DRAFT ENVIRONMENTAL IMPACT ASSESSMENT
&
ENVIRONMENT MANAGEMENT PLAN

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

THIYARANADURGAM ROUGH STONE QUARRIES

At

Thiyaranadurgam Village, Shoolagiri Taluk, Krishnagiri District, Tamil Nadu State

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

IN CLUSTER OVER AN EXTENT OF 8.26.5 Ha

NAME OF PROPOSED PROJECT PROPONENTS APPLYING IN CLUSTER

S.Nos.	Proponent Name	Extent (Ha)
1	Thiru. N.Narayanan	4.24.5
2	Thiru.T.Kesavamoorthy	4.02.0

1. Lr.No. SEIAA-TN/F.No.9104/0 ToR-1177/2022Dated:13.06.2022- Thiru. N. Narayanan
2. Lr.No. SEIAA-TN/F.No.9103/SEAC/ToR-1173/2022Dated:14.06.2022-Thiru.T. Kesavamoorthy

Environmental Consultant
GEO EXPLORATION AND MINING SOLUTIONS
Old No. 260-B, New No. 17,
Advaitha Ashram Road, Alagapuram,
Salem – 636 004, Tamil Nadu, India
Accredited for sector 1 Category 'A' ,31 & 38 Category 'B'
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Phone: 0427-2431989,
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ENVIRONMENTAL LAB

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

Baseline Monitoring Season – Dec 2022 to Feb 2023

JUNE 2023

For the easy representation the Proposed quarries are designated as below –

PROPOSED QUARRIES					
CODE	**Name of the Proponent and Address**	**S.F. Nos, Village & Taluk**	**Extent in Ha**	**G.O. No & Date**	**Status**
P1	**Thiru. N. Narayanan** S/o. Nallappa, D.No.3/38, Chikkagoundanoor, Nagamangalam Village, Denkanikottai Taluk, Krishnagiri District,	940/1 (P-2) of Thiyanadurgam Village, Shoolagiri Taluk	4.24.5ha	Roc.229/2019/Mines dated: 13.06.2019	**ToR: Lr.No. SEIAA-TN/F.No.9104/SEAC/ToR-1177/2022Dated:13.06.2022**
P2	**Thiru.T. Kesavamoorthy** S/o Thimarayappa, D.No 2/38, Varaganapalli, Nagamangalam Post, Denkanikottai Taluk, Krishnagiri District	940/1 (P-1) of Thiyanadurgam Village, Shoolagiri Taluk	4.02.0 Ha	Roc.228/2019/Mines dated: 13.06.2019	**ToR: Lr.No. SEIAA-TN/F.No.9103/SEAC/ToR-1173/2022Dated:14.06.2022**
	Total Extent		**8.26.5 Ha**		
EXISTING QUARRIES					
CODE	**Name of the Proponent and Address**	**S.F. Nos, Village & Taluk**	**Extent in Ha**		**Lease Period**
NIL					
ABANDONED/EXPIRED QURRIES					
CODE	**Name of the Proponent and Address**	**S.F. Nos, Village & Taluk**	**Extent in Ha**		**Lease Period**
NIL					
TOTAL CLUSTER EXTENT			**8.26.5 Ha**		

Note: -

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

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

TERMS OF REFERENCE (ToR) COMPLIANCE

Thiru. N. Narayanan-P1

"ToR Obtained vide Lr.No. SEIAA-TN/F.No.9104/SEAC/ToR-1177/2022Dated: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 30 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 fumish the details of quarry/quarries operated by the proponent ill the past, either in the same location or else where in the State with video and photographic evidences.	Noted and agreed
5	Cauvery North WL sanctuary lies between ESZ ard l0 km distance (6.7 km). Hence special conservation measues should be incorporated in EIA report in consultation with DFO, Hosur and firnds earmarked to be deposited with DFO.	Noted and agreed

6	If the proponent has already carried out the mining activity in the proposed mining lease area after 15.01.2016, then the proponent shall furnish the following details from AD/DD, mines a) what was the period of the operation and stoppage of the earlier mines with last work permit issued by the AD/DD mines? b) Quantity of minerals mined out c) Highest production achieved in any one year d) Detail of approved depth of mining e) Actual depth of the mining achieved earlier f) Name of the person already mined in that leases area g) If EC and CTO already obtained' the copy of the same shall be submitted h) whether the mining was carried out as per the approved mine plan (or EC if issued) with stipulated benches.	➢ It is a Fresh Lease application.
7	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.
8	he PP shall carry out Drone video survey covering the cluster, Green belt, fencing etc.,	Noted and agreed
9	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
10	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.
11	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,
12	The project proponent shall conduct the hydro-geological study considering the contour map of the	The hydro-geological study was conducted to evaluate the possible impact on the ground water

