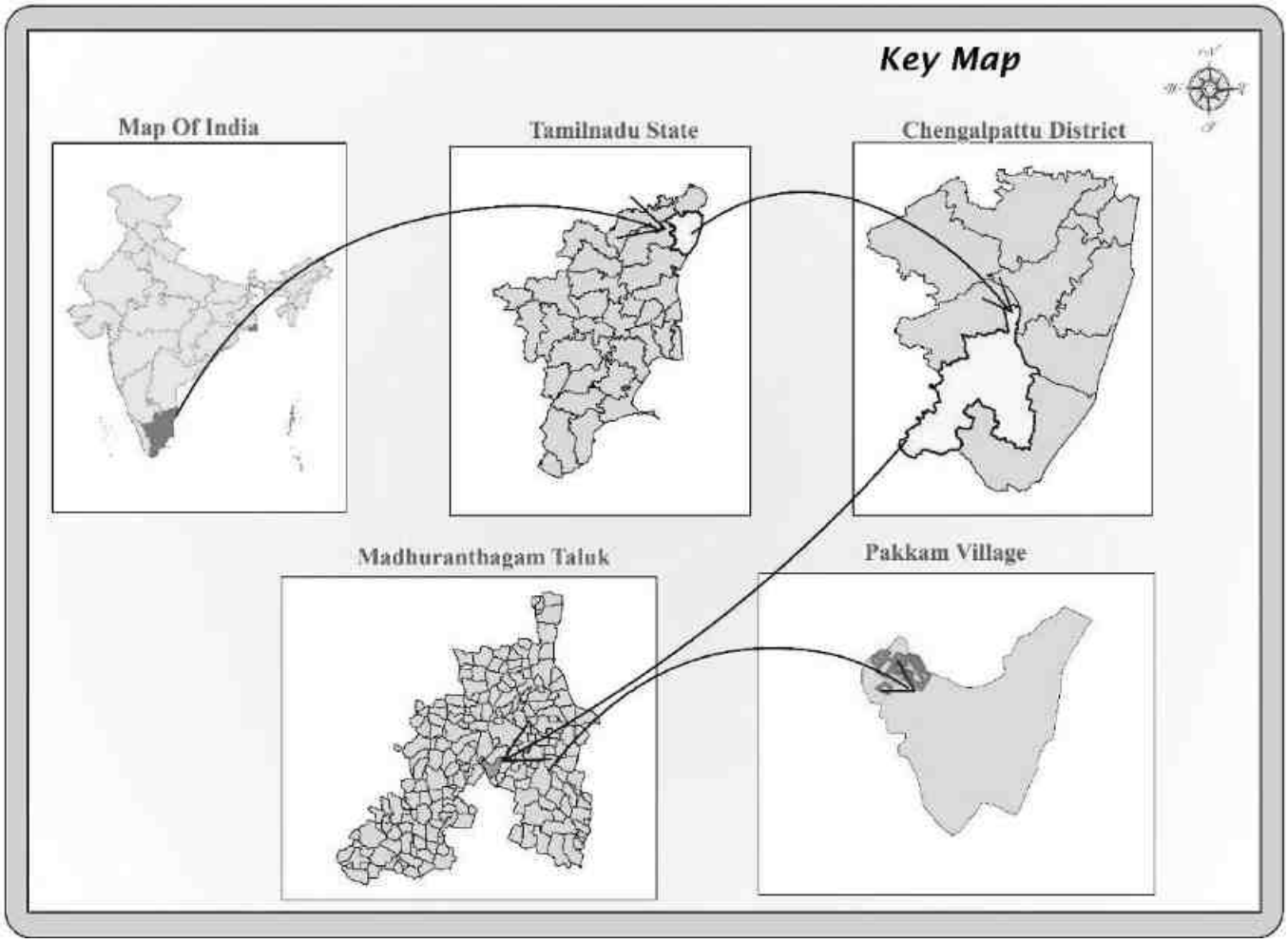
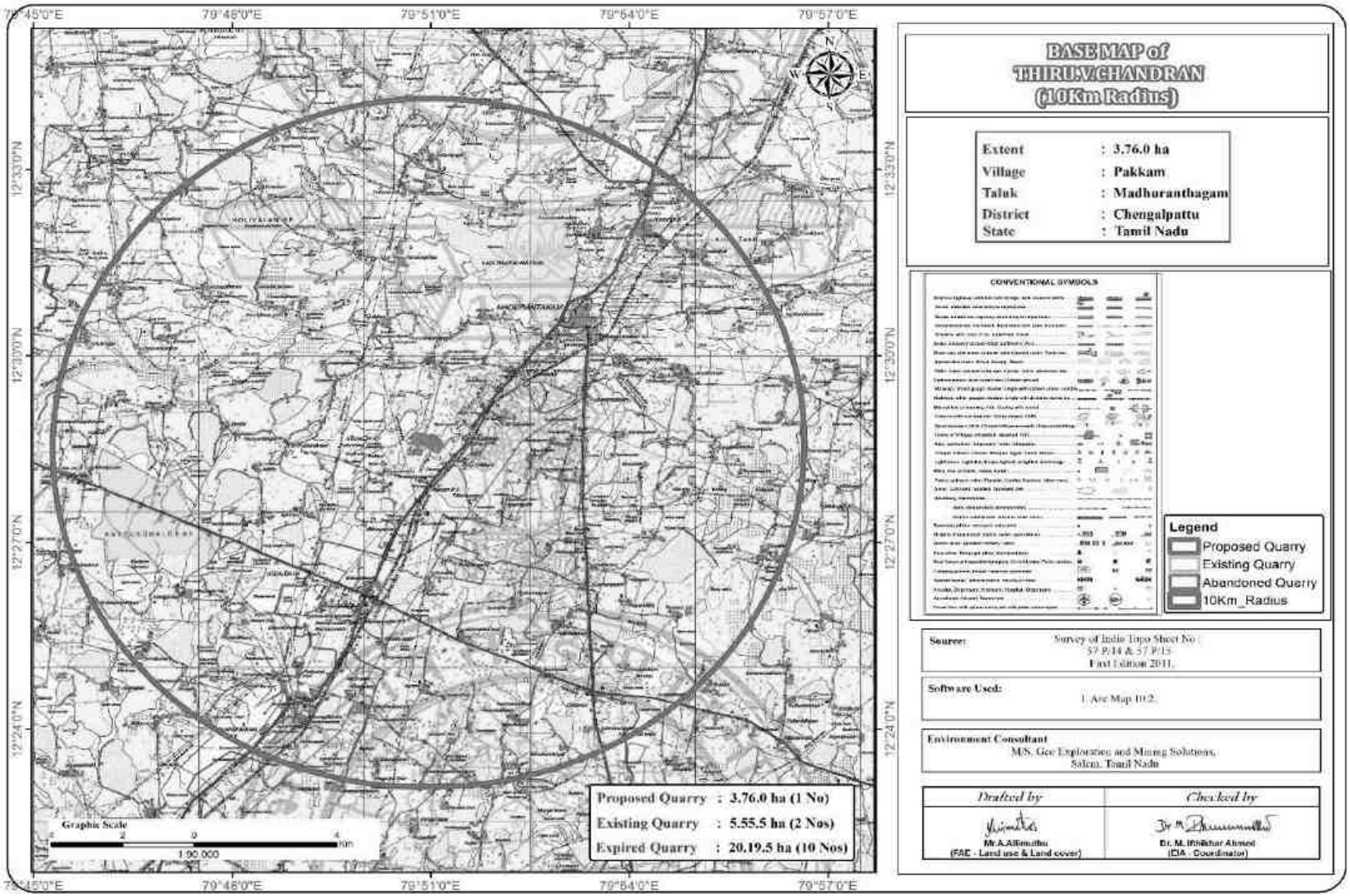


FIGURE 1.2: TOPOSHEET SHOWING LOCATION OF THE PROJECT SITE AROUND 10 KM RADIUS



1.4 ENVIRONMENTAL CLEARANCE

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

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

SCREENING

- The proponent applied for Rough Stone and Gravel Quarry Lease Dated: 22.05.2019
- Precise Area Communication Letter was issued by the Deputy Director / Assistant Director(i/c), Department of Geology and Mining, Chengalpattu District vide letter Rc.No.227/Q2/2019, Dated: 23.08.2021
- The Mining Plan was prepared by Qualified Person and approved by Deputy Director / Assistant Director(i/c), Department of Geology and Mining, Chengalpattu District vide letter Rc.No.227/Q2/2019, Dated: 14.09.2021
- The proposed project falls under "B1" Category as per Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No, 186 of 2016 and MoEF & CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018
- Proponent applied for ToR for Environmental Clearance vide online Proposal No. SIA/TN/MIN/73759/2022, Dated: 16.03.2022

SCOPING

- The proposal was placed in 345th SEAC meeting held on 10/01/2023 and the committee recommended for issue of ToR.
- The proposal was considered in 590th SEIAA meeting held on 09.02.2023 and issued ToR vide Lr.No. SEIAA-TN/F.No.9519/SEAC/ToR-1357/2023 Dated:09.02.2023

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, 2010
- EIA Notification, 14thSeptember, 2006
  - Lr.No. SEIAA-TN/F.No.9519/SEAC/ToR-1357/2023 Dated:09.02.2023.
  - Approved Mining Plan.

1.5 TERMS OF REFERENCE (ToR)

ToR issued vide –

- ToR Lr.No. SEIAA-TN/F.No.9519/SEAC/ToR-1357/2023 Dated:09.02.2023. Area detailed in Page No. I – XLIX.

1.6 POST ENVIRONMENT CLEARANCE MONITORING

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

1.7 GENERIC STRUCTURE OF EIA DOCUMENT

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

1.8 THE SCOPE OF THE STUDY

The main scope of the EIA study is to quantify the cumulative impact in the study area due to cluster quarries and formulate the effective mitigation measures for each individual leases. A detailed account of the emission sources, emissions control equipment, background Air quality levels, Meteorological measurements, Dispersion model and all other aspects of pollution like effluent discharge, Dust generation etc., have been discussed in this report. The baseline monitoring study has been carried out during the Winter season (Dec 2022 to Feb 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	PM10, PM 2.5, SO2, NO2	Continuous 24-hourly samples twice a week for three months at 8 locations (2 Core & 6 Buffer)
2	Meteorology	Wind speed and direction, temperature, relative humidity and rainfall	Near project site continuous for three months with hourly recording and from secondary sources of IMD station
3	Water quality	Physical, Chemical and Bacteriological parameters	Grab samples were collected at 6 locations – 4 ground water and 2 surface water samples; once during study period.
4	Ecology	Existing terrestrial and aquatic flora and fauna within 10 km radius circle.	Limited primary survey and secondary data was collected from the Forest department.
5	Noise levels	Noise levels in dB(A)	8 locations – data monitored once for 24 hours during EIA study
6	Soil Characteristics	Physical and Chemical Parameters	Once at 6 locations during study period
7	Land us e	Existing land use for different categories	Based on Survey of India topographical sheet and satellite imagery and primary survey.
8	Socio-Economic Aspects	Socio-economic and demographic characteristics, worker characteristics	Based on primary survey and secondary sources data like census of India 2011.

9	Hydrology	Drainage pattern of the area, nature of streams, aquifer characteristics, recharge and discharge areas	Based on data collected from secondary sources as well as hydro-geology study report prepared.
10	Risk assessment and Disaster Management Plan	Identify areas where disaster can occur by fires and explosions and release of toxic substances	Based on the findings of Risk analysis done for the risk associated with mining.

Source: Field Monitoring Data
The data has been collected as per the requirement of the ToR issued by SEIAA – TN.

1.8.1 Regulatory Compliance & Applicable Laws/Regulations

- Application for Quarrying Lease as per Tamil Nadu Minor Mineral Concession Rules, 1959
- Obtained Precise Area Communication Letter as per Tamil Nadu Minor Mineral Concession Rules, 1959 for Preparation of Mining Plan and obtaining Environmental Clearance
- The Mining Plan has been approved under Rule 41 & 42 as amended of Tamil Nadu Minor Mineral Concession Rules, 1959
- ToR Lr.No. SEIAA-TN/F.No.9519/SEAC/ToR-1357/2023 Dated:09.02.2023

CHAPTER – 2: PROJECT DESCRIPTION

2.0 GENERAL

The Proposed Rough Stone Quarries requires Environmental Clearance. There are one proposed and two existing quarry forming a cluster; calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016 and the total extent of cluster is **9.34.50 ha**

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

2.1 DESCRIPTION OF THE PROJECT

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

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

2.2 LOCATION OF THE PROJECT

- The proposed quarry project falls in Pakkam Village, Madhuranthagam Taluk, Chengalpattu District.
- Thiru.V. Chandran, cluster is located about 5 km Southwestern side of Pakkam Village
- The Pakkam Village is located about 5 km Southwestern of Madhuranthagam Taluk.
- The area is marked in the Survey of India, Toposheet No. 57-P/15. The area lies between the Latitudes of 12°28'33.23"N to 12°28'43.08"N and Longitudes of 79°50'52.12"E to 79°51'07.58"E

The project does not fall within 10 km radius of any Eco – sensitive zone, National Park, Tiger Reserve, Elephant Corridor and Biosphere Reserves.

TABLE 2.1: SITE CONNECTIVITY

Nearest Roadway	NH – 45- Chennai – Trichy -1.0km-SE SH-117- Madurantakam – Thenpakkam (Vennangupattu)-4.0km-E MD-518-Uthiramerur-Acharapakkam Road -7.0km-W
Nearest Village	Pakkam – 1.0km-SE
Nearest Town	Maduranthakam – 5.0km-SE
Nearest Railway	Madhurandhagam – 5.0km-NE
Nearest Airport	Chennai Airport – -81.0km-NE
Seaport	Ennore Port - 101km – NE

Source: Survey of India Toposheet

TABLE 2.2: BOUNDARY CO-ORDINATES OF PROPOSED PROJECT

Boundary Pillar No.	Latitude	Longitude
1	12° 28' 36.08"N	79° 50' 52.12"E
2	12° 28' 37.30"N	79° 50' 52.95"E
3	12° 28' 39.26"N	79° 50' 53.81"E
4	12° 28' 38.18"N	79° 50' 57.24"E
5	12° 28' 36.22"N	79° 50' 56.81"E

6	12° 28' 35.50"N	79° 50' 59.69"E
7	12° 28' 35.11"N	79° 51' 00.32"E
8	12° 28' 34.70"N	79° 51' 01.50"E
9	12° 28' 41.41"N	79° 50' 59.69"E
10	12° 28' 43.08"N	79° 51' 00.41"E
11	12° 28' 42.00"N	79° 51' 04.03"E
12	12° 28' 36.62"N	79° 51' 07.58"E
13	12° 28' 36.03"N	79° 51' 06.91"E
14	12° 28' 37.27"N	79° 51' 04.55"E
15	12° 28' 37.21"N	79° 51' 04.15"E
16	12° 28' 37.36"N	79° 51' 03.27"E
17	12° 28' 39.41"N	79° 51' 03.61"E
18	12° 28' 40.13"N	79° 51' 01.52"E
19	12° 28' 40.74"N	79° 51' 01.73"E
20	12° 28' 33.23"N	79° 51' 01.01"E
21	12° 28' 34.15"N	79° 50' 58.23"E
22	12° 28' 34.68"N	79° 50' 58.40"E
23	12° 28' 35.08"N	79° 50' 57.04"E
24	12° 28' 35.58"N	79° 50' 55.68"E
25	12° 28' 35.07"N	79° 50' 55.47"E

Source: Approved Mining Plan

FIGURE 2.1: TOPOGRAPHICAL VIEW OF THE PROJECT SITES

FIGURE 2.2: GOOGLE IMAGE ROUGH STONE AND GRAVEL QUARRY PROJECT AREAS

FIGURE 2.3: QUARRY LEASE PLAN / SURFACE PLAN

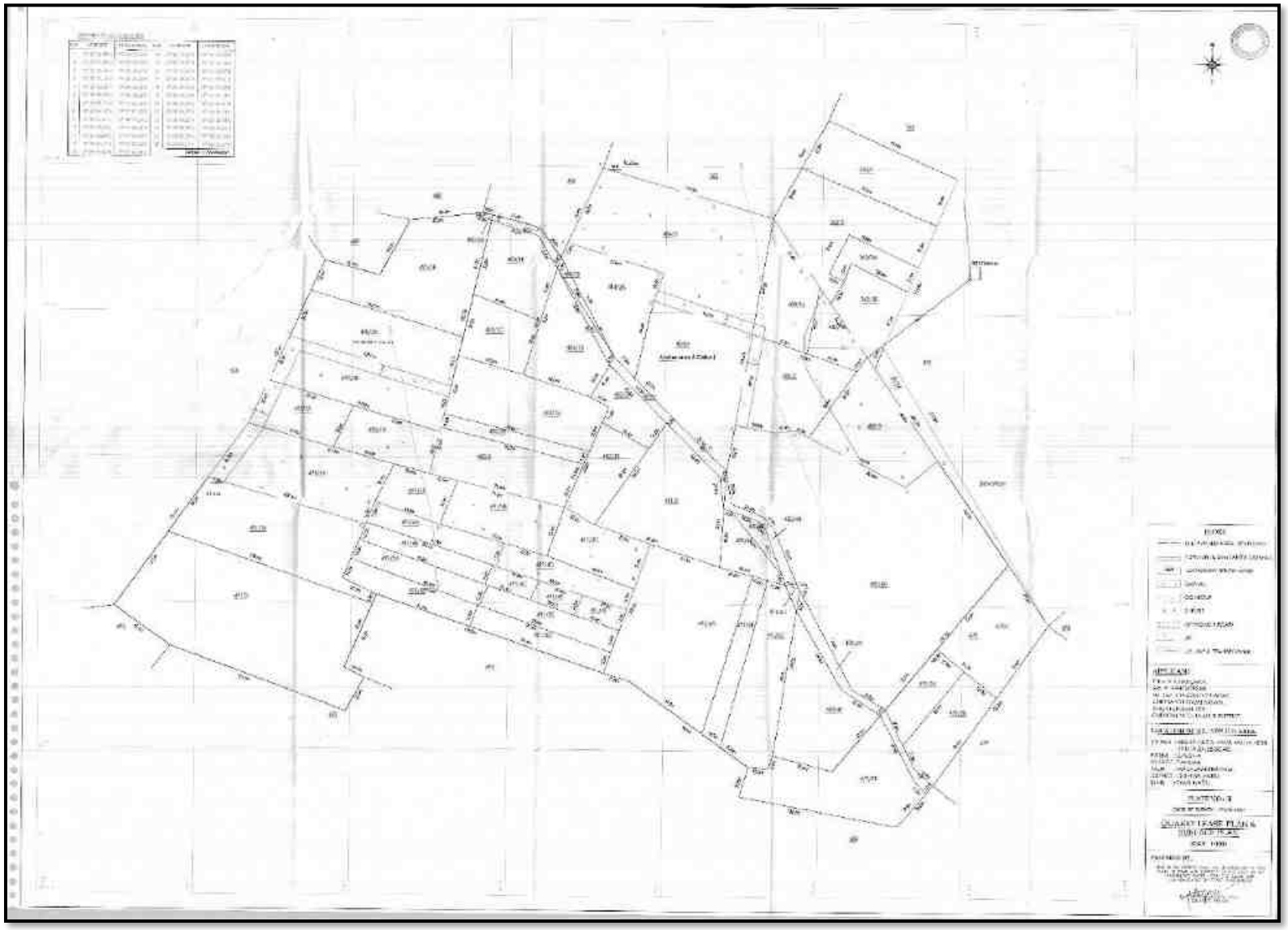


FIGURE 2.4: SATELLITE IMAGERY OF CLUSTER QUARRIES

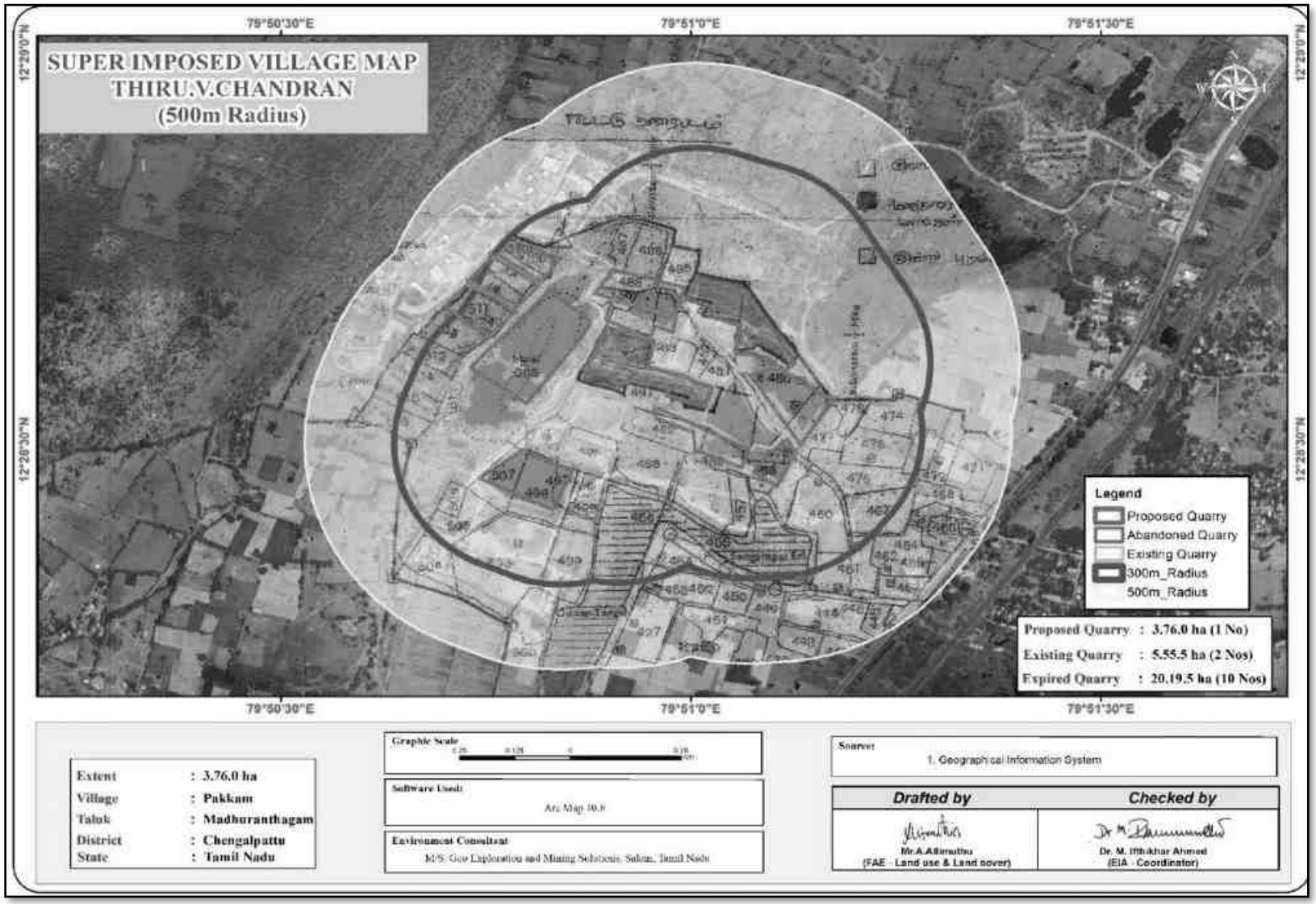


FIGURE 2.5: DIGITIZED MAP OF THE STUDY AREA (10 KM RADIUS FROM PROJECT SITE)

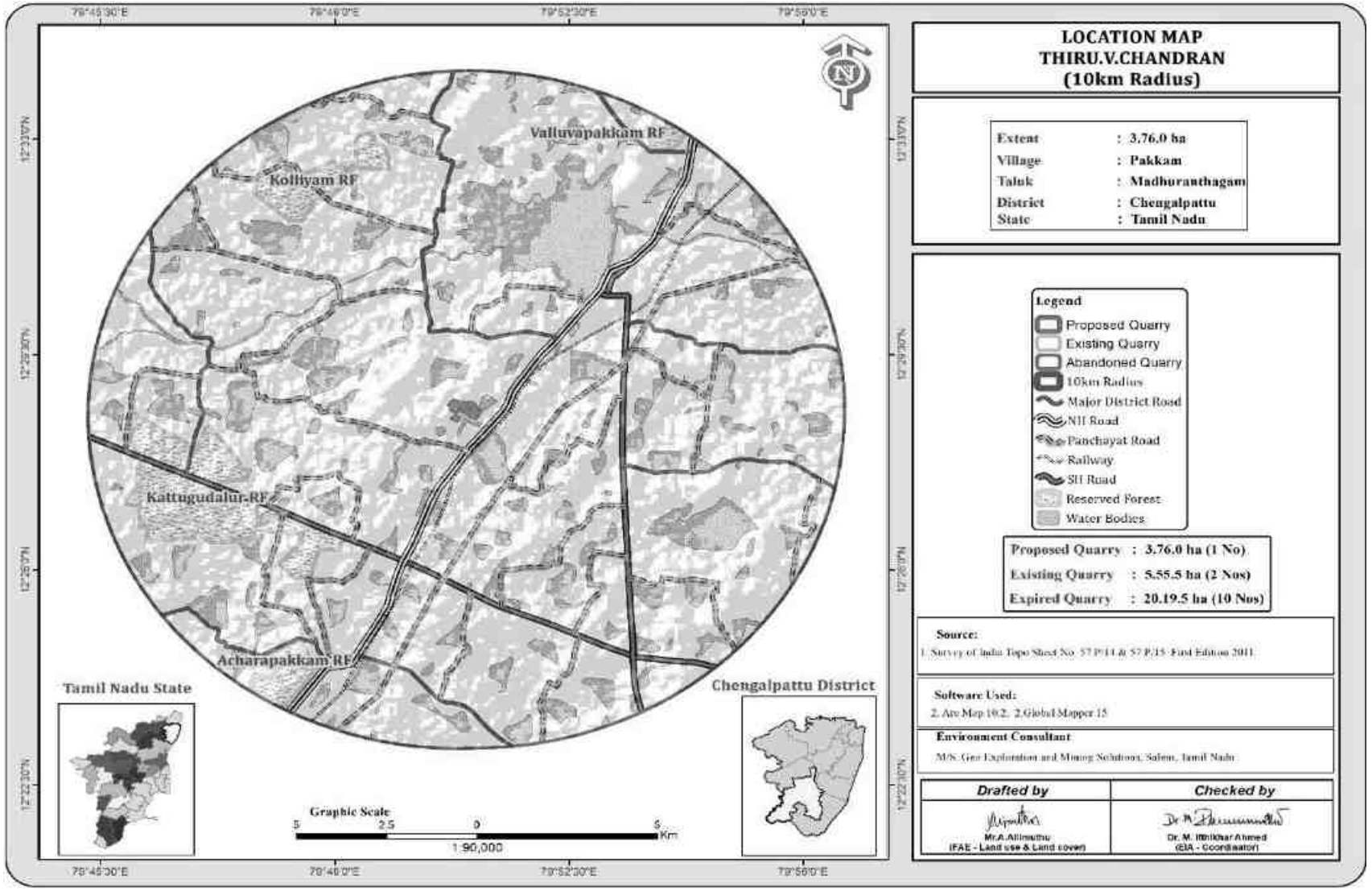


FIGURE 2.6: DIGITIZED MAP OF THE STUDY AREA (5 KM RADIUS FROM PROJECT SITE)

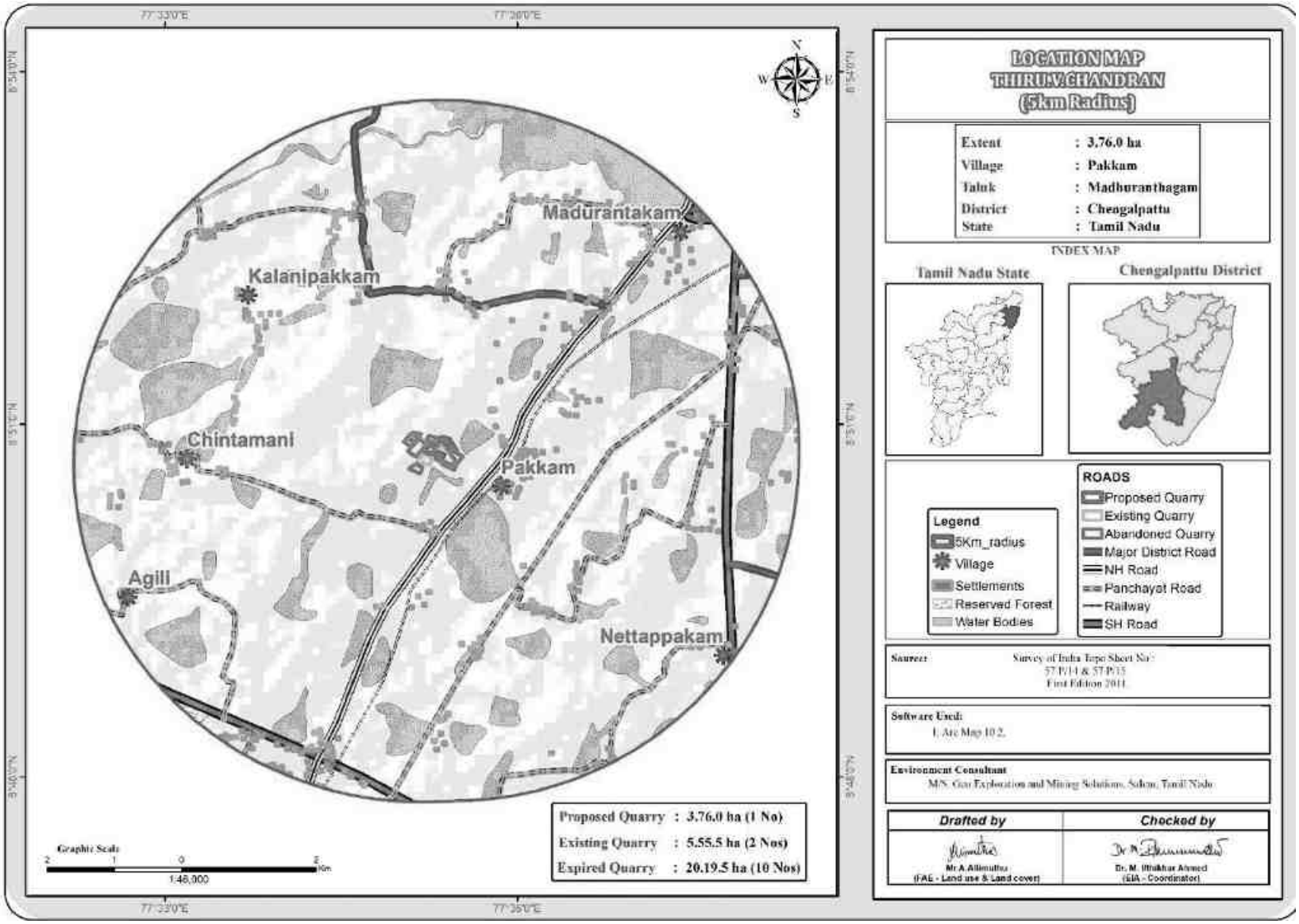
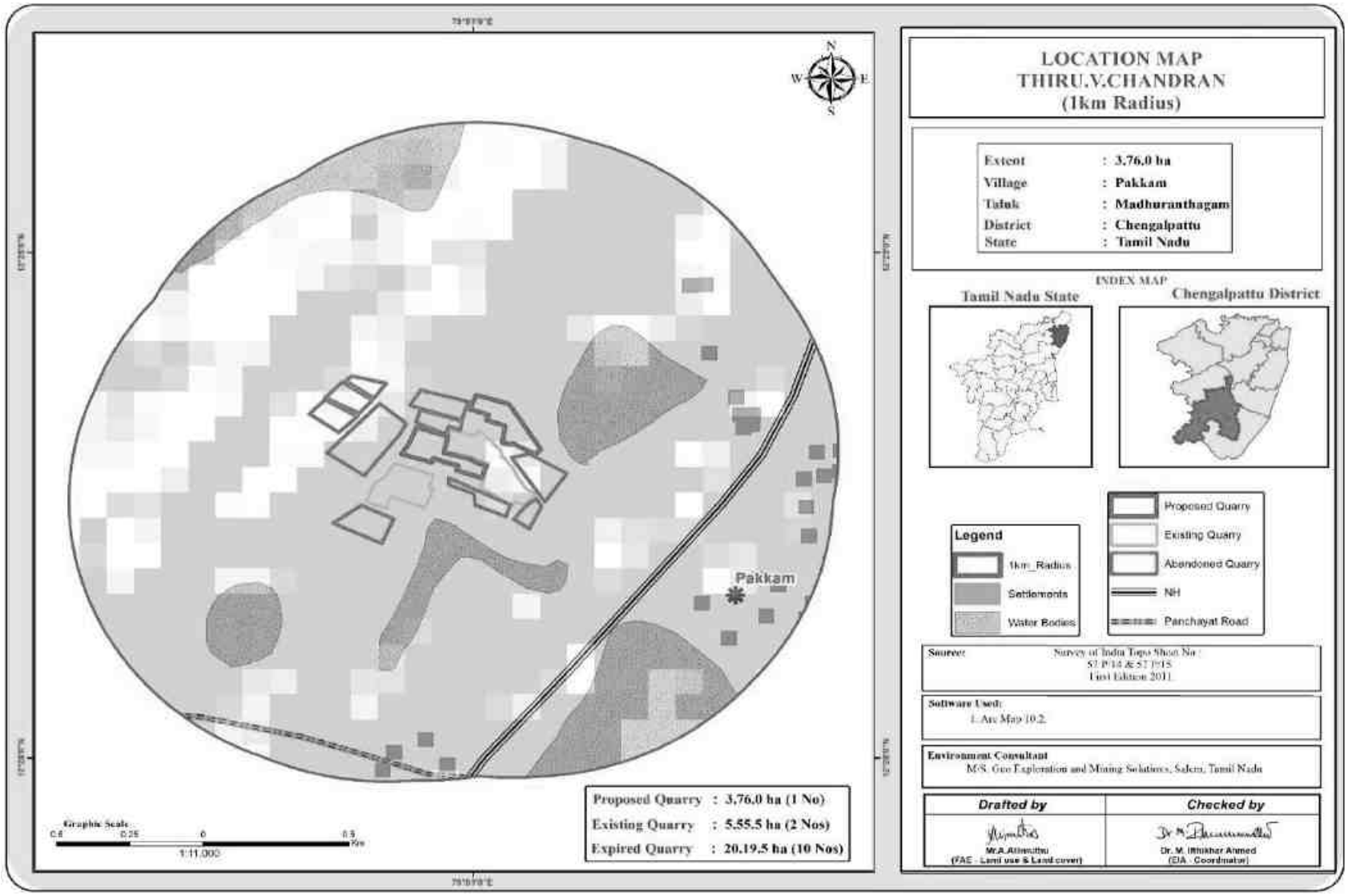


FIGURE 2.7: DIGITIZED MAP OF THE STUDY AREA (1 KM RADIUS FROM PROJECT SITE)



2.2.1 Project Area

(i) All the projects under cluster are site specific, there is No beneficiation or processing proposed inside the project area.

(ii) There is no forest land involved in the proposed project area and is devoid of major vegetation and trees.

TABLE 2.3 – LAND USE PATTERN

Description	Present area in (ha)
Area under Quarrying	Nil
Infrastructure	Nil
Roads	Nil
Green Belt	Nil
Unutilized Area	3.76.0
Grand Total	**3.76.0**

Source: Approved Mining Plan

2.2.2 Size or Magnitude of Operation

TABLE 2.4: OPERATIONAL DETAILS FOR PROPOSED PROJECT

PARTICULARS	DETAILS		
	Rough Stone (5Year Plan period)	**Weathered Rock m^3 (3 Years Plan period)**	**Gravel (3 Years Plan period)**
Geological Resources in m^3	15,04,000 m^3	75,200 m^3	37,600 m^3
Mineable Reserves in m^3	8,81,720 m^3	57,846 m^3	29,613 m^3
Production in m^3	8,81,720 m^3	57,846 m^3	29,613 m^3
Mining Plan Period	10 Years		
Number of Working Days	300 Days		
Production per day in m^3	588	64	33
No of Lorry loads (12m^3 per load)	49	5	3
Total Depth of Mining	43m bgl (1m Gravel + 2m Weathered Rock + 40m Rough stone)		

Source: Approved mining plan

2.3 GEOLOGY

2.3.1 Regional Geology

Peninsular gneiss forms the oldest rock formations, in which the massive formation of Charnockite lies over with rich accumulation of recent quaternary formation. On regional scale of the Charnockite body is N45°E – S45°W with dipping towards SE70º.

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

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

The Kanchipuram area is endowed with a complex geological set up with crystalline rocks occurring in the southern part of the area and the northern part of the area the crystalline rocks occur at depths covered by sedimentary formations ranging from Gondwana to Recent. The depth at which the crystalline rocks occur progressively increase towards north. The sedimentary cover sequence is named as Palar basin and the thickness of the sediments is as high as 300 m in the northern part. The eastern part comprises unconsolidated sediments of fluvio-marine and marine origin.

Source: District Survey Report for Minor Minerals Kancheepuram District – March 2019

https://kancheepuram.nic.in/document/kancheepuram-district-mineral-survey-report/

2.3.2 Local Geology: -

The area exposes crystalline rocks of Archaean age and sedimentary rocks of Gondwana Supergroup and the Cuddalore Formation belonging to Mio-Pliocene age. A gravel and shingle bed locally known as Kanchipuram Gravels belong to the Pliocene to lower Pleistocene age. The laterite and alluvium are related to Quatemary age. The Archaean rocks are represented by Khondalite Group, Charnockite Group and Migmatite complex. Garnet Sillimanite Gneiss is well exposed in the Northeastern part of the district in Pachchamalai hill at Chrompet, Parangimalai and Southeast of Pallavaram. Charnockite in the predominant country rock and the type area for Charnockite is St. Thomas Mount at Pallavaram Taluk. The lower Gondwana sediments (Talchirs) overlie the Archaean rocks unconformably and are seen to the northeast and south of Palar river preserved in the trough faults and comprise boulder beds, dirty white to light green, greyish yellow fine sandstone, siltstone with clasts of rock fragments and khaki green to greenish grey shales. Source: https://tnmines.tn.gov.in/pdf/dsr/15.pdf

2.3.3 Hydrogeology

The Kancheepuram district is principally made up of hardrocks and sedimentary formations. These are overlained by laterites and alluvium. The study area is underlain by formations of Quarternary, Tertiary and Mesozoic ages followed by the basement complex of crystalline rocks of Archaean age. The general trend of the gneiss is NE-SW direction and the regional trend observed is NNE-SSW to NW-SE direction. The deposition of Gondwana raocks, the sedimentary rocks, in faulted troughs and in the rugges topography of crystalline rocks took place during Jurasic period. The insitu soils laterites and alluvial deposits were deposited along the Palar and Cheyyar rivers during the quarternary period.

Aquifer Systems:

Occurrence and storage of groundwater depend upon three factors viz., Geology, Topography and rainfall in the form of precipitation. Apart from Geology, wide variation in topographic profile and intensity of rainfall constitutes the prime factors of groundwater recharge. Aquifers are part of the more complex hydro geological system and the behaviour of the entire system cannot be interpreted easily. In hard rock terrain the occurrence of Ground Water is limited to top weathered, fissured and fractured zone which extends to maximum 30 m on an average it is about 10-15 m in Chengalpattu District.

In Sedimentary formations, the presence of primary inter granular porosity enhances the transmitting capacity of groundwater where the yield will be appreciable. The sedimentary area which occupies the eastern part of the district along the coastal tract is more favourable for groundwater recharge. Ground Water occurs both in semi

confined and confined conditions. A brief description of occurrence of groundwater in each formation is furnished below.

Alluvial Formations

In the river alluvium groundwater occurs under water table condition. The maximum thickness is 37 m and the average thickness of the aquifer is approximately 12 m. These formations are porous and permeable which have good water bearing zones.

Charnockite

Groundwater occurs under water table conditions but the intensity of weathering, joint, fracture and its development is much less when compared to gneissic formations. The groundwater potential is low, when compared with the gneissic formations.

Aquifer Parameters

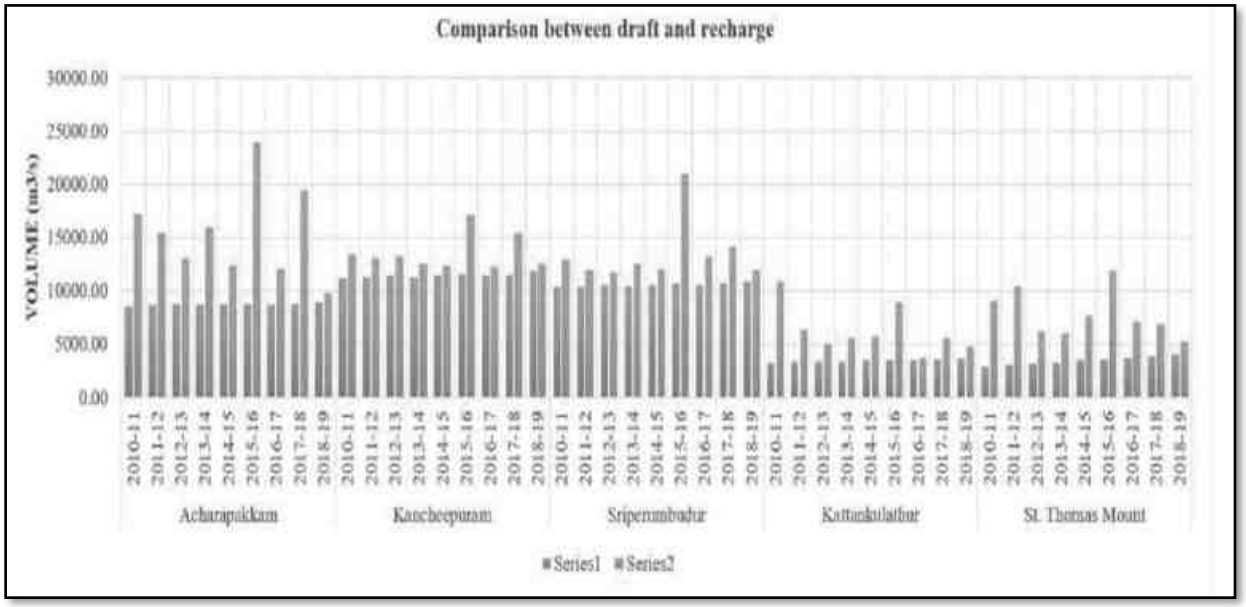
The Transmissivity values in weathered, partly weathered and jointed rocks vary from 10.- 125 m^2 /day and specific yield in these formations is 1.5%. The specific yield of the porus formation varied from 1.4 – 10.6%. The transmissivity in the semi-consolidated and unconsolidated are varies from 23 to 52 m^2 /day and 200 – 300 m^2 /day respectively.

