DRAFT ENVIRONMENTAL IMPACT ASSESSMENT
&
ENVIRONMENT MANAGEMENT PLAN

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

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

THIRU. P. THIRUGNANASAMBANTHAN ROUGH STONE AND GRAVEL QUARRY

CLUSTER EXTENT - 12.27.20 Ha

At

S.F. Nos. 92/3F, 92/3G, 92/3I2, 92/3I3, 92/3J, 92/3K1 etc.,

Ponnamangalam Village, Thirumangalam Taluk, Madurai District, Tamil Nadu State

EXTENT – 4.70.0 ha

NAME OF PROPOSED PROJECT PROPONENT

Thiru. P. Thirugnanasambanthan,
S/o. Palanisamy,
Yathavar Street, Iravathanallur,
Madurai District-625 009.

ToR obtained vide

Lr.No. SEIAA-TN/F.No.9069/SEAC/ToR-1172/2022, Dated:13.06.2022

Environmental Consultant
GEO EXPLORATION AND MINING SOLUTIONS
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ENVIRONMENTAL LAB
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Baseline Monitoring Season – Dec 2022 to Feb 2023

April 2023

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

PROPOSED QUARRIES				
CODE	**Name of the Proponent and Address**	**S.F. Nos, Village & Taluk**	**Extent in Ha**	**Status**
P1	**Thiru.P. Thirugnanasambanthan,** S/o. Palanisamy, Yathavar Street, Iravathanallur, Madurai District-625 009**.** Tamil Nadu State.	92/3F, etc of Ponnamangalam Village, Thirumangalam Taluk, Madurai District	**4.70.0 ha**	Obtained ToR vide, Lr.No. SEIAA-TN/F.No.9069/SEAC/ToR-1172/2022Dated:13.06.2022
P2	**Thiru. S. Vishnuvarthan** S/o, Soundarapandiyan, No.6/315, Madurai Main Road, Chekkanurani, Madurai District – 625 514	86/3, etc., Ponnamangalam Village, Thirumangalam Taluk, Madurai	2.99.50 Ha	EC Granted
	Total Extent		**7.69.50**	
EXISTING QUARRIES				
CODE	**Name of the Proponent and Address**	**S.F. Nos, Village & Taluk**	**Extent in Ha**	**Lease Period**
E1	**Vigensh. S**	1/1(P) (1.41.7) and 1/2A (1.94.5) J Alankulam, Thirumangalam Taluk, Madurai	3.36.2	ROC.NO.289/2016 dt 10.08.2017 11.08.2017 to 10.08.2022
E2	**Vetrivel. I**	1/1 (P), J. Alankulam, Thirumangalam Taluk, Madurai	1.21.5	ROC.NO.430/2018 dt 26.02.2019 08.03.2019 to 07.03.2024
	Total Extent		**4.57.70**	
ABANDONED/EXPIRED QURRIES				
CODE	**Name of the Proponent and Address**	**S.F. Nos, Village & Taluk**	**Extent in Ha**	**Lease Period**
Ex-1	**Thiru. K. Raman**	81/5, 6, 7, 8, 92/3A1, 92/3A2 etc, Ponnamangalam Village, Thirumangalam Taluk, Madurai	**3.27.5 Ha**	ROC.NO.1021/08 dt 05.08.2010 14.10.2010 to 13.10.2015
	Total Extent		**3.27.5**	
TOTAL CLUSTER EXTENT			**12.27.20**	

Note:-

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

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

TERMS OF REFERENCE (ToR) COMPLIANCE

Thiru.P. Thirugnanasambanthan

"ToR Obtained vide Lr.No. SEIAA-TN/F.No.9069/SEAC/ToR-1172/2022 Dated:13.06.2022

SPECIFIC CONDITIONS		
1	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
2	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 40 m below ground level.	Noted and agreed
3	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
4	The EIA Coordinators shall obtain and furnish the details of quarry/quarries operated by the proponent in the past, either in the same location or elsewhere in the State with video and photographic evidences.	Noted and agreed
5	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	➢ **Thiru.P.Thirugnanasambanthan**, over an extent of 1.69.5hectares of Patta lands in S.F.Nos.74/1A1, 1A2 etc., vide RC.No.58/2006/Mines-A, Dated: 22.05.2006 period of five years from 01.08.2006 to 31.07.2011 ➢ **Thiru. S. Alagar,** Legal **Representative P. Shanmugam**, over an extent of 5.19.0ha of Patta lands in S.F.Nos.51/1A, 1B etc., vide RC.No.895/2008/Mines, Dated: 17.06.2009 for five years period from 31.07.2009 to 30.07.2014 ➢ **Thiru. P.Kanthavelu**, Legal **Representative P. Thirugnanasambanthan**, over an extent of 4.41.0ha of Patta lands in S.F.Nos.51/2A, 2B, 2C etc., RC.No.320/2011-Mines, Dated:

	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.	03.07.2015 for five years period from 28.07.2015 to 27.07.2020.
6	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).	Noted and agreed. Project area boundary coordinates superimposed on Toposheet – Figure No. 1.3.
7	The PP shall carry out Drone video survey covering the cluster, Green belt, fencing etc.,	Noted and agreed
8	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
9	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.
10	The Project Proponent shall provide the organization chart indicating the appointment of various statutory officials and other competent persons to be appointed as per the provisions of Mines Act'1952 and the MMR, 1961 for carrying out the quarrying operations scientifically and systematically in order to ensure safety and to protect the environment.	Discussed about Organization chart in Chapter 6,
11	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 are 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.

12	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 (Post Monsoon) Dec to Feb 2023 as per CPCB Notification and MoEF & CC Guidelines. Details in Chapter No. 3.
13	The Proponent shall carry out the Cumulative impact study due to mining operations carried out in the quarry specifically with reference to the specific environment in terms of soil, health, biodiversity, air pollution, water pollution, climate change and flood control & health impacts. Accordingly, the Environment Management plan should be prepared keeping the concerned quarry and the surrounding habitations in the mind.	The Cumulative impact study due to mining operations is explained in chapter – 7
14	Rain water harvesting management with recharging details along with water balance (both monsoon & non-monsoon) be submitted.	Noted and agreed
15	Issues relating to Mine safety, including slope geometry in case of granite quarrying, blasting parameter etc., should be detailed. The proposed safeguard measures in each case should also be provided	Noted and agreed
16	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 pre operational, operational and post operational phases and submitted. Inpact, if any, of change of land use should be given.	Land use and land cover of the study area is discussed in Chapter No. 3. Land use plan of the project area showing pre-operational, operational and post-operational phases are discussed in Chapter No. 2, Table No 2.3.
17	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.	Not applicable
18	Since non-saleable waste /OB/ intermediate waste etc. is huge in the granite quarry, the Proponent shall provide the details pertaining to management of the above material with year wise utilization and average moving inventory be submitted.	No waste is anticipitated in the quarry
19	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	Not Applicable. Project area / Study area is not declared in 'Critically Polluted' Area and does not come under 'Aravalli Range.

	should be secured and furnished to the effect that the proposed mining activities could be considered.	
20	Description of water conservation measures proposed to be adopted itr the Project should be given. Details of rainwater harvesting proposed in the Project, if any, should be provided.	Mine Closure in Chapter -2
21	Impact on local transport infrastructure due to the Project should be indicated.	Transportation details mentioned in Chapter -2
22	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.	Details of the trees in the buffer zone given in Chapter No.3.
23	A detailed mine closure plan for the proposed project shall be included in EIA/EMP report which should be site-specific.	Mine closure plan is detailed in Chapter:4.
24	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 Memomndum of MoEF& CC accordingly.	Noted and agreed
25	The Public hearing advertisement shall be published in one major National daily and onemost circulated vernacular daily.	Noted and agreed
26	The PP shall produce/display the EIA report, Executive summary and other related information with respect to public hearing io Tamil Language also.	Noted and agreed
27	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 and agreed
28	The recommendation for the issue of "Terms of Reference" is subjected to the outcome of the Hon' ble NGT, Principal Bench. New Delhi in O.A No.186 of 2016 (M.A.No.350/2016) and O.A. No.200/2016 and O.A.No.580/2016 (M.A.No.1182/2016) and O.A.No.102/2017 and O.A.No.404/2016 (M.A.No. 758/2016, M.A.No.920/2016, M.A.No.1122/2016, M.A.No.12/2017 & M.A. No. 843/2017) and O.A.No.405/2016 and O.A.No.520 of 2016	Noted and agreed

	(M.A.No. 981/2016, M.A.No.982/2016 & MA.No.384/2017).	
29	The purpose of green belt around the project is to capture the fugitive emissions. Carbon sequestration and to attenuate the noise generated, in addition to improving the aesthetics. A wide range of indigenous plant species should be planted as given in the appendix in consultation with the DFO, State Agriculture University. The plant species with dense/moderate canopy of native origin should be chosen. Species of Small medium/tall trees altemating with shrubs should be planted io a mixed manner.	Species are proposed to plant in the safety barrier as mentioned in the ToR appendix. Proposed species are given in the Chapter No 4
30	Taller/one year old Saplings raised in appropriate size of bags; preferably eco-friendly bags should be planted in proper espacement as per the advice of local forest authorities / botanist / Horticulturist with regard to site specific choices. The proponent shall earmark the greenbelt area with GPS coordinates all along the boundary of the project site with at least 3 meters wide and in between blocks in an organized manner.	It is an Exiting Lease. Around 600 trees are proposed to plant
31	A Disaster management Plan shall be prepared and included in the EIA/EMP Report.	Disaster management Plan details in Chapter-7
32	A Risk Assessment and management Plan shall be prepared and included in the EIA/EMP Report.	A Risk Assessment and management Plan Chapter-7
33	Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	Occupational Health impacts chapter- 10
34	Public health implications of the Project and related activities for the population in the impact zone should be systematically evaluated and the proposed lemedial measures should be detailed along with budgetary allocations.	It is explained in Chapter -3
35	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	Details are listed in Chapter:3.

	indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	
36	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
37	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.	Noted and agreed
38	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.	It is an Existing Lease
39	Concealing any factual information or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this Terms of Reference besides attracting penal provisions in the Environment (Protection) Act, 1986.	Noted and agreed
ADDITIONAL CONDITIONS		
1	Depth of mining shall be restricted to 37m and the corresponding production as per the approved mining plan.	The depth of the quarry is restricted according to the tor condition
2	The scientific studies shall be carried out for any proposed quarry over the existing pit/quarry by the reputed Government Scientific Research / Academic Institutions such as Anna University, NITs, IITs, NIRM, CISR laboratories where the depth of the proposed working (or) ultimate depth of working is extended beyond 40 m below ground level (BGL) in case of flat terrain and the excavation extends beyond 30 m above ground level (AGL) in case of outcrops/hilly terrains for evaluating the stability of slopes. A copy of the report shall be submitted to the SEIAA, the concerned AD/DGM, the concerned DEE/TNPCB and the Director of Mines Safety, Chennai.	The Scientific study will submitted along with the Final EIA report
3	Detailed study shall be carried out in regard to impact of mining around the proposed mine lease area on the nearby Villages, Water-bodies/ Rivers. & Any ecological fragile areas.	Details is discussed in chapter no.2 and 4, Nearest water bodies are Gounda River, Melanesaneri Kanmoi, etc.,

4	The project proponent shall fumish VAO certificate with reference to 300m radius regard to approved habitations, schools, Archaeological structures etc.	VAO certificate is Obtained
5	As per the MoEF& CC office memorandum F.No.22-6512017-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
6	The Environmental Impact Assessment shall study in detail the carbon emission and also suggest the measures to mitigate carbon emission including development of carbon sinks and temperature reduction including control of other emission and climate mitigation activities.	Details of carbon emission and mitigation activities are given int the Chapter No.4
7	The Environmental Impact Assessment should study the biodiversity, the natural ecosystem, the soil micro flora, fauna and soil seed banks and suggest measures to maintain the natural Ecosystem.	Discussed in Chapter: 3.
8	Action should be specifically suggested for sustainable restoration of ecosystem for flow of goods and services.	The Eco System of the area will be retained during the mining operation by the way of planting trees in the boundary barrier and un utilized areas. After completion of mining operation, the quarried-out pit will be facilitated to collect the rainwater to pit act as temporary reservoir.
9	The project proponent shall study impact on fish habitats and food WEB/food chain in the water body and Reservoir.	Nearest water bodies are Gounda River, Melanesaneri Kanmoi, etc.,
10	The Terms of Reference should specifically study impact on soil health, soil erosion. the soil physical, chemical components and microbial components.	There is no Top soil in the project area, the overburden in the form of Gravel formation. The Gravel has been removed during the previous lease period. No proposal for the removal of Top soil in this plan period. Details of impact on soil environment is detailed in Chapter No.4.
11	The Environmental Impact Assessment should study impact on forest, vegetation, endemic, vulnerable and endangered indigenous flora and fauna.	The area is surrounded by quarries on the North, East, South side. Coconut plantation is the main agriculture activity in the study area. Details of flora and fauna studies given in the Chapter No.3.
12	The Environmental Impact Assessment should study impact on standing trees and the existing trees should be numbered and action suggested for protection.	About 2400 trees is planted in safety and along roads

13	The Environmental Impact Assessment should study on wetlands, water bodies, rivers streams, lakes and farmer sites.	Details are discussed in the Chapter No 3.
14	The Environmental Impact Assessment should hold detailed study on EMP with budget for green belt development and mine closure plan including disaster management plan.	Detailed Environmental Management plan with budgetary allocations given in the Chapter No. 10,
15	The Environmental Impact Assessment should study impact on climate change, temperature rise, pollution and above soil & below soil carbon stock.	The project will not cause significant impact on climatic change. Description about the project and climatic changes is described in Chapter No.3.
16	The Environmental Impact Assessment should study impact on protected areas, Reserve Forests, National Parks, Corridors and Wildlife pathways, near project site.	Anticipated Environment Impact and Mitigation measures are detailed in Chapter No.4
17	The project proponent shall study and furnish the impact of project on plantations in adjoining patta lands, Horticulture, Agriculture and livestock.	The project area is bounded by existing quarries on the East side. Nearest dry agriculture land is situated North and East side of the area. Proponent proposed to e green mesh along with fencing on the East side besides, Budgetary allocation given in the Chapter No. 10.
18	The project proponent shall study and furnish the details on potential fragmentation impact of natural environment, by the activities.	Noted and agreed
19	Detailed Environment Management Plan along with adaptation, mitigation & remedial strategies covering the entire mine lease period as per precise area communication order issued.	Discussed in Chapter 10
20	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 and agreed
21	The project proponent shall study and furnish the possible pollution due to plastic and microplastic on the environment. The ecological risks and impacts of plastic & microplastics on aquatic environment and fresh water systems due to activities, contemplated during mining may be investigated and reported.	Plastic waste management plan has been suggested in Chapter:7.
22	The project proponent shall detail study on impact of mining on Reserve forests free ranging wildlife.	Noted and agreed

23	Detailed study shall be caried out in regard to impact of mining around the proposed mine lease area covering the entire mine lease period as per precise arca communication order issued from reputed research institutions on the following a) Soil health & bio-diversity b) Climate change leading to Droughts, Floods etc. c) Pollution leading to release of Greenhouse gases (GHG), rise in Temperature' & Livelihood of the local people. d) Possibilities of water contamination and impact on aquatic ecosystem health' e) Agriculture, Forestry & Traditional practices. 1) Hydrothermal/Geothermal effect due to destruction in the Environment' g) Bio-geochemical processes and its foot prints including environmental stress' h) Sediment geochemistry in the surface steams.	Noted and agreed
24	Hydro-geological study considering the contour map of the water table derailing the number of ground water pumping & open wells, and surface water bodies such as rivers, tanks, canals, ponds etc. within 1 km (radius) so as to assess the impacts on the nearby waterbodies due to mining activity. Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation in this regard may be provided, covering the entire mine lease period.	Details given in Chapter:3
25	To fumish 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.	Details given in Chapter:7
26	To fumish risk assessment and management plan including anticipated vulnerabilities during operational and post operational phases of Mining.	Details given in Chapter:7
27	Detailed Mine Closure Plan covering the entire mine lease period as per precise area communication order issued.	Details given in Chapter:2
STANDARD TERMS OF REFERENCE		
1	Year-wise production details since 1994 should be given, clearly stating the highest production achieved in any one year prior to 1994. It may also be categorically informed whether there had been any increase in production after the EIA Notification 1994 came into force, w.r.t. the highest production achieved prior to 1994.	Not applicable. This is Not a violation category project. This proposal falls under B1 Category (Cluster Condition).

2	A copy of the document in support of the fact that the Proponent is the rightful lessee of the mine should be given.	The applied land for quarrying is a Patta Land. Document is enclosed along with Approved Mining Plan as Annexure Volume 1.
3	All documents including approved mine plan, EIA and Public Hearing should be compatible with one another in terms of the mine lease area, production levels, waste generation and its management, mining technology etc. and should be in the name of the lessee.	Noted & agreed.
4	All corner coordinates of the mine lease area, superimposed on a High-Resolution Imagery/ toposheet, topographic sheet, geomorphology and geology of the area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).	Map showing – Project area is superimposed on Satellite imagery is enclosed in Figure No. 2.1 Project area boundary coordinates superimposed on Toposheet – Figure No. 1.3 Surface Features around the project area covering 10km radius – Figure No. 2.2 Geology map of the project area covering 10km radius - Figure No. 2.7. Geomorphology Map of the Study Area covering 10 km radius – Figure No. 2.8.
5	Information should be provided in Survey of India Toposheet in 1:50,000 scale indicating geological map of the area, geomorphology of land forms of the area, existing minerals and mining history of the area, important water bodies, streams and rivers and soil characteristics.	Map showing – Geology map of the project area covering 10km radius - Figure No. 2.7. Geomorphology Map of the Study Area covering 10 km radius – Figure No. 2.8.
6	Details about the land proposed for mining activities should be given with information as to whether mining conforms to the land use policy of the State; land diversion for mining should have approval from State land use board or the concerned authority.	The applied area was inspected by the officers of Department of Geology along with revenue officials and found that the land is fit for quarrying under the policy of State Government.
7	It should be clearly stated whether the proponent Company has a well laid down Environment Policy approved by its Board of Directors? If so, it may be spelt out in the EIA Report with description of the prescribed operating process/procedures to bring into focus any infringement/deviation/ violation of the environmental or forest norms/conditions? The hierarchical system or administrative order of the Company to deal with the environmental issues and for ensuring compliance with the EC conditions may also be given. The system of	The proponent has framed their Environmental Policy and the same is discussed in the Chapter No 10.1.

	reporting of non-compliances / violations of environmental norms to the Board of Directors of the Company and/or shareholders or stakeholders at large, may also be detailed in the EIA Report.	
8	Issues relating to Mine Safety, including subsidence study in case of underground mining and slope study in case of open cast mining, blasting study etc. should be detailed. The proposed safeguard measures in each case should also be provided.	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. Land use plan of the project area showing pre-operational, operational and post-operational phases are discussed in Chapter No. 2, Table No 2.3.
11	Details of the land for any Over Burden Dumps outside the mine lease, such as extent of land area, distance from mine lease, its land use, R&R issues, if any, should be given	Not Applicable. There is no waste anticipated during this quarry operation. The entire quarried out rough stone will be transported to the needy customers. No Dumps is proposed outside the lease area.
12	Certificate from the Competent Authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area. In the event of any contrary claim by the Project Proponent regarding the status of forests, the site may be inspected by the State Forest Department along with the Regional Office of the Ministry to ascertain the status of forests, based on which, the Certificate in this regard as mentioned above be issued. In all such cases, it would be desirable for representative of	Not Applicable. There is no Forest Land involved in the proposed project area. The proposed project area is a patta land. Approved Mining Plan is enclosed as Annexure Volume 1.

	the State Forest Department to assist the Expert Appraisal Committees.	
13	Status of forestry clearance for the broken-up area and virgin forestland involved in the Project including deposition of net present value (NPV) and compensatory afforestation (CA) should be indicated. A copy of the forestry clearance should also be furnished.	Not Applicable. The proposed project area does not involve any Forest Land.
14	Implementation status of recognition of forest rights under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 should be indicated.	Not Applicable. The project doesn't attract Recognition of Forest Rights Act, 2006.
15	The vegetation in the RF / PF areas in the study area, with necessary details, should be given.	No Reserve Forest within the Study Area.
16	A study shall be got done to ascertain the impact of the Mining Project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the surrounding and any other protected area and accordingly, detailed mitigative measures required, should be worked out with cost implications and submitted.	Not Applicable. There are No National Parks, Biosphere Reserves, Wildlife Corridors, and Tiger/Elephant Reserves within 10 km Radius from the periphery of the project area.
17	Location of National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/ Elephant Reserves/(existing as well as proposed), if any, within 10 KM of the mine lease should be clearly indicated, supported by a location map duly authenticated by Chief Wildlife Warden. Necessary clearance, as may be applicable to such projects due to proximity of the ecologically sensitive areas as mentioned above, should be obtained from the Standing Committee of National Board of Wildlife and copy furnished	Not Applicable. There are No National Parks, Biosphere Reserves, Wildlife Corridors, and Tiger/Elephant Reserves within 10 km Radius from the periphery of the project area.
18	A detailed biological study of the study area [core zone and buffer zone (10 KM radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET Species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the Schedule of the fauna present. In case of any scheduled-I fauna found in the study area, the necessary plan along with budgetary provisions for their conservation should be prepared in consultation with State Forest and Wildlife Department and details furnished. Necessary allocation of funds for implementing	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.

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

	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: 5.0 KLD Discussed under Chapter 2, Table No 2.15 .
25	Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the Project should be provided.	Not Applicable. Water for dust suppression, greenbelt development and domestic use will be sourced from accumulated rainwater/seepage water in mine pits and purchased from local water vendors through water tankers on daily requirement basis. Drinking water will be sourced from the approved water vendors.
26	Description of water conservation measures proposed to be adopted in the Project should be given. Details of rainwater harvesting proposed in the Project, if any, should be provided.	Part of the working pit will be allowed to collect rain water during the spell of rain will be used for greenbelt development and dust suppression. The Mine Closure Plan is prepared for converting the excavated pit into rain water harvesting structure and serve as water reservoir for the project village during draught season.
27	Impact of the Project on the water quality, both surface and groundwater, should be assessed and necessary safeguard measures, if any required, should be provided.	Impact Studies and Mitigation Measures of Water Environment including Surface Water and Ground Water are discussed in Chapter 4.

28	Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation in this regard may be provided. In case the working will intersect groundwater table, a detailed Hydro Geological Study should be undertaken and Report furnished. The Report inter-alia, shall include details of the aquifers present and impact of mining activities on these aquifers. Necessary permission from Central Ground Water Authority for working below ground water and for pumping of ground water should also be obtained and copy furnished.	Not Applicable. The ground water table inferred 65-70m below ground level. The ultimate depth of quarry is 30m agl. This proposal of 30 m below ground level will not intersect the ground water table, which is inferred from the hydro-geological carried out at the project site. Discussed under Chapter 3.
29	Details of any stream, seasonal or otherwise, passing through the lease area and modification / diversion proposed, if any, and the impact of the same on the hydrology should be brought out.	Not Applicable. There is no stream, seasonal or other water bodies passing within the project area. Therefore, no modification/ diversion of water bodies is anticipated.
30	Information on site elevation, working depth, groundwater table etc. Should be provided both in AMSL and Bgl. A schematic diagram may also be provided for the same.	Highest elevation of the project area is 140m AMSL. Ultimate depth of the mine is 42m BGL Water level of the area is 65-70m BGL
31	A time bound Progressive Greenbelt Development Plan shall be prepared in a tabular form (indicating the linear and quantitative coverage, plant species and time frame) and submitted, keeping in mind, the same will have to be executed up front on commencement of the Project. Phase-wise plan of plantation and compensatory afforestation should be charted clearly indicating the area to be covered under plantation and the species to be planted. The details of plantation already done should be given. The plant species selected for green belt should have greater ecological value and should be of good utility value to the local population with emphasis on local and native species and the species which are tolerant to pollution.	Greenbelt Development Plan is discussed under Chapter 4, Page No.123.
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	Traffic density survey was carried out to analyse the impact of Transportation in the study area as per IRC guidelines 1961 and it is inferred that there is no significant impact due to the proposed transportation from the project area. Details in Chapter 2, Page No.30-32.

	Impact of Transportation study as per Indian Road Congress Guidelines.	
33	Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.	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 Page No.32.
34	Conceptual post mining land use and Reclamation and Restoration of mined out areas (with plans and with adequate number of sections) should be given in the EIA report.	Discussed under Chapter 2. Mine Closure Plan is a part of Approved Mining Plan enclosed as Annexure Volume – 1.
35	Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	Occupational Health Impacts of the project and preventive measures are detailed under Chapter 4, Page No.127.
36	Public health implications of the Project and related activities for the population in the impact zone should be systematically evaluated and the proposed remedial measures should be detailed along with budgetary allocations.	No Public Health Implications anticipated due to this project. Details of CER and CSR are discussed under Chapter 8, Page No. 148-149.
37	Measures of socio-economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	No Negative Impact on Socio Economic Environment on the Study Area is anticipated and this project shall benefit the Socio-Economic Environment by ways of employment for 124 people directly and 30 people indirectly. Details in Chapter 2, Page No. 33.
38	Detailed environmental management plan (EMP) to mitigate the environmental impacts which, should inter-alia include the impacts of change of land use, loss of agricultural and grazing land, if any, occupational health impacts besides other impacts specific to the proposed Project.	Detailed Environment Management Plan for the project to mitigate the anticipated impacts described under Chapter 4 is discussed under Chapter 10, Page No. 151 – 156.
39	Public Hearing points raised and commitment of the Project Proponent on the same along with time bound Action Plan with budgetary provisions to implement the same should be provided and also incorporated in the final EIA/EMP Report of the Project.	The outcome of public hearing will be updated in the final EIA/AMP report.

40	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.	No litigation is pending in any court against this project.
41	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	Project Cost is Rs. 1,01,24,000/- and Rs. 96,30,000/- CER Cost is Rs 5,00,000/-
42	A Disaster management Plan shall be prepared and included in the EIA/EMP Report.	Details in Chapter 7.
43	Benefits of the Project if the Project is implemented should be spelt out. The benefits of the Project shall clearly indicate environmental, social, economic, employment potential, etc.	Details in Chapter 8.
44	**Besides the above, the below mentioned general points are also to be followed: -**	
a	Executive Summary of the EIA/EMP Report	Enclosed as separate booklet.
b	All documents to be properly referenced with index and continuous page numbering.	All the documents are properly referenced with index and continuous page numbering.
c	Where data are presented in the Report especially in Tables, the period in which the data were collected and the sources should be indicated.	List of Tables and source of the data collected are indicated.
d	Project Proponent shall enclose all the analysis/testing reports of water, air, soil, noise etc. using the MoEF & CC/NABL accredited laboratories. All the original analysis/testing reports should be available during appraisal of the Project	Baseline monitoring reports are enclosed with This report in Chapter 3. Original Baseline monitoring reports will be submitted in the final EIA report during appraisal.
e	Where the documents provided are in a language other than English, an English translation should be provided.	Not Applicable.
f	The Questionnaire for environmental appraisal of mining projects as devised earlier by the Ministry shall also be filled and submitted.	Will be enclosed along with Final EIA EMP Report.
g	While preparing the EIA report, the instructions for the Proponents and instructions for the Consultants issued by MoEF&CC vide O.M. No. J-11013/41/2006-IA. II(I) Dated: 4th August, 2009, which are available on the website of this Ministry, should be followed.	Noted & agreed. Instructions issued by MoEF & CC O.M. No. J-11013/41/2006-IA. II (I) Dated: 4th August, 2009 are followed.
h	Changes, if any made in the basic scope and project parameters (as submitted in Form-I and the PFR for securing the TOR) should be brought to the attention of MoEF&CC with reasons for	Noted & agreed.

	such changes and permission should be sought, as the TOR may also have to be altered. Post Public Hearing changes in structure and content of the draft EIA/EMP (other than modifications arising out of the P.H. process) will entail conducting the PH again with the revised documentation	
i	As per the circular no. J-11011/618/2010-IA. II(I) Dated: 30.5.2012, certified report of the status of compliance of the conditions stipulated in the environment clearance for the existing operations of the project, should be obtained from the Regional Office of Ministry of Environment, Forest and Climate Change, as may be applicable.	Not Applicable.
j	The EIA report should also include (i) surface plan of the area indicating contours of main topographic features, drainage and mining area, (ii) geological maps and sections and (iii) sections of the mine pit and external dumps, if any, clearly showing the land features of the adjoining area.	Surface Plan – Figure No. 2.2. Geological Plan – Figure No 2.9. Working Plan – Figure No 2.9. Closure Plan – Figure No.2.10.

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CHAPTER – 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 and Gravel are the major requirements for construction industry. This EIA report is prepared by considering Cumulative load of all proposed & existing quarries of Thiru. P. Thirugnanasambanthan Rough Stone and Gravel Cluster Quarries consisting of two Proposed and two Existing Quarries with total extent of Cluster of 12.27.20 Ha in Ponnamangalam Village, Thirumangalam Taluk, Madurai District and Tamil Nadu State, cluster area calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016.

This EIA Report is prepared in compliance with ToR obtained for the below proposals in Table 1.1 and the Baseline Monitoring study has been carried out during the period of December 2022 – February 2023

TABLE 1.1: ToR OBTAINED PROJECTS

CODE	Name of the proponent	Extent (Ha)	Terms of Reference (ToR)
P1	**Thiru. P. Thirugnanasambanthan**	4.70.0	Lr.No.SEIAA-TN/F.No.9069/SEAC/ToR-1172/2022, Dated:13.06.2022

Source: ToR Letter's of the respective project proponents

1.1 Purpose of the report

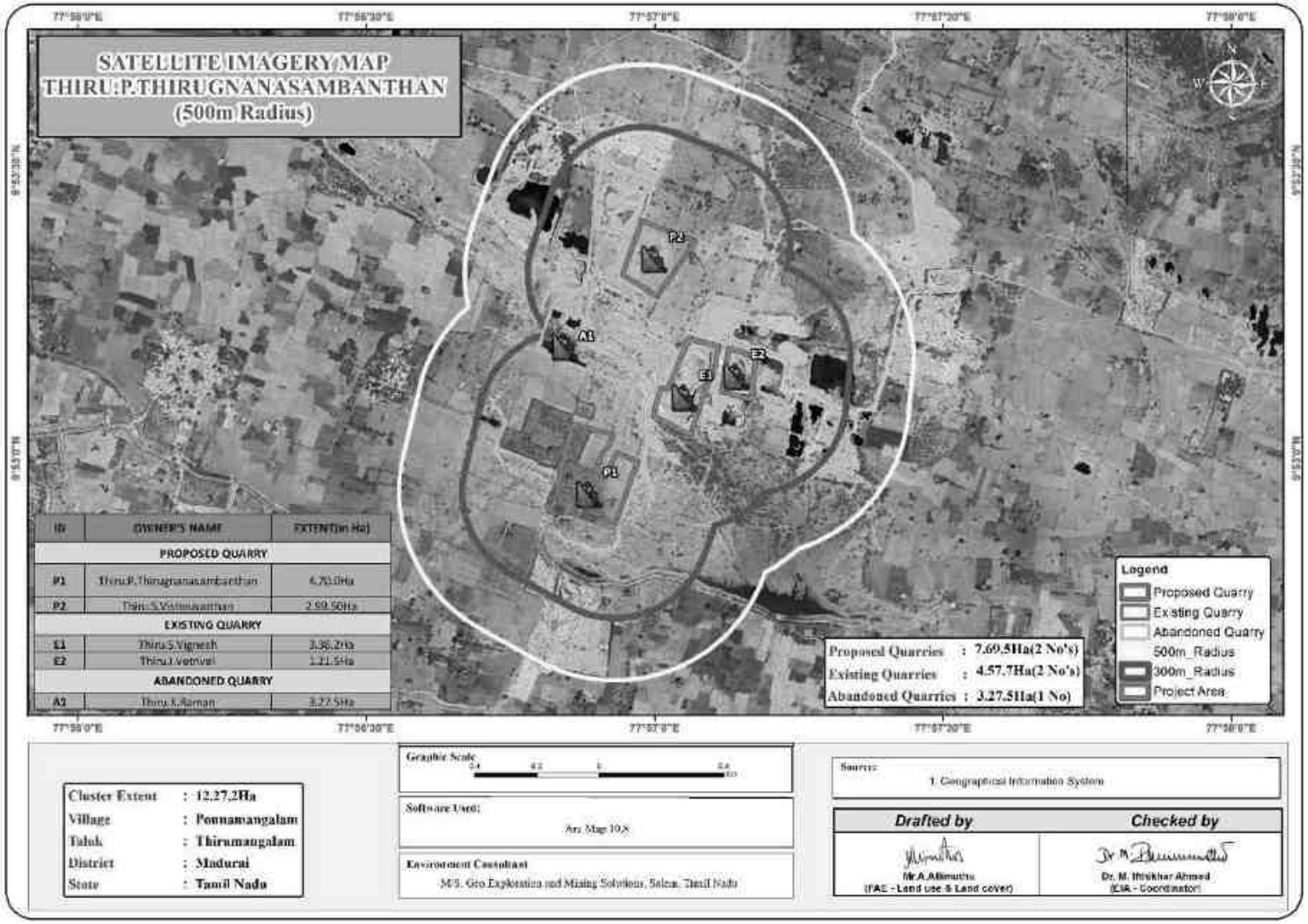
The Ministry of Environment and Forests, Govt. of India, through its EIA notification S.O. 1533(E) of 14th September 2006 and its subsequent amendments as per Gazette Notification S.O. 3977 (E) of 14thAugust 2018, Mining Projects are classified under two categories i.e. A (> 100 Ha) and B (≤ 100 Ha), 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 B1 and appraised by SEAC/ SEIAA as well as for cluster situation.

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

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

FIG.1.1 SATELLITE IMAGERY CLUSTER QUARRIES



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

Note: As per above notification S.O.2269(E) dated: 01.07.2016 in para (b) in Appendix XI, - (i)(6) A cluster shall be formed when the distance between the peripheries of one lease is less than 500 meters from the periphery of other lease in a homogeneous mineral area which shall be applicable to the mine lease or quarry licenses granted on and after 9th September, 2013

1.2 Identification of Project and Project Proponent

1.2.1 Identification of Project

The project areas in the cluster are Patta Land, no forest land is involved

TABLE 1.2: PROPOSED PROJECTS IN THE CLUSTER

Description	PROPOSAL – P1
Name of the Project	Thiru. P. Thirugnanasambanthan Rough Stone & Gravel Quarry
S.F. No.	92/3F, 92/3G, 92/3I2, 92/3I3, 92/3J, 92/3K1, 92/3K2, 92/3K3, 92/3K4 etc.,
Extent	**4.70.0 Ha**
Village Taluk	Ponnamangalam Village, Thirumangalam Taluk
District	Madurai District

Source: Approved Mining Plan

1.2.2 Identification of Project Proponent

TABLE 1.3: DETAILS OF PROJECT PROPONENT

PROPOSAL – P1	
Name of the Company	Thiru. P. Thirugnanasambanthan Rough Stone & Gravel Quarry Project
Address	S/o. Palanisamy, Yadhavar Street, Iravadhanallur, Madurai District, Tamil Nadu – 625 009.
Mobile	+91 7305048510
Status	Proprietor

Source: Approved Mining Plan of the project

1.3 Brief description of the project

1.3.1 Nature and size of the Project

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

TABLE 1.4: SALIENT FEATURES OF THE PROPOSED PROJECTS IN CLUSTER

SALIENT FEATURES OF PROPOSAL "P1"		
Name of the Mine	Thiru. P. Thirugnanasambanthan Rough Stone & Gravel Quarry Project	
Land Type	It is a Patta lands, Registered in the name of Tmt. P. Valliyammal, vide Patta Nos. 1189 & 1362 and Thiru. P. Ketharnath, vide Patta Nos. 1230 & 1195. The applicant has obtained consent from the Pattadars.	
S.F. Nos	92/3F, 92/3G, 92/3I2, 92/3I3, 92/3J, 92/3K1, 92/3K2, 92/3K3 etc.,	
Extent	4.70.0 Ha	
Toposheet No	58 G/13	
Latitude	09°52'53.05"N to 09°53'03.48"N	
Longitude	77°56'49.81"E to 77°56'58.23"E	
Highest elevation	145m AMSL	
Previous quarry operation details	It is a fresh lease application	
Geological Reserves	Rough Stone	Gravel
	21,15,315m^3	94,014m^3
Mineable Reserves	Rough Stone	Gravel
	7,32,635m^3	73,686m^3
Proposed production for First Five years upto the depth of 47m as per ToR	3,68,290 m^3	73,686m^3

Proposed production for Second Five years upto the depth of 47m as per ToR	3,64,345 m^3	
Mining Plan Period / Lease Period	10 Years	
Proposed Depth as per ToR for 10 years	47m	
Ultimate Pit Dimension	Pit 1: 200m(L) x 108m (W) x47m(D) Pit 2: 98m(L) x 114m (W) x47m(D) Pit 3: 59m(L) x 69m (W) x47m(D)	
Water Level in the surrounds area	The Water table is found at a depth of 73m in summer and at 68m in rainy seasons.	
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Topography	The lease applied area is exhibits plain terrain. The area has gentle sloping towards Western side. The altitude of the area is 145m (max) above Mean Sea level. The area is covered by 2m thickness of Gravel formation followed by Massive Biotite – Gneissic Rock which is clearly inferred from the existing quarry pits.	
Machinery proposed	Jack Hammer	9
	Compressor	2
	Excavator with Bucket and Rock Breaker	2
	Tippers	6
Blasting	Usage of Slurry Explosive with MSD detonators	
Manpower Deployment	48 Nos	
Total Project Cost	Project Cost	Rs. 64,36,000/-
	EMP Cost	Rs. 7,60,000/-
	Total	Rs. 71,96,000/-
CER Cost	Rs.5,00,000/-	

1.3.2 Location of the project

The lease applied area is about 19.0km Southwestern side of Madurai, 8.0km Northwestern side of Thirumangalam and 1.5km Southeast side of Ponnamangalam Village.

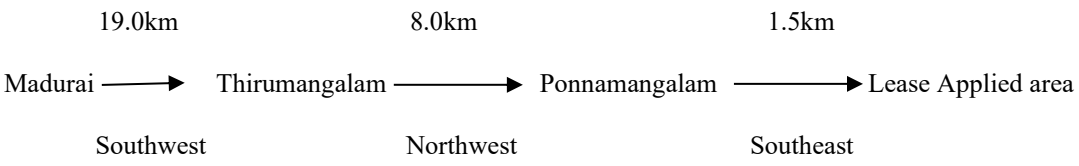


FIG1.1A KEY MAP SHOWING THE LOCATION OF THE PROJECT SITE

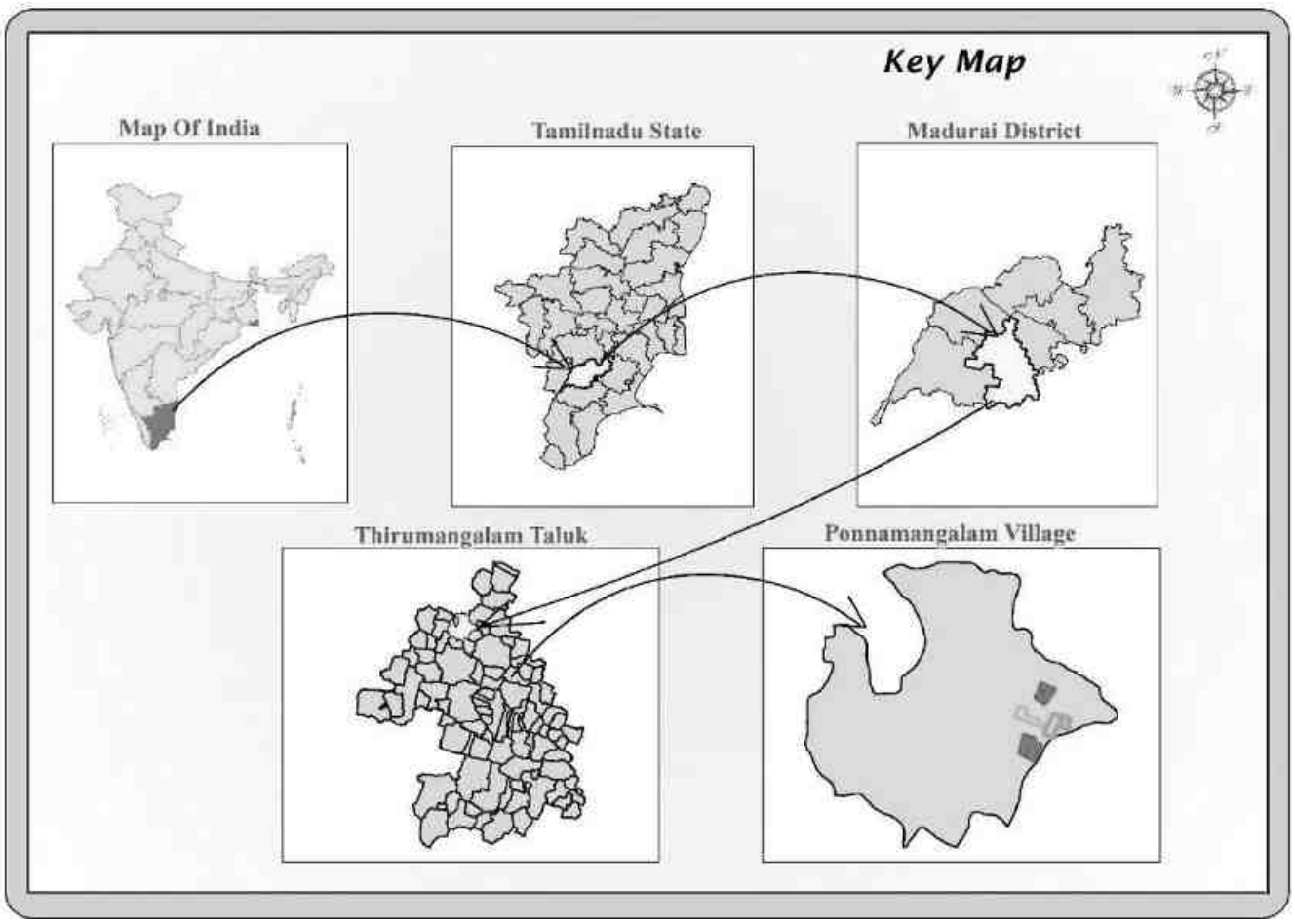
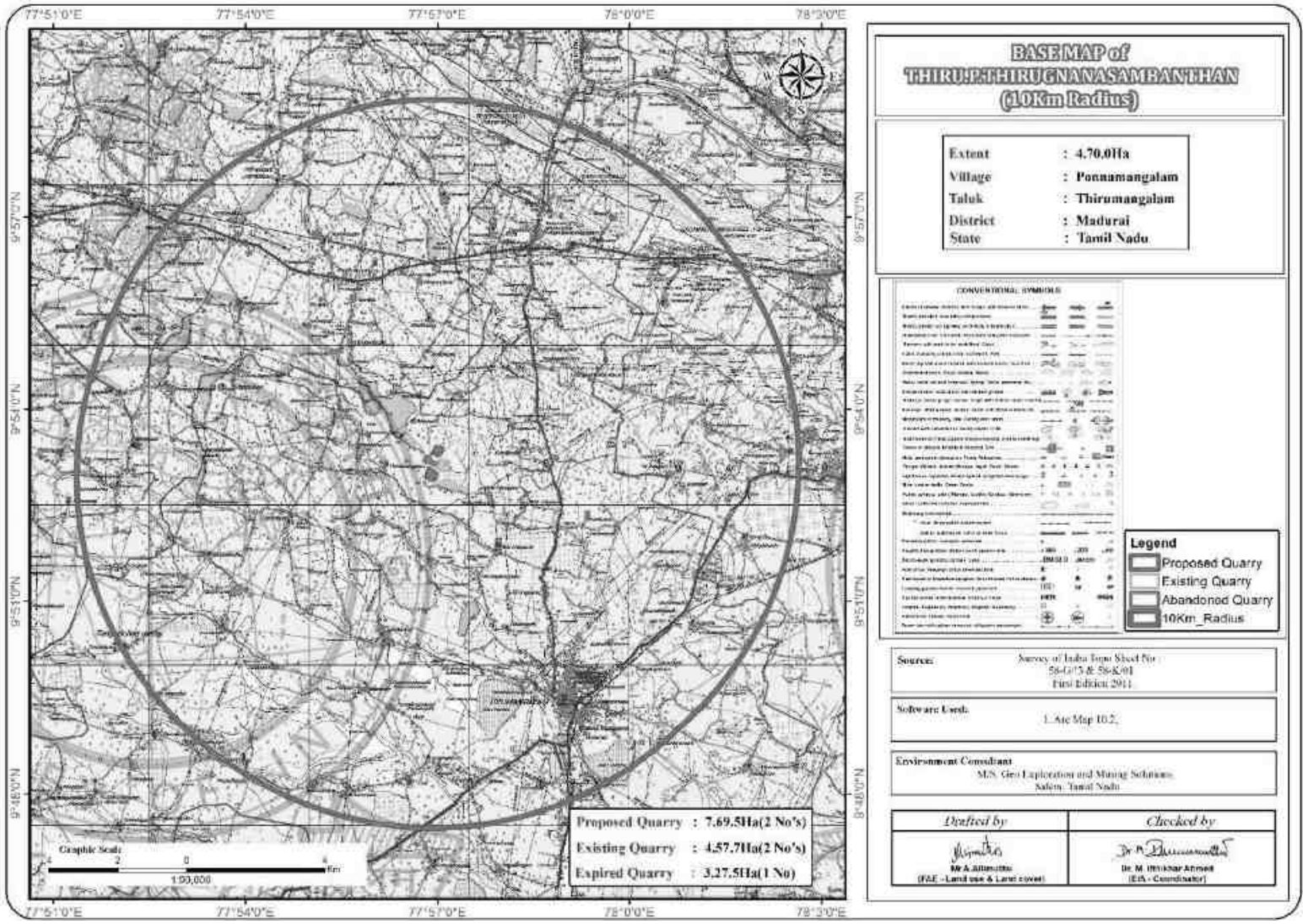


FIGURE 1.2: TOPOSHEET SHOWING LOCATION OF THE PROJECT SITE AROUND 10 KM RADIUS



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: 14.09.2020.
- Thiru. P. Thirugnanasambanthan Precise Area Communication was issued by the Deputy Director, Department of Geology and Mining, Madurai District vide Rc.No.667/Mines/2020, Dated: 24.09.2020 for a period of Ten Years.
- The Mining Plan was prepared by Recognized Qualified Person and approved by Deputy Director, Department of Geology and Mining, Madurai District vide Rc.No.667/Mines/2020, Dated: 03.11.2021
- Proponent applied for ToR for Environmental Clearance vides online Proposal No. SIA/TN/MIN/72683/2022, Dated:26.02.2022

SCOPING –

- The proposal was placed in 274^{h} SEAC meeting held on 19.05.2022 and the committee recommended for issue of ToR.
- The proposal was considered in 519nd SEIAA meeting held on 13.06.2022 and issued ToR vide Lr.No. SEIAA-TN/F.No.9069/SEAC/ToR-1172/2022, Dated:13.06.2022

Public Consultation –

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

Appraisal –

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

The report has been prepared using the following references:

- Guidance Manual of Environmental Impact Assessment for Mining of Minerals, Ministry of Environment and Forests, 2010
- EIA Notification, 14th September, 2006
- ToR Letter No. SEIAA-TN/F.No.9069/SEAC/ToR-1172/2022, Dated:13.06.2022 –- P1
- Approved Mining of the Proposed Rough stone and Gravel quarry project.

1.5 Post Environment Clearance Monitoring

The Project Proponents in the Cluster will 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 every year.

1.6 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.
A brief description of each Chapter is presented in Table No. 1.5.