	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.	table. No significant impacts are anticipated on the water bodies around the project area. Details are discussed under Chapter No. 3.
13	The proponent shall furnish the baseline data for the environmental and ecological parameters with regard to surface water/ground water quality, air quality, soil quality & Flora/fauna including traffic/vehicular movement study.	Baseline Data were collected for One Season (Winter Monsoon) Dec to Feb 2023 as per CPCB Notification and MoEF & CC Guidelines. Details in Chapter No. 3.
14	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
15	Rain water harvesting management with recharging details along with water balance (both monsoon & non-monsoon) be submitted.	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	Proximity to Areas declared as 'Critically Polluted' (or) the Project areas which attracts the court restrictions for mining operations, should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the TNPCB (or) Dept. of Geology and Mining should	Not Applicable. Project area / Study area is not declared in 'Critically Polluted' Area and does not come under 'Aravalli Range.

	be secured and furnished to the effect that the proposed mining activities could be considered.	
19	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
20	Impact on local transport infrastructure due to the Project should be indicated.	Transportation details mentioned in Chapter -2
21	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.
22	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.
23	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
24	The Public hearing advertisement shall be published in one major National daily and onemost circulated vernacular daily.	Noted and agreed
25	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
26	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
27	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	Species are proposed to plant in the safety barrier as mentioned in the ToR appendix. Proposed species are given in the Chapter No 4

	manner.	
28	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 a Proposed Lease. Around 2200 trees are proposed to plant
29	A Disaster management Plan shall be prepared and included in the EIA/EMP Report.	Disaster management Plan details in Chapter-7
30	A Risk Assessment and management Plan shall be prepared and included in the EIA/EMP Report.	A Risk Assessment and management Plan Chapter- 7
31	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
32	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
33	The Socio-economic studies should be carried out within a 5 km buffer zone from the mining activity. Measures of socio-economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	Details are listed in Chapter:3.
34	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
35	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
36	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	It is Fresh Lease

	previous EC with the site photographs which shall duly be certified by MoEF&CC, Regional Office, Chennai (or) the concerned DEE/TNPCB.	
37	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	ln view of the Green patches seen in the north east comer and the water bodies present abutting to the proposed mine lease area. The proponent shall fumish details of Flora & Fauna present within and outside the lease applied. Further, project proponent shall explorc the possibility of leaving a safety distaDce of 120 m in the north east comer of the proposed mine lease area.Accordingly revised mine plan shall be submitted along with EIA study /EMP.	Noted and agreed
2	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 Ponnaiayr River, Kanmoi, etc.,
3	The project proponent shall fumish VAO certificate with reference to 300m radius regard to approved habitations, schools, Archaeological structures etc.	VAO certificate is Obtained
4	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
5	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
6	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.
7	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.
8	The project proponent shall study impact on fish habitats and food WEB/food chain in the water body and Reservoir.	Nearest water bodies are Ponnaiayr River, Kanmoi, etc.,
9	The Terms of Reference should specifically study impact on soil health, soil erosion. the soil physical, chemical components and microbial components.	There is Top soil in the Proposed project area, The Topsoil 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.
10	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.
11	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
12	The Environmental Impact Assessment should study on wetlands, water bodies, rivers streams, lakes and farmer sites.	Details are discussed in the Chapter No 3.
13	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,
14	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.
15	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
16	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.
17	The project proponent shall study and furnish the details on potential fragmentation impact of natural environment, by the activities.	Noted and agreed
18	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	Noted and agreed

	possible land form changes visual and aesthetic impacts.	
19	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.
20	The project proponent shall detail study on impact of mining on Reserve forests free ranging wildlife.	Noted and agreed
21	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
22	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
23	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
24	To fumish risk assessment and management plan including anticipated vulnerabilities during operational and post operational phases of Mining.	Details given in Chapter:7

25	Detailed Mine Closure Plan covering the entire mine lease period as per precise area communication order issued.	Details given in Chapter:2
26	Detailed Environment Management plan along with adaptation, mitigation & remedial strategies covering the entire mine leas€ period as per precise area communication order issued.	Details given in Chapter:10