TABLE 2.5: RANGE OF AQUIFER PARAMETERS

Parameters	Range
Specific yield in %	1.4-10.6%
Transmissivity (T) m^2 /day	10-125 m^2 /day
semi-consolidated and unconsolidated	23-52 m^2/day and 200 – 300 m^2 /day

Source: http://cgwb.gov.in/district_profile/tamilnadu/kancheepuram.pdf

FIGURE 2.8: COMPARISON BETWEEN DRAFT AND RECHARGE OF KANCHEEPURAM DISTRICT



Source: https://aip.scitation.org/doi/pdf/10.1063/5.0025968

TABLE 2.6: GROUND WATER LEVEL VARIATION OF CHENGALPATTU DISTRICT

Jan 2013	May 2013	Jan 2014	May 2014	Jan 2015	May 2015	Jan 2016	May 2016	Jan 2017	May 2017	Jan 2018	May 2018	Jan 2019	May 2019	5 Years Pre Monsoon Average	5Years Post Monsoon Average
6.1	9.4	4.2	7.4	5.6	8.3	5.8	8.3	7.4	12.4	9.16	5.81	6.1	9.4	4.2	7.4

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

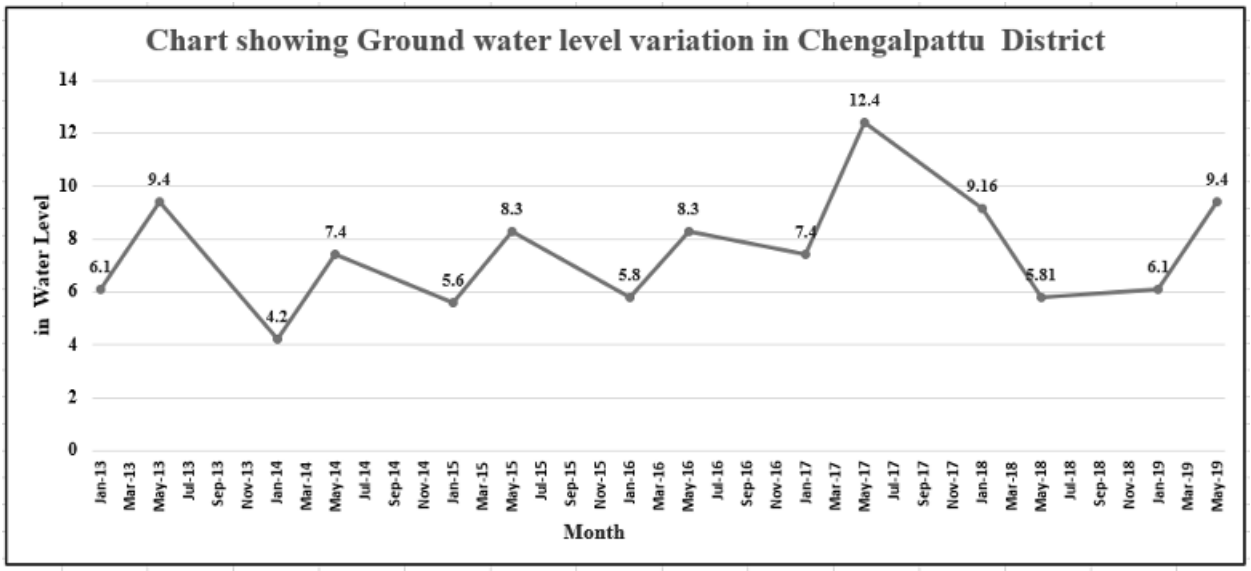


FIGURE 2.9: REGIONAL GEOLOGY MAP

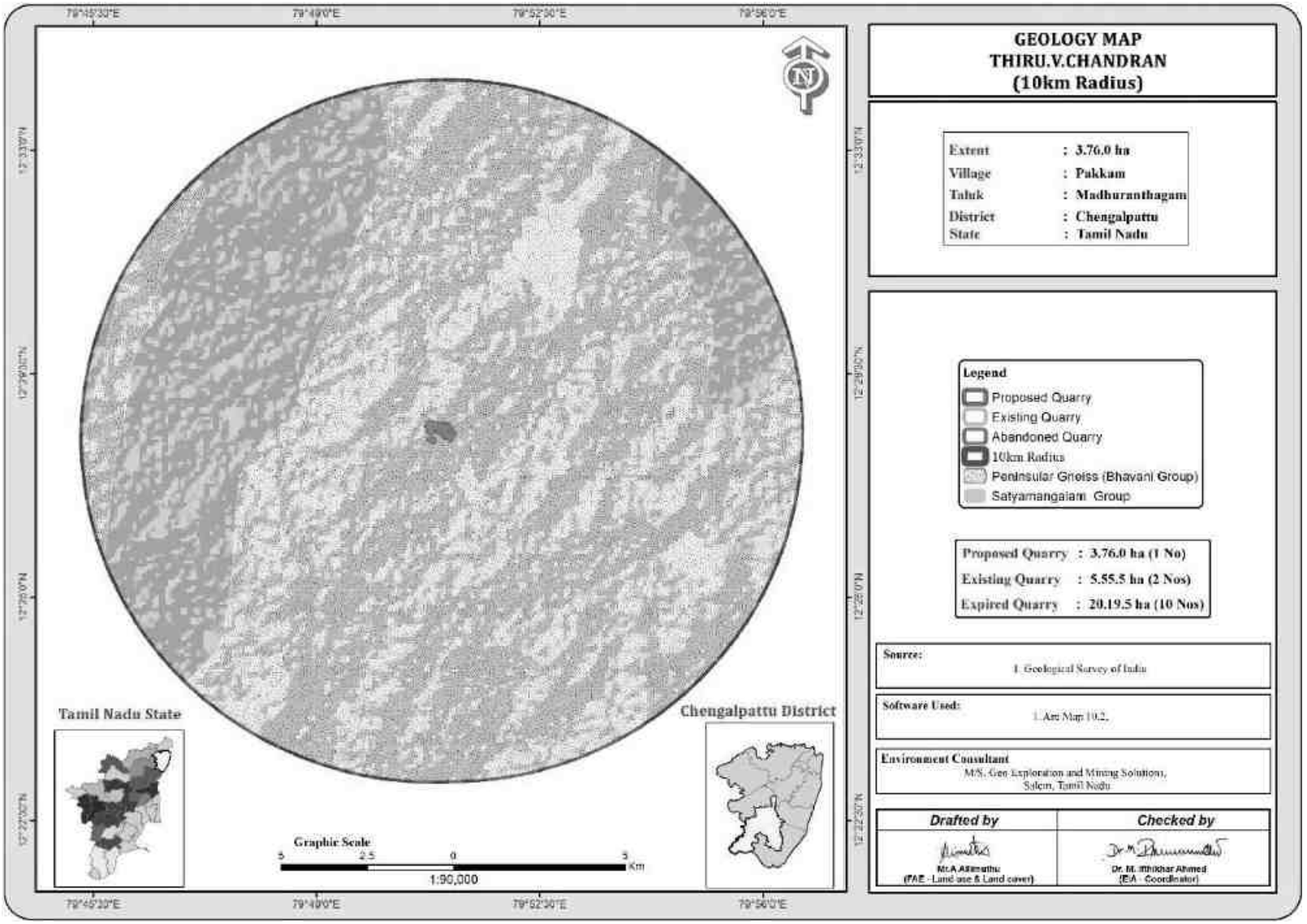


FIGURE 2.10: GEOMORPHOLOGY MAP

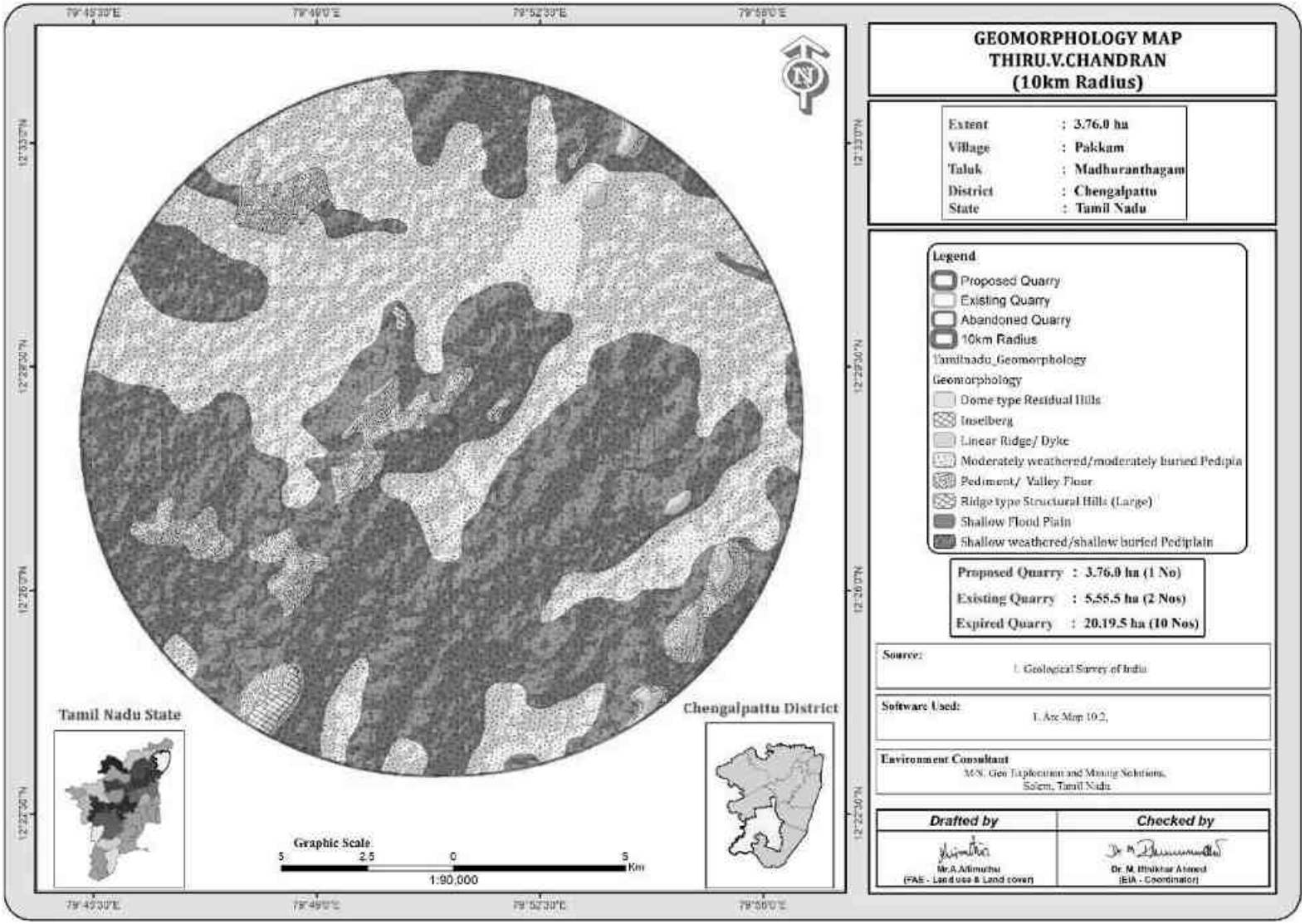
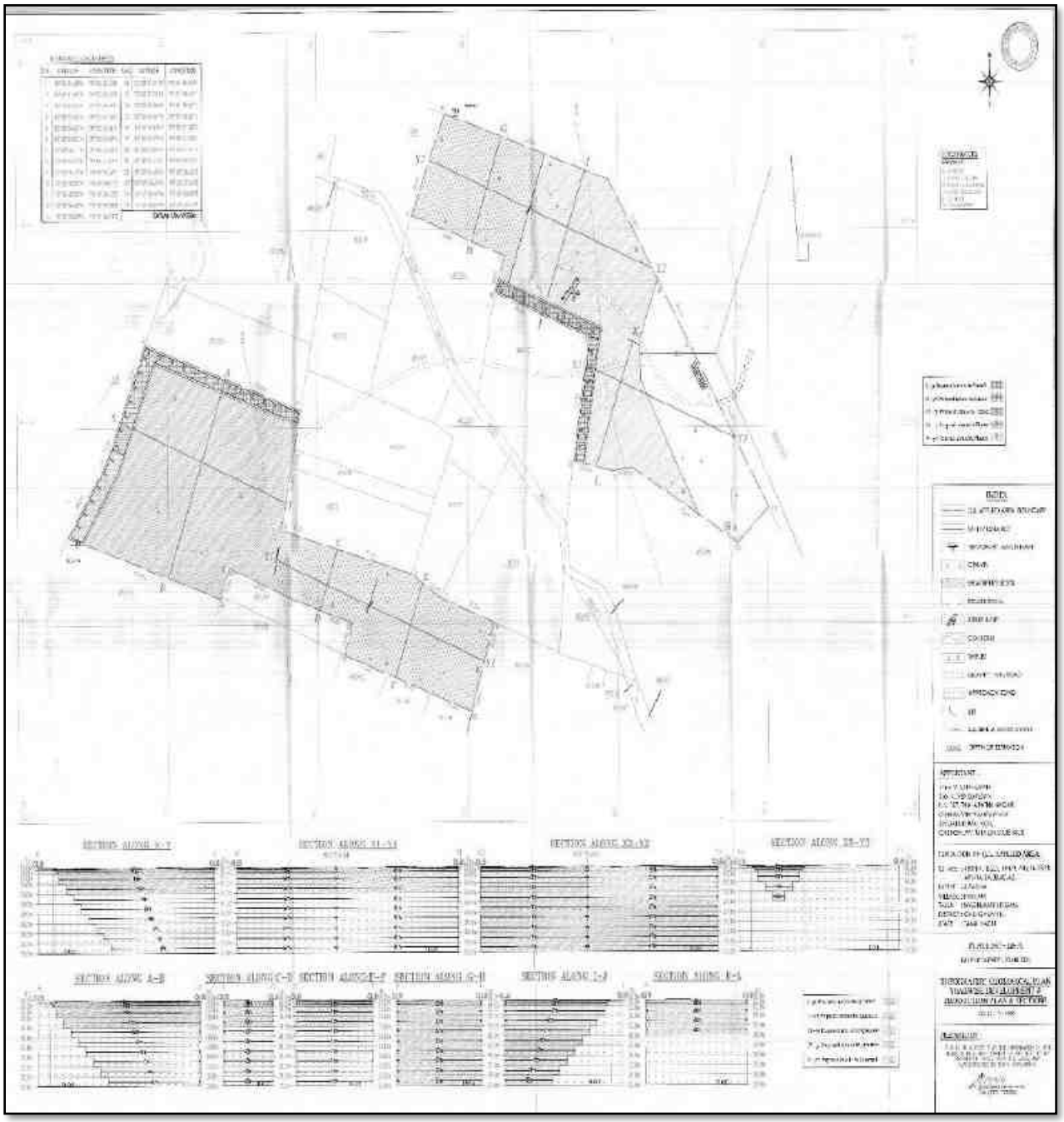


FIGURE 2.11: TOPOGRAPHY, GEOLOGICAL, YEARWISE DEVELOPMENT PRODUCTION PLAN AND SECTION



2.4 RESOURCES AND RESERVES OF THE CLUSTER QUARRIES

The available mineable reserves are calculated after leaving necessary safety distances, reduced depth considering bench width.

TABLE 2.7: ROUGH STONE PRODUCTION FROM THE PROPOSAL

Quarry	Production for five-year plan period considering safety parameters	Per Year Production in m^3	Per Day Production in m^3	Number of Lorry Load Per Day @ $12m^3$ per load
P1	8,81,720m^3	176344	588	49 Trips /Day

TABLE 2.8: GRAVEL PRODUCTION FROM THE PROPOSAL

Quarry	Mineable Reserves in m^3	Per Year Production in m^3	Per Day in m^3	Number of Lorry Load @ $12m^3$ per load
P1	29,613	9,871	33	3Trips per day

Source: Approved Mining Plan

Disposal of Waste

In the entire cluster quarries no waste is anticipated, quarried out materials (Rough stone and Gravel) will be utilized (100%).

2.5 METHOD OF MINING

The method of mining is common for all the proposed projects 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 top layer of overburden (Gravel) will be Excavate directly by Hydraulic Excavators and loaded into tippers directly and sold to needy customers. 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

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

Spacing – 1.2m, Burden –1.0, Depth of hole - 1.5m

2.5.2 Blasting

Blasting will be done as per details below: -

- Controlled blasting parameter: -

Spacing – 1.2m

Burden – 1.0 m

Depth of hole – 1.5 m

Charge per hole – 0.5Kg

Powder factor – 10 tonnes/kg

Dia of hole – 32 mm

Details of blasting design and parameters are discussed in approved mining plan.

No of Holes to be drilled per day: -

Volume of Rough Stone will be excavated from

one kg for explosive	=	6 Tonnes
Total Volume from one proposed quarries	=	8,81,720m^3
	=	8,81,720/5
	=	176344/300
	=	588* 2.6
	=	1529 Tonnes per day
Therefore, Number of Holes per day	=	1529 /6
	=	255 Holes per day (for 1 Quarries)

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

2.5.3 Extent of Mechanization

TABLE 2.9 PROPOSED MACHINERY DEPLOYMENT

PROPOSAL – P1				
S.NO.	**TYPE**	**NOS**	**SIZE/CAPACITY**	**MOTIVE POWER**
1	Jack hammers	11	1.2m to 2.0m	Compressed air
2	Compressor	3	400psi	Diesel Drive
3	Excavator with Bucket / Rock Breaker	2	300 HP	Diesel Drive
4	Trucks	6	20 Tonnes	Diesel Drive

Source: Approved Mining Plan of the respective projects.

2.6 GENERAL FEATURES

2.6.1 Existing Infrastructures

Infrastructures like Mine office, Temporary Rest shelters for workers, Latrine and Urinal Facilities are available in the Existing quarries and the same infrastructure as per the Mine Rule will be arranged after the grant of quarry lease in the proposed quarries.

2.6.1 Drainage Pattern

The general drainage pattern of the area is dendritic. There are no streams, canals or water bodies crossing within the project area, hence there is no requirement of stream or canals diversion in the near future.

2.6.2 Traffic Density

Traffic density measurements were performed as per IRC 1960 Guidelines at three locations based on the transportation route. The monitoring was carried out on 10-12-2022. 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

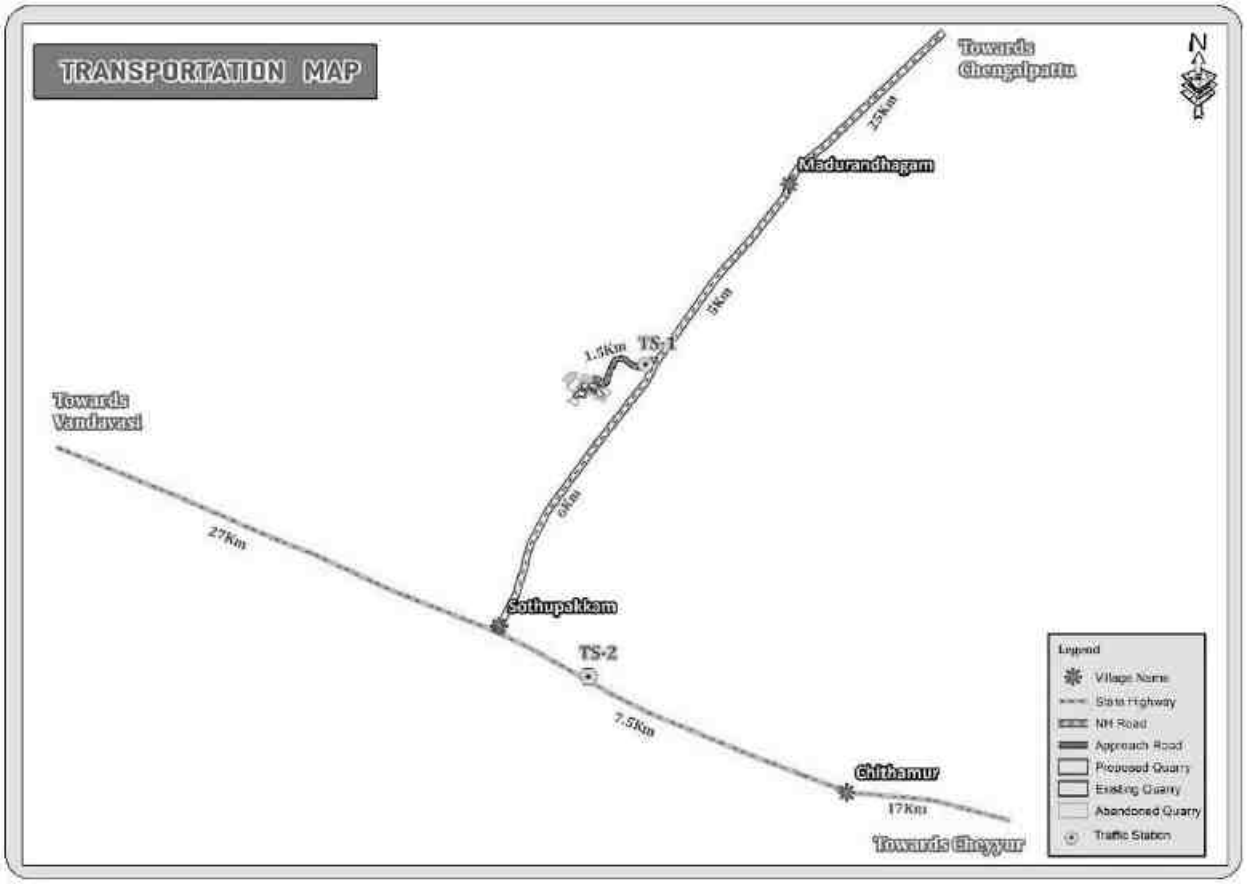
were deployed simultaneously at each station during each shift- one person on either direction for counting the traffic. At the end of each hour, fresh counting and recording was undertaken.

TABLE 2.10 – TRAFFIC SURVEY LOCATION'S

Station code	Station location	Distance and Direction	Type of Road
TS1	Pakkam Road & Approach Road	1km- East	Village road
TS2	Cheyur-Vandavasi Road & State Highway	6.0Km-S	SH Road

Source: On-site monitoring by GEMS FAE & TM

FIGURE 2.12: TRAFFIC SURVEY LOCATIONS & TRANSPORTATION ROUTE MAP



(Source: Survey of India Toposheet)

TABLE 2.11 – EXISTING TRAFFIC VOLUME

Station code	HMV (Hourly Average)		LMV hourly average		2/3 Hourly average		Total PCU per hour
	No	PCU	No	PCU	No	PCU	
TS1	35	105	30	30	40	20	155
TS2	140	420	120	120	120	60	600

Source: On-site monitoring by GEMS FAE & TM

- PCU conversion factor for HMV (Trucks and Bus) = 3, LMV (Car, Jeep and Auto) = 1 and 0.5 for Motor Vehicles (2/3 Wheelers)

TABLE 2.12 – ANTICIPATED TRAFFIC DUE TO THIS PROPOSED PROJECT

Transportation of Rough stone per day		
Capacity of trucks	Cumulative Trips	Volume in PCU
10/20 tonnes	52 per day (49Trips of Rough stone and 3 Trips of Gravel)	156

Source: Anticipated based on Approved Mining Plan Production

TABLE 2.13 – SUMMARY OF TRAFFIC VOLUME

Route	Existing traffic value in PCU	Incremental traffic from the quarry in PCU	Total traffic volume	Hourly Capacity in PCU as per IRC guidelines
Village road	155	156	311	500
Major District Road	600	156	756	1200

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

Rough stone from the project site mainly will be supplied to the needy crushers located within the radius of 2 km from the project site.

- No villages in the proposed mineral transportation route
- Mineral loaded Vehicles will not allow during school hours (Morning 8AM to 10AM & Evening 4.30PM to 5.30PM)

As per the IRC 1960 this existing 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 transportation.

2.6.3 Mineral Beneficiation and Processing

There is no mineral beneficiation processing or ore beneficiation in this project within the lease area.

2.6.4 Existing Infrastructure

The project area is new and Existing quarries for the existing quarries infrastructures are already available within the project area. The infrastructural facilities to be made after the start of the quarrying operations will be prepared outside limit as per the rules and safe distance to be adopted.

2.6.5 Drainage Pattern

The drainage pattern of the area is dendritic – sub dendritic.

2.7 PROJECT REQUIREMENT

2.7.1 Water Source & Requirement

Detail of Total water requirements in KLD as given below:

TABLE 2.14 – WATER REQUIREMENT FOR THE INDIVIDUAL PROJECT

***Purpose**	**Quantity**	**Source**
Dust Suppression	1.0 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Green Belt development	1.0 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Domestic purpose	1.0 KLD	Water Tankers
Total	**3.0 KLD**	

Source: Prefeasibility Report

For the water conservation point of view about 50% water will be required for the suspension of the dust, Water shall be obtained from accumulated rainwater/seepage water in quarry pits. Packaged Drinking Water is available from the nearby approved water vendors.

2.7.2 Power and Other Infrastructure Requirement

The project's does not require power supply for the quarry operation. 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 TNEB. For the quarrying operation like compressor for drilling Diesel will be utilized.

The temporary infrastructures such as Mine Office, First Aid Room, Rest Shelter etc., will be constructed within the project area before commencing the quarry operation. 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.

2.7.3 Fuel Requirement

Electricity for Mines office and Lights only at nights (working is restricted on day time only between 8Am to 6Pm). Diesel (HSD) will be used for quarrying machineries around **7,19,946 Liters** of HSD will be used for the entire project life. Diesel will be brought from nearby diesel pumps. No power is required for the project. Lightings on the Night will be taken from nearby electric poles after obtaining permission from concerned authorities.

***Weathered Rock*:**

Per hour Excavator will consume = 10 liters / hour
Per hour Excavator will excavate = 60$m^3$of Weathered Rock
Weathered Rock Quantity 57,846m^3 = 57,846/60 = 964 hours
Diesel consume = 964 hours x 10 liters
Total diesel consumption = 9640Liters of HSD will be utilized for Weathered Rock

Gravel:

Per hour Excavator will consume = 10 liters / hour
Per hour Excavator will excavate = 60$m^3$of Gravel
Gravel Quantity 29,613m^3 = 29,613/60 = 302 hours
Diesel consume = 493 hours x 10 liters
Total diesel consumption = 4930 Liters of HSD will be utilized for Gravel

Rough stone:

Per hour Excavator will consume = 16 liters / hour
Per hour Excavator will excavate = 20$m^3$of Rough stone
Rough stone quantity = 8,81,720/20 =44,086hours
Diesel consume = 44,086hours x 16 liters
Total diesel consumption = 7,05,376Liters of HSD will be utilized for rough stone
Total diesel consumption is around = **7,19,946Liters** of HSD for the entire period of life.

2.7.4 Employment Requirement:

The skilled, competent qualified statutory persons will be engaged for quarrying operation, preference will be given to the local community.

TABLE 2.15: EMPLOYMENT POTENTIAL FOR PROPOSED QUARRIES

PROPOSAL	
Mines Manager/Mines Foreman	
Mate/Blaster	1
Jack hammer operator	22
Excavator Operator & Drivers	8
Watchman/Security	2
Labour Helper	6

Co-Operator and Cleaner	10
Total	**50**

A total of 14people will get employment due to these proposal quarries.

2.7.5 Project Cost

TABLE 2.16 – PROJECT COST OF PROPOSED PROJECT

Project Cost	Rs.1,50,54,000/-

Source: Approved Mining Plan &Prefeasibility Report of the respective projects

2.8 PROJECT IMPLEMENTATION SCHEDULE

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

TABLE 2.17 – EXPECTED TIME SCHEDULE FOR THE PROPOSED QUARRIES

S. No	Particulars lease execution	Time schedule (in month)					Remarks if any
		1st	2nd	3rd	4th	5th	
1	Environmental Clearance						
2	Consent to operate						Production start period

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

CHAPTER – 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.

As per the MoEF & CC Office Memorandum F. No IA3-22/10/2022.IA.III (E 177258) Dated 8th June, 2022 the baseline data is utilized for this proposal.

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 December 2022, January& Feb 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 quarries 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 Winter season i.e., Dec 2022 – Feb2023.

Study Methodology

Baseline data's was generated for various environmental parameters including Land, Soil, Water (surface and groundwater), Air, Noise, Ecology & Biodiversity and Socio-economic status to determine the quality of the prevailing environmental settings. An MoEF accredited Laboratory was used for generating the baseline data.

1. The project area (Core zone) was surveyed in detail with the help of Total Station survey instrument and the boundary pillars were picked up with the help of handheld GPS. The boundary coordinates were superimposed on the satellite imagery to understand the relief of the area, besides Land use pattern of the area was studied through the Bhuvan (ISRO).
2. Soil samples were collected and analysed for relevant physico-chemical characteristics, exchangeable cations, nutrients & micro nutrients etc., in order to assess the impact of mining activities and proposed greenbelt development.
3. Ground water samples were collected during the study period from the open wells and bore wells, while surface water was collected from river and lake 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 quarries.

4. A meteorological station was setup in pachapalayam village. Wind speed, Wind direction, Dry and wet bulb temperature, Relative humidity, Rainfall with cloud cover and general weather conditions were recorded throughout the study period.
5. In order to assess the Ambient Air Quality (AAQ), samples of Ambient Air were collected by installation of Respiratory Dust Samplers (RDS) for Fugitive dust, PM_{10} and SO_2, NO_X with gaseous attachments & Fine Dust Samplers (FDS) for $PM_{2.5}$ and other parameters as per NAAQ norms and analysed for primary air pollutants to work out the existing status of air quality
6. 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
7. Baseline Ecology and Biodiversity studies were carried out to assess the ecology of the study area to study the existing flora and fauna pattern of the area
8. 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 – ENVIRONMENTAL MONITORING ATTRIBUTES AND FREQUENCY OF MONITORING

ATTRIBUTE	PARAMETERS	FREQUENCY OF MONITORING	NO. OF LOCATIONS	PROTOCOL
Land-use Land cover	Land-use Pattern within 10 km radius of the study area	Data's from census handbook 2011 and from the satellite imagery	Study Area	Satellite Imagery Primary Survey
Soil	Physio - Chemical Characteristics	Once during the study period	6 (1 core & 5 buffer zone)	IS 2720 Agriculture Handbook - Indian Council of Agriculture Research, New Delhi
Water quality	Physical, Chemical and Bacteriological Parameters	Once during the study period	6 (2 surface water & 4 ground water)	IS 10500& CPCB Standards
Meteorology	Wind Speed Wind Direction Temperature Cloud cover Dry bulb temperature Rainfall	1 Hourly Continuous Mechanical/Automatic Weather Station	1	Site specific primary data& Secondary Data from IMD Station
Ambient Air Quality	PM_{10} $PM_{2.5}$ SO_2, NO_X CO Fugitive Dust	24 hourly twice a week (Dec 2022 – Feb 2023)	8 (2 core & 6 buffer)	IS 5182 Part 1-23 National Ambient Air Quality Standards, CPCB
Noise Levels	Ambient Noise	Hourly observation for 24 Hours per location	8 (2core & 6 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
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 EHS360 Labs Private Limited in association with GEMS

* All monitoring and testing are 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 cluster 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 comer coordinates of the mine lease area, superimposed on a High-Resolution Imagery/ topo sheet. 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 ofthe study area (core and buffer zone).

Point No. 10. Lard 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 ResourceSat1 LIII FMX (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 plant area (Core Zone) and 10 km radius from the plant site (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 RESOURCESAT-2A (LISSIII MX) 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 P/15
- 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, 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 - 3.3

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

S.No	Classification	Area_Ha	Area_%
BUILTUP			
1	Builtup Urban	491.56	1.54
2	Builtup Rural	1636.16	5.12
3	Builtup Mining	60.27	0.19
AGRICULTURAL LAND			
4	Crop Land	18193.70	56.90
5	Agricultural Plantation	917.93	2.87
6	Fallow Land	925.45	2.89
FOREST			
7	Evergreen/Semievergreen Forest	726.86	2.27
8	Decidious Forest	897.28	2.81
9	Forest Plantation	564.45	1.77
BARREN/WASTELAND			
10	Salt Affected Land	659.34	2.06
11	Scrub Land	766.06	2.40
12	Barren Rocky	36.60	0.11
WATERBODIES			
13	Waterbodies	6101.61	19.08
		31977.28	**100.00**

Source: NRSC, Bhuvan LU/LC Map for Buffer Zone.

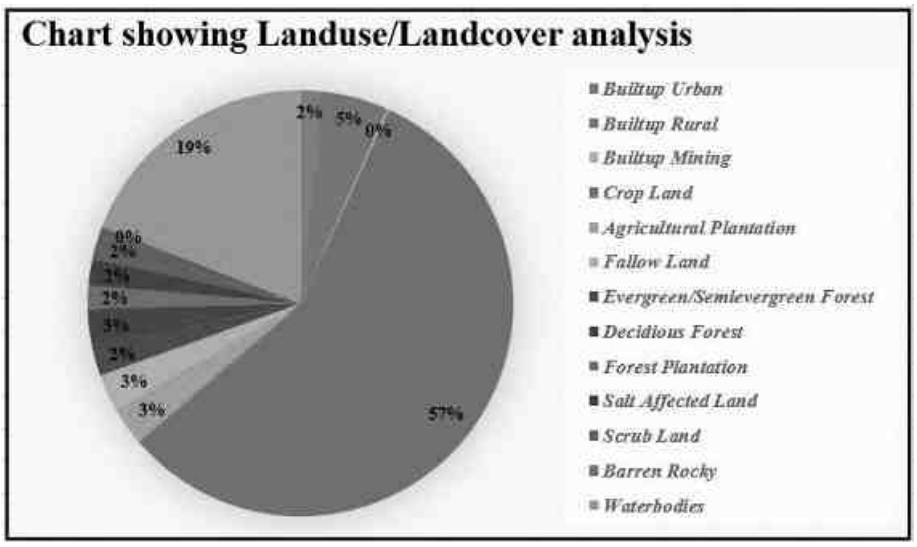


FIGURE 3.1: CHART SHOWING LANDUSE/LANDCOVER ANALYSIS USING LISS III Data

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

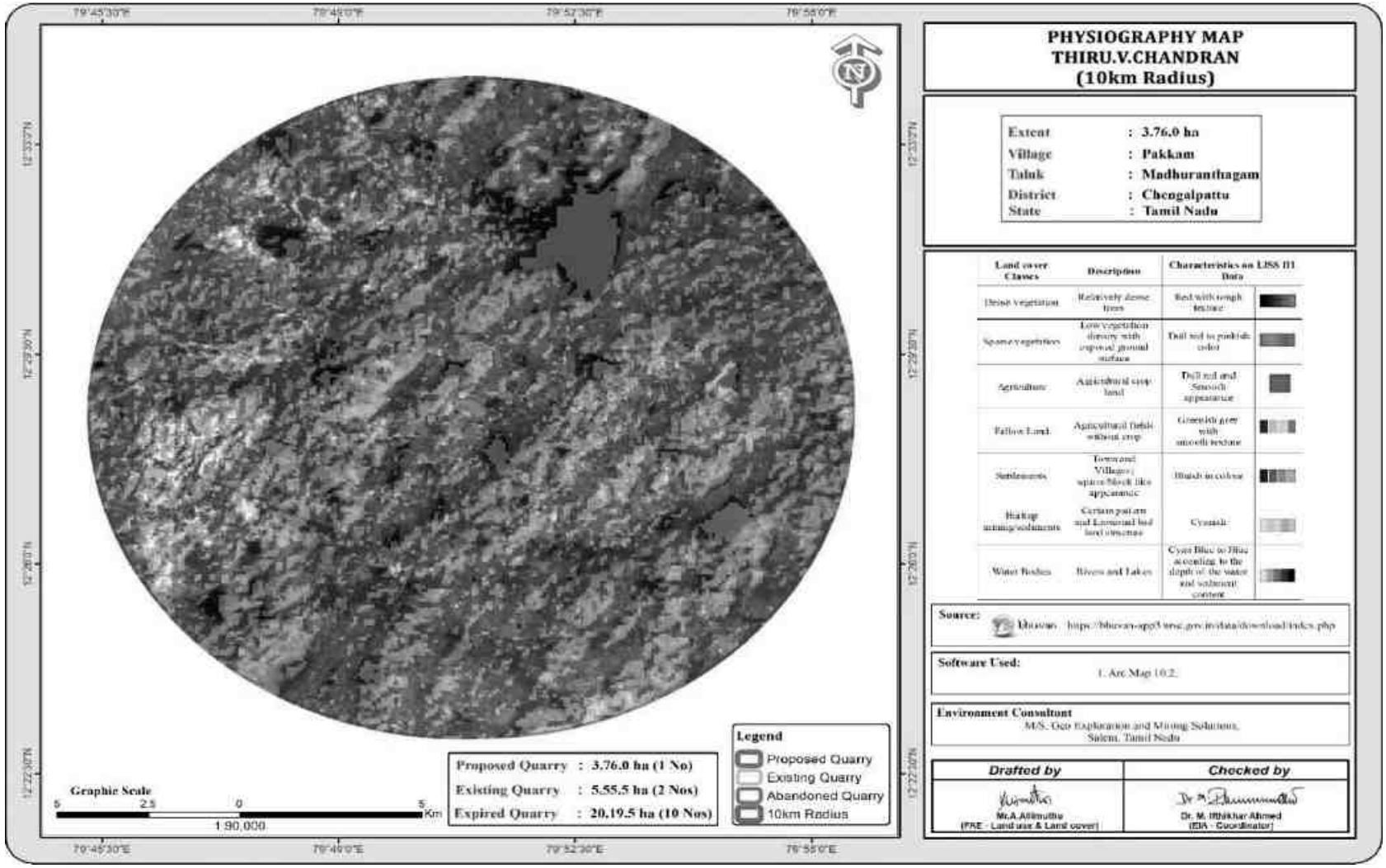
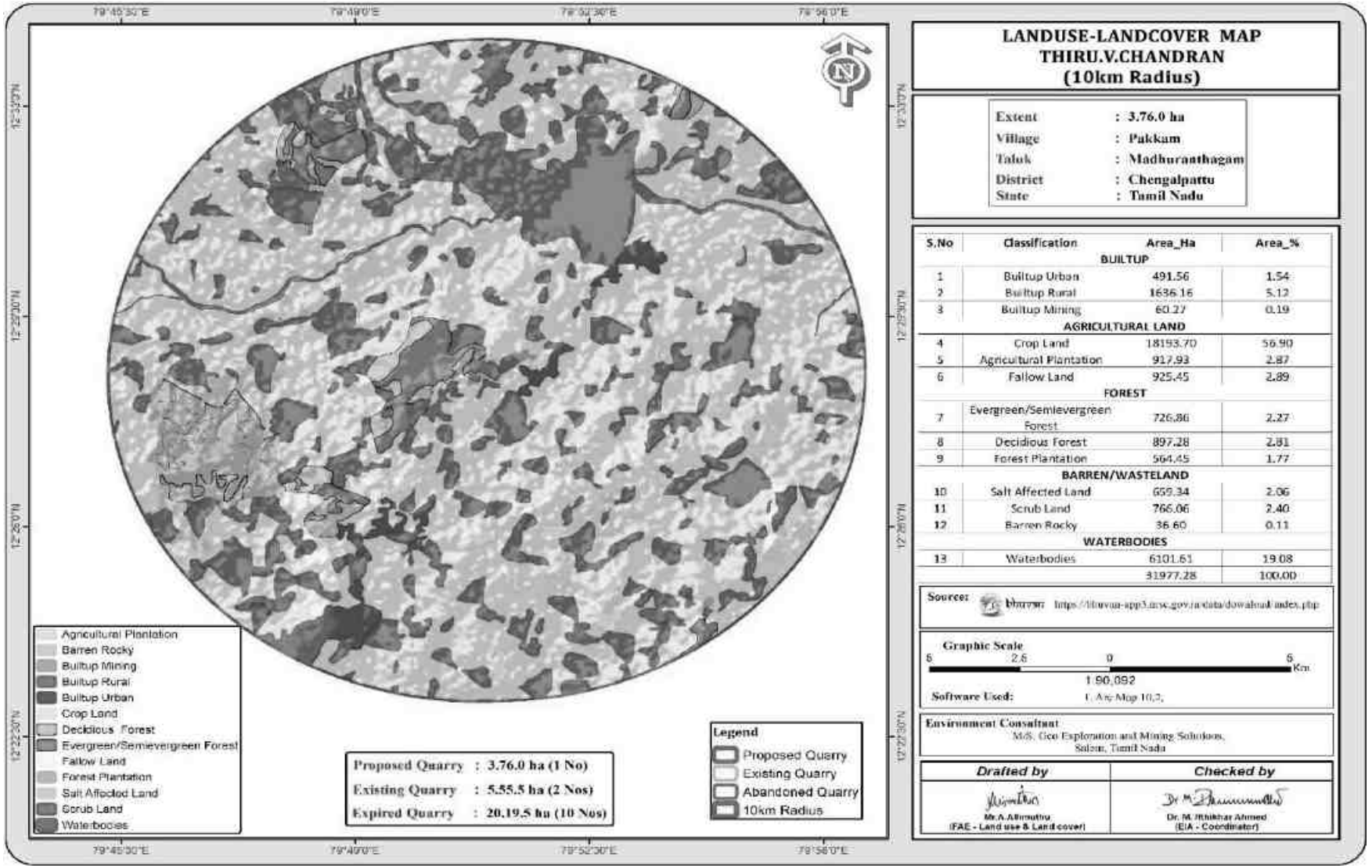


FIGURE 3.3: LAND USE LAND COVER MAP 10KM RADIUS



3.1.4 INTERPRETATION

- The 10 km radius study area mainly comprises of Agricultural land & open Scrub land accounting of 62.66 % & 2.4% of the total study area. The study area also consists of vegetation/plantation of 2.87%.
- The buffer zone studied has no ecological sensitive area (National Park, Wildlife Sanctuary, Biosphere Reserve/ etc.). 5.701 % of the total project area is occupied by the Reserve Forest land such as Kattugudalur RF (6 Km in SW direction) and Gudalur PF (5 Km in SW direction)
- Water Bodies such as ponds/ lakes comprises of 19.08% of the total buffer area. The two seasonal rivers such as Kiliyar River at 4.5 Km in NW direction and Edandur Lake at 6 Km in SE direction of the total study area.
- The Scrub land accounts of 2.40%. 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.
- 0.19% of the total study area is occupied by the mine industries of captive mines. The area occupied by Mainly Crusher and Roughstone, 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 industries also located in the study area.
- 6.66% of the area is covered under the human Settlement. The nearest village within the 3 km radius from the project site boundary is observed to be villages Pakkam, Silavattam and Morapakkam etc.,

3.1.5 Cropping Pattern of the Buffer Zone

Agriculture is the main occupation of the people to which 47% of the population is engaged. Peanuts, Sugarcane, Cereals Millets, and Pulses are other important crops grown. Tanks and wells along the Palar river are important sources of irrigation in the district. The majority of the people of this district are engaged in agriculture. In Chengalpattu Rice is the major crop, sugarcane is also cultivated in some parts of the district. Groundnur are also grown as a major crop in areas where/when there is a shortage of water, lack of rainfall. The cheyyur and Thirupporur taluks are famous for their cash crops like groundnut, Urad Dal, Moong dhal, Karamani, Seasame, etc., Vegetables like Eggplant, Okra is also grown in Thirupporur, Thirukkazhukkundram and Madurantagam regions. Watermelons are grown in summer in Kodur, Cheyyur and Surrounding areas. Beetroot leaves were grown in Karunguzhi. Source: https://www.agrifarming.in/district-wise-crop-production-in-tamil-nadu

3.1.6 Interpretation and Conclusion

- Pakkam Village Roughstone and gravel quarries has proposed Project which will be done within the existing mines.
- Out of the total project area i.e. 31977 ha, 0.06% (i.e., 2188.59 ha) will be developed under greenbelt development/ plantation.
- 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 agricultural land 62.66%. As per current study 2.81% of the area is occupied by deciduous land 1.77% in Forest plantation in 10 km study area land use into quarrie purpose land 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 and gravel 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 is exhibits flat terrain. The area has gentle sloping towards South eastern side from Chengalpattu district. The altitude of the area is 55-60m above Mean Sea level. The area is covered by 2m thickness of Gravel formation. Massive Charnockite which is clearly inferred from the existing and proposed quarry pits.

3.1.8 Digital Elevation Model

Digital Elevation Model (DEM) has been prepared for the project at Pakkam Village, Madurantagam Taluk, Chengalpattu 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 1.1 Percent/degree Flat to almost flat, and no meaningful denudation process. More gentle low speed ground motion, sheet erosion and soil rosion in the 1to13%. Slope zone 0-1.1º, 1.1-5º, 5.04-13.8º and 13.8-36.7º in steep, intensive denudation processes and ground movements are common. (Fig.3.5)

Slope Class	Nature, Process and Natural Conditions
0^0-2^0 (0-2%)	Flat to almost flat, no meaningful denudation process
2^0 - 4^0 (2-7%)	Gentle, low-speed ground motion, sheet erosion and soil erosion (sheet & rill erosion), erosion swamps.
4^0 - 8^0 (7-15%)	More Gentle, the same as above, but with a higher magnitude.
8^0 - 16^0 (15-30%)	Slightly steep, a lot of ground movement and erosion, especially landslides that are flat.
16^0 - 35^0 (30-70%)	Steep, intensive denudation processes and ground movements are common.
35^0 - 55^0 (70-140%)	Very steep, rocks generally begin to unfold, a very intensive denudational process, have begun to produce rework material.
> 55^0 >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 15 m to 139 m in the whole study area, thus having an elevation difference of 124m. The areas in the Southern and Southeastern 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 57m in the elevation range of 10 m interval present on the flat land in the study area.

FIGURE 3.4: DIGITAL ELEVATION MODEL OF THE STUDY AREA WITH CONTOUR MAP

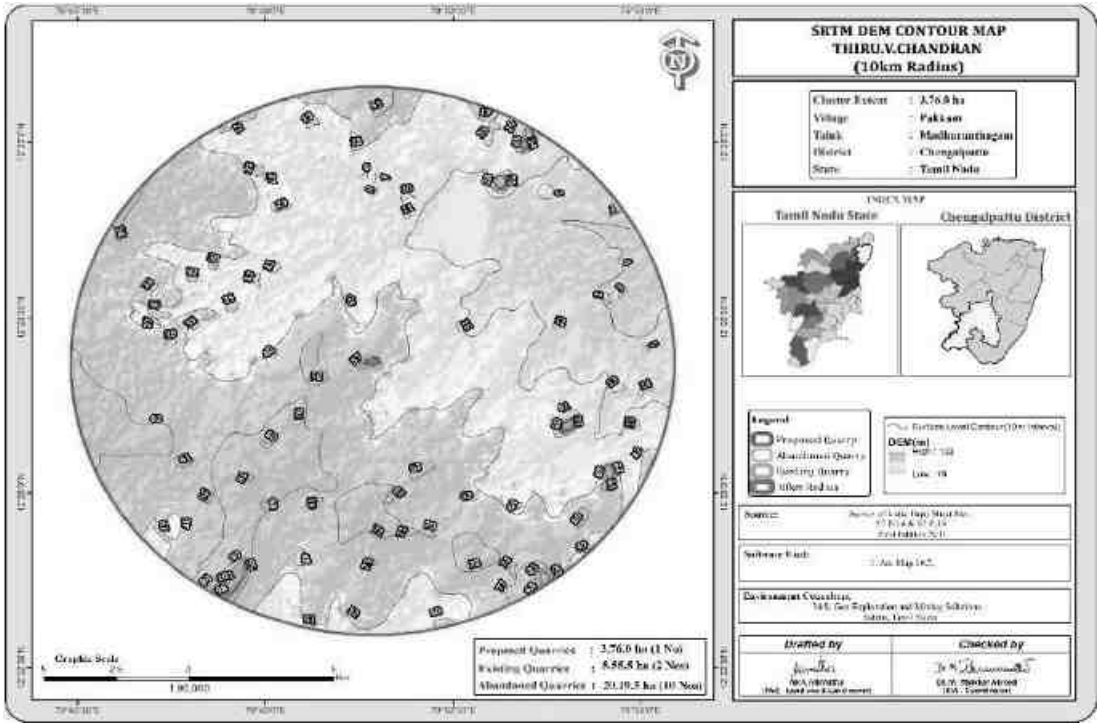
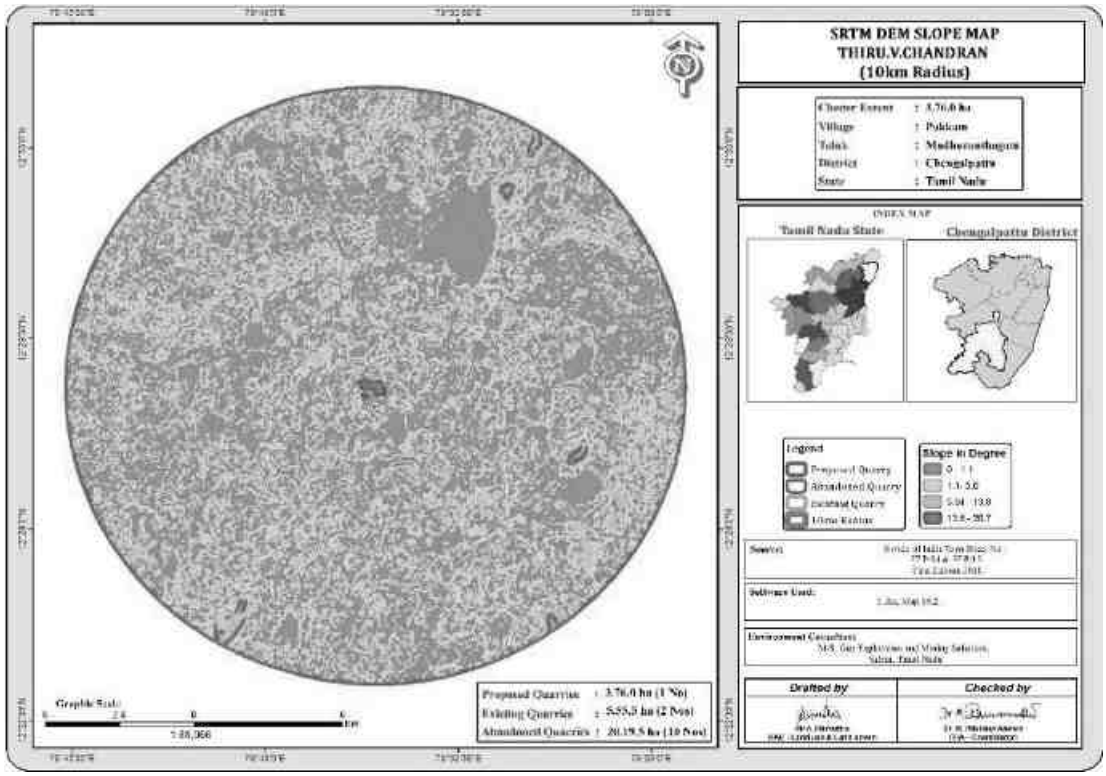


FIGURE 3.5: SLOPE MAP AROUND 10KM RADIUS



3.1.9 Topography

The cluster areas are almost plain terrain with gentle gradient towards Southeast – Southwestern side, maximum elevation of the area is 50m -60m above AMSL. There are no hilly regions in and around the area.

3.1.10 Drainage Pattern of the Area

There are no developed surface drainage channels in the study area. Noyyal, a non-perennial pass 12.0km-North from the project site. The area is studded with few tanks that serve as the source of drinking water and also their surplus feeds adjoining tanks. The area is mostly dry in all seasons except rainy seasons.

The general drainage pattern of the area is of sub dendritic and dendritic pattern. No prominent water course or nallah is inferred. During rainy season the surface runoff flows in W to E direction. The drainage pattern of the study area is given in Fig. 3.5. The quarrying activity will not hinder the natural flow of rainwater.

3.1.11 Environmental Features in the Study Area

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

3.1.12 Seismic Sensitivity

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

TABLE 3.4 – DETAILS OF ENVIRONMENT SENSITIVITY AROUND THE PROJECT AREA

Sl. No	Sensitive Ecological Features	Name	Arial Distance in km from Mine Lease Boundary
1	National Park / Wild life Sanctuaries	None	Vedanthangal Bird Santuary 7km-N
2	Reserve Forest	None	Kattu Gudalur R.F-5km-SW
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	Defence Installation	None	Nil within 10KM Radius

Source: Survey of India Toposheet, Village Cadastral Map& Google Earth/Maps

TABLE 3.5 – WATER BODIES WITHIN THE CLUSTER FROM PROPOSED QUARRY

S.No	LABEL	DISTANCE & DIRECTION	Habitation
1	Kiliyar River	4.5Km & NW	660m_Habitation
2	Edandhur Lake	6Km & SE	
3	Madhuranthagam Lake	4.4Km & N	
4	Tank	830m & SE	
5	Tank	6.5Km & NE	

Source: Village Cadastral Map and Field Survey

3.2 SOIL ENVIRONMENT

Soil quality of the study area is one of the important components of the land environment. The composite soil samples were collected from the study area and analysed for different parameters. The locations of the monitoring sites are detailed in Table 3.6 and Figure 3.6.

TABLE 3.6 – SOIL SAMPLING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	S-1	Core Zone	Project Area	12°28'40.91"N 79°51'3.28"E
2	S-2	Unamalai	1.2km SW	12°28'18.76"N 79°50'17.48"E
3	S-3	Guddalur	3km NW	12°29'33.16"N 79°49'35.62"E
4	S-4	Sholamthangal	6km NE	12°29'39.03"N 79°54'24.95"E
5	S-5	Sendivakkam	4.8km SW	12°27'27.07"N 79°48'34.28"E
6	S-6	Morekuppam	2.2km North	12°29'53.80"N 79°50'53.49"E

Source: On-site monitoring/sampling by EHS360 Labs Private Limited in association with GEMS

The objective of the soil sampling is

1. To determine the baseline soil characteristics of the study area;
2. To determine the impact of proposed activity on soil characteristics and;

To determine the impact on soil more importantly agriculture production point of view.

Methodology

For studying soil quality, sampling locations were selected to assess the existing soil conditions in and around the proposed quarry site representing various land use conditions. The samples were collected by auger boring into the soil up to 90-cm depth. Eight (8) 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 sealed samples were sent to laboratory for analysis. The samples were filled in Polythene bags, coded and sent to laboratory for analysis and the details of methodology in respect are given in below Table 3.5.

TABLE 3.7 – METHODOLOGY OF SAMPLING COLLECTION

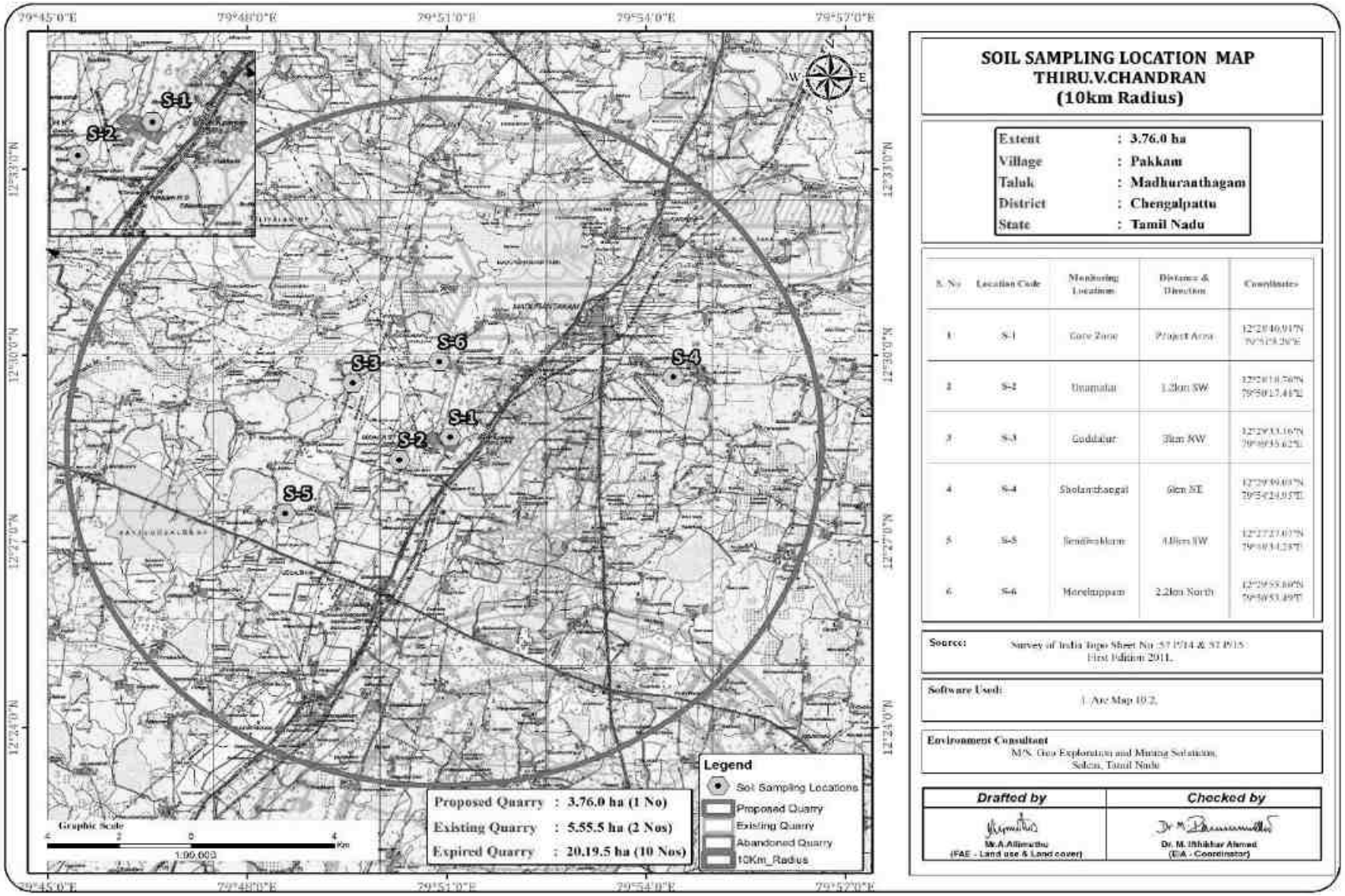
Particulars	Details
Frequency	One grab sample from each station-once during the study period
Methodology	Composite grab samples of the topsoil were collected from 3 depths, and mixed to provide a representative sample for analysis. They were stored in airtight Polythene bags and analysed at the laboratory.