TABLE 1.5 – STRUCTURE OF THE EIA REPORT

S. No	Chapters	Title	Particulars
1	Chapter 1	Introduction	Presents, an Introduction along with Scope and Objective of this EIA/EMP Studies
2	Chapter 2	Project Description	Presents the Technical Details of the Project
3	Chapter 3	Description of Environment	Presents the Baseline Status for various Environmental Parameters in the Study Area for One Season (3 Months)
4	Chapter 4	Anticipated Environmental Impacts and Mitigation Measures	Presents the Identification, Prediction and Evaluation of overall Environmental Impacts due to the Proposed Projects Activities. Also presents Proposed Mitigation Measures.
5	Chapter 5	Analysis of Alternatives (Technology & Site)	Presents Analysis of alternatives with respect to site
6	Chapter 6	Environment Monitoring Programme	Present details of post project environment monitoring
7	Chapter 7	Additional Studies	Presents Public Consultation, Risk Assessment and Disaster Management Plan
8	Chapter 8	Project Benefits	Presents project benefits as: Improvements in the Physical Infrastructure, Social Infrastructure Employment Potential –Skilled; Semi-Skilled and Unskilled etc.,
9	Chapter 9	Cost Benefit Analysis	Environmental Cost Benefit Analysis has not been recommended at Scoping Stage – thus no analysis carried out separately in this EIA/EMP Report.
10	Chapter 10	Environmental Management Plan	Description of the administrative aspects to ensure the Mitigation Measures are implemented and their effectiveness monitored, after approval of the project.
11	Chapter 11	Summary & Conclusion	Summary of the EIA Report

12	Chapter 12	Disclosure of Consultants Engaged	Disclosure of the Consultants

1.7 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 pre monsoon season **(Dec 2022 – 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 1.6 – ENVIRONMENT ATTRIBUTES

Sl.No.	Attributes	Parameters	Source and Frequency
1	Ambient Air Quality	PM_{10}, $PM_{2.5}$, SO_2, NO_2	24 hourly samples twice a week for three months at 7 locations
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, Madurai
3	Water quality	Physical, Chemical and Bacteriological parameters	Grab samples were collected at 4 ground water and 2 surface water locations 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)	At 7 locations data monitored once for 24 hours during EIA study.
6	Soil Characteristics	Physical and Chemical Parameters	Once at 5 locations during study period
7	Land use	Existing land use for different categories	Based on Survey of India topographical sheet and satellite imagery and primary survey.
8	Socio-Economic Aspects	Socio-economic and demographic characteristics, worker characteristics	Based on primary survey and secondary sources data like census of India 2011.
9	Hydrology	Drainage pattern of the area, nature of streams, aquifer characteristics, recharge and discharge areas	Based on data collected from secondary sources as well as hydro-geology study report prepared.
10	Risk assessment and Disaster Management Plan	Identify areas where disaster can occur by fires and explosions and release of toxic substances	Based on the findings of Risk assessment done for the mining associated activities

Source: Field Monitoring Data

The data has been collected as per the requirement of the ToR issued by SEIAA – TN and Standard ToR Published by MoEF & CC.

1.7.1 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 of Rough Stone and Gravel quarry has been approved under Rule 41 & 42 as amended of Tamil Nadu Minor Mineral Concession Rules, 1959
- ToR Letter No. SEIAA-TN/F.No.9069/SEAC/ToR-1172/2022, Dated:13.06.2022 – - P1

  Approved Mining of Proposed Rough stone and Gravel quarry project

CHAPTER – 2: PROJECT DESCRIPTION

2.0 General

The Proposed Rough Stone and Gravel Quarry requires Environmental Clearance. There are two proposed and two existing quarries forming a cluster; calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016 and the total extent of cluster is 12.27.20 ha.

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

2.1 Description of the Project

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

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

2.2 Location of the Project

- The Proposed Project is located in Ponnamangalam village, Thirumangalam taluk, Madurai District, Tamil Nadu State.
- The project falls in Toposheet No: 58 G/13. The Proposed area fall in the Latitude between 09^0 52’53.05” N to 09^0 53’03.48” N and Longitude between 77^0 56’49.81” E to 77°56'58.23" E
- The project under the cluster are classified as patta land (Non-Forest Land) & does not fall within 10 km radius of any Eco – sensitive zone, Wild life Sanctuary, National Park, Tiger Reserve, Elephant Corridor and Biosphere Reserves.

TABLE 2.1: SITE CONNECTIVITY TO THE CLUSTER QUARRIES

Nearest Roadway	(NH – 85) - Theni – Madurai - 6.0km- NorthWest (SH – 73) - Thirumangalam – Pallapatti – Silukkuvarpatti - 3.0km - East (MD – 954) – Chithalai – Thidiyan Road (Via) Vagaikulam, Munduvelampatti, Valangankulam Road – 2.0km – South West
Nearest Village	Ponnamangalam village – 1.3km – North West
Nearest Town	Thirumangalam – 8.0km – South East
Nearest Railway	Thirumangalam – 8.0km – South East
Nearest Airport	Madurai – 16.0km – South East
Seaport	Cochin 184.0 Km - West

Source: Google image, Survey of India Toposheet

The Proposed Project corners coordinates are given below.

TABLE 2.2 – BOUNDARY CO-ORDINATES OF PROPOSED PROJECT

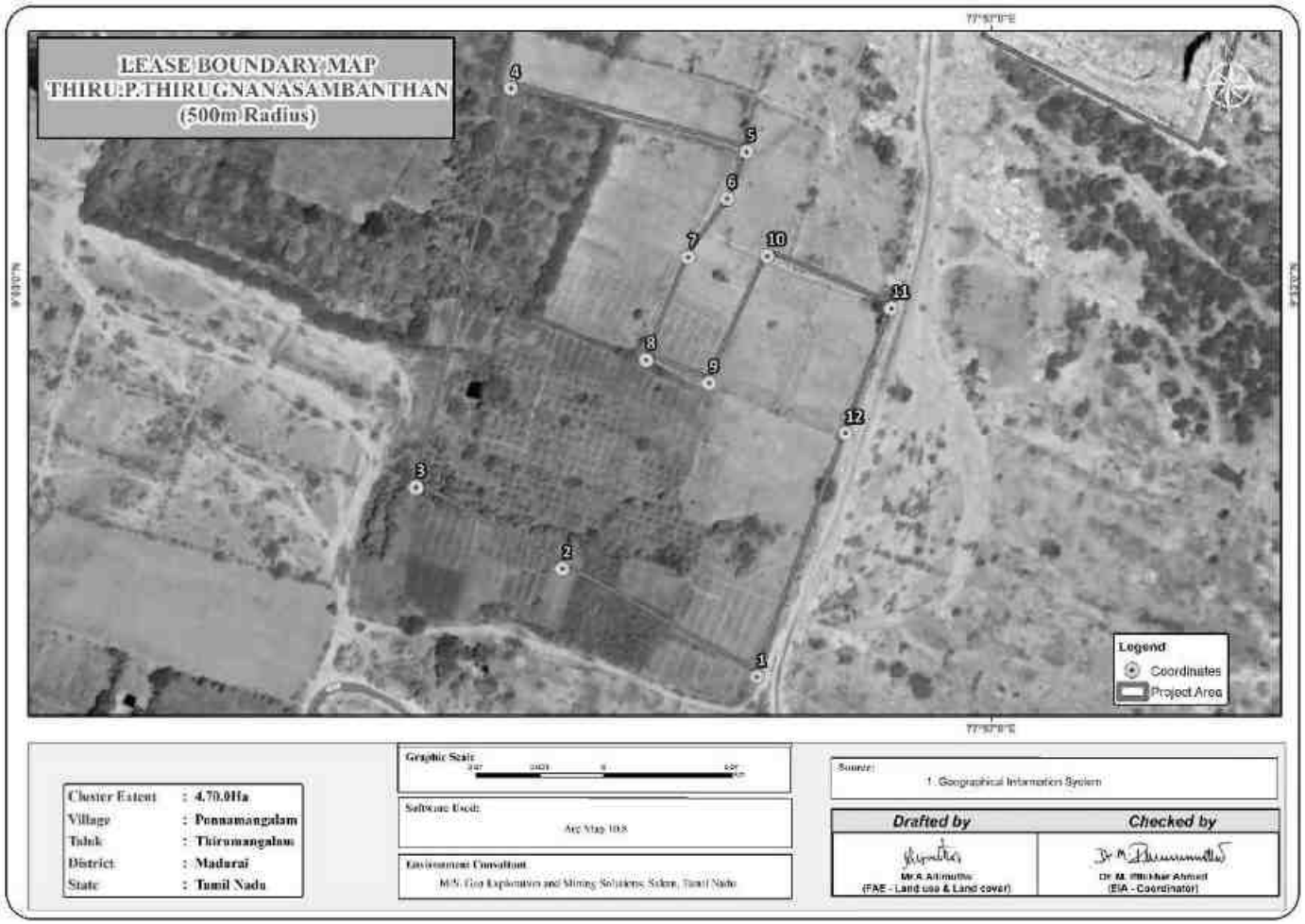
BOUNDARY CO-ORDINATES OF PROJECT – P1		
Corner Nos.	**Latitude**	**Longitude**
1	09^0 52’53.05” N	77^0 56’55.85” E
2	09^0 52’54.97” N	77^0 56’52.40” E
3	09^0 52’56.41” N	77^0 56’49.81” E
4	09^0 53’03.48” N	77^0 56’51.49” E
5	09^0 53’02.36” N	77^0 56’55.67” E
6	09^0 53’01.44” N	77^0 56’55.33” E
7	09^0 53’00.49” N	77^0 56’54.63” E
8	09^0 52’58.67” N	77^0 56’53.89” E
9	09^0 52’58.26” N	77^0 56’55.00” E
10	09^0 53’00.51” N	77^0 56’56.03” E
11	09^0 52’59.58” N	77^0 56’58.23” E
12	09^0 52’57.37” N	77^0 56’57.42” E

Source: Quarry Lease Plan of the respective proposals

FIGURE 2.1: TOPOGRAPHICAL VIEW OF THE PROJECT SITE

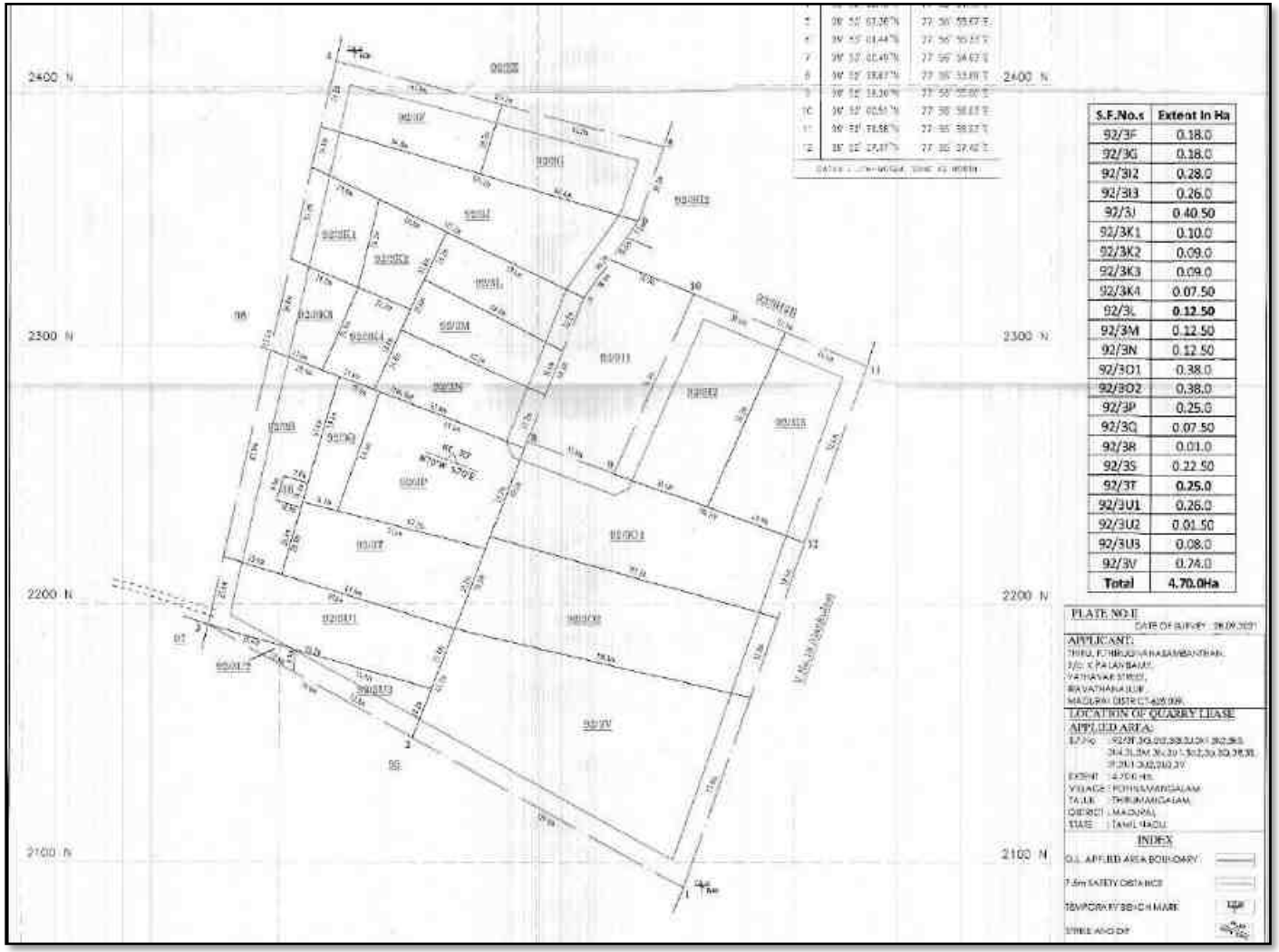
Thiru. P. Thirugnanasambanthan - P1 - project Site

FIGURE 2.2: SHOWING GOOGLE IMAGE ROUGH STONE AND GRAVEL QUARRY PROJECT AREA



P1– Thiru. P. Thirugnanasambanthan

FIGURE 2.3: QUARRY LEASE PLAN



P1– Thiru. P. Thirugnanasambanthan

FIGURE 2.4: SATELLITE IMAGERY OF CLUSTER QUARRIES

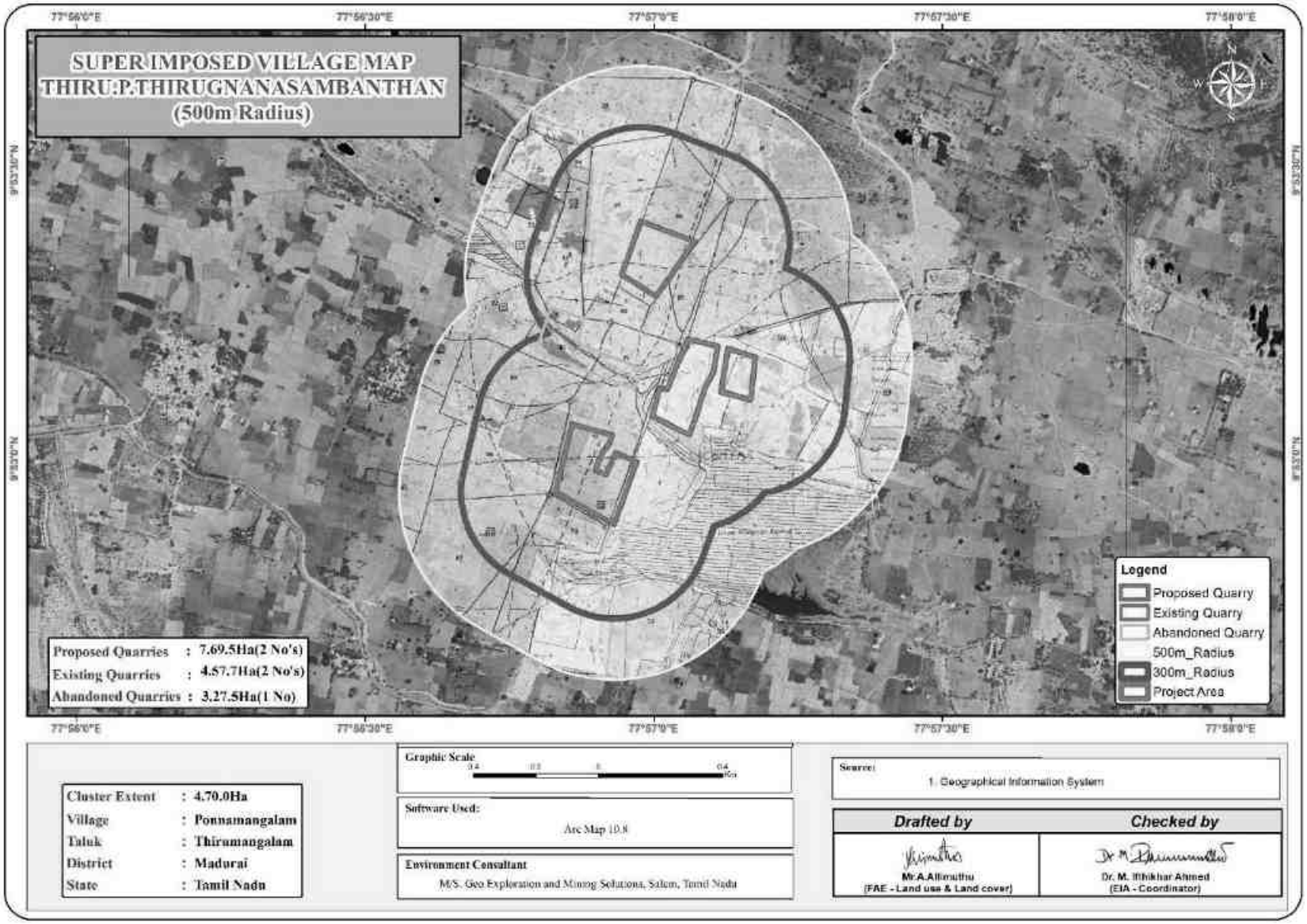


FIGURE 2.5: DIGITIZED MAP OF THE STUDY AREA (10 KM RADIUS FROM PROJECT SITE)

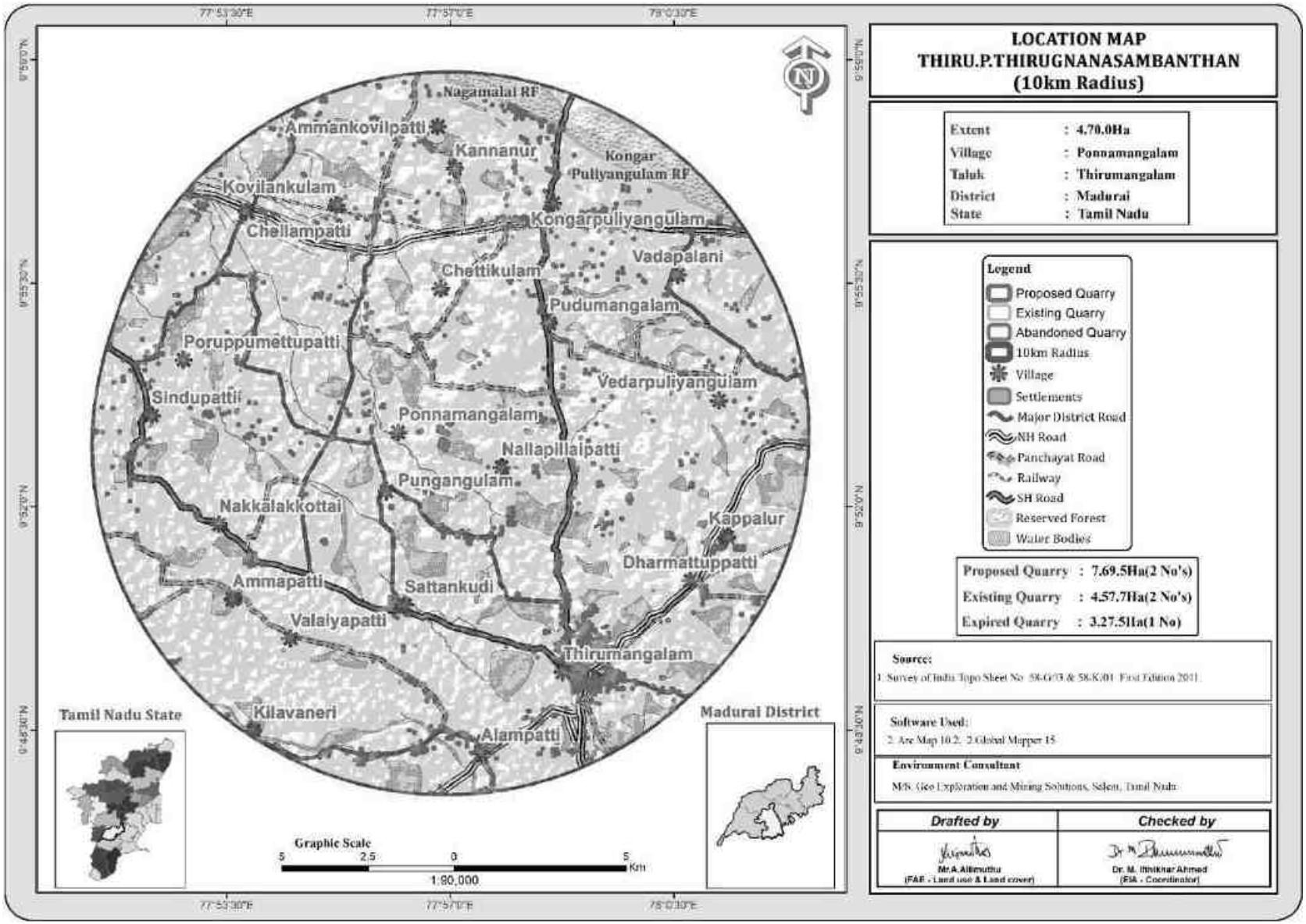


FIGURE 2.6: DIGITIZED MAP OF THE STUDY AREA (5 KM RADIUS FROM PROJECT SITE)

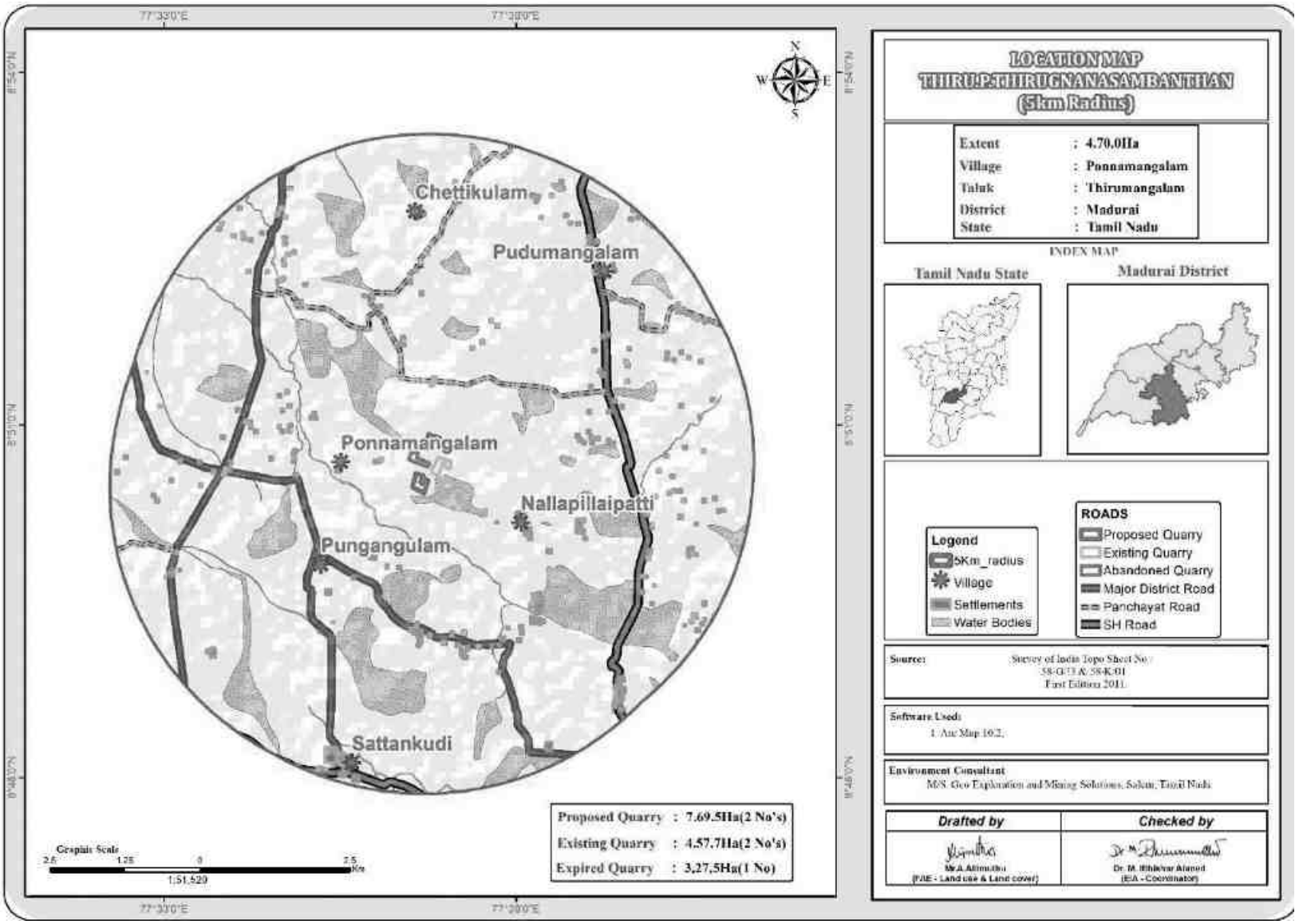
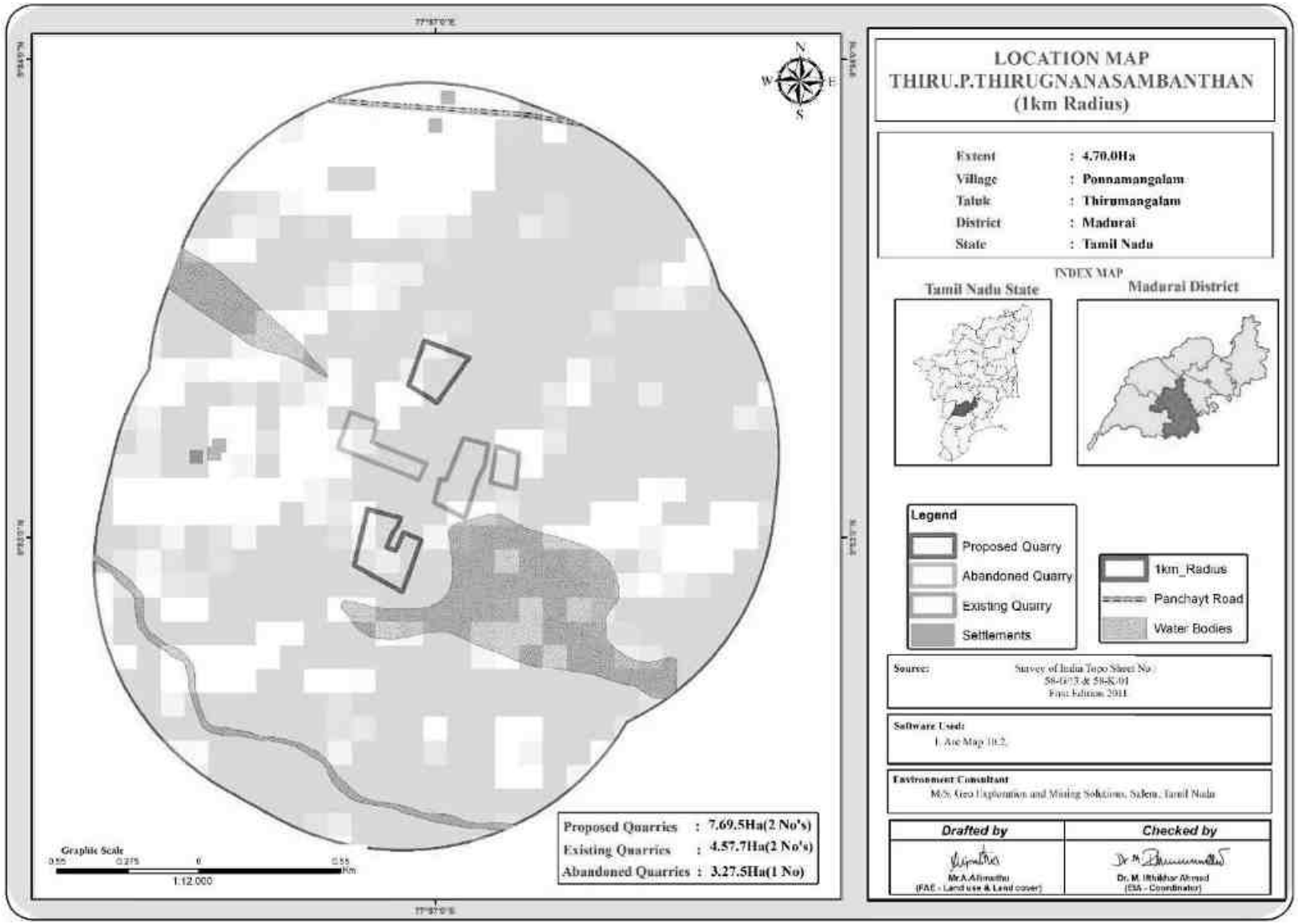


FIGURE 2.7: DIGITIZED MAP OF THE STUDY AREA (1 KM RADIUS FROM PROJECT SITE)



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 OF THE PROPOSED PROJECT

LAND USE PATTERN OF PROJECT – P1			
Description	**Present area in (ha)**	**Area required for first five year plan period (Ha)**	**Area at the end of life of quarry (Ha)**
Area under Quarrying	Nil	3.83.3	3.83.3
Infrastructure	Nil	0.01.0	0.01.0
Roads	Nil	0.02.0	0.05.0
Green Belt	Nil	0.22.8	0.49.6
Un – utilized area	4.70.0	0.60.9	0.31.1
Grand Total	**4.70.0**	**4.70.0**	**4.70.0**

Source: Approved Mining Plan

2.2.2 Size or Magnitude of Operation

TABLE 2.4: OPERATIONAL DETAILS FOR PROPOSED PROJECT

OPERATIONAL DETAILS FOR PROJECT – P1		
PARTICULARS	**DETAILS**	
	Rough Stone (m^3) (5Year Plan period)	**Gravel (m^3) (3 Years Plan per iod)**
Geological Resources	21,15,315m^3	94,014m^3
Mineable Reserves	7,32,635m^3	73,686m^3
Production for first five-year plan period as per ToR	3,68,290m^3	73,686m^3
Production per day	245	82
No of Lorry loads (12m^3 per load)	20	7
Production for second five-year plan period as per ToR	3,64,345 m^3 of Rough Stone	
Production per day	243	
No of Lorry loads (12m^3 per load)	20	
Mining Plan Period / Lease Period	10 Years	
Number of Working Days	300 Days	
Total Depth of Mining for 10 years (As per ToR)	47m	

Source: approved mining plan

* Gravel is proposed to excavate for first year, second year and third years only

2.3 Geology

2.3.1 Regional Geology

Madurai district of Tamil Nadu forms a part of southern Granulitic terrain and is predominantly occupied by crystalline rocks of Archaean to late Proterozoic age. Regionally, the rocks can be grouped under five categories namely:

- ❖ Metasedimentary group comprising quartzite, calc gneiss/crystalline limestone, garnet- sillimanite ± biotite ± cordierite ± spinel gneiss, minor garnet-cordierite gneiss and garnetiferous quartzo-feldspathic gneiss (Khondalites and leptynite), magnetite and quartzite.
- ❖ Charnockite Group consisting of acid charnockite and pyroxene granulite.
- ❖ Older Intrusive rocks consisting of amphibolite, pyroxenite and gabbro (mafic sultramafics).
- ❖ Migmatite group made up of banded hornblende biotite gneiss, grey granitic gneiss,
- ❖ Pink granitic gneiss and grey hornblende granite.

Table 2.5 Stratigraphy of Madurai District

Age	Group	Lithology
Holocene		Red lomy/Block cotton soil/clay ± gypsum
Cenozoic		Kankar/calc-tufa
Neoproterozoic	Acid intrusives	Quartz veins Pegmatite Pink Granite
	Sivamalai syenite Complex	Nepheline-syenite
	Chalk Hills (Basic Intrusives)	Pyroxenite/Dunite
Archaean - Palaeoproterozoic	Peninsular Gneissic Complex (II) PGC (II)	Pink Granite Gneiss Hornblende Biotite gneiss
Archaean	Charnockite Group	Charnockite (Unclassified) Pyroxene Granulite Banded Magnetite Quartzite

2.3.2 Local Geology: -

Regional foliation trend of the rock types in Melur area swerves from NE-SW to ENEWSW direction dipping either east or westwards with dip amounts ranging between 50and 80 depicting a broad antiformal fold with axial plane trending along ENE-WSW direction and plunging at low angles towards ENE direction. The garnetiferousquartzo-feldspathic granulite viz. Kashmir White bands are located mainly in the limb portions of the major fold. The pink medium grained granite viz. Vanjinagaram Pink has been intruded mainly along the weak plane of the above major fold axis and in turn has influenced the adjoining grey granite/ grey migmatite rocks with pink permeations, giving rise to the formation of pink and grey augen gneiss viz. Tiger Skin. Due to the cross folding of the above major fold mainly along NNW-SSE direction, puckering effect (microfolds) besides development of minor step like fractures are seen in the Tiger Skin deposit. Minor folds trending along ENE-WSW direction are also noticed mainly in the Kashmir White bands. Some of the fractures and cleavages are seen filled by pegmatites and quartz veins, especially in Tiger Skin deposit. Apart from the above-mentioned structural features, no other major structural disturbance which may affect production of commercial granite could be deciphered in Melur area.

The study area follows the regional trend and mainly comprises of Hard Rock Formation as a homogeneous formation / Batholith formation of Charnockite. All the project areas are plain terrain, all the project areas are covered

with gravel formation of 2m thickness; Massive Charnockite formation is found after 2 m gravel formation which is clearly inferred from the nearby existing quarry pit.

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

2.3.3 Hydrogeology

The district is underlain predominantly by crystalline formations and alluvium is found along the courses of the river. Ground water occurs under phreatic conditions in weathered residuum and interconnected shallow fractures and under semi-confined to confined conditions in deeper fractures. The depth of weathering varies from 20-25 m bgl in Usilampatti, Sedapatti and Kottampatti area, while it varies from 30 to 40 m bgl in remaining parts of the district. The depth of dug wells varies from 10 – 20 m with a yield of 45 – 135 lpm. In the exploration programme of Central Ground Water Board, 29% of the wells yielded less than 1 lps while 30% of the wells yielded between 1 – 3 lps. In general, there are about 2 – 3 fracture zones less than 50 m and about 2 – 3 fracture form beyond 100 m also. The variation in the yield of bore wells are very high in the district. Potential fractures with high discharge have been established along Valandur-usilampatti Timmarasanayakanur, Thirali-Peraiyur tract and Palkalainagar- Nilayur tract in the district. The depth to water level in the district varies from 3.13 to 7.66 m bgl during premonsoon (May) and 1.86 to 5.74 m bgl during post monsoon period. (Source: CGWB).

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

Aquifer Systems:

Granite, Charnockite, Pegmatite, Gneissic Rocks are largely found in Madurai area. Sedimentary rocks namely calcareous gritty (sand stone mixed clay), and quartz vein. The younger alluvium formations are seen predominantly in the northern part of the area and are considered as highly permeable. The northwest and middle east part of the area consist of fluvial– deltaic sediment deposits, which are laid on Granitoid gneiss and are considered as good zone for groundwater potential. However, the hard rock materials composed of crystalline charnockite, conglomerate, and quartzite vein present in the southern part of the area are not suitable for groundwater potential zones.

Hard Rock Formations

More than 90% of the district is underlain by hard rocks. The gneissic type of formation is found on the western portion in the Western Ghats and its offshoots, Cumbum valley, north of Thirumangalam, parts of Melur, etc., Infact, this is the major formation among the various types of hard rocks.

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. Charnockite occurs as distinct pockets in parts of Periyakulam, Melur, Thirumangalam and Usilampattitaluks. Quartzites which are resistant to weathering are also seen as patches in Charnockite and gneissic varieties.

Valley fill sediments

Valley fill sediments composed of admixtures of calcareous mud, clay, silt and sand occur in several places in the western portion particularly in Uthamapalayam and Usilampattitaluks. Good deposits are found in Cumbum valley, Varshanad valley and near Palakombai. These are the products of quick transportation of weathering material from the adjacent mountain slopes around the valley.

Alluvial Formations

Alluvial deposits such as sand, silt, stiff clay, gravel, etc., which are transported sediments by the river are found on either side of Vaigai near Madurai and Vadipatti blocks. These formations are overlying the hard rock as a thin layer. In the river alluvium groundwater occurs under water table condition. The maximum thickness is 40 m and the average thickness of the aquifer is approximately 15 m. These formations are porous and permeable which have good water bearing zones.

Aquifer Parameters

The thickness of aquifer in this district is highly erratic and varies between 15 m to 40 m below ground level. The intergranular Porosity is essentially dependent on the intensity and degree of weathering and fracture development in the bed rock. As discussed earlier deep weathering has developed in Gneissic formations and moderate weathering in charnockite formations. The range of aquifer parameters in hard rock and sedimentary formations are given below:

TABLE 2.6: RANGE OF AQUIFER PARAMETERS

Type of Aquifer	Water Table conditions
hard rock areas	
Permeability	0.98-2.45 m/day
Transmissivity (T) m2/day	15-60 m^2/day
Well yield in LPM	45-135 lpm
Valley fill sediments	
Permeability	1.95-4.40 m/day
Transmissivity (T) m2/day	75-150 m^2/day
Well yield in LPM	225-450 lpm
Alluvium formation	
Permeability	19.57-48.93 m/day
Transmissivity (T) m2/day	210-1500 m^2/day
Well yield in LPM	315-1080 lpm

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

TABLE 2.7: GROUND WATER LEVEL VARIATIONS OF MADURAI DISTRICT

Jan 2017	May 2017	Jan 2018	May 2018	Jan 2019	May 2019	Jan 2020	May 2020	Jan 2021	May 2021	5 Years Pre Monsoon Average	5Years Post Monsoon Average
9.7	14.1	7.1	10.0	7.2	11.0	7.6	10.3	4.7	5.4	9.3	6.5

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

FIGURE 2.11: REGIONAL GEOLOGY MAP

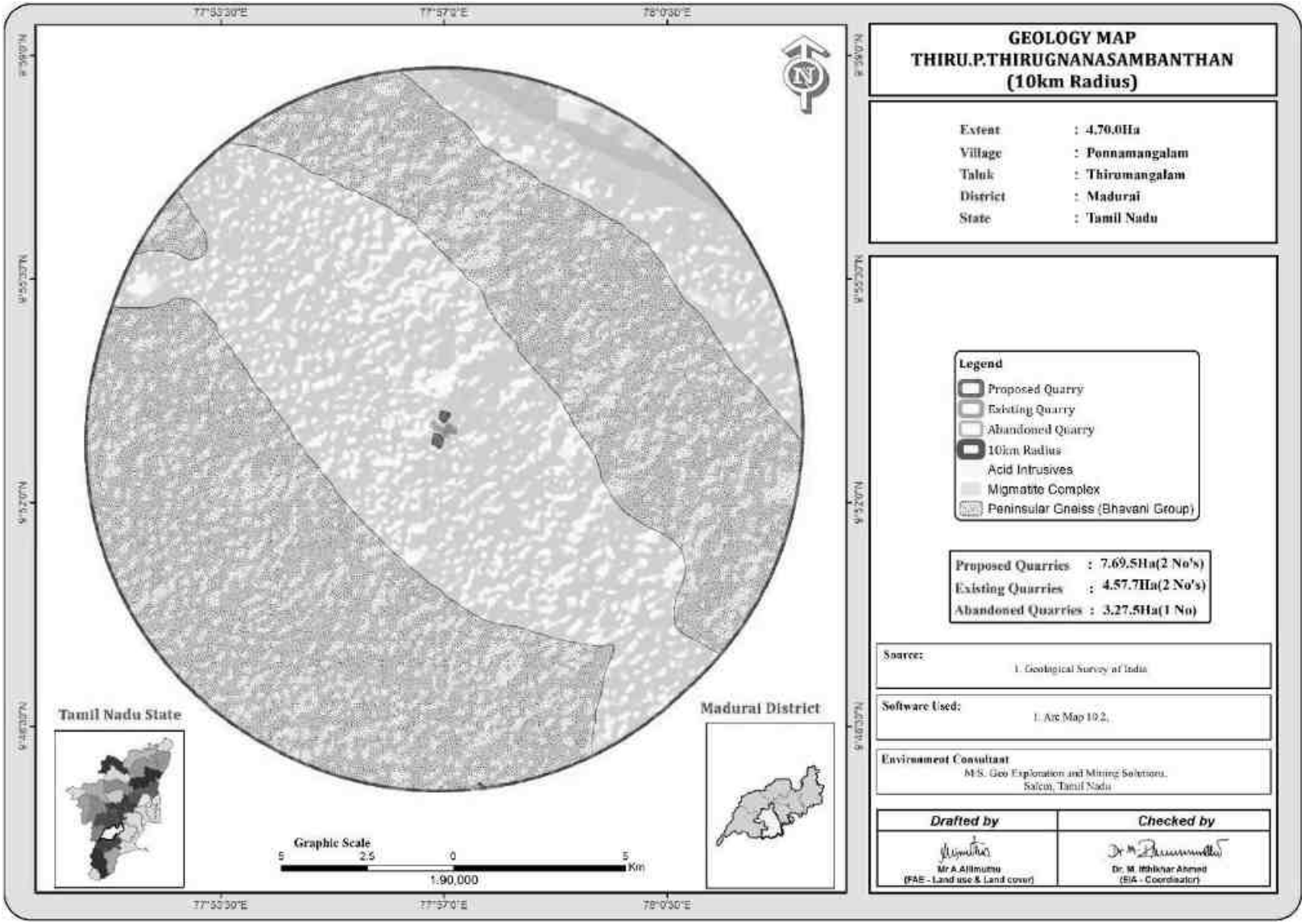


FIGURE 2.12: GEOMORPHOLOGY MAP

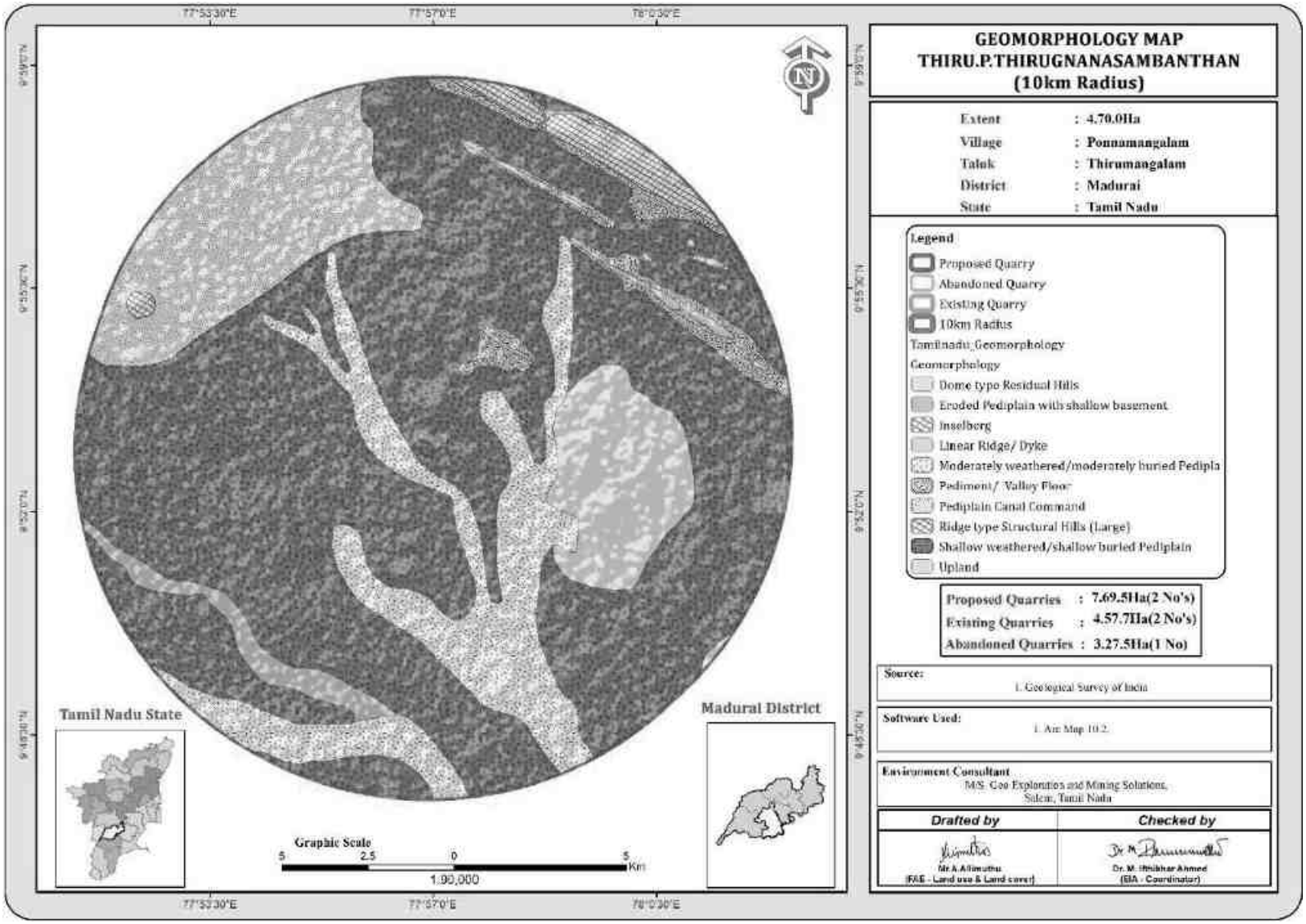
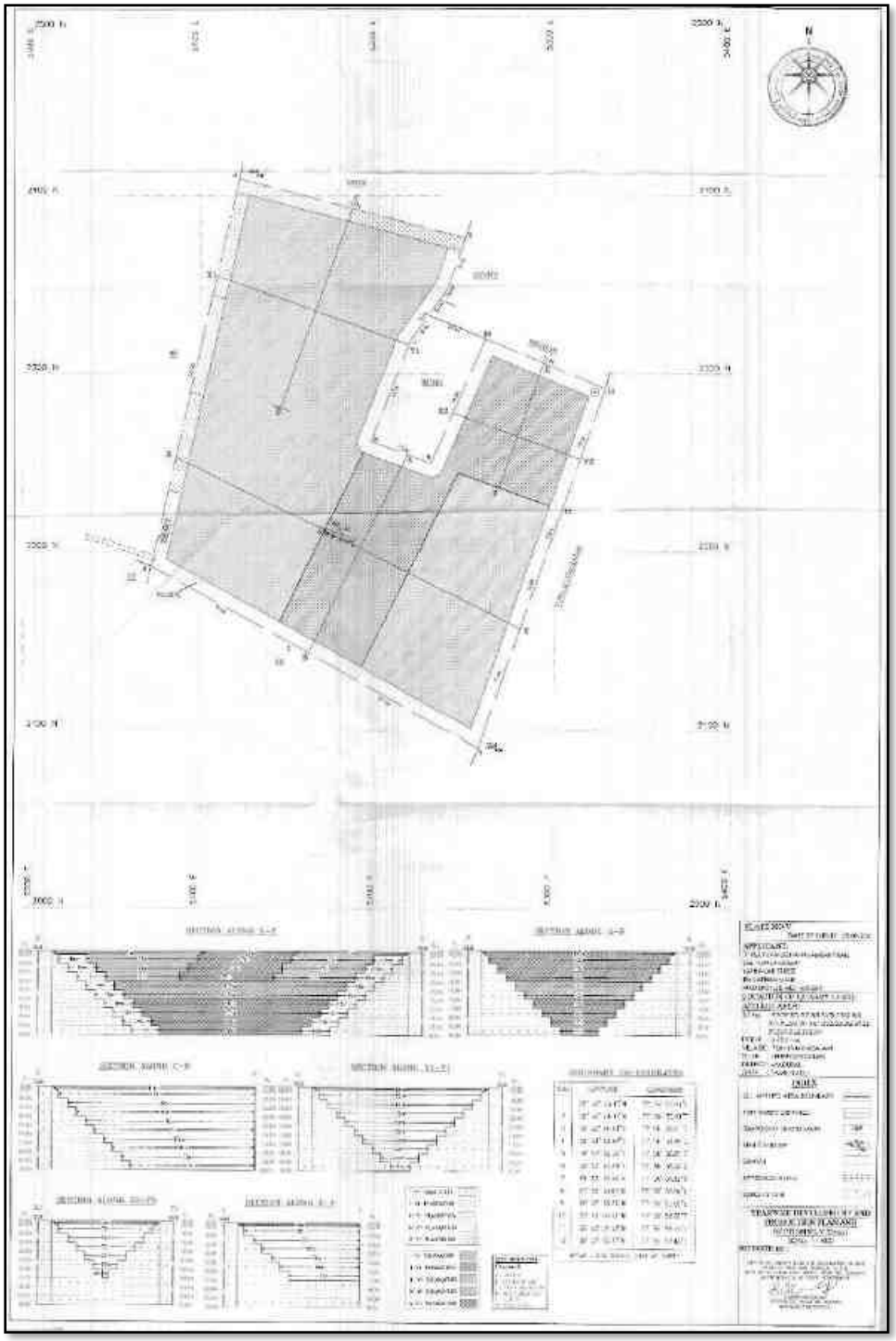