TERMS OF REFERENCE (ToR) COMPLIANCE

Thiru.T. Kesavamoorthy-P2

"ToR Obtained vide Lr.No. SEIAA-TN/F.No.9103/SEAC/ToR-1173/2022Dated:14.06.2022

	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/Ist Class mines manager appointed by the proponent.	Noted and agreed
4	The EIA Coordinators shall obtain and fumish the details of quarry/quarries operated by the proponent ill the past, either in the same location or else where 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 g) If EC and CTO already obtained' the copy of the	It is a Fresh lease application

	same shall be submitted h) whether the mining was carried out as per the approved mine plan (or EC if issued) with stipulated benches	
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	Baseline Data were collected for One Season (Winter Monsoon)Dec2022-Feb2023 as per CPCB

	to surface water/ground water quality, air quality, soil quality & Flora/fauna including traffic/vehicular movement study.	Notification and MoEF & CC Guidelines. Details in Chapter No. 3. including traffic/vehicular movement study. (Chapter-2)
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 Grarute quarrying, blasting pammeters etc. should be detailed. The proposed safeguard measures in each case should also 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 / intemrediate waste etc. is huge in the ganite quarry, the Proponent shall provide the details pertaining to management of the above material with year wise utilization and average moving inyentory be submitted.	Not applicable
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 should be secured and furnished to the effect that the	Not Applicable. Project area / Study area is not declared in 'Critically Polluted' Area and does not come under 'Aravalli Range.

	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 one most circulated vernacular daily.	Noted and agreed
26	The PP shall produce/display the EIA report, Executive summery 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.l86 of 20l6 (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 (M.A.No. 981/2016, M.A.No.982/2016 & M.A.No.384/2017).	Noted and agreed

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-I 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 in 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 bagsshould 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 a fresh Lease. Around 2000 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 indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	Details are listed in Chapter:3.
36	Details of litigation pending against the project, if any, with direction /order passed by any Court of	No Litigation is pending

	Law against the Project should be given.	
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	Details in chapter3 and employment benefits.
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 a fresh 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 41 m and the conesponding production as per the approved mining plan.	Noted and agreed
2	The scientific srudies shall be canied out for any proposed quarry over the existing pit/quarry by the reputed Govemment 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 concemed AD/DGM, the concemed DEE/TNPCB aIId the Director of Mines Safety, Chennai.	Noted and agreed
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.4, Nearest water bodies are Ponnaiyar River, 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 Ponnaiyar River, Kanmoi, etc.,
8	The Terms of Reference should specifically study impact on soil health, soil erosion. the soil physical, chemical components and microbial components	There is Top soil in the project area, the overburden in the form of topsoil formation. Details of impact on soil environment is detailed in Chapter No.4.
10	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 East side. dry agriculture activity in the study area. Details of flora and fauna studies given in the Chapter No.3.
11	The Environmental Impact Assessment should study impact on standing trees and the existing trees should be numbered and action suggested for protection.	About 2000 trees is planted in safety and along roads
12	The Environmental Impact Assessment should study on wetlands, water bodies, rivers streams, lakes and farmer sites.	Details are discussed in the Chapter No 3.
13	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,
14	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
15	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

16	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 fresh quarries. dry agriculture land is situated Western and Eastern side of the area. Proponent proposed to green mesh along with fencing on the South side besides, Budgetary allocation given in the Chapter No. 10.
17	The project proponent shall study and furnish the details on potential fragmentation impact of natural environment, by the activities.	Noted and agreed
18	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
19	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.
20	The project proponent shall detail study on impact of mining on Reserve forests free ranging wildlife.	Noted and agreed
21	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
22	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

23	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
24	To fumish risk assessment and management plan including anticipated vulnerabilities during operational and post operational phases of Mining.	Details given in Chapter:7
25	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 Government Land. Document is enclosed along with Approved Mining Plan as Annexure Volume 1.
3	All documents including approved mine plan, EIA and Public Hearing should be compatible with one another in terms of the mine lease area, production levels, waste generation and its management, mining technology etc. and should be in the name of the lessee.	Noted & agreed.
4	All corner coordinates of the mine lease area, superimposed on a High-Resolution Imagery/ toposheet, topographic sheet, geomorphology and geology of the area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).	Map showing – Project area is superimposed on Satellite imagery is enclosed in Figure No. 2.1 Project area boundary coordinates superimposed on Toposheet – Figure No. 1.3 Surface Features around the project area covering 10km radius – Figure No. 2.2 Geology map of the project area covering 10km radius - Figure No. 2.7. Geomorphology Map of the Study Area covering 10 km radius – Figure No. 2.8.