Source: On-site monitoring/*sampling by **EHS360 Labs Private Limited** in association with GEMS*

Soil Testing Result –

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

FIGURE 3.6: SOIL SAMPLING LOCATIONS AROUND 10 KM RADIUS



S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	S-1	Core Zone	Project Area	12°28'40.91"N 79°51'58.26"E
2	S-2	Unamalai	1.2km SW	12°28'18.76"N 79°50'17.44"E
3	S-3	Goddalur	3km NW	12°29'33.16"N 79°49'35.62"E
4	S-4	Sholanthangal	6km NE	12°29'49.01"N 79°54'24.95"E
5	S-5	Sendivakkam	4.8km SW	12°27'27.07"N 79°50'34.28"E
6	S-6	Morelupparn	2.2km North	12°29'55.86"N 79°50'53.49"E

FIGURE 3.7: SOIL MAP

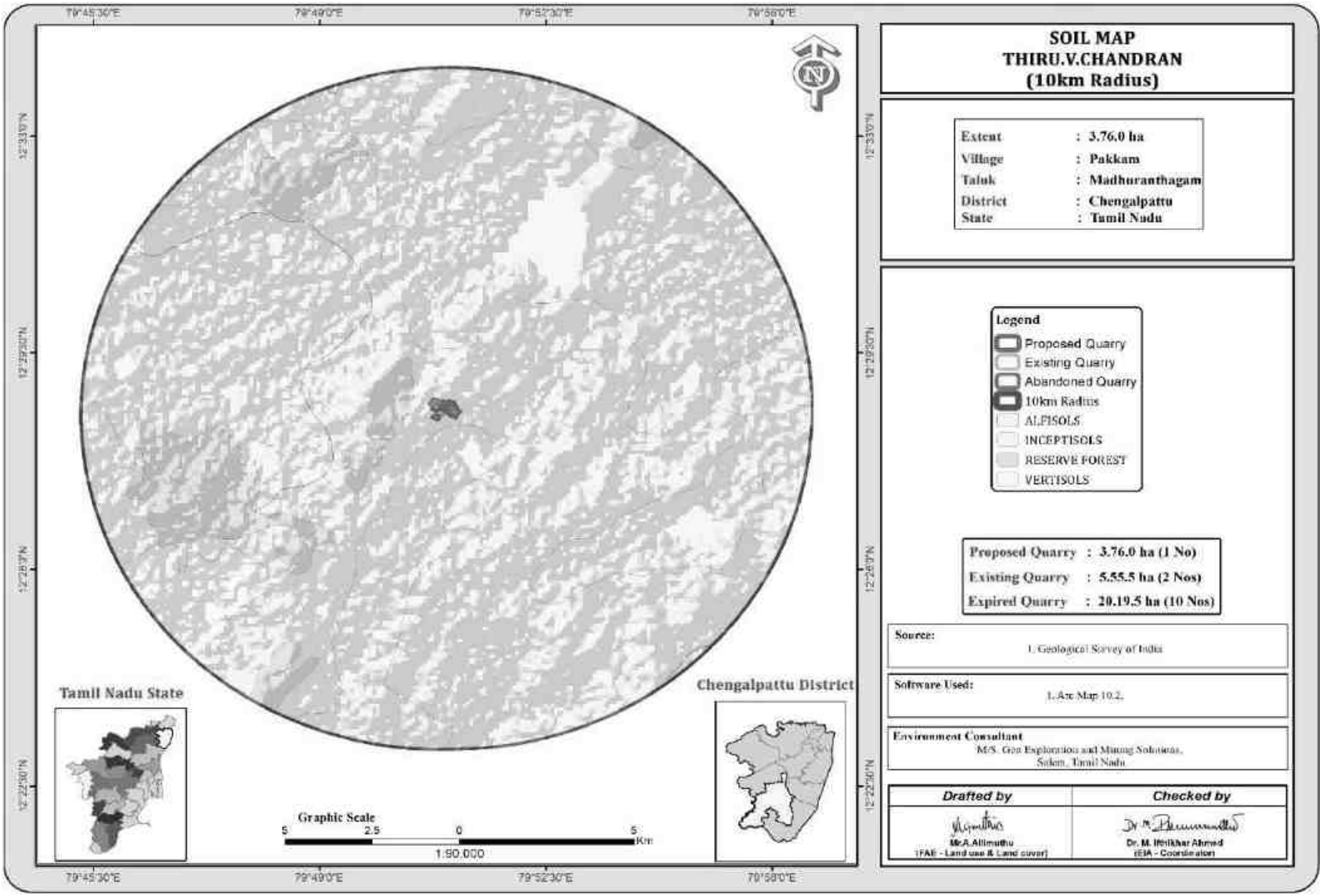


TABLE 3.8 – SOIL QUALITY MONITORING DATA

Sno	Test Parameters	Protocols	S1-core Zone	S2- Unamalai	S3- Guddalur	S4- Sholamthangal	S5- Sendivakkam	S6- Morekuppam
1	pH @ 25°C	IS 2720 Part 26 - 1987	8.74	8.50	8.41	8.93	8.60	8.65
2	Conductivity @ 25°C	IS 14767 - 2000 (Reaff : 2016)	570 µmhos/cm	620 µmhos/cm	467 µmhos/cm	455 µmhos/cm	360 µmhos/cm	570 µmhos/cm
3	Texture :							
	Clay	Gravimetric Method	34.6 %	37.8 %	34.6 %	35.9 %	32.5 %	37.6 %
	Sand		35.7 %	35.1 %	35.4 %	34.2 %	33.9 %	34.4 %
	Silt		29.7 %	27.1 %	30.0 %	29.9 %	33.6 %	28.0 %
4	Water Holding Capacity	By Gravimetric Method	46.8 %	47.4 %	45.1 %	43.7 %	40.3 %	47.1 %
5	Bulk Density	By Cylindrical Method	1.09 g/cm^3	1.38 g/cm^3	0.67 g/cm^3	1.04 g/cm^3	1.22 g/cm^3	1.12 g/cm^3
6	Porosity	By Gravimetric Method	46.7 %	44 %	48.8 %	44.1 %	48.3 %	45.4 %
7	Calcium as Ca	USEPA 3050 B – 1996 &	137 mg/kg	170 mg/kg	245.4 mg/kg	158.4 mg/kg	154 mg/kg	161 mg/kg
8	Magnesium as Mg	USEPA 6010 C - 2000	65.5 mg/kg	128.5 mg/kg	75.5 mg/kg	115 mg/kg	95.5 mg/kg	68.4 mg/kg
9	Manganese as Mn	USEPA 3050 B – 1996 & USEPA 6010 C - 2000	26.1 mg/kg	29.4 mg/kg	24.1 mg/kg	27.1 mg/kg	18.7 mg/kg	20.9 mg/kg
10	Zinc as Zn		1.11 mg/kg	1.16 mg/kg	3.16 mg/kg	3.45 mg/kg	5.3 mg/kg	1.11 mg/kg
11	Boron as B		1.49 mg/kg	1.18 mg/kg	0.91 mg/kg	0.71 mg/kg	2.0 mg/kg	0.96 mg/kg
12	Chloride as Cl	APHA 23rd Edn 2019 4500 Cl B	84.8 mg/kg	180 mg/kg	117 mg/kg	84.2 mg/kg	143 mg/kg	147 mg/kg
13	Total Soluble Sulphate as SO_4	IS 2720 Part 27 : 1977 (Reaff:2015)	0.016 %	0.011 %	0.0022 %	0.019 %	0.019 %	0.027 %
14	Potassium as K	USEPA 3050 B – 1996 & USEPA 6010 C - 2000	27.6 mg/kg	55.3 mg/kg	55 mg/kg	35.5 mg/kg	250 mg/kg	32.9 mg/kg
15	Total Phosphorus as P	IS 10158 : 1982 (Reaff: 2019)	2.51 mg/kg	1.15 mg/kg	1.09 mg/kg	1.20 mg/kg	1.24 mg/kg	2.28 mg/kg
16	Total Nitrogen as N	IS 14684 : 1999 (Reaff:2019)	320 mg/kg	524.6 mg/kg	400 mg/kg	450 mg/kg	463 mg/kg	457 mg/kg
17	Cadmium as Cd	USEPA 3050 B – 1996 & USEPA 6010 C - 2000	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)
18	Total Chromium as Cr		BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)
19	Copper as Cu		BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)
20	Lead as Pb		0.58 mg/kg	0.50 mg/kg	0.64 mg/kg	0.21 mg/kg	0.19 mg/kg	0.55 mg/kg
21	Iron as Fe		1.99 mg/kg	2.28 mg/kg	2.57 mg/kg	2.27 mg/kg	1.88 mg/kg	1.06 mg/kg
22	Organic Matter	IS : 2720 Part 22: 1972 (Reaff: 2015)	2.31 %	1.76 %	2.02 %	2.71 %	2.57 %	1.72 %
23	Organic Carbon	IS : 2720 Part 22: 1972 (Reaff: 2015)	1.34 %	1.02 %	1.17 %	1.57 %	1.49 %	1.00 %
24	Cation Exchange Capacity	USEPA 9080 – 1986	43.8 meq/100g of soil	35.0 meq/100g of soil	40.1 meq/100g of soil	38.5 meq/100g of soil	41.7 meq/100g of soil	48.2 meq/100g of soil

Source: Sampling Results by EHS360 Labs Private Limited,

- This proposed mining activity is for rough stone and Gravel Quarry by opencast mechanized mining method involving occasional drilling & blasting activities on the weathered formation and removal of topsoil and preserving in safety barrier of the lease area to facilitate greenbelt development and winning of rough stone by eco-friendly wire-saw cutting method.
- Dust generation due to this quarrying activity becomes air borne and gets carried away to surrounding areas which may retard the photosynthesis activities of plants and heavy metals naturally occur in soil, but additional pollution come from anthropogenic activities such as agriculture, urbanisation, industrialisation, and mining.
- The proposed rough stone project is a Charnockite formation which does not source to heavy metal contamination.
- This proposed mining is a small-scale activity and in order to mitigate the impact of mining around the proposed mine lease area on Soil Health and Biodiversity its proposed by ways of daily three times water sprinkling by own water tanker and water sprinkling arrangements and greenbelt development all along the mine lease boundary
- Therefore, the implementation of proposed mitigation measures for winning of mineral may not have much of impact on the surrounding Soil Health and Biodiversity.

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 Clay is about ranging from (32.5 -37.8%) and Sandy Soil is about ranging from (33.9 -35.7%) and Bulk Density of Soils in the study area varied between 0.67 – 1.38g/cc. The Water Holding Capacity and Porosity of the soil samples is found to be medium i.e., ranging from 40.3 – 47.4 % and 44 – 48.8%.

Chemical Characteristics –

- The nature of soil is slightly alkaline to strongly alkaline in nature with pH range 8.41 to 8.93
- The available Nitrogen content range between 320 to 546 kg/ha
- The available Phosphorus content range between 1.09 to 2.51 kg/ha
- The available Potassium range between 27.6 to 250 mg/kg

Whereas, the micronutrient as zinc (Zn), iron (Fe) and copper (Cu) were found in the range of 1.11 to 5.3 mg/kg; 1.88 to 2.57 mg/kg and ND

Wilting co efficient in significant level would mean that the soil would support the vegetation. The soil properties in the buffer zone reveal that the soil can sustain vegetation. If amended suitability the core area can also withstand plantation.

3.3 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.

3.3.1 Surface Water Resources:

Kiliyar river lies at 4.5 Km Northwest from the project cluster. The buffer area is studded with few tanks that serve as the source for agriculture and also their surplus feeds adjoining tanks. The rainfall over the area is moderate, the rainwater storage in open wells, trenches is in practice over the area and the stored water acts as source of freshwater for couple of months after rainy season.

3.3.2 Ground Water Resources:

The terrain is underlain by hard rock formations, Fissured and fractured crystalline rocks constitute the important aquifer systems in the Chengalpattu region. Ground water occurs under phreatic to semi-confined conditions in these formations and is being developed by means of dug wells and filter points. Proterozoic formation is the basement rocks which consist of quartzite, crystalline limestone, calc-granulite, hornblende – biotite gneiss,

charnockite or pyroxene granulite, granite and pegmatite. Weathered, a fissured crack, shear zones and joints in the basement rock act as a good groundwater potential zone in the study area.

The study area falls in the Maduranthagam block which is categorized as over-exploited zone as per G.O (MS) No 113 dated 09.06.2016.

3.3.3 Methodology

Reconnaissance survey was undertaken to collect the sampling and locations were finalized based on;

1. Drainage pattern;
2. Location of residential areas representing different activities/likely impact areas; and
3. Likely areas, which can represent baseline conditions

Two (2) surface water and four (4) ground water samples were collected in the study area and physico-chemical, heavy metals and bacteriological parameters were analysed. The samples were analysed as per the procedures specified by CPCB, IS-10500:2012 and 'Standard methods for the Examination of Water and Waste water' published by American Public Health Association (APHA). The water sampling locations are given in Table 3.8 and shown as Figure 3.5.

TABLE 3.9 – WATER SAMPLING LOCATIONS

S. No	Location code	Monitoring Locations	Distance & Direction from the cluster	Coordinates
1	SW-1	Tank Near Morekuppam	1.2km NW	12°29'17.98"N 79°50'52.46"E
2	SW-2	Madhuranthakam Lake	5.5km NE	12°30'52.65"N 79°53'2.30"E
3	WW-1	Near Project Area	300m SE	12°28'27.15"N 79°51'11.53"E
4	WW-2	Polambakkam	5.8km SE	12°25'48.22"N 79°52'48.11"E
5	BW-1	Near Project Area	360m NW	12°28'51.19"N 79°50'51.70"E
6	BW-2	Sendivakkam	4.8km SW	12°27'28.89"N 79°48'27.50"E

Source: On-site monitoring/sampling by ***EHS360 Labs Private Limited*** in association with GEMS
Note: SW- Surface water, WW – Well Water, BW – Bore well

FIGURE 3.8: SITE PHOTOGRAPHS OF WATER SAMPLING LOCATIONS

Sample Collection in Polambakkam

Sample collection in Sendivakkam

TABLE 3.10 – SURFACE WATER ANALYSIS RESULTS

SNO	TEST	PROTOCOL	Surface Water (SW-1) - Tank Near Morekuppam	Surface Water (SW-2) Madhuranthakam Lake
1	Colour	IS 3025 Part 4:1983 (Reaff:2017)	5 Hazen	5 Hazen
2	Odour	IS 3025 Part 5:2018	Agreeable	Agreeable
3	pH at 25°C	IS 3025 Part 11:1983 (Reaff:2017)	7.76	7.51
4	Conductivity @ 25°C	IS 3025 Part 14:2013 (Reaff:2019)	1144 µmhos/cm	1254 µmhos/cm
5	Turbidity	IS 3025 Part 10:1984 (Reaff:2017)	4.1 NTU	3.1 NTU
6	Total Dissolved Solids	IS 3025 Part 16:1984 (Reaff:2017)	675 mg/l	739 mg/l
7	Total Hardness as $CaCO_3$	IS 3025 Part 21:2009 (Reaff:2019)	204.04 mg/l	228.07 mg/l
8	Calcium as Ca	IS 3025 Part 40:1991 (Reaff:2019)	35.8 mg/l	42.8 mg/l
9	Magnesium as Mg	IS 3025 Part 46:1994 (Reaff:2019)	27.9 mg/l	29.5 mg/l
10	Total Alkalinity as $CaCO_3$	IS 3025 Part 23:1986 (Reaff:2019)	230 mg/l	247.4 mg/l
11	Chloride as Cl	IS 3025 Part 32:1988 (Reaff:2019)	171.5 mg/l	194 mg/l
12	Sulphate as SO_4	IS 3025 Part 24:1986 (Reaff:2019)	85.1 mg/l	97.6 mg/l
13	Iron as Fe	IS 3025 Part 53:2003 (Reaff:2019)	0.36 mg/l	0.34 mg/l
14	Residual Free Chlorine	IS 3025 Part 26:1986 (Reaff:2019)	BDL (DL:0.1 mg/l)	BDL (DL:0.1 mg/l)
15	Fluoride as F	APHA 23rd Edn. 2017:4500 F,D	0.24 mg/l	0.28 mg/l
16	Nitrate as NO_3	IS 3025 Part 34:1988 (Reaff:2019)	12.6 mg/l	6.1 mg/l
17	Copper as Cu	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
18	Manganese as Mn	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)
19	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)
20	Cadmium as Cd	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)	BDL (DL:0.001 mg/l)
21	Selenium as Se	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
22	Aluminium as Al	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
23	Lead as Pb	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
24	Zinc as Zn	IS 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)
25	Total Chromium as Cr	IS 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.02 mg/l)	BDL(DL : 0.02 mg/l)
26	Boron as B	IS 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)
27	Mineral Oil	IS 3025 Part 39-1991 (Reaff. 2019)	BDL(DL : 0.01 mg/l)	BDL(DL : 0.01 mg/l)
28	Phenolic compounds as C_6H_5OH	IS 3025 Part 43-1992(Reaff: 2019)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)
29	Anionic Detergents (as MBAS)	IS 13428 – 2005 (Reaff:2019) (Annex K)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
30	Cyanide as CN	IS 3025 Part 27-1986 (Reaff. 2019)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
31	BOD @ 27°C for 3 days	IS 3025 Part 44:1993 (Reaff:2019)	7.5 mg/l	5.7 mg/l
32	Chemical Oxygen Demand	IS 3025 Part 58:2006 (Reaff:2017)	32 mg/l	24 mg/l
33	Dissolved Oxygen	IS 3025 Part 38:1989 (Reaff:2019)	5.6 mg/l	5.5 mg/l
34	Barium as Ba	IS 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.05 mg/l)	BDL(DL:0.05 mg/l)
35	Ammonia (as total ammonia-N)	IS 3025 Part 34-1988 (Reaff. 2019)	BDL (DL:0.01 mg/l)	1.1 mg/l
36	Sulphide as H_2S	IS 3025 Part 29-1986 (Reaff: 2019)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
37	Molybdenum as Mo	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)
38	Total Arsenic as As	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
39	Total Suspended Solids	IS 3025 Part 17 -1984 (Reaff:2017)	12.1 mg/l	10.2 mg/l
40	**Total Coliform**	**APHA 23rd Edn. 2017:9221B**	980 MPN/100ml	1040 MPN/100ml
41	***Escherichia coli***	**APHA 23rd Edn. 2017:9221F**	100 MPN/100ml	150 MPN/100ml
Note : APHA – American Public Health Association, BDL – Below Detection Limit, DL – Detection Limit, MPN – Most Probable Number				

TABLE 3.11 – GROUND WATER ANALYSIS RESULTS

Sno	Test	Protocol	Ground Water (WW-1) – Near Project Area	Ground Water (WW-2) – Polambakkam	Ground Water (BW1) Near Project Area	Ground Water (BW-2) – Sendivakkam
1	Colour	IS 3025 Part 4:1983 (Reaff:2017)	5	5 Hazen	5 Hazen	5 Hazen
2	Odour	IS 3025 Part 5:2018	Agreeable	Agreeable	Agreeable	Agreeable
3	pH at 25°C	IS 3025 Part 11:1983 (Reaff:2017)	7.25	7.04	6.98	7.68
4	Conductivity @ 25°C	IS 3025 Part 14:2013 (Reaff:2019)	884 µmhos/cm	1252 µmhos/cm	1182 µmhos/cm	1068 µmhos/cm
5	Turbidity	IS 3025 Part 10:1984 (Reaff:2017)	1.1 NTU	1.0 NTU	1.3 NTU	1.4 NTU
6	Total Dissolved Solids	IS 3025 Part 16:1984 (Reaff:2017)	520 mg/l	738 mg/l	697 mg/l	630 mg/l
7	Total Hardness as $CaCO_3$	IS 3025 Part 21:2009 (Reaff:2019)	180.28 mg/l	267.15 mg/l	206.42 mg/l	219.22 mg/l
8	Calcium as Ca	IS 3025 Part 40:1991 (Reaff:2019)	36.5 mg/l	43.3 mg/l	38.9 mg/l	37.6 mg/l
9	Magnesium as Mg	IS 3025 Part 46:1994 (Reaff:2019)	21.7 mg/l	38.7 mg/l	26.6 mg/l	30.5 mg/l
10	Total Alkalinity as $CaCO_3$	IS 3025 Part 23:1986 (Reaff:2019)	155 mg/l	271.2 mg/l	249 mg/l	179.7 mg/l
11	Chloride as Cl	IS 3025 Part 32:1988 (Reaff:2019)	130.1 mg/l	170 mg/l	166 mg/l	151.2 mg/l
12	Sulphate as SO_4	IS 3025 Part 24:1986 (Reaff:2019)	65.7 mg/l	94.1mg/l	71 mg/l	75 mg/l
13	Iron as Fe	IS 3025 Part 53:2003 (Reaff:2019)	0.21 mg/l	0.21 mg/l	0.24 mg/l	0.34 mg/l
14	Residual Free Chlorine	IS 3025 Part 26:1986 (Reaff:2019)	BDL (DL:0.1 mg/l)	BDL (DL:0.1 mg/l)	BDL (DL:0.1 mg/l)	BDL (DL:0.1 mg/l)
15	Fluoride as F	APHA 23rd Edn. 2017:4500 F,D	0.14 mg/l	0.29 mg/l	0.15 mg/l	0.26 mg/l
16	Nitrate as NO_3	IS 3025 Part 34:1988 (Reaff:2019)	5.1 mg/l	5.1mg/l	6.3 mg/l	5.4 mg/l
17	Copper as Cu	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
18	Manganese as Mn	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)
19	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)
20	Cadmium as Cd	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)	BDL (DL:0.001 mg/l)	BDL (DL:0.001 mg/l)	BDL (DL:0.001 mg/l)
21	Selenium as Se	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
22	Aluminium as Al	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
23	Lead as Pb	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
24	Zinc as Zn	IS 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)
25	Total Chromium as Cr	IS 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.02 mg/l)	BDL(DL : 0.02 mg/l)	BDL(DL : 0.02 mg/l)	BDL(DL : 0.02 mg/l)
26	Boron as B	IS 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)
27	Mineral Oil	IS 3025 Part 39-1991 (Reaff. 2019)	BDL(DL : 0.01 mg/l)	BDL(DL : 0.01 mg/l)	BDL(DL : 0.01 mg/l)	BDL(DL : 0.01 mg/l)
28	Phenolic compounds as C_6H_5OH	IS 3025 Part 43-1992(Reaff: 2019)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)
29	Anionic Detergents (as MBAS)	IS 13428 – 2005 (Reaff:2019) (Annex K)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
30	Barium as Ba	IS 3025 Part 27-1986 (Reaff. 2019)	BDL(DL:0.05 mg/l)	BDL(DL:0.05 mg/l)	BDL(DL:0.05 mg/l)	BDL(DL:0.05 mg/l)
31	Ammonia (as total ammonia-N)	IS 3025 Part 44:1993 (Reaff:2019)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
32	Sulphide as H_2S	IS 3025 Part 58:2006 (Reaff:2017)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
33	Molybdenum as Mo	IS 3025 Part 38:1989 (Reaff:2019)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)
34	Total Arsenic as As	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
35	Total Suspended Solids	IS 3025 Part 17 -1984 (Reaff:2017)	BDL (DL:1.0 mg/l)	BDL (DL:1.0 mg/l)	BDL (DL:1.0 mg/l)	BDL (DL:1.0 mg/l)
36	**Total Coliform**	APHA 23rd Edn. 2017:9221B	170 MPN/100ml	100 MPN/100ml	80 MPN/100ml	70 MPN/100ml
37	***Escherichia coli***	APHA 23rd Edn. 2017:9221F	< 1.8 MPN/100ml	< 1.8 MPN/100ml	< 1.8 MPN/100ml	< 1.8 MPN/100ml

Note : APHA – American Public Health Association, BDL – Below Detection Limit, DL – Detection Limit, MPN – Most Probable Number

* 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.

Source: Sampling Results by EHS360 Labs Private Limited

3.3.4 Interpretation& Conclusion

Surface Water

The pH of surface 7.51-7.76 while turbidity found within the standards. Total Dissolved Solids 675-739 mg/l and Chloride 171-194 mg/l. Nitrates 6.1-12.6 mg/l, while sulphates 85.1-97.6 mg/l.

Ground Water

The pH of the water samples collected ranged from 6.98 to 7.68 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. Total Dissolved Solids were found in the range of 521- 738mg/l in all samples. The Total hardness varied between 180.28 mg/l – 267.15 mg/l 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.

3.3.5 Hydrology and Hydrogeological studies

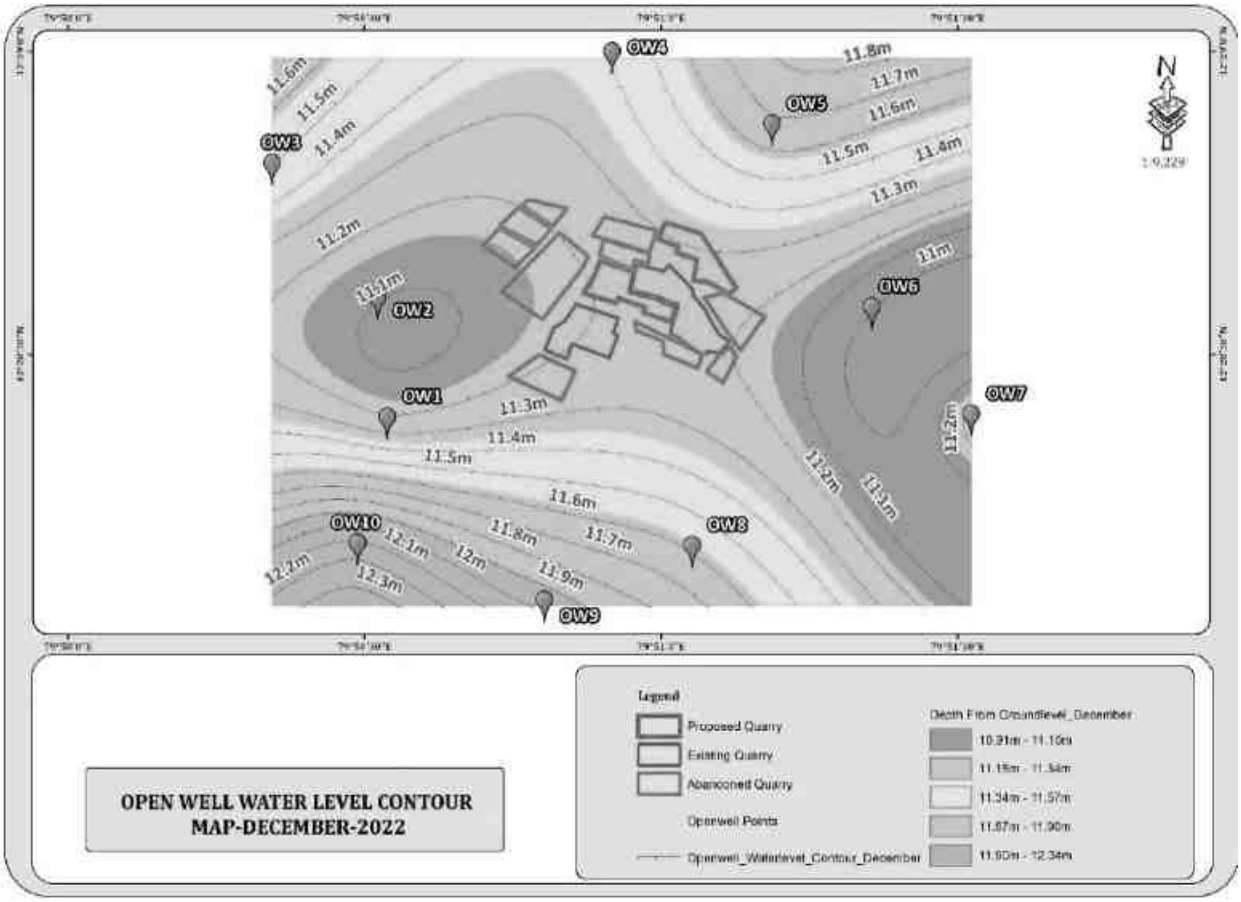
The district is underlain by hard rock formation Fissured and Fractured crystalline rocks constitute the important aquifer systems in the district. Geophysical prospecting was carried out in that area by SSRMP-80 Instrument by qualified Geo physicist with the help of IGIS software and it was inferred that the low resistance encountered at the depth between 60 - 65m. The Maximum depth of the quarrying operation in this proposal is 47m hence there is no possibilities of water table intersection during the entire mine life period besides it is also inferred topographically that there are no major water bodies intersecting the project area. There is no necessity of stream, channel diversion due to this upcoming project.

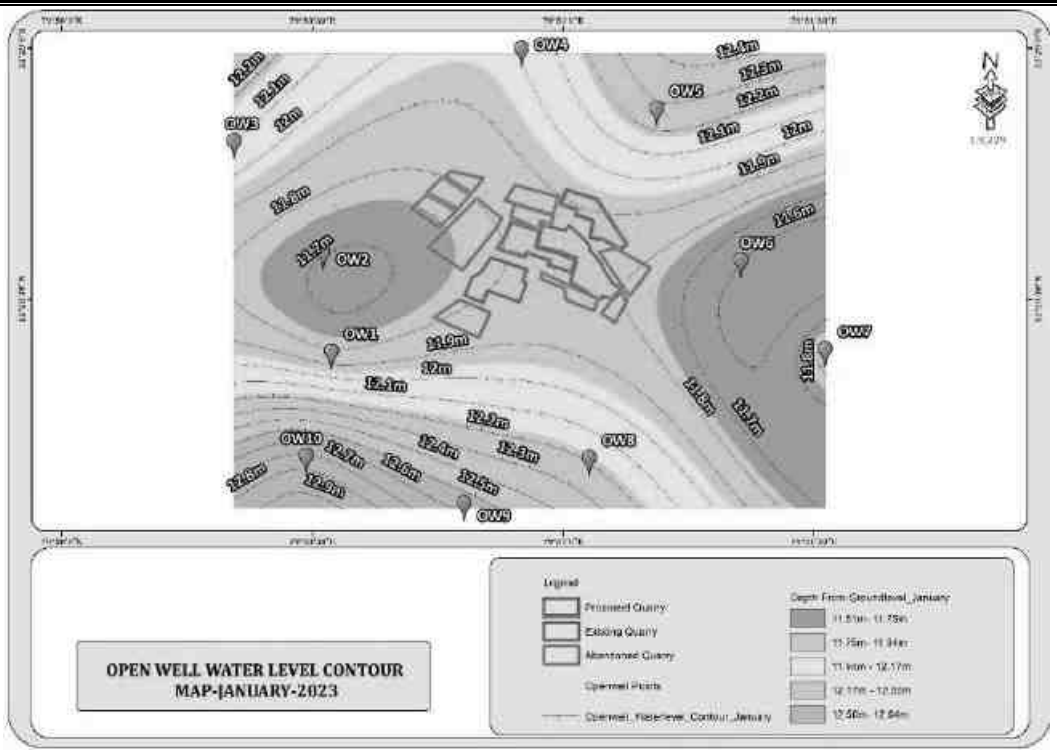
During the rainy season there is a possibility of collection of seepage water from the subsurface levels this is due to the high intensity of fracture and weathered portion upto a depth of 10m thus the collected seepage water will be stored in the mine sump pits and will be used for dust suppression and greenbelt development and during the end of the life of the mine this collected water will be as a temporary reservoir in that area.

TABLE 3.12: POST MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS

S.No	Name	LATITUDE	LONGITUDE	DEC 2022	JAN 2023	FEB 2023
1	OW1	12° 28' 23.20"N	79° 50' 32.27"E	11.2	11.8	12.4
2	OW2	12° 28' 35.01"N	79° 50' 31.29"E	11.1	11.7	12.3
3	OW3	12° 28' 48.33"N	79° 50' 20.62"E	11.5	12.1	12.7
4	OW4	12° 28' 59.37"N	79° 50' 55.04"E	11.4	12	12.6
5	OW5	12° 28' 52.22"N	79° 51' 11.19"E	11.7	12.3	12.9
6	OW6	12° 28' 34.08"N	79° 51' 21.33"E	11	11.6	12.2
7	OW7	12° 28' 23.46"N	79° 51' 31.36"E	11.3	11.9	12.5
8	OW8	12° 28' 10.46"N	79° 51' 03.13"E	11.6	12.2	12.8
9	OW9	12° 28' 05.05"N	79° 50' 48.17"E	12	12.6	13.2
10	OW10	12° 28' 10.70"N	79° 50' 29.25"E	12.2	12.8	13.4
11	OW1	12° 28' 23.20"N	79° 50' 32.27"E	11.2	11.8	12.4

FIGURE 3.9: CONTOUR MAP OF OPEN WELL WATER LEVEL




OW1
OW2
OW3
OW4
OW5
OW6
OW7
OW8
OW9
OW10
OPEN WELL WATER LEVEL CONTOUR
MAP-JANUARY-2023

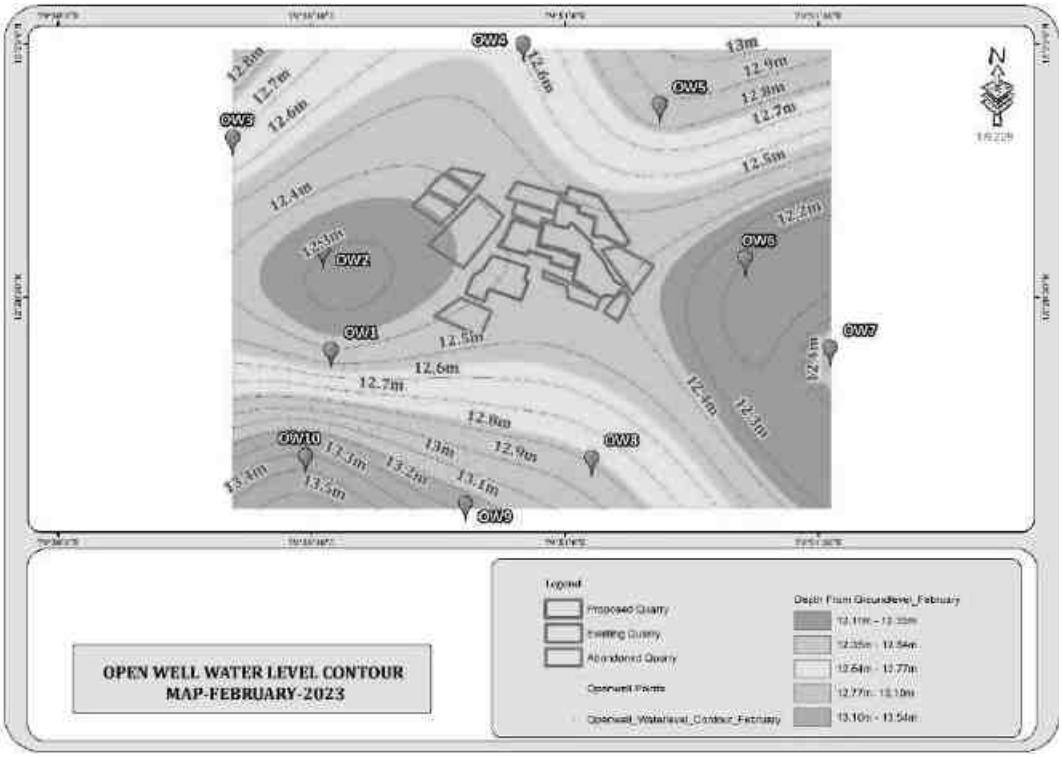
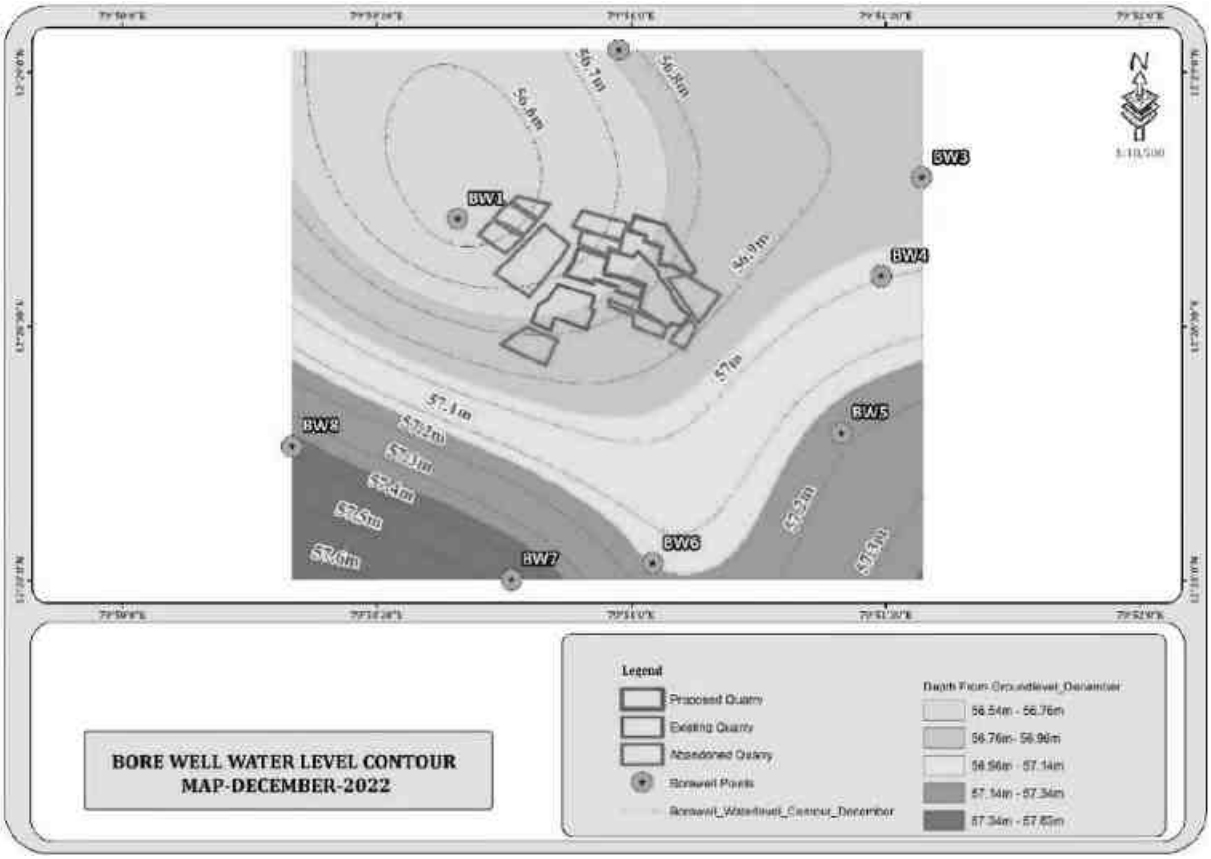
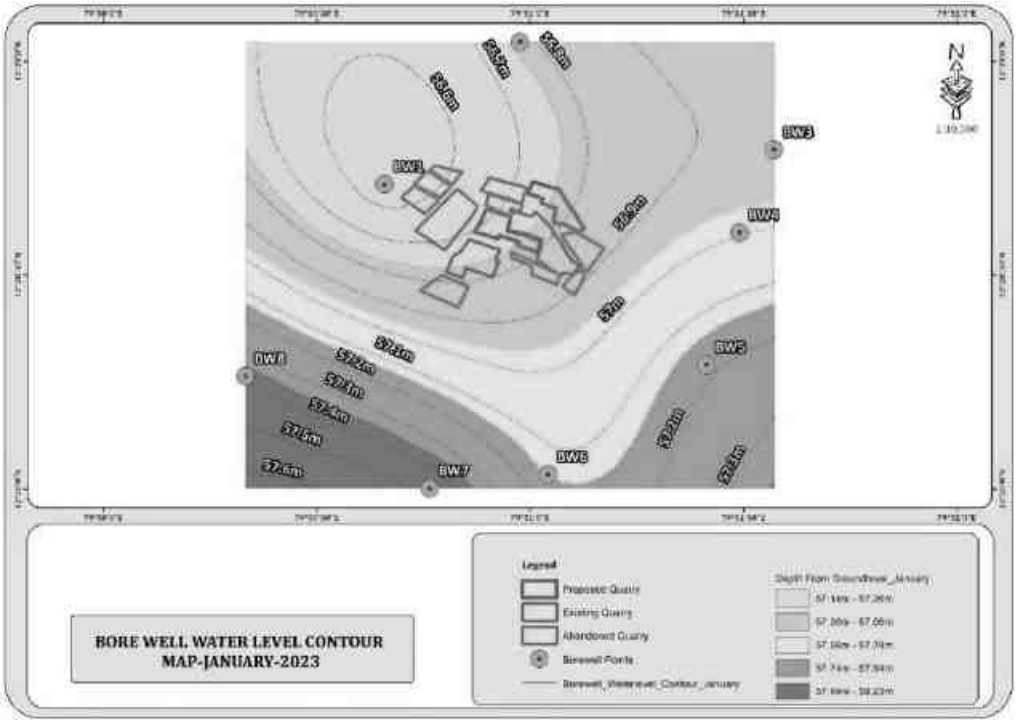

OW1
OW2
OW3
OW4
OW5
OW6
OW7
OW8
OW9
OW10
OPEN WELL WATER LEVEL CONTOUR
MAP-FEBRUARY-2023

TABLE 3.13: POST MONSOON WATER LEVEL OF BOREWELLS 1 KM RADIUS

S.No	Name	LATITUDE	LONGITUDE	DEC 2022	JAN 2023	FEB 2023
1	BW1	12° 28' 42.69"N	79° 50' 39.51"E	56.5	57.1	57.7
2	BW2	12° 29' 02.65"N	79° 50' 58.55"E	56.8	57.4	58
3	BW3	12° 28' 47.56"N	79° 51' 34.30"E	56.9	57.5	58.1
4	BW4	12° 28' 35.93"N	79° 51' 29.47"E	57	57.6	58.2
5	BW5	12° 28' 17.34"N	79° 51' 24.78"E	57.2	57.8	58.4
6	BW6	12° 28' 01.96"N	79° 51' 02.52"E	57.1	57.7	58.3
7	BW7	12° 28' 00.05"N	79° 50' 45.90"E	57.5	58.1	58.7
8	BW8	12° 28' 15.80"N	79° 50' 19.99"E	57.4	58	58.6

FIGURE 3.10: CONTOUR MAP OF BORE WELL WATER LEVEL




BW1
BW2
BW3
BW4
BW5
BW6
BW7
BORE WELL WATER LEVEL CONTOUR
MAP-JANUARY-2023
Legend
Proposed Quarry
Existing Quarry
Abandoned Quarry
Borewell Points

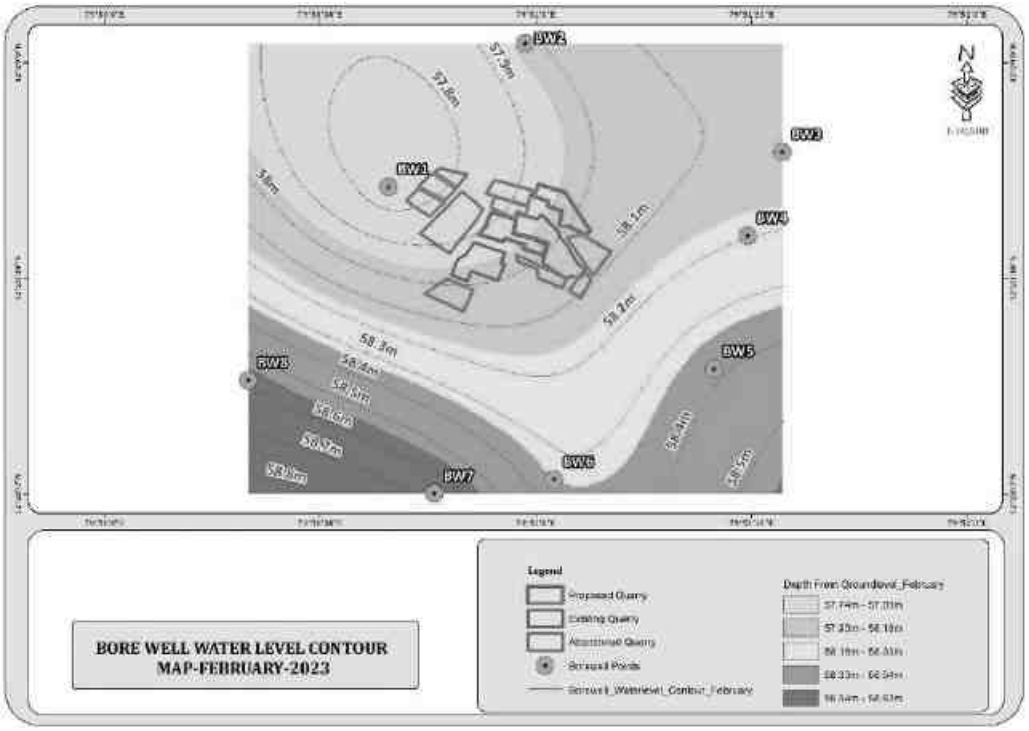

BW1
BW2
BW3
BW4
BW5
BW6
BW7
BORE WELL WATER LEVEL CONTOUR
MAP-FEBRUARY-2023
Legend
Proposed Quarry
Existing Quarry
Abandoned Quarry
Borewell Points

FIGURE 3.11: DRAINAGE MAP AROUND 10 KM RADIUS FROM PROJECT SITE

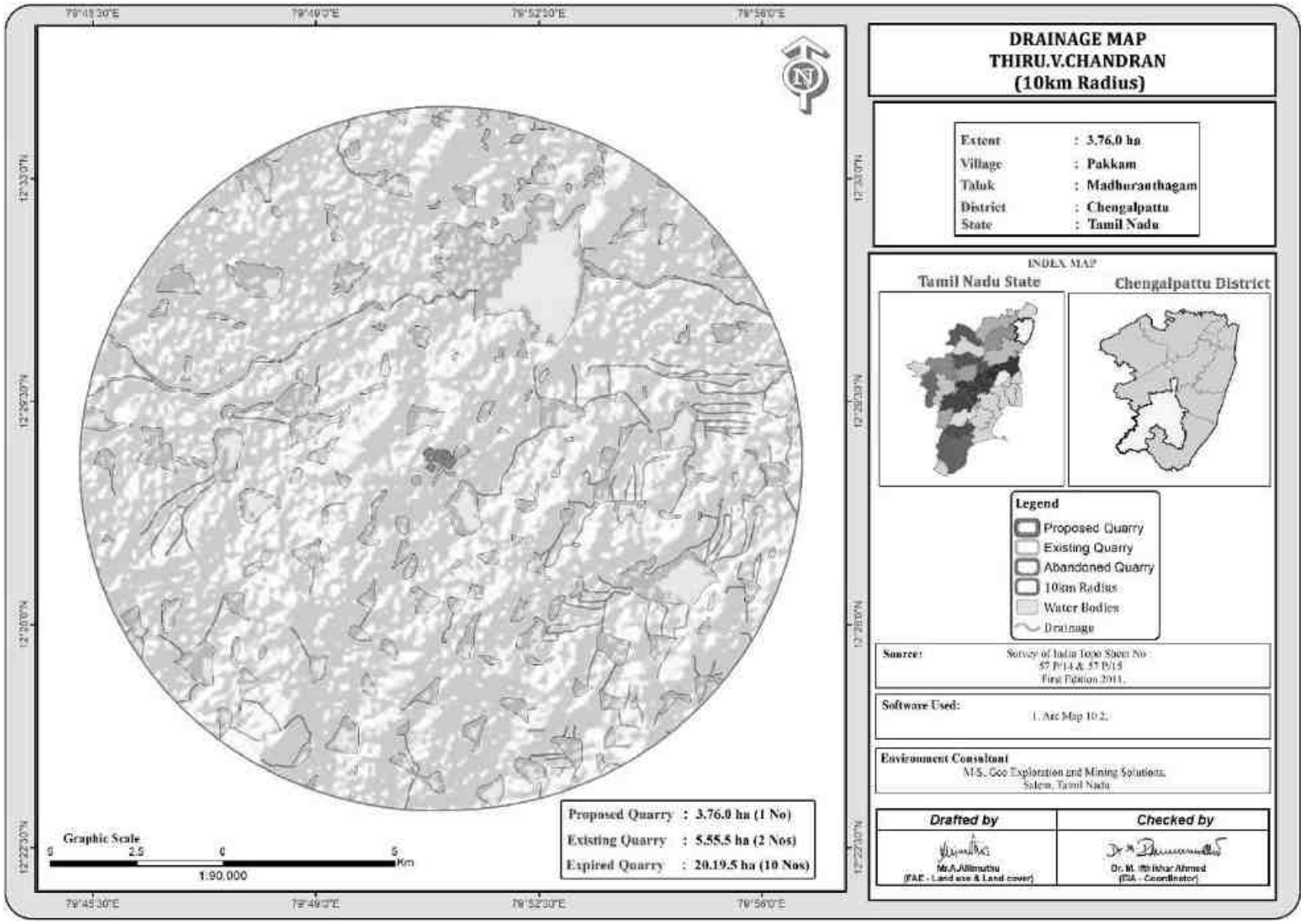
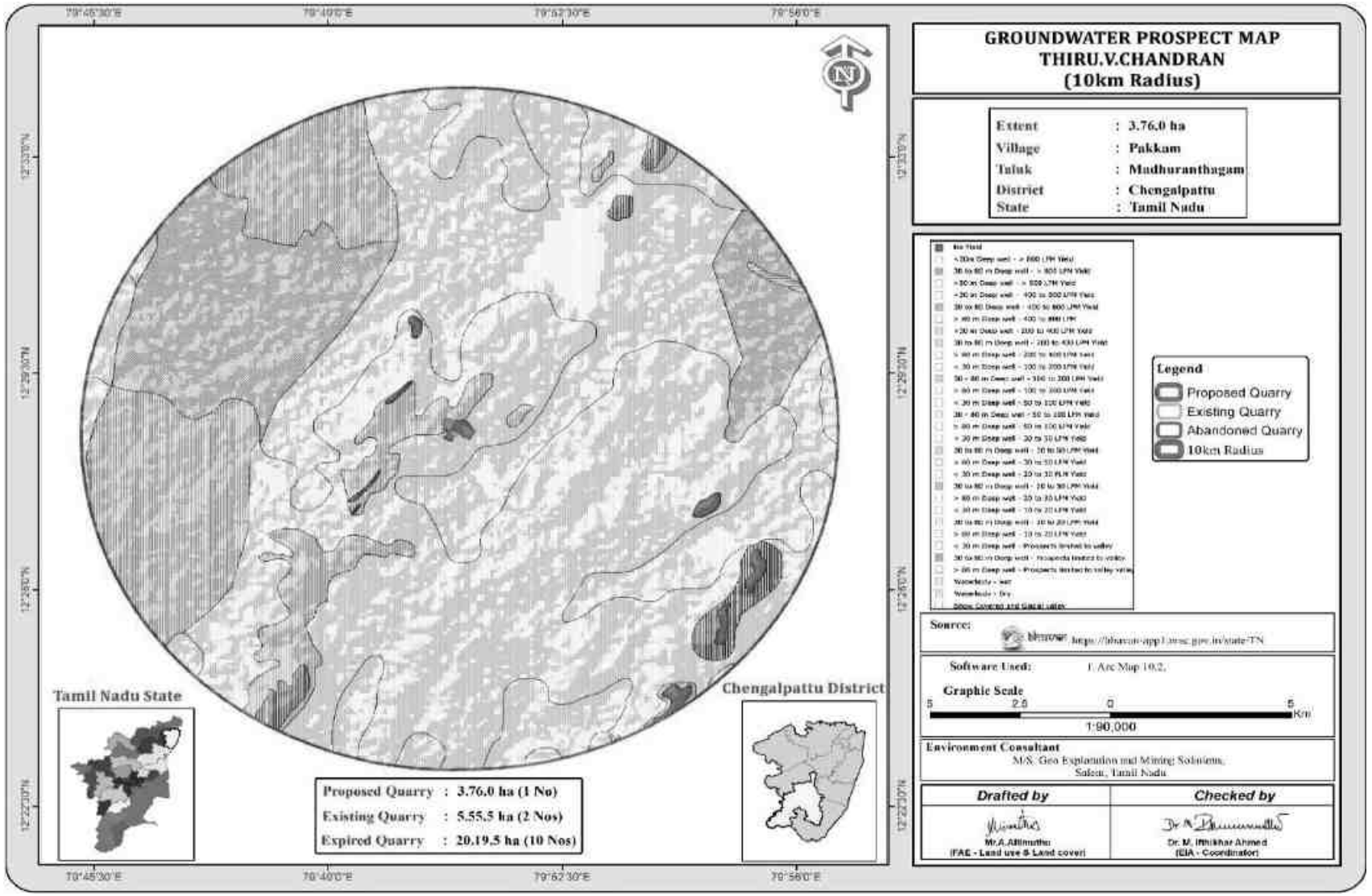


FIGURE 3.12: GROUND WATER LEVEL MAP



3.3.5.1 Methodology and Data Acquisition

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

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

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

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

ΔV = potential difference between receiving electrodes

G = Geometric Factor.