FIGURE 2.13: TOPOGRAPHY, GEOLOGICAL, YEARWISE DEVELOPMENT PRODUCTION PLAN AND SECTION



2.4 Resources and Reserves of the Cluster quarries

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

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

TABLE 2.8: AVAILABLE GEOLOGICAL RESOURCES OF PROPOSED PROJECT

Description	Rough Stone	Gravel
Geological Resource in m^3	21,15,315	94,014
Mineable Resource in m^3	7,32,635	73,686

Source: Approved Mining Plan

TABLE 2.9: YEAR-WISE PRODUCTION PLAN OF PROPOSED PROJECT

YEAR	ROUGH STONE (m^3)	GRAVEL (m^3)
I	73,250	40,488
II	73,140	19,590
III	64,860	13,608
IV	94,670	-
V	73,720	-
VI	84,870	-
VII	70,885	-
VIII	88,480	-
IX	53,840	-
X	66,270	-
TOTAL	**7,32,635**	**73,686**

Source: Approved Mining Plan

Disposal of Waste

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

Conceptual Mining Plan/ Final Mine Closure Plan

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

TABLE 2.10: ULTIMATE PIT DIMENSION OF PROPOSED PROJECT

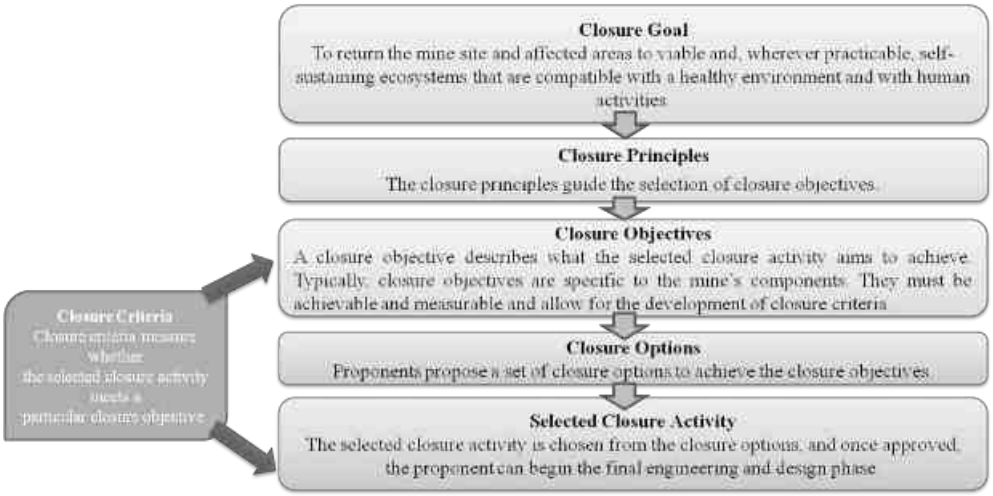
First Five Years	Pit	Length (Max) (m)	Width (Max) (m)	Depth (Max) (m)
	I	200	108	47
	II	98	114	2
	III	59	69	2
Second Five Years	**I**	200	108	47
	II	98	114	47
	III	59	69	32

Source: Approved Mining Plan

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

Closure Objectives –

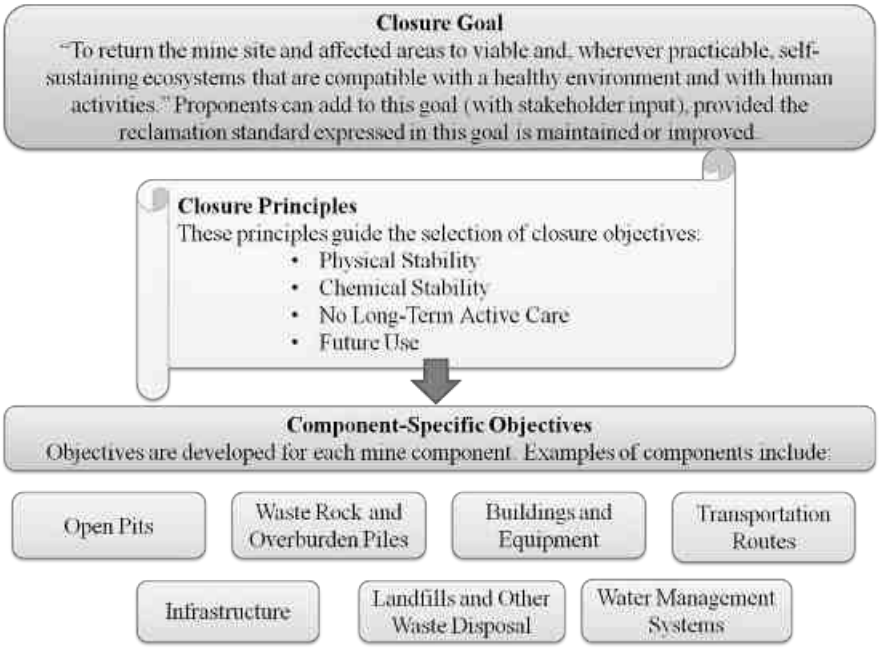
- Access to be limited, for the safety of humans and wildlife.
- The open pit mine workings and pit boundary are physically and geo-technically stable.
- Water quality in flooded pits is safe for humans, aquatic life, and wildlife.
- Discharge of contaminated drainage has been minimized and controlled.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



Closure Planning & Options Considerations in Mine Design –

- The closure of mine is well planned at the initial stage of planning & design consideration by the internal and external stake holders
- Construction of 2m height bund all along the mine pit boundary and ensure its stability all time & construction of garland drain along the natural slope to avoid sliding and collection of soil to the pit & surface runoff during rainfall
- After complete exploitation of mineral, the lowest bench foot wall side will be maintained as plain surface without any sump pits to avoid any accidents
- All the sharp edges will be dressed to smoother face before the closure of mine and ensure no loose debris on hanging wall side
- There is a river on southern side of the project area. The river will not be hindered by any of mine closure activities
- The project proponent as a part of social responsibilities assures to supply the stored mine pit water to the nearby villages after effective treatment process as per the standards of TNPCB & TWAD
- Native species will be planted in 3 row patterns on the boundary barriers and 1st bench, a full-time sentry will be appointed at the gate to prevent inherent entry of public & cattle.
- The access road to the quarry will be cut-off immediately after the closure
- The layout design shall be prepared and get approved from Department of Geology and Mining.

- The proponent is instructed to construct as per the layout approved
- Physical and chemical stability of structures left in place at the site, the natural rehabilitation of a biologically diverse, stable environment, the ultimate land use is optimized and is compatible with the surrounding area and the requirements of the local community, and taking the needs of the local community into account and minimizing the socio-economic impact of closure
- There will be a positive change in the environmental and ecology due to the mine closure



Post-Closure Monitoring –

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

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

TABLE 2.11: MINE CLOSURE BUDGET FOR THE PROPOSED PROJECT

ACTIVITY		YEARS										RATE	COST (Rs.)
		I	II	III	IV	V	VI	VII	VIII	IX	X		
Plantation under safety zone	Nos.	50	50	50	50	50	60	60	60	60	60	@100 Rs Per sapling	55,000/-
	Cost	5000	5000	5000	5000	5000	6000	6000	6000	6000	6000		
Plantation in the quarried out in around the quarried out top benches and approach road	Nos.	75	75	75	75	75	75	75	75	75	75		75,000/-
	Cost	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500		
Wire Fencing (In Mtrs) 1050 Mtrs		324000	-	-	-	-	-	-	-	-	-	@300 Rs Per Meter	3,24,000/-
Garland drain (In Mtrs) 750 Mtrs		312000	-	-	-	-	-	-	-	-	-	@300 Rs Per Meter	3,12,000/-
TOTAL													**7,66,000/-**

Source: Proposed by FAE's and EC

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 – 1.5m

  Charge per hole – 0.5Kg

  Powder factor – 6.0 tonnes/kg

  Dia of hole – 30-32 mm

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

Volume of Rough Stone will be excavated from one hole	=	3 Tonnes
Total Volume from proposed quarry	=	**7,32,635**m^3
	=	**7,32,635**/10
	=	**73,263**/300
	=	245* 2.6
	=	636 Tonnes per day
Therefore, Number of Holes per day	=	636/3
	=	212 Holes per day

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 2.12 PROPOSED MACHINERY DEPLOYMENT

PROPOSAL – P1				
S.NO.	**TYPE**	**NOS**	**SIZE/CAPACITY**	**MOTIVE POWER**
1	Jack hammers	9	1.2m to 2.0m	Compressed air
2	Compressor	2	400psi	Diesel Drive
3	Excavator with Bucket / Rock Breaker	2	300 HP	Diesel Drive
4	Tippers	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.

2.6.2 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.

2.6.3 Traffic Density

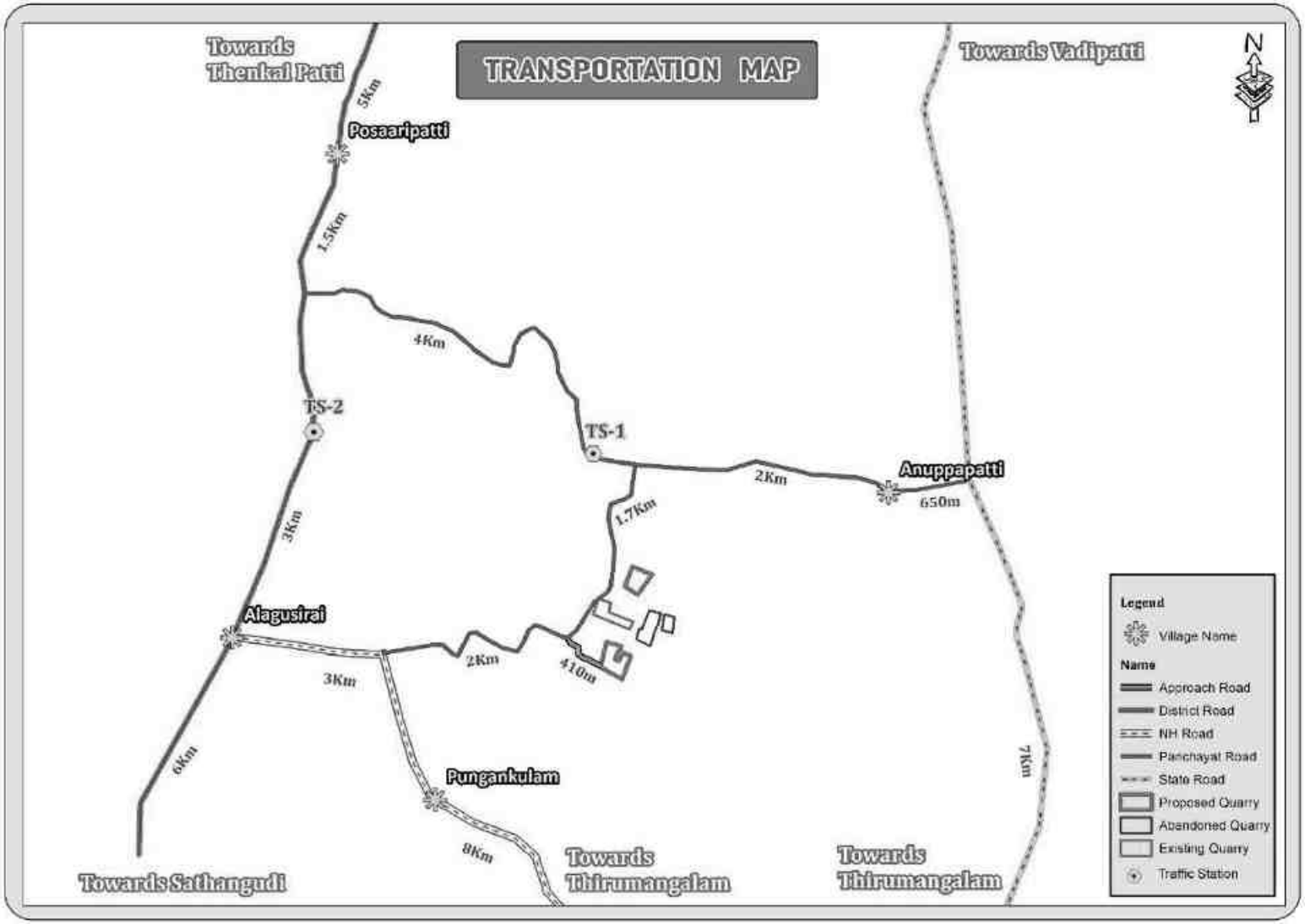
Traffic density measurements were performed as per IRC 1960 Guidelines at three locations based on the transportation route. Traffic density measurement were made continuously for 24 hours by visual observation and counting of vehicles under three categories, viz., heavy motor vehicles, light motor vehicles 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 2.13 – TRAFFIC SURVEY LOCATION'S

Station code	Station location	Distance and Direction	Type of Road
TS1	Anuppattiti-Poosaripatti Road	1.6Km & North	Panchayat Road
TS2	Sathangudi-Poosaripatti Road	3km & NorthWest	Major District Road

Source: On-site monitoring by GEMS FAE & TM

FIGURE 2.14: TRAFFIC SURVEY LOCATIONS & TRANSPORTATION ROUTE MAP



(Source: Survey of India Toposheet)

TABLE 2.14 – 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	30	90	40	40	114	57	187
TS2	110	330	65	65	224	112	507

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 2.15 – ANTICIPATED TRAFFIC DUE TO THIS PROPOSED PROJECT

Transportation of Rough stone per day		
Capacity of trucks	Cumulative Trips	Volume in PCU
10/20 tonnes	20 Trips	20

Source: Anticipated based on Approved Mining Plan Production

TABLE 2.16 – 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
Panchayat Road	187	20	207	500
District Road	507	20	527	1200

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

- As per the IRC 1960 this existing District Road can handle 1200 PCU in hour in hour & village road 500 PCU hence there will not be any conjunction due to this proposed transportation.

2.6.4 Mineral Beneficiation and Processing

There is no proposal for the mineral processing or ore beneficiation in this project

2.7 Project Requirement

2.7.1 Water Source & Requirement

Detail of Total water requirements in KLD as given below:

TABLE 2.17 – WATER REQUIREMENT FOR THE PROPOSED PROJECT

PROPOSAL – P1		
*Purpose	Quantity	Source
Dust Suppression	1.0 KLD	from bore well and open well from nearby area through tankers
Green Belt development	0.8 KLD	From Existing bore wells from nearby area
Drinking and Domestic purpose	0.5 KLD	From existing, bore wells and drinking water will be sourced from Approved water vendors.
Total	**2.3 KLD**	

Source: Prefeasibility Report

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

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

Average diesel consumption is around = Total of 1,000 Liters of HSD per day for proposed project

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 2.18: EMPLOYMENT POTENTIAL FOR PROPOSED PROJECT

Identification code	Employment in Nos
P1	48
Total	**48**

A total of 48 people will get employment due to the proposed quarry

2.7.5 Project Cost

TABLE 2.19 – PROJECT COST OF PROPOSED PROJECT

Identification code	Project Cost
P1	Rs. 71,96,000/-
Total	**Rs. 71,96,000 /-**

Source: Approved Mining Plan &Prefeasibility Report of the project

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 2.20 – 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. 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 Dec2022, Jan & Feb 2023 with CPCB guidelines. Environmental data has been collected with reference to cluster quarries by **Chennai Mettex lab** private Limited– Approved by AAI, AGMARK, APEDA, BIS, [IC, FSSAI, GAFTA, IOPEPC, MOEF & TEA BOARD, for the below attributes-

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

Study Area

An area of 10 km radius (aerial distance) from the periphery of the cluster is considered for EIA study. The data collection has been used to understand the existing environment scenario around the cluster 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 pre-monsoon season i.e Dec 2022 - Feb 2023

Study Methodology

Baseline data 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. A 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 biological 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	Datas from census handbook 2011 and from the satellite imagery	Study Area	Satellite Imagery Primary Survey
*Soil	Physio-Chemical Characteristics	Once during the study period	6 (1 core & 5 buffer zone)	IS 2720 Agriculture Handbook - Indian Council of Agriculture Research, New Delhi
*Water Quality	Physical, Chemical and Bacteriological Parameters	Once during the study period	6 (2 surface water & 4 ground water)	IS 10500& CPCB Standards

Meteorology	Wind Speed Wind Direction Temperature Cloud cover Dry bulb temperature Rainfall	1 Hourly Continuous Mechanical/Automatic Weather Station	1	Site specific primary data& Secondary Data from IMD Station
*Ambient Air Quality	PM_{10} $PM_{2.5}$ SO_2 NO_X Fugitive Dust	24 hourly twice a week (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 (2 core & 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 – Forest Working Plan
Socio Economic Aspects	Socio–Economic Characteristics, Population Statistics and Existing Infrastructure in the study area	Site Visit & Census Handbook, 2011	Study Area	Primary Survey, census handbook & need based assessments.

Source: On-site monitoring/sampling by Chennai Mettex Lab Private Limited in association with GEMS

* All monitoring and testing 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 proposed mine site so that temporal changes due to the mining activities on the surroundings can be assessed in future.

3.1.1 Land Use/ Land Cover

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

TABLE: 3.2 LAND USE / LAND COVER DETAILS OF STUDY AREA

S.No	Classification	Area_Ha	Area_%
BUILTUP			
1	Builtup Urban	578.02	1.73
2	Builtup Rural	565.05	1.70
3	Builtup Mining	101.17	0.30
AGRICULTURAL LAND			
4	Crop Land	20666.72	62.02
5	Agricultural Plantation	383.89	1.15
6	Fallow Land	5141.23	15.43
FOREST			
7	Evergreen/Semievergreen Forest	650.96	1.95
8	Scrub Forest	113.97	0.34
BARREN/WASTELAND			
9	Scrub Land	1452.19	4.36
10	Sandy Area	113.97	0.34
11	Barren Rocky	837.10	2.51
WATERBODIES			
12	Waterbodies	2720.93	8.16
		33325.20	100.00

Source: Bhuvan, NRSC.

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

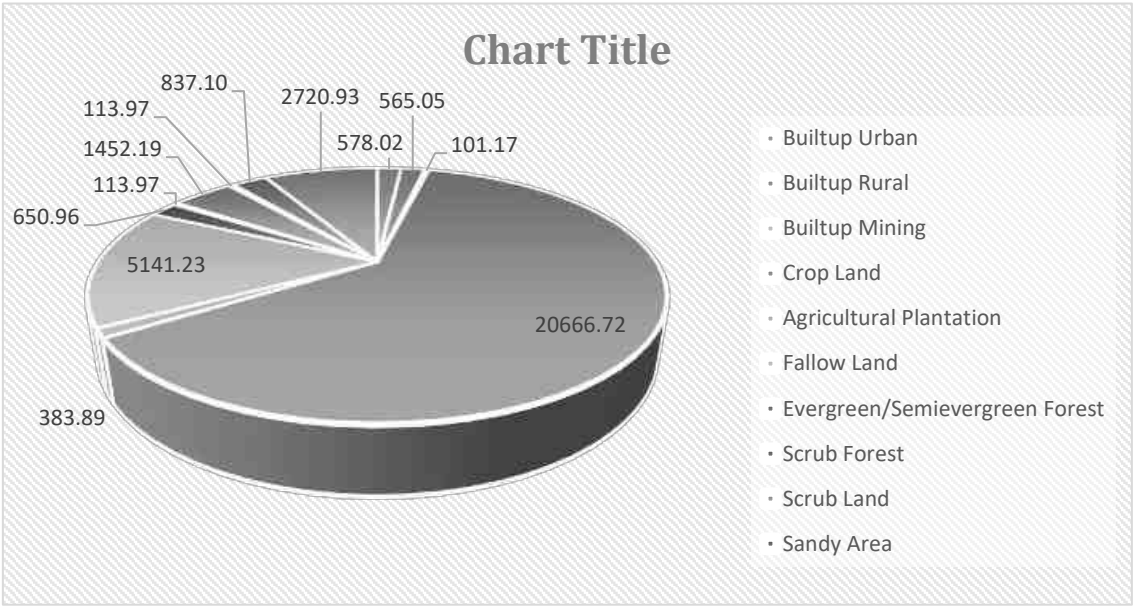
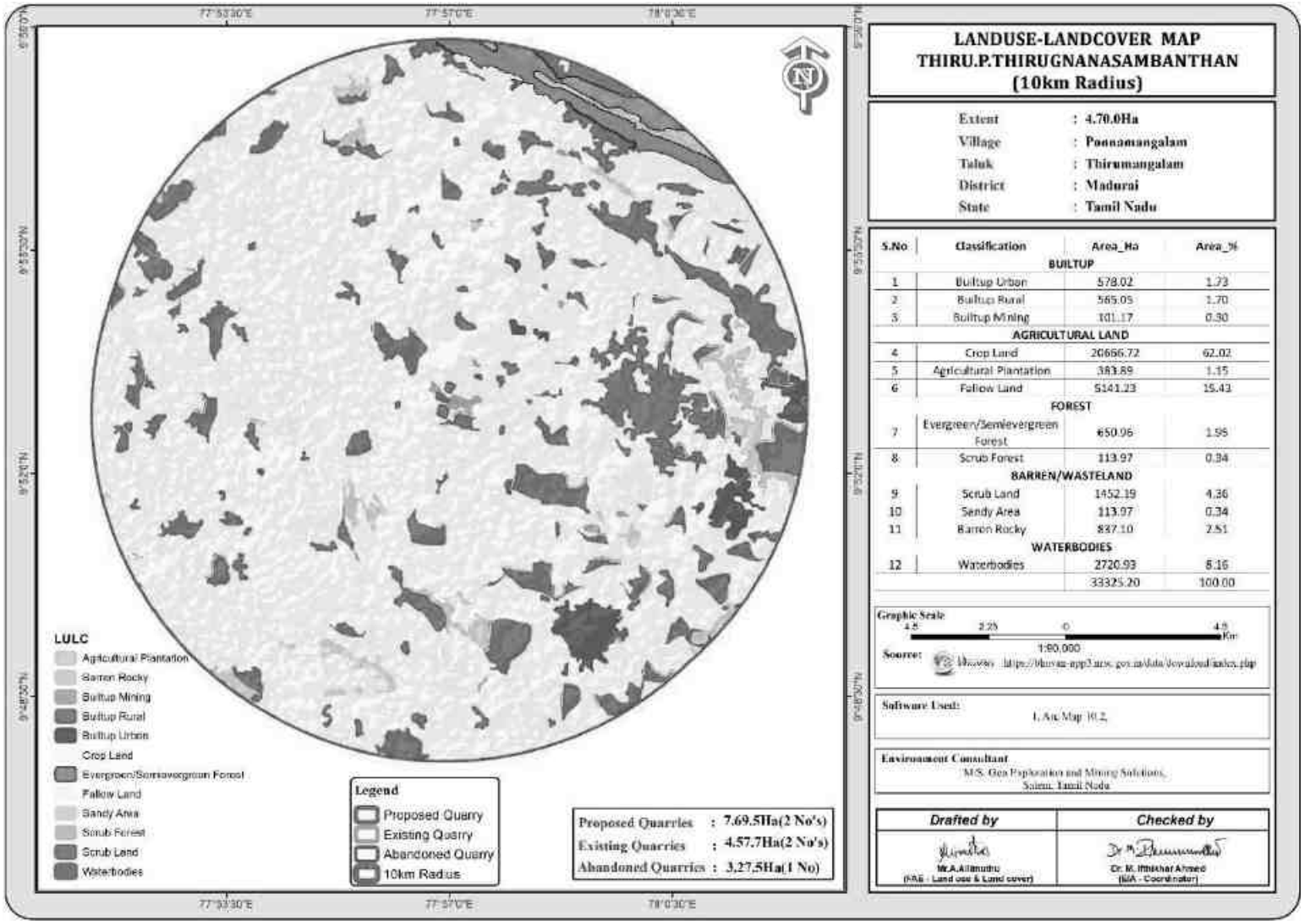


FIGURE 3.2: LAND USE LAND COVER MAP 10KM RADIUS



From the above table, pie diagram and land use map it is inferred that the majority of the land in the study area is Agriculture and fallow land (includes crop land) 78% followed by Forest land– 2.3%, Water bodies 8.16%,Waste land 7% and Built-up Lands – 3.7%.

The total mining area within the study area is 101 ha i.e., 0.30%. The cluster area of 12.27.0 ha contributes about 12.27% of the total mining area within the study area. This small percentage of Mining Activities shall not have any significant impact on the environment.

3.1.2 Topography

The proposed project area is plain terrain with a maximum elevation of 145m AMSL, sloping towards Western side. Massive Biotite - Gneissic formation is found after 2m Gravel formation which is clearly inferred from the nearby existing quarry pits.

3.1.3 Drainage Pattern of the Area

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

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

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

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

3.1.4 Seismic Sensitivity

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

3.1.5 Environmental Features in the Study Area

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

TABLE 3.3 – DETAILS OF ENVIRONMENT SENSITIVITY AROUND THE PROJECT AREA

Sl.No	Sensitive Ecological Features	Name	Arial Distance in km from Cluster
1	National Park / Wild life Sanctuaries	None	Nil within 10km Radius
2	Reserve Forest	Nagamalai RF	9.30km - North East
3	Nearest Habitation	Nearest Habitation	560m – North West
4	Tiger Reserve/ Elephant Reserve/ Biosphere Reserve	None	Nil within 10 km Radius
5	Critically Polluted Areas	None	Nil within 10 km Radius

6	Mangroves	None	Nil within 10 km Radius
7	Mountains/Hills	None	Nil within 10 km Radius
8	Notified Archaeological Sites	None	Nil within 10 km Radius
9	Defence Installation	None	Nil within 10 km Radius

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

TABLE 3.4 – NEAREST WATER BODIES FROM PROPOSED QUARRIES

Sl.No	NAME	DISTANCE & DIRECTION
1	Tank	40m South
2	Urappanur Kanmoi	2.5Km SE
3	Sengulam Lake	4.5Km SE
4	Periyamaravan Lake	7Km SE
5	Gavundan River	8Km South
6	Koothiyarkundu Kanmoi	9Km SE
7	Thenpalanji lake	6Km NE
8	Poolangkulam Kanmoi	8Km NW
9	Uchapatti Kanmoi	9.5Km NW

Source: Village Cadastral Map and Field Survey, PFR Report

3.1.6 Soil Environment

Soil quality of the study area is one of the important components of the land environment. The composite soil samples were collected from the study area and analysed for different parameters. The locations of the monitoring sites are detailed in Table 3.5 and Figure 3.6.

TABLE 3.5 – SOIL SAMPLING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	S-1	Core Zone	Project Area	9°52'59.22" N 77°56'57.27" E
2	S-2	Anuppapatti	2.8km NE	9°53'45.50" N 77°58'18.05" E
3	S-3	Erramalampatti	4km SW	9°52'13.06" N 77°54'40.04" E
4	S-4	Vagaikulam	6.0km West	9°54'11.02" N 77°53'51.69" E
5	S-5	Mela Urappanur	2.5km SE	9°52'3.67" N 77°57'55.03" E
6	S-6	Paraipatti	6km NE	9°56'4.70" N 77°57'54.79" E

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

FIGURE 3.3: SITE PHOTOGRAPHS OF SOIL SAMPLING LOCATIONS

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 (6) locations were selected for soil sampling on the basis of soil types, vegetative cover, industrial & residential activities including infrastructure facilities, which would accord an overall idea of the soil characteristics. The samples were analysed for physical and chemical characteristics. The 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 3.6.

TABLE 3.6 – METHODOLOGY OF SAMPLING COLLECTION

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

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

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 3.4: SOIL SAMPLING LOCATIONS AROUND 10 KM RADIUS

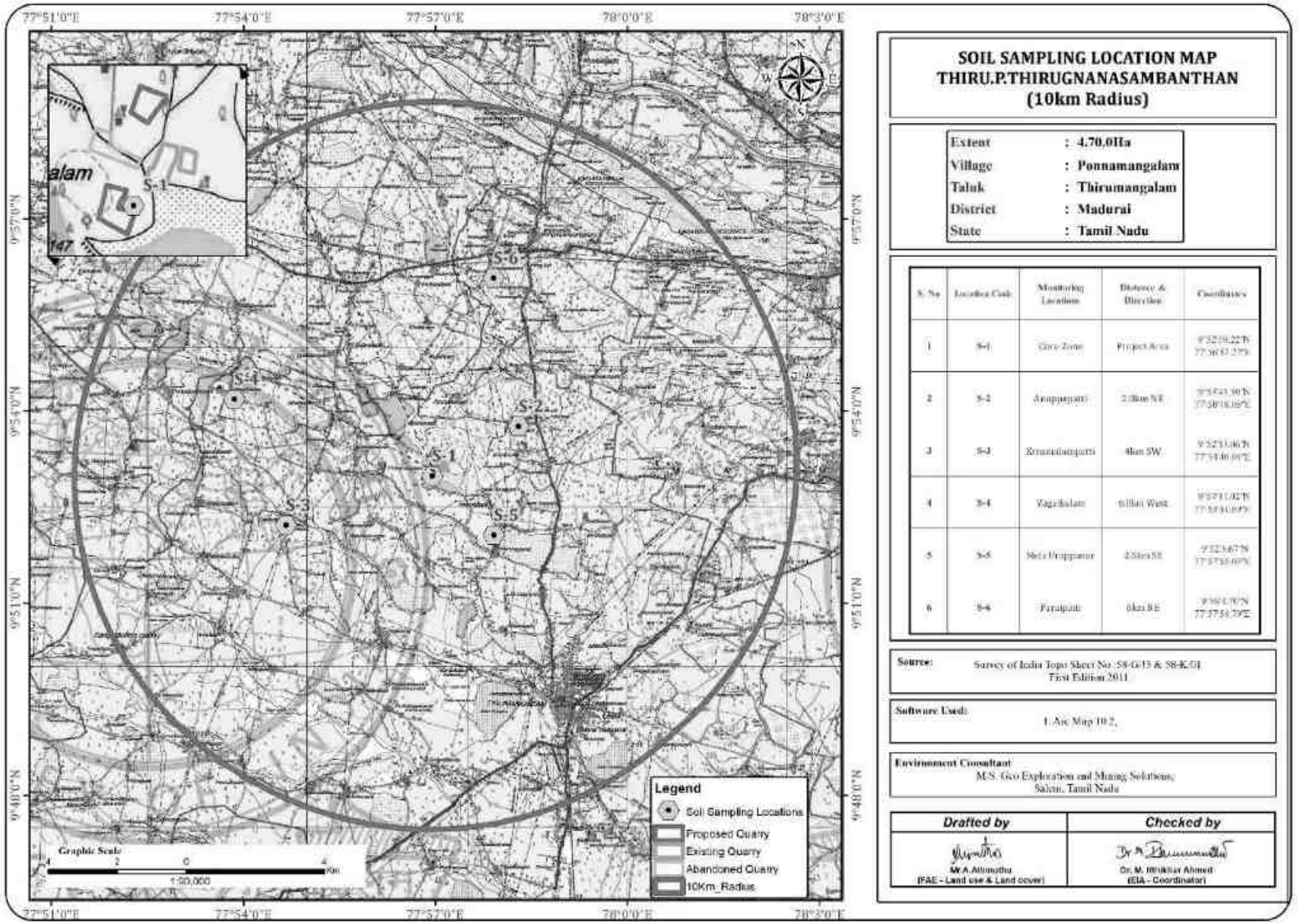


FIGURE 3.5: SOIL MAP

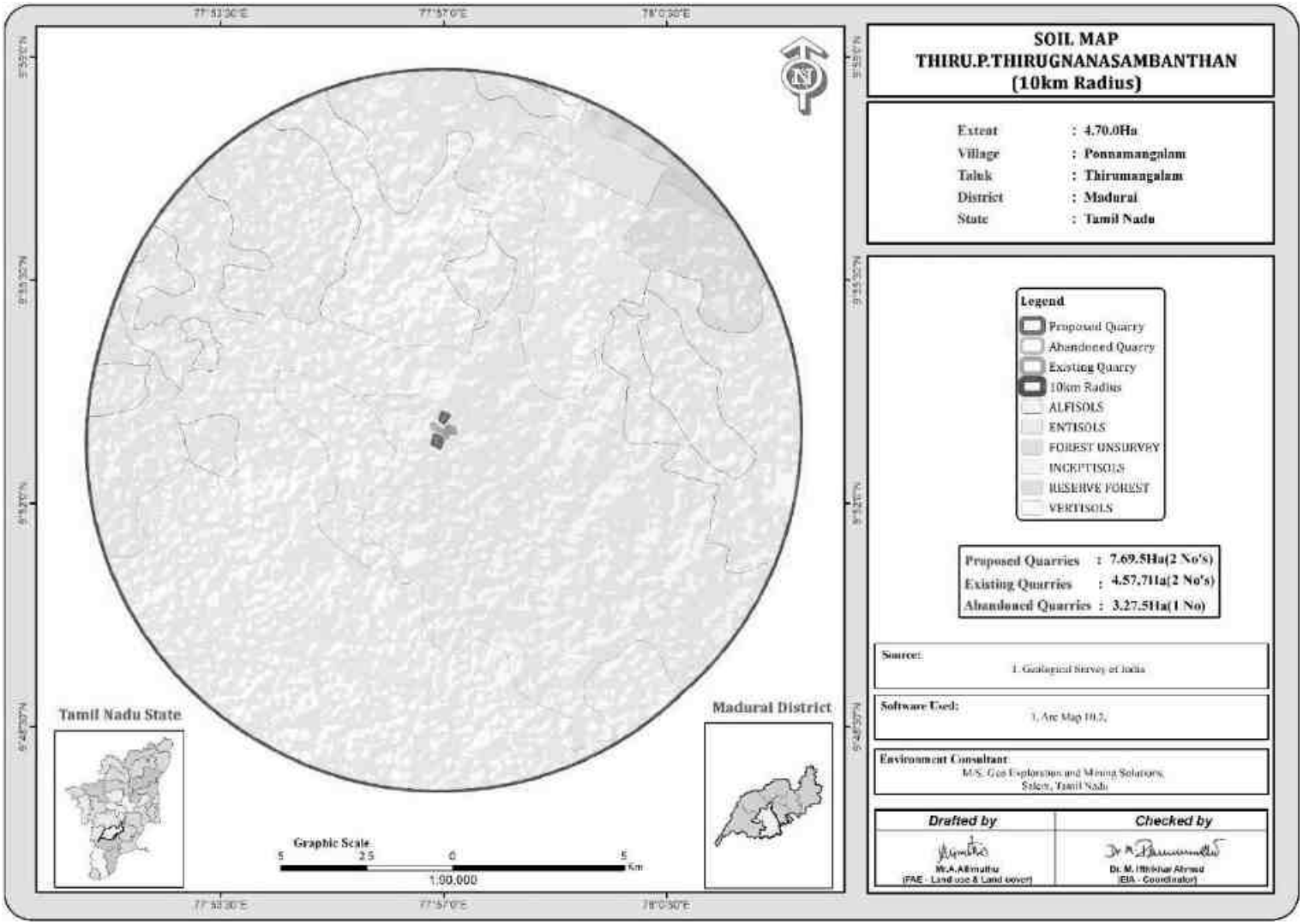


TABLE 3.7 – SOIL QUALITY MONITORING DATA

S. No	Test Parameters	Protocols	S1-core Zone	S2-Anuppapatti	S3-Erramalampatti	S4- Vagaikulam	S5- Mela Urappanur	S6- Paraipatti
01	pH @ 25°C	IS 2720 Part 26 - 1987 (Reaff:2016)	8.58	8.55	8.27	8.46	8.03	8.91
02	Conductivity @ 25°C	IS 14767 - 2000 (Reaff : 2016)	461 µmhos/cm	597 µmhos/cm	496 µmhos/cm	480 µmhos/cm	370 µmhos/cm	550 µmhos/cm
03	**Texture :**							
	Clay	Gravimetric Method	33.8 %	35.8 %	38.3 %	35.4 %	36.6 %	33.8 %
	Sand		35.5 %	36.7 %	35.5 %	34.6 %	34.4 %	34.7 %
	Silt		30.7 %	27.5 %	26.2 %	30.0 %	29.0 %	31.5 %
04	Water Holding Capacity	By Gravimetric Method	46.8 %	44.8 %	47.2 %	48.8 %	42.2 %	38.5 %
05	Bulk Density	By Cylindrical Method	1.01 g/cm^3	1.1 g/cm^3	0.99 g/cm^3	1.14 g/cm^3	1.34 g/cm^3	1.09 g/cm^3
06	Porosity	By Gravimetric Method	46.4 %	47.1 %	45.5 %	41.6 %	45.7 %	41.5 %
07	Calcium as Ca	USEPA3050B–1996&USEPA 6010 C - 2000	170 mg/kg	170 mg/kg	246 mg/kg	173 mg/kg	155.4 mg/kg	165.3 mg/kg
08	Magnesium as Mg		81 mg/kg	133 mg/kg	75 mg/kg	110 mg/kg	120 mg/kg	124 mg/kg
09	Manganese as Mn		24.3 mg/kg	28.7 mg/kg	20.4 mg/kg	25.3 mg/kg	19.5 mg/kg	16.6 mg/kg
10	Zinc as Zn		1.22 mg/kg	1.24 mg/kg	3.1 mg/kg	1.77 mg/kg	2.41 mg/kg	1.13 mg/kg
11	Boron as B		1.54 mg/kg	1.56 mg/kg	1.55 mg/kg	0.86 mg/kg	3.15 mg/kg	1.24 mg/kg
12	Chloride as Cl	APHA 23rd Edn 2019 4500 Cl B	120 mg/kg	192 mg/kg	166 mg/kg	75.5 mg/kg	149 mg/kg	142 mg/kg
13	Total Soluble Sulphate as SO_4	IS 2720 Part 27 : 1977 (Reaff:2015)	0.021 %	0.018 %	0.015 %	0.011 %	0.019 %	0.022 %
14	Potassium as K	USEPA3050B–1996&USEPA 6010 C - 2000	28.6 mg/kg	48 mg/kg	41.5 mg/kg	35.5 mg/kg	297 mg/kg	34.2 mg/kg
15	Total Phosphorus as P	IS 10158 : 1982 (Reaff: 2019)	1.86 mg/kg	1.21 mg/kg	1.6 mg/kg	1.87 mg/kg	1.43 mg/kg	2.12 mg/kg
16	Total Nitrogen as N	IS 14684 : 1999 (Reaff:2019)	275 mg/kg	510 mg/kg	379 mg/kg	420 mg/kg	367 mg/kg	360.5 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		0.54 mg/kg	0.73 mg/kg	0.42 mg/kg	0.65 mg/kg	0.29 mg/kg	0.61 mg/kg
21	Iron as Fe		1.90 mg/kg	2.44 mg/kg	1.84 mg/kg	2.12 mg/kg	1.97 mg/kg	20.10 mg/kg
22	Organic Matter	IS : 2720 Part 22: 1972 (Reaff: 2015)	1.81 %	2.10 %	2.82 %	1.98 %	2.48 %	2.57 %
23	Organic Carbon	IS : 2720 Part 22: 1972 (Reaff: 2015)	1.05 %	1.22 %	1.64 %	1.15 %	1.44 %	1.49 %
24	Cation Exchange Capacity	USEPA 9080 – 1986	35.5 meq/100g of soil	32.3 meq/100g of soil	42.0 meq/100g of soil	39.2 meq/100g of soil	45.5 meq/100g of soil	40.2 meq/100g of soil

Source: Sampling Results by Chennai Mettex Lab Private Limited

Interpretation & Conclusion

Physical Characteristics –

The physical properties of the soil samples were examined for texture, bulk density, porosity and water holding capacity. The soil texture found in the study area is Clay to Sandy Soil and Bulk Density of Soils in the study area varied between 0.99– 1.34 g/cc. The Water Holding Capacity of the soil samples ranging from 38.5 – 48.8% and Porosity of the soil is found to be medium i.e ranging from 41.5 – 47.1%.

Chemical Characteristics –

- The nature of soil is slightly alkaline to strongly alkaline in nature with pH range 8.03 to 8.91
- The available Nitrogen content range between 275 to 510 mg/kg
- The available Phosphorus content range between 1.21 to 2.12 mg/kg
- The available Potassium range between 28.6 to 297 mg/kg

Whereas, the micronutrient as zinc (Zn), iron (Fe) and copper (Cu) were found in the range of 1.13 to 2.41 mg/kg; 1.90 to 20.10 mg/kg.

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.

3.2 Water Environment

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

3.2.1 Surface Water Resources:

Gavundan river lies at 8.0 Km south from the project cluster. The area is studded with few tanks and kanmai 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.

3.2.2 Ground Water Resources:

The terrain is underlain by hard rock formations, Fissured and fractured crystalline rocks constitute the important aquifer systems in the Madurai 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 Thirumangalam block which is categorized as over-exploited zone as per G.O (MS) No 113 dated 09.06.2016.

3.2.3 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

One (1) surface water and six (6) 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.

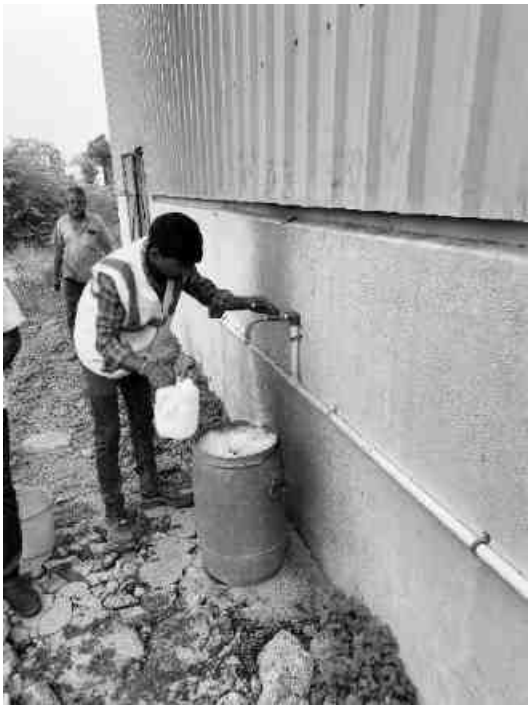
TABLE 3.8 – WATER SAMPLING LOCATIONS

S. No	Location code	Monitoring Locations	Distance & Direction	Coordinates
1	SW-1	Tank Near Nallapillaipatti	650m SE	9°52'43.81" N 77°57'13.85" E
2	SW-2	Urappanur Kanmai	4km SE	9°51'32.43" N 77°58'38.24" E
3	WW-1	Near Project Area	200m SW	9°52'52.61" N 77°56'44.75" E
4	WW-2	Vagaikulam	6.0km West	9°54'15.02" N 77°53'50.95" E
5	BW-1	Near Project Area	300m South	9°52'45.46" N 77°56'50.28" E
6	BW-2	Paraipatti	6km NE	9°56'10.46" N 77°57'47.84" E

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

Note: SW- Surface water, WW – Well Water, BW – Bore well

FIGURE 3.6: SITE PHOTOGRAPHS OF WATER SAMPLING LOCATIONS



Sample Collection in Bore well

TABLE 3.9 – SURFACE WATER ANALYSIS RESULTS

SNO	TEST	PROTOCOL	Surface Water (SW-1) - Tank Near Nallapillaipatti	Surface Water (SW-2) – Urappanur Kanmai
1	Colour	IS 3025 Part 4:1983 (Reaff:2017)	5 Hazen	10 Hazen
2	Odour	IS 3025 Part 5:2018	Agreeable	Agreeable
3	pH at 25°C	IS 3025 Part 11:1983 (Reaff:2017)	7.66	7.29
4	Conductivity @ 25°C	IS 3025 Part 14:2013 (Reaff:2019)	1035 µmhos/cm	1000 µmhos/cm
5	Turbidity	IS 3025 Part 10:1984 (Reaff:2017)	3.5 NTU	2.2 NTU
6	Total Dissolved Solids	IS 3025 Part 16:1984 (Reaff:2017)	611 mg/l	590 mg/l
7	Total Hardness as CaCO3	IS 3025 Part 21:2009 (Reaff:2019)	215.86 mg/l	198.51 mg/l
8	Calcium as Ca	IS 3025 Part 40:1991 (Reaff:2019)	41.2 mg/l	35.4 mg/l
9	Magnesium as Mg	IS 3025 Part 46:1994 (Reaff:2019)	27.5 mg/l	26.8 mg/l
10	Total Alkalinity as CaCO3	IS 3025 Part 23:1986 (Reaff:2019)	200 mg/l	210 mg/l
11	Chloride as Cl	IS 3025 Part 32:1988 (Reaff:2019)	161 mg/l	138.4 mg/l
12	Sulphate as SO4	IS 3025 Part 24:1986 (Reaff:2019)	70 mg/l	65.5 mg/l
13	Iron as Fe	IS 3025 Part 53:2003 (Reaff:2019)	0.22 mg/l	0.21 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	0.23 mg/l	0.55 mg/l
16	Nitrate as NO3	IS 3025 Part 34:1988 (Reaff:2019)	8.5 mg/l	7.7 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 C6H5OH	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)	8.8 mg/l	5.9 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)	5.2 mg/l	5.0 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)	1.3 mg/l	1.5 mg/l
36	Sulphide as H2S	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)	30.1 mg/l	24.2 mg/l
40	**Total Coliform**	**APHA 23rd Edn. 2017:9221B**	900 MPN/100ml	950 MPN/100ml
41	***Escherichia coli***	**APHA 23rd Edn. 2017:9221F**	110 MPN/100ml	90 MPN/100ml
Note : APHA – American Public Health Association, BDL – Below Detection Limit, DL – Detection Limit, MPN – Most Probable Number				

TABLE 3.10 – GROUND WATER ANALYSIS RESULTS

Sno	Test	Protocol	Ground Water (WW-1) – Near Project Area	Ground Water (WW-2) – Vagaikulam	Ground Water (BW-1) – Near Project Area	Ground Water (BW-2) – Paraipatti
1	Colour	IS 3025 Part 4:1983 (Reaff:2017)	5 Hazen	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)	7.59	6.89	7.05	7.38
4	Conductivity @ 25°C	IS 3025 Part 14:2013 (Reaff:2019)	963 µmhos/cm	1250 µmhos/cm	984 µmhos/cm	1018 µmhos/cm
5	Turbidity	IS 3025 Part 10:1984 (Reaff:2017)	1.1 NTU	1.4 NTU	1.5 NTU	1.5 NTU
6	Total Dissolved Solids	IS 3025 Part 16:1984 (Reaff:2017)	568 mg/l	737 mg/l	581 mg/l	600 mg/l
7	Total Hardness as CaCO3	IS 3025 Part 21:2009 (Reaff:2019)	183.85 mg/l	224.05 mg/l	185.84 mg/l	191.39 mg/l
8	Calcium as Ca	IS 3025 Part 40:1991 (Reaff:2019)	31.5 mg/l	39.7 mg/l	35.1 mg/l	30.9 mg/l
9	Magnesium as Mg	IS 3025 Part 46:1994 (Reaff:2019)	25.6 mg/l	30.4 mg/l	23.9 mg/l	27.8 mg/l
10	Total Alkalinity as CaCO3	IS 3025 Part 23:1986 (Reaff:2019)	178 mg/l	240 mg/l	224.5 mg/l	194 mg/l
11	Chloride as Cl	IS 3025 Part 32:1988 (Reaff:2019)	151.2 mg/l	189 mg/l	180 mg/l	150 mg/l
12	Sulphate as SO4	IS 3025 Part 24:1986 (Reaff:2019)	58.6 mg/l	98.1 mg/l	61.8 mg/l	78.3 mg/l
13	Iron as Fe	IS 3025 Part 53:2003 (Reaff:2019)	0.18 mg/l	0.24 mg/l	0.33 mg/l	0.14 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	0.20 mg/l	0.31 mg/l	0.31 mg/l	0.33 mg/l
16	Nitrate as NO3	IS 3025 Part 34:1988 (Reaff:2019)	5.5 mg/l	6.1 mg/l	4.3 mg/l	5.1 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)	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 C6H5OH	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	Cyanide as CN	IS 3025 Part 27-1986 (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)
31	Barium as Ba	IS 3025 Part 44:1993 (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)
32	Ammonia (as total ammonia-N)	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	Sulphide as H2S	IS 3025 Part 38:1989 (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)
34	Molybdenum as Mo	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)
35	Total Arsenic as As	IS 3025 Part 34-1988 (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)
36	**Total Coliform**	**APHA 23rd Edn. 2017:9221B**	230 MPN/100ml	150 MPN/100ml	140 MPN/100ml	120 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 Chennai Mettex Laboratories

3.2.4 Interpretation& Conclusion

Surface Water

The pH of surface 7.29-7.66 while turbidity found within the standards. Total Dissolved Solids 590 - 611 mg/l and Chloride 138.4 - 161 mg/l. Nitrates 7.7 – 8.5 mg/l, while sulphates 65.5 – 70.0 mg/l.