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

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

ρr = Resistivity of Rocks

ρw = Resistivity of water in pores of rock

F = Formation Factor

$\emptyset$ = Fractional pore volume

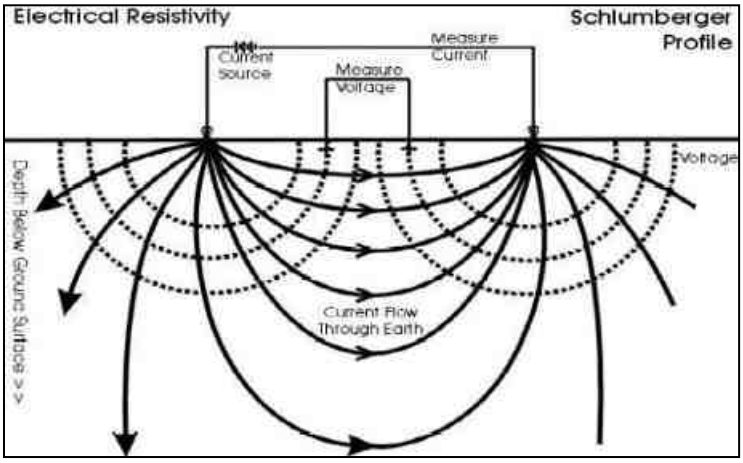
A = Constants with values ranging from 0.5 to 2.5

3.3.5.2 Survey Layout

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

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

RESISTIVITY SURVEY PROFILE



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

3.3.5.3 Data Presentation

It was inferred that the low resistance encountered at the depth between 60-65m. The maximum depth proposed in this cluster quarries 47 m 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.

3.3.5.4 Geophysical Data Interpretation and Conclusion

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

Based on the Geophysical interpretation water table fracture zone is expected above 60m bgl, Water level in the open well is ranges from 10.4m to 12.5m bgl it is only collected from the seepage water in shallow depth open wells are selected on the basis of suitable lineament and hydro fractures environment in shallow depth. Water level in the bore well is ranges from 65.8 to 68m bgl which will clearly evidence that the potential aquifer in the area is above 65m bgl. The depth of the mining operation in the cluster is maximum 47m bgl hence this mining operation will not intersect the Ground water table**.** Seepage water will be collected in the mine pit will be utilized for greenbelt development and dust suppression.

3.4 AIR ENVIRONMENT

The ambient air quality with respect to the study area of 10 km radius including the cluster quarries forms the baseline information. The prime objective of baseline air quality monitoring is to assess existing air quality of the area. This will also be useful in assessing the conformity to standards of the ambient air quality during the operations

The existing ambient air quality of the area is important for evaluating the impact of mining activities on the ambient air quality. These will also be useful for assessing the conformity to standards of the ambient air quality during the operation of Existing and proposed quarries within the radius of 500m.

The sources of air pollution in the region are mostly due to vehicular traffic, dust arising from unpaved village road and domestic & agricultural activities. This section describes the identification of sampling locations, methodology adopted during the monitoring period and sampling frequency.

The baseline status of the ambient air quality has been assessed through scientifically designed ambient air quality network. The design of monitoring network in the air quality surveillance program has been based on the following considerations:

- Meteorological conditions.
- Topography of the study area.
- Likely impact area.

3.4.1 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. The station was installed at a height of 4 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 –

- This city has a tropical climate. In winter, there is much less rainfall than in summer. The climate here is classified as Aw by the Köppen-Geiger system. The average annual temperature in Chengalpattu is 27.8 °C | 82.0 °F. In a year, the rainfall is 995 mm | 39.2 inch.
- Chengalpattu experiences a moderate climate, and the summers are not easy to define. The best time to visit is January, February, March, December.
- The least amount of rainfall occurs in February. The average in this month is 9 mm | 0.4 inch. Most precipitation falls in October, with an average of 205 mm | 8.1 inch.
- The temperatures are highest on average in May, at around 31.2 °C | 88.2 °F. In January, the average temperature is 24.2 °C | 75.5 °F. It is the lowest average temperature of the whole year.

https://en.climate-data.org/asia/india/tamil-nadu/chengalpattu-767200/

Rainfall

The average annual rainfall and the 5 years rainfall is as follows:

TABLE 3.14 – RAINFALL DATA

Actual Rainfall in mm					Normal Rainfall in mm
2015	2016	2017	2018	2019	
2256.6	990.5	1191.7	833.0	1051.17	1263.8

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

TABLE 3.15 – METEOROLOGICAL DATA RECORDED AT SITE

S.No	Parameters		Dec – 2022	Jan – 2023	Feb – 2023
1	Temperature (^{0}C)	**Max**	28.2	27.1	26.64
		Min	26.08	23.44	23.13
		Avg	27.14	25.27	24.88
2	Relative Humidity (%)	**Avg**	76.59	83.09	84
3	Wind Speed (m/s)	**Max**	6.24	6.63	8.97
		Min	1.7	2.14	1.91
		Avg	3.97	4.38	5.44
4	Cloud Cover (OKTAS)		0-8	0-8	0-8
5	Wind Direction		**SE,ENE**	**NE,NNE**	**NE,NNE**

Source: On-site monitoring/sampling by **EHS360 Labs Private Limited** in association with GEMS.

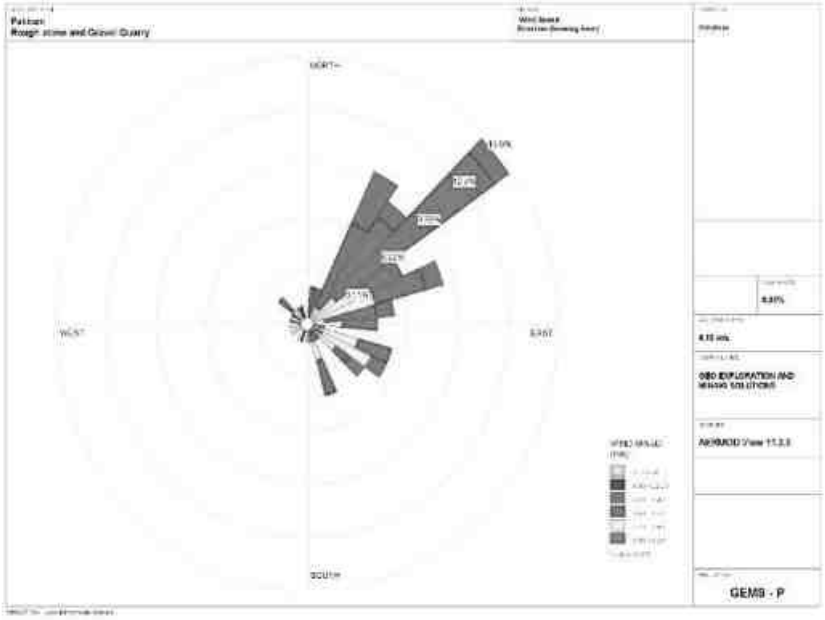
Correlation between Secondary and Primary Data

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

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

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

FIGURE 3.13: WINDROSE DIAGRAM



Environmental 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

1. Predominant winds were from SE,ENE,NE, NNE
2. Wind velocity readings were recorded between 0.50 to 8.80 km / hour
3. Calm conditions prevail of about 0.00% of the monitoring period
4. Temperature readings ranging from 23.13^0 to 28.2^0C
5. Relative humidity ranging from 76 to 84 %
6. The monitoring was carried out continuously for three months

3.4.2 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.,

3.4.3 Sampling and Analytical Techniques

TABLE 3.16 – METHODOLOGY AND INSTRUMENT USED FOR AIR QUALITY ANALYSIS

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 modified method)	Respirable Dust Sampler with gaseous attachment
Free Silica	NIOSH – 7601	Visible Spectrophotometry

Source: Sampling Methodology followed by EHS360 Labs Private Limited & 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 ($\mu g/m^3$)	Annual Avg.* 24 hours**	50.0 80.0	20.0 80.0
2	Nitrogen Dioxide ($\mu g/m^3$)	Annual Avg. 24 hours	40.0 80.0	30.0 80.0
3	Particulate matter (size less than 10µm) PM_{10} ($\mu g/m^3$)	Annual Avg. 24 hours	60.0 100.0	60.0 100.0
4	Particulate matter (size less than 2.5 µm $PM_{2.5}$ ($\mu g/m^3$)	Annual Avg. 24 hours	40.0 60.0	40.0 60.0

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

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

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

3.4.4 Frequency & Parameters for Sampling

Ambient air quality monitoring has been carried out with a frequency of two samples per week at seven (8) locations, adopting a continuous 24 hourly (3 shift of 8-hour) schedule for the period Dec-Feb2023. The baseline data of ambient air has been generated for PM_{10}, $PM_{2.5}$, Sulphur Dioxide (SO_2) & Nitrogen Dioxide (NO_2).

3.4.5 Ambient Air Quality Monitoring Stations

The (eight) monitoring stations were set up in the study area as depicted in Figure 3.18 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	**AAQ-1**	Core Zone	Project Area	12°28'36.64"N 79°50'53.21"E
2	**AAQ-2**	Core Zone	Project Area	12°28'38.99"N 79°51'5.74"E
3	**AAQ-3**	Unamalai	1.2km SW	12°28'18.16"N 79°50'16.22"E
4	**AAQ-4**	Guddalur	3km NW	12°29'33.73"N 79°49'34.84"E
5	**AAQ-5**	Sholamthangal	6km NE	12°29'35.16"N 79°54'22.60"E
6	**AAQ-6**	Polambakkam	6km SE	12°25'37.09"N 79°52'50.33"E
7	**AAQ-7**	Sendivakkam	4.8km SW	12°27'26.54"N 79°48'27.51"E
8	**AAQ-8**	Morekuppam	2.2km North	12°29'53.49"N 79°50'55.62"E

Source: On-site monitoring/sampling by EHS360 Labs Private Limited in association with GEMS

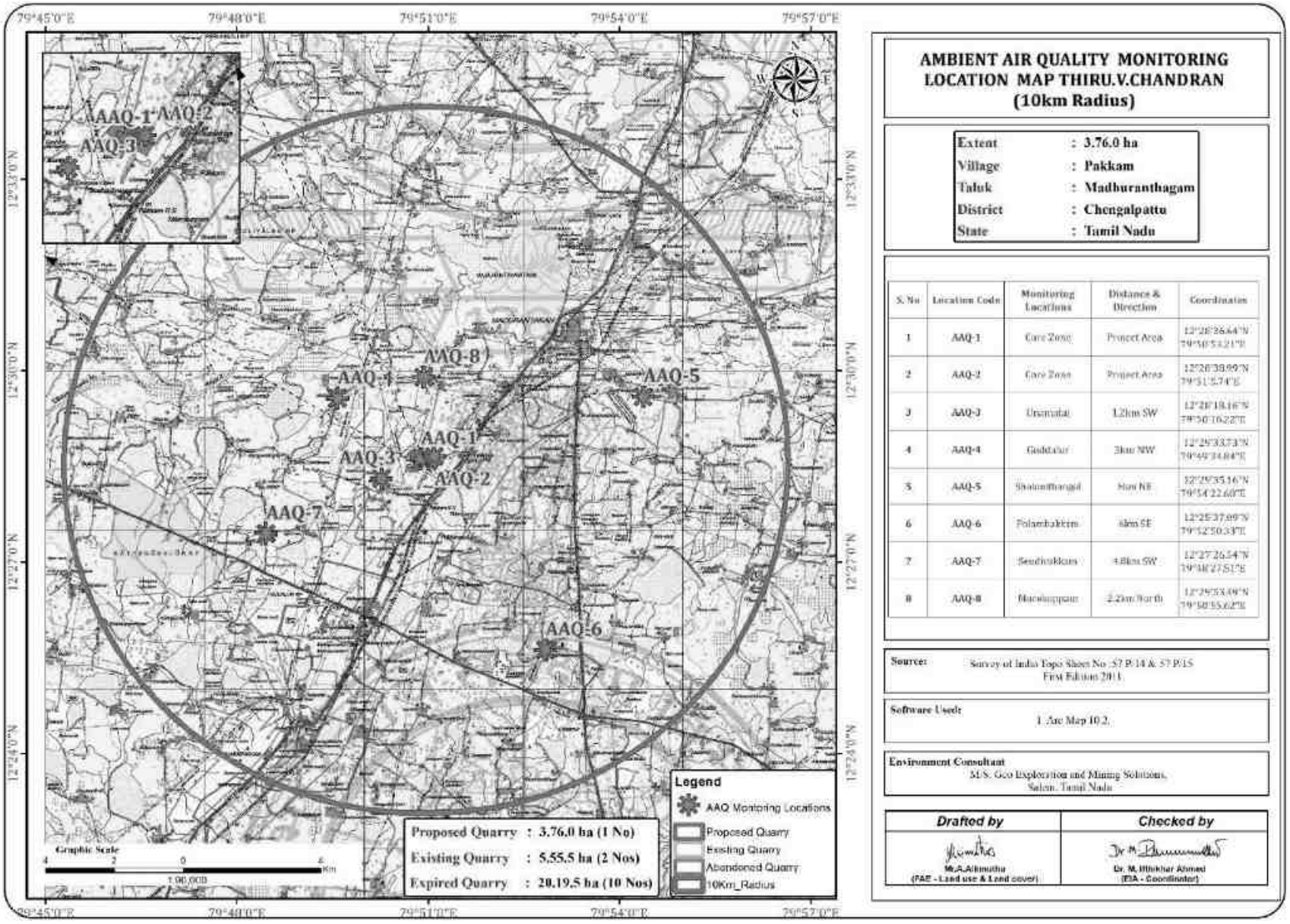
FIGURE 3.14: SITE PHOTOGRAPHS OF AMBIENT AIR MONITORING

Unamalai

Guddalur

Source: Monitoring photographs from the FAE and Team Members

FIGURE 3.15 AMBIENT AIR QUALITY LOCATIONS AROUND 10 KM RADIUS



S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	AAQ-1	Core Zone	Project Area	12°28'26.64"N 79°50'53.21"E
2	AAQ-2	Core Zone	Project Area	12°28'38.89"N 79°51'5.74"E
3	AAQ-3	Uraiyadai	1.2km SW	12°28'18.16"N 79°50'16.22"E
4	AAQ-4	Gaddalur	3km NW	12°29'33.73"N 79°49'34.84"E
5	AAQ-5	Sholamthangal	4km NE	12°29'35.16"N 79°54'22.60"E
6	AAQ-6	Polambakkam	6km SE	12°25'37.89"N 79°52'50.33"E
7	AAQ-7	Seedhakkam	4.8km SW	12°27'26.54"N 79°48'27.51"E
8	AAQ-8	Maraimpattu	2.2km North	12°29'53.49"N 79°50'55.62"E

TABLE 3.19 – AAQ1- CORE ZONE

Period: Dec– Feb 2023 *Location: AAQ1- Core Zone* Sampling Time: 24-hourly

Ambient AirMonitoring Details		**Particulate Pollutant**			**Gaseous Pollutant**					**Metals Pollutant**			**Organic Pollutant**	
Parameters		**SPM**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_2**	**NH_3**	**O_3**	**CO**	**Pb**	**Ni**	**As**	**C_6H_6**	**BaP**
NAAQ Norms		**200**	**100**	**60**	**80**	**80**	**400**	**180**	**4**	**1**	**20**	**6**	**5**	**1**
Unit		$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	mg/m^3	$\mu g/m^3$	ng/m^3	ng/m^3	$\mu g/m^3$	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
01.12.2022	7:00-7:00	68.5	44.5	20.1	8.4	19.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.12.2022	7:15-7:15	69.5	41.4	22.5	8.3	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.12.2022	7:00-7:00	67.4	42.6	20.2	7.9	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.12.2022	7:15-7:15	69.3	43.7	21.2	8.1	21.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.12.2022	7:00-7:00	68.2	42.6	22.7	8.3	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.12.2022	7:15-7:15	66.7	41.5	21.5	8.4	19.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.12.2022	7:00-7:00	63.3	41.9	21.4	7.4	18.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.12.2022	7:15-7:15	62.5	42.8	21.3	7.6	19.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.12.2022	7:00-7:00	61.6	45.5	23.1	8.2	18.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.12.2023	7:15-7:15	64.5	44.9	22.5	8.5	19.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.01.2023	7:00-7:00	62.7	43.1	22.8	7.6	20.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.01.2023	7:15-7:15	63.5	42.6	21.3	7.8	22	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.01.2023	7:00-7:00	70.5	42.8	22.5	8.6	21.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.01.2023	7:15-7:15	71.4	42.5	22.4	8.4	20.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.01.2023	7:00-7:00	68.7	41.4	21.8	7.6	21.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.01.2023	7:15-7:15	69.3	42.3	22.3	7.9	22.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.01.2023	7:00-7:00	70.6	40.6	21.8	8.3	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.01.2023	7:15-7:15	69.9	41.4	21.5	8.6	19.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.02.2023	7:00-7:00	70.3	40.3	20.2	7.3	18.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.02.2023	7:15-7:15	71.9	42.4	21.7	7.8	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.02.2023	7:00-7:00	69.3	40.4	21.3	7.6	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.02.2023	7:15-7:15	68.8	41.9	20.6	9	19.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.02.2023	7:00-7:00	69.4	41.6	21.2	7.2	18.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.02.2023	7:15-7:15	70.5	40.1	21.7	7.8	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.02.2023	7:00-7:00	68.4	41.2	21.3	7.6	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.02.2023	7:15-7:15	67.9	41.3	20.6	8.4	19.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1.0); **Pb**: BDL (DL:0.1); **Ni**: BDL (DL:1.0); **As**: BDL (DL:1.0); **C_6H_6**: BDL (DL:1.0); **BaP**: BDL (DL:0.1)

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

TABLE 3.20 – AAQ2 - CORE ZONE

Period: Dec– Feb 2023 *Location: AAQ2- Core Zone* Time: 24-hourly

Ambient AirMonitoring Details		**Particulate Pollutant**			**Gaseous Pollutant**					**Metals Pollutant**			**Organic Pollutant**	
Parameters		**SPM**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_2**	**NH_3**	**O_3**	**CO**	**Pb**	**Ni**	**As**	**C_6H_6**	**BaP**
NAAQ Norms		**200**	**100**	**60**	**80**	**80**	**400**	**180**	**4**	**1**	**20**	**6**	**5**	**1**
Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	µg/m³	ng/m³	ng/m³	µg/m³	ng/m³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
01.12.2022	7:00-7:00	70.5	42.7	21.6	6.2	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.12.2022	7:15-7:15	70.2	43.6	20.4	6.3	21.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.12.2022	7:00-7:00	71.4	44.3	22.2	6.2	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.12.2022	7:15-7:15	71.6	43.4	21.2	5.3	21.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.12.2022	7:00-7:00	70.2	44.6	20.9	5.4	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.12.2022	7:15-7:15	69.2	43.5	21.5	6.2	20.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.12.2022	7:00-7:00	67.3	44.5	22.4	6.3	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.12.2022	7:15-7:15	68.5	43.3	20.3	5.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.12.2022	7:00-7:00	67.6	44.6	21.4	6.5	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.12.2023	7:15-7:15	68.7	45.8	23.1	6.7	21.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.01.2023	7:00-7:00	69.8	43.2	22.8	5.9	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.01.2023	7:15-7:15	67.5	42.6	21	5.8	22.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.01.2023	7:00-7:00	66.5	41.4	19.9	5.7	19.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.01.2023	7:15-7:15	70.4	42.4	20.8	5.8	19.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.01.2023	7:00-7:00	71.7	43.8	21.7	7.5	19.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.01.2023	7:15-7:15	70.4	44.9	22.8	7.9	20.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.01.2023	7:00-7:00	69.6	45.6	21.2	6.2	21.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.01.2023	7:15-7:15	68.5	42.7	19.8	6.4	22.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.02.2023	7:00-7:00	67.3	43.6	22.2	7.4	19.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.02.2023	7:15-7:15	66.4	45.4	21.7	7.2	20.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.02.2023	7:15-7:15	69.2	43.4	21.5	7.6	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.02.2023	7:15-7:15	70.4	42.9	20.5	7.7	20.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.02.2023	7:00-7:00	69.4	41.6	22.5	6.8	22.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.02.2023	7:15-7:15	68.6	44.4	21.1	6.1	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.02.2023	7:00-7:00	67.5	42.5	22.3	5.9	19.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.02.2023	7:15-7:15	69.4	44.3	20.4	5.5	19.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1.0); **Pb**: BDL (DL:0.1); **Ni**: BDL (DL:1.0); **As**: BDL (DL:1.0); **C_6H_6**: BDL (DL:1.0); **BaP**: BDL (DL:0.1)

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

TABLE 3.21 – AAQ3 – UNAMALAI (BUFFER ZONE)

Period: Dec– Feb 2023 *AAQ3- Unamalai* Sampling Time: 24-hourly

Ambient Air Monitoring Details		**Particulate Pollutant**			**Gaseous Pollutant**					**Metals Pollutant**			**Organic Pollutant**	
Parameters		**SPM**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_2**	**NH_3**	**O_3**	**CO**	**Pb**	**Ni**	**As**	**C_6H_6**	**BaP**
NAAQ Norms		**200**	**100**	**60**	**80**	**80**	**400**	**180**	**4**	**1**	**20**	**6**	**5**	**1**
Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	µg/m³	ng/m³	ng/m³	µg/m³	ng/m³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
01.12.2022	7:00-7:00	64.4	44.5	22.3	7.4	22.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.12.2022	7:15-7:15	65.6	42.8	23.4	7.5	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.12.2022	7:00-7:00	68.1	43.6	24.3	8.6	20.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.12.2022	7:15-7:15	67.5	45.7	22.2	8.5	22.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.12.2022	7:00-7:00	69.5	44.6	21.3	8.3	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.12.2022	7:15-7:15	70.3	43.3	20.7	9.2	19.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.12.2022	7:00-7:00	72.1	42.8	21.9	9.4	18.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.12.2022	7:15-7:15	70.3	44.1	22.4	7.6	19.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.12.2022	7:00-7:00	69.8	46.7	23.6	7.4	20.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.12.2023	7:15-7:15	67.2	43.8	21.4	7.3	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.01.2023	7:00-7:00	65.5	42.3	22.2	8.2	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.01.2023	7:15-7:15	70.7	44.8	22.4	8.4	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.01.2023	7:00-7:00	72.6	43.9	23.2	7.3	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.01.2023	7:15-7:15	68.8	45.8	22.4	6.2	19.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.01.2023	7:00-7:00	65.5	43.9	23.3	9.1	20.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.01.2023	7:15-7:15	64.8	44.7	21.9	8.4	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.01.2023	7:00-7:00	75.6	42.6	22.3	8.1	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.01.2023	7:15-7:15	73.1	45.1	21.1	7.4	20.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.02.2023	7:00-7:00	71.4	42.7	22.4	8.4	22.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.02.2023	7:15-7:15	71.3	43	24.5	8.1	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.02.2023	7:00-7:00	62.5	44.8	21.4	8.4	20.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.02.2023	7:15-7:15	61.8	43.5	22.8	8.3	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.02.2023	7:00-7:00	71.5	44.6	22.9	8.9	23.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.02.2023	7:15-7:15	73.5	43.2	24	7.9	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.02.2023	7:00-7:00	69.4	45.4	21.4	6.5	19.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.02.2023	7:15-7:15	68.8	43.2	22	8.3	20.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1.0); **Pb**: BDL (DL:0.1); **Ni**: BDL (DL:1.0); **As**: BDL (DL:1.0); **C_6H_6**: BDL (DL:1.0); **BaP**: BDL (DL:0.1)

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

TABLE 3.22– AAQ4 – GUDDALUR (BUFFER ZONE)

Period: Dec– Feb 2023 Location: AAQ4 - *Guddalur* Sampling Time: 24-hourly

Ambient Air Monitoring Details		**Particulate Pollutant**			**Gaseous Pollutant**					**Metals Pollutant**			**Organic Pollutant**	
Parameters		**SPM**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_2**	**NH_3**	**O_3**	**CO**	**Pb**	**Ni**	**As**	**C_6H_6**	**BaP**
NAAQ Norms		**200**	**100**	**60**	**80**	**80**	**400**	**180**	**4**	**1**	**20**	**6**	**5**	**1**
Unit		**µg/m³**	**µg/m³**	**µg/m³**	**µg/m³**	**µg/m³**	**µg/m³**	**µg/m³**	**mg/m³**	**µg/m³**	**ng/m³**	**ng/m³**	**µg/m³**	**ng/m³**
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
01.12.2022	7:00-7:00	65.3	43.8	21.4	7.5	19.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.12.2022	7:15-7:15	64.6	42.8	22.5	7.1	20.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.12.2022	7:00-7:00	63.8	41.6	20.3	6.6	21.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.12.2022	7:15-7:15	62.5	42.2	21.2	6.5	22.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.12.2022	7:00-7:00	61.8	43.6	21.3	6.3	20.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.12.2022	7:15-7:15	63.9	42.3	21.7	6.2	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.12.2022	7:00-7:00	64.8	42.8	21.5	7.2	20.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.12.2022	7:15-7:15	65.8	44.1	22.8	7.6	19.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.12.2022	7:00-7:00	63.5	44.7	22.9	7.4	19.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.12.2023	7:15-7:15	64.8	43.8	20.9	7.3	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.01.2023	7:00-7:00	62.5	42.3	21.2	6.1	20.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.01.2023	7:15-7:15	64.8	43.8	22.4	6.6	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.01.2023	7:00-7:00	66.6	42.9	23.5	6.3	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.01.2023	7:15-7:15	67.8	45.8	22.4	6.2	19.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.01.2023	7:00-7:00	66.5	41.9	20.8	7.1	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.01.2023	7:15-7:15	67.8	44.7	21.9	8.4	19.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.01.2023	7:00-7:00	67.6	42.6	22.3	8.1	20.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.01.2023	7:15-7:15	66.1	45.8	21.1	6.4	22.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.02.2023	7:00-7:00	67.4	42.9	22.4	6.6	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.02.2023	7:15-7:15	65.3	43.5	22.5	6.1	20.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.02.2023	7:00-7:00	68.5	44.4	22.4	8.4	19.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.02.2023	7:15-7:15	67.8	43.6	21.8	8.6	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.02.2023	7:00-7:00	67.5	42.9	21.9	6.4	19.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.02.2023	7:15-7:15	68.6	41.3	20.1	7.9	20.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.02.2023	7:00-7:00	66.5	41.4	22.4	6.8	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.02.2023	7:15-7:15	68.1	42.1	21	6.4	22.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1.0); **Pb**: BDL (DL:0.1); **Ni**: BDL (DL:1.0); **As**: BDL (DL:1.0); **C_6H_6**: BDL (DL:1.0); **BaP**: BDL (DL:0.1)

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

TABLE 3.23 – AAQ5 – SHOLAMTHANGAL (BUFFER ZONE)

Period: Dec– Feb 2023 Location *: AAQ5- Sholamthangal* Sampling Time: 24-hourly

Ambient Air Monitoring Details		**Particulate Pollutant**			**Gaseous Pollutant**					**Metals Pollutant**			**Organic Pollutant**	
Parameters		**SPM**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_2**	**NH_3**	**O_3**	**CO**	**Pb**	**Ni**	**As**	**C_6H_6**	**BaP**
NAAQ Norms		**200**	**100**	**60**	**80**	**80**	**400**	**180**	**4**	**1**	**20**	**6**	**5**	**1**
Unit		$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	mg/m^3	$\mu g/m^3$	ng/m^3	ng/m^3	$\mu g/m^3$	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
01.12.2022	7:00-7:00	75.2	45.3	22.4	7.5	21.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.12.2022	7:15-7:15	72.5	44.5	22.2	7.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.12.2022	7:00-7:00	73.2	45.6	23.3	5.6	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.12.2022	7:15-7:15	72.5	42.4	21.2	5.5	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.12.2022	7:00-7:00	68.4	43.5	22.3	5.3	19.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.12.2022	7:15-7:15	69.5	44.3	22.5	5	18.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.12.2022	7:00-7:00	70.4	42.8	21.4	6.3	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.12.2022	7:15-7:15	72.5	43.1	22	6.6	20.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.12.2022	7:00-7:00	71.5	44.5	22.3	7.4	20.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.12.2023	7:15-7:15	76.8	42.3	20.4	7.3	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.01.2023	7:00-7:00	74.5	41.1	21.2	7.1	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.01.2023	7:15-7:15	72.8	43.6	22.4	7.4	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.01.2023	7:00-7:00	70.6	42.3	21	7.3	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.01.2023	7:15-7:15	68.5	45.2	22.4	6.5	20.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.01.2023	7:00-7:00	66.4	42.4	21.8	7.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.01.2023	7:15-7:15	64.5	44.3	22.3	7.4	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.01.2023	7:00-7:00	63.4	44.6	22.6	6.6	20.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.01.2023	7:15-7:15	64.4	45.8	22.5	7.4	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.02.2023	7:00-7:00	65.4	42.6	21.2	8.2	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.02.2023	7:15-7:15	64.3	43	21.5	7.2	20.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.02.2023	7:00-7:00	65.5	42.3	22.6	7.3	19.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.02.2023	7:15-7:15	67.8	44.6	21.8	8.2	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.02.2023	7:00-7:00	70.5	42.9	22.5	7.6	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.02.2023	7:15-7:15	72.4	41.5	20.4	7.5	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.02.2023	7:00-7:00	73.9	42.4	21.6	7.2	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.02.2023	7:15-7:15	75.2	43.5	22.4	8.1	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1.0); **Pb**: BDL (DL:0.1); **Ni**: BDL (DL:1.0); **As**: BDL (DL:1.0); **C_6H_6**: BDL (DL:1.0); **BaP**: BDL (DL:0.1)

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

TABLE 3.24 – AAQ6 - POLAMBAKKAM (BUFFER ZONE)

Period: Dec– Feb 2023 *Location: AAQ6* – Polambakkam Sampling Time: 24-hourly

Ambient Air Monitoring Details		**Particulate Pollutant**			**Gaseous Pollutant**					**Metals Pollutant**			**Organic Pollutant**	
Parameters		**SPM**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_2**	**NH_3**	**O_3**	**CO**	**Pb**	**Ni**	**As**	**C_6H_6**	**BaP**
NAAQ Norms		**200**	**100**	**60**	**80**	**80**	**400**	**180**	**4**	**1**	**20**	**6**	**5**	**1**
Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	µg/m³	ng/m³	ng/m³	µg/m³	ng/m³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
01.12.2022	7:00-7:00	73.5	44.2	22.1	7.5	21.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.12.2022	7:15-7:15	72.5	42.5	21.4	7.6	22.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.12.2022	7:00-7:00	70.5	43.4	21.6	6.2	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.12.2022	7:15-7:15	71.3	41.3	20.5	6.4	19.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.12.2022	7:00-7:00	68.2	42.4	22.2	8.1	18.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.12.2022	7:15-7:15	67.5	43.3	21.3	8.2	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.12.2022	7:00-7:00	65	44.2	22.5	6.2	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.12.2022	7:15-7:15	63.2	44.3	21.3	6.3	20.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.12.2022	7:00-7:00	67.3	43.2	22.1	7.2	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.12.2023	7:15-7:15	68.3	45.4	22.2	7.1	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.01.2023	7:00-7:00	72.1	44.5	21.3	6.4	22.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.01.2023	7:15-7:15	73.6	46.3	23.4	7.2	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.01.2023	7:00-7:00	75.2	44.2	22.4	7.4	20.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.01.2023	7:15-7:15	70.2	43.3	22.3	6	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.01.2023	7:00-7:00	72.3	44.5	22.4	6.3	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.01.2023	7:15-7:15	71.2	44.3	22.3	7.2	21.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.01.2023	7:00-7:00	72.6	43.4	22.6	7.4	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.01.2023	7:15-7:15	68.2	42.3	20.7	6.6	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.02.2023	7:00-7:00	66.2	43.2	22.1	7.3	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.02.2023	7:15-7:15	64.3	44.5	22.3	7.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.02.2023	7:00-7:00	62.1	43.3	22.2	7.5	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.02.2023	7:15-7:15	60.2	44.2	22.1	7.3	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.02.2023	7:00-7:00	63.1	42.4	22.6	7.4	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.02.2023	7:15-7:15	65.3	43.6	22.4	6.4	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.02.2023	7:00-7:00	66.3	44.2	22.3	6.8	22.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.02.2023	7:15-7:15	63.1	45.2	22.2	8.6	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1.0); **Pb**: BDL (DL:0.1); **Ni**: BDL (DL:1.0); **As**: BDL (DL:1.0); **C_6H_6**: BDL (DL:1.0); **BaP**: BDL (DL:0.1)

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

TABLE 3.25 – AAQ7 - SENDIVAKKAM VILLAGE (BUFFER ZONE)

Period: Dec– Feb 2023 *Location: AAQ7– Sendivakkam* Sampling Time: 24-hourly

Ambient Air Monitoring Details		**Particulate Pollutant**			**Gaseous Pollutant**					**Metals Pollutant**			**Organic Pollutant**	
Parameters		**SPM**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_2**	**NH_3**	**O_3**	**CO**	**Pb**	**Ni**	**As**	**C_6H_6**	**BaP**
NAAQ Norms		**200**	**100**	**60**	**80**	**80**	**400**	**180**	**4**	**1**	**20**	**6**	**5**	**1**
Unit		$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	mg/m^3	$\mu g/m^3$	ng/m^3	ng/m^3	$\mu g/m^3$	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
01.12.2022	7:00-7:00	67.4	45.2	23.1	7.6	19.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.12.2022	7:15-7:15	68.3	45.5	24.2	7.7	20.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.12.2022	7:00-7:00	69.2	43.6	24.3	7.2	18.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.12.2022	7:15-7:15	68.4	45.3	24.5	8.3	20.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.12.2022	7:00-7:00	67.5	47.1	23.1	9.2	21.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.12.2022	7:15-7:15	68.6	47.6	23.3	9.1	22.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.12.2022	7:00-7:00	66.5	42.8	23	8.1	19.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.12.2022	7:15-7:15	68.4	44.6	24.3	6.2	17.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.12.2022	7:00-7:00	67.6	43.8	24.4	7.8	17.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.12.2023	7:15-7:15	68.7	44.9	23.2	8.3	20.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.01.2023	7:00-7:00	69.4	45.5	23.5	7.3	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.01.2023	7:15-7:15	68.4	46.6	24.3	7.1	18.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.01.2023	7:00-7:00	68.5	42.5	24.2	7.3	22.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.01.2023	7:15-7:15	65.4	45.8	24.4	6.8	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.01.2023	7:00-7:00	69.3	44	23.4	6.6	20.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.01.2023	7:15-7:15	69.7	45.6	24	8.1	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.01.2023	7:00-7:00	67.4	46.2	24.3	7.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.01.2023	7:15-7:15	65.6	46.3	24.4	6.2	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.02.2023	7:00-7:00	64.3	43.2	23.1	7.3	20.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.02.2023	7:15-7:15	67.4	42.9	24.3	7.5	19.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.02.2023	7:00-7:00	65.3	43.5	24.2	8.4	22.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.02.2023	7:15-7:15	68.2	44.9	23.4	7.6	19.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.02.2023	7:00-7:00	72.5	45.8	24.5	7.4	19.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.02.2023	7:15-7:15	71.9	47.7	25.3	7.9	20.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.02.2023	7:00-7:00	72.4	48.6	24.2	6.5	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.02.2023	7:15-7:15	70.6	45.1	23.4	6.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1.0); **Pb**: BDL (DL:0.1); **Ni**: BDL (DL:1.0); **As**: BDL (DL:1.0); **C_6H_6**: BDL (DL:1.0); **BaP**: BDL (DL:0.1)

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

TABLE 3.26 – AAQ8 - MOREKUPPAM VILLAGE (BUFFER ZONE)

Period: Dec– Feb 2023 *Location: AAQ8– Morekuppam* Sampling Time: 24-hourly

Ambient Air Monitoring Details		**Particulate Pollutant**			**Gaseous Pollutant**					**Metals Pollutant**			**Organic Pollutant**	
Parameters		**SPM**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_2**	**NH_3**	**O_3**	**CO**	**Pb**	**Ni**	**As**	**C_6H_6**	**BaP**
NAAQ Norms		**200**	**100**	**60**	**80**	**80**	**400**	**180**	**4**	**1**	**20**	**6**	**5**	**1**
Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	µg/m³	ng/m³	ng/m³	µg/m³	ng/m³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
01.12.2022	7:00-7:00	64.5	20.5	39.5	6.2	20.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.12.2022	7:15-7:15	62.4	20.8	40.6	7.8	20.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.12.2022	7:00-7:00	69.3	20	40.5	6.6	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.12.2022	7:15-7:15	67.7	21.9	40.8	5.4	21.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.12.2022	7:00-7:00	66.9	20.5	40.5	5.7	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.12.2022	7:15-7:15	67.6	21.8	40.1	6.3	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.12.2022	7:00-7:00	68.4	20.6	41.6	6.9.	21.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.12.2022	7:15-7:15	69.8	20.3	39.5	5.3	21.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.12.2022	7:00-7:00	67.4	20.5	40.5	5.4	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.12.2023	7:15-7:15	66.9	19.1	40.1	5.7.	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.01.2023	7:00-7:00	68.7	20.8	41.3	5.4	20.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.01.2023	7:15-7:15	67.8	21.2	41.6	6.9	20.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.01.2023	7:00-7:00	66.8	21.5	40.6	5.2	21.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.01.2023	7:15-7:15	69.4	21.8	41.5	5.4	20.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.01.2023	7:00-7:00	65.2	20.4	41.6	5.3	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.01.2023	7:15-7:15	67.4	20.9	41.9	7.6	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.01.2023	7:00-7:00	68.8	21.4	41.8	7.5	22.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.01.2023	7:15-7:15	69.3	21.9	40.5	7.9	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.02.2023	7:00-7:00	67.9	19.1	41.6	7.2	22.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.02.2023	7:15-7:15	66.4	19.3	42.8	7.8	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.02.2023	7:00-7:00	69.9	20.4	41.3	7.6	20.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.02.2023	7:15-7:15	68.4	20.9	42.6	7.5	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.02.2023	7:00-7:00	67.2	21.4	42.9	7.1	24.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.02.2023	7:15-7:15	66.6	20.1	42.8	7.2	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.02.2023	7:00-7:00	69.4	20.4	43.9	7.5	25.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.02.2023	7:15-7:15	67.7	20.1	42.8	6.7	20.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1.0); **Pb**: BDL (DL:0.1); **Ni**: BDL (DL:1.0); **As**: BDL (DL:1.0); **C_6H_6**: BDL (DL:1.0); **BaP**: BDL (DL:0.1)

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

TABLE 3.27– ABSTRACT OF AMBIENT AIR QUALITY DATA

1	**Parameter**	**PM2.5**	**PM10**	**SO_2**	**NO_2**
2	No. of Observations	260	260	260	260
3	10^{th} Percentile Value	20.9	21.4	5.9	19.4
4	20^{th} Percentile Value	21.3	41.5	6.3	19.9
5	30^{th} Percentile Value	21.6	42.4	6.6	20.5
6	40^{th} Percentile Value	22.2	42.8	7.2	20.8
7	50^{th} Percentile Value	22.4	43.3	7.3	21.4
8	60^{th} Percentile Value	22.5	43.6	7.5	21.5
9	70^{th} Percentile Value	23.1	44.3	7.6	21.8
10	80^{th} Percentile Value	24.3	44.7	8.1	22.4
11	90^{th} Percentile Value	40.5	45.6	8.4	22.7
12	95^{th} Percentile Value	41.6	46.1	8.6	23.4
13	98^{th} Percentile Value	42.8	47.6	9.2	24.5
14	Arithmetic Mean	27.6	42.1	7.5	21.7
15	Geometric Mean	26.4	41.3	7.5	21.6
16	Standard Deviation	9.1	7.1	1.0	1.5
17	Minimum	20.9	21.4	5.9	19.4
18	Maximum	42.8	47.6	9.2	24.5
19	**NAAQ Norms***	**100.0**	**60.0**	**80.0**	**80.0**
	% Values exceeding Norms*	0.0	0.0	0.0	0.0

Legend: $PM_{2.5}$-Particulate Matter size less than 2.5 µm; PM_{10}-Respirable Particulate Matter size less than 10 µm; SO_2-Sulphur dioxide; NO_2-Nitrogen Dioxide; CO-Carbon monoxide; O_3-Ozone; NH_3-Ammonia; Pb-Particulate Lead; As-Particulate Arsenic; Ni-Particulate Nickel; C_6H_6-Benzene & BaP- Benzo (a) pyrene in particulate phase levels were monitored below their respective detectable limits.