Ground Water

The pH of the water samples collected ranged from 6.89 to 7.59 and within the acceptable limit of 6.5 to 8.5. pH, Sulphates and Chlorides of water samples from all the sources are within the limits as per the Standard. on Turbidity, the water samples meet the requirement. The Total Dissolved Solids were found in the range of 568 – 737 mg/l in all samples. The Total hardness varied between 183.85 – 224.05 mg/l for all samples.

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

3.2.5 Hydrology and Hydrogeological studies

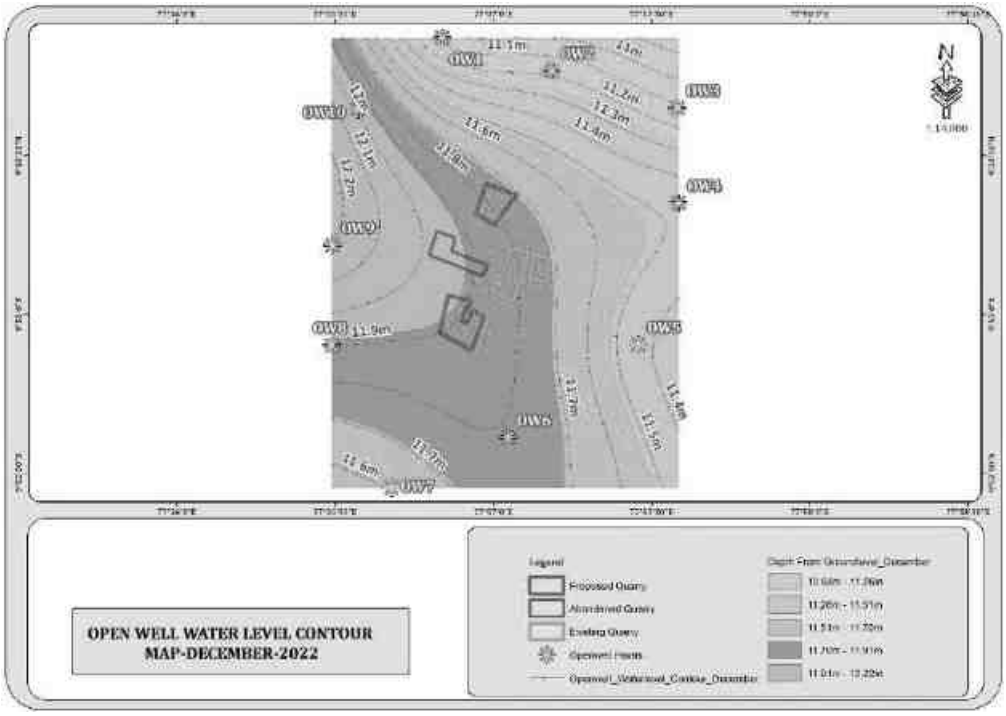
The district is underlain by hard rock formation Fissured and Fractured crystalline rocks constitute the important aquifer systems in the district. Geophysical prospecting was carried out in that area by SSRMP-80 Instrument by qualified Geo physicist with the help of IGIS software and it was inferred that the low resistance encountered at the depth between 68-73m. the quarrying operations is restricted upto 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.

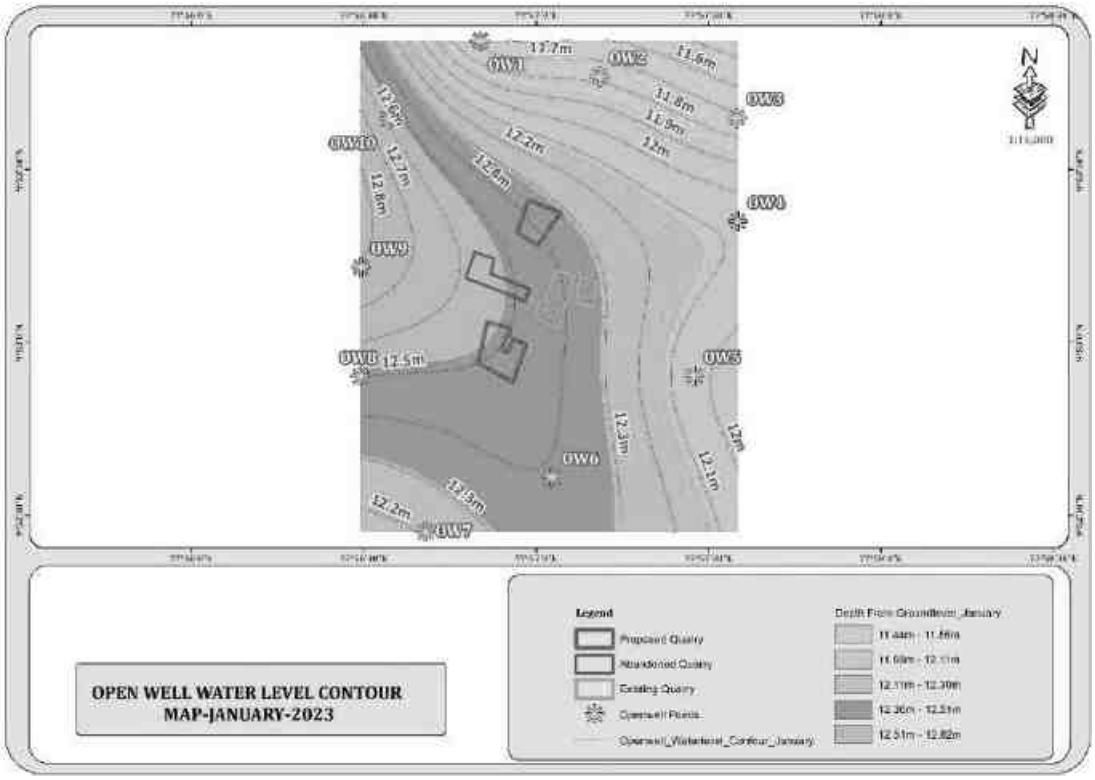
During the rainy season there is a possibility of collection of seepage water from the subsurface levels this is due to the high intensity of fracture and weathered portion upto a depth of 10m thus the collected seepage water will be stored in the mine sump pits and will be used for dust suppression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

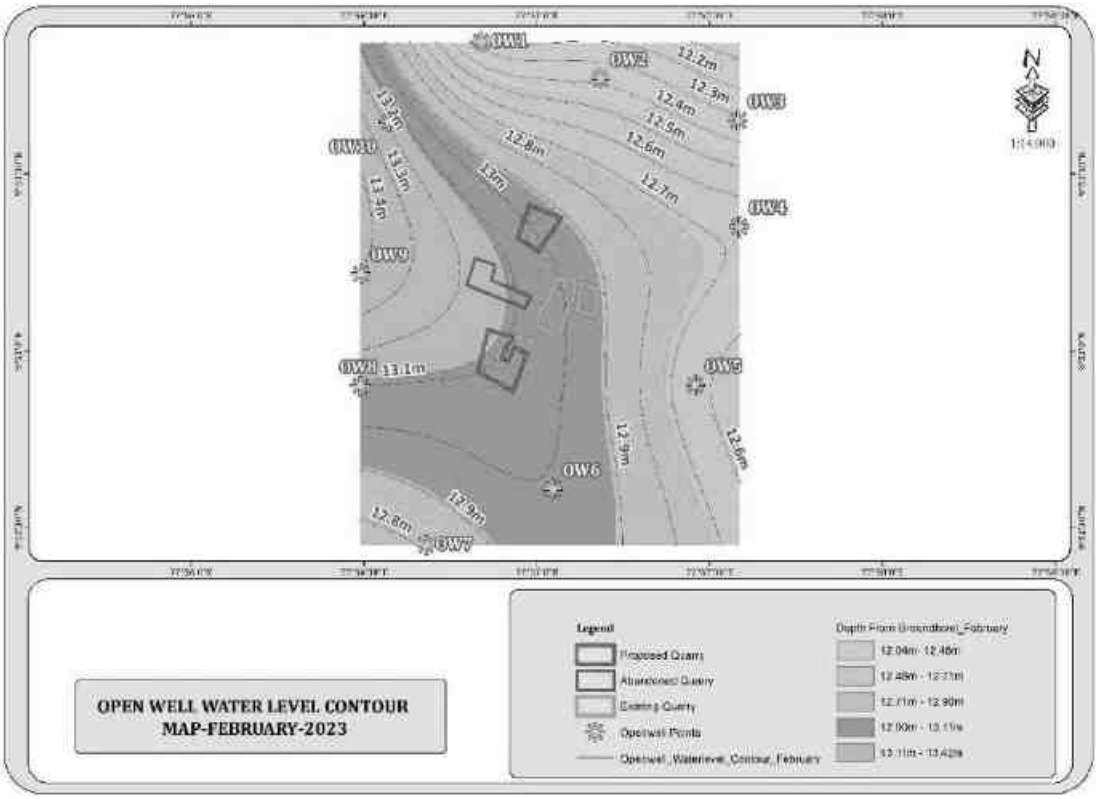
TABLE 3.11: POST MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS

S.No	Name	LATITUDE	LONGITUDE	DEC	JAN	FEB
1	OW1	9° 53' 52.404"N	77° 56' 50.32"E	11	11.6	12.2
2	OW2	9° 53' 46.194"N	77° 57' 11.07"E	11.2	11.8	12.4
3	OW3	9° 53' 39.053"N	77° 57' 34.93"E	11.1	11.7	12.3
4	OW4	9° 53' 21.010"N	77° 57' 35.13"E	11.5	12.1	12.7
5	OW5	9° 52' 54.164"N	77° 57' 27.48"E	11.4	12	12.6
6	OW6	9° 52' 36.534"N	77° 57' 02.81"E	11.8	12.4	13
7	OW7	9° 52' 27.040"N	77° 56' 40.72"E	11.6	12.2	12.8
8	OW8	9° 52' 54.072"N	77° 56' 29.33"E	11.9	12.5	13.1
9	OW9	9° 53' 13.036"N	77° 56' 29.49"E	12.2	12.8	13.4
10	OW10	9° 53' 38.807"N	77° 56' 34.34"E	12	12.6	13.2

FIGURE 3.7: CONTOUR MAP OF OPEN WELL WATER LEVEL




OW1
OW2
OW3
OW4
OW5
OW6
OW7
OW8
OW9
OW10
11.7m
11.6m
11.8m
11.9m
12m
12.2m
12.4m
12.6m
12.7m
12.8m
12.5m
12.3m
12.1m
12.9m
12.2m
N
OPEN WELL WATER LEVEL CONTOUR
MAP-JANUARY-2023
Legend
Proposed Quarry
Abandoned Quarry
Existing Quarry
Openwell Points
Depth From Groundlevel_January


OW1
OW2
OW3
OW4
OW5
OW6
OW7
OW8
OW9
OW10
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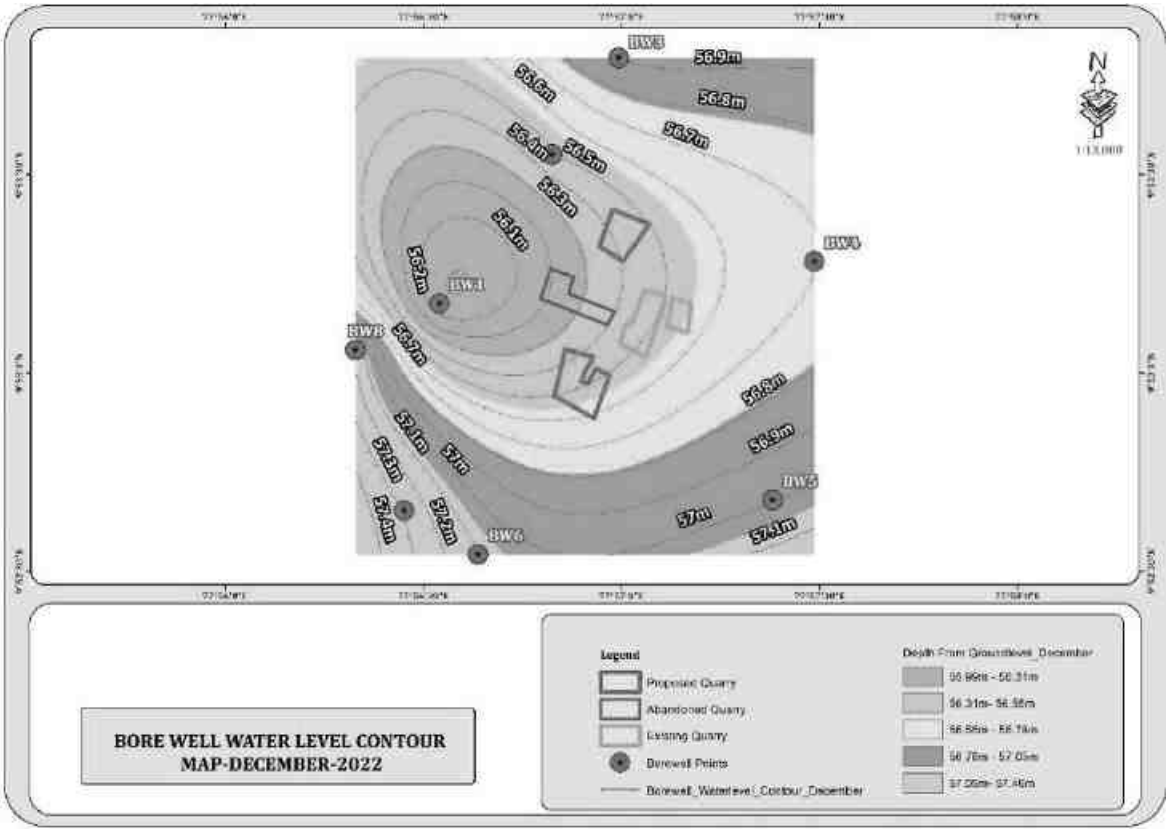
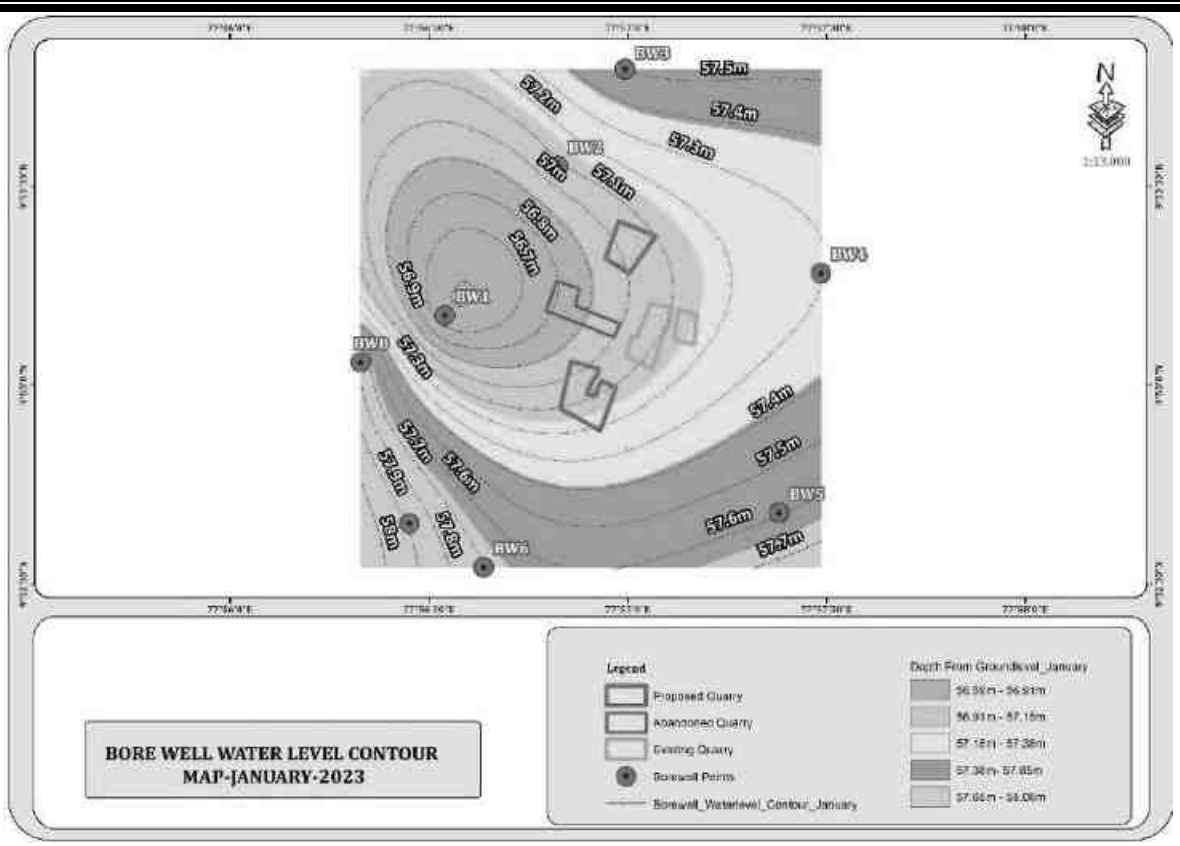
12.6m
12.7m
12.8m
13m
13.1m
13.2m
13.3m
13.4m
12.9m
N
OPEN WELL WATER LEVEL CONTOUR
MAP-FEBRUARY-2023
Legend
Proposed Quarry
Abandoned Quarry
Existing Quarry
Openwell Points
Depth From Groundlevel_February

TABLE 3.12: POST MONSOON WATER LEVEL OF BOREWELLS 1 KM RADIUS

S. No	Name	LATITUDE	LONGITUDE	DEC	JAN	FEB
1	BW1	9° 53' 10.504"N	77° 56' 32.46"E	56	56.6	57.2
2	BW2	9° 53' 33.025"N	77° 56' 49.52"E	56.5	57.1	57.7
3	BW3	9° 53' 47.666"N	77° 56' 59.63"E	56.9	57.5	58.1
4	BW4	9° 53' 16.817"N	77° 57' 29.23"E	56.7	57.3	57.9
5	BW5	9° 52' 40.720"N	77° 57' 22.90"E	57	57.6	58.2
6	BW6	9° 52' 32.489"N	77° 56' 38.31"E	57.1	57.7	58.3
7	BW7	9° 52' 39.126"N	77° 56' 27.08"E	57.3	57.9	58.5
8	BW8	9° 53' 03.431"N	77° 56' 19.72"E	57.2	57.8	58.4

FIGURE 3.8: CONTOUR MAP OF BORE WELL WATER LEVEL

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57.5m
57.2m
57.4m
BW2
57.5m
57.1m
56.8m
56.7m
BW1
BW4
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BW1
BW6
57.2m
57.4m
57.1m
57.6m
57.5m
57.9m
BW5
57.6m
57.4m
57.7m
BW6
N
Legend
Proposed Quarry
Abandoned Quarry
Existing Quarry
Borewell Points
Borewell_Waterlevel_Contour_January
Depth From Ground level_January
BORE WELL WATER LEVEL CONTOUR
MAP-JANUARY-2023

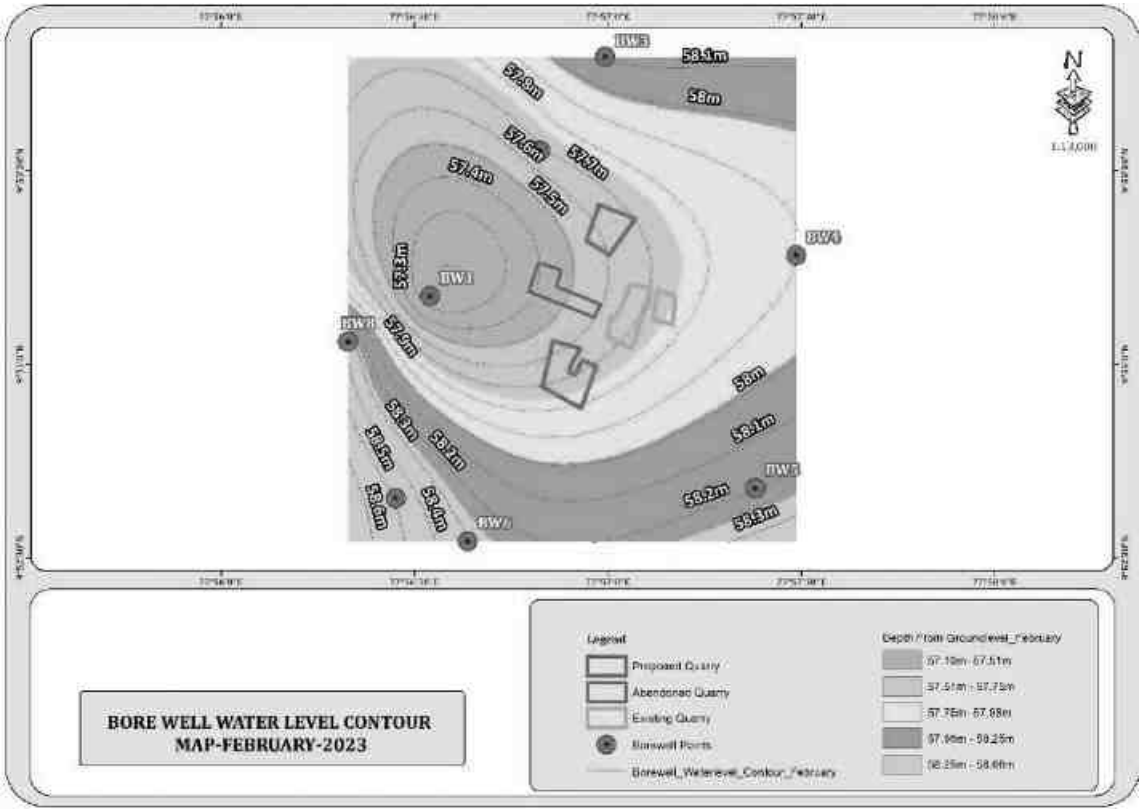

BW3
58.1m
57.9m
58m
57.6m
57.9m
57.4m
57.5m
BW1
BW4
57.6m
58m
58.1m
58.3m
58.2m
58.3m
58.6m
58.4m
BW6
BW5
58.2m
58.3m
N
Legend
Proposed Quarry
Abandoned Quarry
Existing Quarry
Borewell Points
Borewell_Waterlevel_Contour_February
Depth From Ground level_February
BORE WELL WATER LEVEL CONTOUR
MAP-FEBRUARY-2023

FIGURE 3.9: DRAINAGE MAP AROUND 10 KM RADIUS FROM PROJECT SITE

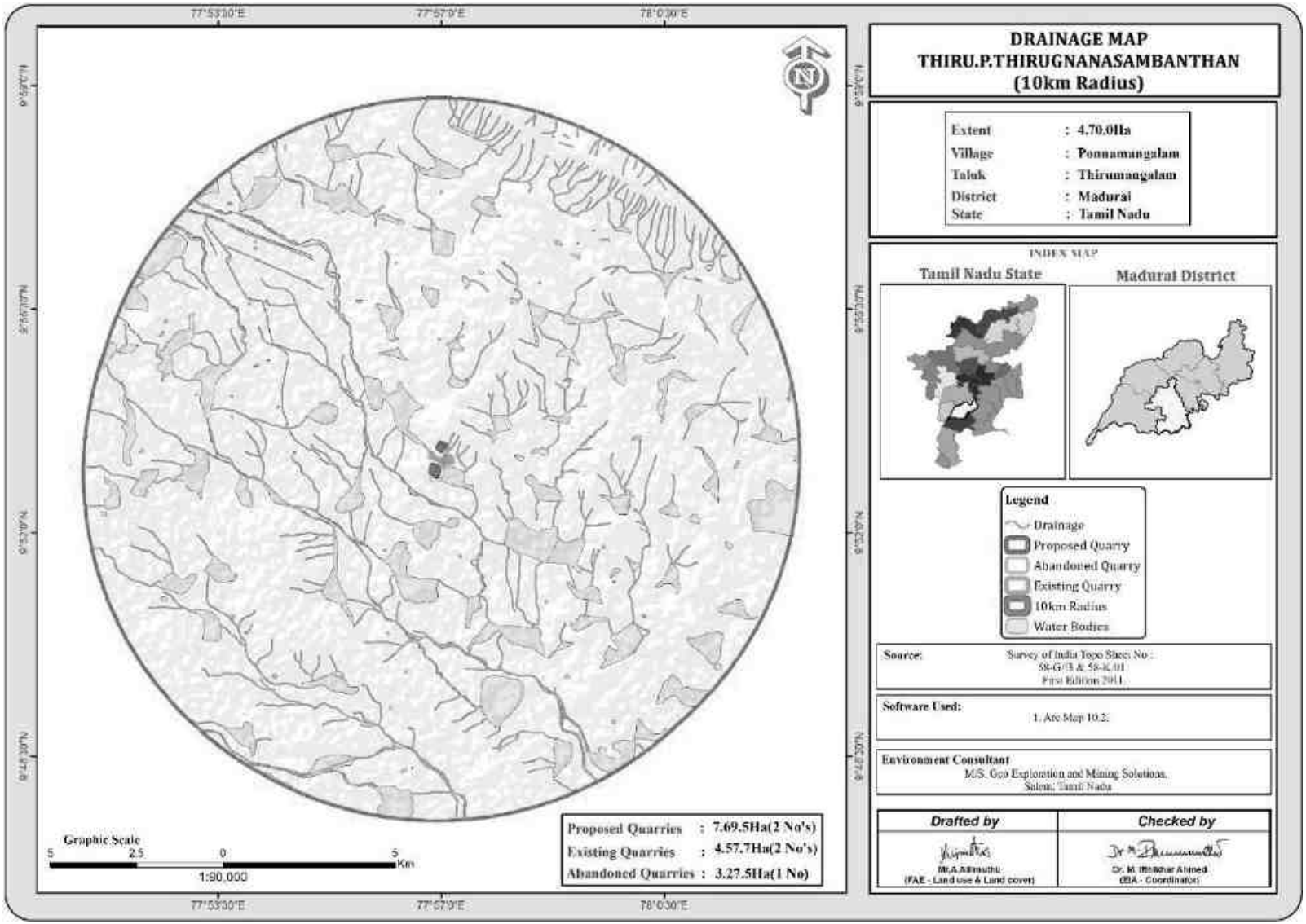
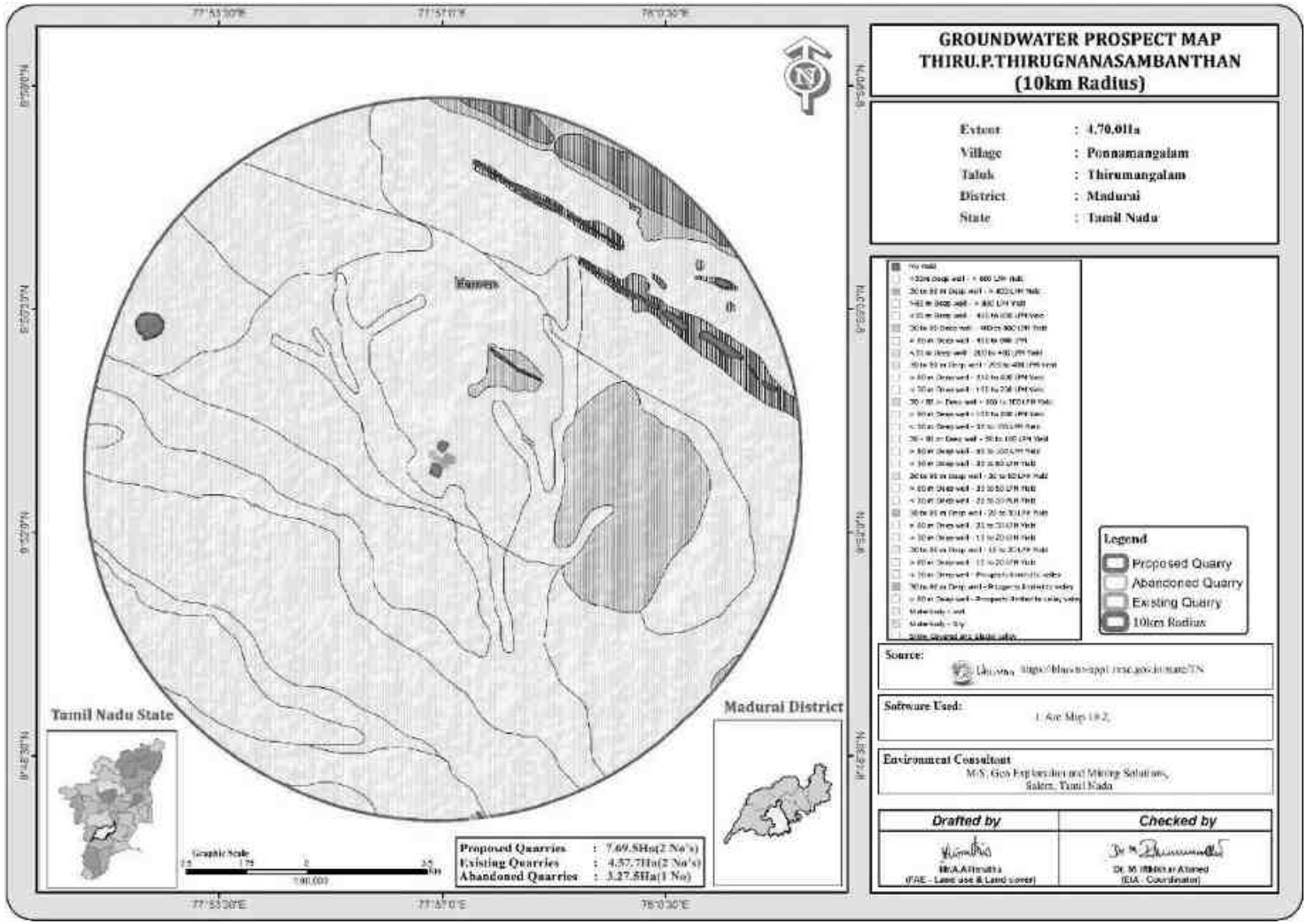


FIGURE 3.10: GROUND WATER LEVEL MAP



Source : Bhuvan

3.2.5.1 Methodology and Data Acquisition

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

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

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

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

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

Ø = Fractional pore volume

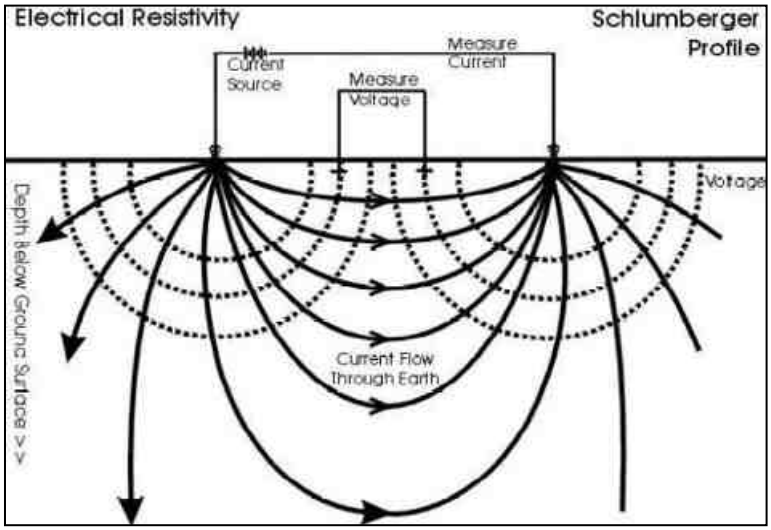
A = Constants with values ranging from 0.5 to 2.5

3.2.5.2 Survey Layout

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

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

RESISTIVITY SURVEY PROFILE



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

3.2.5.3 Data Presentation

It was inferred that the low resistance encountered at the depth between 68-73m. The maximum depth proposed project is 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.

3.2.5.4 Geophysical Data Interpretation

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

3.3 Air Environment

The 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.
-

3.3.1 Meteorology & Climate

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

A temporary meteorological station was installed at project site. 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 –

- The climate here is tropical. The summers are much rainier than the winters in Madurai. This location is classified as Aw by Köppen and Geiger. In Madurai, the average annual temperature is 28.2 °C | 82.7 °F. In a year, the rainfall is 849 mm | 33.4 inch.
- This region, situated near the equator line, is characterized by difficult-to-define summer seasons. The best time to visit is January, February, March, September, November, December.
- The driest month is January, with 16 mm | 0.6 inch of rain. The greatest amount of precipitation occurs in October, with an average of 180 mm | 7.1 inch.
- May is the warmest month of the year. The temperature in May averages 31.0 °C | 87.8 °F. The lowest average temperatures in the year occur in December, when it is around 24.6 °C | 76.4 °F.
  https://en.climate-data.org/asia/india/tamil-nadu/madurai-5892/

Rainfall –

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

TABLE 3.13 – RAINFALL DATA

Actual Rainfall in mm					Normal Rainfall in mm
2017	2018	2019	2020	2021	
904.6	734.1	671.9	915.5	1095.2	985

Source: **https://www.twadboard.tn.gov.in/content/Madurai**

TABLE 3.14 – METEOROLOGICAL DATA RECORDED AT SITE

S.No	Parameters		Dec–2022	Jan–2023	Feb-2023
1	Temperature (^{0}C)	Max	24.84	25.08	26.74
		Min	22.27	21	23.83
		Avg	23.55	23.04	25.28
2	Relative Humidity (%)	Avg	85.56	81.09	69.37
3	Wind Speed (m/s)	Max	4.26	4.23	4.05
		Min	1.07	2.45	2.58
		Avg	2.66	3.34	3.31
4	Cloud Cover (OKTAS)		0-8	0-8	0-8
5	Wind Direction		NE,ENE	E,ESE	ESE,E

Source: On-site monitoring/sampling by Chennai Mettex Lab Private Limited in association with GEMS

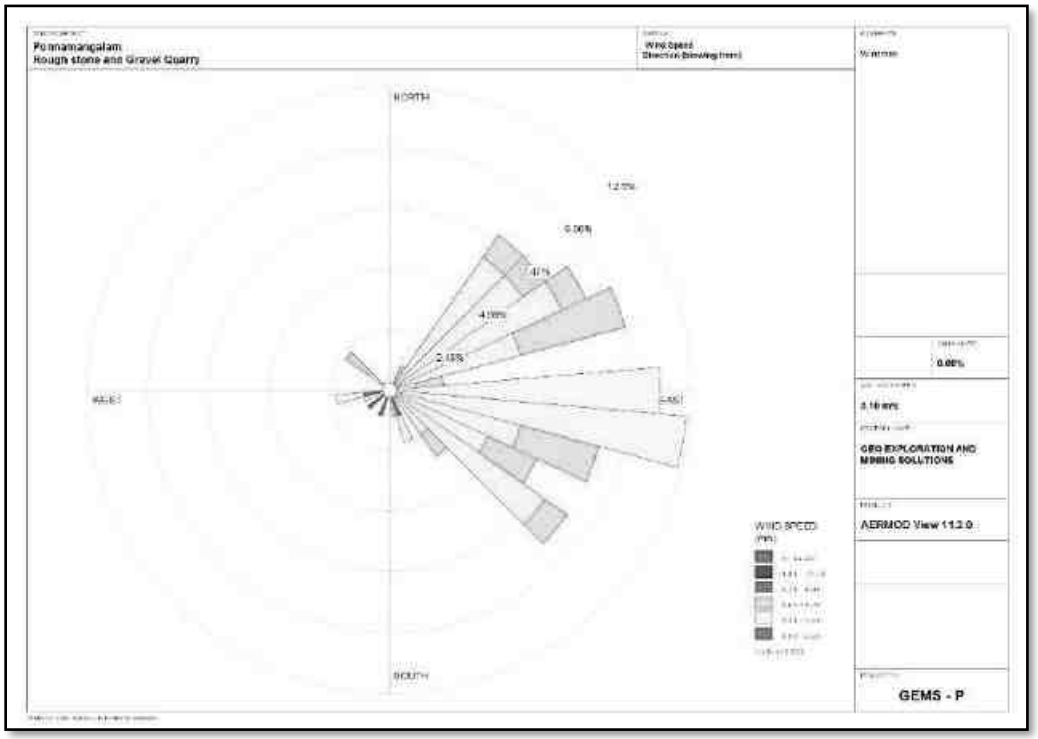
Correlation between Secondary and Primary Data

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

- The average maximum and minimum temperatures of IMD, Madurai agro showed a higher in respect of on-site data i.e. in Thirumangalam village.
- The relative humidity levels were lesser at site as compared to IMD, Madurai agro.
- The wind speed and direction at site shows similar trend that of IMD, Madurai 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 3.11: WINDROSE DIAGRAM



Environmental In the abstract of collected data wind rose were drawn on presented in figure No.3.14 during the monitoring period in the study area

1. Predominant winds were from NE, NE,E, ENE,SE
2. Calm conditions prevail of about 0.00% of the monitoring period
3. Temperature readings ranging from 24.6^{0}C to 31.0^{0}C
4. Relative humidity ranging from 57% to 71%
5. The monitoring was carried out continuously for three months

3.3.2 Methodology and Objective

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

- Meteorological condition on synoptic scale;
- Topography of the study area;
- Representatives of regional background air quality for obtaining baseline status;
- Location of residential areas representing different activities;
- Accessibility and power availability; etc

3.3.3 Sampling and Analytical Techniques

TABLE 3.15 – METHODOLOGY AND INSTRUMENT USED FOR 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 withgaseous attachment
NO_x	IS-5182 Part II (Jacob & Hochheiser modifiedmethod)	Respirable Dust Sampler with gaseous attachment
Free Silica	NIOSH – 7601	Visible Spectrophotometry

Source: Sampling Methodology followed by Enviro-Tech Services Laboratories & CPCB Notification

TABLE 3.16 – NATIONAL AMBIENT AIR QUALITY STANDARDS

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

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

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

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

3.3.4 Frequency & Parameters for Sampling

Ambient air quality monitoring has been carried out with a frequency of two samples per week at seven (8) locations, adopting a continuous 24 hourly (3 shift of 8-hour) schedule for the period Dec2022 – Feb 2023. The baseline data of ambient air has been generated for PM_{10}, $PM_{2.5}$, Sulphur Dioxide (SO_2) & Nitrogen Dioxide (NO_2).

3.3.5 Ambient Air Quality Monitoring Stations

Eight (8) monitoring stations were set up in the study area as depicted in Figure 3.6.1 for assessment of the existing ambient air quality. Details of the sampling locations are as per given below.

TABLE 3.17 – AMBIENT AIR QUALITY (AAQ) MONITORING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	AAQ-1	Core Zone	Project Area	9°53'2.08" N 77°56'55.02" E
2	AAQ-2	Near Existing Quarry	200m NE	9°53'7.64" N 77°56'59.84" E
3	AAQ-3	Anuppapatti	2.8km NE	9°53'45.25" N 77°58'12.99" E
4	AAQ-4	Erramalampatti	4km SW	9°52'18.07" N 77°54'40.73" E
5	AAQ-5	Sathangudi	4.5km South	9°50'34.48" N 77°56'6.51" E
6	AAQ-6	Vagaikulam	6.0km West	9°54'16.67" N 77°53'44.50" E
7	AAQ-7	Mela Urappanur	2.5km SE	9°51'53.21" N 77°57'50.11" E
8	AAQ-8	Paraipatti	6km NE	9°56'6.74" N 77°57'54.74" E

Source: On-site monitoring/sampling by Chennai Mettex Lab Private Limited in association with GEMS

FIGURE 3.12: SITE PHOTOGRAPHS OF AMBIENT AIR MONITORING

Thiru. P. Thirugnanasambanthan - P1

Source: Monitoring photographs from the FAE and Team Members

FIGURE 3.13 AMBIENT AIR QUALITY LOCATIONS AROUND 10 KM RADIUS

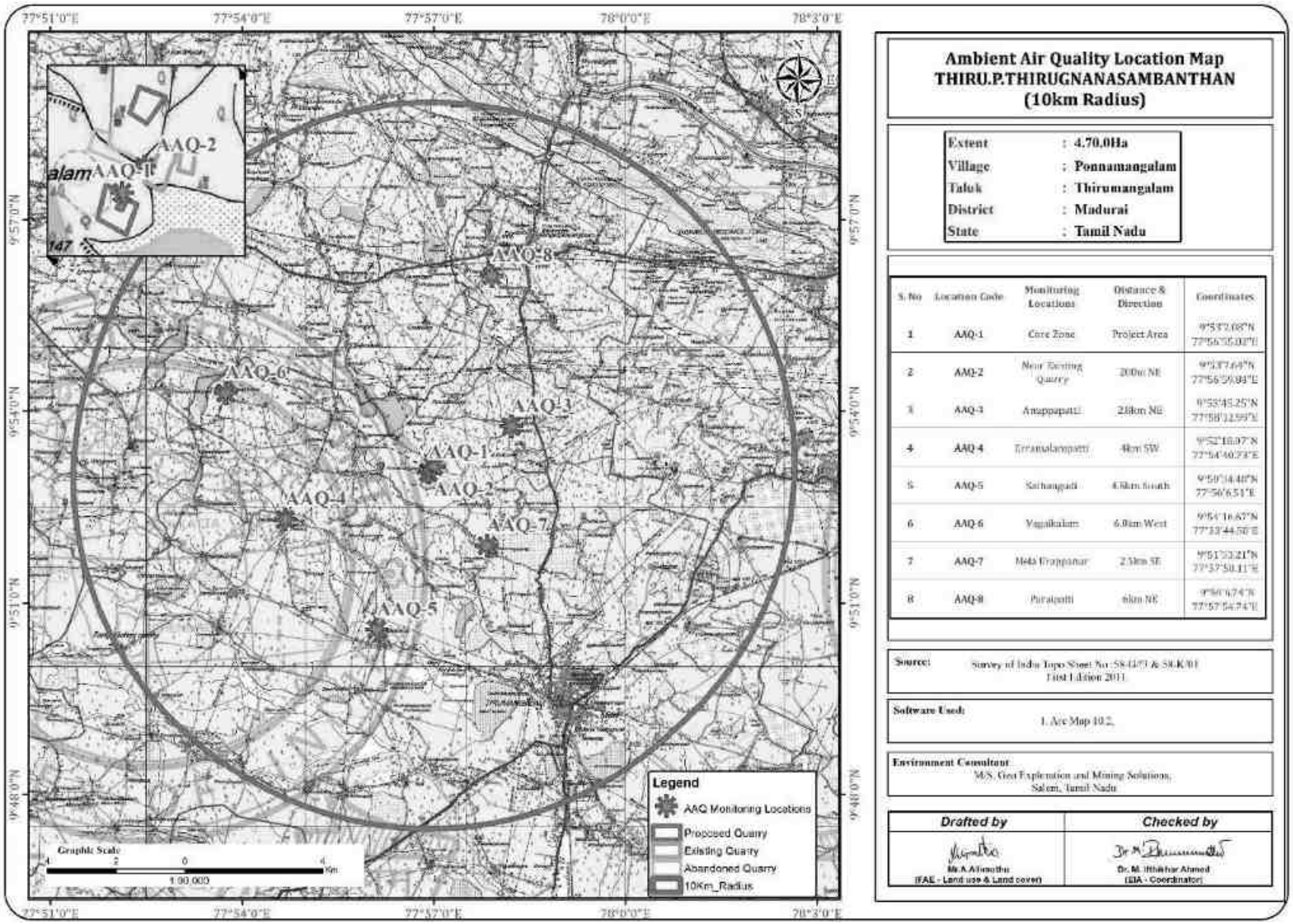


TABLE 3.18 – AAQ1- CORE ZONE

Period: Dec2022 – Feb 2023 *Location: AAQ1-* Core Zone Sampling Time: 24-hourly

Ambient AirMonitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	$PM_{2.5}$	PM_{10}	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	60	100	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
05.12.2022	7:00-7:00	67.3	19.8	39.3	8.3	21.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	67.9	20.1	41.5	8.1	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	68.3	20.3	39.6	8.6	21.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	68.6	18.5	40.7	8.2	21.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	68.1	18.8	41.3	7.5	22.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	68.7	18.7	39.8	7.6	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.12.2022	7:00-7:00	67.4	18.2	38.9	7.3	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.12.2022	7:15-7:15	67.9	20.7	40.4	7.5	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.01.2023	7:00-7:00	67.3	20.0	42.6	7.6	21.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.01.2023	7:15-7:15	67.1	20.3	41.2	7.4	22.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.01.2023	7:00-7:00	68.7	19.9	40.2	7.8	21.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.01.2023	7:15-7:15	68.6	19.3	41.5	7.3	21.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.01.2023	7:00-7:00	68.4	19.5	42.2	7.2	21.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.01.2023	7:15-7:15	69.2	20.6	41.9	7.2	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.01.2023	7:00-7:00	66.6	20.5	41.3	8.4	22.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.01.2023	7:15-7:15	66.1	20.7	40.2	8.6	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.01.2023	7:00-7:00	66.7	19.2	40.5	8.7	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.01.2023	7:15-7:15	66.2	20.3	41.7	8.3	21.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.02.2023	7:00-7:00	66.1	21.9	41.3	7.5	21.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.02.2023	7:15-7:15	65.9	20.1	41.5	7.6	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.02.2023	7:00-7:00	65.7	20.7	41.5	7.9	21.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.02.2023	7:15-7:15	66.7	21.2	40.2	8.2	20.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.02.2023	7:00-7:00	66.2	20.3	41.3	7.7	20.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.02.2023	7:15-7:15	66.8	19.9	41.7	7.6	20.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.02.2023	7:00-7:00	66.1	20.3	41.5	8.3	20.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.02.2023	7:15-7:15	66.7	20.7	40.2	8.1	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note:BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1.0); **Pb**: BDL (DL:0.1); **Ni**: BDL (DL:1.0); **As**: BDL (DL:1.0); **C_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 3.19 – AAQ2 – NEAR EXISTING QUARRY

Period: Dec2022 – Feb 2023 *Location: AAQ2- Near Existing Quarry* Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	$PM_{2.5}$	PM_{10}	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	60	100	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
05.12.2022	7:00-7:00	69.2	20.8	45.7	9.6	22.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	68.3	19.3	44.5	9.1	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	68.2	20.3	45.6	8.6	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	68.8	19.3	44.4	8.4	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	69.9	20.3	45.3	8.6	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	69.7	20.7	46.3	8.8	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.12.2022	7:00-7:00	69.2	20.2	43.4	9.1	22.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.12.2022	7:15-7:15	67.4	21.4	47.7	9.5	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.01.2023	7:00-7:00	67.1	21.6	47.8	7.6	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.01.2023	7:15-7:15	69.1	21.7	45.3	7.8	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.01.2023	7:00-7:00	69.5	20.6	46.9	8.8	24.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.01.2023	7:15-7:15	69.8	21.5	48.1	9.9	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.01.2023	7:00-7:00	68.8	21.7	44.5	8.6	21.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.01.2023	7:15-7:15	67.9	20.4	44.7	8.7	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.01.2023	7:00-7:00	68.7	20.6	45.3	8.6	22.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.01.2023	7:15-7:15	69.4	20.3	43.1	8.2	20.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.01.2023	7:00-7:00	68.5	21.7	42.8	9.3	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.01.2023	7:15-7:15	69.3	21.6	43.5	9.1	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.02.2023	7:00-7:00	67.8	20.1	45.6	8.4	22.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.02.2023	7:15-7:15	65.7	21.5	45.1	8.5	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.02.2023	7:00-7:00	66.2	20.4	46.7	8.7	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.02.2023	7:15-7:15	65.3	20.9	44.8	8.3	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.02.2023	7:00-7:00	66.1	20.2	45.5	8.7	20.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.02.2023	7:15-7:15	66.8	20.6	45.9	8.6	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.02.2023	7:00-7:00	68.7	21.2	45.5	8.1	22.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.02.2023	7:15-7:15	68.4	21.9	46.9	8.3	22.4	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 3.20 – AAQ3 – ANUPPAPATTI

Period: Dec 2022 – Feb 2023 *AAQ3- Anuppapatti* Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	$PM_{2.5}$	PM_{10}	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	60	100	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
05.12.2022	7:00-7:00	69.7	19.6	45.9	8.1	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	69.2	20.9	45.8	8.2	20.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	69.4	18.7	45.7	8.6	20.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	60.1	20.3	44.4	8.2	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	60.3	20.4	46.6	8.3	21.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	68.3	20.5	45.9	8.6	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.12.2022	7:00-7:00	68.6	20.1	45.3	8.3	21.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.12.2022	7:15-7:15	68.4	20.6	45.4	8.7	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.01.2023	7:00-7:00	68.2	21.8	44.1	8.5	21.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.01.2023	7:15-7:15	68.1	20.7	44.8	8.3	20.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.01.2023	7:00-7:00	67.6	20.6	46.6	8.5	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.01.2023	7:15-7:15	67.3	21.5	45.8	8.1	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.01.2023	7:00-7:00	67.8	21.8	44.5	7.2	20.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.01.2023	7:15-7:15	66.3	20.3	45.4	8.4	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.01.2023	7:00-7:00	66.7	20.5	45.6	7.3	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.01.2023	7:15-7:15	66.2	21.2	45.4	7.6	21.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.01.2023	7:00-7:00	65.3	19.7	45.9	7.8	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.01.2023	7:15-7:15	66.7	20.3	45.6	8.0	22.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.02.2023	7:00-7:00	66.2	21.4	44.5	8.2	21.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.02.2023	7:15-7:15	67.1	21.6	46.7	7.3	22.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.02.2023	7:00-7:00	67.9	20.5	44.3	8.1	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.02.2023	7:15-7:15	66.3	21.3	44.9	8.1	21.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.02.2023	7:00-7:00	66.2	21.6	45.6	7.6	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.02.2023	7:15-7:15	66.1	21.8	45.5	7.9	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.02.2023	7:00-7:00	67.8	20.9	45.9	7.4	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.02.2023	7:15-7:15	67.6	20.5	46.8	7.1	21.0	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– AAQ4 – ERRAMALAMPATTI

Period: Dec 2022 – Feb 2023 Location: AAQ4 - *Erramalamaptti* Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	$PM_{2.5}$	PM_{10}	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	60	100	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
05.12.2022	7:00-7:00	62.3	18.7	41.3	8.6	20.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	62.6	18.5	40.8	7.9	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	63.4	15.8	42.5	6.8	20.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	63.7	19.5	40.6	7.4	20.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	64.6	19.5	39.8	8.5	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	64.2	20.6	38.9	8.9	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.12.2022	7:00-7:00	64.6	21.5	40.5	7.6	20.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.12.2022	7:15-7:15	64.6	16.8	39.5	7.8	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.01.2023	7:00-7:00	63.3	21.6	42.4	7.4	21.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.01.2023	7:15-7:15	63.7	22.7	43.2	7.3	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.01.2023	7:00-7:00	63.8	18.8	38.9	7.9	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.01.2023	7:15-7:15	64.1	17.9	41.5	7.6	21.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.01.2023	7:00-7:00	64.8	18.9	39.5	8.2	22.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.01.2023	7:15-7:15	64.3	19.4	43.2	8.5	22.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.01.2023	7:00-7:00	63.7	20.3	41.6	8.1	21.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.01.2023	7:15-7:15	63.9	20.1	42.8	8.8	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.01.2023	7:00-7:00	63.8	21.7	43.8	8.6	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.01.2023	7:15-7:15	62.1	22.8	41.9	8.7	21.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.02.2023	7:00-7:00	62.7	19.8	43.9	7.9	21.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.02.2023	7:15-7:15	62.6	20.5	40.8	7.3	22.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.02.2023	7:00-7:00	62.8	21.7	41.8	7.1	22.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.02.2023	7:15-7:15	64.1	18.7	42.6	7.8	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.02.2023	7:00-7:00	63.7	18.8	40.3	7.5	22.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.02.2023	7:15-7:15	63.6	17.2	41.5	7.7	21.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.02.2023	7:00-7:00	63.1	18.3	40.3	6.3	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.02.2023	7:15-7:15	63.4	18.9	40.7	6.1	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1.0); **Pb**: BDL (DL:0.1); **Ni**: BDL (DL:1.0); **As**: BDL (DL:1.0); **C_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 – AAQ5 – SATHANGUDI

Period: Dec 2022 – Feb 2023 *AAQ5- Sathangudi* Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	$PM_{2.5}$	PM_{10}	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	60	100	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
05.12.2022	7:00-7:00	63.6	21.3	40.8	6.3	21.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	63.9	20.7	41.2	6.2	21.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	64.8	22.9	42.7	6.4	22.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	64.6	20.4	41.3	6.7	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	64.7	21.6	42.8	5.9	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	64.3	22.3	41.5	5.8	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.12.2022	7:00-7:00	66.2	20.7	40.3	5.9	22.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.12.2022	7:15-7:15	66.1	21.3	42.4	6.4	22.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.01.2023	7:00-7:00	66.8	20.8	41.9	6.7	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.01.2023	7:15-7:15	65.7	21.9	43.4	6.3	23.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.01.2023	7:00-7:00	65.3	22.3	42.7	6.8	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.01.2023	7:15-7:15	65.8	21.7	40.1	6.1	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.01.2023	7:00-7:00	65.7	23.4	43.4	7.3	22.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.01.2023	7:15-7:15	68.4	21.8	42.8	7.9	20.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.01.2023	7:00-7:00	67.2	21.9	41.9	7.5	20.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.01.2023	7:15-7:15	65.1	20.5	42.3	7.6	20.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.01.2023	7:00-7:00	69.3	20.3	42.1	6.4	22.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.01.2023	7:15-7:15	68.2	21.7	42.6	6.1	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.02.2023	7:00-7:00	67.1	21.5	43.5	6.4	21.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.02.2023	7:15-7:15	65.6	22.3	43.1	6.7	22.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.02.2023	7:00-7:00	63.7	20.7	42.7	6.2	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.02.2023	7:15-7:15	68.4	21.8	41.6	5.3	22.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.02.2023	7:00-7:00	64.1	21.4	42.8	5.1	24.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.02.2023	7:15-7:15	62.3	22.6	40.6	5.8	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.02.2023	7:00-7:00	68.7	21.0	41.6	6.3	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.02.2023	7:15-7:15	62.6	21.1	41.2	6.1	24.1	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 3.23 – AAQ 6 - VAGAIKULAM

Period: Dec 2022 – Feb 2023 *Location: AAQ6* – Vagaikulam Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	$PM_{2.5}$	PM_{10}	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	60	100	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
05.12.2022	7:00-7:00	76.3	20.7	41.3	8.3	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	76.4	20.4	42.4	8.5	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	75.2	21.5	41.8	8.7	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	75.8	20.9	42.4	8.1	24.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	63.2	20.5	44.3	8.6	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	63.7	21.9	43.7	8.7	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.12.2022	7:00-7:00	64.6	21.7	40.6	7.3	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.12.2022	7:15-7:15	64.8	21.5	42.5	8.5	24.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.01.2023	7:00-7:00	64.2	20.6	43.6	7.2	23.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.01.2023	7:15-7:15	64.3	20.8	42.7	7.1	21.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.01.2023	7:00-7:00	64.7	20.4	41.6	7.6	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.01.2023	7:15-7:15	63.2	21.3	42.9	7.8	22.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.01.2023	7:00-7:00	63.8	20.8	43.8	7.1	21.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.01.2023	7:15-7:15	64.6	21.7	42.5	7.8	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.01.2023	7:00-7:00	64.8	21.6	41.9	6.6	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.01.2023	7:15-7:15	64.1	22.8	41.3	6.3	20.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.01.2023	7:00-7:00	63.2	21.2	42.7	6.1	21.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.01.2023	7:15-7:15	63.7	21.3	41.3	6.5	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.02.2023	7:00-7:00	63.1	20.5	43.6	6.8	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.02.2023	7:15-7:15	64.3	20.3	42.5	6.5	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.02.2023	7:00-7:00	64.8	21.7	44.8	7.6	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.02.2023	7:15-7:15	63.7	21.3	42.5	7.1	20.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.02.2023	7:00-7:00	63.1	20.8	41.3	7.8	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.02.2023	7:15-7:15	65.5	21.5	42.7	7.1	20.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.02.2023	7:00-7:00	65.1	21.1	41.5	5.6	20.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.02.2023	7:15-7:15	65.9	21.9	41.9	5.9	21.5	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 3.24 – AAQ7 – MELA URAPPANUR

Period: Dec 2022 – Feb 2023 *Location: AAQ7– Mela Urappanur* Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	$PM_{2.5}$	PM_{10}	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	60	100	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
05.12.2022	7:00-7:00	68.8	19.7	43.2	5.3	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	68.5	19.6	41.8	5.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	65.9	18.4	42.6	5.9	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	65.1	21.6	43.5	6.3	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	67.3	19.6	40.9	6.8	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	67.7	20.4	41.6	6.4	22.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.12.2022	7:00-7:00	66.2	21.6	40.1	6.9	22.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.12.2022	7:15-7:15	67.1	18.6	41.7	6.8	23.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.01.2023	7:00-7:00	66.3	18.5	42.5	6.7	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.01.2023	7:15-7:15	66.2	19.7	41.8	6.2	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.01.2023	7:00-7:00	68.1	20.5	41.9	7.3	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.01.2023	7:15-7:15	68.7	21.6	42.4	7.5	22.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.01.2023	7:00-7:00	64.3	21.8	40.6	7.6	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.01.2023	7:15-7:15	64.7	19.6	40.3	7.9	20.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.01.2023	7:00-7:00	65.0	19.7	40.7	7.1	20.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.01.2023	7:15-7:15	63.6	21.5	41.8	6.6	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.01.2023	7:00-7:00	65.6	20.4	42.2	6.8	22.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.01.2023	7:15-7:15	64.2	18.8	42.4	6.9	21.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.02.2023	7:00-7:00	65.9	19.7	41.6	6.1	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.02.2023	7:15-7:15	66.1	21.5	41.8	6.7	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.02.2023	7:00-7:00	69.7	20.9	40.7	5.9	22.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.02.2023	7:15-7:15	69.3	22.1	43.3	6.8	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.02.2023	7:00-7:00	66.1	21.7	42.7	7.3	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.02.2023	7:15-7:15	65.8	20.8	40.8	7.5	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.02.2023	7:00-7:00	68.9	19.9	40.3	7.8	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.02.2023	7:15-7:15	68.1	19.7	40.6	6.9	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 – AAQ8 – PARAIPATTI

Period: Dec 2022 – Feb 2023 *Location: AAQ8– Paraipatti* Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	$PM_{2.5}$	PM_{10}	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	60	100	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
05.12.2022	7:00-7:00	65.3	18.3	39.5	6.2	20.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	65.7	18.8	39.2	6.5	20.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	65.6	19.4	38.5	6.4	20.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	65.7	18.9	38.8	6.8	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	66.1	18.3	38.6	6.8	20.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	66.2	19.7	38.7	7.2	20.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.12.2022	7:00-7:00	66.7	19.7	39.6	7.5	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.12.2022	7:15-7:15	66.2	18.2	39.8	7.4	21.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.01.2023	7:00-7:00	66.5	19.8	38.6	7.5	21.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.01.2023	7:15-7:15	65.8	20.3	38.1	7.7	20.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.01.2023	7:00-7:00	65.9	19.3	38.5	7.4	20.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.01.2023	7:15-7:15	65.7	20.1	38.4	7.1	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.01.2023	7:00-7:00	66.8	20.2	39.2	6.8	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.01.2023	7:15-7:15	66.9	20.4	39.3	6.5	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.01.2023	7:00-7:00	67.5	20.9	39.2	6.6	21.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.01.2023	7:15-7:15	67.3	20.3	39.6	7.2	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.01.2023	7:00-7:00	67.8	19.5	39.7	7.6	20.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.01.2023	7:15-7:15	66.5	19.7	38.2	7.9	20.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.02.2023	7:00-7:00	66.7	19.4	39.5	7.2	20.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.02.2023	7:15-7:15	66.8	19.5	38.3	7.1	22.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.02.2023	7:00-7:00	67.3	20.3	38.5	6.2	23.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.02.2023	7:15-7:15	67.9	20.7	39.5	6.5	22.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.02.2023	7:00-7:00	67.1	20.2	39.3	6.5	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.02.2023	7:15-7:15	67.5	18.3	40.5	6.8	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.02.2023	7:00-7:00	67.8	19.6	41.1	7.5	20.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.02.2023	7:15-7:15	68.2	19.8	41.5	7.1	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 3.26: SUMMARY OF AAQ

PM2.5	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	20.0	20.8	20.7	19.6	21.1	21.2	20.3	19.6
Minimum	18.2	19.3	18.7	15.8	20.3	20.3	18.4	18.2
Maximum	21.9	21.9	21.8	22.8	23.4	22.8	22.1	20.9
NAAQ Norms	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0

PM10	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	40.9	45.4	45.5	41.3	42.1	42.5	41.7	39.2
Minimum	38.9	42.8	44.1	38.9	40.1	40.6	40.1	38.1
Maximum	42.6	48.1	46.8	43.9	43.5	44.8	43.5	41.5
NAAQ Norms	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SO_2	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	7.9	8.7	8.0	7.8	6.4	7.4	6.8	7.0
Minimum	7.2	7.6	7.1	6.1	5.1	5.6	5.3	6.2
Maximum	8.7	9.9	8.7	8.9	7.9	8.7	7.9	7.9
NAAQ Norms	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0

NO_2	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	21.5	22.7	21.6	21.6	22.4	22.2	22.6	21.2
Minimum	20.1	20.5	20.1	20.1	20.4	20.1	20.6	20.1
Maximum	22.8	24.4	22.7	22.8	24.9	24.8	24.3	23.8
NAAQ Norms	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0

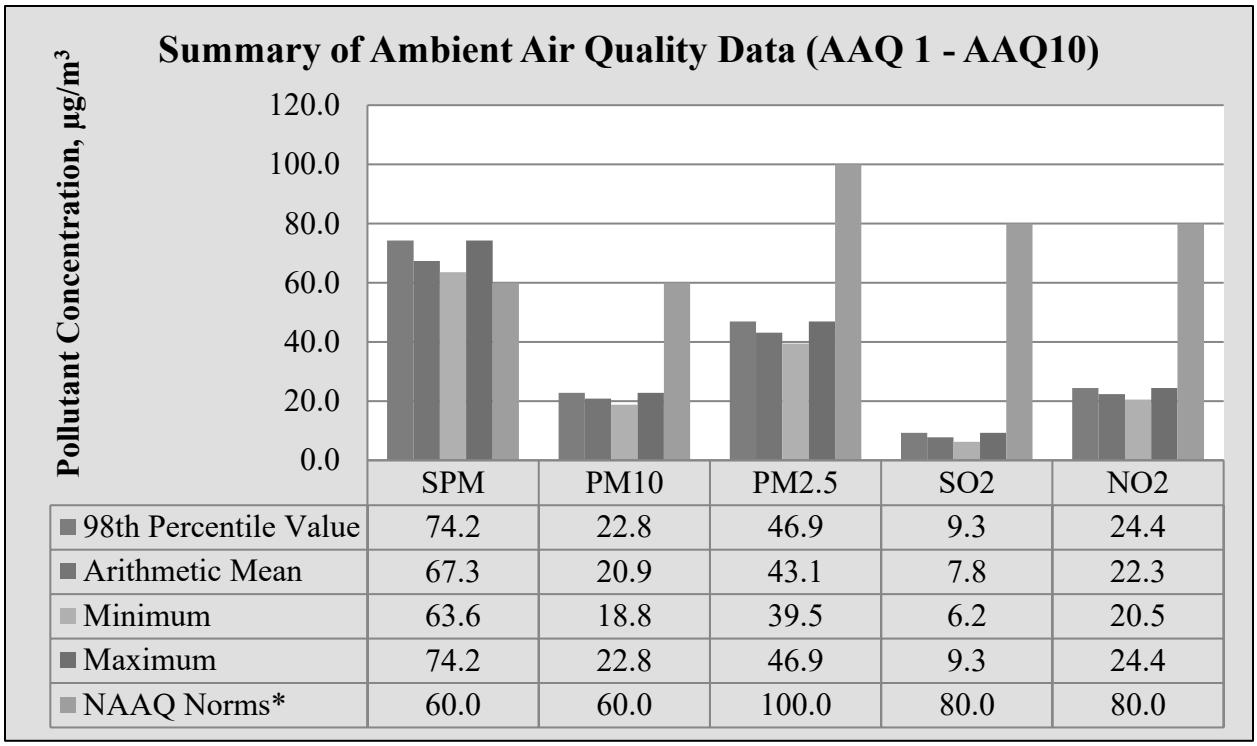
TABLE 3.27 – ABSTRACT OF AMBIENT AIR QUALITY DATA

1	**Parameter**	**PM2.5**	**PM10**	**SO_2**	**NO_2**
2	No. of Observations	208	208	208	208
3	10^{th} Percentile Value	18.8	39.5	6.2	20.5
4	20^{th} Percentile Value	19.6	40.3	6.6	21.0
5	30^{th} Percentile Value	20.1	41.2	6.9	21.3
6	40^{th} Percentile Value	20.3	41.5	7.3	21.5
7	50^{th} Percentile Value	20.5	41.9	7.5	21.8
8	60^{th} Percentile Value	20.7	42.6	7.8	22.1
9	70^{th} Percentile Value	21.2	43.3	8.1	22.6
10	80^{th} Percentile Value	21.6	44.5	8.4	22.9
11	90^{th} Percentile Value	21.8	45.6	8.6	23.6
12	95^{th} Percentile Value	22.0	46.5	8.8	23.8
13	98^{th} Percentile Value	22.8	46.9	9.3	24.4
14	Arithmetic Mean	20.9	43.1	7.8	22.3
15	Geometric Mean	20.8	43.0	7.7	22.3
16	Standard Deviation	1.2	2.5	1.0	1.3
17	Minimum	18.8	39.5	6.2	20.5
18	Maximum	22.8	46.9	9.3	24.4
19	**NAAQ Norms***	**60.0**	**100.0**	**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.

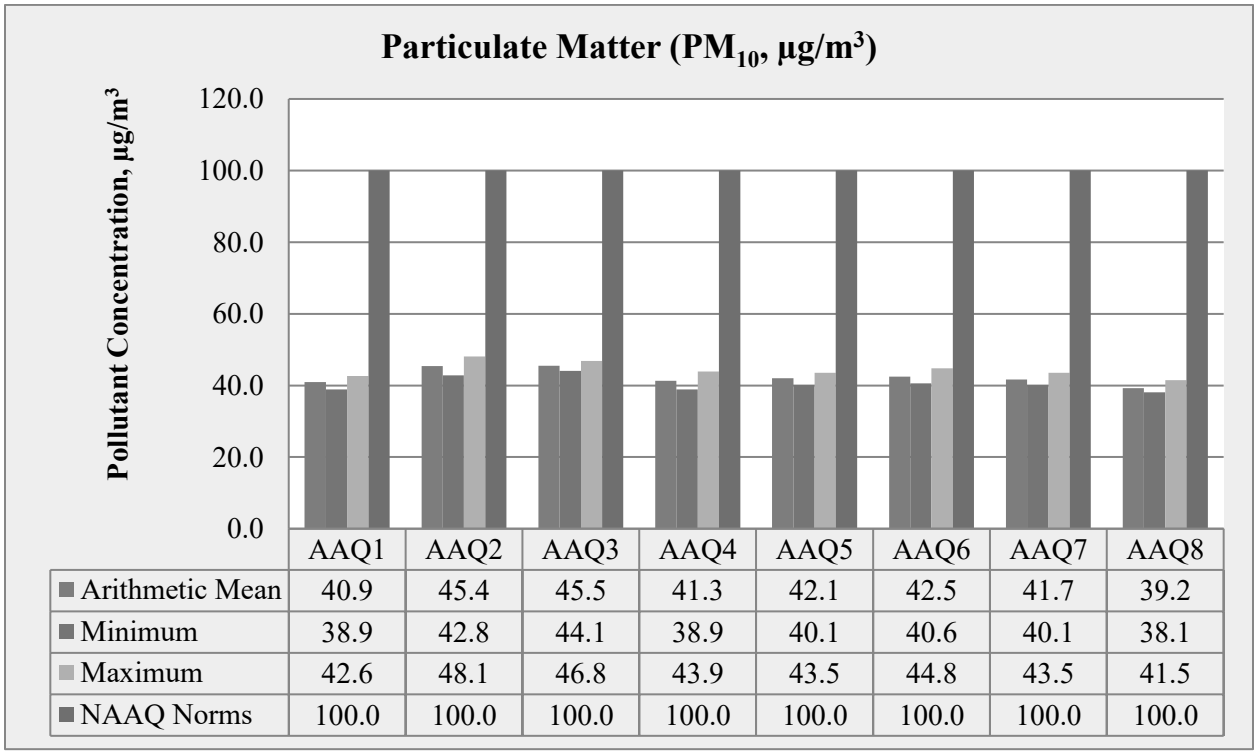
* NAAQ Norms-National Ambient Air Quality Norms-Revised as per GSR 826(E) dated 16.11.2009 for Industrial, Residential, Rural and other Area.

FIGURE 3.14: BAR DIAGRAM OF SUMMARY OF AAQ 1 – AAQ 8



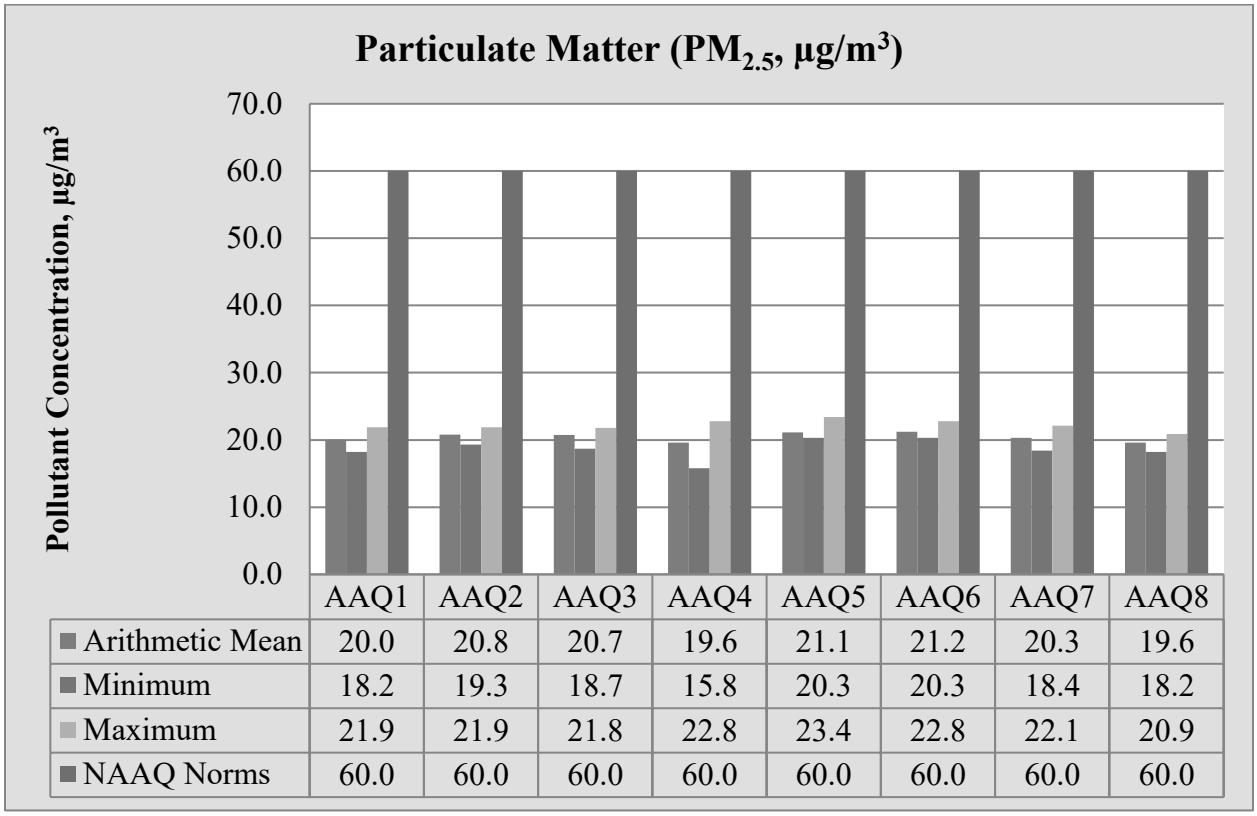
	SPM	PM10	PM2.5	SO2	NO2
98th Percentile Value	74.2	22.8	46.9	9.3	24.4
Arithmetic Mean	67.3	20.9	43.1	7.8	22.3
Minimum	63.6	18.8	39.5	6.2	20.5
Maximum	74.2	22.8	46.9	9.3	24.4
NAAQ Norms*	60.0	60.0	100.0	80.0	80.0

FIGURE 3.15: BAR DIAGRAM OF PARTICULATE MATTER (PM_{10})



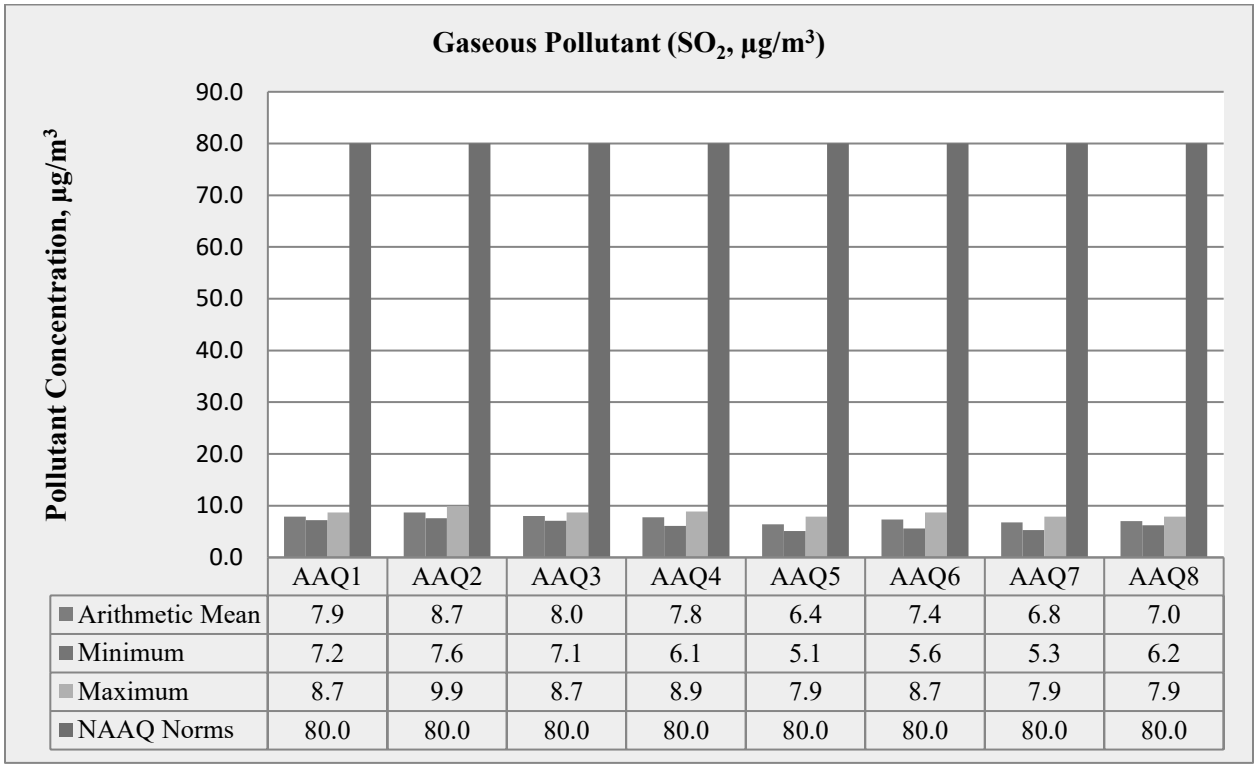
	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	40.9	45.4	45.5	41.3	42.1	42.5	41.7	39.2
Minimum	38.9	42.8	44.1	38.9	40.1	40.6	40.1	38.1
Maximum	42.6	48.1	46.8	43.9	43.5	44.8	43.5	41.5
NAAQ Norms	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

FIGURE 3.16: BAR DIAGRAM OF PARTICULATE MATTER ($PM_{2.5}$)



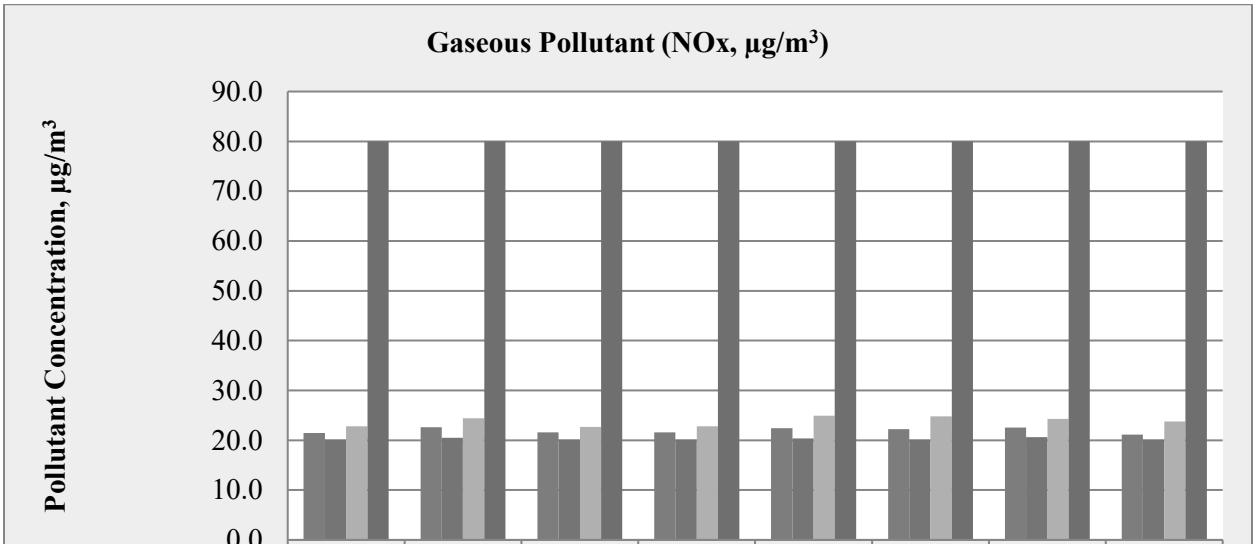
	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	20.0	20.8	20.7	19.6	21.1	21.2	20.3	19.6
Minimum	18.2	19.3	18.7	15.8	20.3	20.3	18.4	18.2
Maximum	21.9	21.9	21.8	22.8	23.4	22.8	22.1	20.9
NAAQ Norms	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0

FIGURE 3.17: BAR DIAGRAM OF PARTICULATE MATTER (SO_2)



	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	7.9	8.7	8.0	7.8	6.4	7.4	6.8	7.0
Minimum	7.2	7.6	7.1	6.1	5.1	5.6	5.3	6.2
Maximum	8.7	9.9	8.7	8.9	7.9	8.7	7.9	7.9
NAAQ Norms	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0

FIGURE 3.18 : BAR DIAGRAM OF PARTICULATE MATTER (NO_2)



	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	21.5	22.7	21.6	21.6	22.4	22.2	22.6	21.2
Minimum	20.1	20.5	20.1	20.1	20.4	20.1	20.6	20.1
Maximum	22.8	24.4	22.7	22.8	24.9	24.8	24.3	23.8
NAAQ Norms	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0

3.3.6 Interpretations & Conclusion

As per monitoring data, PM_{10} ranges from 39.5 µg/m^3 to 46.9 µg/m^3, $PM_{2.5}$ data ranges from 18.8 µg/m^3 to 22.8 µg/m^3, SO_2 ranges from 6.2 µg/m^3 to 9.3 µg/m^3 and NO_2 data ranges from 20.5 µg/m^3 to 24.4 µg/m^3. The concentration levels of the above criteria pollutants were observed to be well within the limits of NAAQS prescribed by CPCB.

3.3.7 FUGITIVE DUST EMISSION

Fugitive dust was recorded at 8 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	67.3
AAQ 2	68.2
AAQ 3	66.9
AAQ 4	63.6
AAQ 5	65.7
AAQ 6	66
AAQ 7	66.7
AAQ 8	66.7

Source: Chennai Mettex Lab Private Limited.

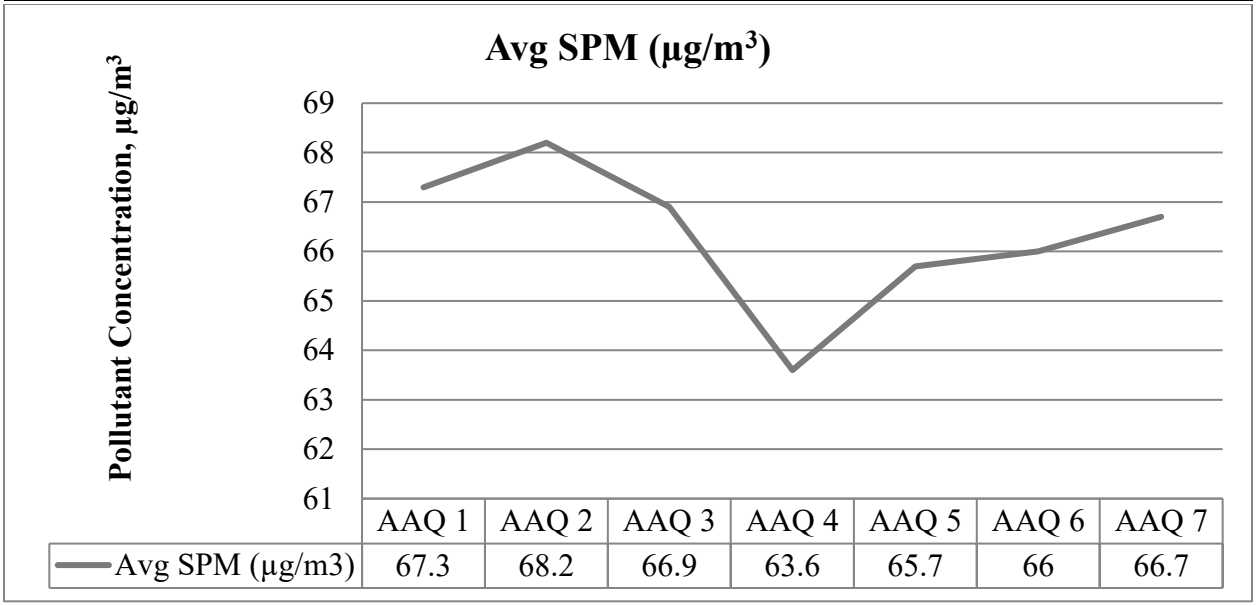
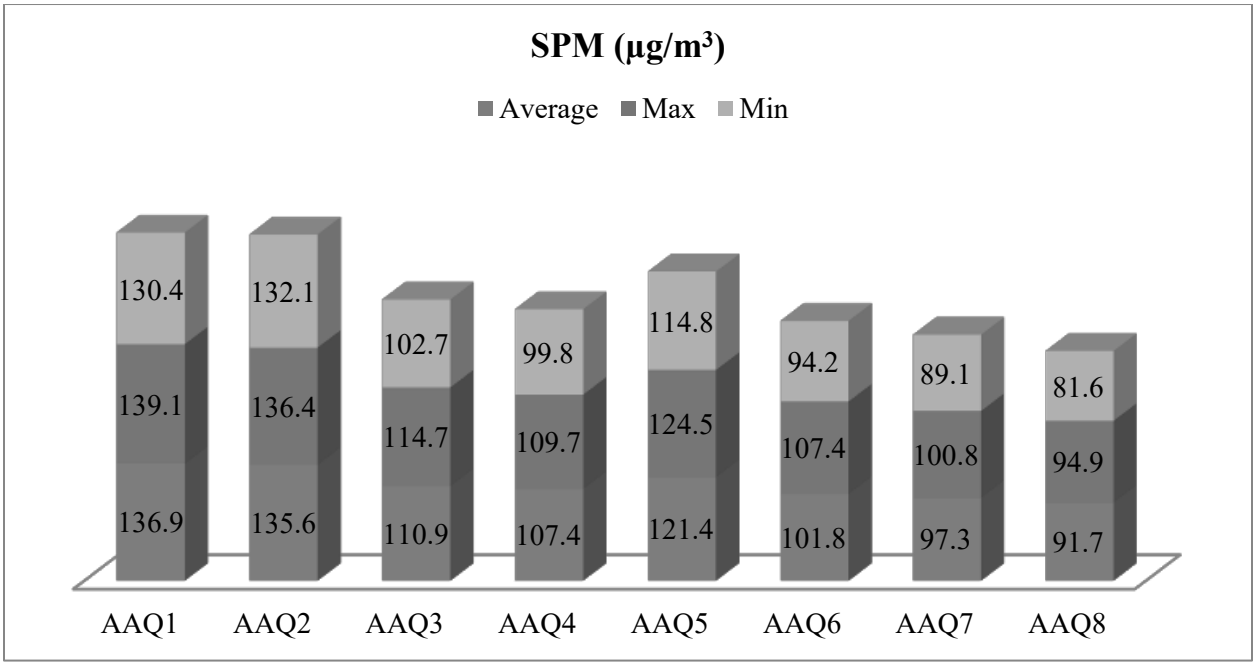


TABLE 3.29– FUGITIVE DUST SAMPLE VALUES IN µg/m³

SPM (µg/m³)	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Average	67.3	68.2	66.9	63.6	65.7	66.0	66.7	66.7
Min	65.7	65.3	60.1	62.1	62.3	63.1	63.6	65.3
Max	69.2	69.9	69.7	64.8	69.3	76.4	69.7	68.2

Source: Calculations from Lab Analysis Reports



Source: Bar Diagram of table 3.30

3.4 Noise Environment

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

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

3.4.1 Identification of Sampling Locations

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

TABLE 3.30 – DETAILS OF SURFACE NOISE MONITORING LOCATIONS

S. No	Location code	Monitoring Locations	Distance & Direction	Coordinates
1	N-1	Core Zone	Project Area	9°52'53.71" N 77°56'55.78" E
2	N-2	Near Existing Quarry	200m NE	9°53'8.04" N 77°57'0.28" E
3	N-3	Anuppapatti	2.8km NE	9°53'45.44" N 77°58'13.82" E
4	N-4	Erramalampatti	4km SW	9°52'16.68" N 77°54'40.92" E
5	N-5	Sathangudi	4.5km South	9°50'35.55" N 77°56'6.97" E
6	N-6	Vagaikulam	6.0km West	9°54'14.07" N 77°53'46.19" E
7	N-7	Mela Urappanur	2.5km SE	9°51'53.90" N 77°57'50.24" E
8	N-8	Paraipatti	6km NE	9°56'6.76" N 77°57'53.74" E

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

FIGURE 3.19: SITE PHOTOGRAPHS OF NOISE MONITORING IN CLUSTER

Thiru. P. Thirugnanasambanthan - P1

3.4.2 Method of Monitoring

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

Leq = 10 Log L / T∑ (10Ln/10)

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

3.4.3 Analysis of Ambient Noise Level in the Study Area

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	47.5	39.8	**Industrial Day Time- 75 dB (A) Night Time- 70 dB (A)**
2	Near Existing Quarry	47.0	38.5	
3	Anuppapatti	42.3	36.4	**Residential Day Time– 55 dB (A) Night Time- 45 dB (A)**
4	Erramalampatti	41.9	36.8	
5	Sathangudi	39.7	36.8	
6	Vagaikulam	39.3	36.3	
7	Mela Urappanur	39.8	36.3	
8	Paraipatti	39.2	37.8	

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

FIGURE 3.20: NOISE MONITORING STATIONS AROUND 10 KM RADIUS

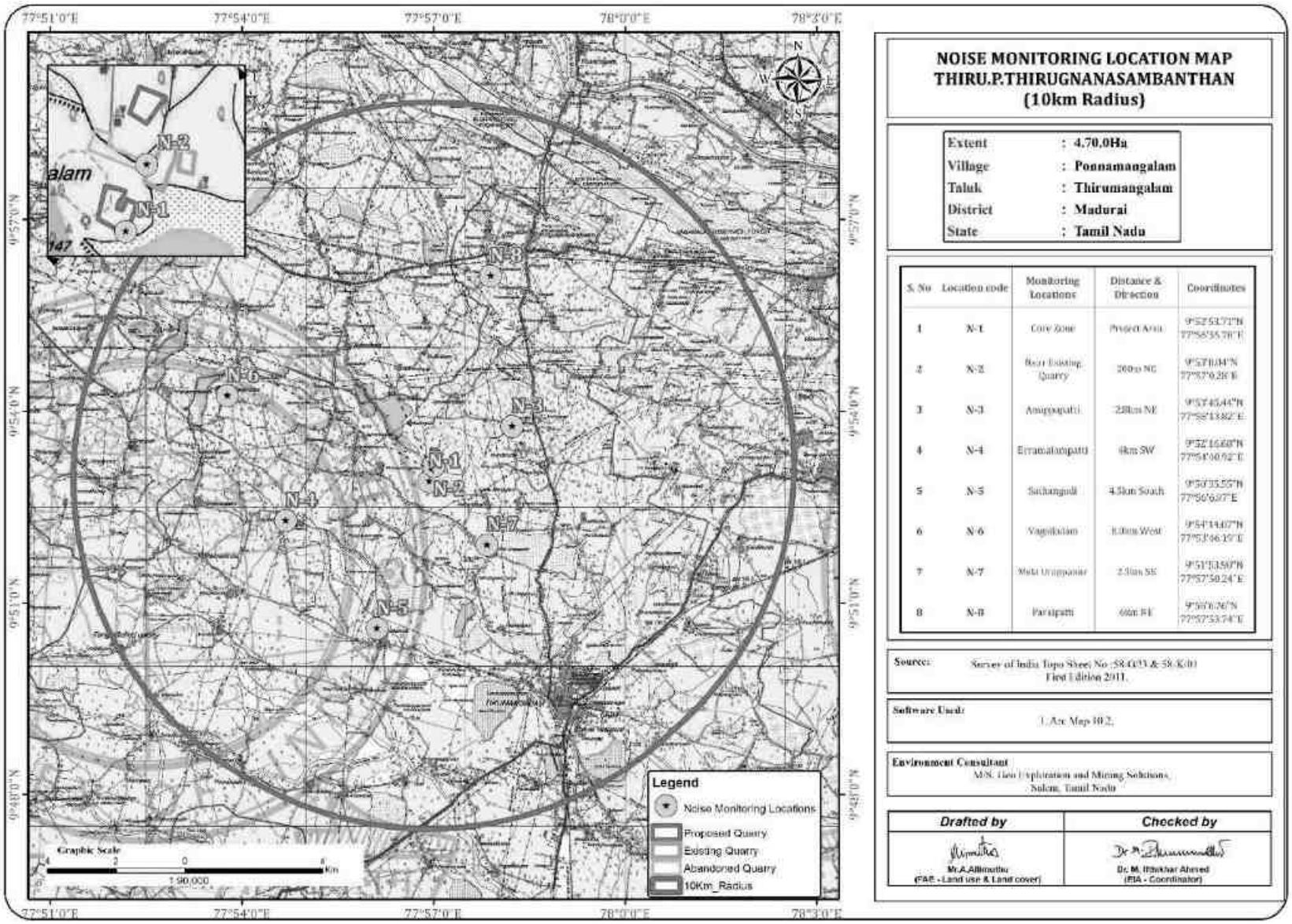
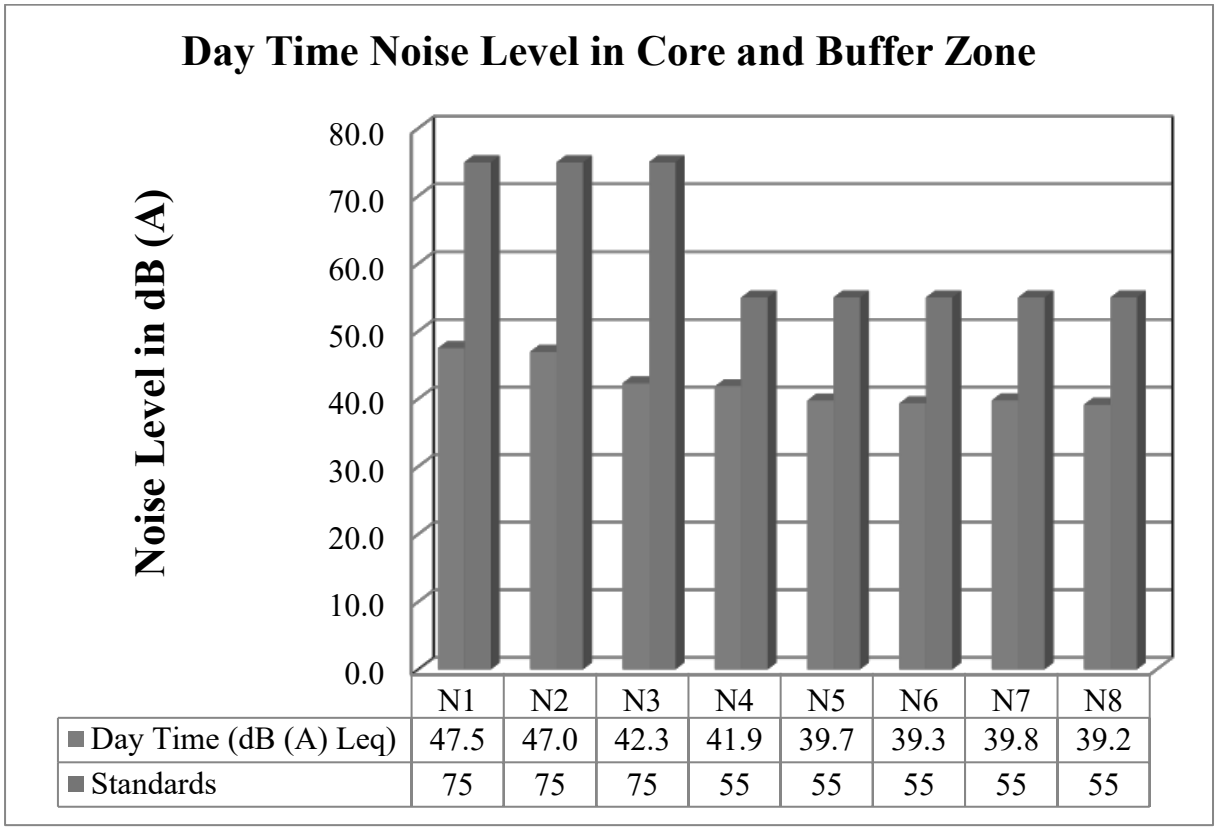
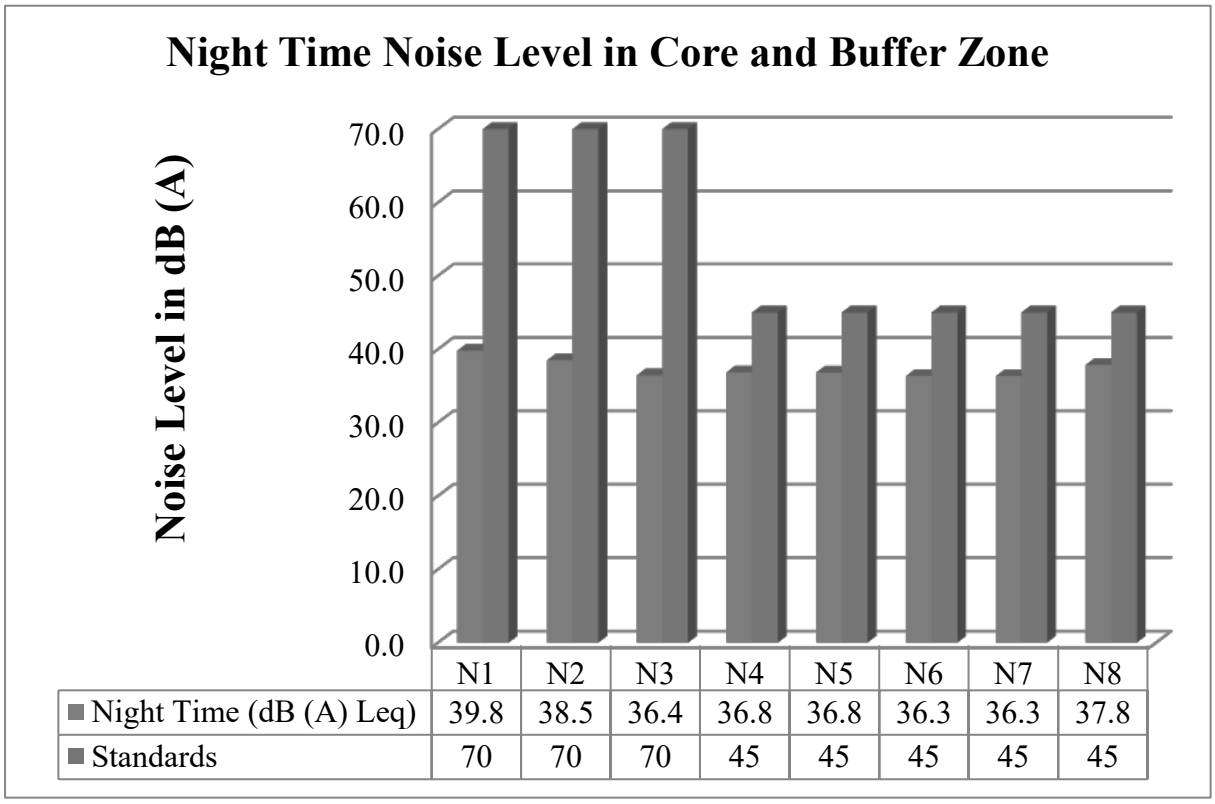


FIGURE 3.21: DAY & NIGHT TIME NOISE LEVELS IN CORE AND BUFFER ZONE





3.4.4 Interpretation & Conclusion:

Ambient noise levels were measured at 8 (eight) locations around the project area considering cluster quarries. Noise levels recorded in core zone during day time were from 47.0 – 47.5 dB (A) Leq and during night

time were from 38.5 – 39.8 (A) Leq. Noise levels recorded in buffer zone during day time were from 39.2 – 42.3 dB (A) Leq and during night time were from 36.3– 37.8 dB (A) Leq.