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

FIGURE 3.16: BAR DIAGRAM OF SUMMARY OF AIR QUALITY MODEL(AAQ1-AAQ8)

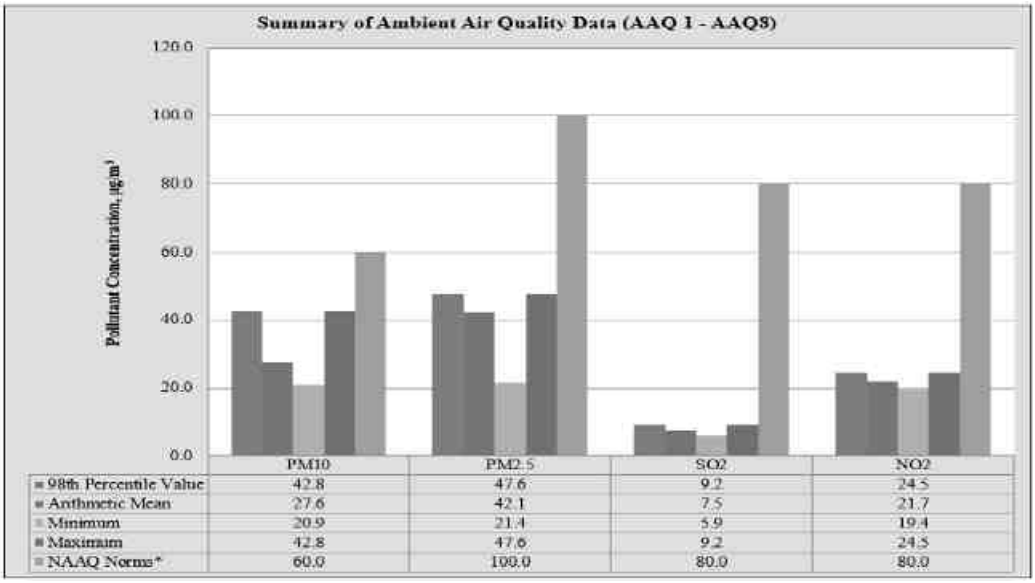
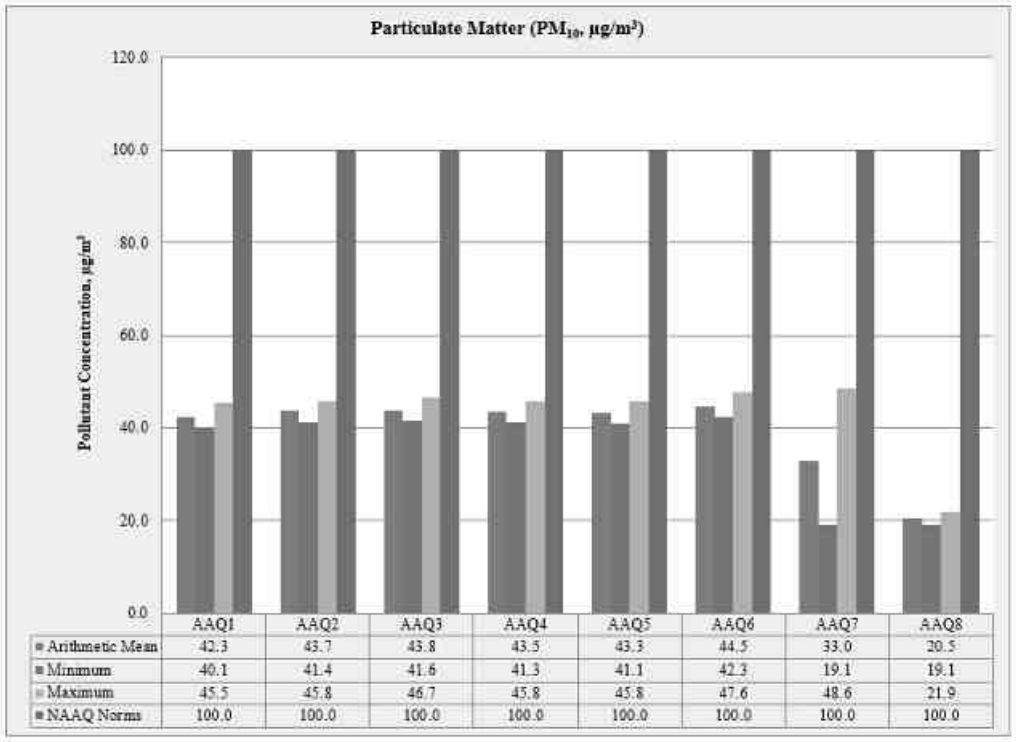
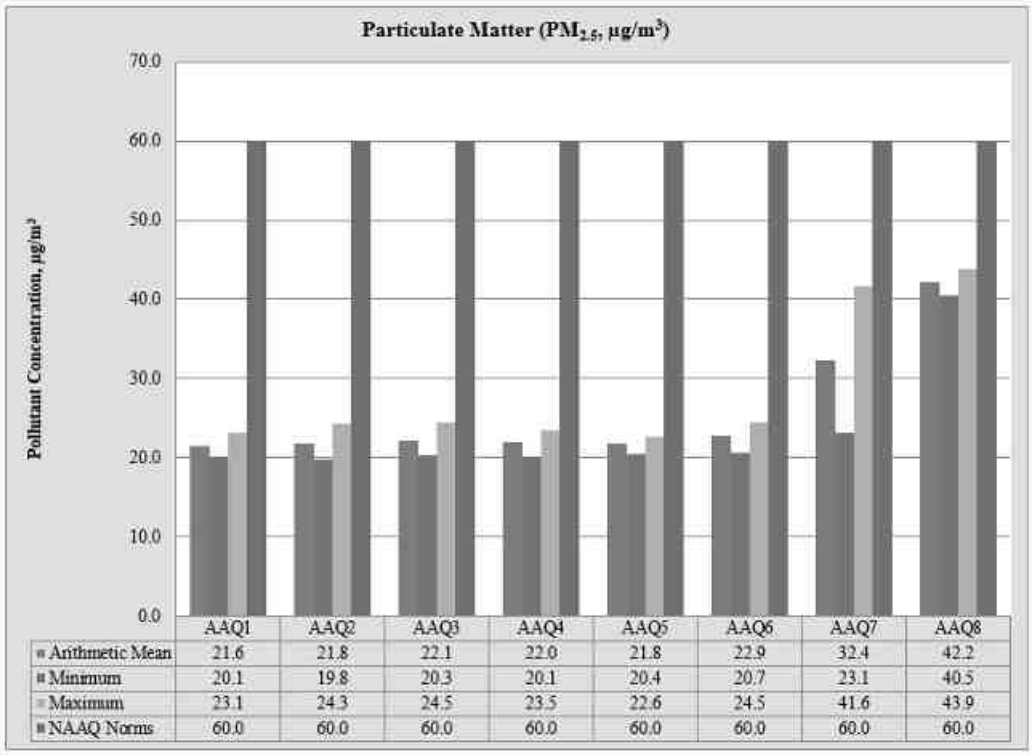


FIGURE 3.17: BAR DIAGRAM OF PARTICULATE MATTER (PM_{10})



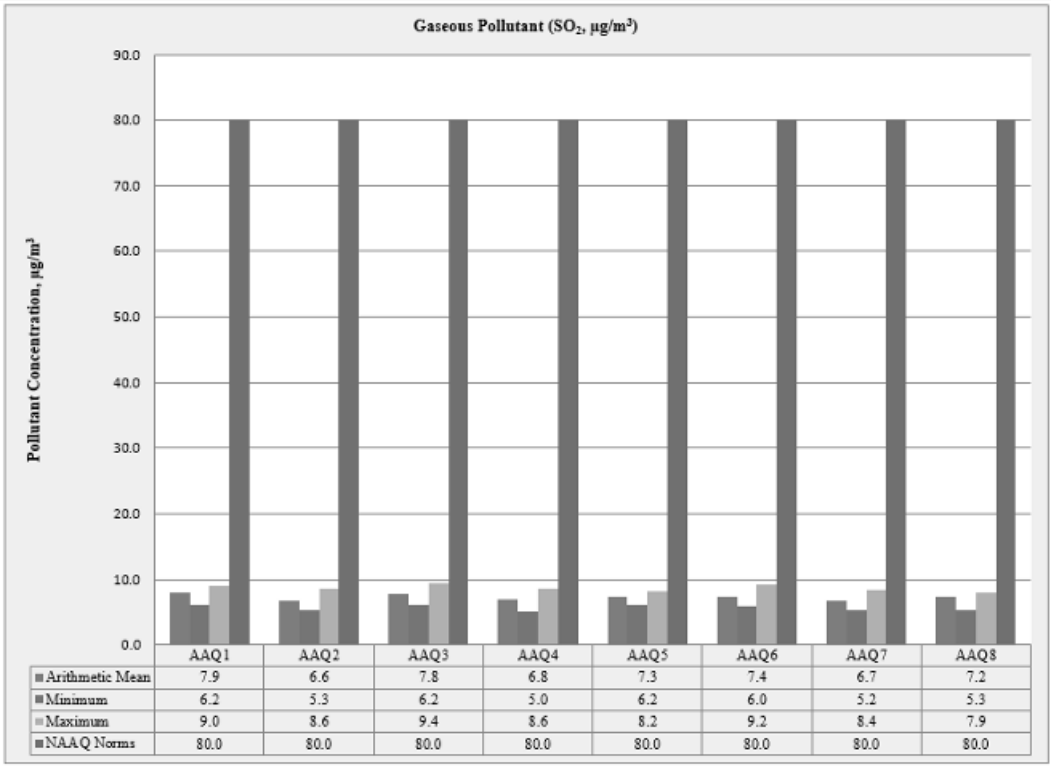
	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	42.3	43.7	43.8	43.5	43.3	44.5	33.0	20.5
Minimum	40.1	41.4	41.6	41.3	41.1	42.3	19.1	19.1
Maximum	45.5	45.8	46.7	45.8	45.8	47.6	48.6	21.9
NAAQ Norms	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

FIGURE 3.17A : BAR DIAGRAM OF PARTICULATE MATTER (PM2.5)



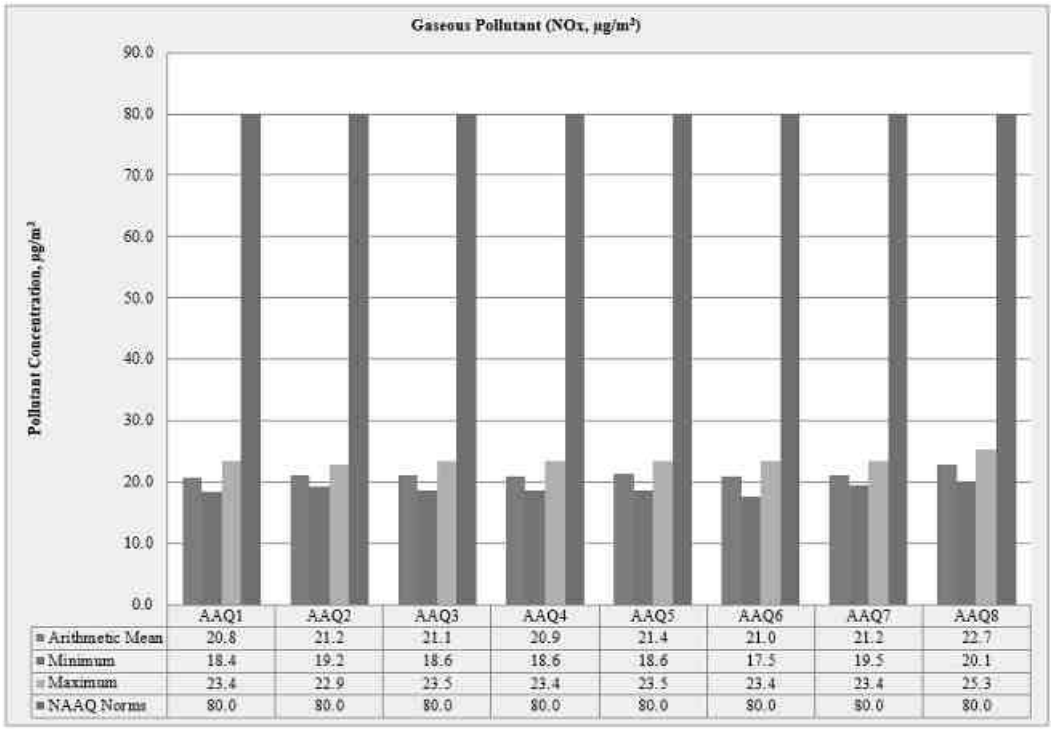
	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	21.6	21.8	22.1	22.0	21.8	22.9	32.4	42.2
Minimum	20.1	19.8	20.3	20.1	20.4	20.7	23.1	40.5
Maximum	23.1	24.3	24.5	23.5	22.6	24.5	41.6	43.9
NAAQ Norms	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0

FIGURE 3.18: BAR DIAGRAM OF PARTICULATE MATTER (SO_2)



	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	7.9	6.6	7.8	6.8	7.3	7.4	6.7	7.2
Minimum	6.2	5.3	6.2	5.0	6.2	6.0	5.2	5.3
Maximum	9.0	8.6	9.4	8.6	8.2	9.2	8.4	7.9
NAAQ Norms	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0

FIGURE 3.18A: BAR DIAGRAM OF PARTICULATE MATTER (NO_2)



	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	20.8	21.2	21.1	20.9	21.4	21.0	21.2	22.7
Minimum	18.4	19.2	18.6	18.6	18.6	17.5	19.5	20.1
Maximum	23.4	22.9	23.5	23.4	23.5	23.4	23.4	25.3
NAAQ Norms	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0

3.4.6 Interpretations & Conclusion

As per monitoring data, PM_{10} ranges from 19.1 µg/m^3 to 48.6 µg/m^3, $PM_{2.5}$ data ranges from 19.8 µg/m^3 to 43.9 µg/m^3, SO_2 ranges from 5.0 µg/m^3 to 9.4 µg/m^3 and NO_2 data ranges from 21.2 µg/m^3 to 25.3 µg/m^3. The concentration levels of the above criteria pollutants were observed to be well within the limits of NAAQS prescribed by CPCB.

The minimum & maximum concentrations of PM_{10} were found to be 19.1 µg/m^3 in Morekuppam village & 48.6 µg/m^3 in Sendivakkam village respectively. The minimum & maximum concentrations of $PM_{2.5}$ were found to be 19.8 µg/m^3 in Core zone & 43.9 µg/m^3 in Morekuppam village area respectively. The maximum concentration in the core zone is due to the cluster of quarries situated within 500m radius.

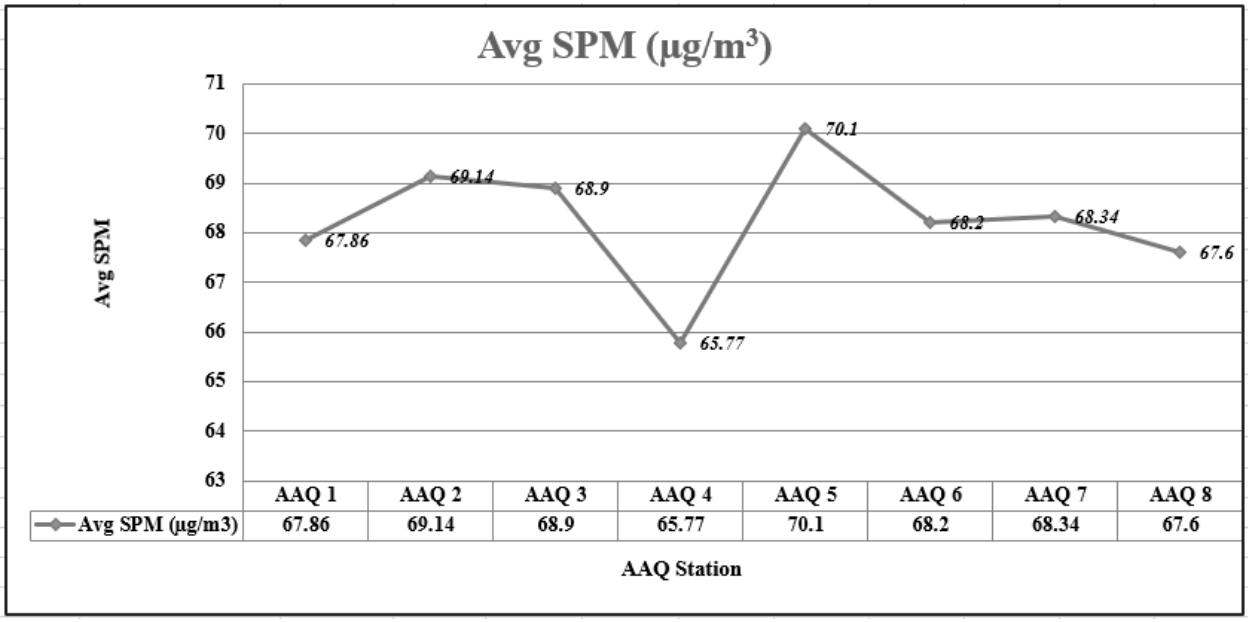
3.4.7 FUGITIVE DUST EMISSION –

Fugitive dust was recorded at 10 AAQ monitoring stations for 30 days average during the study period.

TABLE 3.28– AVERAGE FUGITIVE DUST SAMPLE VALUES IN µg/m^3

AAQ Locations	Avg SPM (µg/m^3)
AAQ 1	67.86
AAQ 2	69.14
AAQ 3	68.90
AAQ 4	65.77
AAQ 5	70.1
AAQ 6	68.20
AAQ 7	68.34
AAQ 8	67.60

Source: Onsite monitoring/ sampling by EHS360 Labs Private Limited

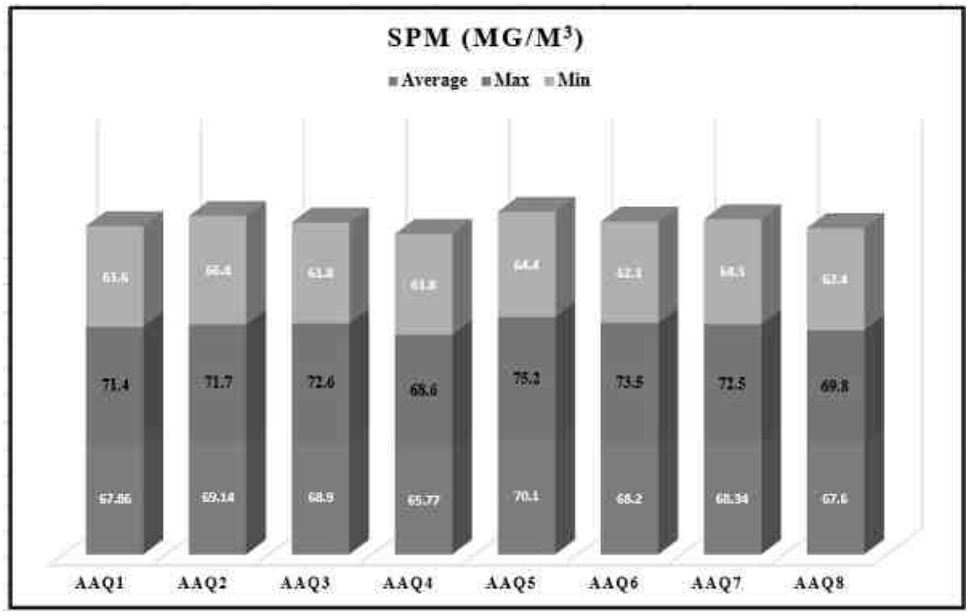


Source: Line Diagram of Table 3.29

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

SPM (µg/m^3)	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Average	67.86	69.14	68.9	65.77	70.1	68.2	68.34	67.6
Max	71.4	71.7	72.6	68.6	75.2	73.5	72.5	69.8
Min	61.6	66.4	61.8	61.8	64.4	62.1	64.3	62.4

Source: Calculations from Lab Analysis Reports



Source: Bar Diagram of table 3.30

3.5 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.

3.5.1 Identification of Sampling Locations

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

TABLE 3.30– DETAILS OF SURFACE NOISE MONITORING LOCATIONS

S. No	Location code	Monitoring Locations	Distance & Direction	Coordinates
1	N-1	Core Zone	Project Area	12°28'36.71"N 79°50'54.55"E
2	N-2	Core Zone	Project Area	12°28'41.52"N 79°51'3.80"E
3	N-3	Unamalai	1.2km SW	12°28'17.37"N 79°50'16.70"E
4	N-4	Guddalur	3km NW	12°29'33.53"N 79°49'35.40"E
5	N-5	Sholamthangal	6km NE	12°29'35.38"N 79°54'21.83"E
6	N-6	Polambakkam	6km SE	12°25'38.49"N 79°52'51.80"E
7	N-7	Sendivakkam	4.8km SW	12°27'27.22"N 79°48'28.94"E
8	N-8	Morekuppam	2.2km North	12°29'48.49"N 79°51'0.46"E

Source: On-site monitoring/sampling by EHS360 Labs Private Limited in association with GEMS

3.5.2 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.

Leq = 10 Log L / T∑ (10Ln/10)

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

T = Time interval of observation

3.5.3 Analysis of Ambient Noise Level in the Study Area

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 3.6

Day time : 6:00 hours to 22.00 hours.

Night time : 22:00 hours to 6.00 hours

TABLE 3.31 – NOISE MONITORING RESULTS IN CORE AND BUFFER ZONE

S. No	Locations	Noise level (dB (A) Leq)		Ambient Noise Standards
		Day Time	Night Time	
1	Core Zone	43.4	35.8	**Industrial Day Time- 75 dB (A) Night Time- 70 dB (A)**
2	Core Zone	42.9	34.7	
3	Unamalai	42.2	34.8	
4	Guddalur	40.6	34.2	
5	Sholamthangal	41.0	34.7	**Residential Day Time– 55 dB (A) Night Time- 45 dB (A)**
6	Polambakkam	41.3	35.8	
7	Sendivakkam	40.8	36.4	
8	Morekuppam	41.0	38.2	

Source: On-site monitoring/sampling by EHS360 Labs Private Limited in association with GEMS

FIGURE 3.19: NOISE MONITORING STATIONS AROUND 10 KM RADIUS

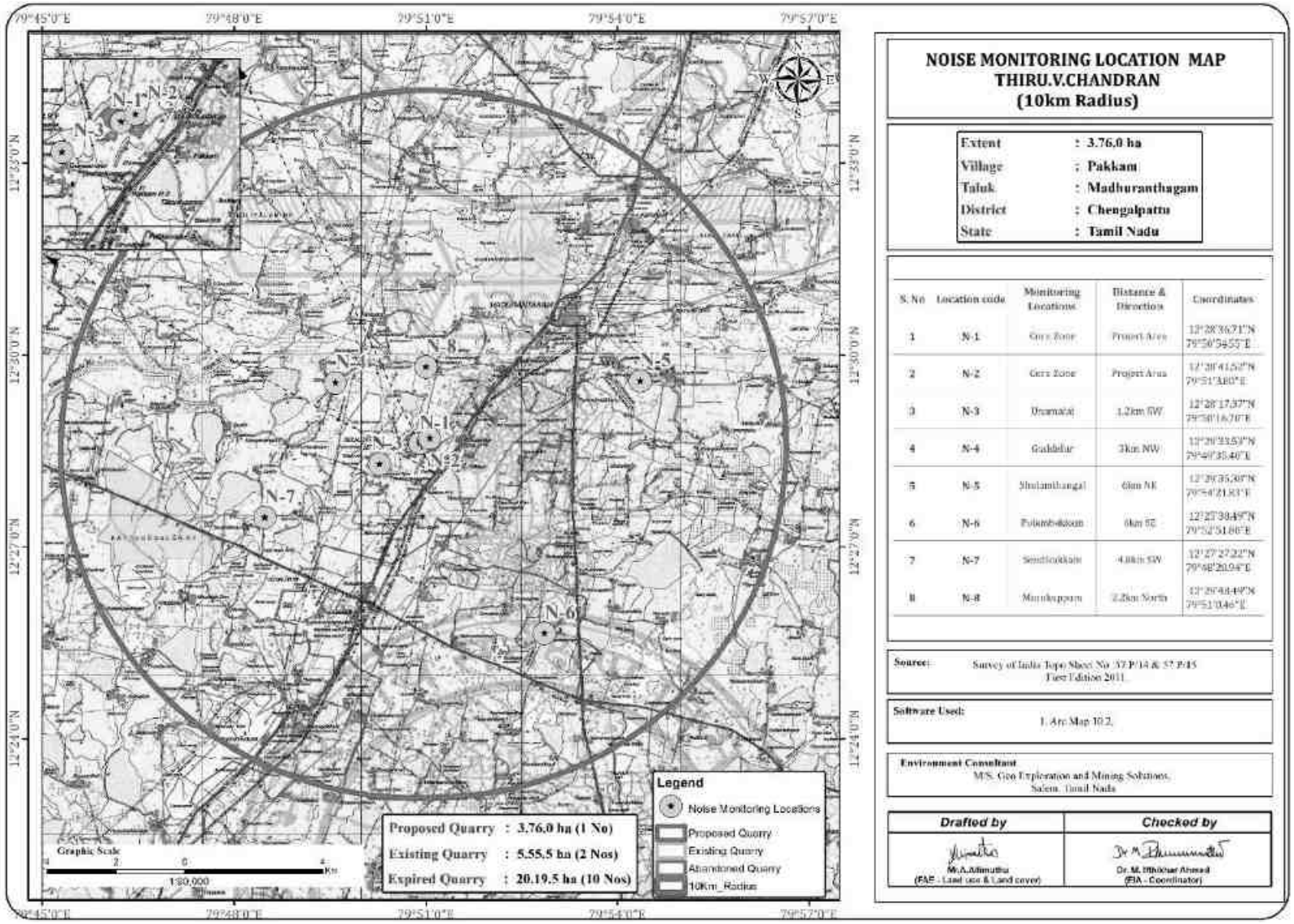
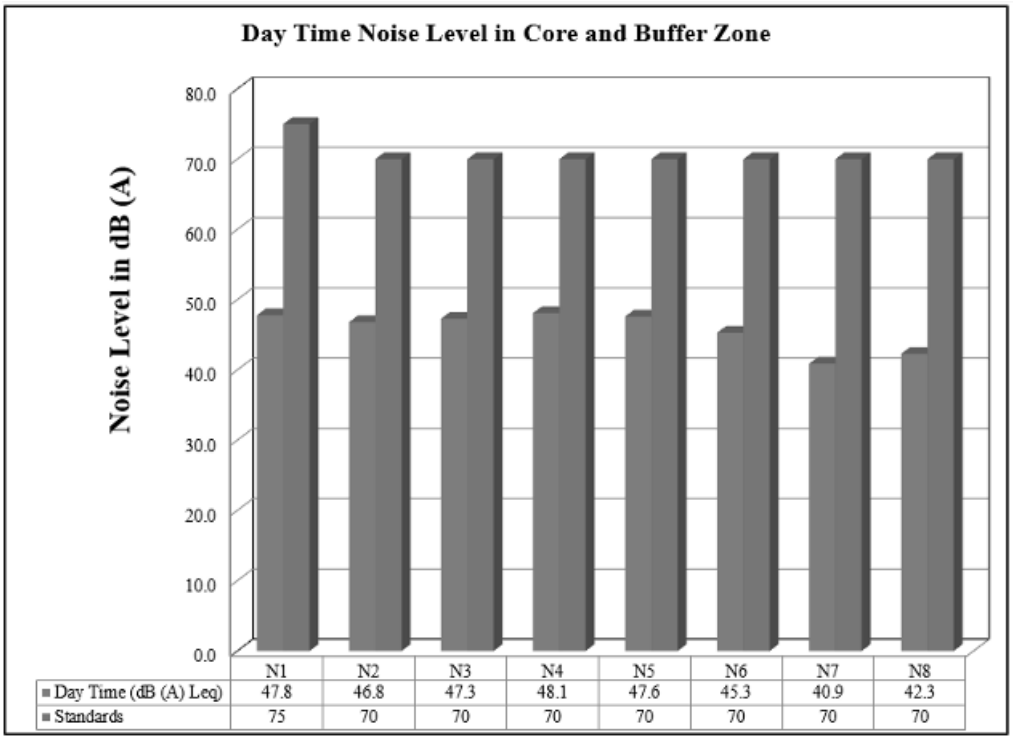


FIGURE 3.20: DAY & NIGHT TIME NOISE LEVELS IN CORE AND BUFFER ZONE



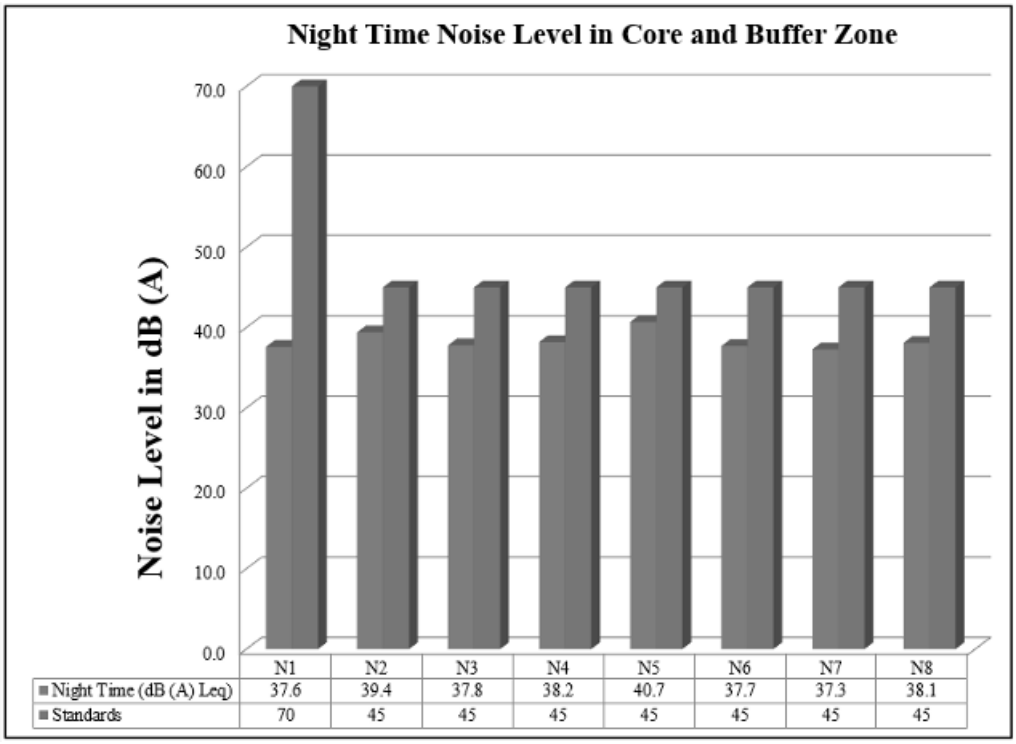


FIGURE 3.21: SITE PHOTOGRAPHS FOR NOISE IN CORE AND BUFFER ZONE

Gudalur

3.5.4 Interpretation & Conclusion:

Ambient noise levels were measured at 8 (eight) locations around the project area considering cluster quarries. Noise levels recorded in core zone during day time were from 46.8 – 47.8 dB (A) Leq and during night time were from 37.6 – 39.4 dB (A) Leq. Noise levels recorded in buffer zone during day time were from 40.9 – 48.1dB (A) Leq and during night time were from 37.3 – 40.7 dB (A) Leq.

The values of noise observed in some of the areas are primarily owing to quarrying activities due to cluster of quarries within 500m radius, movement of vehicles and other anthropogenic activities. Noise monitoring results reveal that the maximum & minimum noise levels at day time were recorded in the range of 46.8 dB(A) in Project area and 47.8 dB(A) in Core zone area and 37.6dB(A) in core zone area & 39.4dB(A) in Project area respectively in night time. Thus, the noise level for Industrial and Residential area meets the requirements of CPCB.

3.6 ECOLOGY AND BIO DIVERSITY ENVIRONMENT

There is no Reserved Forest land, National Parks, Eco sensitive areas, Wild life sanctuaries within the radius of 10km.

The core area extent of **3.76. Ha** of Rough Stone and Gravel quarry has an impact on the diversity of flora and fauna of the surrounding area. But present work was carried out the on detailed study of the impacts of Rough stone and Gravel quarry on the ecology and biodiversity of the core lease area with the proper mitigation and sustainable management plan. The Core mining area is situated with exhibits plain topography. whereas in the buffer zone some places agricultural land is dominated. The following methods were applied during the baseline study of flora, fauna, and diversity assessment.

3.6.1 Methodology Adopted & Objective

To achieve the above objective, a detailed study of the area was undertaken in 10 km radius area with the proposed quarry area. The different methods adopted were as follows:

a) Identification and listing of flora and fauna are important as per the Wildlife (Protection) Act 1972.
b) 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.
c) To identify the impacts of mining on agricultural lands and how it affects.

d) Proper collection of information about wildlife Sanctuaries/ national parks/ biosphere reserves of the project area.

e) Devise management & conservation measures for biodiversity.

3.6.2 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 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.

3.6.3 Part I Field Sampling Techniques

1 Transect walk – Birds

Six no of 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.

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 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 for search. VES technique is one of the simplest methods, and an appropriate technique for both inventory and monitoring Herpetofauna (Heyer et al. 1994).

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.

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 coloured 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).

3.6.5 Flora

The quadrat sampling technique was used for sampling vegetation. Sampling quadrats of regular shape of dimensions 10 × 10 m, 5 × 5 m, and 1 × 1 m, were nested within each other and were defined as the units for sampling the area and measuring the diversity of trees, Shrub, and herbs respectively.

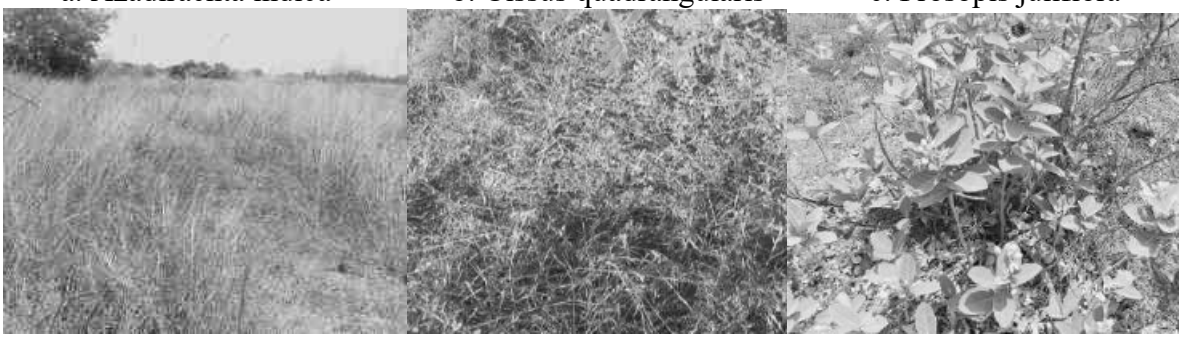
TABLE 3.32 – FLORA

SI.No	English Name	Vernacular Name	Scientific Name	Family Name
Trees				
1.	Neem	Vembu	*Azadirachta indica*	Meliaceae
2.	Velvet mesquite	Mullu maram	*Prosopis juliflora*	Fabaceae
3.	Wild Date Palm	Ichamaram	*Phoenix sylvestris*	Arecaceae
4.	Chinesh cheery	Thenpazham	*Muntingia calabura*	Tiliaceae
5.	Noni	Nuna maram	*Morinda citrifolia*	Rubiaceae
6.	Black plum	Navalmaram	*Sygygium cumini*	Myrtaceae
7.	Millettia pinnata	Pongam oiltree	*Pongamia pinnata*	Fabaceae
8.	Asian Palmyra palm	Panai maram	*Borassus flabellifer*	Arecaceae
Shrubs				
9.	Touch-me-not	Thottalchinungi	*Mimosa pudica*	Mimosaceae
10.	Ipomoea cornea	Neivelikattamanaku	*Ipomoea cornea*	Convolvulaceae
11.	Avaram	Avarai	*Senna auriculata*	Fabaceae
12.	Milk Weed	Erukku	*Calotropis gigantea*	Apocynaceae

Herbs				
13.	Common leucas	Thumbai	*Leucas aspera*	Lamiaceae
14.	Devil's thorn	Nerunji	*Tribulus terrestris*	Zygophyllales
15.	Yellow-fruit Nightshade	Kantang kathrikai	*Solanum virginianum*	Solanaceae
16.	Cleome viscosa	Nai kadugu	*Celome viscosa*	Capparidaceae
17.	Fish poison	Kolinchi	*Tephrosia purpurea*	Fabaceae
18.	Coat buttons	Thatha poo	*Tridax procumbens*	Asteraceae
19.	Indian Catmint	Pei viratti	*Anisomeles malabarica*	Lamiaceae
20.	Pignut	-	*Mesosphaerum suaveolens*	Lamiaceae
Climber				
21.	Stemmed vine	Perandai	*Cissus quadrangularis*	Vitaceae
22.	Stinking passionflower	Poonai puduku chedi	*Passiflora foetida L*	Passifloraceae
Grasses				
23.	Indian doab	Arugampul	*Cynodon dactylon*	Poaceae
24.	Eragrostis	Pullu	*Eragrostis ferruginea*	Poaceae
25.	Great brome	Thodappam	*Bromus diandrus*	Poaceae

FIGURE 3.23: FIELD IMAGERY OF FLORA STUDY

a. Azadirachta indica b. Cissus quadrangularis c. Prosopis juliflora

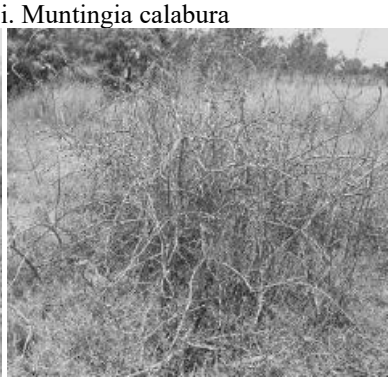


d. Bromus diandrus e. Cynodon dactylon f. Calotropis gigantea

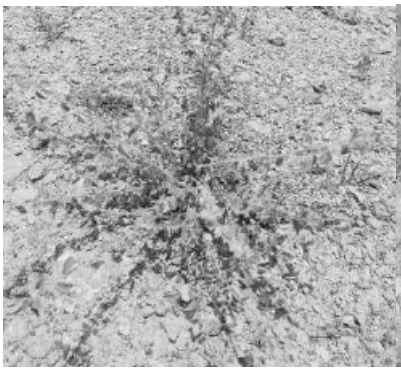


g. Morinda citrifolia h. Borassus flabellifer i. Muntingia calabura





j. Pongamia pinnata k. Phoenix sylvestris l. Ipomoea cornea



m. Mesosphaerum suaveolens n. Anisomeles malabarica o. Sygygium cumini

TABLE 3.33 – Flora in Buffer Zone of Thiru.V. Chandran, Rough stone and Gravel quarry

SI.No	Scientific Name	Family Name	Local Name	Resource use type *(E,M,EM)
Trees				
1.	Tamarindus indica	Legumes	Puliyamaram	EM
2.	Ficus religiosa	Moraceae	Arasanmaram	M
3.	Azadirachta indica	Meliaceae	Vembu	M
4.	Muntingia calabura	Tiliaceae	Thenpazham	EM
5.	Cocos nucifera	Arecaceae	Thennai maram	EM
6.	Borassus flabellifer	Arecaceae	Panai maram	E
7.	Musa	Musaceae	Vazhaimaram	EM
8.	Mangifera indica	Anacardiaceae	Manga	E
9.	Phoenix sylvestris	Arecaceae	Ichamaram	EM
10.	Pongamia pinnata	Fabaceae	Pongam oiltree	EM

11.	Ficus benghalensis	Moraceae	Alamaram	E
12.	Sygygium cumini	Myrtaceae	Navalmaram	EM
13.	Bambusa bambo	Poaceae	Moonghil	E
14.	Ficus recemosa	Moraceae	Athi	EM
15.	Vachellia nilotica	Fabaceae	Karuvelam	E
16.	Lawsonia inermis	Lythraceae	Marudaani	EM
17.	Tectona grandis	Verbenaceae	Thekku	E
18.	Psidium guajava	Myrtaceae	Koyya	EM
19.	Ziziphus mauritiana	Rhamnaceae	Elanthai maram	EM
20.	Emblica officinalis	Phyllanthaceae	Nelli	EM
21.	Morinda citrifolia	Rubiaceae	Nuna maram	M
22.	Sygygium cumini	Myrtaceae	Navalmaram	EM
23.	Manilkara zapota	Sapotaceae	Sapota	E
24.	Calophyllu inophyllum	Calophyllaceae	Punnai	M
25.	Carica papaya L	Caricaceae	Pappali maram	EM
26.	Vachellia nilotica	Fabaceae	Karuvelam maram	M
27.	Vitex negundo	Verbenaceae	Nochi	E
28.	Annona reticulata	Annonaceae	Seethapazham	E
29.	Murraya koenigii	Asclepiadaceae	Velipparuthi	EM
30.	Citrus lemon	Rutaceae	Ezhumuchaipalam	EM
31.	Eucalyptus globules	Myrtaceae	Eucalyptus	EM
Herbs				
1.	Leucas aspera	Lamiaceae	Thumbai	M
2.	Acalypha indica	Euphorbiaceae	Kuppaimeni	M
3.	Eclipta prostata	Asteraceae	Karisilanganni	EM
4.	Euphorbia hirta	Euphorbiaceae	Amman pacharisi	M
5.	Centella asiatica	Apiaceae	Vallarai	EM
6.	Anisomeles malabarica	Lamiaceae	Pei viratti	M
7.	Celome viscosa	Capparidaceae	Nai kadugu	M
8.	Phyllanthus amarus	Phyllanthaceae	Kilanelli	M
9.	Commelina benghalensis	Commelinaceae	Kanamvazha	M
10.	Achyranthes aspera	Amaranthaceae	Nayuruv	M
11.	Mesosphaerum suaveolens	Lamiaceae	-	M
12.	Boerheavia diffusa	Nyctaginaceae	Mukkarattai Keerai	M
13.	Ocimum tenuiflorum	Lamiaceae	Thulasi	M
14.	Cyperus rotundus	Cyperaceae	Korai	NE
15.	Boerhavia diffusa	Nyctaginaceae	Mukurattai	M
16.	Tridax procumbens	Asteraceae	Veetukaayapoondu	M
17.	Cynodon dactylon	Poaceae	Arugampul	E
18.	Solanumnigrum	Solanaceae	Manathakkali	EM
19.	Cyperus compressus	Cyperaceae	Kunnakora	NE
Shrubs				
1.	Solanum torvum	Solanaceae	Sundaika	EM
2.	Phoenix pusilla	Arecaceae	Icham	EM
3.	Abutilon indicum	Meliaceae	Thuthi	M
4.	Ziziphus oenoplia	Rhamnaceae	Surai Ilantai	EM
5.	Senna auriculata	Fabaceae	Avarai	M
6.	Calotropis procera	Asclepiadaceae	Vellerukku	M
7.	Ziziphus nummularia	Rhamnaceae	Narielandai	M
8.	Nerium indicum	Apocynaceae	Arali	M
9.	Ipomoea cornea	Convolvulaceae	Neivelikattamanaku	E
10.	Hibiscu rosa-sinensis	Malvaceae	Chemparuthi	EM
11.	Datura metel	Solanaceae	Umathai	M

12.	Jatropha curcas	Euphorbiaceae	Kattamanakku	EM
13.	Calotropis gigantea	Apocynaceae	Erukku	M
14.	Abrus precatorius	Fabaceae	Kundumani	M
15.	Xoracoc cinea	Rubiaceae	Idlipoo	M
16.	Mimosa pudica	Mimosaceae	Thottalchinungi	M
17.	Lantana camara	Verbenaceae	Unni chedi	M
Climber				
1.	Jasminum augustifolium	Oleaceae	Malli	EM
2.	Cissus quadrangularis	Vitaceae	Perandai	M
3.	Lagenaria siceraria	Cucurbitaceae	Sorakkai	EM
4.	Coccinia grandis	Cucurbitaceae	Kovai	M
5.	Clitoriaternatia	Fabaceae	Sangupoo	M
6.	Solanum trilobatum	Solanaceae	Thuthuvelai	EM
7.	Trichosanthes dioica	Cucurbitaceae	Kovakkai	EM
8.	Passiflora foetida	Passifloraceae	Sirupunaikkali	EM
9.	Clitoria ternatea	Fabaceae	Karkakartum	M

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

3.6.6 Flora Composition in the Buffer Zone

The buffer region has a similar type of habitat, but it has a wider variety of vegetation than the core zone area. The lease-applied area is exhibit plain topography. It contains a total of 76 species that have been recorded from the buffer zone. The floral (76) varieties among them Trees 31, herbs 19, shrubs 17, and Climbers 9, were identified. The result of the buffer zone of flora studies shows that Fabaceae and Arecacea, Myrtaceae is the main dominating species in the study area mentioned in Table No.3.33 Horticulture and agricultural land are untouched. There are no Rare, Endangered, and Threatened Flora species in the mining area and their surrounding study area. Details of flora with the scientific name were mentioned in Table No.3.33

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

There are no National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar sites, Tiger/Elephant Reserves/(existing as well as proposed) within 10 km of the mine lease area. There are no protected forests within the project area. Hence submission of clearance from the National Board of Wildlife does not arise. No Wildlife Sanctuary in the study area. In addition, No Biosphere Reserves, Wildlife corridors, or, Tiger / Elephant reserves within 10 km of the project area. No protected (PF) forests either in the mine lease area or in the buffer zone. Thus, no forest land is involved in any manner.

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. 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.

3.6.7 Fauna

3.6.7.1 Fauna Composition in the Core Zone

A total of 22 varieties of species were observed in the Core zone of Pakkam Village, Rough stone and gravel quarry (Table No.3.3) among them numbers of Insects 9, Reptiles 4, Mammals 3, and Avian 6. None of these species are threatened or endemic in the study area and surroundings. There is no Schedule I species according to the Indian

wildlife Act 1972. A total of 6 species of bird were sighted in the mining lease area. There are no critically endangered, endangered, vulnerable, and endemic species were observed.

Table No: 3.34 Fauna in the Core zone of lase area

SI.No	Scientific Name	Family Name	WPA Schedule	IUCN List
Insects				
1.	*Danaus plexippus*	Nymphalidae	Schedule IV	LC
2.	*Catopsilia pyranthe*	Peridae	NL	LC
3.	*Hieroglyphus sp*	Acrididae	NL	LC
4.	*Hamitermes silvestri*	Blattodea	NL	LC
5.	*Mantis religiosa*	Mantidae	NL	NL
6.	*Crausius morosus*	Lonchodidae	NL	LC
7.	*Sympetrum fonscolombii*	Libellulidae	NL	LC
8.	*Acraea violae*	Nymphalidae	NL	LC
9.	*Danaus genutia*	Nymphalidae	NL	NL
Reptiles				
1.	*Hemidactylus frenatus*	Gekkonidae	NL	LC
2.	*Eutropis carinata*	Scincidae	NL	LC
3.	*Calotes versicolor*	Agamidae	NL	LC
4.	*Sitanaponticeriana*	Agamidae	NL	LC
Mammals				
1.	*Rattus rattus*	Muridae	Schedule IV	LC
2.	*Mus booduga*	Muridae	Schedule IV	NL
3.	*Herpestes javanicus*	Herpestidae	Schedule II	LC
Aves				
1.	*Meropsorientalis*	Meropidae	NL	LC
2.	*Bubulcus ibis*	Ardeidae	NL	LC
3.	*Acridotheres tristis*	Sturnidae	NL	LC
4.	*Coturnix coturnix*	Phasianidae	Schedule IV	LC
5.	*Corvussplendens*	Corvidae	NL	LC
6.	*Dicrurus macrocercus*	Dicruridae	Schedule IV	LC

*NL- Not listed, LC- Least Concern

3.6.7.2. Fauna Composition in the Buffer Zone

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

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

The list of bird species recorded during field survey and literature from the study area is given in Table 3.36 The list of reptilian species recorded during field survey and literature from the study area are given in Table 3.38 The list of insect species recorded during field survey and literature from the study area are given in Table 3.37 The list of Amphibian species recorded during the field survey and literature from the study area are given in Table 3.41 and List of Butterflies identified from the project site and their conservation status is given in Table No.3.35. 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 62 species were identified from the project site. Based on habitat classification the majority of species were Insects 14, followed by birds 17, Reptiles 8, Mammals 5, amphibians 3, and Butterflies 15. A total of 17 species of bird were sighted in the study area. There are no critically endangered, endangered, vulnerable, and endemic species were observed. There are no impacts on nearby fauna species. Dominant species are mostly birds and insects, and three were observed during the extensive field visit Sphaerotheca breviceps, Euphlyctis hexadactylus, Bufomelanostictus, there is no schedule I Species in the study area. There are no critically endangered, endangered, vulnerable, and endemic species were observed.

Table 3.35 List of Fauna & Their Conservation Status (Mammals)

SI. No	Scientific Name	Common Name	IUCN Conservation Status
1.	*Funambulus palmarum*	Indian palm squirrel	LC
2.	*Mus booduga*	Indian Field Mouse	LC
3.	*Herpestes javanicus*	Asian Small Mongoose	LC
4.	*Lepus nigricollis*	Indian hare	LC
5.	*Rattus norwegicus*	Brown rat	LC

Near Threatened; VU – Vulnerable, DA – Data Deficient, NE – Not Evaluated

Table 3.36. Listed birds

SI. No	Scientific Name	Family Name	WPA Schedule	IUCN List
1.	*Eudynamys*	Cucalidae	Schedule IV	LC
2.	*Bubulcus ibis*	Ardeidae	NL	LC
3.	*Acridotheres tristis*	Sturnidae	NL	LC
4.	*Corvussplendens*	Corvidae	NL	LC
5.	*Meropsorientalis*	Meropidae	NL	LC
6.	*Pycnonotuscafer*	Pycnonotidae	Schedule IV	LC
7.	*Psittacula krameri*	Psittaculidae	NL	LC
8.	*Accipiter badius*	Accipitridae	NL	LC
9.	*Coturnix coturnix*	Phasianidae	Schedule IV	LC
10.	*Dicrurus macrocercus*	Dicruridae	Schedule IV	LC
11.	*Francolinus pondicerianus*	Phasianidae	Schedule IV	LC
12.	*Coturnix coturnix*	Phasianidae	Schedule IV	LC
13.	*Amaurornis phoenicurus*	Rallidae	NL	LC
14.	*Fulica atra*	Rallidae	Schedule IV	LC
15.	*Sphaerotheca breviceps*	Dicroglossidae	Schedule IV	LC
16.	*Rana hexadactyla*	Ranidae	Schedule IV	LC
17.	*Hoplobatrachus tigerinus*	Chordata	Schedule IV	LC

Not Evaluated (NE) Least Concern (LC) Near Threatened (NT) Endangered (E)

Table 3.37 List of insects either spotted or reported from the study area

SI. No	Scientific Name	Family	IUCN Conservation Status	IUCN List
1.	*Apis cerana*	Apidae	Schedule IV	LC
2.	*Danaus plexippus*	Nymphalidae	Schedule IV	LC
3.	*Danaus chrysippus*	Nymphalidae	Schedule IV	LC
4.	*Danaus genutia*	Nymphalidae	Schedule IV	LC
5.	*Eurythyrea austriaca*	Buprestidae	Schedule IV	NA
6.	*Sympetrum fonscolombii*	Libellulidae	NL	LC
7.	*Camponotus Vicinus*	Formicidae	NL	NL
8.	*Ceratogomphus pictus*	Gomphidae	Schedule IV	-
9.	*Danainae*	Nymphalidae	NL	LC
10.	*Euploea core*	Nymphalidae	Schedule IV	LC
11.	*Mantis religiosa*	Mantidae	NL	NL
12.	*Hieroglyphus sp*	Acrididae	NL	LC
13.	*Zizina Otis indica*	Lycaenidae	Schedule IV	LC
14.	*Tirumala limniace*	Nymphalidae	Schedule IV	LC

NT – Near Threatened; VU – Vulnerable, DA – Data Deficient, NE – Not Evaluated

Table 3.38 List of Reptiles either spotted or reported from the study area.

SI. No	Scientific Name	Common Name	IUCN Red List data
1	*Calotes versicolor*	Oriental garden lizard	LC
2	*Hemidactylus flaviviridis*	House lizards	NL
3	*Naja naja*	Indian cobra	LC
4	*Vipera russseli*	Russell's viper	NL
5	*Ahaetulla nasuta*	Green vine snake	LC
6	*Ptyas mucosa*	Rat snake	NL
7	*Bungarus caeruleus*	Common krait	LC
8	*Mabuya carinatus*	Common skink	LC

Table.3.39 List of Butterflies identified from the project site and their conservation status

SI. No	Scientific Name	Common Name	IUCN Conservation Status
1.	*Danaus genutia*	Striped Tiger	LC
2.	*Danaus chrysippuschrysippus*	Plain Tiger	LC
3.	*Acraea terpsicore*	Tawny Coster	LC
4.	*Papiliopolytespolytes*	Common Mormon	LC
5.	*Papiliopolytesromulus*	Common Mormon	LC
6.	*Papiliodemoleusdemoleus*	Lime Butterfly	LC
7.	*Junoniahierta*	Yellow Pansy	LC
8.	*Junonialemonias*	Lemon Pansy	LC
9.	*Phalantaphalantha*	Common Leopard	LC
10.	*Zizulahylax*	Tiny Grass Blue	LC
11.	*Euploea core*	Common Crow	LC
12.	*Melanitisledaleda*	Common Evening Brown	LC
13.	*Jamidescelenoceleno*	Common Cerulean	LC
14.	*Evereslacturnus*	Indian Cupid	LC
15.	*Pachlioptaaristolochiae*	Common Rose	LC

3.6.8 Aquatic Ecology

Small seasonal waterbodies are located nearby the study area. There is no aquatic flora and, aquatic fauna. 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.

3.6.8.1. 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.

3.6.8.2 Macrophytes

The macrophytes observed within the study area are tabulated in Table 3.40.

Table No.3.40 Description of Macrophytes

S.No	Scientific name	Common Name	IUCN Red List of Threatened Species
1.	*Aponogetonnatans*	Floating laceplant	NA
2.	*Cyperus exaltatus*	Tall Flat Sedge	LC
3.	*Carex cruciata*	Cross Grass	NA
4.	*Chrysopogon aciculatus*	Golden false beardgrass	NA
5.	*Hydrilla verticillata*	Waterthymes	LC
6.	*Eichornia crassipe*	Water hyacinth	NA
7.	*Marsilea quadrifolia*	Water clover	LC

3.6.9 Aquatic Faunal Diversity

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

Table no. 3.41 Amphibians Observed/Recorded from the Study Area

SI. No	Scientific Name	Common Name	IUCN Red List data
1.	*Sphaerotheca breviceps*	Indian Burrowing frog	LC
2.	*Euphlyctis hexadactylus*	Green pond frog	LC
3.	*Bufomelanostictus*	Indian Toad	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

3.6.10 Fishes

Fish is commonly found in all types of natural water bodies and very common source of food in Easterner South India. The local fishermen were enquired and also the secondary resources were reviewed to collect information on the fish found in the study area. Few common species are; Catla (Catla catla), Dwarf panchax (Aplocheilus parvus), Mrigal (Cirrhinus mrigala), Roho (Labeo rohita) etc., Species of fish reported in the study area are given in table 3.42

Table 3.42 Based on Actual Sighting, based on inputs from locals and Perused from Secondary Data

S.No	Common name	Scientific name	Family
1.	Dwarf panchax	*Aplocheilus parvus*	Aplocheilidae
2.	Mrigal	*Cirrhinus mrigala*	Chordata
3.	Catla	*Catla Catla*	Cyprinidae
4.	Rohu	*Labeo rohita*	Cyprinidae
5.	Catfish	*Siluriformes*	Diplomystidae

3.6.11Findings/Results

The assessment was carried out during the Winter season. The inspection day was quite all right 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.

Breeding and spawning grounds

No breeding and spawning grounds were earmarked for the wildlife fauna in project area.

There are no critically endangered, endangered, vulnerable and endemic species were observed. As the rainfall in the area is scanty and as no toxic wastes are produced or discharged on account of mining, the proposed mining activity is not going to have any additional and adverse impacts on these RET species. There are no ecologically sensitive areas or protected areas within the 10 Km radius. Hence no specific conservation for conservation of any RET species or Wildlife is envisaged.

There are no National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar sites, Tiger/Elephant Reserves/(existing as well as proposed) within 10 km of the mine lease area. There are no protected forests within the project area. Hence submission of clearance from the National Board of Wildlife does not arise.

There are no endangered, endemic and RET Species. There is no Schedule I species in study area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] The proposed project is not going to have any direct or indirect adverse impact on the species mentioned above.

3.6.12 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.

3.7 SOCIO ECONOMIC ENVIRONMENT

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

3.7.1 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.
e) To study the socio-economic status of the people living in the study area Roughstone and Gravel quarry project region
f) To assess the impact on socio-economic environment due to Roughstone and Gravel quarry project region
g) To analysis of impact of socio economic and Environmental Infrastructure facilities and road accessibility.