3.5. Biological Environment

3.5.1.Study area Ecology

The core area extent of **4.70.0 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 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 flat terrain. 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.

3.5.2. Objectives of Biological Studies

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.

3.5.3. Methodology of Sampling

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

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

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.

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.

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.

Observations from Sampling

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

Equipment/ References

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

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

3.5.4. Part I Field Sampling Techniques

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.

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.

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).

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.

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).

3.5.5. 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, Shrubs and herbs respectively.

TABLE: 3.32. FLORA IN THE CORE ZONE OF LEASE AREA

SI.No	English Name	Vernacular Name	Scientific Name	Family Name
Trees				
1.	Neem or Indian lilac	Vembu maram	*Azadirachta indica*	Meliaceae
2.	Velvet mesquite	Mullu maram	*Prosopis juliflora*	Fabaceae
3.	White Bark Acacia	Vela maram	*Vachellia leucophloea*	Fabaceae
4.	Gum arabic tree	Karuvelam	*Vachellia nilotica*	Fabaceae
5.	Indian mulberry	Nuna maram	*Morinda tinctoria*	Rubiaceae
Shrubs				
6.	Avaram	Avarai	*Senna auriculata*	Fabaceae

7.	Milk Weed	Erukku	*Calotropis gigantea*	Apocynaceae
8.	Carray Cheddle	Kaarai	*Canthiumparviflorum*	Rubiaceae
Herbs				
9.	Indian nettle	Nayuruvi	*Achyranthes aspera*	Amaranthaceae
10.	Coat buttons	Thatha poo	*Tridax procumbens*	Asteraceae
11.	Indian doab	Arugampul	*Cynodon dactylon*	Poaceae
12.	Holy basil	Thulasi	*Ocimum tenuiflorum*	Lamiaceae
13.	Common leucas	Thumbai	*Leucas aspera*	Lamiaceae
Grasses				
14.	Eragrostis	Pullu	*Eragrostis ferruginea*	Poaceae
15.	Great brome	Thodappam	*Bromus diandrus*	Poaceae
Climber				
16.	Veld grape	Pirandai	*Cissusquadrangularis*	Vitaceae

Flora's Composition of the Core Zone

Taxonomically a total of 16 species belonging to nine families have been recorded from the core mining lease area. The lease-applied area exhibits plain topography. Based on the habitat classification of the enumerated plants the majority of species were trees 5 followed by Herbs 5, Grasses 2, Shrubs 3, and Climber 1. The result of the core zone of flora studies shows that Fabaceae and Poaceae and Lamiaceae are the main dominating species in the study area it mentioned in Table No.3. No species found as the threatened category (Table No. 3.1).

Azadirachta indica

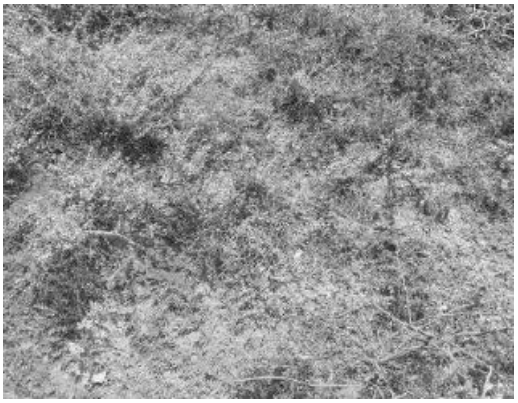
Prosopis juliflora

Vachellia nilotica

Senna auriculata

Morinda tinctoria

Vachellia leucophloea



Ocimum tenuiflorum

Canthiumparviflorum

Bromus diandrus

Dichrostachyscinere

Cissusquadrangularis

Cynodon dactylon

FIG NO: 3.22. FLORA SPECIES OBSERVATION IN THE CORE ZONE AREA

TABLE: 3.33. FLORA IN THE BUFFER ZONE OF THE CLUSTER STUDY AREA.

SI.No	English Name	Vernacular Name	Scientific Name	Family Name
Trees				
1.	Coconut	Thennai maram	*Cocos nucifera*	Arecaceae
2.	Neem or Indian lilac	Vembu	*Azadirachta indica*	Meliaceae
3.	Frywood	Vaagai	*Albizia lebbeck*	Mimosaceae
4.	Indian plum	Elanthai maram	*Ziziphus mauritiana*	Rhamnaceae
5.	Pongamia pinnata	Pongam	*Millettia pinnata*	Fabaceae
6.	Oil cake tree	Wunja	*Albizia amara*	Fabaceae
7.	Eucalyptus	Thailam maram	*Eucalyptus tereticornis*	Myrtaceae
8.	Velvet mesquite	Mullu maram	*Prosopis juliflora*	Fabaceae
9.	Indian rosewood	Shisham	*Dalbergia sissoo*	Fabales
10.	Madras thorn	Kudukapuli	*Pithecellobium dulce*	Fabaceae
11.	Portia tree	Poovarasan	*Thespesia Populnea*	Malvaceae
12.	Royal poinciana	Cemmayir Konra	*Delonix regia*	Fabaceae
13.	Lemon	Ezhumuchaipalam	*Citrus lemon*	Rutaceae
14.	Jamun Fruit Plant	Naval maram	*Syzygium cumini*	Myrtaceae
15.	Gum arabic tree	Karuvelam	*Vachellia nilotica*	Fabaceae
16.	Kassod Tree	ManjalKonrai	*Cassia siamea*	Fabaceae
17.	Asian Palmyra palm	Panai maram	*Borassus flabellifer*	Arecaceae
18.	Bamboo	Moongil	*Bambusoideae*	Poaceae
19.	Teak	Thekku	*Tectona grandis*	Verbenaceae
20.	Indian mulberry	Nuna maram	*Morinda tinctoria*	Rubiaceae
21.	Banyan	Alai	*Ficus benghalensis*	Moraceae
22.	Cashew	Munthiri	*Anacardium occidentale*	Anacardiaceae
23.	Common fig	Athi Maram	*Ficus Carica*	Anacardiaceae
24.	Horsetail She-oak	Savukku maram	*Casuarina equisetifolia*	Casuarinaceae
25.	Tamarind	Puliyamaram	*Tamarindus indica*	Legumes
26.	Creamy peacock flower	Perungondrai	*Delonix elata*	Fabaceae
27.	Indian bael	Vilvam	*Aegle marmelos*	Rutaceae
28.	Indian gooseberry	Nelli	*Phyllanthus emblica*	Phyllanthaceae
29.	Guava	Koyya	*Psidium guajava*	Myrtaceae
30.	Mango	Manga	*Mangifera indica*	Anacardiaceae
31.	Sugar apple	Sitapalam	*Annona squamosal*	Annonaceae
32.	Papaya	Pappali maram	*Carica papaya L*	Caricaceae
33.	Banana tree	Vazhaimaram	*Musa acuminata*	Musaceae
34.	Jack fruit	Palamaram	*Artocarpus heterophyllus*	Moraceae
Shrubs				
1.	Milk Weed	Erukku	*Calotropis gigantea*	Apocynaceae
2.	Solanum pubescens	Malaisundai	*Solanum pubescens Willd*	Solanaceae
3.	Night shade plan	Sundaika	*Solanum torvum*	Solanaceae
4.	Stachytarpheta urticifolia	Rat tai	*Stachytarpheaurticifolia*	Verbenaceae
5.	Devil's trumpet	Umathai	*Datura metel*	Solanaceae
6.	Castor bean	Amanakku	*Ricinus communis*	Euphorbiaceae
7.	Shoe flower	Chemparuthi	*Hibiscu rosa-sinensis*	Malvaceae
8.	Bellyache bush	Kaatamanaku	*Jatropagossypifolia*	Euphorbiaceae
9.	Touch-me-not	Thottalchinungi	*Mimosa pudica*	Mimosaceae
10.	Indian mallow	Maanikham	*Abutilon indicum*	Meliaceae

11.	Avaram	Avarai	*Senna auriculata*	Fabaceae
12.	Indian Oleander	Arali	*Nerium indicum*	Apocynaceae
13.	West Indian Lantana	Unni chedi	*Lantana camara*	Verbenaceae
Herbs				
1.	Purple pitcher plant	Kavali	*Tephrosia purpurea*	Fabaceae
2.	Chamber bitter	Malai Kizhanelli	*Phyllanthus urinaria L.*	Euphorbiaceae
3.	Carrot grass	Vishapoondu	*Parthenium hysterophorus*	Asteraceae
4.	Billygoat weed	Pumpillu	*Ageratum conyzoides*	Asteraceae
5.	Aloe barbadensis	Katrazhai	*Aloe vera*	Asphodelaceae
6.	Indian Mercury	Kuppamani	*Acalypha indica*	Euphorbiaceae
7.	Indian nettle	Nayuruvi	*Achyranthes aspera*	Amaranthaceae
8.	Indian doab	Arugampul	*Cynodon dactylon*	Poaceae
9.	Cleome viscosa	Nai kadugu	*Celome viscosa*	Capparidaceae
10.	Common leucas	Thumbai	*Leucas aspera*	Lamiaceae
11.	Asthma-plant	Amman pacharisi	*Euphorbia hirta*	Euphorbiaceae
12.	Poor land flatsedg	Kunnakora	*Cyperus compressus*	Cyperaceae
13.	Holy basil	Thulasi	*Ocimum tenuiflorum*	Lamiaceae
14.	Tridax daisy	Thatha poo	*Tridax procumbens*	Asteraceae
15.	Gale of the wind	Keelaneeli	*Phyllanthus niruri*	Phyllanthaceae
Climber				
1.	Ivy gourd	Kovai	*Coccinia grandis*	Cucurbitaceae
2.	Bitter apple	Peikkumatti	*Citrullus colocynthis*	Cucurbitaceae
3.	Wild water lemon	Poonai puduku chedi	*Passiflora foetida*	Passifloraceae
4.	Stemmed vine	Perandai	*Cissus quadrangularis*	Vitaceae
Grass				
1.	Great brome	Thodappam	*Bromus diandrus*	Poaceae
2.	Windmill grass	Chevvarakupul	*Chloris barbata*	Amaranthaceae
3.	Eragrostis	Pullu	*Eragrostis ferruginea*	Poaceae

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

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 proposed lease area has plain terrain. There are 69 different species identified in the buffer zone. Among the identified, floral (69) species were 34 trees, 15 herbs, 13 shrubs, 4 climbers, and grasses 3. According to the findings of the buffer zone flora studies, the dominant species in the study area are Fabaceae, Poaceae, and Solanaceae, as shown in Table No.3.2. Apart from the proposed project area, there is agricultural land. Horticulture and agricultural land are untouched. There are no Rare, Endangered, and Threatened Flora species in the mining area and their surrounding study area. Details of flora with the scientific name were mentioned in Table No.3.2

Economically important Flora of the study area

Agricultural crops: The main agricultural crops are maize and paddy. The locals also cultivate a variety of vegetables and fruits, including brinjal, drumsticks, onion, and coriander, as well as fruits like banana, papaya, mangoes, and guava.

Medicinal species: Several more medicinal plants commonly found in wastelands are also present in the near area. Azadirachta indica (Neem), Ocimum tenuiflorum (Holy basil),etc., and others are common medicinal plants in the area.

Rare and endangered floral species: There are no rare or endangered or threatened (RET) species in the study area. During the vegetation survey, there are no species that are endangered or threatened under IUCN (International Union for Conservation of Nature and Natural resources) guidelines.

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.

3.5.6. Fauna

Fauna Composition in the Core Zone

A total of 27 varieties of species were observed in the Core zone of Ponnamangalam Village, Rough stone and gravel quarry (Table No.3.4) among them numbers of Insects 11, Reptiles 3, Mammals 2, and Avian 11. 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 11 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, ROUGH STONE AND GRAVEL QUARRY

Sl. No	Scientific Name	Common Name	IUCN Red List data
Insects			
1.	Junoniahierta	Yellow Pansy	LC
2.	Danaus chrysippuschrysippus	Plain Tiger	LC
3.	Junonialemonias	Lemon Pansy	LC
4.	Danaus genutia	Common Tiger	NL
5.	Musca domestica	House fly	-
6.	Hieroglyphus sp	Grasshopper	LC
7.	Euploea core	Common Crow	LC
8.	Danaus genutia	Striped Tiger	LC
9.	Agriansp	Dragonfly	-
10.	Apisindica	Honey Bee	-
11.	Hamitermes silvestri	Termite	LC
Reptiles			
1.	Ahaetulla nasuta	Green vine snake	NL
2.	Mabuya carinatus	Common skink	LC
3.	Calotes versicolor	Garden lizard	LC
Mammals			
1.	Herpestes javanicus	Asian Small Mongoose	LC
2.	Mus booduga	Indian Field Mouse	NL
Aves			
1.	Columbidae	Rock pigeon	LC
2.	Acridotheres tristis	Common myna	LC
3.	Eudynamys	Koel	LC
4.	Corvussplendens	House crow	LC
5.	Dicrurus macrocercus	Black drongo	LC
6.	Psittacula krameri	Rose-ringed parkeet	LC
7.	Coturnix coturnix	Common quail	LC
8.	Bubulcus ibis	Cattle egret	LC
9.	Laniusexcubitor	Shikra	LC
10.	Saxicoloides fulicata	Indian Robin	LC
11.	Ardeo labacchus	Pond-Heron	LC

*NL- Not listed, LC- Least Concern

(**Sources:** Species observation in the field study)

Fauna Composition in the Buffer Zone

As the animals, especially vertebrates move from place to place in search of food, shelter, mate or other biological needs, separate lists for core and buffer areas are not feasible however, a separate list of fauna pertaining to core and buffer zone are listed separately. Though there are no

reserved forest in the buffer zone. As such there are no chances of occurrence of any rare or endangered or endemic or threatened (REET) species within the core or buffer area.

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

The list of bird species recorded during field survey and literature from the study area is given in Table 3.6. The list of reptilian species recorded during field survey and literature from the study area are given in Table 3.7. The list of insect species recorded during field survey and literature from the study area are given in Table 3.8. The list of Amphibian species recorded during the field survey and literature from the study area are given in Table 3.9 and List of Butterflies identified from the project site and their conservation status is given in Table No.3.10. 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 64 species were identified from the project site. Based on habitat classification the majority of species were Insects 5, followed by birds 23, Reptiles 8, Mammals 6, amphibians 2, and Butterflies 20. A total of 23 species of bird were sighted in the study area. There are no critically endangered, endangered, vulnerable, and endemic species were observed. There are no impacts on nearby fauna species.

Dominant species are mostly birds and insects, and two were observed during the extensive field visit Sphaerotheca breviceps, and Euphlyctis hexadactylus. 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: (*directly sighted animals & Secondary data)

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
6.	Lepus nigricollis	Rabbit	LC

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

TABLE 3.36. LISTED BIRDS

SI. No	Scientific Name	Common Name	IUCN Conservation Status
1.	Bubulcus ibis	Cattle Egret	LC
2.	Saxicoloidesfulicata	Indian Robin	LC
3.	Streptopeliachinensis	Spotted Dove	LC
4.	Accipiter badius	Shikra	LC
5.	Coraciasbenghalensis	Indian Roller	LC
6.	Anthusrufulus	Paddyfield Pipit	LC
7.	Nectarinia minima	Small Sunbird	LC
8.	Acridotherestristis	Common Myna	LC
9.	Vanellusindicus	Red-wattled Lapwing	-
10.	Dicrurusmacrocercus	Black Drongo	LC
11.	Lonchurapunctulata	Spotted Munia	LC
12.	Dendrocittavagabunda	Indian Treepie	LC
13.	Corvussplendens	House Crow	LC
14.	Eudynamys	Koel	LC
15.	Psittacula krameni	Rose ringed parakeet	LC
16.	Dicrurus macrocercus	Black drongo	LC
17.	Corvus splendens	House crow	LC
18.	Alcedo atthis	Small blue kingfisher	LC
19.	Cuculus canorus	Common Cukoo	LC
20.	Pycnonotus cafer	Red vented Bulbul	LC
21.	Milvus migrans	Black kite	LC
22.	Meropsorientalis	Small Bee-eater	LC
23.	Halcyon smyrnensis	White-breasted Kingfisher	LC

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

TABLE 3.37. 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 3.38. LIST OF INSECTS EITHER SPOTTED OR REPORTED FROM THE STUDY AREA

SI. No	Scientific Name	Common Name	IUCN Conservation Status
1.	Apis cerana	Indian honey bee	-
2.	Hamitermes silvestri	Termite	LC
3.	Hieroglyphus sp	Grasshopper	LC
4.	Camponotus Vicinus	Ant	NL
5.	Ceratogomphus pictus	Dragonfly	-

TABLE 3.39. LIST OF AMPHIBIANS EITHER SPOTTED OR REPORTED 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

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

TABLE.3.40. 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.	Hypolimnasmisippus	DanaidEggfly	LC
8.	Junoniahierta	Yellow Pansy	LC
9.	Junonialemonias	Lemon Pansy	LC
10.	Hypolimnasmisippus	DanaidEggfly	LC
11.	Phalantaphalantha	Common Leopard	LC
12.	Zizulahylax	Tiny Grass Blue	LC
13.	Catochrysopsstrabo	Forget-Me-Not	LC
14.	Euchrysopscnejus	Gram Blue	LC
15.	Lampidesboeticus	Pea Blue	LC
16.	Euploea core	Common Crow	LC
17.	Melanitisledaleda	Common Evening Brown	LC
18.	Jamidescelenoceleno	Common Cerulean	LC
19.	Evereslacturnus	Indian Cupid	LC
20.	Pachlioptaaristolochiae	Common Rose	LC

Findings/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.

3.5.7. Conclusion

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

3.6 SOCIO ECONOMIC ENVIRONMENT

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

3.6.1 Objectives of the Study

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

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

b) To identify the basic needs of the nearby villages within the study area.

c) To assess the impact on socio-economic environment due to the project.

d) To provide the employment and improved living standards.

e) To study the socio-economic status of the people living in the study area rough stone and gravel quarry project region.

f) To assess the impact on socio-economic environment due to rough stone and gravel quarry project region.

g) To analysis of impact of socio economic and Environmental Infrastructure facilities and road accessibility.

3.6.2 Scope of Work

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

3.6.3 Methodology

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

a) The details of the activities and population structure have been obtained from Census 2001 and 2011 and analysed.

b) Based on the above data, impacts due to plant operation on the community have been assessed and recommendations for further improvement have been made.

3.6.4 Sources of Information and Data Base

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

3.6.5 Primary Survey

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

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

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

3.6.6 Collection of Data from Secondary Sources

Data from secondary sources were collected on following aspects:

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

TABLE 3.41 TYPE OF INFORMATION AND SOURCES

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

b) Data Presentation and Analysis

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

3.7 Background Information of the Area

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

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

3.8 Geography of the Area

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

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

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

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

3.9 Population Growth Rate

In 1991, there were only 21 districts in the State of Tamil Nadu. In 2001, eight new districts were created by reorganising the territorial jurisdiction. The nine districts are – Madurai, Namakkal, Perambalur,

Viluppuram, Thiruvarur, Nagapattinam and Theni. The population and its growth trend are important economic factors in a developing economy.

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

3.10 Madurai District

Madurai district ranked 9th in terms of the highest population among the districts. Madurai District is situated in the South of Tamil Nadu state. It is bounded on the North by the districts of Dindigul, Thiruchirapalli and on the East by Sivagangai and on the West by Theni and South by Virudhunagar.

Geographical location:

North Latitude: Between 9°30.00 and 10°30.00

East Latitude: Between 77°00.00 and 78°30.00

Madurai District consists of three Revenue Divisions viz., Madurai, Melur and Usilampatti Eleven Taluks viz., Madurai North, Madurai West, Thirupparankundram, Vadipatti, Melur, Madurai East, Madurai South, Usilampatti, Thirumangalam, Peraiyur and Kalligudi comprising of 665 Revenue Villages. The District has Thirteen blocks viz. Madurai East, Madurai West, Thirupparankundram, Melur, Kottampatti, Vadipatti, Alanganallur, Usilampatti, Chellampatti, T.Kallupatti, Sedapatti, Thirumangalam and Kallikudi comprising of 420 Village Panchayats. There are three Municipalities viz. Melur, Thirumangalam and Usilampatti Nine Town Panchayats viz. A.Vallalapatti, Alanganallur, Elumalai, Palamedu, Paravai, Peraiyur, Sholavandan, T.Kallupatti and Vadipatti and one Madurai Corporation.

Madurai is surrounded by several mountains. The Madurai city has 3 hills as its city boundary. Yanaimalai, Nagamalai, Pasumalai named after Elephant, Snake and Cow respectively. It is famous for Jasmine Flowers. Jasmine flowers are transported to other cities of India from Madurai.

3.11 Study Area

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

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

TABLE 3.42. SHOWS THE SOCIO-ECONOMIC PROFILE OF THE STUDY AREA AS COMPARED TO DISTRICT, STATE AND NATIONAL LEVEL SOCIO-ECONOMIC PROFILE

Particular	India	Tamil Nadu	Madurai District	Study Area (10km Radius)
Area (in sq. km.)	3,287,263	130058	3710	324
Population Density/ sq. Km.	368	554	819	550
No. of Households	249454252	13357027	794887	48290
Population	1210569573	72147030	3038252	178161
Male	623121843	36137975	1526475	90082
Female	587447730	36009055	1511777	88079
Scheduled Tribes	104281034	794697	11096	38
Scheduled Castes	201378086	14438445	408976	21724
Literacy Rate	**72.99%**	**80%**	**75%**	**80%**
Sex Ratio (Females per 1000 Males)	**943**	**996**	**990**	**978**

Source: Census of India, 2011

Table no 3.12.1 show demographic pattern of India, Tamil Nadu, Madurai District & Study area (10km Radius). In India had total area of 3.2 sqkm, State of Tamil Nadu area was 130058 sqkm, District of Madurai area was 3710 sqkm and study area is about 324 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 819 sqkm and study area density is about 550 sqkm. As per Census 2011, about 5.96percent of population in the state lives in areas. Madurai had comparing state wise 4.21 percent of population lives in the district. In study area has 5.86% around 10km radius. State, District and study area. In Tamil Nadu state SC categories people had about 19 %, district of Madurai about 13.46 % it has increasing to Study area about 15% increasing in the total population Similarly ST population is about 1.10%, 0.36% and 0.02 % of the total population in the study area. State level Literacy rate is 80%, district level is 75% but study area has increased about 80%. There is literacy rate is study area is an increase comparing district level decreased. Sex ratio female per thousand males about state level is 996, District level is 990 and study area is 978.

The study area has population density 550 persons per sq.km of total population about 178161 as per census 2011. There were about 50 percent male and 49% female population. Study area has literate rate is about 80%, District had about 75% of literate rate as per census 2011.

3.13 Population Projection of the Study Area

Madurai Population 2022 – 2023

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

Year	Projected Population (Estimation)
2001	**2,578,201**
2011	**3,038,252**
2021	3,490,000
2025	3,640,000
2031	3,740,000

Source: **https://www.census2011.co.in/census/district/45-madurai.html**

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

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

TABLE 3.43. TOTAL POPULATION OF STUDY AREA

Sl No.	Population in 2001	Population in 2011
1	150514	178161

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

TABLE 3.44 POPULATION PROJECTION OF STUDY AREA

S. No	Year	Projected Population (Approximately)
1.	2021	205808
2.	2031	233455
3.	2041	261102
4.	2051	288749

Source: Calculated by Excel Sheet-Forecast Method.

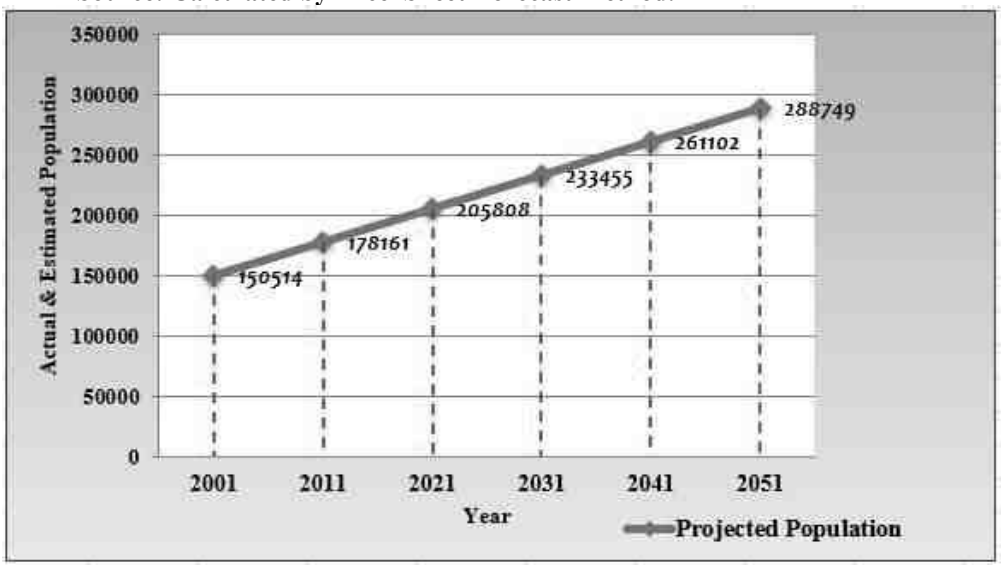


FIGURE 3.33. GRAPH SHOWING POPULATION PROJECTION

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 29) is used to calculate the intercept and the slope.

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

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

3.14 Population Growth of the Study Area

TABLE 3.45. POPULATION GROWTH RATE IN STUDY AREA

Year	Actual Population	Growth Rate %
2001	150514	-
2011	178161	11.84
2021	205808	11.55
2031	233455	11.34
2041	261102	11.18
2051	288749	11.06

Source: Compiled by Author-2022

above table no 3.14.1 is showing the growth rate of population since 2001, as per census in 2001 the population of study area was 150514 and 2011 it was 178161 if the population growth rate is 11.84%, it will approximately gradually an increase about 205808 in year 2021 and 288749 in the year of 2051. It has approximately population growth rate decline will be 11.06%.

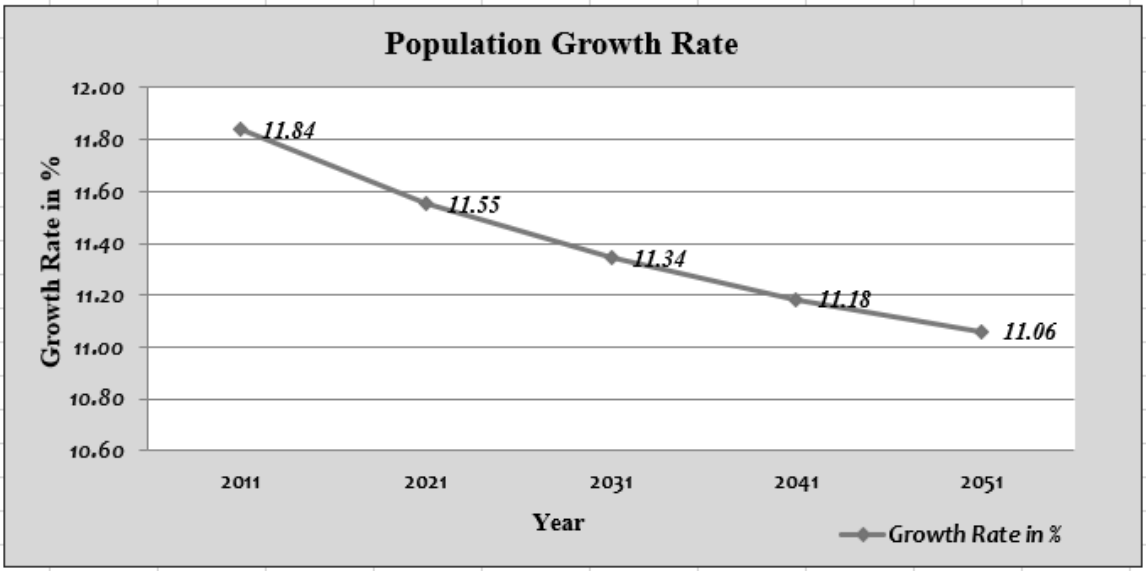


FIGURE.3.34. GRAPH SHOWING POPULATION GROWTH RATE

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**

3.15 Population Distribution and Composition of Study Area

The population as per 2011 Census records is 79440 (for 10 km radius buffer zone). Total no. of household is 1108, 6321 and 13365 respectively, in primary, secondary and tertiary zone. Sex ratio is 1003,997 and 984 (females per 1000 males) observed in primary, secondary and tertiary zone respectively. SC population distribution is 1551, 8879 and 10972 respectively in primary, secondary and tertiary zone. ST population distribution is very less 0,37 and 71 respectively in primary, secondary and tertiary. Average household size is 4. Zone wise Demographic profile of study area is given in the table 3.15.1 below:

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

TABLE 3.46. ZONE WISE DEMOGRAPHIC PROFILE OF STUDY AREA

Zone	No. of Villages	Total Household	Total Population	Male Population	%	Female Population	%
Primary Zone (0 - 3 Km)	9	2852	10990	5607	51.02	**5383**	48.98
Secondary Zone (3 - 7 Km)	13	9383	34153	17425	51.02	**16728**	48.98
Tertiary Zone (7 - 10 km)	25	36055	133018	67050	50.41	**65968**	49.59
Study Area (0-10 km)	**47**	**48290**	**178161**	**90082**	**50.56**	**88079**	**49.44**

Source: Census of India, 2011

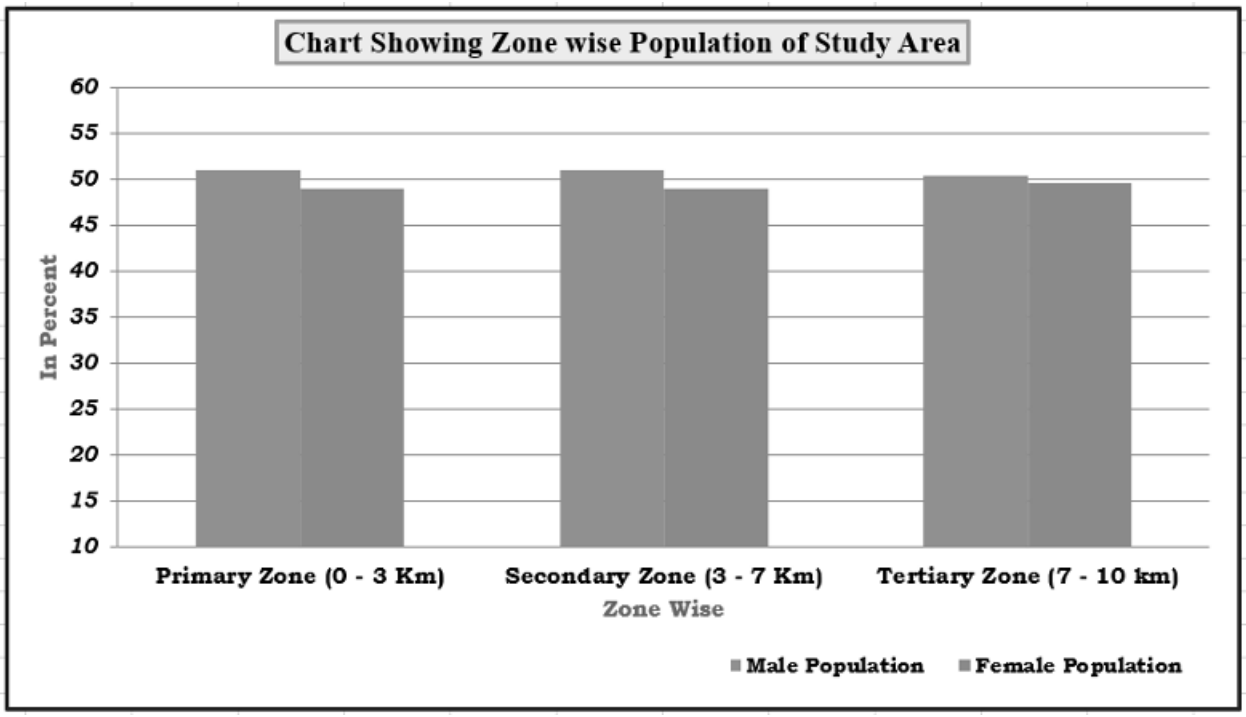


FIGURE 3.35. POPULATION OF STUDY AREA

- ✓ Above table identifies the presence of villages and their subsequent population divided under three zones from plant boundary (i.e., Primary, secondary and tertiary zone).
- ✓ Primary zone has 9 villages where as much as 2852 households with 10990 population are located. Mostly lying on Built-up land for their livelihood and substance.
- ✓ Secondary and tertiary zone both comprise of 13 and 25 villages having a total population of 34153 and 133018 respectively.

TABLE 3.47. VILLAGE WISE DEMOGRAPHIC PROFILE OF THE STUDY AREA (Core and Buffer Zone)

Sno	Name	TRU	No Household	Total Population	Male Population	Female Population	Person 0-6 yrs	Male 0-6 yrs	Female 0-6yrs	SC Persons	ST Person	Literate Person	Male Literate	Female Literate	Total Workers	Main Workers	Marginal workers	Non Workers
0-3km																		
1	Chettipillayarnatham	Rural	220	841	425	416	69	37	32	220	0	587	331	256	489	479	10	352
2	Rayapalayam	Rural	239	880	445	435	65	32	33	0	0	689	378	311	470	319	151	410
3	Melanesaneri	Rural	79	310	168	142	44	21	23	0	0	184	117	67	193	187	6	117
4	Tirali	Rural	949	3288	1633	1655	307	176	131	477	0	2416	1315	1101	1748	1726	22	1540
5	Andipatti	Rural	256	969	488	481	83	46	37	224	0	684	377	307	546	209	337	423
6	Melakottai	Rural	1376	5156	2564	2592	515	255	260	1943	0	3850	2120	1730	2545	1915	630	2611
	Total		**3119**	**11444**	**5723**	**5721**	**1083**	**567**	**516**	**2864**	**0**	**8410**	**4638**	**3772**	**5991**	**4835**	**1156**	**5453**
3-7km																		
1	Sathangudi	Rural	1202	4369	2206	2163	470	258	212	674	0	3008	1683	1325	2245	1879	366	2124
2	Kadukulam	Rural	262	1019	531	488	106	52	54	89	0	682	413	269	430	409	21	589
3	Ponnampatti	Rural	81	320	170	150	41	25	16	236	0	199	120	79	193	193	0	127
4	Kilavaneri	Rural	501	1891	933	958	190	81	109	459	0	1248	698	550	1024	1018	6	867
5	Naduvakkottai	Rural	288	1074	543	531	131	71	60	89	0	707	401	306	636	630	6	438
6	Karisalpatti	Rural	445	1835	901	934	162	83	79	650	1	1423	772	651	852	834	18	983
7	Vadagarai	Rural	1262	4900	2513	2387	525	283	242	1691	0	3452	1934	1518	2005	1805	200	2895
8	Nadukottai	Rural	453	1749	905	844	176	94	82	499	0	1304	723	581	850	449	401	899
9	Mallampatti	Rural	166	664	332	332	67	35	32	484	0	466	253	213	421	103	318	243
10	Giriyagoundanpatti	Rural	203	743	368	375	79	42	37	124	0	551	301	250	502	477	25	241
11	T.Pudupatti (Tirumangalam)	Rural	319	1100	536	564	96	44	52	183	0	867	470	397	511	432	79	589
12	Sengappadai	Rural	1157	3924	1977	1947	376	181	195	625	0	2722	1531	1191	2420	2346	74	1504
13	Swamimallampatti	Rural	125	472	239	233	55	30	25	34	0	370	204	166	291	276	15	181
14	Karisalkalampatti	Rural	326	1158	589	569	142	71	71	39	0	722	424	298	683	615	68	475
15	Keelanesaneri	Rural	130	498	251	247	54	34	20	96	0	307	175	132	252	249	3	246
16	Sivarakottai	Rural	905	3331	1646	1685	347	190	157	449	27	2386	1294	1092	1694	1170	524	1637
17	Arasapatti	Rural	615	2210	1130	1080	257	139	118	121	0	1297	797	500	1288	1264	24	922
18	Thirumangalam (M)	Urban	13564	51194	25426	25768	4952	2551	2401	3691	17	41934	21699	20235	19212	18294	918	31982
	Total		**22004**	**82451**	**41196**	**41255**	**8226**	**4264**	**3962**	**10233**	**45**	**63645**	**33892**	**29753**	**35509**	**32443**	**3066**	**46942**
7-10km																		
1	Chittalai	Rural	218	752	394	358	57	32	25	241	0	474	297	177	437	434	3	315
2	Pungankulam	Rural	362	1317	654	663	131	67	64	635	0	921	509	412	841	787	54	476
3	Kandai	Rural	284	1117	541	576	111	56	55	810	0	663	384	279	699	686	13	418
4	Pannikundu	Rural	504	1737	881	856	163	90	73	264	0	1146	659	487	963	910	53	774
5	Urappanur	Rural	1314	4644	2362	2282	424	232	192	877	0	3022	1759	1263	2737	2327	410	1907
6	Dharmathupatti	Rural	641	2477	1279	1198	275	146	129	71	0	1850	1022	828	1056	1003	53	1421
7	S.Puliankulam	Rural	100	418	209	209	47	30	17	37	0	298	161	137	255	248	7	163
8	Kappalur	Rural	1026	3848	1913	1935	421	199	222	315	0	2681	1502	1179	1743	1678	65	2105
9	Maravankulam	Rural	802	2877	1436	1441	308	168	140	408	0	1950	1042	908	1261	1137	124	1616
10	Kudiraicharikulam	Rural	262	954	488	466	81	44	37	58	0	601	350	251	499	442	57	455

11	Ammapatti	Rural	546	1868	902	966	198	94	104	627	0	1087	593	494	1011	926	85	857
12	Alappalacheri	Rural	459	1693	853	840	183	98	85	267	0	1044	618	426	1117	88	1029	576
13	Sowdarpatti	Rural	964	3395	1696	1699	320	168	152	473	1	2284	1296	988	2103	1586	517	1292
14	Vidathakulam	Rural	520	1934	987	947	197	99	98	422	0	1295	758	537	1174	1151	23	760
15	Virusankulam	Rural	227	860	423	437	96	44	52	58	0	563	328	235	499	259	240	361
16	Ulagani	Rural	386	1466	743	723	170	84	86	151	0	815	522	293	740	716	24	726
17	Maikkudi	Rural	345	1382	701	681	177	83	94	430	0	839	494	345	774	598	176	608
18	Valayankulam	Rural	274	1050	517	533	126	59	67	28	0	527	336	191	603	600	3	447
19	Nedungulam	Rural	266	897	445	452	83	42	41	88	0	558	337	221	518	494	24	379
20	Thoombakulam	Rural	325	1149	564	585	156	77	79	102	0	610	386	224	655	636	19	494
21	Saluppapillayarnatham	Rural	603	2129	1043	1086	220	112	108	690	0	1305	736	569	1390	1380	10	739
22	Kalligudi	Rural	1618	5427	2682	2745	515	284	231	1575	0	4083	2169	1914	2772	2380	392	2655
	Total		**12046**	**43391**	**21713**	**21678**	**4459**	**2308**	**2151**	**8627**	**1**	**28616**	**16258**	**12358**	**23847**	**20466**	**3381**	**19544**
	G.total		**37169**	**137286**	**68632**	**68654**	**13768**	**7139**	**6629**	**21724**	**46**	**100671**	**54788**	**45883**	**65347**	**57744**	**7603**	**71939**

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

3.16 Gender and Sex Ratio

Sex ratio is used to describe the number of females per 1000 of males. Sex ratio is a valuable source for finding the population of women in India and what is the ratio of women to that of men in India. In the Population Census of 2011, it was revealed that the population ratio in India 2011 is 940 females per 1000 of males. The study area has 1000 females per 978 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 47 villages lying in study area (buffer zone) as primary, secondary and tertiary zone.

TABLE 3.48. SEX RATIO OF THE STUDY AREA

S. No.	Buffer Zone	Sex Ratio of Study area Female/ 1000 Male
1	Primary Zone (0-3 km)	960
2	Secondary zone (3-7 km)	960
3	Tertiary Zone (7-10 km)	984

Source: Census of India, 2011

FIGURE 3.36. SEX RATIO WITHIN 10 KM STUDY AREA

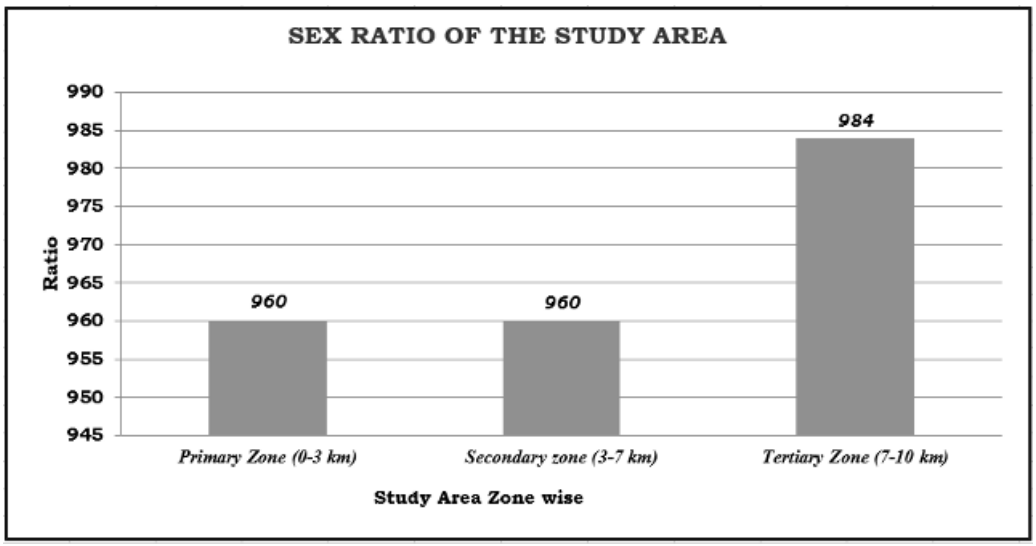


TABLE 3.49. CHILD SEX RATIO OF THE STUDY AREA

S. No.	Buffer Zone	Sex Ratio of Study area Female/ 1000 Male
1	Primary Zone (0-3 km)	882
2	Secondary zone (3-7 km)	877
3	Tertiary Zone (7-10 km)	925

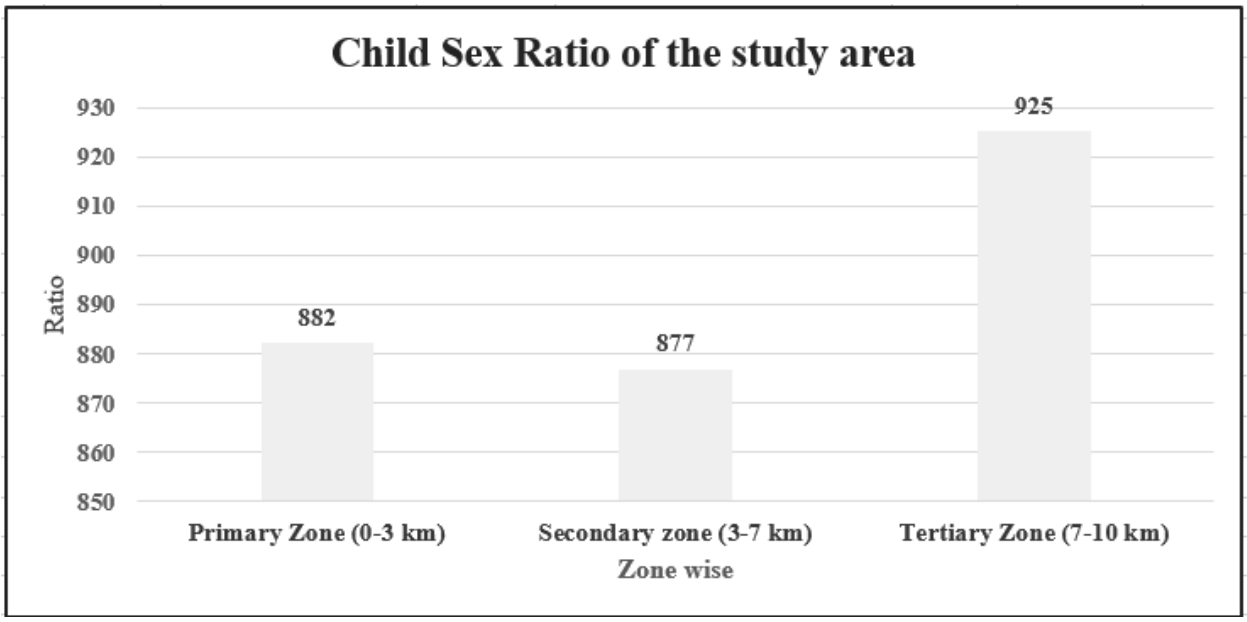


FIGURE 3.37. CHILD SEX RATIO WITHIN 10 KM STUDY AREA

3.17 Literacy Rate in Study Area

Literacy Rate is the percentage of people in a country with the ability to read and write. The analysis of the literacy levels is done in the study area. The 10 km radius of study area demonstrates a literacy rate of 80.24% as per census data 2011. The male literacy rate in the study area indicates 87.94% whereas the female literacy rate, which is an important indicator for social change, is observed to be 72.42% as per the census data 2011. This needs to focus on the study area and enhance further development focusing on education. (Table no 3.17.1).

TABLE 3.50. 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)	9	**4173**	83.24	**3059**	62.96	**7232**	73.26
Secondary Zone (3 - 7 Km)	13	**13280**	85.44	**9974**	66.15	**23254**	75.94
Tertiary Zone (7 - 10 Km)	25	**53583**	88.98	**44607**	74.78	**98190**	81.91
Study Area (0-10km)	**47**	71036	**87.94**	57640	**72.42**	128676	**80.24**

Source: Census of India, 2011

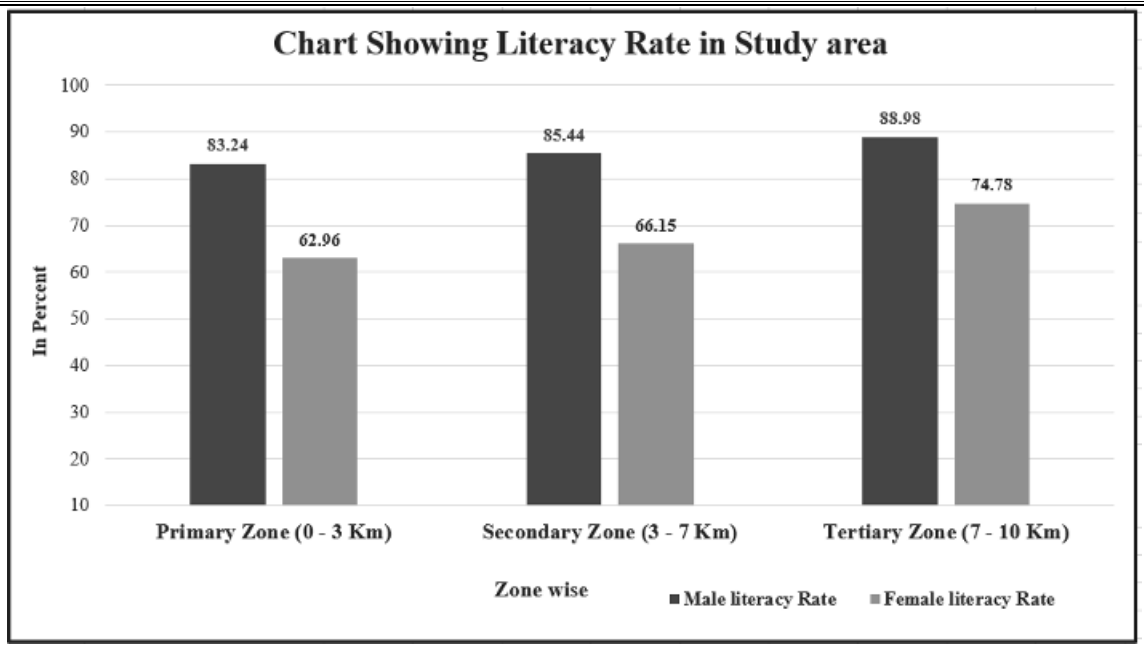


FIGURE 3.38. GENDER WISE LITERACY RATE IN THE STUDY AREA

3.18 Family Size

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

3.19 Vulnerable Group

While developing an action plan, it is very important to identify the population who fall under the marginalized and vulnerable groups and special attention has to be given towards these groups while making action plans. Special provisions should be made for them. In the observed villages schedule caste (SC) population is 14.95% and Schedule Tribe population 0.02 %, Other Population is 85 % 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)	9	3484	31.70	0	0.00	7506	68.30
Secondary Zone (3 - 7 Km)	13	6126	17.94	0	0.00	28027	82.06
Tertiary Zone (7 - 10 Km)	25	17026	12.80	38	0.03	115954	87.17
Total area (10km)	**47**	**26636**	**14.95**	**38**	**0.02**	**151487**	**85.03**

Source: Census of India, 2011

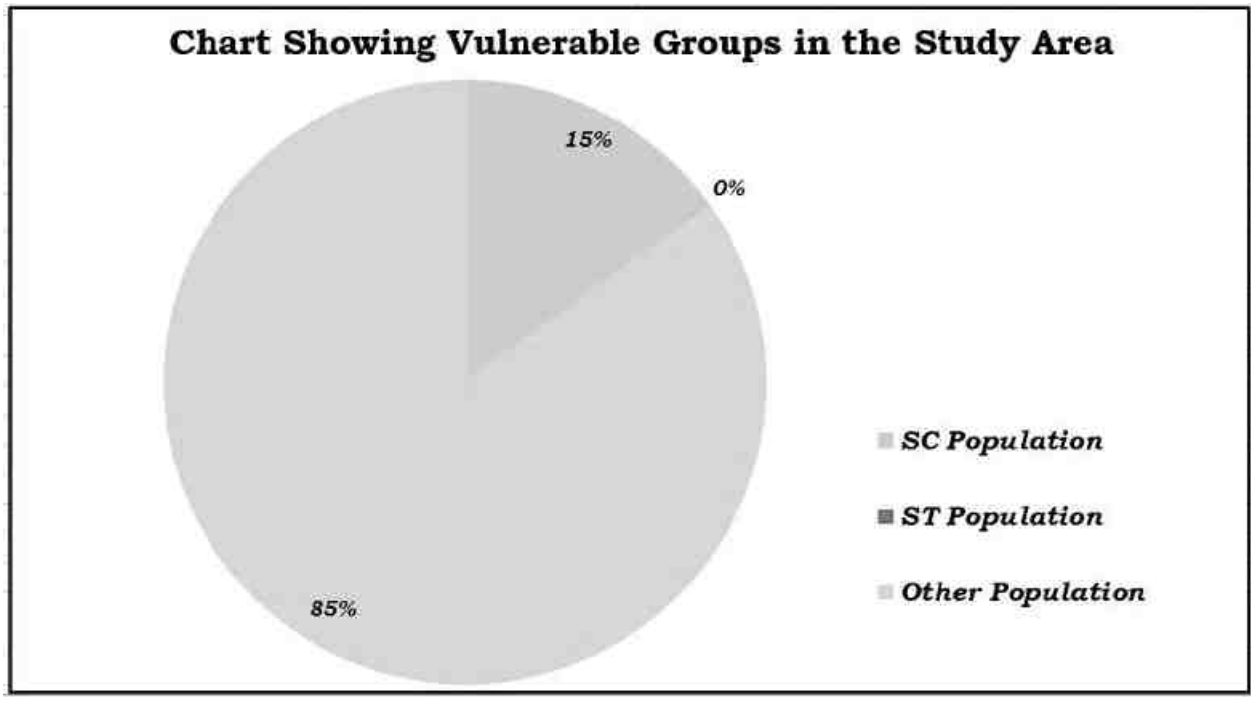


FIGURE 3.39. VULNERABLE GROUPS

3.20 Economic Activities

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

TABLE 3.52. 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)	9	7111	64.70	5871	53.42	1240	11.28	3879	35.30
Secondary Zone (3 - 7 Km)	13	18215	53.33	14216	41.62	3999	11.71	15938	46.67
Tertiary Zone (7 - 10 Km)	25	61240	46.04	51117	38.43	10123	7.61	71778	53.96
Study Area (10 Km)	**47**	**86566**	**48.59**	**71204**	**39.97**	**15362**	**8.62**	**91595**	**51.41**

Source: Census of India, 2011

The above table shows that out of the total working population, the percentage of main workers is 39.97% while 8.62% are marginal workers. Number of working populations is 48.59% and non-working

population is 51.41% 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.

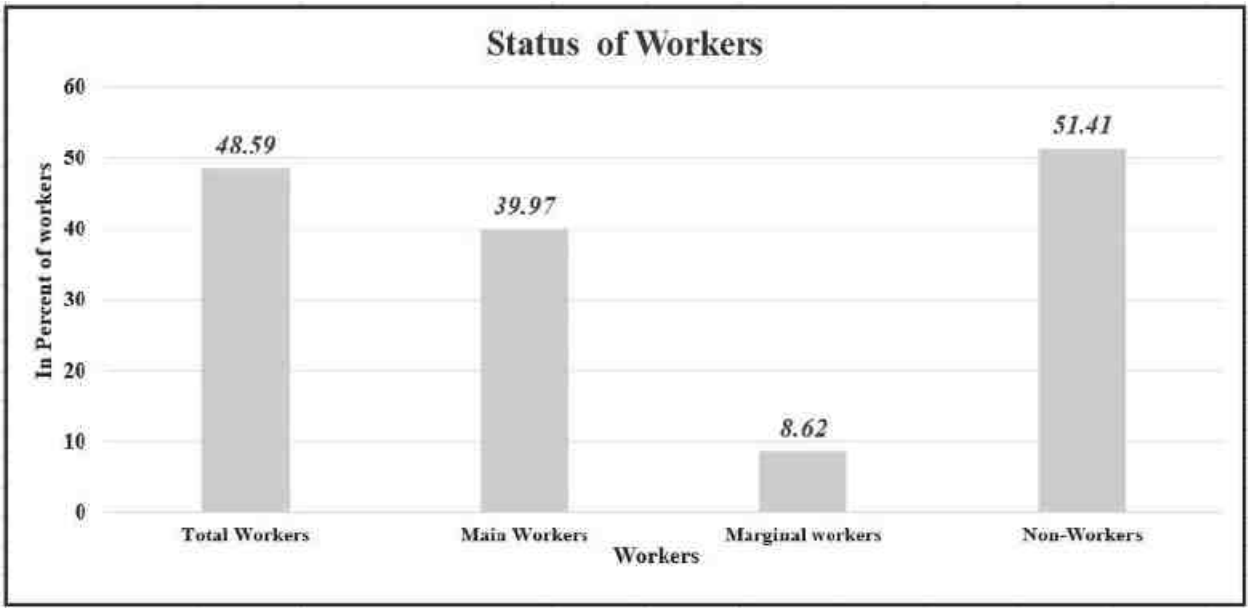


FIGURE 3.40. WORKING POPULATION IN THE STUDY AREA

3.21 Infrastructure Base

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

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

- **Administrative offices** are located in Tamil Nadu, Madurai District (21km-NE) from site which by local transport.
- **Sengulam Lake (SE-4.6km), Urappanur Lake** from mine lease boundary this river wet. There is require people around the village and Josyar alangulam, Pungankulam, Chittalai from mine lease boundary.
- **Availability of** Government primary school, Keela Urappanur Village (4.5km-E),Government Kallar Higher secondary school, Mela Urappanur Village (3km-SE), Municipal Primary school, Thirumangalam Taluk, Government Primary School, Urappanur (7.0km-N), Government Higher secondary school, Thummakundu Village (9km-SW), Government Higher secondary school,

Santhankudi Village (3km-SE), many Pre-primary school, Elementary school, Engineering college, Medical and Training institute found in study area.

- **Health facilities** covered in the area PHC Acchampatti (4.5km-W), Government PHC, Chellampatti (8.0km-NW), Government PHC, Thummakundu Village (9km-SW), Government Sub primary Healthcentre, Keela Urappanur Village (4.5km-E),Government Hospital, Mela Urappanur Village (3km-SE), Government TB Hospital, K.Pudupatti Village (7.0km-E), Government Hospital, Thirumangalam Taluk (4.5km-NE) Buffer zone area like Government Hospital, Madurai, Government Hospital and Thirumangalam Taluks. Other private clinics and Pharmacy available in the study area.

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)	Private Arts and Science Degree College (Numbers)
0-3km											
1	Karadikal	4	0	2	0	1	0	1	0	0	0
2	Melandal	0	0	0	1	0	0	0	0	0	0
3	Ponnamangalam	2	1	2	0	0	0	0	0	0	0
4	Vannankulam	0	0	0	0	0	0	0	0	0	0
5	Kunnamampatti	1	0	1	0	0	0	0	0	0	0
6	Josyar Alangulam	1	0	0	0	0	0	0	0	0	0
7	Chittalai	1	0	1	0	0	0	0	0	0	0
8	Pungankulam	1	0	0	0	0	0	0	0	0	0
9	Kandai	1	0	1	0	0	0	0	0	0	0
	Total	**11**	**1**	**7**	**1**	**1**	**0**	**1**	**0**	**0**	**0**
3-7km											
1	Kinnimangalam	7	1	2	1	1	1	1	0	0	0
2	Kokkulam (Anaiyur)	1	0	0	0	0	0	0	0	0	0
3	Puliyakavundanpatti	0	0	0	0	0	0	0	0	0	0
4	Vagaikulam	1	0	1	0	0	0	0	0	0	0
5	Alagusirai	1	0	0	0	0	0	0	0	0	0
6	Erramalampatti	1	0	1	0	0	0	0	0	0	0
7	Kangayanatham	2	1	0	0	0	0	0	0	0	1
8	Pokkampatti	1	0	0	0	0	0	0	0	0	0
9	Pannikundu	0	0	0	0	0	0	0	0	0	0
10	Sathangudi	0	0	0	0	0	0	0	0	0	0
11	Urappanur	1	0	1	0	0	1	0	0	0	0
12	Kadukulam	3	1	1	0	1	0	1	0	0	0
13	Thenpalanji	1	0	0	0	0	0	0	0	0	0

	Total	**19**	**3**	**6**	**1**	**2**	**2**	**2**	**0**	**0**	**1**
7-10km											
1	Panniyan	1	0	0	0	0	0	0	0	0	1
2	Kannanur	1	0	0	0	0	0	0	0	0	0
3	Valandur	1	0	1	0	0	0	0	0	0	0
4	Jothimanickam	2	0	0	0	0	0	0	0	0	0
5	Kovilankulam	2	0	1	0	1	0	1	0	0	0
6	Karumathur	0	0	0	0	0	0	0	0	0	0
7	Nattarmangalam	1	0	0	0	0	0	0	0	0	0
8	Thidian	3	1	2	0	2	0	2	0	0	0
9	Poruppumethupatti	1	1	0	1	0	1	0	1	0	0
10	Thummakundu	0	0	0	0	0	0	0	0	0	0
11	Sindupatti	1	0	1	0	1	0	0	0	0	0
12	K.Puliyankulam	2	0	0	0	0	0	0	0	0	0
13	Dharmathupatti	4	0	3	0	0	0	0	0	0	0
14	Maravankulam	3	0	1	0	1	0	0	0	0	0
15	Thangalacheri	1	0	0	0	0	0	0	0	0	0
16	Ponnampatti	1	0	1	0	0	0	0	0	0	0
17	Kilavaneri	1	0	1	0	0	0	0	0	0	0
18	Naduvakkottai	1	0	1	0	0	0	0	0	0	0
19	Tirali	1	0	0	0	0	0	0	0	0	0
20	Andipatti	3	0	2	0	1	0	0	0	0	0
21	Karisalpatti	2	0	1	0	0	0	0	0	0	0
22	Thirumangalam (M)	5	0	4	0	1	0	1	0	1	1
23	Vadapalanji	1	0	0	0	0	0	0	0	0	0
24	Thoppur	1	0	1	0	0	0	0	0	0	0
25	Thanakkankulam (CT)	1	0	1	0	0	0	0	0	0	0
	Total	**40**	**2**	**21**	**1**	**7**	**1**	**4**	**1**	**1**	**2**
	Grant total	**70**	**6**	**34**	**3**	**10**	**3**	**7**	**1**	**1**	**3**

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)	Veterinary Hospital (Numbers)	Family Welfare Centre (Numbers)	Non Government Medical facilities Others (Numbers)
0-3km										
1	Karadikal	0	0	1	0	0	0	0	0	0
2	Melandal	0	0	0	0	0	0	0	0	0
3	Ponnamangalam	0	0	1	0	0	0	1	0	1
4	Vannankulam	0	0	0	0	0	0	0	0	0
5	Kunnamampatti	0	0	0	0	0	0	0	0	0
6	Josyar Alangulam	0	0	0	0	0	0	0	0	0
7	Chittalai	0	0	0	0	0	0	0	0	0
8	Pungankulam	0	0	0	0	0	0	0	0	0
9	Kandai	0	0	0	0	0	0	0	0	0
	Total	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**0**	**1**
3-7km										
1	Kinnimangalam	0	1	1	1	0	1	1	1	0
2	Kokkulam (Anaiyur)	0	0	0	0	0	0	0	0	0
3	Puliyakavundanpatti	0	0	0	0	0	0	0	0	0
4	Vagaikulam	0	0	1	0	0	0	1	0	0
5	Alagusirai	0	0	0	0	0	0	0	0	0
6	Erramalampatti	0	0	0	0	0	0	0	0	0
7	Kangayanatham	0	0	1	0	0	0	0	0	0
8	Pokkampatti	0	0	0	0	0	0	0	0	0
9	Pannikundu	0	0	0	0	0	0	0	0	0
10	Sathangudi	0	0	0	0	0	0	0	0	0
11	Urappanur	0	1	1	1	0	1	1	1	0
12	Kadukulam	0	0	1	0	0	0	0	0	0

13	Thenpalanji	0	0	0	0	0	0	0	0	0
	Total	**0**	**2**	**5**	**2**	**0**	**2**	**3**	**2**	**0**
					7-10km					
1	Panniyan	0	0	0	0	0	0	0	0	0
2	Kannanur	0	0	0	0	0	0	0	0	0
3	Valandur	0	0	1	0	0	0	0	0	0
4	Jothimanickam	0	0	1	0	0	0	0	0	0
5	Kovilankulam	0	0	1	0	0	0	1	0	0
6	Karumathur	0	0	0	0	0	0	0	0	0
7	Nattarmangalam	0	0	0	0	0	0	0	0	0
8	Thidian	0	0	1	0	0	0	0	0	1
9	Poruppumethupatti	0	0	0	0	0	0	0	0	0
10	Thummakundu	0	0	0	0	0	0	0	0	0
11	Sindupatti	0	0	1	0	0	0	0	0	0
12	K.Puliyankulam	0	0	0	0	0	0	0	0	0
13	Dharmathupatti	0	0	1	0	0	0	0	0	0
14	Maravankulam	0	0	0	0	0	0	1	0	0
15	Thangalacheri	0	0	0	0	0	0	0	0	0
16	Ponnampatti	0	0	0	0	0	0	0	0	0
17	Kilavaneri	0	0	0	0	0	0	0	0	0
18	Naduvakkottai	0	0	0	0	0	0	0	0	0
19	Tirali	0	0	0	0	0	0	0	0	0
20	Andipatti	0	0	0	0	0	0	0	0	0
21	Karisalpatti	0	0	1	0	0	0	0	0	0
22	Thirumangalam (M)	1	1	1	1	0	1	0	1	36
23	Vadapalanji	0	0	0	0	0	0	0	0	0
24	Thoppur	0	0	0	0	0	0	0	0	0
25	Thanakkankulam (CT)	1	1	1	1	0	1	0	1	12
	Total	**2**	**2**	**9**	**2**	**0**	**2**	**2**	**2**	**49**
	G.Total	**2**	**4**	**16**	**4**	**0**	**4**	**6**	**4**	**50**

Source: DCHB Census 2011, Tamil Nadu

TABLE 3.55. WATER & DRAINAGE FACILITIES IN THE SURVEYED AREA

Sno	Village Name	Tap Water-Treated (Status A(1)/NA(2))	Tap Water Untreated (Status A(1)/NA(2))	Covered Well (Status A(1)/NA(2))	Uncovered Well (Status A(1)/NA(2))	Hand Pump (Status A(1)/NA(2))	Tube Wells/Borehole (Status A(1)/NA(2))	Spring (Status A(1)/NA(2))	River/Canal (Status A(1)/NA(2))	Tank/Pond/Lake (Status A(1)/NA(2))	Others (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	Karadikal	1	1	2	1	1	1	2	2	2	1	1	1	2
2	Melandal	1	2	2	2	2	1	2	2	2	2	1	1	2
3	Ponnamangalam	1	1	1	2	1	1	1	2	2	2	1	1	2
4	Vannankulam	1	2	1	2	2	2	2	2	2	2	2	1	2
5	Kunnamampatti	1	1	1	2	1	1	2	2	2	2	1	1	2
6	Josyar Alangulam	1	1	1	2	1	2	2	2	2	2	2	1	2
7	Chittalai	1	1	1	2	1	2	2	2	2	2	2	1	2
8	Pungankulam	1	1	1	2	1	2	2	2	2	2	2	1	2
9	Kandai	1	1	1	2	1	2	2	2	2	2	2	1	2
3-7km														
1	Kinnimangalam	1	1	2	2	1	1	2	2	2	1	1	1	2
2	Kokkulam (Anaiyur)	1	1	2	2	2	1	2	2	2	2	1	1	2
3	Puliyakavundanpatti	1	1	2	2	2	2	2	2	2	2	2	2	1
4	Vagaikulam	1	2	2	2	1	1	2	2	2	2	1	1	2
5	Alagusirai	2	1	1	1	2	1	2	2	2	2	1	1	2
6	Erramalampatti	1	2	2	2	1	1	2	2	2	2	1	1	2
7	Kangayanatham	1	1	2	1	1	1	2	2	2	1	1	1	2
8	Pokkampatti	1	1	2	2	2	2	2	2	2	2	1	1	2

9	Pannikundu	1	1	2	2	2	2	2	2	2	2	1	2	2
10	Sathangudi	1	1	2	2	2	1	2	2	2	2	2	1	2
11	Urappanur	1	1	2	2	1	1	2	1	2	2	1	1	2
12	Kadukulam	1	1	2	1	1	1	2	2	2	2	1	1	2
13	Thenpalanji	1	1	2	1	2	2	2	2	2	2	1	1	2
7-10km														
1	Panniyan	1	1	1	1	2	1	2	2	1	1	1	1	2
2	Kannanur	1	1	1	2	1	1	2	2	2	2	1	1	2
3	Valandur	1	1	2	2	2	1	2	2	2	2	1	1	2
4	Jothimanickam	1	1	2	1	2	1	1	2	2	2	1	1	2
5	Kovilankulam	1	1	2	1	1	2	1	1	1	2	1	1	2
6	Karumathur	1	1	2	1	2	1	2	2	2	2	1	1	2
7	Nattarmangalam	1	1	1	2	2	1	2	2	2	2	1	1	2
8	Thidian	1	1	2	2	2	1	2	2	2	1	1	1	2
9	Poruppumethupatti	1	1	1	2	1	1	1	2	2	1	1	1	2
10	Thummakundu	1	2	2	2	1	2	2	2	2	2	2	1	2
11	Sindupatti	1	1	2	1	2	1	2	2	2	2	1	1	2
12	K.Puliyankulam	1	1	1	1	2	2	2	2	2	2	1	1	2
13	Dharmathupatti	1	1	1	1	1	2	2	2	2	1	1	1	2
14	Maravankulam	1	2	1	2	2	2	2	2	2	2	1	1	2
15	Thangalacheri	1	1	2	2	2	2	2	2	2	2	1	1	2
16	Ponnampatti	1	2	1	2	2	1	1	2	2	2	1	1	2
17	Kilavaneri	1	1	2	1	1	1	2	2	2	2	1	1	2
18	Naduvakkottai	1	1	2	2	1	1	2	2	2	2	1	1	2
19	Tirali	1	1	1	2	2	1	2	2	2	2	1	1	2
20	Andipatti	1	1	2	2	1	1	2	2	2	2	2	1	2
21	Karisalpatti	1	1	1	1	1	1	2	2	2	1	1	1	2
22	Thirumangalam (M)	1	1	2	2	1	1	2	2	2	1	1	1	2

23	Vadapalanji	1	1	2	2	1	1	2	2	2	2	2	1	2
24	Thoppur	1	1	1	1	1	1	2	2	2	1	1	1	2
25	Thanakkankulam (CT)	1	1	2	2	1	1	2	2	2	1	1	1	2

Source: DCHB Census 2011, Tamil Nadu

Index: A(1) means Available, NA(2) means Not Available in the village

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))	Cycle-pulled Rickshaws (machine driven) (Status A(1)/NA(2))	Carts Drivens by Animals (Status A(1)/NA(2))	Sea/River/Ferry Service (Status A(1)/NA(2))	National Highway (Status A(1)/NA(2))	State Highway (Status A(1)/NA(2))	Major District Road (Status A(1)/NA(2))	Other District Road (Status A(1)/NA(2))
0-3km																		
1	Karadikal	2	1	2	2	1	1	2	1	2	2	2	2	2	1	2	1	1
2	Melandal	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2
3	Ponnamangalam	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
4	Vannankulam	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
5	Kunnamampatti	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
6	Josyar Alangulam	2	2	2	2	1	2	2	2	2	1	2	2	2	2	2	2	2
7	Chittalai	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
8	Pungankulam	2	2	2	2	1	2	2	2	2	1	2	2	2	2	2	2	2
9	Kandai	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3-7km																		
1	Kinnimangalam	2	1	2	2	2	2	2	1	2	1	2	2	2	2	2	1	1
2	Kokkulam (Anaiyur)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1
3	Puliyakavundanpatti	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2
4	Vagaikulam	2	1	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2
5	Alagusirai	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
6	Erramalampatti	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2
7	Kangayanatham	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
8	Pokkampatti	2	2	2	2	1	1	2	2	2	1	2	2	2	2	2	1	1
9	Pannikundu	2	2	2	2	1	1	2	2	2	1	2	2	2	2	2	2	2
10	Sathangudi	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	2	1
11	Urappanur	1	2	1	2	2	2	2	2	2	2	2	2	2	1	2	1	2
12	Kadukulam	2	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2
13	Thenpalanji	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2
7-10km																		
1	Panniyan	2	1	2	2	1	2	2	1	2	2	2	2	2	2	2	2	2
2	Kannanur	2	2	2	2	1	2	2	1	2	2	2	2	2	2	2	2	1
3	Valandur	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2
4	Jothimanickam	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	1	1
5	Kovilankulam	2	1	2	2	1	2	2	1	2	2	2	2	2	2	2	2	2
6	Karumathur	2	1	2	2	1	2	2	1	1	1	2	2	2	1	2	1	1
7	Nattarmangalam	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
8	Thidian	2	1	2	2	2	2	2	1	1	1	2	2	2	1	1	1	1
9	Poruppumethupatti	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10	Thummakundu	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2
11	Sindupatti	2	1	2	2	1	2	2	1	2	1	2	2	2	2	2	2	2
12	K.Puliyankulam	2	1	2	2	1	1	2	2	2	1	2	2	2	2	2	1	2
13	Dharmathupatti	2	1	2	2	1	1	2	1	1	1	2	2	2	2	2	2	1

14	Maravankulam	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
15	Thangalacheri	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2
16	Ponnampatti	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	2	1
17	Kilavaneri	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
18	Naduvakkottai	2	2	2	2	1	2	2	2	2	2	2	2	2	2	1	2	2
19	Tirali	2	1	2	2	1	1	2	2	2	2	2	2	2	2	2	2	1
20	Andipatti	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	1
21	Karisalpatti	2	1	2	2	1	2	2	2	2	2	2	2	2	2	2	1	2
22	Thirumangalam (M)	1	1	1	2	1	1	2	1	2	2	2	2	2	2	1	2	2
23	Vadapalanji	2	1	2	2	1	2	2	1	2	1	2	2	2	2	2	2	2
24	Thoppur	2	1	2	2	1	1	2	2	2	1	2	2	2	2	2	1	2
25	Thanakkankulam (CT)	1	1	1	2	1	1	2	1	2	2	2	2	2	2	1	2	2

Source: DCHB Census 2011, Tamil Nadu.

Index: A(1) means Available, NA(2) means Not Available in the village

3.22. Other Issues in the Study Area

1. Deforestation of Land (Cutting Trees or Plant etc.)
2. Agriculture Land decreases
3. Lack of awareness among vulnerable groups for their welfare
4. Medical/Clinic facilities and PHC need for the Core area
5. Environmental clean with solid wastage pin each village.
6. Functioning of Hospital facilities with Sub Health care centers.
7. Need proper drainage system with public toilet men and women separately.
8. Avoid Road damage during carriage by mine vehicles (tipper Lorry).
9. Use sprinkler water when loading mine materials, to avoid water pollution during dust emission.
10. Water bodies like Urappanur Kanmoi, Sengulam Lake, pond avoid dust emission.

3.23 Interpretation

Based on the data, following inferences could be drawn:

- Total literacy rate in the study area is 80%.
- The study area had average educational facilities. The overall status depicts that the education is limited to primary and middle level.
- The schedule tribe community forms 0.02% and Scheduled Caste forms 15% of the total population of study area.
- The Other Population forms 85% of the total population of study area.
- The study area is well connected by NH/SH/Village Road.
- The study area not well health facilities of primary level.
- **Sengulam Lake, J.Alangula lake** Southern eastern side from mine lease boundary.
- Considering the above facts, the proposed project will boost the socio-economic development activities in the area and hence will leave positive impact.
- The study area has mobile connectivity.

3.24 Recommendation and Suggestions

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

- **Women empowerment–** Home based income generation activities, vocational training programs and common education centre for increasing the literacy rate.

- **Education –** Free uniform, construction of common rooms and library, computer education and physical education, additional schools for girls, furniture and equipment in schools, up-gradation of existing school infrastructure.
- **Agriculture/livestock –** Infrastructure such as agricultural practices, electricity connections, assistance with buying improved tools and equipment, capacity building, supply and/or knowledge of better variety of seeds, pasture land development and trainings on animal husbandry& facility of veterinary doctor.
- **Health –** Improvements in sanitary conditions of villages, assistance with construction of latrines, improvement in drainage system, health camps and awareness campaigns for diseases like Covid-19, malaria, typhoid, tuberculosis, yellow fever and pneumonia. Repairing of PHCs and Anganwadi centers.
- **People with disability** – Establishment of centre 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.

3.25 Conclusion

To evaluate the impacts of proposed rough stone and gravel 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 **Ponnamangalam rough stone and gravel Cluster quarry** will adopt adequate control measures to protect the surrounding environment and will contribute in development of the study areas.

Socio Economic/ demographic status of the study area reveals that area further require improvement in the Economy and Infrastructure Development of the area. Hence it can be concluded that the present baseline environment status of the study area will not be affected by the proposed project.

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

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

4.1 Land Environment

4.1.2 Anticipated Impact from Proposed Project

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

4.1.2.1 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

4.1.3 Soil Environment

4.1.4 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).

4.1.5 Common Mitigation Measures for Proposed Project

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

4.1.6 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.

4.2 Water Environment

4.2.1 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 the cluster is 47m and water table is found at a depth of 68m BGL 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

PROPOSAL – P1		
*Purpose	Quantity	Source
Dust Suppression	1.0 KLD	from bore well and open well from nearby area through tankers
Green Belt development	0.8 KLD	From Existing bore wells from nearby area
Drinking and Domestic purpose	0.5 KLD	From existing, bore wells and drinking water will be sourced from Approved water vendors.
Total	**2.3 KLD**	

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

Source: Approved Mining Plan Pre-Feasibility Report

Total water requirement in the proposed quarry is about 2.3 KLD, the water for dust suppression and greenbelt development will be sourced from the mine pit water collected during rainy seasons, the water for domestic purpose and drinking will be sourced from the approved water vendors.

4.2.2 Common Mitigation measures:

- Garland drain, settling tank will be constructed along the proposed mining lease area. The Garland drain will be connected to settling tank and sediments will be trapped in the settling traps and only clear water will be discharged out to the natural drainage
- Rainwater will be collected in sump in the mining pits and will be allowed to store and pumped out to surface setting tank of 15 m x 10m x 3m to remove suspended solids if any. This collected water will be judiciously used for dust suppression and such sites where dust likely to be generated and for developing green belt. The proponent will collect and judicially utilize the rainwater as part of rainwater harvesting system.
- Providing benches with inner slopes and through a system of drains and channels, allowing rain water to descent into surrounding drains, so as to minimize the effects of erosion & water logging arising out of uncontrolled descent of water.

- Reuse the water collected during storm for dust suppression and greenbelt development within the mines
- Installing interceptor traps/oil separators to remove oils and greases. Water from the tipper wash-down facility and machinery maintenance yard will pass through interceptor traps/oil separators prior to its reuse;
- Using flocculating or coagulating agents to assist in the settling of suspended solids during monsoon seasons;
- Periodic (every 6 month once) analysis of quarry pit water and ground water quality in nearby villages.
- Domestic sewage from site office & urinals/latrines provided in ML is discharged in septic tank followed by soak pits.
- Waste water discharge from mine will be treated in settling tanks before using for dust suppression and tree plantation purposes.
- De-silting will be carried out before and immediately after the monsoon season.
- Regular monitoring (every 6 month once) and analysing the quality of water in open well, bore wells and surface water

4.3 Air Environment

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.

4.3.1. Anticipated Impact

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

4.3.1.1. Modelling of Incremental Concentration 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.

4.3.1.2 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

EMISSION ESTIMATION FOR PROPOSAL "P1"				
	Activity	**Source type**	**Value**	**Unit**
Estimated Emission Rate for PM_{10}	Drilling	Point Source	0.099601923	g/s
	Blasting	Point Source	0.002371118	g/s
	Mineral Loading	Point Source	0.045528630	g/s
	Haul Road	Line Source	0.002502175	g/s/m
	Overall Mine	Area Source	0.075976375	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.001391894	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000139841	g/s

4.3.2 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 been has measured at 2 locations in the core zone 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, Madurai 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

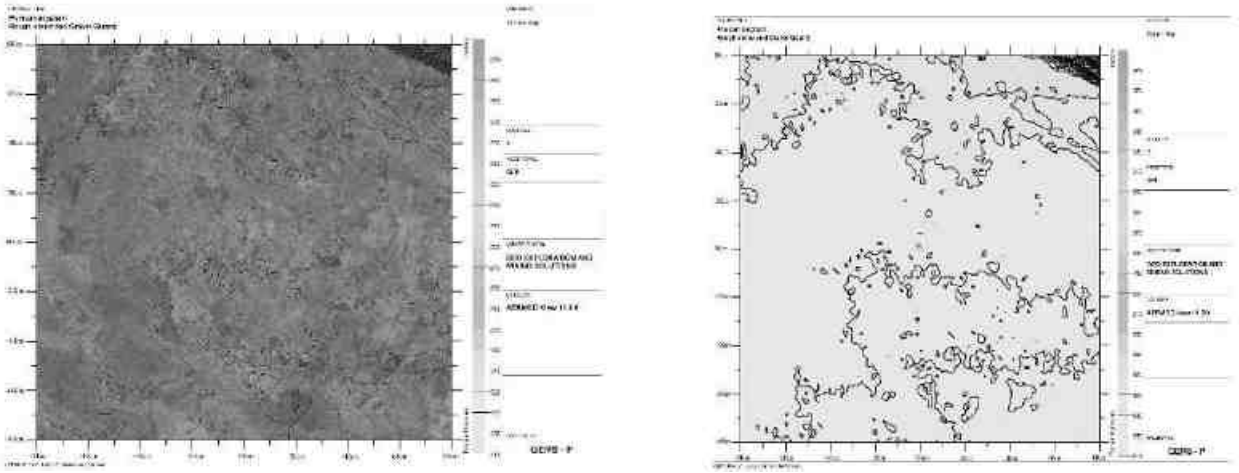


FIGURE 4.2: PREDICTED INCREMENTAL CONCENTRATION OF PM_{10}

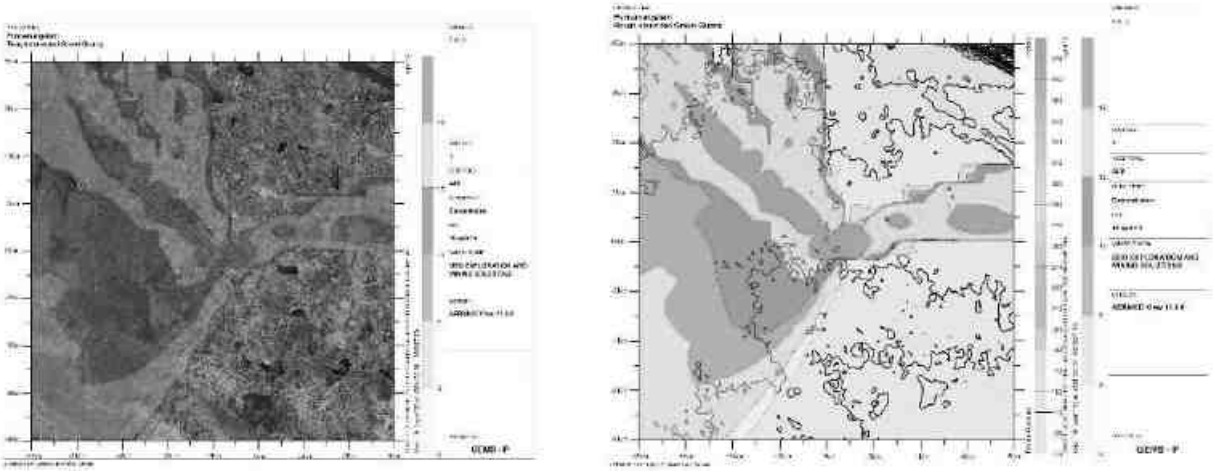


FIGURE 4.3: PREDICTED INCREMENTAL CONCENTRATION OF PM_{25}

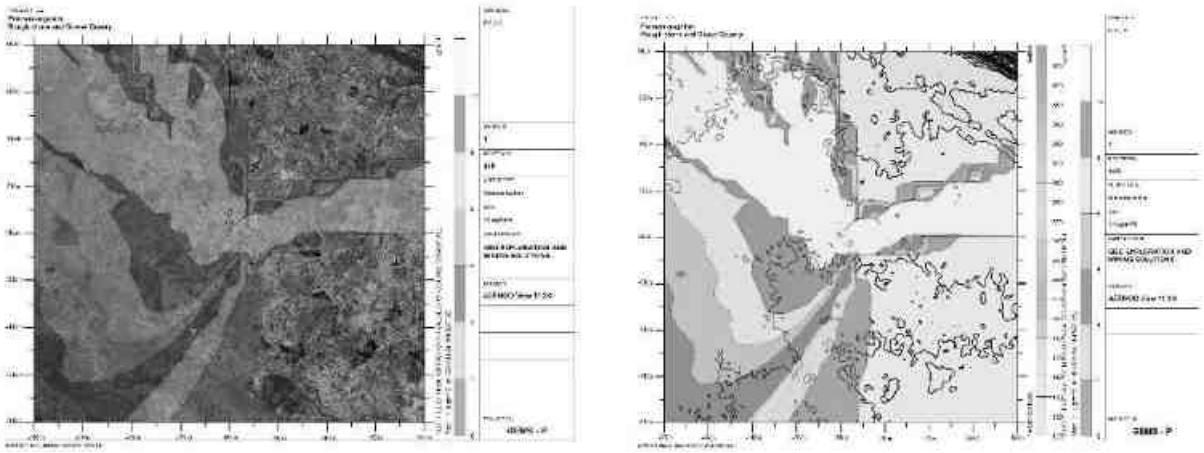


FIGURE 4.4: PREDICTED INCREMENTAL CONCENTRATION OF SO_2

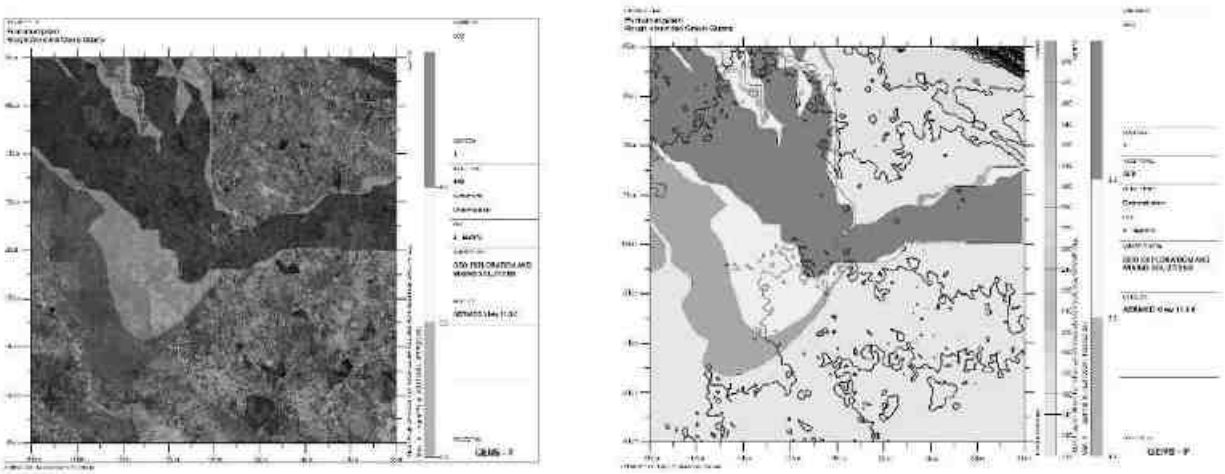


FIGURE 4.5: PREDICTED INCREMENTAL CONCENTRATION OF NO_x

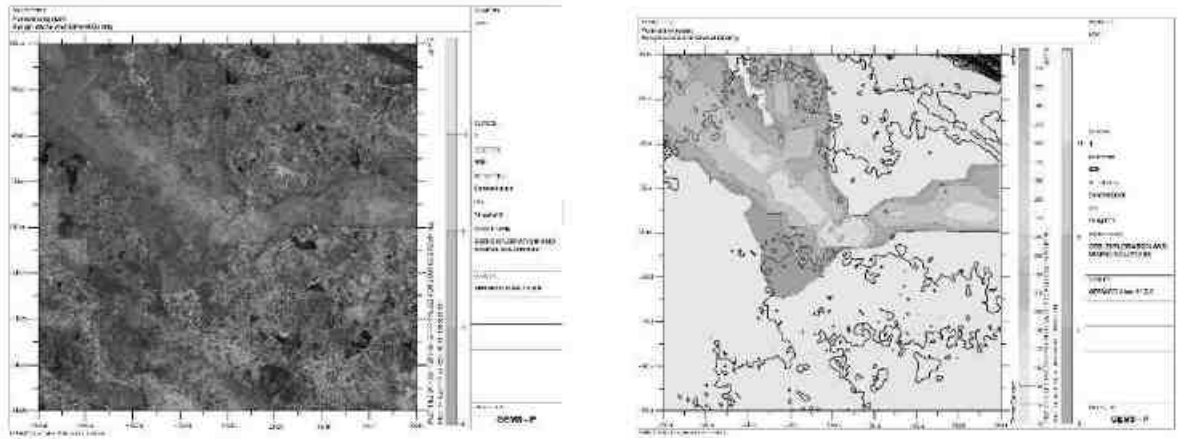
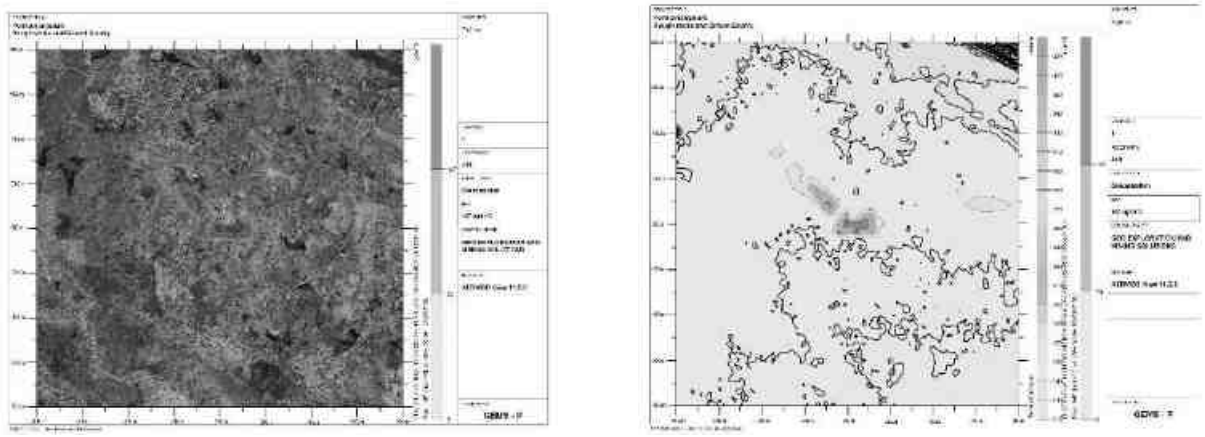


FIGURE 4.6: PREDICTED INCREMENTAL CONCENTRATION OF FUGITIVE DUST



4.3.2.1 Model Results

The post project Resultant Concentrations of PM10, PM2.5, SO2& NOX (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	9°53'2.08"N 77°56'55.02"E	34	111	20.80	19.83	40.63
AAQ2	9°53'18.98"N 77°56'53.88"E	-2	635	19.91	19.21	39.12
AAQ3	9°53'45.25"N 77°58'12.99"E	2436	1443	20.85	0	20.85
AAQ4	9°52'19.41"N 77°56'4.45"E	-1516	-1205	18.95	17.39	36.34
AAQ5	9°50'34.48"N 77°56'6.51"E	-1456	-4468	20.73	4.00	24.73
AAQ6	9°54'16.67"N 77°53'44.50"E	-5819	2412	20.30	13.50	33.8
AAQ7	9°52'48.60"N 77°58'55.80"E	3753	-315	18.89	2.41	21.3
AAQ8	9°56'19.80"N 77°55'4.63"E	-3355	6226	19.68	9.64	29.32

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	9°53'2.08"N 77°56'55.02"E	34	111	41.53	11.90	53.43
AAQ2	9°53'18.98"N 77°56'53.88"E	-2	635	41.60	11.25	52.85
AAQ3	9°53'45.25"N 77°58'12.99"E	2436	1443	42.85	0.37	43.22
AAQ4	9°52'19.41"N 77°56'4.45"E	-1516	-1205	39.1	10.00	49.1
AAQ5	9°50'34.48"N 77°56'6.51"E	-1456	-4468	42.41	3.20	45.61
AAQ6	9°54'16.67"N 77°53'44.50"E	-5819	2412	44.03	7.00	51.03
AAQ7	9°52'48.60"N 77°58'55.80"E	3753	-315	38.37	1.77	40.14
AAQ8	9°56'19.80"N 77°55'4.63"E	-3355	6226	39.79	5.09	44.88

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	9°53'2.08"N 77°56'55.02"E	34	111	7.60	5.42	13.02
AAQ2	9°53'18.98"N 77°56'53.88"E	-2	635	6.59	5.03	11.62
AAQ3	9°53'45.25"N 77°58'12.99"E	2436	1443	6.75	0	6.75
AAQ4	9°52'19.41"N 77°56'4.45"E	-1516	-1205	6.44	4.06	10.5
AAQ5	9°50'34.48"N 77°56'6.51"E	-1456	-4468	7.81	0	7.81
AAQ6	9°54'16.67"N 77°53'44.50"E	-5819	2412	6.75	2.39	9.14
AAQ7	9°52'48.60"N 77°58'55.80"E	3753	-315	7.13	0	7.13
AAQ8	9°56'19.80"N 77°55'4.63"E	-3355	6226	7.45	0.76	8.21

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	9°53'2.08"N 77°56'55.02"E	34	111	21.86	14.79	36.65
AAQ2	9°53'18.98"N 77°56'53.88"E	-2	635	19.96	14.12	34.08
AAQ3	9°53'45.25"N 77°58'12.99"E	2436	1443	19.98	0	19.98
AAQ4	9°52'19.41"N 77°56'4.45"E	-1516	-1205	19.95	7.30	27.25
AAQ5	9°50'34.48"N 77°56'6.51"E	-1456	-4468	22.39	0	22.39
AAQ6	9°54'16.67"N 77°53'44.50"E	-5819	2412	22.36	0	22.36
AAQ7	9°52'48.60"N 77°58'55.80"E	3753	-315	19.91	0	19.91
AAQ8	9°56'19.80"N 77°55'4.63"E	-3355	6226	22.83	0	22.83

TABLE 4.7: INCREMENTAL & RESULTANT GLC OF FUGITIVE DUST

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline Fugitive (µg/m^3)	Incremental value of Fugitive due to mining (µg/m^3)	Total Fugitive (µg/m^3) (5+6)
AAQ1	9°53'2.08"N 77°56'55.02"E	34	111	62.13	147	209.13
AAQ2	9°53'18.98"N 77°56'53.88"E	-2	635	68.35	34	102.35
AAQ3	9°53'45.25"N 77°58'12.99"E	2436	1443	67.56	0	67.56
AAQ4	9°52'19.41"N 77°56'4.45"E	-1516	-1205	61.63	0	61.63
AAQ5	9°50'34.48"N 77°56'6.51"E	-1456	-4468	57.66	0	57.66
AAQ6	9°54'16.67"N 77°53'44.50"E	-5819	2412	65.42	0	65.42
AAQ7	9°52'48.60"N 77°58'55.80"E	3753	-315	63.61	0	63.61
AAQ8	9°56'19.80"N 77°55'4.63"E	-3355	6226	68.5	0	68.5

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 µg/m3 for PM10, SO2 & NOX respectively. By adopting suitable mitigation measures, the pollutant levels in the atmosphere can be further being controlled.