3.7.2 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

3.7.3 Methodology

The methodology adopted for the socio-economic impact assessment is as follows:
a) The details of the activities and population structure have been obtained from Census 2001 and 2011 and analyzed.
b) Based on the above data, impacts due to plant operation on the community have been assessed and recommendations for further improvement have been made.

3.7.4 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.

3.7.5 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 Pakkam Village, Madhuranthagam Taluk, Chengalpattu 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).

3.7.6 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 3.7.1 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.

3.7.7 Background Information of the Area

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

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

3.7.8 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.

3.7.9 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 seven districts are – Kancheepuram, 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

3.7.10 Kancheepuram District

Kancheepuram district is situated on the northern East Coast of Tamil Nadu and is adjacent by Bay of Bengal and Chennai city and is bounded in the west by Vellore and Thiruvannamalai district, in the north by Thiruvallur district and Chennai district, in the south by Villuppuram district in the east by Bay of Bangal. It lies between 11° 00′ to 12° 00’ North latitudes and 77° 28′ to 78° 50′ East longitudes. The district has a total geographical area of 1704.79 Sq.Kms and coastline of 87.2 Kms. Kancheepuram, the temple town is the district headquarters. For administrative reasons, the district has been divided into 2 revenue divisions comprising of 5 taluks with 520 revenue villages. For development reasons, it is divided into 5 development blocks with 274 Village Panchayats.

Source: https://kancheepuram.nic.in/about-district/

Chengalpattu District:

Chengalpattu district came into existence on 29.11.2019, when it was carved out of the erstwhile Kancheepuram district. Chengalpattu district being part of the Kancheepuram district until recently and being in close geographical proximity to the city of Kancheepuram which is a cultural hub for the region, has undergone through almost all the phases of history which Kancheepuram has witnessed.

Geography of the area

Chengalpattu district is situated on the north east coast of Tamilnadu with a total geographical area of 2945 Sq.Kms. The district is bounded on the north by the Chennai district, West by the Kancheepuram district and Thiruvanamalai districts and on the south by the Vilupuram district. With a coastal length of 57 Kms, the district is bounded in the east by the Bay of Bengal. The river Palar is one of the major rivers in the state of Tamil Nadu traversing through

Chengalpattu district for a length of 54 Kms. The river Palar enters the district at Palur village and confluxes with Bay of Bengal between Vayalur and Kadalur village.

3.7.11 Study Area

Detailed socio-economic survey was conducted in the study area (Core and buffer zone) within 10 km radius of the area at Pakkam Village, Madhuranthagam Taluk, Chengalpattu District, Tamil Nadu State 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.

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

TABLE 3.43 SHOWS THE SOCIO-ECONOMIC PROFILE OF THE STUDY AREA AS COMPARED TO DISTRICT, STATE AND NATIONAL LEVEL SOCIO-ECONOMIC PROFILE

Particular	India	Tamil Nadu	Kancheepuram District	Study Area (10km Radius)
Area (in sq. km.)	3,287,263	130058	1705	322
Population Density/ sq. Km.	368	554	2345	377
No. of Households	249454252	13357027	1006245	29817
Population	1210569573	72147030	3998252	121469
Male	623121843	36137975	2012958	60669
Female	587447730	36009055	1985294	60800
Scheduled Tribes	104281034	794697	41210	1757
Scheduled Castes	201378086	14438445	948081	44613
Literacy Rate	**72.99%**	**80%**	**75.36%**	**77.41%**
Sex Ratio (Females per 1000 Males)	**943**	**996**	**986**	**1002**

Source: Census of India, 2011

Table no 3.43 show demographic pattern of India, Tamil Nadu, Kancheepuram District (Chengalpattu) & Study area (10km Radius). In India had total area of 3.2 sqkm, State of Tamil Nadu area was 130058 sqkm, District of Kancheepuram area was 1705 sqkm and study area is about 322 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 452 sqkm and study area density is about 377 sqkm. As per Census 2011, about 5.96percent of population in the state lives in areas. Kancheepuram had comparing state wise 5.54 percent of population lives in the district. In study area has 3.04 % around 10km radius. State, District and study area. In Tamil Nadu state SC categories people had about 19 %, district of Kancheepuram about 23.71 % it has increasing to Study area about 36.73% increasing in the total population Similarly ST population is about 1.10%, 1.03% and 1.45% of the total population in the study area. State level Literacy

rate is 80%, district level is 75% but study area has an increased about 77%. There is literacy rate is study area increase comparing district level decrease in the study area. Sex ratio female per thousand males about state level is 996, District level is 986 and study area is 1002.

The study area has population density 377 persons per sq.km of total population about 121469 as per census 2011. There were about 50 percent male and 50% female population. Study area has literate rate is about 77%. District had about 76% of literate rate as per census 2011.

3.7.13 Population Projection of the Study Area

A population projection is an estimation of the number of people expected to be alive at a future date that is made based on assumptions of population structure, fertility, mortality and migration. It is an essential to assess the need for new jobs, schools, doctors and nurses, planning urban housing, foods, clothing and requirements of energy and resources. It is also needed for policy discourse i.e., helps to the policy-makers to understand the existing problems and finally supports to develop the suitable solutions.

TABLE 3.44. TOTAL POPULATION OF STUDY AREA

Sl No.	Population in 2001	Population in 2011
1	110133	121469

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

TABLE 3.45 POPULATION PROJECTION OF STUDY AREA

S. No	Year	Projected Population (Approximately)
1.	2021	132805
2.	2031	144141
3.	2041	155477
4.	2051	166813

Source: Calculated by SPSS v29, 2022.

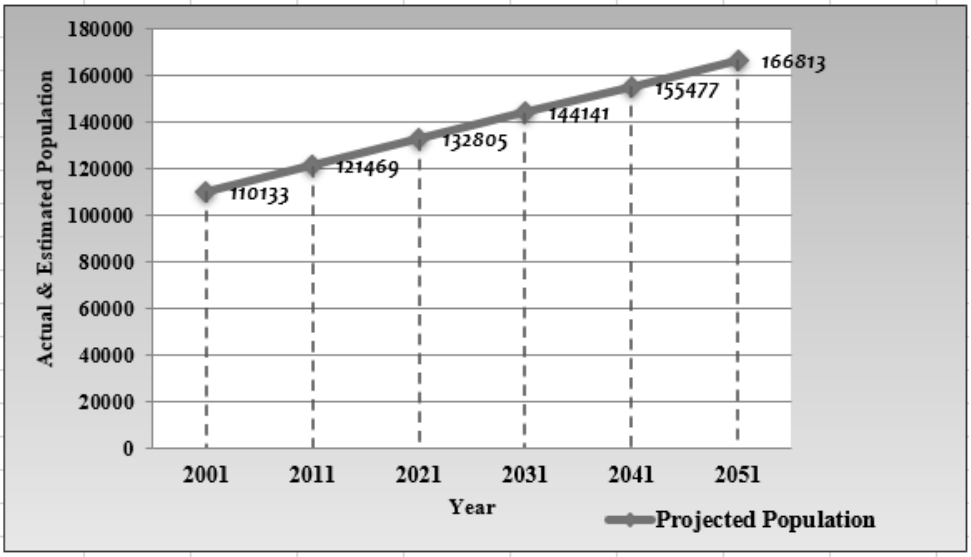


Fig 3.24 Graph Showing Population Projection

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

3.7.14 Population Growth of the Study Area

TABLE 3.46 POPULATION GROWTH RATE IN STUDY AREA

Year	Actual Population	Growth Rate %
2001	**110133**	-
2011	**121469**	11.03
2021	132805	10.93
2031	144141	10.85
2041	155477	10.79
2051	166813	10.73

Source: Compiled by Author-2022

Above table no 3.46 is showing the growth rate of population since 2001, as per census in 2001 the population of study area was 110133 and 2011 it was 121469 if the population growth rate is 11.03%, it will approximately 132805 in year 2021 and 166813 in the year of 2051. It has approximately population growth rate decline will be 10.73%.

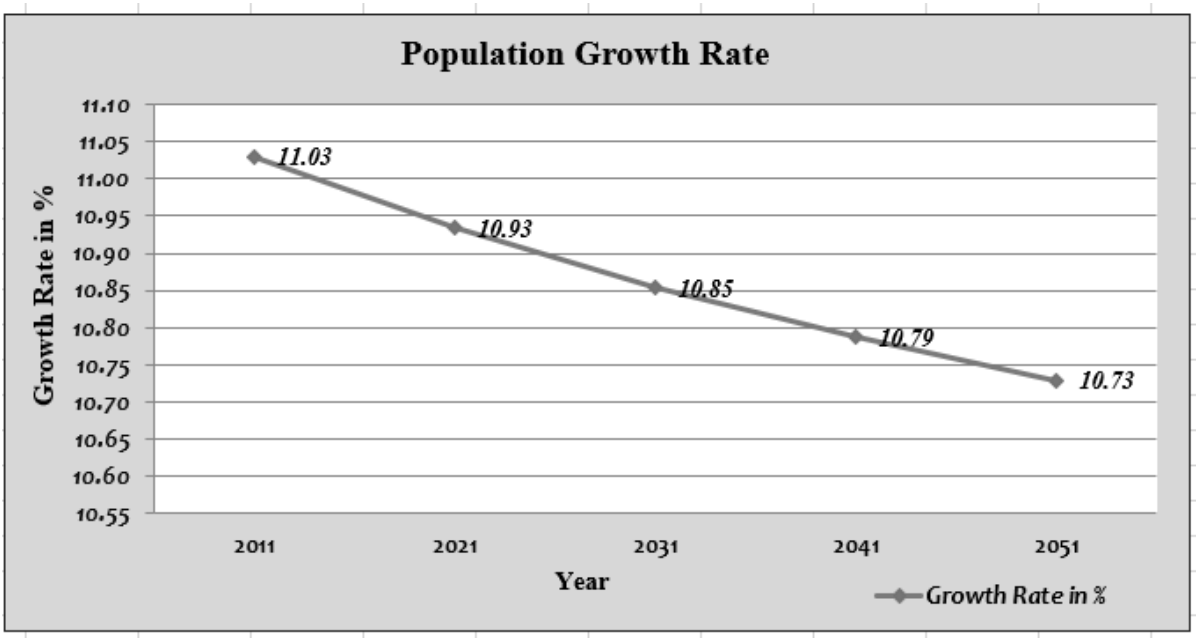


Fig.3.25 Graph Showing Population Growth Rate

Planning Analysis:

Calculating Growth Rates

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

Where:

$$PR = \frac{(V_{Present} - V_{Past})}{V_{Past}} x100$$

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**

3.7.15 Population Distribution and Composition of Study Area

The population as per 2011 Census records is 121469 (for 10 km radius buffer zone). Total no. of household is 2209, 13252 and 14356 respectively, in primary, secondary and tertiary zone. Sex ratio is 1009, 1004 and 999 (females per 1000 males) observed in primary, secondary and tertiary zone respectively. SC population distribution is 3893, 15793 and 24927 respectively in primary, secondary and tertiary zone. ST population distribution is 118, 644 and 995 respectively in primary, secondary and tertiary. Average household size is 4. Zone wise Demographic profile of study area is given in the table 3.47 and 3.48 below:

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

TABLE 3.47 ZONE WISE DEMOGRAPHIC PROFILE OF STUDY AREA

Zone	No. of Villages	Total Household	Total Population	Male Population	%	Female Population	%
Primary Zone (0 - 3 Km)	6	2209	8719	4340	49.78	4379	50.22
Secondary Zone (3 - 7 Km)	22	13252	55099	27490	49.89	27609	50.11
Tertiary Zone (7 - 10 km)	32	14356	57651	28839	50.02	28812	49.98
Study Area (0-10 km)	**60**	**29817**	**121469**	**60669**	**49.95**	**60800**	**50.05**

Source: Census of India, 2011

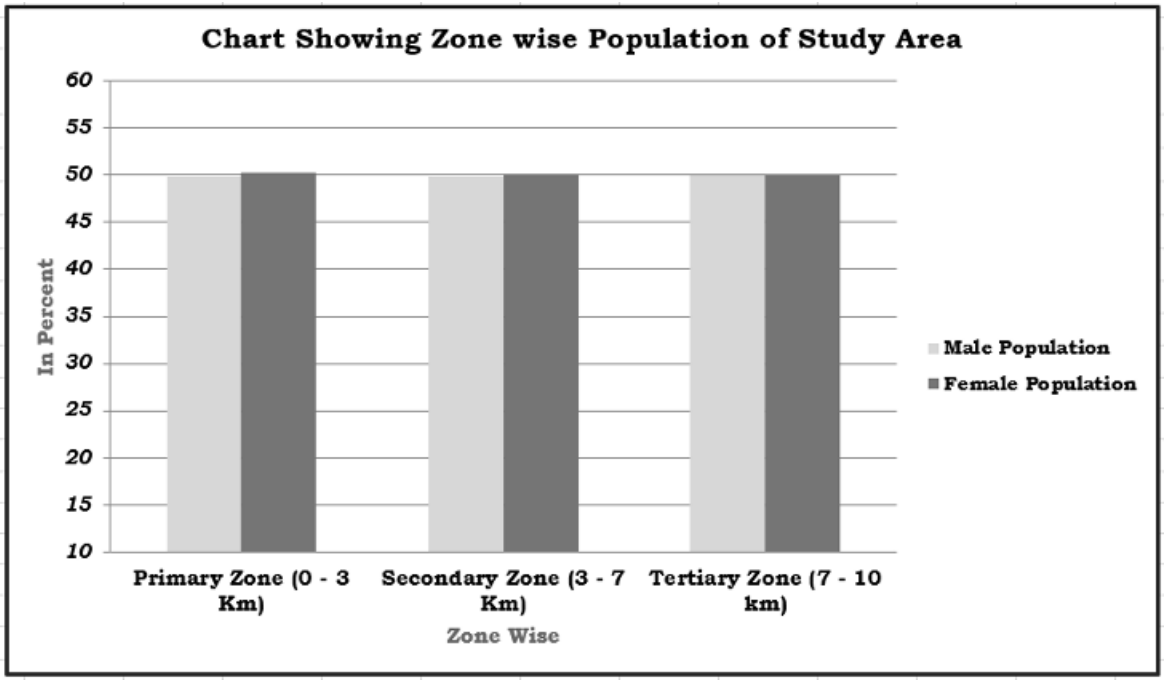


Figure 3.26 Population of study area

- ✓ 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 6 villages where as much as 2209 households with 8719 population are located. Mostly lying on Built-up land for their livelihood and substance.
- ✓ Secondary and tertiary zone both comprise of 22 and 32 villages having a total population of 55099 and 57651 respectively.

TABLE 3.48 VILLAGE WISE DEMOGRAPHIC PROFILE OF THE STUDY AREA (CORE AND BUFFER ZONE)

Sno	Name	No. of Households	Total population	Total Male	Total Female	Population below 6	Male below 6	Female below 6	SC population	SC Male	SC Female	ST population	ST Male	ST Female	Literate population	Male Literate	Female Literate	Total workers	Main workers	Marginal workers	Nonworkers
0-3km																					
1	Silavattam	831	3119	1556	1563	342	175	167	736	359	377	11	7	4	2001	1117	884	1292	1075	217	1827
2	Guddalur	351	1487	724	763	180	84	96	1268	610	658	0	0	0	855	454	401	846	649	197	641
3	Chinthamani	52	207	103	104	17	11	6	160	77	83	0	0	0	148	76	72	119	13	106	88
4	Unamalai	441	1751	910	841	222	115	107	764	413	351	90	44	46	1079	619	460	985	815	170	766
5	Pakkam	452	1864	908	956	177	84	93	765	372	393	0	0	0	1192	664	528	1038	711	327	826
6	Muniyanthangal	82	291	139	152	23	10	13	200	90	110	17	9	8	215	112	103	128	126	2	163
		2209	**8719**	**4340**	**4379**	**961**	**479**	**482**	**3893**	**1921**	**1972**	**118**	**60**	**58**	**5490**	**3042**	**2448**	**4408**	**3389**	**1019**	**4311**
3-7km																					
1	Mambakkam	92	346	179	167	32	14	18	35	21	14	17	7	10	177	99	78	99	97	2	247
2	Maduranthakam (M)	7699	30796	15254	15542	3184	1615	1569	5010	2423	2587	342	179	163	23221	12395	10826	12135	9547	2588	18661
3	Vedanthangal	459	1704	855	849	160	78	82	1309	661	648	5	2	3	1113	624	489	834	793	41	870
4	Pillanthikuppam	19	69	32	37	1	0	1	17	7	10	0	0	0	40	21	19	35	22	13	34
5	Puducheri	215	815	414	401	87	44	43	712	358	354	0	0	0	437	243	194	460	340	120	355
6	Madurai	36	135	60	75	13	4	9	94	42	52	11	4	7	67	33	34	89	64	25	46
7	Perumbakkam	473	1756	877	879	160	78	82	1038	529	509	24	12	12	1153	645	508	1196	1050	146	560
8	Semppondi	388	1596	812	784	186	99	87	328	160	168	13	8	5	933	558	375	974	968	6	622
9	Sholamthangal	76	289	148	141	31	15	16	213	113	100	9	5	4	194	105	89	161	143	18	128
10	Gendracheri	375	1522	761	761	155	77	78	788	395	393	0	0	0	947	524	423	874	228	646	648
11	Orathur	171	723	332	391	64	22	42	429	195	234	33	16	17	501	254	247	253	245	8	470
12	Sendivakkam	199	820	412	408	70	30	40	63	36	27	24	13	11	613	339	274	424	241	183	396
13	Mathur	299	1186	586	600	106	56	50	407	200	207	0	0	0	729	406	323	643	437	206	543
14	Agili	299	1214	619	595	139	70	69	663	337	326	85	45	40	744	423	321	634	330	304	580
15	Vasanthavadi	133	513	255	258	47	25	22	290	149	141	3	2	1	336	200	136	303	149	154	210
16	Sirunallur	550	2163	1079	1084	193	101	92	791	394	397	10	5	5	1440	798	642	1317	416	901	846
17	Avirimedu	146	562	285	277	67	34	33	170	83	87	11	6	5	315	194	121	401	150	251	161
18	Polambakkam	570	2242	1117	1125	240	125	115	1073	533	540	23	12	11	1409	791	618	1085	841	244	1157
19	Kurambarai	121	528	267	261	54	25	29	465	238	227	0	0	0	258	140	118	267	267	0	261
20	Maluvankaranai	243	1050	529	521	119	59	60	522	252	270	27	15	12	682	378	304	561	125	436	489
21	Poraiyur	402	1703	859	844	195	110	85	898	464	434	0	0	0	1140	643	497	807	85	722	896
22	Melmaruvathur	287	3367	1758	1609	99	51	48	478	194	284	7	4	3	3165	1688	1477	589	141	448	2778
		13252	**55099**	**27490**	**27609**	**5402**	**2732**	**2670**	**15793**		**8009**	**644**	**335**	**309**	**39614**	**21501**	**18113**	**24141**	**16679**	**7462**	**30958**
7-10km																					
1	Chithalamangalam	148	579	289	290	56	28	28	180	84	96	4	2	2	334	180	154	278	267	11	301
2	Vinayaganallur	211	814	415	399	84	40	44	561	285	276	47	23	24	527	294	233	460	176	284	354
3	Vellaputhur	354	1363	689	674	146	70	76	634	316	318	143	71	72	739	433	306	761	228	533	602

4	Thuraiyur	51	187	97	90	17	10	7	168	87	81	0	0	0	124	64	60	92	28	64	95
5	Chithathur	164	657	321	336	79	41	38	374	186	188	0	0	0	400	213	187	401	140	261	256
6	Pappanallur	290	1134	556	578	119	63	56	6	4	2	0	0	0	692	390	302	619	480	139	515
7	Kozhiyalam	136	492	240	252	38	18	20	137	67	70	2	0	2	380	202	178	346	34	312	146
8	Valayaputhur	204	804	419	385	96	45	51	363	185	178	9	4	5	509	298	211	411	367	44	393
9	Kunnavakkam	20	65	34	31	6	4	2	0	0	0	0	0	0	33	20	13	42	28	14	23
10	Pudupattu	256	1030	514	516	136	67	69	523	257	266	151	80	71	593	316	277	462	336	126	568
11	Uludamangalam	99	416	212	204	38	22	16	338	170	168	0	0	0	308	164	144	266	228	38	150
12	Kathiricheri	176	638	322	316	64	37	27	542	270	272	0	0	0	414	237	177	376	99	277	262
13	Vaippanai	188	737	363	374	91	47	44	617	310	307	0	0	0	459	251	208	318	2	316	419
14	Ladakaranai	176	692	347	345	68	40	28	54	26	28	42	25	17	502	269	233	336	187	149	356
15	Pasuvankaranai	45	162	79	83	17	8	9	0	0	0	0	0	0	87	50	37	93	89	4	69
16	Munuthikuppam	129	477	238	239	62	32	30	293	143	150	2	1	1	299	164	135	316	162	154	161
17	Mulli	68	286	144	142	34	13	21	184	95	89	4	1	3	185	103	82	96	92	4	190
18	Devadur	333	1298	647	651	114	61	53	661	329	332	38	17	21	810	449	361	690	205	485	608
19	Arungunam	578	2129	1063	1066	164	79	85	935	475	460	73	39	34	1438	813	625	1139	573	566	990
20	Chitravadi	198	828	411	417	83	39	44	379	198	181	20	10	10	551	299	252	478	141	337	350
21	Z.Endathur	726	3014	1539	1475	270	134	136	1552	803	749	69	35	34	1882	1049	833	1512	1296	216	1502
22	Peruveli	858	3381	1671	1710	342	183	159	2175	1075	1100	5	2	3	2414	1286	1128	1569	1162	407	1812
23	Nallamur Keelakaranai	743	3122	1545	1577	303	166	137	2540	1246	1294	4	2	2	2148	1136	1012	1608	720	888	1514
24	Chitamur	67	315	166	149	25	10	15	211	117	94	0	0	0	189	120	69	175	175	0	140
25	Uthamanallur	261	1072	552	520	131	67	64	538	276	262	108	58	50	634	360	274	548	485	63	524
26	Thirumukkadu	190	776	377	399	74	42	32	700	343	357	9	5	4	409	222	187	474	214	260	302
27	Pallipettai	854	3506	1742	1764	390	191	199	739	364	375	0	0	0	2585	1400	1185	1312	903	409	2194
28	Karunguzhi (TP)	3075	12485	6245	6240	1300	668	632	4577	2322	2255	135	65	70	9133	4923	4210	4950	4231	719	7535
29	Acharapakkam (TP)	2565	10362	5150	5212	1097	554	543	3023	1493	1530	48	24	24	7689	4127	3562	3976	3121	855	6386
30	Keezhamur	236	947	478	469	100	53	47	471	233	238	0	0	0	617	339	278	665	508	157	282
31	Velamur	759	3057	1545	1512	298	155	143	722	369	353	31	17	14	1911	1081	830	1588	1371	217	1469
32	Kattugudalur	198	826	429	397	104	66	38	730	379	351	51	28	23	400	233	167	446	445	1	380
	Total	**14356**	**57651**	**28839**	**28812**	**5946**	**3053**	**2893**	**24927**	**12507**	**12420**	**995**	**509**	**486**	**39395**	**21485**	**17910**	**26803**	**18493**	**8310**	**30848**
	G.total	**29817**	**121469**	**60669**	**60800**	**12309**	**6264**	**6045**	**44613**	**14428**	**22401**	**1757**	**904**	**853**	**84499**	**46028**	**38471**	**55352**	**38561**	**16791**	**66117**

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

3.7.16.1 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 1002 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 60 villages lying in study area (buffer zone) as primary, secondary and tertiary zone.

TABLE 3.49 SEX RATIO OF THE STUDY AREA

S. No.	Buffer Zone	Sex Ratio of Study area Female/ 1000 Male
1	Primary Zone (0-3 km)	1009
2	Secondary zone (3-7 km)	1004
3	Tertiary Zone (7-10 km)	999

Source: Census of India, 2011

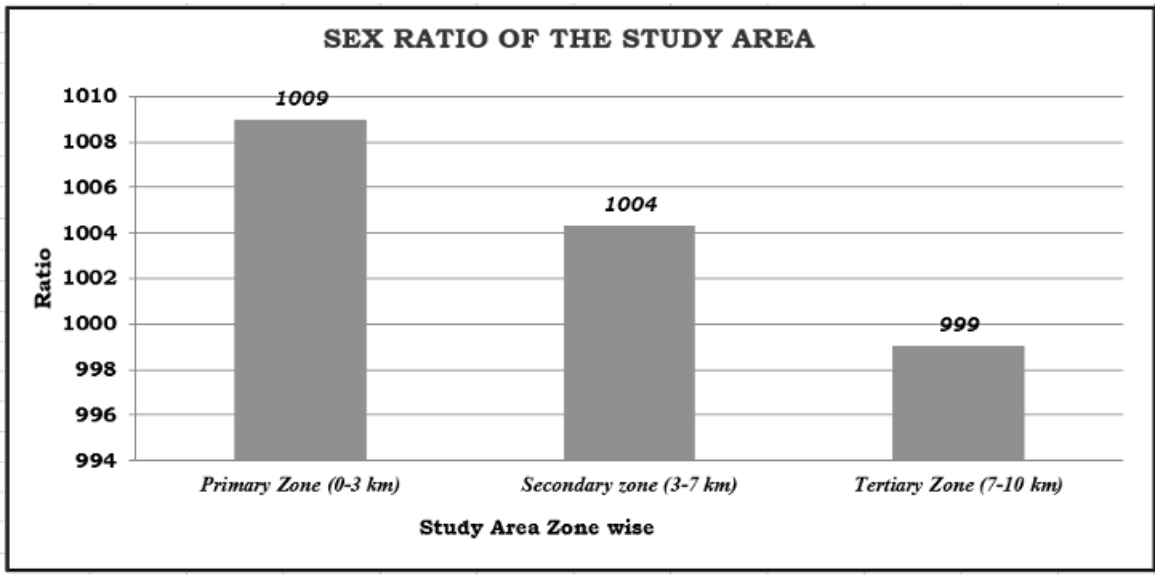


Figure 3.27 Sex Ratio within 10 Km study area

3.7.16.2 Child Sex Ratio

S. No.	Buffer Zone	Sex Ratio of Study area Female/ 1000 Male
1	Primary Zone (0-3 km)	1006
2	Secondary zone (3-7 km)	977
3	Tertiary Zone (7-10 km)	948

Source: Census of India, 2011

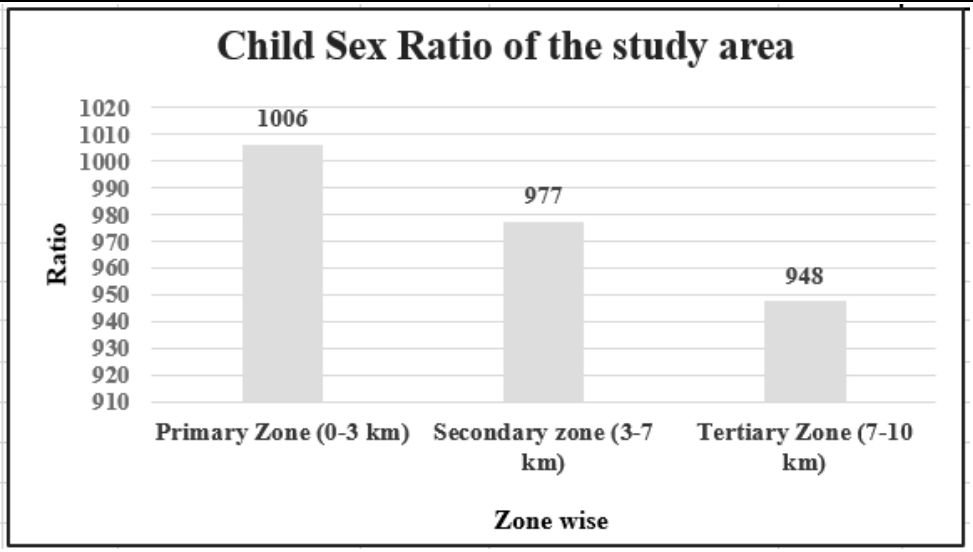


Figure 3.28 Child Sex Ratio within 10 Km study area

3.7.17 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 77.41% as per census data 2011. The male literacy rate in the study area indicates 84.60% whereas the female literacy rate, which is an important indicator for social change, is observed to be 70.26% as per the census data 2011. This needs to focus on the region and enhance further development focusing on education. (Table no 3.50).

TABLE 3.50 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)	6	**3042**	78.79	**2448**	62.82	**5490**	70.77
Secondary Zone (3 - 7 Km)	22	**21501**	86.84	**18113**	72.63	**39614**	79.71
Tertiary Zone (7 - 10 Km)	32	**21485**	83.32	**17910**	69.10	**39395**	76.19
Study Area (0-10km)	**60**	**46028**	**84.60**	**38471**	**70.26**	**84499**	**77.41**

Source: Census of India, 2011

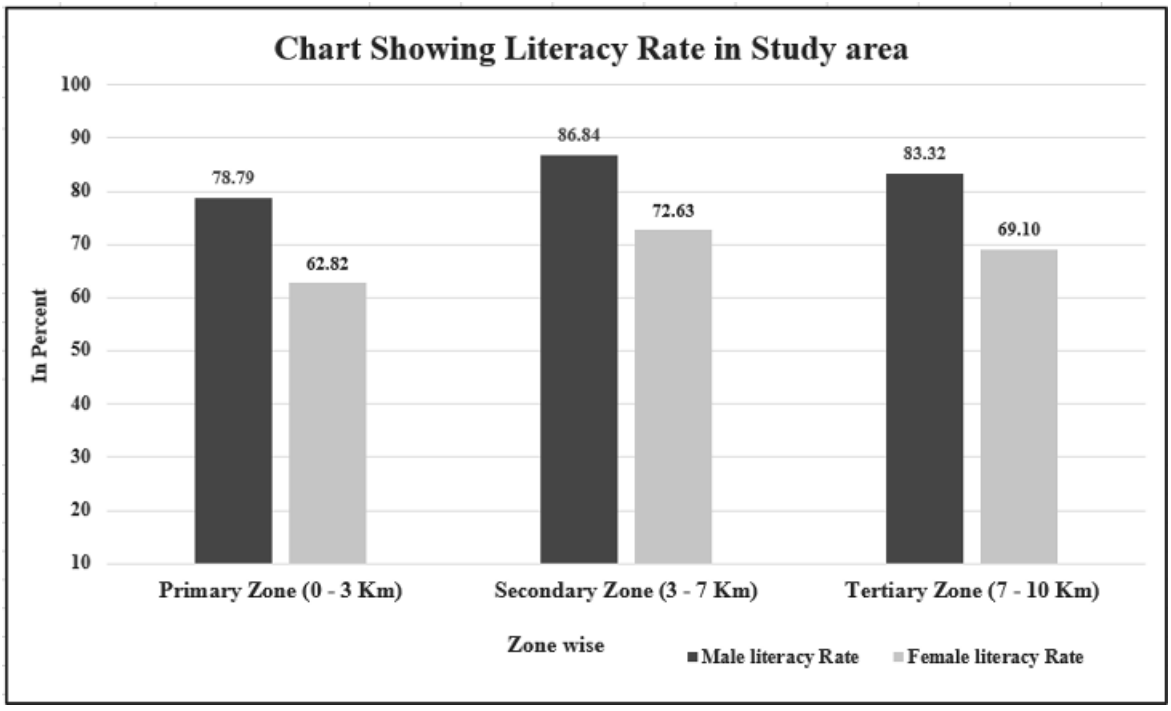


Figure 3.29 Gender wise Literacy Rate in the study area

3.7.18 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.

3.7.19 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 36.73% and Schedule Tribe population 1.45%, Other Population is 61.83% in Total study area.

TABLE 3.51 VULNERABLE GROUPS OF THE STUDY AREA

Zone	No. of Villages	Vulnerable Groups					
		SC Population	%	ST Population	%	Other Population	%
Primary Zone (0 - 3 Km)	6	3893	44.65	118	1.35	4708	54.00
Secondary Zone (3 - 7 Km)	22	15793	28.66	644	1.17	38662	70.17
Tertiary Zone (7 - 10 Km)	32	24927	43.24	995	1.73	31729	55.04
Total area (10km)	**60**	**44613**	**36.73**	**1757**	**1.45**	**75099**	**61.83**

Source: Census of India, 2011

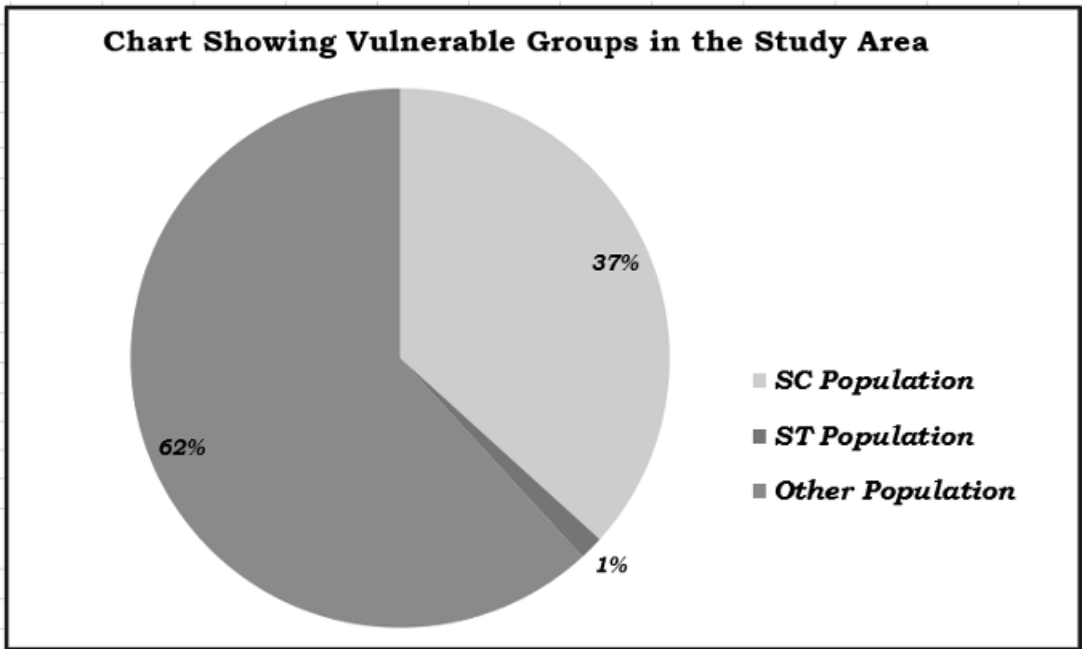


Figure 3.30 vulnerable groups

3.7.20 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 3.52 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)	6	4408	50.56	3389	38.87	1019	11.69	4311	49.44
Secondary Zone (3 - 7 Km)	22	24141	43.81	16679	30.27	7462	13.54	30958	56.19
Tertiary Zone (7 - 10 Km)	32	26803	46.49	18493	32.08	8310	14.41	30848	53.51
Study Area (10 Km)	**60**	**55352**	**45.57**	**38561**	**31.75**	**16791**	**13.82**	**66117**	**54.43**

Source: Census of India, 2011

The above table shows that out of the total working population, the percentage of main workers is 31.73 % while 13.82 % are marginal workers (Table 3.52). Number of working populations is 45.57% and non-working population is 54.53% 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 3.31 Working population in the study area

3.7.21 Infrastructure Base

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

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

- Administrative offices are located in Tamil Nadu, Kancheepuram district (23km-NE) and Sub collector office, Maduranthakam (3.0km-NE) from site which by local transport.
- Maduranthakam Lake, Palaru River North Eastern side (15km) around 10 km from quarry lease boundary.
- Availability of Government high school, Morekuppam Village (NE-4.0km), Government school, Vasanthavadi (SE-2.5km), Government High School, Velamur (SW-9km), Maduranthakam Taluk many Arts and Engineering college and Training institute found in study area.
- Health facilities covered in the Core zone area Maduranthakam Government Hospital (5.5km-N), Government Hospital, Pudupattu, Kunnavakkam (9km-N), Government Hospital's, Acharapakkam (8.0km-SW), Government Hospital, Chithamur (8.0km-NE), Government Hospital, Velamur (10km-SW) some private and clinics are located in the Major district and taluks.

TABLE 3.53 EDUCATIONAL FACILITIES IN THE SURVEYED AREA

Sno	Village Name	Govt Primary School (Numbers)	Private Primary School (Numbers)	Govt Middle School (Numbers)	Private Middle School (Numbers)	Govt Secondary School (Numbers)	Private Secondary School (Numbers)	Govt Senior Secondary School (Numbers)	Private Senior Secondary School (Numbers)	Govt Arts and Science Degree College (Numbers)
0-3km										
1	Silavattam	1	0	1	0	0	0	0	0	0
2	Guddalur	1	0	1	0	0	0	0	0	0
3	Muniyanthangal	0	0	0	0	0	0	0	0	0
4	Chinthamani	0	0	0	0	0	0	0	0	0
5	Unamalai	1	0	1	0	0	0	0	0	0
6	Pakkam	1	0	1	0	0	0	0	0	0
	Total	**4**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**
3-7km										
1	Mambakkam	0	0	0	0	0	0	0	0	0
2	Vedanthangal	2	0	1	0	1	0	0	0	0
3	Pillanthikuppam	0	1	0	0	0	0	0	0	0
4	Puducheri	1	0	0	0	0	0	0	0	0
5	Madurai	0	0	0	0	0	0	0	0	0
6	Perumbakkam	1	0	0	0	0	0	0	0	0
7	Semppondi	1	0	1	0	0	0	0	0	0
8	Sholamthangal	1	0	1	0	0	0	0	0	0
9	Gendracheri	0	0	0	0	0	0	0	0	0
10	Orathur	1	0	0	0	0	0	0	0	0
11	Sendivakkam	2	0	0	1	0	1	0	1	0
12	Mathur	3	0	1	0	0	0	0	0	0
13	Agili	1	0	0	0	0	0	0	0	0
14	Vasanthavadi	1	0	0	0	0	0	0	0	0
15	Sirunallur	1	0	1	0	0	0	0	0	0
16	Avirimedu	1	0	0	0	0	0	0	0	0
17	Polambakkam	1	0	1	0	1	0	1	0	0
18	Kurambarai	0	0	0	0	0	0	0	0	0
19	Maluvankaranai	1	1	0	0	0	0	0	0	0
20	Poraiyur	1	0	1	0	0	0	0	0	0
21	Melmaruvathur	1	2	0	3	0	2	0	1	0
22	Maduranthakam (M)	12	4	11	4	7	3	2	1	
	Total	**32**	**8**	**18**	**8**	**9**	**6**	**3**	**3**	**0**
7-10km										
1	Chithalamangalam	1	0	0	0	0	0	0	0	0
2	Vinayaganallur	1	0	0	0	0	0	0	0	0
3	Vellaputhur	1	0	1	0	0	0	0	0	0
4	Thuraiyur	0	0	0	0	0	0	0	0	0
5	Chithathur	1	0	0	0	0	0	0	0	0
6	Pappanallur	1	0	0	0	0	0	0	0	0
7	Kozhiyalam	1	0	0	0	0	0	0	0	0
8	Valayaputhur	0	1	0	0	0	0	0	0	0
9	Kunnavakkam	0	0	0	0	0	0	0	0	0
10	Pudupattu	1	0	1	0	0	0	0	0	0
11	Uludamangalam	0	0	0	0	0	0	0	0	0
12	Kathiricheri	1	0	0	0	0	0	0	0	0
13	Vaippanai	1	0	0	0	0	0	0	0	0
14	Ladakaranai	1	0	0	0	0	0	0	0	0
15	Pasuvankaranai	1	0	0	0	0	0	0	0	0
16	Munuthikuppam	1	1	1	1	0	0	0	0	0
17	Mulli	1	0	0	0	0	0	0	0	0

18	Devadur	1	1	1	0	0	0	0	0	0
19	Arungunam	1	0	1	0	0	0	0	0	0
20	Keezhamur	1	0	1	0	0	0	0	0	0
21	Velamur	3	0	1	0	1	0	0	0	0
22	Kattugudalur	1	0	1	0	0	0	0	0	0
23	Chitravadi	0	0	0	0	0	0	0	0	0
24	Z.Endathur	1	0	1	0	1	0	0	0	0
25	Peruveli	2	0	1	1	0	0	0	0	0
26	Nallamur Keelakaranai	1	0	1	0	0	0	0	0	0
27	Chitamur	1	0	0	0	0	0	0	0	0
28	Uthamanallur	1	0	0	0	0	0	0	0	0
29	Thirumukkadu	0	0	0	0	0	0	0	0	0
30	Pallipettai	2	0	0	0	0	0	0	0	0
31	Acharapakkam (TP)	3	3	3	1	2	1	2	1	0
32	Karunguzhi (TP)	5	3	4	1	1	1	1	1	0
	Total	**36**	**9**	**18**	**4**	**5**	**2**	**3**	**2**	**0**
	G.total	**72**	**17**	**40**	**12**	**14**	**8**	**6**	**5**	**0**

Source: ***DCHB Census 2011, Tamil Nadu.***

TABLE 3.54 HEALTH/ MEDICAL FACILITIES IN THE SURVEYED AREA

Sno	Village Name	Community Health Centre (Numbers)	Primary Health Centre (Numbers)	Primary Heallth Sub Centre (Numbers)	Maternity And Child Welfare Centre (Numbers)	Hospital Allopathic (Numbers)	Dispensary (Numbers)	Dispensary Doctors Total Strength (Numbers)	Veterinary Hospital (Numbers)	Family Welfare Centre (Numbers)	Non Government Medical facilities Medicine Shop (Numbers)
0-3km											
1	Silavattam	0	0	1	0	0	0	0	0	0	0
2	Guddalur	0	0	1	1	0	0	0	0	0	0
3	Muniyanthangal	0	0	0	0	0	0	0	0	0	0
4	Chinthamani	0	0	0	0	0	0	0	0	0	0
5	Unamalai	0	0	0	0	0	0	0	0	0	0
6	Pakkam	0	0	1	0	0	0	0	0	0	0
	Total	**0**	**0**	**3**	**1**	**0**	**0**	**0**	**0**	**0**	0
3-7km											
1	Mambakkam	0	0	0	0	0	0	0	0	0	0
2	Vedanthangal	0	0	1	0	0	0	0	0	0	0
3	Pillanthikuppam	0	0	0	0	0	0	0	0	0	0
4	Puducheri	0	0	0	0	0	0	0	0	0	0
5	Madurai	0	0	0	0	0	0	0	0	0	0
6	Perumbakkam	0	0	0	0	0	0	0	0	0	0
7	Semppondi	0	0	0	0	0	0	0	1	0	0
8	Sholamthangal	0	0	0	0	0	0	0	0	0	0
9	Gendracheri	0	0	0	0	0	0	0	0	0	0
10	Orathur	0	0	1	0	0	0	0	0	0	0
11	Sendivakkam	0	0	0	0	0	0	0	1	0	0
12	Mathur	0	0	0	0	0	0	0	0	0	0
13	Agili	0	0	0	0	0	0	0	0	0	0
14	Vasanthavadi	0	0	0	0	0	0	0	0	0	0
15	Sirunallur	0	0	0	0	0	0	0	0	0	0
16	Avirimedu	0	0	0	0	0	0	0	0	0	0
17	Polambakkam	0	1	1	1	0	1	2	0	1	0
18	Kurambarai	0	0	0	0	0	0	0	0	0	0
19	Maluvankaranai	0	0	0	0	0	0	0	0	0	0
20	Poraiyur	0	0	0	0	0	0	0	0	0	0
21	Melmaruvathur	0	0	1	0	0	0	0	0	0	1
22	Maduranthakam (M)	1	2	2	4	1	1	1	1	1	12
	Total	**1**	**3**	**6**	**5**	**1**	**2**	**3**	**3**	**2**	**13**
7-10km											
1	Chithalamangalam	0	0	0	0	0	0	0	0	0	0
2	Vinayaganallur	0	0	0	0	0	0	0	0	0	0
3	Vellaputhur	0	0	0	0	0	0	0	0	0	0
4	Thuraiyur	0	0	0	0	0	0	0	0	0	0
5	Chithathur	0	0	0	0	0	0	0	0	0	0
6	Pappanallur	0	0	1	0	0	0	0	0	0	0
7	Kozhiyalam	0	0	0	0	0	0	0	0	0	0
8	Valayaputhur	0	0	0	0	0	0	0	0	0	0
9	Kunnavakkam	0	0	0	0	0	0	0	0	0	0
10	Pudupattu	0	0	0	0	0	0	0	0	0	0
11	Uludamangalam	0	0	0	0	0	0	0	0	0	0
12	Kathiricheri	0	0	0	0	0	0	0	0	0	0

13	Vaippanai	0	0	0	0	0	0	0	0	0	0
14	Ladakaranai	0	0	0	0	0	0	0	0	0	0
15	Pasuvankaranai	0	0	1	0	0	0	0	0	0	0
16	Munuthikuppam	0	0	0	0	0	0	0	0	0	0
17	Mulli	0	0	0	0	0	0	0	0	0	0
18	Devadur	0	0	0	0	0	0	0	0	0	0
19	Arungunam	0	0	1	0	0	0	0	0	0	0
20	Keezhamur	0	0	1	0	0	0	0	0	0	0
21	Velamur	0	1	1	1	0	1	3	1	1	1
22	Kattugudalur	0	0	1	0	0	0	0	0	0	0
23	Chitravadi	0	0	0	0	0	0	0	0	0	0
24	Z.Endathur	1	1	1	1	0	1	1	0	1	0
25	Peruveli	0	0	1	0	0	0	0	0	0	1
26	Nallamur Keelakaranai	0	0	1	0	0	0	0	0	0	0
27	Chitamur	0	0	0	0	0	0	0	0	0	0
28	Uthamanallur	0	0	0	0	0	0	0	0	0	0
29	Thirumukkadu	0	0	1	0	0	0	0	0	0	0
30	Pallipettai	0	0	1	0	0	0	0	0	0	0
31	Acharapakkam (TP)	1	1	0	0	0	0	0	0	0	0
32	Karunguzhi (TP)	1	1	0	1	1	1	1	1	1	5
	Total	**3**	**4**	**0**	**1**	**1**	**1**	**1**	**1**	**0**	5
	G.total	**3**	**4**	**11**	**4**	**1**	**4**	**6**	**3**	**3**	**12**

Source: ***DCHB Census 2011, Tamil Nadu.***

TABLE 3.55 WATER & DRAINAGE FACILITIES IN THE SURVEYED AREA

21	Village Name	Tap Water-Treated (Status A(1)/NA(2))	Tap Water Untreated (Status A(1)/NA(2))	Covered Well (Status A(1)/NA(2))	Uncovered Well (Status A(1)/NA(2))	Hand Pump (Status A(1)/NA(2))	Tube Wells/Borehole (Status A(1)/NA(2))	Spring (Status A(1)/NA(2))	River/Canal (Status A(1)/NA(2))	Tank/Pond/Lake (Status A(1)/NA(2))	Closed Drainage (Status A(1)/NA(2))	Open Drainage (Status A(1)/NA(2))	No Drainage (Status A(1)/NA(2))
0-3km													
1	Silavattam	1	1	2	2	2	1	2	2	2	1	1	1
2	Guddalur	1	1	2	2	2	2	2	2	2	2	1	1
3	Muniyanthangal	1	1	2	1	1	1	2	2	2	2	1	1
4	Chinthamani	1	1	1	1	1	2	2	2	2	1	1	1
5	Unamalai	1	1	1	1	1	1	2	2	2	1	1	1
6	Pakkam	1	1	1	1	1	1	2	2	2	1	1	1
3-7km													
1	Mambakkam	2	1	2	2	2	1	2	2	2	1	1	1
2	Vedanthangal	1	1	2	2	2	2	2	2	1	1	1	1
3	Pillanthikuppam	1	2	2	2	2	2	2	2	2	2	2	1
4	Puducheri	1	1	2	2	2	2	2	2	2	2	1	1
5	Madurai	1	2	2	2	2	2	2	2	2	2	1	1
6	Perumbakkam	1	1	2	2	2	2	2	2	2	1	1	1
7	Semppondi	1	2	2	1	1	2	2	2	2	1	1	1
8	Sholamthangal	1	2	1	2	2	2	2	2	2	2	1	1
9	Gendracheri	1	1	2	2	2	2	2	2	2	2	1	1
10	Orathur	1	1	2	1	2	2	2	2	2	2	2	1
11	Sendivakkam	2	2	1	2	2	1	2	2	2	1	2	1
12	Mathur	1	1	2	2	2	2	2	2	2	2	1	1
13	Agili	1	1	1	2	2	1	2	2	2	1	2	1
14	Vasanthavadi	1	2	2	2	2	2	2	2	2	2	1	1
15	Sirunallur	1	1	1	1	2	2	2	2	1	1	1	1
16	Avirimedu	1	1	2	2	2	1	2	2	2	1	1	1
17	Polambakkam	1	1	1	1	2	2	2	2	2	1	1	1
18	Kurambarai	2	1	2	1	2	2	2	2	2	2	1	1
19	Maluvankaranai	1	2	1	1	2	2	2	2	2	1	1	1
20	Poraiyur	1	1	1	1	2	1	2	2	2	1	1	1
21	Melmaruvathur	1	1	1	1	2	1	2	2	2	1	1	1
22	Maduranthakam (M)	1	2	2	4	1	1	1	1	1	12	0	0
7-10km													
1	Chithalamangalam	1	1	2	2	1	2	2	2	2	1	1	2
2	Vinayaganallur	1	2	2	2	2	2	2	2	2	2	2	1
3	Vellaputhur	1	1	2	1	1	1	2	2	2	1	1	1
4	Thuraiyur	1	2	1	2	2	2	2	2	2	1	1	1
5	Chithathur	1	1	2	2	2	2	2	2	2	1	1	1
6	Pappanallur	1	1	1	2	1	1	2	2	2	1	1	1
7	Kozhiyalam	1	1	2	1	2	1	2	2	2	1	1	1
8	Valayaputhur	1	2	1	2	2	1	2	2	2	1	2	1
9	Kunnavakkam	1	2	2	2	2	2	2	2	2	2	2	1

10	Pudupattu	1	1	2	2	2	2	2	2	1	1	1	1
11	Uludamangalam	1	2	2	2	1	2	2	2	2	1	2	1
12	Kathiricheri	1	2	2	2	2	2	2	2	2	1	1	1
13	Vaippanai	1	1	2	2	2	2	2	2	2	1	2	1
14	Ladakaranai	2	1	2	2	1	2	2	2	2	1	1	1
15	Pasuvankaranai	1	1	2	2	2	2	2	2	1	1	1	1
16	Munuthikuppam	1	1	1	2	1	1	1	2	2	1	1	1
17	Mulli	1	2	2	2	2	2	2	2	2	1	2	1
18	Devadur	1	1	1	1	1	2	2	2	2	1	1	1
19	Arungunam	1	1	2	1	1	2	2	2	2	1	1	1
20	Keezhamur	1	1	1	1	1	1	2	2	2	1	1	1
21	Velamur	1	1	1	1	2	1	1	2	1	1	1	1
22	Kattugudalur	1	2	2	2	2	2	2	2	2	1	2	1
23	Chitravadi	1	1	2	2	1	2	2	2	2	2	1	1
24	Z.Endathur	1	1	1	2	1	1	1	2	1	1	1	1
25	Peruveli	1	1	1	2	1	2	2	2	2	1	1	1
26	Nallamur Keelakaranai	1	1	2	1	1	1	2	2	2	1	1	1
27	Chitamur	2	1	2	2	2	2	2	2	2	2	1	1
28	Uthamanallur	2	1	2	1	2	2	2	2	2	2	1	1
29	Thirumukkadu	1	2	2	2	1	2	2	2	2	2	2	1
30	Pallipettai	1	1	1	1	1	1	2	2	2	1	1	1
31	Acharapakkam (TP)	2	1	2	2	2	1	2	2	2	1	1	1
32	Karunguzhi (TP)	1	1	0	1	1	1	1	1	1	5	1	1

Source: DCHB Census 2011, Tamil Nadu.

Note: ***1 for available ad 2 for Not Available in the censu.***

TABLE 3.56 TRANSPORT AND OTHER INFRASTRUCTURE FACILITIES IN THE SURVEYED AREA

Sno	Village Name	Post Office (Status A(1)/NA(2))	Sub Post Office (Status A(1)/NA(2))	Post And Telegraph Office (Status A(1)/NA(2))	Private Courier Facility (Status A(1)/NA(2))	Public Bus Service (Status A(1)/NA(2))	Private Bus Service (Status A(1)/NA(2))	Railway Station (Status A(1)/NA(2))	Auto/Modified Autos (Status A(1)/NA(2))	Taxi (Status A(1)/NA(2))	Vans (Status A(1)/NA(2))	Tractors (Status A(1)/NA(2))	National Highway (Status A(1)/NA(2))	State Highway (Status A(1)/NA(2))	Major District Road (Status A(1)/NA(2))	Other District Road (Status A(1)/NA(2))
0-3km																
1	Silavattam	2	2	2	2	2	2	2	1	2	2	2	1	2	1	1
2	Guddalur	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2
3	Muniyanthangal	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2
4	Chinthamani	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2
5	Unamalai	2	1	2	2	1	1	1	2	2	2	2	1	2	2	2
6	Pakkam	2	1	2	2	1	1	1	1	2	2	2	1	2	1	1
3-7km																
1	Mambakkam	2	2	2	2	1	2	2	1	2	2	2	2	2	2	1
2	Vedanthangal	2	1	2	2	1	1	2	2	2	2	2	2	2	1	1
3	Pillanthikuppam	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
4	Puducheri	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
5	Madurai	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2
6	Perumbakkam	2	1	2	2	1	1	2	2	2	2	2	2	2	1	1
7	Semppondi	2	2	2	2	1	2	2	2	2	1	2	2	2	2	2
8	Sholamthangal	2	2	2	2	1	2	2	1	2	2	2	2	2	1	1
9	Gendracheri	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10	Orathur	2	2	2	2	1	1	2	2	2	2	2	2	2	1	1
11	Sendivakkam	2	1	2	2	1	2	2	2	2	2	2	2	1	1	1
12	Mathur	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2
13	Agili	2	2	2	2	1	2	2	2	2	2	2	2	1	1	1
14	Vasanthavadi	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
15	Sirunallur	2	2	2	2	1	1	2	1	1	2	2	2	2	1	1
16	Avirimedu	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
17	Polambakkam	2	1	2	2	1	1	2	2	2	2	2	2	1	1	2
18	Kurambarai	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2
19	Maluvankaranai	2	2	2	2	1	2	2	2	2	2	2	2	1	2	2
20	Poraiyur	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2
21	Melmaruvathur	1	2	1	1	1	1	1	1	2	2	2	1	1	2	1
22	Maduranthakam (M)	1	2	2	4	1	1	1	1	1	12	0	0	0	0	0
7-10km																
1	Chithalamangalam	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	Vinayaganallur	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2
3	Vellaputhur	2	1	2	2	1	2	2	2	2	2	2	2	2	2	2
4	Thuraiyur	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
5	Chithathur	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2
6	Pappanallur	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2
7	Kozhiyalam	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2
8	Valayaputhur	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2
9	Kunnavakkam	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10	Pudupattu	2	1	2	2	1	1	2	2	2	2	2	2	2	1	1
11	Uludamangalam	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
12	Kathiricheri	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2

13	Vaippanai	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2
14	Ladakaranai	2	2	2	2	1	1	2	1	1	1	2	2	2	2	2
15	Pasuvankaranai	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
16	Munuthikuppam	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2
17	Mulli	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
18	Devadur	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2
19	Arungunam	2	1	2	2	1	1	2	1	2	1	2	2	2	2	2
20	Keezhamur	2	2	2	2	1	1	2	1	2	2	2	2	2	1	1
21	Velamur	2	1	2	2	1	2	2	1	1	1	2	2	1	1	2
22	Kattugudalur	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2
23	Chitravadi	2	2	2	2	1	1	2	1	2	2	2	2	2	1	1
24	Z.Endathur	1	2	1	2	1	1	2	1	2	2	2	2	2	2	2
25	Peruveli	2	1	2	2	1	1	2	1	1	1	2	2	1	2	2
26	Nallamur Keelakaranai	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2
27	Chitamur	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
28	Uthamanallur	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
29	Thirumukkadu	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
30	Pallipettai	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31	Acharapakkam (TP)	2	1	2	2	1	2	2	1	1	1	2	2	2	2	2
32	Karunguzhi (TP)	1	1	0	1	1	1	1	1	1	5	1	1	1	1	1

Source: DCHB Census 2011, Tamil Nadu.

Note: 1 for available ad 2 for Not Available in the census.

3.7.22. Other Issues in the Study Area

1. Deforestation of Land (Cutting Trees or Plant etc.)
2. Agriculture Land decreases
3. Nearest Built-up Land increase the noise and air
4. Lack of awareness among vulnerable groups for their welfare.
5. Medical/Clinic facilities and PHC need for the Core area.
6. Environmental clean with solid wastage pin each village.
7. Functioning of Hospital facilities with Sub Health care centers.
8. Need proper drainage system with public toilet men and women separately.
9. Need local transport available.
10. Road condition improve the study area.

3.7.23 Interpretation

Based on the data, following inferences could be drawn:

- Total literacy rate in the study area is 77.41%.
- 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 1.45% and Scheduled Caste forms 36.73% of the total population of study area.
- The Other Population forms 62% of the total population of study area.
- The study area is well connected by National and District Road.
- The study area improves healthcare 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.

3.7.24 Recommendation and Suggestions

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

- **Women empowerment–** Home based income generation activities, vocational training programs and common education centre for increasing the literacy rate.
- **Education –** Free uniform, construction of common rooms and library, computer education and physical education, additional schools for girls, furniture and equipment in schools, up-gradation of existing school infrastructure.
- **Agriculture/livestock –** Infrastructure such as agricultural practices, electricity connections, assistance with buying improved tools and equipment, capacity building, supply and/or knowledge of better variety of seeds, pasture land development and trainings on animal husbandry& facility of veterinary doctor.
- **Health –** Improvements in sanitary conditions of villages, assistance with construction of latrines, improvement in drainage system, health camps and awareness campaigns for diseases like Covid-19, malaria, typhoid, tuberculosis, yellow fever and pneumonia. Repairing of PHCs and Anganwadi centers.
- **People with disability –** Establishment of center for special education, sensitization of the community towards disabled and awareness on Government schemes.
- While **Developing an Action Plan**, it is very important to identify the population who falls under the marginalized and vulnerable groups. So that special attention can be given to these groups with special provisions while making action plans.
- **Connectivity –**Transport connectivity to easiness accessibility to the region.

3.7.25 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.

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

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

CHAPTER – 4: ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.0 General

The environmental impact can be categorized as either primary or secondary, primary impacts which are attributed directly by the project; secondary impacts are those which are indirectly induced. The open cast mining operations involve development of benches, Approach Road, Haul Road, Excavation and handling of material. If adequate control measures are not taken to prevent/mitigate the adverse environmental impacts/lead to damage of the eco-system.

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 for sustainable resource extraction. Based on the baseline environmental status at the existing mine site, the environmental factors that are likely to be affected (Impacts) are identified, quantified and assessed. The various anticipated impacts will be on

- Land environment
- Water Environment
- Air Environment
- Noise Environment
- Socio economic environment
- Solid waste
- Soil environment

In general, the main findings regarding the potential impacts of climate change are Land Use Type, Energy Use, Water use & Dust emission and Biodiversity & rehabilitation.

Whereas, this mining activity is restricted to a small-scale mining and the proposal falls in "B1" Category, the surrounding environment is already subjected to mining activities and based on the past weather data its inferred that there is no much of change in the climate data of the region and the district profile has no records or past history of climate change leading to Droughts and floods.

- The mine pit shall act as a rain water harvesting structure and formation of garland drains along the mine lease boundary to divert the surface runoff and collecting the runoff water for greenbelt development and dust suppression activities shall prove beneficial.
- The greenbelt development plan, all along the mine lease boundary, along with the budget allocation for the proposed mitigation measures shall prove beneficial to surrounding environment.
- Therefore, the implementation of proposed mitigation measures for winning of mineral may not have much of impact on the surrounding Climate Change

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.
- Impact due to heritage site, Archaeological sites.

4.1.2.1 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
- There are no Archaeological sites, heritage site in the vicinity of the project area, the topography will be changed due to excavation of rough stone and Gravel.

4.2 Soil Environment

4.2.1 Impact on Soil Environment

The top layer of the project site in the form of Gravel formation, the Gravel will be directly loaded into tippers for the filling and levelling of low-lying areas. There is no disposal of Gravel. The excavated rough stone will be directly loaded into dumpers to the needy customers.

There will be no disposal of waste water from the quarry operation, No discharge of toxic effluent from the proposed projects. The dust emission at working face and haul roads will be controlled by water sprinkling and plantation.

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).

4.2.2 Common Mitigation Measures

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

4.2.3 Waste Dump Management

There are no wastages anticipated in this rough stone and gravel quarrying operation. The entire quarried out materials will be utilized (100%). The overburden in the form of gravel formation the gravel will be also sold to needy customers for the filling and levelling of low-lying areas.

4.3 Water Environment

4.3.1 Anticipated Impact on Surface and ground water

The impact due to quarrying on the water quality is expected to be insignificant because of no use of chemicals or hazardous substances during quarrying process. The quarrying activity will not intersect ground water table as the maximum depth of the quarry in 43m and water table is found at 70m in summer season and 65m in rainy season.

The quarrying operation will be carried out well above the water table. There is no intersection of surface water bodies (Streams, Canal, Odai etc.,) in the project area. During rainy season rain water will be collected in the quarry pit and later used for greenbelt development and for the water sprinkling in the haul roads. There is no proposal for discharging of quarry pit water outside the project area.

TABLE 4.1: WATER REQUIREMENTS

*Purpose	Quantity	Source
Domestic & Drinking purpose	1.0KLD	From Existing, bore wells and drinking water will be sourced from Approved Water vendors.
Dust Suppression	1.0KLD	From Existing bore wells from nearby area
Green Belt	1.0KLD	From Existing bore wells from nearby area
Total	**3.0KLD**	

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

Total water requirement in the proposed project is about 3.0 KLD, the water for dust suppression and greenbelt development will be sourced From Existing bore wells from nearby area collected during rainy seasons, the water for domestic purpose and drinking will be sourced from the approved water vendors.

4.3.2 Common Mitigation measures:

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

Possibilities of water contamination and impact on an aquatic ecosystem health

- Anticipated impact from this proposed mining activity is surface runoff from cleared surfaces, or discharges from the quarry pit or floor, is likely to have elevated levels of sediment (both suspended and dissolved). The quality of the water discharged from the site can have impacts on downstream ecological communities and water users.
- Therefore, Run-off diversion is proposed – 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 with only clear water after the garland drains are enrooted through settlement traps.
- And, the depth of the mining is maximum 43m bgl and the ground water level in the surrounding areas is about 70-65 m bgl and there are no possibilities of encountering any ground water aquifers system and hence no ground water table intersection is anticipated.
- After the completion of quarry operation, the quarried out open pit mine may utilized for pici-culture or temporary reservoir pit for use of water for domestic purpose during dry seasons.
- Therefore, its inferred that the implementation of proposed mitigation measures for winning of mineral may not have much of impact on the possibilities of water contamination and impact on an aquatic ecosystem health.

4.4 Air Environment

The air borne particulate matter is the main air pollutant in this opencast mining. The mining operation will be carried out by jackhammer drilling (35mm dia) and Hydraulic Excavators will be utilized for excavation of Rough Stone waste.

4.4.1. Anticipated

Impact

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

4.4.1.1. 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 PM_{10} & $PM_{2.5}$ and emissions of Sulphur dioxide (SO_2) & Oxides of Nitrogen (NOx) due to excavation/loading equipment and vehicles plying on haul roads are the cause of air pollution in the project area.

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

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

The impact on Air Environment is due to the mining and allied activities during Land Development phase, Mining process and Transportation. The emissions of Sulphur dioxide (SO_2), Oxides of Nitrogen (NOx) due to excavation/loading equipment and vehicles plying on haul roads are marginal. Loading - unloading and transportation of Rough Stone, wind erosion of the exposed area and movement of light vehicles will be the main polluting source

in the mining activities releasing Particulate Matter (PM_{10}) affecting Ambient Air of the area. Prediction of impacts on air environment has been carried out taking into consideration cumulative production three proposed quarries. Air environment and net increase in emissions by Open pit source modelling in AERMOD Software.

4.4.1.2 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 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 4-2.

TABLE 4.2: ESTIMATED EMISSION RATE FOR PROPOSED PROJECT

EMISSION ESTIMATION FOR QUARRY "P1"				
	Activity	**Source type**	**Value**	**Unit**
Estimated Emission Rate for PM_{10}	Drilling	Point Source	0.122496138	g/s
	Blasting	Point Source	0.006671545	g/s
	Mineral Loading	Point Source	0.047232165	g/s
	Haul Road	Line Source	0.002511059	g/s/m
	Overall Mine	Area Source	0.072047657	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.002025379	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000170526	g/s

4.4.2 Frame work of Computation & Model details

The prediction included the impact of Excavation, Drilling, Blasting, loading and movement of vehicles during transportation and meteorological parameters such as wind speed, wind direction, temperature, rainfall, humidity and Cloud cover.

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

Air Pollution Dispersion Modelling.

Baseline Air Quality –

Baseline air quality has been measured at 2 locations in the cluster and 6 locations within the buffer zone of the study area. The 24 - hourly average samples of particulate matters (PM_{10} and $PM_{2.5}$), SO_2 and NO_x were measured following the National Ambient Air Quality Standards (NAAQS), 2009. Monitoring data of 8 sampling stations are given below –

Meteorological Data –

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 and monitored continually for study period without break. The station was installed at a height of 4 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. A weather data was collected from IMD, Chengelpattu agro for the month of Dec 2022– Feb 2023 to correlate with site data and found not much of change in the parameters.

FIGURE 4.1: AERMOD TERRAIN MAP

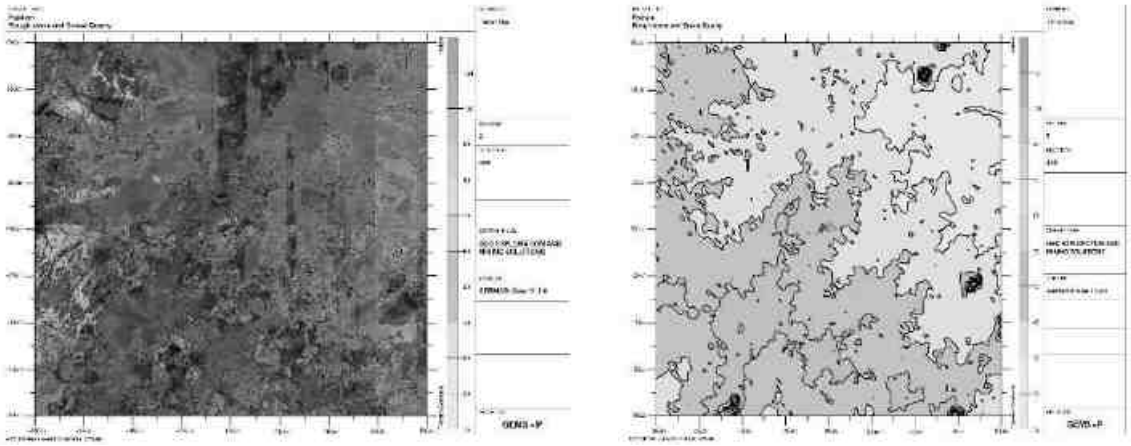


FIGURE 4.2: PREDICTED INCREMENTAL CONCENTRATION OF PM_{10}

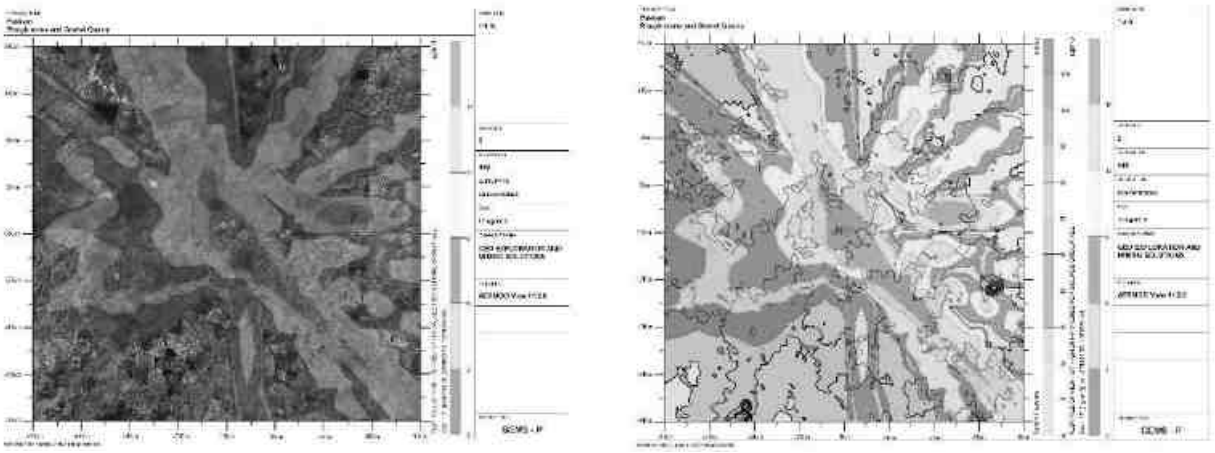


FIGURE 4.3: PREDICTED INCREMENTAL CONCENTRATION OF SO_2

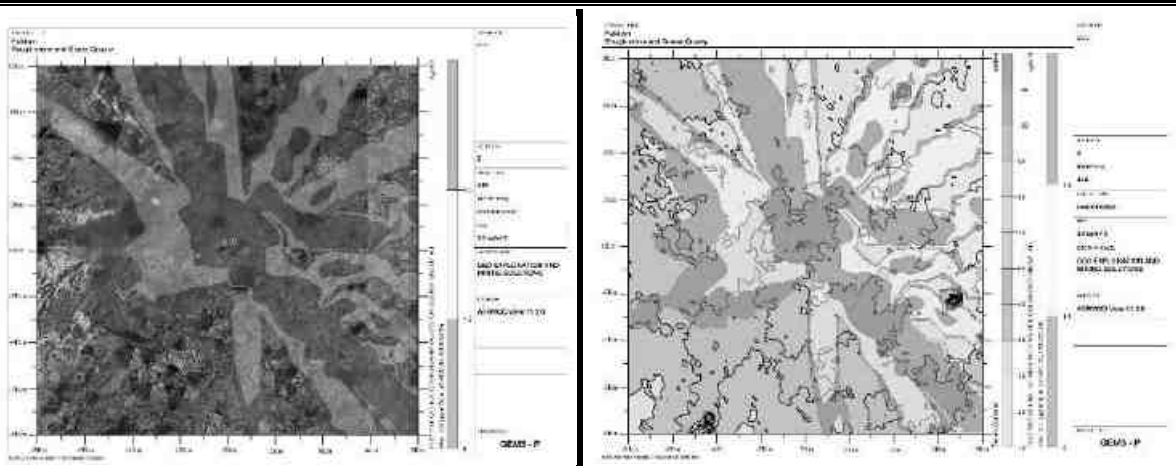


FIGURE 4.4: PREDICTED INCREMENTAL CONCENTRATION OF NO_x

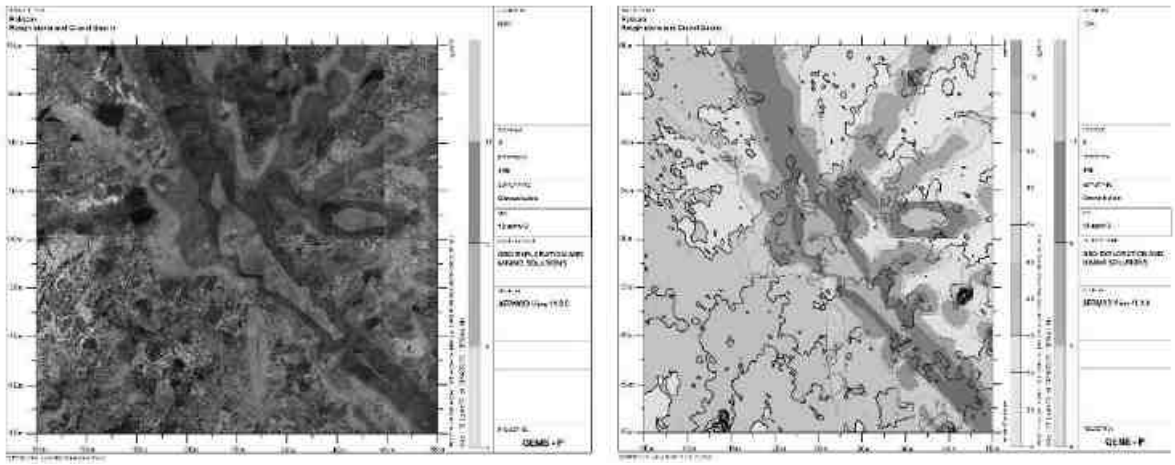
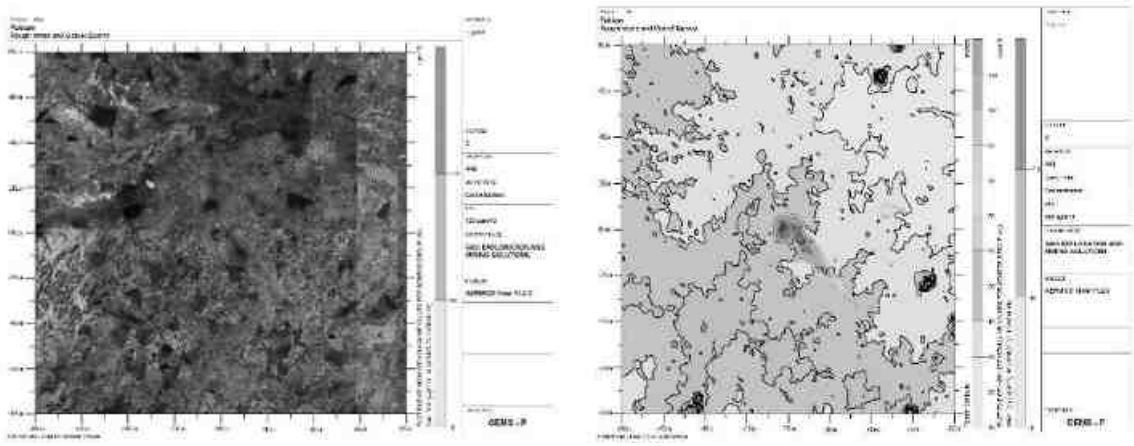


FIGURE 4.5: PREDICTED INCREMENTAL CONCENTRATION OF FUGITIVE DUST



4.3.2.1 Model Results

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

TABLE 4.3: INCREMENTAL & RESULTANT GLC OF PM_{10}

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline PM_{10} ($\mu g/m^3$)	Incremental value of PM_{10} due to mining ($\mu g/m^3$)	Total PM_{10} ($\mu g/m^3$) (5+6)
AAQ1	12°28'36.64"N 79°50'53.21"E	-111	19	42.20	17.90	60.1
AAQ2	12°28'38.99"N 79°51'5.74"E	274	88	43.65	17.42	61.07
AAQ3	12°28'18.16"N 79°50'16.22"E	-1232	-561	44.05	15.06	59.11
AAQ4	12°30'25.96"N 79°47'21.45"E	-6535	3382	43.21	5.00	48.21
AAQ5	12°29'38.84"N 79°54'32.54"E	6546	1930	43.47	0	43.47
AAQ6	12°25'37.09"N 79°52'50.33"E	3444	-5519	43.75	11.89	55.64
AAQ7	12°27'26.54"N 79°48'27.51"E	-4531	-2149	45.17	8.10	53.27
AAQ8	12°32'16.20"N 79°52'12.56"E	2298	6786	20.67	1.75	22.42

TABLE 4.4: INCREMENTAL & RESULTANT GLC OF $PM_{2.5}$

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline $PM_{2.5}$ ($\mu g/m^3$)	Incremental value of $PM_{2.5}$ due to mining ($\mu g/m^3$)	Total $PM_{2.5}$ ($\mu g/m^3$) (5+6)
AAQ1	12°28'36.64"N 79°50'53.21"E	-111	19	21.59	9.82	31.41
AAQ2	12°28'38.99"N 79°51'5.74"E	274	88	21.43	9.23	30.66
AAQ3	12°28'18.16"N 79°50'16.22"E	-1232	-561	22.45	8.00	30.45
AAQ4	12°30'25.96"N 79°47'21.45"E	-6535	3382	21.79	2.53	24.32
AAQ5	12°29'38.84"N 79°54'32.54"E	6546	1930	21.93	0.21	22.14
AAQ6	12°25'37.09"N 79°52'50.33"E	3444	-5519	22.03	6.13	28.16
AAQ7	12°27'26.54"N 79°48'27.51"E	-4531	-2149	23.93	4.39	28.32
AAQ8	12°32'16.20"N 79°52'12.56"E	2298	6786	41.35	1.60	42.95

TABLE 4.5: INCREMENTAL & RESULTANT GLC OF SO_2

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline So_2 ($\mu g/m^3$)	Incremental value of So_2 due to mining ($\mu g/m^3$)	Total So_2 ($\mu g/m^3$) (5+6)
AAQ1	12°28'36.64"N 79°50'53.21"E	-111	19	8.02	3.49	11.51
AAQ2	12°28'38.99"N 79°51'5.74"E	274	88	6.38	3.20	9.58
AAQ3	12°28'18.16"N 79°50'16.22"E	-1232	-561	8.04	3.01	11.05
AAQ4	12°30'25.96"N 79°47'21.45"E	-6535	3382	7.00	0.12	7.12
AAQ5	12°29'38.84"N 79°54'32.54"E	6546	1930	7.00	0	7
AAQ6	12°25'37.09"N 79°52'50.33"E	3444	-5519	7.08	1.00	8.08
AAQ7	12°27'26.54"N 79°48'27.51"E	-4531	-2149	7.5	2.27	9.77
AAQ8	12°32'16.20"N 79°52'12.56"E	2298	6786	6.09	0	6.09

TABLE 4.6: INCREMENTAL & RESULTANT GLC OF NO_X

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline Nox ($\mu g/m^3$)	Incremental value of Nox due to mining ($\mu g/m^3$)	Total Nox ($\mu g/m^3$) (5+6)
AAQ1	12°28'36.64"N 79°50'53.21"E	-111	19	20.71	12.73	33.32
AAQ2	12°28'38.99"N 79°51'5.74"E	274	88	21.16	12.16	27.67
AAQ3	12°28'18.16"N 79°50'16.22"E	-1232	-561	21.17	6.50	20.98
AAQ4	12°30'25.96"N 79°47'21.45"E	-6535	3382	20.98	0	21.28
AAQ5	12°29'38.84"N 79°54'32.54"E	6546	1930	21.28	0	23.47
AAQ6	12°25'37.09"N 79°52'50.33"E	3444	-5519	21.67	1.80	20.5
AAQ7	12°27'26.54"N 79°48'27.51"E	-4531	-2149	20.50	0	21.89
AAQ8	12°32'16.20"N 79°52'12.56"E	2298	6786	21.89	0	33.32

TABLE 4.7: INCREMENTAL & RESULTANT GLC OF FUGITIVE DUST

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline Fugitive ($\mu g/m^3$)	Incremental value of Fugitive due to mining ($\mu g/m^3$)	Total Fugitive ($\mu g/m^3$) (5+6)
AAQ1	12°28'36.64"N 79°50'53.21"E	-111	19	67.86	123.68	191.54
AAQ2	12°28'38.99"N 79°51'5.74"E	274	88	69.14	123	192.14
AAQ3	12°28'18.16"N 79°50'16.22"E	-1232	-561	68.90	0	68.9
AAQ4	12°30'25.96"N 79°47'21.45"E	-6535	3382	65.77	0	65.77
AAQ5	12°29'38.84"N 79°54'32.54"E	6546	1930	70.1	0	70.1
AAQ6	12°25'37.09"N 79°52'50.33"E	3444	-5519	68.20	0	68.2
AAQ7	12°27'26.54"N 79°48'27.51"E	-4531	-2149	68.34	0	68.34
AAQ8	12°32'16.20"N 79°52'12.56"E	2298	6786	67.60	0	67.6

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

4.4.4. Common Mitigation

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

Advantages of Wet Drilling: -

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

Blasting –

- Establish time of blasting to suit the local conditions and water sprinkling on blasting face.
- Avoid blasting i.e., when temperature inversion is likely to occur and strong wind blows towards residential areas.
- Controlled blasting includes Adoption of suitable explosive charge and short delay detonators, adequate stemming of holes at collar zone and restricting blasting to a particular time of the day i.e. at the time lunch hours, controlled charge per hole as well as charge per round of hole
- Before loading of material water will be sprayed on blasted material
- Dust mask will be provided to the workers and their use will be strictly monitored

Haul Road & Transportation –

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

Green Belt –

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

Occupational Health –

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

Climatic Changes:

- In general, the main findings regarding the potential impacts of climate change are Land Use Type, Energy Use, Water use & Dust emission and Biodiversity & rehabilitation.
- Whereas, this proposed mining activity is restricted to a small scale mining the proposals falls in a cluster situation where the surrounding environment is already subjected to mining activities and based on the past weather data its inferred that there is no much of change in the climate data of the region and the district profile has no records or past history of climate change leading to Droughts and floods.
- The project area's proposed with land use type of patta land for mining with 5 m height bench with 5 m width bench and Pollution Under Control Certified Machineries is proposed for wining of mineral by opencast mechanized mining method and water consumption are proposed with water tankers from nearby areas and the mine pit itself shall act as a rain water harvesting structure and formation of garland drains along the mine lease boundary to divert the surface runoff and collecting the runoff water for greenbelt development and dust suppression activities shall prove beneficial.
- The greenbelt development plan, all along the mine lease boundary @ 4,700 Nos of trees, along with the budget allocation for the proposed mitigation measures shall prove beneficial to surrounding environment.
- Therefore, the implementation of proposed mitigation measures for winning of mineral may not have much of impact on the surrounding Climate Change leading Droughts and Floods etc.,

4.5 Noise Environment (Impact & Mitigation Measures)

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

Predictions have been carried out to compute the noise level at various distances around the working pit due to these major noise-generating sources. Noise modelling has been carried out to assess the impact on surrounding ambient noise levels. Basic phenomenon of the model is the geometric attenuation of sound. Noise at a point generates spherical waves, which are propagated outwards from the source through the air at a speed of 1,100 ft/sec, with the first wave making an ever-increasing sphere with time. As the wave spreads the intensity of noise diminishes as the fixed amount of energy is spread over an increasing surface area of the sphere. The assumption of the model is based on point source relationship i.e., for every doubling of the distance the noise levels are decreased by 6 dB (A).

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

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

Where:

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

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

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

4.4.1 Anticipated Impact

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

- Source data
- Receptor data
- Attenuation factor

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

TABLE 4.8: ACTIVITY AND NOISE LEVEL PRODUCED BY MACHINERY

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

*50 feet from source = 15.24 meters

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

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

TABLE 4.9: PREDICTED NOISE INCREMENTAL VALUES

Location ID	**N1**	**N2**	**N3**	**N4**	**N5**	**N6**	**N7**	**N8**
Maximum Monitored Value (Day) dB(A)	55.3	54.5	55.3	46.5	51.8	57.6	54.7	53.5
Incremental Value dB(A)	42.8	46.7	48.7	41.0	44.5	44.5	46.1	42.4
Total Predicted Noise level dB(A)	53.7	53.4	53.9	47.6	52.5	53.2	52.5	53.8
NAAQ Standards	**Industrial**		**Day Time- 75 dB (A)**			**Night Time- 70 dB (A)**		
	Residential		**Day Time– 55 dB (A)**			**Night Time- 45 dB (A)**		

4.5.2 Common Mitigation Measures

The following noise mitigation measures are proposed for control of Noise.

- Time intervals for each quarry during blasting.
- Use of personal protective devices i.e., earmuffs and earplugs by workers, who are working in high noise generating areas.
- Limiting time exposure of workers to excessive noise.
- Proper and regular maintenance of vehicles, machinery and other equipment's.
- The noise generated by the machinery will be reduced by proper lubrication of the machinery and other equipment's.
- Speed of trucks entering or leaving the quarry will be limited to moderate speed to prevent undue noise from empty vehicles.
- Noise levels will be controlled by using optimum explosive charge, proper delay detonators and proper stemming to prevent blow out of holes (occasionally).
- Providing proper noise proof enclosure for the workers separated from the noise source and noise prone equipment.
- Provision of Quiet areas, where employees can get relief from workplace noise.
- The development of green belts around the periphery of the quarry site to attenuate noise.
- Regular medical check–up and proper training to personnel to create awareness about adverse noise level effects.

4.5.3 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 project area is located 1km Southeast in Karacheri village. The ground vibrations due to the blasting in proposed mine are calculated using the empirical equation.

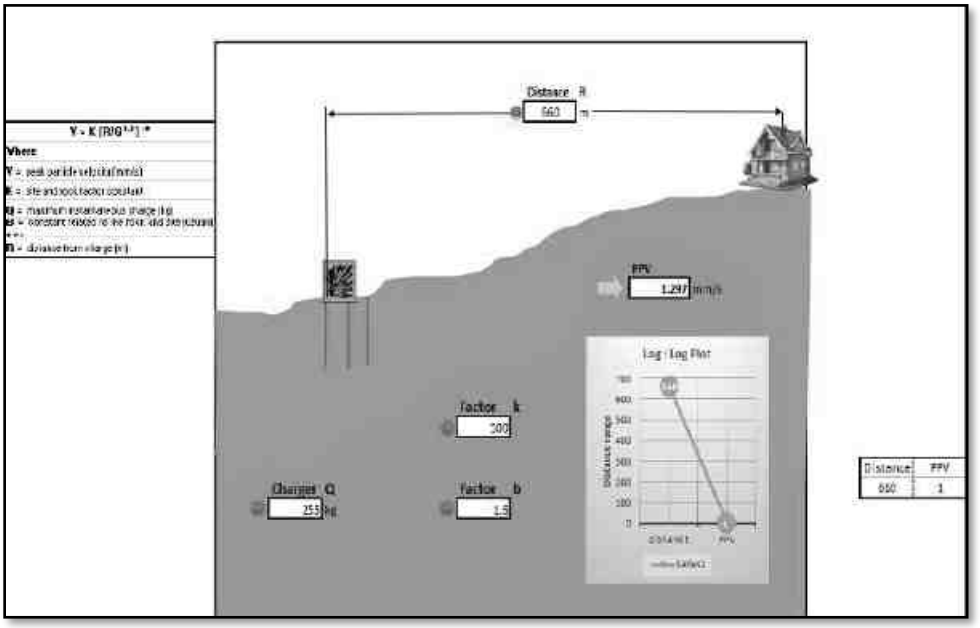
The empirical equation for assessment of peak particle velocity (PPV) is:

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

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 4.10: PREDICTED PPV VALUES DUE TO BLASTING

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in m/ms
P1	255	660	1.297



From the above graph, the Maximum charge per blast of 29 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. It is proposed to carry out blasting not exceeding 2kg of Explosives per one blasting round. However, as per statutory requirement control measures will be adopted to avoid the impacts due to ground vibrations and fly rocks due to blasting.

4.5.3.1 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

4.6 Impact on Biological Environment

Environmental impact studies are required for systematic identification, qualification, and interpretation of the anticipated changes. The main environmental problems associated with mining activities are deforestation, land degradation (change in topography, soil erosion), visual intrusion, disturbance to the hydrological system, and water, air, and noise pollution which ultimately impact the floral and faunal status of the project area. However, the occurrence and magnitude of these impacts entirely depend on project location, mode of operation, and adoption of the latest technologies.

4.6.1. Impact Identification and Evaluation

In general, impact prediction methods argue that the foremost step in impact appraisal must consider and identify project actions that are likely to bring significant changes in the project environment. The present study determined to predict the likely impacts of the Proposed Rough and Gravel quarry Mining Project in the surrounding environment with a specific focus on biological attributes covering habitats/ecosystems and associated biodiversity. Likely impacts identified were categorized into different levels like, direct or primary and indirect or secondary impacts based on the influence of sources of impacts.

There is no National Park or Wildlife Sanctuary in the study area. In addition, No Biosphere Reserves, Wildlife corridors, or, Tiger / Elephant reserves within 10 km of the project area. No Schedule- I species were found in the buffer zone of the proposed project area during the biodiversity assessment.

4.6.2. Impact on Flora

The proposed mine lease exhibits plain topography and it is Patta land which is not fit for cultivation. It is mostly devoid of any considerable vegetation. The proposed mine lease area (core zone) not encompasses any designated forest land within it. The vegetation is very sparse and scanty. So, there will be no impact on flora from the mining operation. There will not be much contamination of soil or any other materials from the mining operation. No threatened plant species were reported in the core and buffer study area during the field survey.

4.6.2.1. Anticipated Impact on agricultural land associated with flora

1. There are no impacts on the nearby agricultural land due to this mining activity.
2. None of the plants will be cut during the operational phase of the mine.
3. There shall be negligible air emissions or effluents from the project site. During loading the truck, dust generation will be likely. This shall be a temporary effect and not anticipated to affect the surrounding vegetation significantly.

Most of the land in the buffer area is undulating terrain with croplands, grass patches, and small shrubs. Hence, there will be no effect on the flora of the region.

4.7 Mitigation Measures

4.7.1. General Guidelines for Green Belt Development

In selecting plant species for green belt and plantation purposes in and around the proposed mine lease area native species, fruit-bearing trees, medicinal plants, and dense canopy trees should be selected. These species should be tolerant to pollution levels as per Bio- Geography zones of India.

After the operation of mining production capacity, green belt, and plantation species should be in accordance with the Terms and Conditions of the Environmental Clearance Green belt is created not only for the purpose of protecting sensitive areas or maintaining the ecological balance but because they also act as efficient biological filters or sinks for particulate and gaseous emissions, generated by vehicular movements and various industrial and mining activities.

a. Characteristic features of plants to be used for Absorption of pollutant gases

- Plant species should be perennial and evergreen with thick canopy cover.
- The crown of the tree (mass of foliage/leaves and branches growing outward from the trunk of the tree) should be either Oblong, Round or Spreading for effective absorption of pollutant gases.
- Plant should have foliage of longer duration.
- The foliage should be freely exposed through adequate height of the crown, Openness of foliage/leaves in the canopy, big leaves (long and broad laminar surfaces).

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.

Table No. 4.11. List of plant species proposed for Greenbelt development

S. No	Scientific name	Tamil Name
1	*Aegle marmelos*	Vilva maram
2	*Albizia lebbeck*	Vaagai maram
3	*Cassia fistula*	Konrai tree
4	*Lannea coromandelica*	Othiyam
5	*Limonia acidissima*	Vila maram
6	*Syzygium cumini*	Naval maram
7	*Toona ciliata*	Santhana Vembu
8	*Ficus hispida*	Aththi maram
9	*Borassus flabellifer*	Panai-maram

Table No. 4.12. Species suitable for abatement of noise and dust pollution

S. No	Botanical name	Common name
1	*Azadirachta indica*	Vembhu maram
2	*Ficus religiosa*	Arasan maram
3	*Ficus hispida*	Aththi maram
4	*Bombax ceiba*	Mul Elavu
5	*Syzygium cumini*	Naval maram
6	*Tamarindus indica*	Puliyamaram
7	*Mangifera indica*	Manga maram
8	*Harwickia binata*	Anjan maram
9	*Delonix regia*	Neruppu Kondrai
10	*Cassia Fistula*	Sara Kondrai

The above-suggested list covers species with thick canopy cover, perennial green nature, native origin, and a large leaf area index. The proposed species will help in forming an effective barrier between the mine site area and the surroundings.

4.7.2. Anticipated Impact on Fauna

- Since the terrestrial fauna in the study area is distributed away from the mine site, the impacts of the project are likely to be much low on the terrestrial fauna of the region. The proposed mining lease area is devoid of any significant vegetation, it is not suitable for permanent habitat for any specific wildlife.

- Habitat degradation and disturbance to faunal group due to ground vibration and increase in noise level will be minimize or resolved by modern technologies. So, from above facts it is revealed that there will be no impact on fauna. No threatened fauna species reported in the core and buffer study area.

4.7.3 Measures for protection and conservation of wildlife species

- 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 to the flora and fauna in consultation with Forest Department.
- Plantation around the mine area will help in creating habitats for small faunal species and create a better environment for various fauna. Creating and developing awareness for nature and wildlife in the adjoining villages.

4.8. 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. 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. The project is not likely to affect the aquatic ecology.

Table No: 4.13. General Impacts vs. Mitigation Matrix

Particulars	Issues	Reason/Status in relation to the mine site	Reference/Method	Suggestions
Species	Rare/ Endangered/ Threatened species	Not reported	Field observation, interviews of local people	**Nil**
	Endemic Species	No endemic species of any flora, fauna or wildlife are present in the study area.	Field survey, Literature review	**Nil**
	Protected Areas	No National Park, Wildlife Sanctuary, Tiger reserve, and Biosphere Reserve falls in the 10-km radius study area	ENVIS, Government of Tamil Nadu protected area website, Google Earth, Project Maps, etc.	**Nil**
	Important Bird Areas	No Important Bird Areas are falling in the 10-km radius area for Migratory Bird Habitat	ENVIS Centre on Wildlife & Protected Areas, Important Bird Area in India, IBA Book (Birdlife International)	**Nil**

Important Natural Habitats	Ramsar site	No Ramsar sites present in the surrounding area region	Ramsar Web site	**Nil**
	Wetlands of National Importance	Nil	ENVIS Centre on Wildlife & Protected Areas, Wetlands directory of Government of India	**Nil**
	Wetlands of International Importance	Nil	Nil	**Nil**
	Wildlife Corridors	No Wildlife Corridor is falling in 10 km radius project study area	Protected Areas, Consultation with local naturalists & authenticated location map.	**Nil**
	Eco-sensitive zone identified by the government	No Eco-sensitive zone is falling 10 km radius project study area	ENVIS, Consultation with local naturalists & authenticated location map	**Nil**
	Forest Areas	No Reserve Forest is falling in 10 km radius project study area	ENVIS, Government of Tamil Nadu protected area website, Google Earth, Project Maps, etc.	NIL, Applicant will create the green belt plantation on the periphery of mine sites.
	Water bodies	Nil	Project Map and local maps, Google Earth	Ensure minimum destruction during in operation phase.
	Breeding/nesting areas	No breeding/Nesting's site are falling in the study area	Literature Survey Project Map and local maps, Google Earth	NIL

TABLE 4.14: GREENBELT DEVELOPMENT PLAN

PROPOSAL FOR P1 – Thiru.V. Chandran				
Year	**No. of trees proposed to be planted**	**Survial %**	**Area to be planted**	**Name of the species**
I	It is proposed to plant 1880 **Nos** of trees in the 1st year	80 %	Safety barrier, Un utilized areas and nearby village roads	Neem, Pungam, Sengondrai, Panai, Naval

TABLE 4.15: BUDGET FOR GREEBELT DEVELOPMENT PLAN

ACTIVITY		YEARS										RATE	COST (Rs.)
		I	II	III	IV	V	VI	VII	VIII	IX	X		
Plantation under safety zone	Nos	35	35	35	35	35	35	35	35	35	35	@100 Rs Per sapling	35,000/-
	Cost	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500		
Plantation in quarried out benches and approach road	Nos	45	45	45	45	45	45	45	45	45	45		45,000/-
	Cost	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500		
Wire Fencing (In Mtrs) 560 Mtrs		168000	-	-	-	-	-	-	-	-	-	@300 Rs Per Meter	1,68,000/-
Garland drain (In Mtrs) 460 Mtrs		138000	-	-	-	-	-	-	-	-	-	@300 Rs Per Meter	1,38,000/-
TOTAL													**3,86,000/-**

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.

4.8.1Anticipated Impact on Fauna

- There is no Wildlife Sanctuary and Biosphere Reserve within 10 km radius of the project site.
- No rare, endemic & endangered species are reported in the buffer zone. However, during the course of mining, the management will practice scientific method of mining with proper Environmental Management Plan including pollution control measures especially for air and noise, to avoid any adverse impact on the surrounding wildlife.
- Fencing around all the proposed mine lease areas will be constructed to restrict the entry of stray animals
- Green belt development will be carried out which will help in minimizing adverse impact on the flora found in the area.

4.8.2 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.

4.8.3. Mitigation Measures

- All the preventive measures will be taken for growth & development of fauna.
- Creating and development awareness for nature and wildlife in the adjoin villages.

- The workers shall be trained to not harm any wildlife, should it come near the project site. No work shall be carried out after 6.00 pm.

4.9. Impact on Aquatic Biodiversity

Mining activities will not disturb the existing 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. Hence, aquatic biodiversity is not observed in the mine lease area.

4.9.1. Impact Assessment on Biological Environment

A detail of impact and assessments was mentioned in Table No 4.15.

TABLE 4.16: ECOLOGICAL IMPACT ASSESSMENTS

SI.No	Attributes	Assessment
1	Proximity to national park/wildlife sanctuary/reserve forest /mangroves/ coastline/estuary/sea	Vedanthangal Bird sanctuary-7km-N Karikili Bird Santuary-13km-N.
2	Proposed mining project impact surface water quality that also provide water to wildlife	'NO 'scheduled or threatened wildlife animal sighted regularly core in core area.
3	Located near an area populated by rare or endangered species	NO endangered, critically endangered, vulnerable species sighted in core mining lease area.
4	Proposed project restricts access to waterholes for wildlife	'NO'
5	Project likely to affect migration routes	'NO 'migration route observed during monitoring period.
6	Proposed mining project increase siltation that would affect nearby biodiversity area.	Surface runoff management such as garland drains is proposed to be constructed, so there will be no siltation nearby mining area.
7	Risk of fall/slip or cause death to wild animals due to project activities	'NO'
8	Activities of the project affects the breeding/nesting sites of birds and animals	No breeding and nesting site was identified in mining lease site. The fauna sighted mostly migrated from buffer area.
9	Mining project effect the forest-based livelihood/ any specific forest product on which local livelihood depended	'NO'
10	The project release effluents into a water body that also supplies water to a wildlife	No water body near to core zone so chances of water become polluted is low.
11	The project likely to affect wetlands, Fish breeding grounds, marine ecology	'NO'. Wetland was not present in near core Mining lease area. No breeding and nesting ground present in core mining area.
12	Project likely to affect flora of an area, which have medicinal value	'NO'
13	Forestland is to be diverted, has carbon high sequestration	'NO' There was no forest land diverted.

TABLE 4.17: ANTICIPATED IMPACT OF ECOLOGY AND BIODIVERSITY

Sl. No	Aspect Description	Likely Impacts on Ecology and Biodiversity (EB)	Impact Consequence - Probability Description / Justification	Significance	Mitigation Measures
Pre-Mining Phase					
1		Site specific loss of common floral	Site possesses common floral (not trees)	Less severe	No immediate action required. However,

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

4.10 Socio Economic Impact

4.10.1 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 behavioral 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 behavioral 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.

4.10.2 Operation Phase:

Anticipated Impacts:

♣ Long term exposure to the pollutants such as PM, SO_2 and NO_2 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 SO_2 scrubber and De - NOx 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 center for its employees and nearby villagers.

4.10.3 Impact Evaluation:

Table 4.18.1 Impact Evaluation Impact evaluation *is given in table below.*

<table>
<tr><td>Impact Evaluation Element</td><td colspan="4">Impact on socio economics due to the applied for rough stone and Gravel quarry over an extent of 3.76.0ha of Patta lands in S.F.Nos.480/1A, 1B, 2, 3, 484/3, 490/1A, 1B, 2B, 491/1A, 3A, 3B, 3C & 4D of Pakkam Village, Madhuranthagam Taluk, Chengalpattu District, Tamil Nadu State.</td></tr>
<tr><td>Potential Effect/ Concern</td><td colspan="4">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.</td></tr>
<tr><td colspan="5">Characteristics of Impacts</td></tr>
<tr><td rowspan="2">Nature</td><td colspan="2">Positive</td><td>Nagative</td><td>Netural</td></tr>
<tr><td colspan="2">✓</td><td></td><td></td></tr>
<tr><td rowspan="2">Type</td><td>Direct</td><td>Indirect</td><td colspan="2">Cumulative</td></tr>
<tr><td></td><td></td><td colspan="2">✓</td></tr>
<tr><td rowspan="2">Extent</td><td>Project area</td><td>Local</td><td>Zonal</td><td>Regional</td></tr>
<tr><td>✓</td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Duration</td><td colspan="2">Short time</td><td colspan="2">Long term</td></tr>
<tr><td colspan="2"></td><td colspan="2">✓</td></tr>
</table>

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

4.10.4 Common Mitigation Measures for Respective Individual Proposed Project

- Good maintenance practices will be adopted for all machinery and equipment, which will help to avert potential noise problems.
- Green belt will be developed in and around the project site as per Central Pollution Control Board (CPCB) guidelines.
- Air pollution control measure will be taken to minimize the environmental impact within the core zone.
- For the safety of workers, personal protective appliances like hand gloves, helmets, safety shoes, goggles, aprons, nose masks and ear protecting devices will be provided as per mines act and rules.
- Benefit to the State and the Central governments through financial revenues by way of royalty, tax, duties, etc.., from this project directly and indirectly.
- From above details, the quarry operations will have highly beneficial positive impact in the area
- No villages in the proposed mineral transportation route
- Mineral loaded Vehicles will not allow during school hours (Morning 8AM to 10AM & Evening 4.30PM to 5.30PM)

4.11 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

4.11.1 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

4.11.2 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.