4.3.4. Common Mitigation Measures for Proposed Project

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

Advantages of Wet Drilling: -

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

Blasting –

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

Haul Road & Transportation –

- Water will be sprinkled on haul roads twice a day to avoid dust generation during transportation
- Transportation of material will be carried out during day time and material will be covered with taurpaulin

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

Green Belt –

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

Occupational Health –

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

4.4 Noise Environment

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.

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

Where:

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

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

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

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)	55.4	55.9	46.6	48.1	46.2	44.9	46.7	43.6
Incremental Value dB(A)	60.1	54.1	31.2	28.1	27.0	24.5	32.1	24.5
Total Predicted Noise level dB(A)	61.4	58.1	46.7	48.1	46.3	44.9	46.8	43.7
NAAQ Standards	**Industrial** **Day Time- 75 dB (A)** **Night Time- 70 dB (A)** **Residential** **Day Time– 55 dB (A)** **Night Time- 45 dB (A)**							

4.4.2 Common Mitigation Measures for Proposed Project

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

- Time intervals for each quarries 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.

4.4.3 Ground Vibrations

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

Another impact due to blasting activities is fly rocks. These may fall on the houses or agricultural fields nearby the mining lease area and may cause injury to persons or damage to the structures. Nearest habitation from the 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

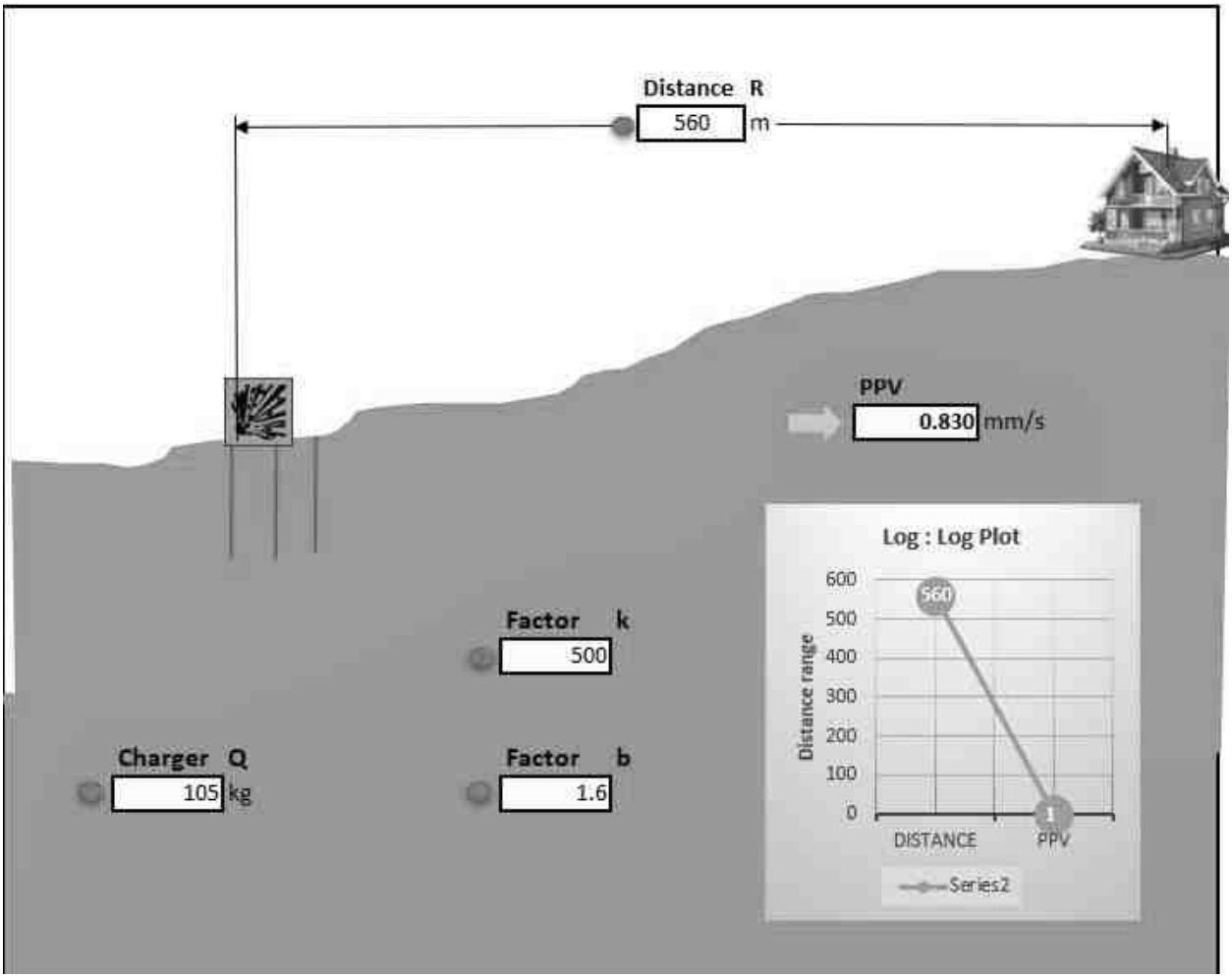
Q = maximum instantaneous charge (kg)

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	105	560	0.830



From the above, the charge per blast of 105 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 should be ensured that the explosives used for blasting at one blast should not exceed more than 28 Kg at any point of time. However, as per statutory requirement control measures will be adopted to avoid the impacts due to ground vibrations and fly rocks due to blasting.

4.4.3.1 Common Mitigation Measures for Respective Proposed Project

- The blasting operations in the cluster quarries are carried out without deep hole drilling and blasting using delay detonators, which reduces the ground vibrations;
- Proper quantity of explosive, suitable stemming materials and appropriate delay system will be adopted to avoid overcharging and for safe blasting;

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

4.5 Impact on Biological Environment

The developmental programs, policies, and projects operated or managed by government or private bodies can cause potentially significant changes in the physical, biological, and socio-economic environment. In some cases, the changes may be beneficial while in others it may be detrimental to the environment. Accordingly, 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 upon the floral and faunal status of the project area.

4.5.1. Impact on Flora

The proposed mine lease area is plain terrain 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.

4.5.1.1. 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 the loading of the truck, dust generation will be likely. This shall be a temporary effect and not anticipated to affect the surrounding vegetation significantly.
4. Most of the land in the buffer area is undulating terrain with croplands, grass patches, and small shrubs. Hence, there will be no effect on the flora of the region.

4.5.2 Mitigation Measures

4.5.2.1. Green Belt Development Plan

Greenbelt means the planting of special types of plants suitable to that particular agroclimatic zone and soil characteristics in a place that will make the area cooler, reduce air pollution, prevent soil erosion, and further improve the soil fertility status. A green belt around the periphery of the boundary and roadside will be created to avoid erosion of soil, prevention of landslides, and minimize air pollution and noise pollution in the project area. Green plants are capable of absorbing air pollutants and forming sinks for pollutants. Leaves with their vast area in a tree crown, absorb pollutants on their surface, effectively reducing their concentration and noise level in the ambient.

4.5.3.2.Proposed Green Belt

Extensive green belt development will be started during the construction phase, which will continue till the operation of the plant. About 1500-2000 trees will be planted per hectare all around the plant, approach roads, and township premises. Locally available types of trees which are resistant to pollutants will be planted. In addition to the above, all open spaces available within the premises will be developed as nurseries, parks, gardens, and other forms of greenery. 5 m wide greenbelt will be developed along the plant premises, as per land available.

4.5.3.3. Design of Green Belt

The present plan comprises the details of field investigations. Plant species for greenbelt development are selected as per CPCB guidelines. The green belt will be developed along the periphery of the Proposed Rough stone and gravel quarry. The greenbelt development plan has been formulated considering the parameters such as climate, soil types, topography, etc.

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.

TABLE 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

(*Source: Term of Reference-ToR)

TABLE 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

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

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. These species need to be planted along the periphery of the lease area to absorb fugitive emissions and noise levels which are generated during mining activities.

Some of the important aspects to be considered are:

- ✓ Planting of trees in each row will be in staggered orientation.
- ✓ In the front row, shrubs will be grown.
- ✓ Since the trunks of the tall trees are generally devoid of foliage, it will be useful to have shrubs in front of the trees so as to give coverage to this portion.

- ✓ The spacing between the trees will be maintained slightly less than the normal spaces, so that the trees may grow vertically and slightly increase the effective height of the green belt.

TABLE 4.13: GREENBELT DEVELOPMENT PLAN

PROPOSAL FOR P1 – Thiru. P. Thirugnanasambanthan				
Year	**No. of trees proposed to be planted**	**Survial %**	**Area to be planted**	**Name of the species**
I	It is proposed to plant 3000 **Nos** of trees in the 1st year	80%	Safety barrier, Un utilized areas and nearby village roads	Neem, Pongamia pinnata, Casuarina, etc

TABLE 4.14: 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.	50	50	50	50	50	60	60	60	60	60	@200 Rs Per sapling	1,10,000/-
	Cost	5000	5000	5000	5000	5000	6000	6000	6000	6000	6000		
Plantation in the quarried out in around the quarried out top benches and approach road	Nos.	75	75	75	75	75	75	75	75	75	75		1,50,000/-
	Cost	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500		
TOTAL													**2,60,000/-**

Source: approved Mining Plan

4.5.4. Anticipated Impact on Fauna

- Since the terrestrial fauna in the study area is distributed away from the mine site, the impacts of project are likely to be much low on 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 the faunal group due to ground vibration and increase in noise level will be minimized 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.

4.5.4.1. Measures for protection and conservation of wildlife species

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

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

4.5.5. 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, Odai, Vaari, Canal, Channel, lakes, ponds, tanks, and farmer sites. There are few small seasonal water bodies located in the study area. There is no water during the study period. Aquatic biodiversity is not observed in the study area. There is no impact on fish habitats and the food WEB/ food chain in the water body and Reservoir.

TABLE NO 4.15. ECOLOGICAL IMPACT ASSESSMENTS OF PONNAMANGALAM VILLAGE, MADURAI DISTRICT, TAMIL NADU.

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

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

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

TABLE 4.16: ANTICIPATED IMPACT OF ECOLOGY AND BIODIVERSITY

Sl. No	Aspect Description	Likely Impacts on Ecology and Biodiversity (EB)	Impact Consequence - Probability Description / Justification	Significance	Mitigation Measures
Pre-Mining Phase					
1	Uprooting of vegetation of lease area	Site specific loss of common floral diversity (Direct impact)	Site possesses common floral (not trees) species. Clearance of these species will not result in loss of flora	Less severe	No immediate action required. However, Greenbelt /plantation will be developed in project site and in periphery of the project boundary, which will improve flora and fauna diversity of the project area.
		Site specific loss of associated faunal diversity (Partial impact)	Site supports only common species, which use wide variety of habitats of the buffer zone reserve forest area. So, there is no threat of faunal diversity.		
		-Loss of Habitat (Direct impact)	Site does not form Unique / critical habitat structure for unique flora or fauna.		
Mining phase					
2	Excavation of mineral using machine and labours, Transportation activities will generate noise.	Site-specific disturbance to normal faunal movements at the site due to noise. (Partial impact)	Site does not form unique / critical habitat structure for unique flora or fauna.	Less severe	Mining activity should not be operated after 5PM. Excavation of dump and transportation work should stop before 7PM.

3	Vehicular Movement for transportation of materials will result in generation of dust (SPM) due to haul roads and emission of SO2, NO2, CO etc.	Impact on surrounding agriculture and associated fauna due to deposition of dust and Emission of CO. (Indirect impact)	Impact is less as the agricultural land far from core area.	Less severe	All vehicles will be certified for appropriate Emission levels. More plantation has been suggested Upgrade the vehicles with alternative fuel such biodiesel, methanol and biofuel around the mining area.

4.6 Socio Economic Impats

4.1 Construction Phase

Anticipated Impacts:

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

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

♣ Population influx during the construction phase can introduce various water and vector borne diseases which can lead to various unhygienic health problems in the area by disturbing the existing sanitation infrastructure.

♣ Rapid diverse population influx at the project site can create unusual behavioural activity such as worker-community conflicts, increase violence such as theft/stabbing and increased consumption of drugs/alcohol within the area.

♣ Impacts on the health of nearby villagers can be envisaged due to the transportation activities leading to short term exposure of fugitive dust, resulting in various acute diseases such as increased eye irritation, nausea, headache etc.

Mitigation measures:

♣ Deploying of mobile toilets or the construction of temporary toilets will be done near to the construction site with the adequate water supply.

♣ Awareness programme will be conducted before the monsoon season regarding the spread of water borne/ vector diseases.

♣ Mosquito repellents will be provided in the nearby villages and at construction site to avoid the spread of diseases.

♣ To overcome behavioural impact, proper site in charge with timely supervision will be done. In advance, facilities with equipped medical and safety services will be provided to take a control over the incident/violence if any caused.

♣ To overcome behavioural impact, supervision will be done by site in charge. In advance, emergency cell will be formed with fully equipped communication system, medical and safety services to take control over the incident/violence caused.

4.2 Operation Phase:

Anticipated Impacts:

♣ Long term exposure to the pollutants such as PM, SO2 and NO2 Cement dust have a potential to create health impacts such as risk of cardiovascular and respiratory disease, eye irritation, bronchitis, lung damage, increased heart ailments, etc.

♣ Other impacts, associated with the applied for rough stone and gravel quarry Project will create a positive impact as it will result in the overall development of the area in respect to the infrastructure development, educational growth, health facilities etc., as a part of the CSR activity.

Mitigation Measures:

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

♣ For emergency, proposed to develop an occupational health centre for its employees and nearby villagers.

4.3 Impact Evaluation:

TABLE 4.17. IMPACT EVALUATION IMPACT EVALUATION IS GIVEN IN TABLE BELOW

Impact Evaluation Element	Impact on socio economics due to the applied for Ponnamangalam rough stone and Gravel cluster quarry over an extent of 4.70.0 ha of Patta lands of Ponnamangalam Village, Thirumangalam Taluk, Madurai District, Tamil Nadu State.			
Potential Effect/ Concern	Proposed project will provide direct & indirect employment opportunities to the local residents, which will help to increase their earning and better living standard as well as further up-liftment of socio-economic status of the area.			
Characteristics of Impacts				
Nature	Positive		Nagative	Netural
	✓			
Type	Direct	Indirect	Cumulative	
			✓	
Extent	Project area	Local	Zonal	Regional

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

4.7 Occupational Health and Safety

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

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

4.7.1 Respiratory Hazards

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

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

4.7.2 Noise

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

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

4.7.3 Physical Hazards

The following measures are proposed for control of physical hazards

- Specific personnel training on work-site safety management will be taken up;
- Work site assessment will be done by rock scaling of each surface exposed to workers to prevent accidental rock falling and / or landslide, especially after blasting activities;
- Natural barriers, temporary railing, or specific danger signals will be provided along rock benches or other pit areas where work is performed at heights more than 2m from ground level;
- Maintenance of yards, roads and footpaths, providing sufficient water drainage and preventing slippery surfaces with an all-weather surface, such as coarse gravel will be taken up

4.7.4 Occupational Health Survey

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

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

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

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

4.8 Mine Waste Management

No waste is anticipated from any of the proposed quarries.

4.9 Mine Closure

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

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

- To create a productive and sustainable after-use for the site, acceptable to mine owners, regulatory agencies, and the public

- To protect public health and safety of the surrounding habitation
- To minimize environmental damage
- To conserve valuable attributes and aesthetics
- To overcome adverse socio-economic impacts.

4.9.1 Mine Closure Criteria

The criteria involved in mine closure are discussed below:

4.9.1.1 Physical Stability

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

4.9.1.2 Chemical Stability

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

4.9.1.3 Biological Stability

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

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

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

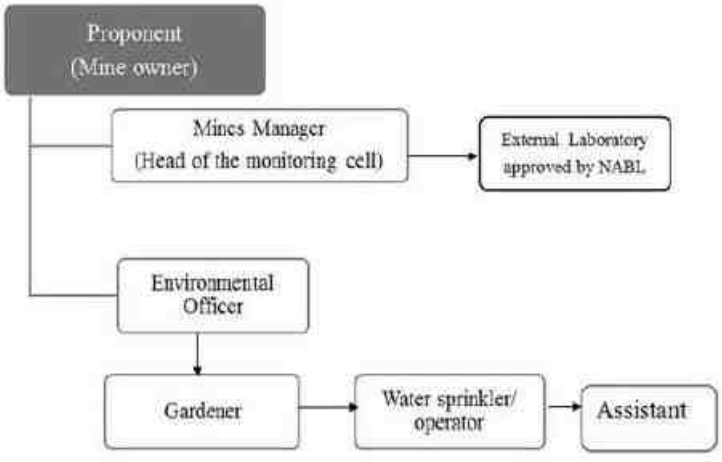
The monitoring and evaluation of environmental parameters indicates potential changes occurring in the environment, which paves way for implementation of rectifying measures wherever required to maintain the status of the natural environment. Evaluation is also a very effective tool to judge the effectiveness 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	2 Locations (1 Core & 1 Buffer)	24 hours	Once in 6 months	Fugitive Dust, $PM_{2.5}$, PM_{10}, SO_2 and NO_x.
2	Meteorology	At mine site before start of Air Quality Monitoring & IMD Secondary Data	Hourly / Daily	Continuous online monitoring	Wind speed, Wind direction, Temperature, Relative humidity and Rainfall
3	Water Quality Monitoring	2 Locations (1SW & 1 GW)	-	Once in 6 months	Parameters specified under IS:10500, 1993 & CPCB Norms
4	Hydrology	Water level in open wells in buffer zone around 1 km at specific wells	-	Once in 6 months	Depth in bgl
5	Noise	2 Locations (1 Core & 1 Buffer)	Hourly – 1 Day	Once in 6 months	Leq, Lmax, Lmin, Leq Day & Leq Night
6	Vibration	At the nearest habitation (in case of reporting)	–	During blasting Operation	Peak Particle Velocity
7	Soil	2 Locations (1 Core & 1 Buffer)	–	Once in six months	Physical and Chemical Characteristics
8	Greenbelt	Within the Project Area	Daily	Monthly	Maintenance

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

6.4 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 proposed quarry in cluster for the mining plan period is Rs 7,60,000/-.

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.7,60,000/-
	Total	**Rs. 7,60,000/-**

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. Items identified by public and other stakeholders will be incorporated after Public Hearing.

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

7.1. Public Consultation:

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

7.2 Risk Assessment

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

		Improper charging, stemming & Blasting/ fining of blast holes Vibration due to movement of vehicles	▪ 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 While reversal & overtaking of vehicle Operator of truck leaving his cabin when it is loaded.	▪ Before commencing work, drivers personally check the dumper/truck/tipper for oil(s), fuel and water levels, tyre inflation, general cleanliness and inspect the brakes, steering system, warning devices including automatically operated audio-visual reversing alarm, rear view mirrors, side indicator lights etc., are in good condition. ▪ Not allow any unauthorized person to ride on the vehicle nor allow any unauthorized person to operate the vehicle. ▪ Concave mirrors should be kept at all corners ▪ All vehicles should be fitted with reverse horn with one spotter at every tipping point ▪ Loading according to the vehicle capacity ▪ Periodical maintenance of vehicles as per operator manual.
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.

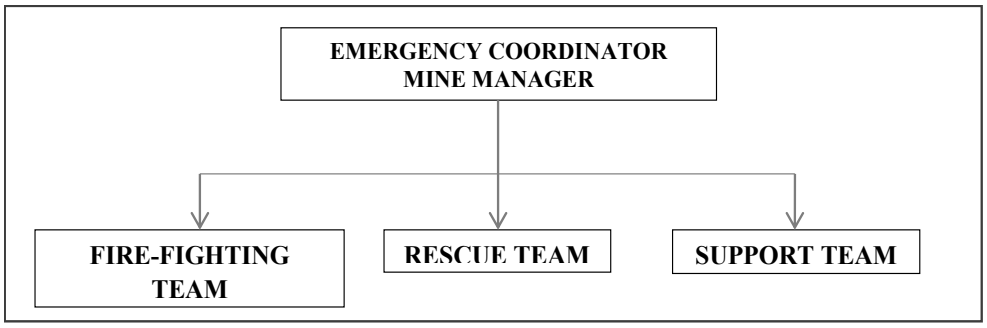
The objective of the Disaster Management Plan is to make use of the combined resources of the mine and the outside services to achieve the following:

- 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 FOR P1



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

There are two proposed and two existing quarries, one abandoned quarry falls in the cluster. The list of quarries is as below –

TABLE 7.3: LIST OF QUARRIES WITHIN 500 METER RADIUS FROM THIS PROPOSAL

PROPOSED QUARRIES				
CODE	**Name of the Proponent and Address**	**S.F. Nos, Village & Taluk**	**Extent in Ha**	**Status**
P1	**Thiru.P.Thirugnanasambanthan,** S/o. Palanisamy, Yathavar Street, Iravathanallur, Madurai District-625 009**.** Tamil Nadu State.	92/3F, etc of Ponnamangalam Village, Thirumangalam Taluk, Madurai District	**4.70.0 ha**	Obtained ToR vide, Lr.No. SEIAA-TN/F.No.9069/SEAC/ToR-1172/2022Dated:13.06.2022
P2	**Thiru. S. Vishnuvarthan** S/o, Soundarapandiyan, No.6/315, Madurai Main Road, Chekkanurani, Madurai District – 625 514	86/3, etc., Ponnamangalam Village, Thirumangalam Taluk, Madurai	2.99.50 Ha	EC Granted
	Total Extent		**7.69.5 Ha**	
EXISTING QUARRIES				
CODE	**Name of the Proponent and Address**	**S.F. Nos, Village & Taluk**	**Extent in Ha**	**Lease Period**
E1	**Vigensh. S**	1/1(P) (1.41.7) and 1/2A (1.94.5) J Alankulam, Thirumangalam Taluk, Madurai	3.36.2	ROC.NO.289/2016 dt 10.08.2017 11.08.2017 to 10.08.2022
E2	**Vetrivel. I**	1/1 (P), J.Alankulam, Thirumangalam Taluk, Madurai	1.21.5	ROC.NO.430/2018 dt 26.02.2019 08.03.2019 to 07.03.2024
	Total Extent		**4.57.7**	
ABANDONED/EXPIRED QURRIES				
CODE	**Name of the Proponent and Address**	**S.F. Nos, Village & Taluk**	**Extent in Ha**	**Lease Period**
Ex-1	**Thiru. K. Raman**	81/5, 6, 7, 8, 92/3A1, 92/3A2 etc, Ponnamangalam Village, Thirumangalam Taluk, Madurai	**3.27.5 Ha**	ROC.NO.1021/08 dt 05.08.2010 14.10.2010 to 13.10.2015
	Total Extent		**3.27.5**	
TOTAL CLUSTER EXTENT			**12.27.2 Ha**	

Source :500m Cluster Letter by AD,G&M, Madurai.

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"

TABLE 7.4: SALIENT FEATURES OF THE PROPOSED PROJECTS IN CLUSTER

SALIENT FEATURES OF PROPOSAL "P1"		
Name of the Mine	**Thiru. P. Thirugnanasambanthan** Rough Stone & Gravel Quarry Project	
Land Type	It is a Patta lands, Registered in the name of Tmt. P. Valliyammal, vide Patta Nos. 1189 & 1362 and Thiru. P. Ketharnath, vide Patta Nos. 1230 & 1195. The applicant has obtained consent from the Pattadars.	
S.F. Nos	92/3F, 92/3G, 92/3I2, 92/3I3, 92/3J, 92/3K1, 92/3K2, 92/3K3 etc.,	
Extent	4.70.0 Ha	
Toposheet No	58 G/13	
Latitude	09°52'53.05"N to 09°53'03.48"N	
Longitude	77°56'49.81"E to 77°56'58.23"E	
Highest elevation	145m AMSL	
Previous quarry operation details	It is a fresh lease application	
Geological Reserves	Rough Stone	Gravel
	21,15,315m^3	94,014m^3
Mineable Reserves	Rough Stone	Gravel
	7,32,635m^3	73,686m^3
Proposed production for First Five years upto the depth of 47m as per ToR	3,68,290 m^3	73,686m^3
Proposed production for Second Five years upto the depth of 47m as per ToR	3,64,345 m^3	
Mining Plan Period / Lease Period	10 Years	
Proposed Depth as per ToR for 10 years	47m	
Ultimate Pit Dimension	Pit 1: 200m(L) x 108m (W) x47m(D) Pit 2: 98m(L) x 114m (W) x47m(D) Pit 3: 59m(L) x 69m (W) x47m(D)	
Water Level in the surrounds area	The Water table is found at a depth of 73m in summer and at 68m in rainy seasons.	
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Topography	The lease applied area is exhibits flat terrain. The area has gentle sloping towards Western side. The altitude of the area is 145m (max) above Mean Sea level. The area is covered by 2m thickness of Gravel formation followed by Massive Biotite – Gneissic Rock which is clearly inferred from the existing quarry pits.	
Machinery proposed	Jack Hammer	9
	Compressor	2
	Excavator with Bucket and Rock Breaker	2
	Tippers	6
Blasting	Usage of Slurry Explosive with MSD detonators	
Manpower Deployment	48 Nos	
Total Project Cost	Project Cost	Rs. 64,36,000/-
	EMP Cost	Rs. 7,60,000/-
	Total	Rs. 71,96,000/-
CER Cost	Rs.10,00,000/-	
SALIENT FEATURES OF PROPOSAL "P2"		
Name of the Mine	**Thiru.S. Vishnuvarthan** Roughstone and gravel quarry	
S.F. No.	86/3	
Extent	2.99.5 Ha	
Previous quarry operation details	It is a fresh lease application	

Proposed Depth	32m	
Geological Resources	Rough Stone	Gravel
	14,91,750m^3	59,670m^3
Mineable Reserves	Rough Stone	Gravel
	6,24,200m^3	49,680m^3
Proposed production for five years	4,92,472m^3	49,680m^3
Mining Plan Period / Lease Period	5 Years	
Toposheet No	58 - G/13	
Latitude	09°53' 16.95"N to 09° 53' 24.70"N	
Longitude	77° 56' 56.57"E to 77° 57' 03.84"E	
Manpower Deployment	18 Nos	
Total Project Cost	Rs. 65,70,000/-	
CER Cost	Rs.5,00,000/-	

SALIENT FEATURES OF EXISTING "E1"		
Name of the Mine	**Thiru. S. Vignesh** Rough stone and Gravel quarry	
Land Type	It is a Patta land	
S.F. No.	1/1(P) & 1/2A	
Extent	3.36.2 Ha	
Geological Resources	Rough Stone	Gravel
	6,41,618	-
Mineable Reserves	Rough Stone	Gravel
	1,10,000	-
Proposed production for five years	1,10,000	-
Mining Plan Period / Lease Period	5 Years	
SALIENT FEATURES OF EXISTING "E2"		
Name of the Mine	**Thiru. I. Vetrivel** Rough stone and Gravel quarry	
Land Type	It is a Patta land	
S.F. No.	1/1(P)	
Extent	1.21.5 Ha	
Geological Resources	Rough Stone	Gravel
	1,72,285	-
Mineable Reserves	Rough Stone	Gravel
	85,000	-
Proposed production for five years	85,000	
Mining Plan Period / Lease Period	5 Years	

Source: Approved Mining Plan of the respective proposals

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

Quarry	Proposed Production m^3	Per Year Production in m^3	Per Day Production in m^3	Number of Lorry Load Per Day @ $12m^3$ per load
P1	7,32,635	73,263	244	20 Trips /Day
P2	4,92,472	98,494	328	27 Trips /Day
Total	**12,25,107**	**1,71,757**	**572**	**47 Trips /Day**
E1	1,10,000	22,000	73	6 Trips /day
E2	85,000	17,000	57	5 Trips /day
Total	**1,95,000**	**39,000**	**130**	**11Trips /Day**
Grant Total	**14,20,107**	**2,10,757**	**702**	**58 Trips /Day**

TABLE 7.6: CUMULATIVE PRODUCTION OF GRAVEL IN CLUSTER

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	73,686	24,562	82	7 Trips /day
P2	49,680	16,560	55	5 Trips /day
TOTAL	**1,23,366**	**41,122**	**137**	**12 Trips/ day**
E1	-	-	-	-
E2	-	-	-	-
Total	-	-	-	-
Grand total	**1,23,366**	**41,122**	**137**	**12 Trips/ day**

Source: Approved Mining plans of the respective projects

Based on the above production quantities the emissions due to various activities in all the 2 proposed quarry and 2 existing quarries 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: EMISSION ESTIMATION FROM CLUSTER

EMISSION ESTIMATION FOR QUARRY "P1"- Thiru. P. Thirugnanasambanthan				
	Activity	**Source type**	**Value**	**Unit**
Estimated Emission Rate for PM_{10}	Drilling	Point Source	0.099601923	g/s
	Blasting	Point Source	0.002371118	g/s
	Mineral Loading	Point Source	0.045528630	g/s
	Haul Road	Line Source	0.002502175	g/s/m
	Overall Mine	Area Source	0.075976375	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.001391894	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000139841	g/s
EMISSION ESTIMATION FOR QUARRY "P2"- Thiru.S. Vishnuvarthan				
	Activity	**Source type**	**Value**	**Unit**
Estimated Emission Rate for PM_{10}	Drilling	Point Source	0.102857774	g/s
	Blasting	Point Source	0.002784839	g/s
	Mineral Loading	Point Source	0.045011818	g/s
	Haul Road	Line Source	0.002500015	g/s/m
	Overall Mine	Area Source	0.063108564	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.001234418	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000082382	g/s

EMISSION ESTIMATION FOR QUARRY "E1"- Thiru. S. Vignesh				
	Activity	**Source type**	**Value**	**Unit**
Estimated Emission Rate for PM_{10}	Drilling	Point Source	0.065605612	g/s
	Blasting	Point Source	0.000293981	g/s
	Mineral Loading	Point Source	0.038148604	g/s
	Haul Road	Line Source	0.002485574	g/s/m
	Overall Mine	Area Source	0.062629824	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.000254697	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000018207	g/s
EMISSION ESTIMATION FOR QUARRY "E2"- Thiru. I. Vetrivel				
	Activity	**Source type**	**Value**	**Unit**
Estimated Emission Rate for PM_{10}	Drilling	Point Source	0.060722391	g/s
	Blasting	Point Source	0.000199691	g/s
	Mineral Loading	Point Source	0.037177594	g/s
	Haul Road	Line Source	0.002484798	g/s/m
	Overall Mine	Area Source	0.041555814	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.000178122	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000005084	g/s

Source: Emission Formula

TABLE 7.8: INCREMENTAL & RESULTANT GLC WITHIN CLUSTER

PM_{10} in $\mu g/m^3$	
Location	AAQ1 – CORE
Background (average)	41.53
Highest Incremental	11.90
Resultant	53.43
NAAQ Norms	100 $\mu g/m^3$
PM2.5 in $\mu g/m^3$	
Background (average)	20.80
Highest Incremental	19.83
Resultant	40.63
NAAQ Norms	80 $\mu g/m^3$
SO_2 in $\mu g/m^3$	
Location	AAQ1 – CORE
Background (average)	7.60
Highest Incremental	5.42
Resultant	13.02
NAAQ Norms	80 $\mu g/m^3$
NO_x in $\mu g/m^3$	
Location	AAQ1 – CORE
Background (average)	21.86
Incremental	14.79
Resultant	36.65
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 7.9: 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)
N1	55.4	60.1	61.4	Residential (A) Day Time– 55 dB Night Time- 45 dB (A)
N2	55.9	54.1	58.1	
N3	46.6	31.2	46.7	
N4	48.1	28.1	48.1	
N5	46.2	27.0	46.3	
N6	44.9	24.5	44.9	
N7	46.7	32.1	46.8	
N8	43.6	24.5	43.7	

Source: Lab Monitoring Data

The incremental noise level is found within the range of 8.5– 43.4 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 2proposed quarry and 2 existing quarries within cluster are anticipated due to operation of Mining Machines like Excavators, drilling and blasting, transportation vehicles, etc. However, the major source of ground vibration from the all the 2 proposed quarry and 2 existing quarries is blasting. The major impact of the ground vibrations is observed on the domestic houses located in the villages nearby the mine lease area. The kuchha houses are more prone to cracks and damage due to the vibrations induced by blasting whereas RCC framed structures can withstand more ground vibrations. Apart from this, the ground vibrations may develop a fear factor in the nearby settlements.

Another impact due to blasting activities is fly rocks. These may fall on the houses or agricultural fields nearby the mining areas and may cause injury to persons or damage to the structures. Nearest Habitations from 2 mines respectively are as in below Table 7.9

TABLE 7.10: NEAREST HABITATION FROM EACH MINE

Location ID	Distance in Meters
Habitation Near P1	560
Habitation Near P2	570

Source: Satellite Imagery and Field Data

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 7.11: GROUND VIBRATIONS AT 2 MINES

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in m/ms
P1	209	200	7.472
P2	250	570	1.614

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 4 mines shall provide employment and revenue will be created to government

TABLE 7.12: SOCIO ECONOMIC BENEFITS FROM 4 MINES

Location Code	Employment	Project Cost	CER Cost
P1	48	Rs. 71,96,000/-	Rs.5,00,000/-
P2	18	Rs. 65,70,000/-	Rs.5,00,000/-
Total	**66**	**Rs. 1,37,66,000/-**	**Rs. 10,00,000/-**
E1	32	Rs. 67,40,000	Rs 1,34,000/-
E2	16	Rs. 30,17,000	Rs. 60,000/-
Total	**48**	**Rs. 97,57,000**	**Rs. 1,94,000/-**

Grand Total	**114**	**Rs.2,35,23,000/-**	**Rs.11,94,000/-**

A total of 114 people will get employment due to 4 mines in cluster and already employed at existing mines are 16 Nos. 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 by all the mines.

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

- 2 Proposed projects shall fund towards CER – **Rs. 10,00,000/-**
- Projects in Cluster shall fund towards CER – **Rs. 10,00,000/-**

TABLE 7.13: GREENBELT DEVELOPMENT BENEFITS FROM 3MINES & 1 EXISTING MINES

PROPOSAL FOR P1 – Thiru. P. Thirugnanasambanthan,				
Year	**No. of trees proposed to be planted**	**Survial %**	**Area to be planted**	**Name of the species**
I	It is proposed to plant 2800 **Nos** of trees in the 1st year	80%	Safety barrier, Un utilized areas and nearby village roads	Neem, Pongamia pinnata, Casuarina, etc
PROPOSAL FOR P2 – Thiru.S. Vishnuvarthan,				
I	It is proposed to plant 18**00 Nos** of trees in the 1st year	80%	Safety barrier, Un utilized areas and nearby village roads	Neem, Pongamia, pinnata, Casuarina, etc.,
EXISTING FOR E1 – Thiru. S. Vignesh				
I	It is proposed to plant 2000**Nos** of trees in the 1st year	80%	Safety barrier, Un utilized area's and nearby village roads	Neem, Pongamia Pinnata, Casuarina, Thespesia populnea etc.,
EXISTING FOR – E2- Thiru. I. Vetrivel,				
I	It is proposed to plant 700 Nos of trees in the 1st year	80%	Safety barrier, Un utilized area's and nearby village roads	Neem, Pongamia Pinnata, Casuarina, etc

Based on the Proposed Mining Plans it's anticipated that there shall growth of native species of Neem, Pongamia Pinnata, Casuarina, etc in the Cluster at a rate of 2000 Trees Planted over a period of 5 Years with Survival Rate of 80% and expected growth is around 7,300 Trees over an area of all proposed quarries and existing quarries.

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 7.14: 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

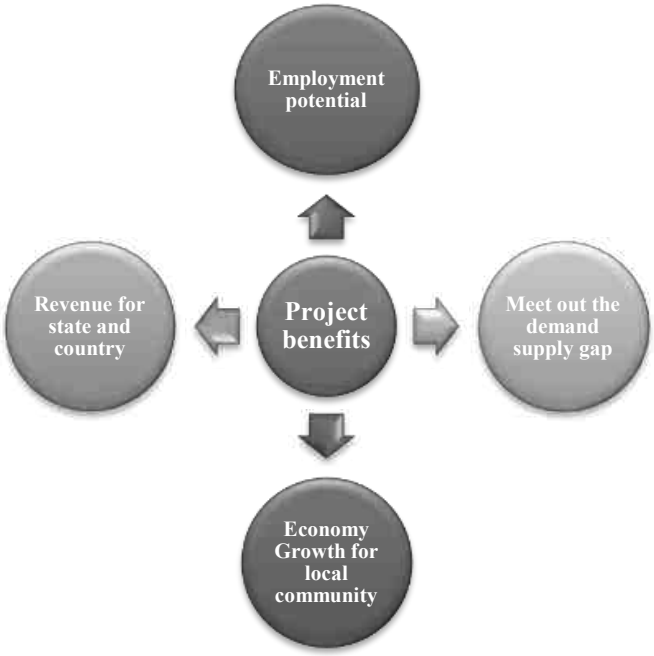
Source: Proposed by FAE's and EC

CHAPTER – 8: PROJECT BENEFITS

8.0 General

The two Proposed Projects for Quarrying Rough Stone and Gravel at Ponnamangalam Village aims to produce cumulatively 12,25,107m^3 of Rough Stone & 1,23,366m^3 of Gravel over a period of 3 Years. This will enhance the socio-economic activities in the adjoining areas and will result in the following benefits

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



8.1 Employment Potential

It is proposed to provide employment to about 66 persons for carrying out mining operations and give preference to the local people in providing employment. In addition, there will be opportunity for indirect employment to many people in the form of contractual jobs, business opportunities, service facilities etc. the economic status of the local people will be enhanced due to mining project.

8.2 Socio-Economic Welfare Measures Proposed

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

8.3 Improvement in Physical Infrastructure

The proposed project site is located in Ponnamangalam village, Thirumangalam Taluk, Madurai 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.

8.4 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.

8.5 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.,

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

CSR Cost Estimation

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

CORPORATE ENVIRONMENT RESPONSIBILITY–

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

As per para 6 (II) of the office memorandum, all the mines being a green field project & Capital Investment is ≤ 100 crores, they shall contribute of Capital Investment towards CER as per directions of EAC/SEAC and the total CER amount from the 2 proposed mines is Rs10,00,000/-.

TABLE 8.1 CER – ACTION PLAN

Code	CER
P1	Rs 5,00,000/-
P2	Rs 5,00,000/-
Total	**Rs 10,00,000/-**

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

CHAPTER – 9: ENVIRONMENTAL COST BENEFIT ANALYSIS

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

CHAPTER - 10: ENVIRONMENTAL MANAGEMENT PLAN – P1

10.1 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.

10.2 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. P. Thirugnanasambanthan**, 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.

10.3 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, Inhibition 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

10.4 Soil Management

Top Soil Management –

- There is no topsoil for this project site.

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

10.5 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 47m BGL, the water table in the area is 68m – 73 m 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

10.6 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.

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

10.7 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) of the project area to attenuate the noise and the same will be maintained	Mines Manager
Preventive maintenance of mining machinery and replacement of worn-out accessories to control noise generation	Mines Foreman
Deployment of mining equipment with an inbuilt mechanism to reduce noise	Mines Manager
Provision of earmuff / ear plugs to workers working in noise prone zones in the mines	Mining Mate
Provision of effective silencers for mining machinery and transport vehicles	Mines Manager
Provision of sound proof AC operator cabins to HEMM	Mines Manager
Sharp drill bits are used to minimize noise from drilling	Mines Foreman
Controlled blasting technologies are adopted by using delay detonators to minimize noise from blasting	Mines Manager
Annual ambient noise level monitoring shall be carried out in the project area and in surrounding villages to 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

10.8 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

10.9 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.

10.9.1 Green Belt Development Plan

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

TABLE 10.7 PROPOSED GREENBELT ACTIVITIES FOR – P1

PROPOSAL FOR P1 – Thiru. P. Thirugnanasambanthan,				
Year	**No. of trees proposed to be planted**	**Survial %**	**Area to be planted**	**Name of the species**
I	It is proposed to plant 2800 **Nos** of trees in the 1st year	80%	Safety barrier, Un utilized areas and nearby village roads	Neem, Pongamia pinnata, Casuarina, etc

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.

10.9.2 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 – P1

S.No	Botanical Name	Local Name	Importance
1.	Azadirachta indica	Neem, Vembu	Neem oil & neem products
2.	Tamarindus indica	Tamarind	Edible & Medicinal and other Uses
3.	Polyalthia longifolia	Nettilinkam	Tall and evergreen tree
4.	Borassus Flabellifer	Palmyra Palm	Tall Wind breaker tree and its fruits are edible

Source: Proposed by FAE's & EIA Coordinator

10.10 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.

10.10.1 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 10.10.1: MEDICAL EXAMINATION SCHEDULE – P1

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.		

10.10.2 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 – P1

10.10.3 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 10.10.2: LIST OF PERIODICAL TRAININGS PROPOSED FOR EMPLOYEES – P1

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

10.10.4 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 10.10.3: EMP BUDGET FOR PROPOSED PROJECT – P1

	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	47000	47000
	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 - 9 Units	225000	22500
	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	94000
	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	1904851
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	47000	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	940000	10000
	3. Progressive Closure Activity Green belt development - 500 trees per one hectare - Proposal for 2080 Trees - (720 Inside Lease Area & 2080 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)	144000	21600

		Avenue Plantation @ 300 per plant (capital) for plantation outside the lease area and @ 30 per plant maintenance (recurring)	624000	62400
	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	114900	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	4322547	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) - 48 Employees	192000	48000
	Health check up for workers will be provisioned	IME & PME Health check up @ Rs. 1000/- per employee	0	48000
	First aid facility will be provided	Provision of 2 Kits per Hectare @ Rs. 2000/-	0	9400
	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	235000	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 (1st Class / 2nd 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			**3944000**	**3241251**

In order to implement the environmental protection measures, an amount of Rs.39.44 lakhs as capital cost and recurring cost as Rs. 32.41 lakhs as recurring cost is proposed considering present market price considering present market scenario for the proposed project.

Year Wise Break Up	
1st Year	71,85,251
2nd Year	34,03,314
3rd Year	35,73,479
4th Year	37,52,153
5th Year	40,54,661
6th Year	62,29,394
7th Year	45,68,864
8th Year	47,97,307
9th Year	50,37,172
10th Year	54,03,931
Total	480 lakhs

10.11 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

Ponnamangalam Rough Stone & Gravel Quarry (Extent 12.27.20 ha) falls under "B1" category as per MoEF & CC Notification (S.O. 3977 (E)).

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

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

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

The main scope of the EIA study is to quantify the cumulative impact in the study area due to cluster quarries and formulate the effective mitigation measures for each individual leases. A detailed account of the emission sources, emissions control equipment, background Air quality levels, Meteorological measurements, Dispersion model and all other aspects of pollution like effluent discharge, Dust generation etc., have been discussed in this report. The baseline monitoring study has been carried out during the months December 2022 to February 2023 for various environmental components so as to assess the anticipated impacts of the cluster quarry projects on the environment and suitable mitigation measures for likely adverse impacts due to the proposed project is suggested individually for the respective proposed project under Chapter 10.

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

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

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

Sustainable and modern mining leads us to see positive impact of mining operation and providing consistent employment for nearly 114 people directly in the cluster and indirectly around 200 people.

As discussed, it is safe to say that the proposed quarries are not likely to cause any significant impact to the ecology of the area, as adequate preventive measures will be adopted to keep the various pollutants within the permissible limits. Green belt development around the area will also be taken up as an effective pollution mitigate

technique, as well as to serve as biological indicators for the pollutants released from the Ponnamangalam Rough Stone & Gravel Quarries (Extent: 12.27.20ha)

CHAPTER 12: DISCLOSURE OF CONSULTANTS

The Project Proponent's –

1. **Thiru. P. Thirugnanasambanthan**

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 Extent of 13.05.0 ha in Ponnamangalam Village of Thirumangalam Taluk, Madurai District, Tamil Nadu State. It is also certified that information furnished in the above EIA study are true and correct to the best of our knowledge.

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

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

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

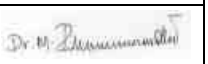
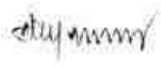
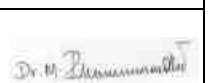
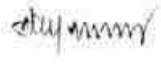
Date & Signature: 

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

Associated Team Member with EIA Coordinator:

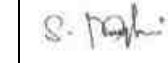
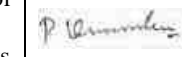
1. **Mr. S. Nagamani**
2. **Mr. Viswanathan**
3. **Mr. Santhoshkumar**
4. **Mr. S. Ilavarasan**

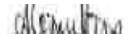
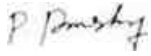
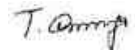
FUNCTIONAL AREA EXPERTS ENGAGED IN THE PROJECT

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	Mrs. K. Anitha	

		▪ Corporate Environment Responsibility.		
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 Cluster Quarries over an Extent of 12.27.20 ha in Ponnamangalam Village, Thirumangalam Taluk, Madurai District, Tamil Nadu State. It is also certified that information furnished in the EIA study are true and correct to the best of our knowledge.

Signature& Date: 

Name:	**Dr. M. Ifthikhar Ahmed**
Designation:	**Managing Partner**
Name of the EIA Consultant Organization:	**M/s. Geo Exploration and Mining Solutions**
NABET Certificate No & Issue Date: Validity:	**NABET/EIA/2225/RA 0276 Dated: 20-2-2023** **Valid till 06.8.2025**