4.11.3 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

4.11.4 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.

4.12 Mine Waste Management

No waste is anticipated from any of the proposed quarries.

4.13 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 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.

4.13.1 Mine Closure Criteria

The criteria involved in mine closure are discussed below:

4.13.1.1 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.,

4.13.1.2 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.

4.13.1.3 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 mining 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.

CHAPTER – 5: ANALYSIS OF ALTERNATIVES (TECHNOLOGY AND SITE)

5.0 Introduction:

Consideration of alternatives to a project proposal is a requirement of EIA process. This quarry is site specific. The site has been selected based on geological investigation and exploration and from the Existing quarry pits around the project site. Drilling, Blasting, Excavation, Loading & Transportation will be carried out in this quarrying operation.

- This area denotes the indicative of flow pattern of the rock mass in $N30^0E$ to $S30^0W$ with dipping $SE60^0$.
- Transportation facility for materials & manpower.
- Overall impact on environment and mitigation feasibility.
- Socio – economic background.

Enough infrastructure exists and lesser resources are required to be deployed. Since, any major construction for infrastructure is not required and hence does not affect the environment considerably.

5.1 Factors Behind the Selection of Project Site

Rough Stone and Gravel Quarry Projects at Pakkam Villages are a site specific. The proposed mining lease area has 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 within the project areas.
- Availability of skilled, semi-skilled and unskilled workers in this region.
- All the basic amenities such as medical, fire-fighting, 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

5.2 Analysis of Alternative Site

The mineral deposits are site specific in nature; hence, question of seeking alternate site does not arise for this project.

5.3 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 quarry areas fall in the clusters has following advantages –

- As the mineral deposition is homogeneous and batholith formation, therefore opencast method of working out deposit is preferred over underground method
- The material will be loaded after sprinkling with water 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.

5.4 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 inbuilt flexibility for increasing or decreasing the production as per market condition.

CHAPTER – 6: ENVIRONMENTAL MONITORING PROGRAMME

6.0 General

Environmental Monitoring will be taken up for various environmental components as per conditions stipulated in Environmental Clearance Letter issued by MoEF & Consent to Operate issued by the State Pollution Control Board. Monitoring reports will be submitted to regulator as per statutory requirements. The entire monitoring work will be carried out by MoEF & CC / NABL recognized laboratories.

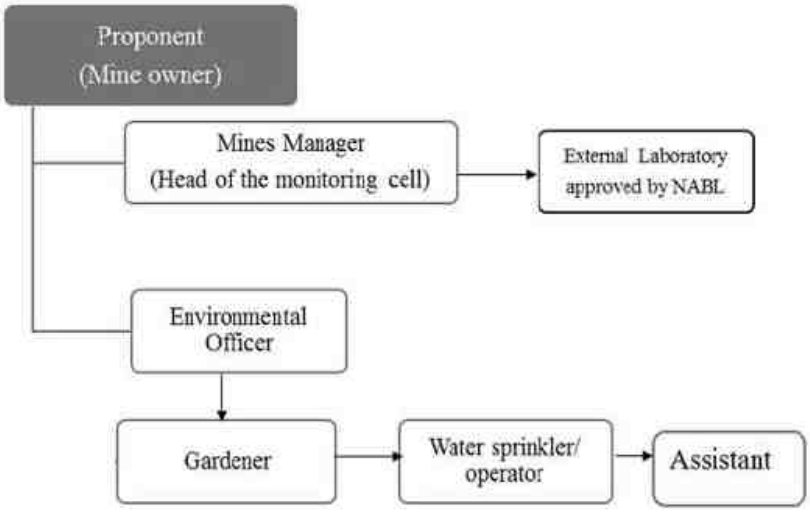
The monitoring and evaluation of environmental parameters indicates potential changes occurring in the environment, which paves way for implementation of rectifying measures wherever required to maintain the status of the natural environment. Evaluation is also a very effective tool to judge the effectiveness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

6.1 Methodology of Monitoring Mechanism

Implementation of EMP and periodic monitoring will be carried out by the proponents and respective quarry owners in the cluster quarries. A comprehensive monitoring mechanism has been devised for monitoring of impacts due to proposed project; Mine Management Level environmental protection measures like dust suppression, treatment and recycling of waste water, control of noise due to blasting and Ground vibration, maintenance of machinery and vehicles, housekeeping in the mine premises, plantation, implementation of other hand, implementation of area level protection measures like plantation and green Environmental Management Plan and environmental clearance conditions will be monitored by the proponent. On the belt development, environmental quality monitoring etc.,

An environment monitoring cell (EMC) will be constituted at the quarry consisting of following members to monitor the implementation of EMP and other environmental protection measures.

FIGURE 6.1 HIERARCHY OF ENVIRONMENTAL MONITORING CELL



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. 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 monthly, half-yearly and yearly. The half-yearly reports will be 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).

6.2 Implementation Schedule of Mitigation Measures

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

TABLE 6.1 IMPLEMENTATION SCHEDULE

Sl No.	Recommendations	Time Period	Schedule
1	Land Environment Control Measures	Before commissioning of the project	Immediately after the commencement of the project
2	Soil Quality Control Measures	Before commissioning of the project	Immediately after the commencement of the 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

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 "P1"

S. No.	Environment Attributes	Location	Monitoring		Parameters
			Duration	Frequency	
1	Air Quality	8 Locations (2 Core & 6 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	6 Locations (2SW & 4 GW)	-	Once in 6 months	Parameters specified under IS:10500, 1993 & CPCB Norms
4	Hydrology	Water level in open wells in buffer zone around 1 km at specific wells	-	Once in 6 months	Depth in bgl
5	Noise	8 Locations (2 Core & 6 Buffer)	Hourly – 1 Day	Once in 6 months	Leq, Lmax, Lmin, Leq Day & Leq Night
6	Vibration	At the nearest habitation (in case of reporting)	–	During blasting Operation	Peak Particle Velocity
7	Soil	6 Locations (1 Core & 5 Buffer)	–	Once in six months	Physical and Chemical Characteristics
8	Greenbelt	Within the Project Area	Daily	Monthly	Maintenance

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

6.4 Environmental Policy of the Proponents

The project proponents in the proposed quarries are committed to ensure that:

- Protect the environment by control and prevention of pollution and promote green environment.
- To operate the quarry with an objective of no injuries and accidents at the work place and provide a safe work place for our employees, contractors and others who perform their duties.
- Adequate health care will be taken to all the employees and create process to reduce the adverse effect of the operations on Health of the employees.
- Provide safety appliance and continuous training in safety to employees to ensure safe production and achieve the target of zero accidents.
- Develop safe working methods and practices, remove unsafe work conditions and consider all the aspects at the early stages of process development to provide safe working atmosphere.
- Communicate Safety, Health and Environmental Policy to all employees for better understanding and practice.

6.5 Budgetary Provision for Environmental Monitoring Programme

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 total cost for Environmental Monitoring Programme for one proposed quarry for the mining plan period is Rs 3,80,000/-.

TABLE 6.3 ENVIRONMENT MONITORING BUDGET

Parameter	Sl. Nos	Capital Cost
Air Quality Meteorology Water Quality Hydrology Soil Quality Noise Quality Vibration Study Greenbelt	**P1**	Rs.3,80,000/-
TOTAL		**Rs. 3,80,000/-**

Source: Approved Mining Plan

6.6 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 proponent with Environmental Monitoring cell and necessary corrective measures will be carried out. 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
- SEIAA, Chennai, Tamil Nadu

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

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

CHAPTER – 7: ADDITIONAL STUDIES

7.0 General

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

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

7.1. Public Consultation:

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

7.2 Risk Assessment

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

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

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

TABLE 7.1 RISK ASSESSMENT & CONTROL MEASURES

S. No	Risk factors	Causes of risk	Control measures
1	Accidents due to explosives and heavy mining machineries	Improper handling and unsafe working practice	▪ All safety precautions and provisions of Mine Act, 1952, Metalliferrous Mines Regulation, 1961 and Mines Rules, 1955 will be strictly followed during all mining operations; ▪ Entry of unauthorized persons will be prohibited; ▪ Fire fighting and first-aid provisions in the mine office complex and mining area; ▪ Provisions of all the safety appliances such as safety boot, helmets, goggles etc. will be made available to the employees and regular check for their use. ▪ Working of quarry, as per approved plans and regularly updating the mine plans;

			▪ Cleaning of mine faces 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& Blasting	Due to improper and unsafe practices Due to high pressure of compressed air, hoses may burst Drill Rod may break	▪ Safe operating procedure established for drilling (SOP) will be strictly followed. ▪ Only trained operators will be deployed. ▪ No drilling shall be commenced in an area where shots have been fired until the blaster/blasting foreman has made a thorough Examination of all places, ▪ Drilling shall not be carried on simultaneously on the benches at places directly one above the other. ▪ Periodical preventive maintenance and replacement of worn-out accessories in the compressor and drill equipment as per operator manual. ▪ All drills unit shall be provided with wet drilling shall be maintained in efficient working in condition. ▪ Operator shall regularly use all the personal protective equipment.
3	Blasting	Fly rock, ground vibration, Noise and dust. Improper charging, stemming & Blasting/ fining of blast holes Vibration due to movement of vehicles	▪ The maximum charge per delay and by optimum blast hole pattern, vibrations will be controlled within the permissible limit and blast 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 is and will be distinctly demarcated (by means of red flags).
4	Transportation	Potential hazards and unsafe workings contributing to accident and injuries Overloading of material	▪ Before commencing work, drivers personally check the dumper/truck/tipper for oil(s), fuel and water levels, tyre inflation, general cleanliness and inspect the brakes, steering system, warning devices including automatically operated audio-visual reversing alarm, rear view mirrors, side indicator lights etc., are in good condition.

		While reversal & overtaking of vehicle Operator of truck leaving his cabin when it is loaded.	▪ 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
5	Natural calamities	Unexpected happenings	▪ Escape Routes will be provided to prevent inundation of storm water ▪ Fire Extinguishers & Sand Buckets
6	Failure of Mine Benches and Pit Slope	Slope geometry, Geological structure	▪ Ultimate or over all pit slope shall be below 60° and each bench height shall be 5m height.

7.3 Disaster Management Plan

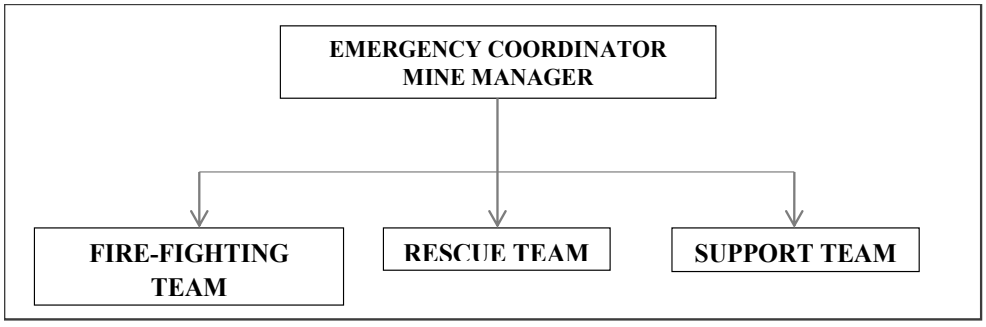
Natural disasters like Earthquake, Land slides has not been recorded in the past history as the terrain is categorized under seismic zone III. The area is far away from the sea hence the disaster due to heavy floods and tsunamis are not anticipated. The Disaster Management Plan is aimed to ensure safety 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. There would be three teams for taking care of emergency situations – Fire-Fighting Team, Rescue Team and Support Team. The proposed composition of the teams is given in Table 7.2.

TABLE 7.2: PROPOSED TEAMS TO DEAL WITH EMERGENCY SITUATION

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

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

Roles and responsibilities of emergency team –

(a) Emergency coordinator (EC)

The emergency coordinator shall assume absolute control of site

(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 is proposed at strategic locations within the quarry.

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
- Fire fighting and first-aid provisions in the mines office complex and mining area will be 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 the quarry in phase manner
- Cleaning of mine faces will be carried out regularly
- Provision of high-capacity standby pumps with generator sets with enough quantity of diesel for emergency pumping especially during monsoon.
- A blasting SIREN will be used at the time of blasting for audio signal.
- Checking of blasting area for any un-blasted hole or material.
- Warning notice boards indicating the time of blasting and NOT TO TRESPASS will be displayed at prominent places

7.4 CUMULATIVE IMPACT STUDY

Totally 14 quarries within the cluster, there are 1 Nos of Proposed quarry, 2 existing quarries falls in the cluster, 11 Abandoned quarries. The list of quarries is as below –

TABLE 7.3: LIST OF QUARRIES IN THE CLUSTER

PROPOSED QUARRIES				
CODE	**Name of the Proponent and Address**	**S.F. Nos, Village & Taluk**	**Extent in Ha**	**Status**
P1	**Thiru.V.Chandran**, S/O.V.Venkatesan, No.5/68, VLS Office, Thalapathi Nagar,Venjambakkam, SP Koil, Chengelpet.	480/1A, 1B,2,3,484/3, 490/1A,1B,2B, 491/1A,3A,3B,3C,4D of Pakkam Village, Maduranthagam Tk	**3.76.0**	Obtained ToR vide, Lr.No. SEIAA-TN/F.No.9519/SEAC/ToR-1357/2023 Dated:09.02.2023
EXISTING QUARRIES				
CODE	**Name of the Proponent and Address**	**S.F.Nos , Village & Taluk**	**Extent in Ha**	**Lease Period**
E1	**Thiru.V.Chandran**, S/O.V.Venketesan, No.5/68, VLS Office, Thalapathi Nagar,Venjambakkam, SP Koil, Chengelpet.	491/6A, 482/2A, 483/2A,2B, 482/2B, 480/4C2, 4E, 481/2, 491/6D, 6B Pakkam Village, Maduranthagam Tk	3.23.0	17.10.2018 to 16.10.2023
E2	Thiru.R.Anugraha Prasath S/O.Ramadass, No.7,Thirumanjana Veethi, Seerkazhi, Nagapattinam District.	491/2,495/1,495/2,494/1 Pakkam Village, Maduranthagam Tk	2.35.50	08.11.2018 to 07.11.2023
		Total	**5.58.5 Ha**	
ABANDONED QURRIES				
CODE	**Name of the Proponent and Address**	**S.F. Nos, Village & Taluk**	**Extent in Ha**	**Lease Period**
A-1	**Thiru.A.Tikkaraman,** Melavalampattu Village, Karunkuzhi Post, Madurantakam Tk.	486/1,2, 487/1A Pakkam Village, Maduranthagam Tk	**1.21.5**	30.10.2002 to 29.10.20047
A-2	**Thiru.S.Sugumar,** No.47, Meenakshiamman Koil street, Madurantakam Tk	479/1,2A,2B, Pakkam Village, Maduranthagam Tk	**0.66.5**	23.11.2004 to 22.11.2009
A-3	**Thiru.T.Ravi,** No.135, Marapakkam Village & Post, Madurantakam Tk.	508(P),Q.No.2, Pakkam Village, Maduranthagam Tk	**3.00.0**	05.01.2005 to 04.01.2010
A-4	**Thiru.S A.Gopinathan**, No.22, Amman Koil Street, Kadaperi, Chennai-45	511/1A, 2A, 1B, Pakkam Village, Maduranthagam Tk	**1.88.5**	03.10.2005 to 02.10.2010
A-5	**Thiru.S.Sugumar,** No.47, Meenakshiamman Koil street, Madurantakam Tk.	479/1A,2A,2B, Pakkam Village, Maduranthagam Tk	**0.66.5**	08.07.2010 to 07.7.2015
A-6	**Thiru.V.Chandran**, S/O.V.Venketesan, No.5/68, VLS Office, Thalapathi Nagar,Venjambakkam, SP Koil, Chengelpet.	509,510,511/1A,1B,2A, Pakkam Village, Maduranthagam Tk	**2.45.0**	09.08.2010 to 08.08.2017
A-7	**Thiru.J.Saravanan,** S/o.Jeevanantham, Old No.12, New No.27, Sampanthan St, Bharathipuram, chrompet, Chennai-44	480/4A, Pakkam Village, Maduranthagam Tk	**1.87.5**	01.09.2012 to 31.08.2017
A-8	**Thiru.V.Chandran**, S/O.V.Venketesan, No.5/68, VLS Office, Thalapathi Nagar,Venjambakkam, SP Koil, Chengelpet.	511/2B,512,514,515, Pakkam Village, Maduranthagam Tk	**3.25.0**	01.09.2012 to 31.08.2017
A-9	**Thiru.P.Thiruvengadam,** S/O.Parthasarathy, No.5/70, Istasithi Vinayagar Koil St, Venkateswara Nagar, Pozhichalur, Chennai-74	496/1A, 1B,2,3,4,5, 497, 506,507/1,2, Pakkam Village, Maduranthagam Tk	**3.23.0**	01.09.2012 to 31.08.2017
A-10	**Thiru.C.Kanniappan,** S/O.K.Sokkalingam, No.66/74, Senkazhaniyamman Koil St, Puzuthivakkam, Chennai-91	483/1B,1C,490/3B, Pakkam Village, Maduranthagam Tk	**0.94.5**	30.07.2013 to 29.07.2018
A-11	**Thiru.S.Surendiran S/o.Sugumar No.47, Meenatchiamman Koil St, Madurantakam**	489,491/1B, 4A,4C,4E,4F,5A,5B,5C,5D, Pakkam Village, Maduranthagam Tk	**1.68.0**	03.03.2014 to 02.03.2019
TOTAL CLUSTER EXTENT			**9.34.50**	**TOTAL CLUSTER EXTENT**

Note:-

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

TABLE 7.4: SALIENT FEATURES OF THE PROPOSAL PROJECT -P1

Name of the Quarry	**Thiru.V. Chandran,** Rough Stone & Gravel Quarry		
Toposheet No	57-P/15		
Latitude between	12°28'33.23"N to 12°28'43.08"N		
Longitude between	79°50'52.12"E to 79°51'07.58"E		
Highest Elevation	66 m AMSL		
Proposed Depth of Mining	43m (1m Gravel + 2m Weathered Rock + 40m Rough stone) below ground level		
Lease Period	10 Years		
Geological Resources	**Rough Stone in m^3**	**Weathered Rock m^3**	**Gravel m^3**
	15,04,000m^3	75,200m3	37,600m3
Mineable Reserves	**Rough Stone in m^3**	**Weathered Rock m^3**	**Gravel m^3**
	8,81,720m^3	57,846m^3	29,613m^3
Ultimate Pit Dimension	Pit-1 108m (L) x 100m (W) x 43m Pit-I1 148m (L) x 51m (W) x 43m Pit-1II 158m (L) x 71m (W) x 43m Pit-IV 36m (L) x 68m (W) x 18m		
Water Level in the surrounds area	70m Summer - 65m Rainy bgl		
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting		
Topography	The lease applied area is exhibits plain topography. The area has gentle sloping towards Northeast side. The altitude of the area is 66m (max) above Mean Sea level. The area is covered by 1m thickness of Gravel and 2m of Weathered Rock formation. Massive Charnockite is found after 3m (1m Gravel + 2m Weathered Rock) which is clearly inferred from the nearby existing quarry pits.		
Machinery proposed	Jack Hammer	11Nos	
	Compressor	3Nos	
	Excavator with bucket and rock breaker	2 Nos	
	Tipper	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	50 Nos		
Project Cost	Rs.1,50,54,000/-		
EMP Cost	Rs. 7,60,000/-		
Total	Rs.1,58,14,000/-		
CER Cost	Rs 5,00,000		
Nearby Water Bodies	Kiliyar River	4.5Km & NW	
	Edandhur Lake	6Km & SE	
	Madhuranthagam Lake	4.4Km & N	

	Tank	830m & SE
	Tank	6.5Km & NE
Greenbelt Development Plan	Proposed to plant 1880 trees in 3000 Sq.m area in the 7.5m Safety Zone and panchayat roads.	
Proposed Water Requirement	7.5 KLD	
Nearest Habitation	Pakkam – 660m- NE	

SALIENT FEATURES OF EXISTING QUARRIES "E-1"		
Name of the Mine	**Thiru.V. Chandran,** Rough stone and Gravel quarry	
Land Type	Patta land – Registered in the name of Thiru.V. Chandran vide patta no 1138	
S.F. No.	491/6A, 482/2A, 483/2A,2B, 482/2B, 480/4C2, 4E, 481/2, 491/6D, 6B	
Extent	3.23.0 Ha	
Previous quarry details	It is a Fresh lease,	
Proposed depth of mining	12m BGL	
Geological Reserves	Rough Stone	Gravel
	11,30,500 m^3	64,600 m^3
Mineable Reserves	Rough Stone	Gravel
	5,37,600 m^3	61,952 m^3
Proposed production for this five-year mining plan period	Rough Stone	Gravel
	5,37,600 m^3	61,952 m^3
Mining Plan Period / Lease Period	5 years	
Ultimate Pit Dimension	Pit-1 176m (L) X 79m (W) X 37m (D) Pit-II 177m (L) X 98m (W) X 37m (D)	
Toposheet No	57-P/15	
Latitude	12°28'30.04" N to 12°28'38.93" N	
Longitude	79°50'56.85" E to 79°51'06.95" E	
Water Level	45 to 40m BGL	
Machinery	Jack Hammer	6
	Compressor	1
	Hydraulic Excavator	2
	Dumpers	4
Blasting	Usage of Slurry Explosive with MSD detonators	
Manpower Deployment	30Nos	
Total Project Cost	Project Cost	Rs. 1,53,95,262/-
	EMP Cost	Rs.3,80,000/-
	Total	Rs.1,57,75,262/-
CER cost	Rs. 5,00,000	

SALIENT FEATURES OF EXISTING QUARRIES "E-2"	
Name of the Mine	**Thiru.R. Anugraha Prasath**, Rough stone and Gravel quarry
Land Type	Patta land – Registered the Name of the T.Prasanna in S.F.No491/2, 495/1 &495/2 Patta no. 1056 and another S.F.No.494/1 Registered Name of the Thiru.P.Thiruvengadam vide Patta No.413
S.F. No.	491/2,495/1,495/2,494/1
Extent	2.35.50 Ha
Previous quarry details	It is fresh Lease

Ultimate pit dimension	Pit-1 110m (L) X 135m (W) X 47m (D) Pit-2 75m (L) X 62m (W) X 47m (D)	
Proposed depth of mining	47m (D) BGL	
Geological Reserves	Rough Stone	Gravel
	10,46,250 m^3	46,500 m^3
Mineable Reserves	Rough Stone	Gravel
	5,32,320 m^3	38,240m^3
Proposed production for this five-year mining plan period	Rough Stone	Gravel
	5,32,320 m^3	38,240m^3
Mining Plan Period / Lease Period	5 years	
Ultimate Pit Dimension (end of Mining Plan Period)	Pit-1 110m (L) X 135m (W) X 47m (D) Pit-2 75m (L) X 62m (W) X 47m (D)	
Toposheet No	57-P/15	
Latitude	12°28'30.47" N to 12°28'34.93" N	
Longitude	79°50'48.21" E to 79°50'55.67" E	
Water Level	45 to 40m BGL	
Machinery	Jack Hammer	6
	Compressor	1
	Hydraulic Excavator	2
	Dumpers	4
Blasting	Usage of Slurry Explosive with MSD detonators	
Manpower Deployment	30 Nos	
Total Project Cost	Project Cost	Rs. 1,08,55,037/-
	EMP Cost	Rs.3,80,000/-
	Total	Rs.1,12,35,037/-
CER cost	Rs. 5,00,000	

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

Impact on Air Environment –

Calculating the Cumulative Load of Mining within the cluster is as shown in table 7.5 & 7.6

TABLE 7.5 CUMULATIVE PRODUCTION LOAD OF ROUGH STONE IN CLUSTER

Proposed Quarry				
Quarry	**Production for five-year plan period considering safety parameters**	**Per Year Production in m^3**	**Per Day Production in m^3**	**Number of Lorry Load Per Day @ 12m^3 per load**
P1	**8,81,720**	**1,76,344**	**588**	**49Trips /Day**
Existing Quarries				
Quarry	**Production for five-year plan period**	**Per Year Production in m^3**	**Per Day Production in m^3**	**Number of Lorry Load Per Day @ 12m^3 per load**
E-1	5,37,600	1,07,520	358	30Trips /Day
E-2	5,32,320	1,06,464	355	30Trips/Day
Total	**1,069,920**	**2,13,984**	**713**	**60Trips/ Day**

TABLE 7.6: CUMULATIVE PRODUCTION OF GRAVEL IN CLUSTER

Proposed Quarry				
Quarry	**Production for three-year plan period considering safety parameters**	**Per Year Production in m^3**	**Per Day Production in m^3**	**Number of Lorry Load Per Day @ $12m^3$ per load**
P1	37,600	12,533	42	3 trips per day /
Existing Quarries				
Quarry	**Production for three-year plan period**	**Per Year Production in m^3**	**Per Day Production in m^3**	**Number of Lorry Load Per Day @ $12m^3$ per load**
E-1	61,952	20,650	69	6 Trips /Day
E-2	38,420	12,807	43	4Trips/Day
Total	**1,00,372**	**33,457**	**112**	**10Trips/ Day**

Based on the above production quantities the emissions due to various activities in all the 1 proposal quarry includes various activities like ground preparation, excavation, handling and transport of mineral. 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 7.7.

TABLE 7.7: INCREMENTAL & RESULTANT GLC WITHIN CLUSTER

PM_{10} in $\mu g/m^3$	
Location	**AAQ1 – CORE**
Background (average)	42.20
Anticipated Incremental due to the proposals	17.90
Resultant	60.1
NAAQ Norms	100 $\mu g/m^3$
$PM_{2.5}$ in $\mu g/m^3$	
Location	**AAQ1 – CORE**
Background (average)	21.59
Highest Incremental	9.82
Resultant	31.41
NAAQ Norms	80 $\mu g/m^3$
SO_2 in $\mu g/m^3$	
Location	**AAQ1 – CORE**
Background (average)	8.02
Anticipated Incremental due to the proposals	3.49
Resultant	11.51
NAAQ Norms	80 $\mu g/m^3$
NO_x in $\mu g/m^3$	
Location	**AAQ1 – CORE**
Background (average)	20.71
Anticipated Incremental due to the proposals	12.73
Resultant	33.32
NAAQ Norms	80 $\mu g/m^3$

Noise Environment –

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

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

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

Where:

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

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

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

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

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

TABLE 7.8: 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 NorthEast from the cluster 660m	47.8	43.7	49.2	55

Source: Lab Monitoring Data

The incremental noise level is found within the range of 39.8 – 43.7 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 the all the 3 Mines within cluster are anticipated due to operation of Mining Machines like Excavators, drilling and blasting, transportation vehicles, etc., However, the major source of ground vibration from all the 3 mines is blasting. The major impact of the ground vibrations is observed on the domestic houses located in the villages nearby the mine lease areas. 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 Cluster is tabulated in Table 7.9

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 7.9: GROUND VIBRATIONS AT MINES

PROPOSAL QUARRY			
Location ID	**Maximum Charge in kgs**	**Nearest Habitation in m**	**PPV in m/ms**
P1	255	660	1.297
EXISTING QUARRIES			
Location ID	**Maximum Charge in kgs**	**Nearest Habitation in m**	**PPV in m/ms**
E1	155	717	0.763
E2	154	1030	0.425

Source: PPV Calculation

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 mines shall provide employment and revenue will be created to government

TABLE 7.10: SOCIO ECONOMIC BENEFITS FROM CLUSTER MINES

PROPOSAL QUARRY			
Code	**Employment**	**Project Cost**	**CER**
P1	**50**	Rs.1,50,54,000/-	Rs 5,00,000
EXISTING QUARRIES			
Code	**Employment**	**Project Cost**	**CER**
E1	30	Rs.1,53,95,262/-	Rs. 5,00,000
E2	30	Rs.1,12,35,037/-	Rs. 5,00,000
Total	**60**	**Rs. 2,66,30,299/-**	**Rs. 10,00,000/-**
Grand Total	**110**	**Rs. 4,16,84,229/-**	**Rs. 15,00,000/-**

A total of 110 people will get employment due to this cluster, in this already 60 people employed in the existing quarries. For the Existing quarries Corporate Environment Responsibility (CER) allocated as per Government of India, MoEF & CC Office Memorandum F.No.22-65/2017-IA.III, Dated: 01.05.2018.

For the proposed projects it is recommended to spent Rs 5,00,000/- towards CER Activities in the nearby Government School for Renovation or reconstruction of Existing Toilet, Providing Note books to the school library and Plantation in the school ground any other recommendations by the School Head masters.

- In this cluster from the 1 Proposal, it is proposed to spent Rs 5,00,000/- for CER activities

Considering 500 Nos of trees per hectare it is proposed to plant About 1880 nos. of saplings in the proposed projects for the Mining plan period in safety barrier, Un utilized area and village roads with survival rate 80% (Anticipated). 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 7.11: GREENBELT DEVELOPMENT BENEFITS FROM PROPOSAL MINE

Proposed project				
CODE	**No of Trees proposed to be planted**	**Survival %**	**Area to be covered**	**Name of the Species**
P1	1880	80	Safety barrier, Un utilized area and Village roads	Neem, Pongamia, Pinnata, Causarina, etc.,

It is anticipated that there shall growth of native species of Neem, Pongamia, Pinnata, Causarina, etc., in the Proposal at a rate due to these proposals 160 Trees Planted over a period of 5 Years with Survival Rate of 80%. Besides every individual lease holder will plant Saplings in the School ground as part of CER activities.

7.5 PLASTIC WASTE MANAGEMENT PLAN FOR P1

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 7.12: 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

Carbon Emission

Carbon dioxide (CO_2): Carbon dioxide enters the atmosphere through burning fossil fuels (coal, natural gas, and oil), solid waste, trees and other biological materials. Carbon dioxide is removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.

Methane (CH_4): Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices, land use and by the decay of organic waste in municipal solid waste landfills.

Nitrous oxide (N2O): Nitrous oxide is emitted during agricultural, land use, and industrial activities; combustion of fossil fuels and solid waste; as well as during treatment of wastewater.

In this quarrying activities, anticipated GHG is mainly CO_2 as its proposed for usage of HSD (High Speed Diesel) for proposed machinery totally deployed are 7 Nos. Compressor, 7 Nos Excavator and 8 Nos. of Tippers for which an approximate usage of HSD is around 675 Liters per day. Which contributes to 90.45 kg of CO_2 for the stretch of daily activity of 20 kms @ 1 Liter Diesel produces 2.68 kg of CO2 on the contrast 1 tree absorbs approximately 20-40 kgs of CO_2 per year.

- It is proposed to plant 160 Nos of trees in the 1 proposal shall absorb 94,000 kgs of CO_2 per year on average basis.
- Apart from which, its proposed for deployment of New Modern Machineries (BSVI) and PUC certified Vehicles.

Therefore, the implementation of proposed mitigation measures for winning of mineral may not have much of impact on the surrounding environment leading to release of Greenhouse gases (GHC), rise in temperature & livelihood of local people.

Hydrothermal/Geothermal effect due to destruction in the Environment.

- Hydrothermal –relating to hot water used especially of the formation of minerals by hot solutions rising from a cooling magma.
- Geothermal -relating to or produced by the internal heat of the earth.
- The proposed activity is for quarrying of rough stone by opencast mechanized mining method for an ultimate depth of 43 m bgl.
- The proposed mining area and the surrounding falls under hard rock formation i.e., Charnockite Formation and the district has not recorded any Hydrothermal / Geothermal effect and as per the Seismic Zonation Map of India, the district falls under the Zone II of seismic zones classification.
- The resultant of this open cast mining shall not have any Hydrothermal/Geothermal effect on the surrounding environment.

Bio-geochemical processes and its foot prints including environmental stress.

- Bio-geochemical cycle – any of the natural pathways by which essential elements of living matter are circulated. The term biogeochemical is a contraction that refers to the consideration of the biological, geological, and chemical aspects of each cycle.
- This proposed activity is for quarrying of rough stone quarry and maximum depth of mining is 43 m bgl and the applied area for quarrying is a patta land with no major vegetation and it is proposed for greenbelt development all along the safety barrier and construction of garland drainage and implement the proposed EMP strictly to mitigate the impacts on surrounding environment.
- No Bio-geochemical processes and its foot prints including environmental stress are anticipated and at the end of life of mine the proposed quarry shall be left as an artificial reservoir structure and allowed to collect rain water and shall enrich the ecosystem.

Sediment's geochemistry in the surface streams.

- Sedimentary Geochemistry has been in use to understand the conditions of deposition, climatic variations, tectonic setting, provenance, reservoir characteristics, etc.,
- The elemental composition of sediments in surface streams is the product of physical and chemical erosion of rocks, which is then transported across drainage networks.
- The project area when broken up lead to create void and land use pattern of the proposed area is alerted by ways of formation of open pit and as mitigation measure its proposed for garland drain all along the boundary barrier to ensure that no natural drainage pattern is disturbed and the garland drains are in turn connected to settlement traps were its ensured that no debris are carried away and hence the proposed activity shall not lead to any deposition of sediments in the nearby surface streams.

CHAPTER – 8: PROJECT BENEFITS

8.1 *General*

The Proposed Project for Quarrying Rough Stone and Gravel at Pakkam Village aims to produce 8,81,720 m^3 Rough Stone Period of 5 years (**588** m^3 rough stone @ **49** Tipper per day) & **29,613**m^3 of Gravel over a period of 3 Years. (33 m^3 gravel @ 3per load).

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

8.2 Employment Potential

This prosed project falls in the cluster will provide employment opportunities to about employment to about 50 persons directly. 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.

8.3 Socio-Economic Welfare Measures Proposed

The impact of mining activity in the area will be more positive than negative 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.

8.4 Improvement in Physical Infrastructure

The proposed project site is located in Pakkam village, Maduranthagam taluk, Chengalpattu 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 the cluster quarry projects.

- 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.

8.5 Improvement in Social Infrastructure

The quarry projects in the region will have positive impact on the social economic condition of the area by way of providing employment to the local peoples; thereby increasing the per capita income, housing, education, medical and transportation facilities, economic status, health and agriculture.

- Social welfare program like medical camps, educational facilities to the poverty level students, providing water supply from the quarries during drought seasons will be taken from the project proponent's
- Supplementing Govt. efforts in health monitoring camps, social welfare and various Awareness programs among the rural population.

8.6 Other Tangible Benefits

The proposed quarry project 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 quarry site 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.,

8.7 CORPORATE SOCIAL RESPONSIBILITY

Individual Project Proponents 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

8.8 CORPORATE ENVIRONMENT RESPONSIBILITY

For the existing quarries 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, all the mines being a green field project & Capital Investment is ≤ 100 crores, they shall contribute 2% of Capital Investment towards CER.

For the proposed projects it is recommended to spent Rs 5,00,000 towards CER Activities in the nearby Government School for Renovation or reconstruction of Existing Toilet, Providing Note books to the school library and Plantation in the school ground any other recommendations by the School Head masters.

TABLE 8.1 CER – ACTION PLAN

Code	CER
P1	Rs 5,00,000/-
Total	**Rs 5,00,000/-**

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

CHAPTER – 9: ENVIRONMENTAL COST BENEFIT ANALYSIS

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

CHAPTER - 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.V. Chandran** will –

- Meet the requirements of all laws, acts, regulations, and standards relevant to its operations and activities
- 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 a program to train employees in general environmental issues and individual workplace environmental responsibilities.
- 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 –

Land degradation is one of the major adverse impacts of opencast mining in the form of excavated voids and contamination of soil affects the viability of the soil resource.

Soil contamination then has a number of flow-on effects like, Inhabition of plant growth, and death of existing plants in contaminated areas and contamination of soil also has potential to impact on a surface water quality and groundwater resources.

TABLE 10.1: PROPOSED CONTROLS FOR LAND ENVIRONMENT

CONTROL	RESPONSIBILITY
Designing vehicle wash-down system so that all washed water is captured and passed through grease and oil separators.	Mines Manager
Re fueling will be carried out in a safe location, away from vehicle movement pathways	Mine Foreman & Mining Mate
Greenbelt development and its maintenance	Environment Officer
Garland drains with catch pits to be provided all around the project area to prevent run off affecting the surrounding lands.	Environment Officer
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
Thick plantation using native flora spices will be carried out on the top benches.	Mines Manager
There will be formation of a small surface water body in the mined-out area, which can be used for watering the greenbelt at the conceptual stages.	Environment Officer

Source: Proposed by FAE's & EIA Coordinator

10.3 Soil Management

Top Soil Management –

- There is no top soil within the project area thin layer of soil will be utilized for Greenbelt purpose.

Overburden / Waste and Side Burden Management –

- The overburden in the form of Gravel formation, the Gravel will be directly loaded into tippers for the filling and levelling of low-lying areas, this will be done only after obtaining permission and paying necessary seigniorage fees to the Government.

TABLE 10.2: PROPOSED CONTROLS FOR SOIL MANAGEMENT

CONTROL	RESPONSIBILITY
Garland drains are to be paved around the quarry pit area to arrest possible wash off in the rainy seasons	Mines Manager
Surface run-off from the surface water 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	Environment Officer
keeping records of mitigation of erosion events, to improve on management techniques	Environment Officer

A monitoring map with information including their GPS coordinates, erosion type, intensity, and the extent of the affected area, as well as existing control measures and assessment of their performance	Environment Officer
Empty sediment from sediment traps Maintain, repair or upgrade garland drain system	Environment Officer
Test soils for pH, EC, chloride, exchangeable cations, particle size and water holding capacity	Mines Manager

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 43m 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 existing and proposed mining activities would result in the increase of particulate matter concentrations due to fugitive dust. Water sprinkling twice per day 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.

Carbon dioxide (CO_2): Carbon dioxide enters the atmosphere through burning fossil fuels (Coal, natural gas, and oil), solid waste, trees and other biological materials. Carbon dioxide is removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.

In this quarrying activity, anticipated GHG is mainly CO_2 as its proposed for usage of HSD (High Speed Diesel) for machinery to be deployed are 1 Nos. Compressor, 1 Nos. Excavator attached with rock breaker/ bucket 2 No. of Tippers for which an approximate usage of HSD is around 350 Liters per day. Which contributes to 62.53 kg of CO_2 for the stretch of daily activity of 15 kms @ 1 Liter Diesel produces 2.68 kg of CO_2 on the contrast 1 tree absorbs approximately 20-40 kgs of CO_2 per year.

Therefore, the proposal for 750 Nos. of trees shall absorb 26,250 kgs of CO_2 per year on average basis.

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 Management

There will be intermittent noise levels due to vehicular movement, trucks loading, drilling and blasting and other allied 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 and 50m safety barrier) 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 in-built 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 access the impact due to the mining activities and the efficacy of the adopted noise control measures. Additional noise control measures will be adopted if required as per the observations during monitoring	Mines Manager
Reduce maximum instantaneous charge using delays while blasting	Mining Mate
Change the burden and spacing by altering the drilling pattern and/or delay layout, or altering the hole inclination	Mines Manager
Undertake noise or vibration monitoring	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

10.7 Ground Vibration and Fly Rock Control

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

About1880 nos. of saplings is proposed to be planted for the Mining plan period in safety barrier and nearby village roads 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 – P1

Year	No. of tress proposed to be planted	Area to be covered	Name of the species	Survival rate expected in %
I	1880	Safety zone, Un utilized area & Village roads	Neem, Pungam, Sengondrai, Panai, Naval	80

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

The objectives of the greenbelt development plan are –

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

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

10.8.2 Species Recommended for Plantation

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

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

TABLE 10.8: RECOMMENDED SPECIES TO PLANT IN THE GREENBELT

S.No	Botanical Name	Local Name	Importance
1.	Azadirachta indica	Neem, Vembu	Neem oil & neem products
2.	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	1st Year	2nd Year	3rd Year	4th Year	5th Year
1	Initial Medical Examination (Mine Workers)					
A	Physical Check-up					
B	Psychological Test					
C	Audiometric Test					
D	Respiratory Test					
2	Periodical Medical Examination (Mine Workers)					
A	Physical Check – up					
B	Audiometric Test					
C	Eye Check – up					
D	Respiratory Test					
3	Medical Camp (Mine Workers & Nearby Villagers)					
4	Training (Mine Workers)					

Medical Follow ups:- Work force will be divided into three targeted groups age wise as follows:-

Age Group	**PME as per Mines Rules 1955**	**Special Examination**
Less than 25 years	Once in a Three Years	In case of emergencies
Between 25 to 40 Years	Once in a Three Years	In case of emergencies
Above 40 Years	Once in a Three Years	In case of emergencies

Medical help on top priority immediately after diagnosis/ accident is the essence of preventive aspects.

10.9.2 Proposed Occupational Health and Safety Measures –

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

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

FIGURE 10.1: PERSONAL PROTECTIVE EQUIPMENT TO THE MINE WORKERS

10.9.3 Health and Safety Training Programme

The 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 – P1

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	37600	37600
	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 - 11 Units	275000	27500
	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 Governers @ Rs. 5000/- per Tipper/Dumper deployed - 6 Units	30000	1500
	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	75200
	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	2292472
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	37600	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	752000	10000
	3. Progressive Closure Activity Green belt development - 500 trees per one hectare - Proposal for 1880Trees - (950 Inside Lease Area & 930 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)	190000	28500
		Avenue Plantation @ 300 per plant (capital) for plantation outside the lease area and @ 30 per plant maintenance (recurring)	279000	27900
	4. Implementation of Final Mine Closure Actity 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	57900	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	5202148	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) - 50 Employees	200000	50000
	Health check up for workers will be provisioned	IME & PME Health check up @ Rs. 1000/- per employee	0	50000
	First aid facility will be provided	Provision of 2 Kits per Hectare @ Rs. 2000/-	0	7520
	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	188000	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			**3449200**	**3580192**

* Marked cost is already discussed in the mining plan hence that is not included in the total Environmental Management plan cost

Total Cost for the Ten years

Year	Total Cost
1st	₹ 70,29,392
2nd	₹ 37,59,202
3rd	₹ 39,47,162
4th	₹ 41,44,520
5th	**₹ 44,09,646**
6th	₹63,54,728
7th	₹ 49,47,864
8th	₹ 51,95,257
9th	₹ 54,55,020
10th	**₹ 57,27,771**

Cost inflation 5% per annum

Note: This Environmental Management plan cost will vary according to the public consultation comments

In order to implement the environmental protection measures, an amount of Rs.34,49,200 as capital cost and recurring cost as Rs. 35,80,192 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.

CHAPTER – 11: SUMMARY AND CONCLUSIONS

Thiru.V. Chandran Rough Stone & Gravel Quarry (Extent – 3.76.0 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 the Final EIA /EMP Report will be prepared based on the outcome of Public Consultation and the outcome will be incorporated in the EMP Report.

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 Dec to Feb 2023 (Baseline Data Used is as per MoEF & CC Office Memorandum No. J-11013/41/2006-IA-II (I) (Part) Dated 29th August 2017 & MoEF & CC Office Memorandum F.No.IA3-22/10/2022-IA.III [E 177258] Dated: 08.06.2022) for various environmental components so as to assess the anticipated impacts of the cluster quarry projects on the environment and suitable mitigation measures for likely adverse impacts due to the proposed project is suggested individually for the respective proposed project under Chapter 10.

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

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

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

Sustainable and modern mining leads us to see positive impact of mining operation and providing consistent employment for nearly 50 people directly in the proposed projects people.

As discussed, it is safe to say that the one proposed quarry in cluster is not likely to cause any significant impact to the ecology of the area, as adequate preventive measures will be adopted to keep the various pollutants within the permissible limits.

CHAPTER 12.0: DISCLOSURE OF CONSULTANTS

The Project Proponent's –

Thiru.V. Chandran Rough Stone & Gravel Quarry (3.76.0 ha) 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.

Name and address of the consultancy:

GEO EXPLORATION AND MINING SOLUTIONS

No 17, Advaitha Ashram Road,

Alagapuram, Salem – 636 004

Tamil Nadu, India

Email: infogeoexploration@gmail.com

Web: www.gemssalem.com

Phone: 0427 2431989.

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

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

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

DECLARATION BY EXPERTS CONTRIBUTING TO THE EIA/EMP

Declaration by experts contributing to the EIA/EMP for Rough Stone & Gravel Cluster Quarries over an cluster Extent of 9.34.50 ha in Pakkam Village of Maduranthagam Taluk, Chengalpattu 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**

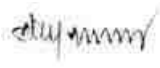
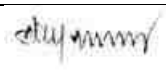
Date & Signature: 

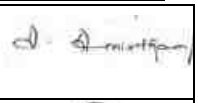
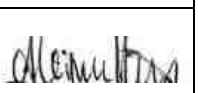
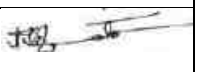
Period of Involvement: **December 2022 to till date**

Associated Team Member with EIA Coordinator:

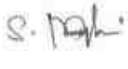
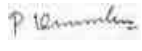
1. **Mr. S. Nagamani**
2. **Mr. Viswanathan**
3. **Mr. Santhoshkumar**
4. **Mr. S. Ilavarasan**

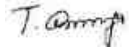
FUNCTIONAL AREA EXPERTS ENGAGED IN THE PROJECT

Sl. No.	Functional Area	Involvement	Name of the Expert/s	Signature
1	AP	▪ Identification of different sources of air pollution due to the proposed mine activity ▪ Prediction of air pollution and propose mitigation measures / control measures	Mr. A. Jagannathan	
2	WP	▪ Suggesting water treatment systems, drainage facilities ▪ Evaluating probable impacts of effluent/waste water discharges into the receiving environment/water bodies and suggesting control measures.	Dr. M. Ifthikhar Ahmed	
			Mr. N. Senthilkumar	
3	HG	▪ Interpretation of ground water table and predict impact and propose mitigation measures. ▪ Analysis and description of aquifer Characteristics	Dr. P. Thangaraju	
4	GEO	▪ Field Survey for assessing the regional and local geology of the area. ▪ Preparation of mineral and geological maps. ▪ Geology and Geo morphological analysis/description and Stratigraphy/Lithology.	Dr. M. Ifthikhar Ahmed	
			Dr. P. Thangaraju	
5	SE	▪ Revision in secondary data as per Census of India, 2011. ▪ Impact Assessment & Preventive Management Plan ▪ Corporate Environment Responsibility.	Mrs. K. Anitha	

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

LIST OF TEAM MEMBERS ENGAGED IN THIS PROJECT

Sl.No.	Name	Functional Area	Involvement	Signature
1	Mr. S. Nagamani	AP; GEO; AQ	▪ Site Visit with FAE ▪ Provide inputs & Assisting FAE with sources of Air Pollution, its impact and suggest control measures ▪ Provide inputs on Geological Aspects ▪ Analyse & provide inputs and assist FAE with meteorological data, emission estimation, AERMOD modelling and suggesting control measures	
2	Mr. Viswanathan	AP; WP; LU	▪ Site Visit with FAE ▪ Provide inputs & Assisting FAE with sources of Air Pollution, its impact and suggest control measures ▪ Assisting FAE on sources of water pollution, its impacts and suggest control measures ▪ Assisting FAE in preparation of land use maps	
3	Mr. Santhoshkumar	GEO; SC	▪ Site Visit with FAE ▪ Provide inputs on Geological Aspects ▪ Assist in Resources & Reserve Calculation and preparation of Production Plan & Conceptual Plan	

			▪ Provide inputs & Assisting FAE with soil conservation methods and identifying impacts	
4	Mr. Umamahesvaran	GEO	▪ Site Visit with FAE ▪ Provide inputs on Geological Aspects ▪ Assist in Resources & Reserve Calculation and preparation of Production Plan & Conceptual Plan	
5	Mr. A. Allimuthu	SE	▪ Site Visit with FAE ▪ Assist FAE with collection of data's ▪ Provide inputs by analysing primary and secondary data	
6	Mr. S. Ilavarasan	LU, SC	▪ Site Visit with FAE ▪ Assisting FAE in preparation of land use maps ▪ Provide inputs & Assisting FAE with soil conservation methods and identifying impacts	
7	Mr. E. Vadivel	HG	▪ Site Visit with FAE ▪ Assist FAE & provide inputs on aquifer characteristics, ground water level/table ▪ Assist with methods of ground water recharge and conduct pump test, flow rate	
8	Mr. D. Dinesh	NV	▪ Site Visit with FAE ▪ Assist FAE and provide inputs on impacts due to proposed mine activity and suggest mitigation measures ▪ Assist FAE with prediction modelling	
9	Mr. Panneer Selvam	EB	▪ Site Visit with FAE ▪ Assist FAE with collection of baseline data ▪ Provide inputs and assist with labelling of Flora and Fauna	
10	Mrs. Nathiya	EB	▪ Site Visit with FAE ▪ Assist FAE with collection of baseline data ▪ Provide inputs and assist with labelling of Flora and Fauna	

DECLARATION BY THE HEAD OF THE ACCREDITED CONSULTANT ORGANIZATION

I, Dr. M. Ifthikhar Ahmed, Managing Partner, Geo Exploration and Mining Solutions, hereby, confirm that the above-mentioned Functional Area Experts and Team Members prepared the EIA/EMP for Rough Stone & Gravel Quarries over an Cluster Extent of 9.34.50 ha in Pakkam Village, Maduranthagam Taluk, Chengalpattu District of Tamil Nadu. It is also certified that information furnished in the EIA study are true and correct to the best of our knowledge.

Signature& Date:

Name:	**Dr. M. Ifhikhar Ahmed**
Designation:	**Managing Partner**
Name of the EIA Consultant Organization:	**M/s. Geo Exploration and Mining Solutions**
NABET Certificate No & Issue Date:	**NABET/EIA/2225/RA0276 Dated: 20.2.2023**
Validity:	**August 06, 2025**