5	Information should be provided in Survey of India Toposheet in 1:50,000 scale indicating geological map of the area, geomorphology of land forms of the area, existing minerals and mining history of the area, important water bodies, streams and rivers and soil characteristics.	Map showing – Geology map of the project area covering 10km radius - Figure No. 2.7. Geomorphology Map of the Study Area covering 10 km radius – Figure No. 2.8.
6	Details about the land proposed for mining activities should be given with information as to whether mining conforms to the land use policy of the State; land diversion for mining should have approval from State land use board or the concerned authority.	The applied area was inspected by the officers of Department of Geology along with revenue officials and found that the land is fit for quarrying under the policy of State Government.
7	It should be clearly stated whether the proponent Company has a well laid down Environment Policy approved by its Board of Directors? If so, it may be spelt out in the EIA Report with description of the prescribed operating process/procedures to bring into focus any infringement/deviation/ violation of the environmental or forest norms/conditions? The hierarchical system or administrative order of the Company to deal with the environmental issues and for ensuring compliance with the EC conditions may also be given. The system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the Company and/or shareholders or stakeholders at large, may also be detailed in the EIA Report.	The proponent has framed their Environmental Policy and the same is discussed in the Chapter No 10.1.
8	Issues relating to Mine Safety, including subsidence study in case of underground mining and slope study in case of open cast mining, blasting study etc. should be detailed. The proposed safeguard measures in each case should also be provided.	It is an opencast quarrying operation proposed to operate in Mechanized method. The Rough Stone quarry 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,	Land use and land cover of the study area is discussed in Chapter No. 3.

	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 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 quarry will be transported to the needy customers. No Dumps is proposed outside the lease area.
12	Certificate from the Competent Authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area. In the event of any contrary claim by the Project Proponent regarding the status of forests, the site may be inspected by the State Forest Department along with the Regional Office of the Ministry to ascertain the status of forests, based on which, the Certificate in this regard as mentioned above be issued. In all such cases, it would be desirable for representative of the State Forest Department to assist the Expert Appraisal Committees.	Not Applicable. There is no Forest Land involved in the proposed project area. The proposed project area is a It is a Government Poramboke Land.. Approved Mining Plan is enclosed as Annexure Volume 1.
13	Status of forestry clearance for the broken-up area and virgin forestland involved in the Project including deposition of net present value (NPV) and compensatory afforestation (CA) should be indicated. A copy of the forestry clearance should also be furnished.	Not Applicable. The proposed project area does not involve any Forest Land.
14	Implementation status of recognition of forest rights under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 should be indicated.	Not Applicable. The project doesn't attract Recognition of Forest Rights Act, 2006.
15	The vegetation in the RF / PF areas in the study area, with necessary details, should be given.	No Reserve Forest within the Study Area.
16	A study shall be got done to ascertain the impact of the Mining Project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the surrounding and any other protected area and accordingly, detailed mitigative measures required, should be worked out with cost implications and submitted.	Not Applicable. There are No National Parks, Biosphere Reserves, Wildlife Corridors, and Tiger/Elephant Reserves within 10 km Radius from the periphery of the project area.

17	Location of National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/ Elephant Reserves/(existing as well as proposed), if any, within 10 KM of the mine lease should be clearly indicated, supported by a location map duly authenticated by Chief Wildlife Warden. Necessary clearance, as may be applicable to such projects due to proximity of the ecologically sensitive areas as mentioned above, should be obtained from the Standing Committee of National Board of Wildlife and copy furnished	Not Applicable. There are No National Parks, Biosphere Reserves, Wildlife Corridors, and Tiger/Elephant Reserves within 10 km Radius from the periphery of the project area.
18	A detailed biological study of the study area [core zone and buffer zone (10 KM radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET Species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the Schedule of the fauna present. In case of any scheduled-I fauna found in the study area, the necessary plan along with budgetary provisions for their conservation should be prepared in consultation with State Forest and Wildlife Department and details furnished. Necessary allocation of funds for implementing the same should be made as part of the project cost.	Detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] was carried out and discussed under Chapter No. 3. There is no schedule I species of animals observed within study area as per Wildlife Protection Act 1972 as well as no species is in vulnerable, endangered or threatened category as per IUCN. There is no endangered red list species found in the study area.
19	Proximity to Areas declared as 'Critically Polluted' or the Project areas likely to come under the 'Aravalli Range', (attracting court restrictions for mining operations), should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the SPCB or State Mining Department should be secured and furnished to the effect that the proposed mining activities could be considered.	Not Applicable. Project area / Study area is not declared in 'Critically Polluted' Area and does not come under 'Aravalli Range.
20	Similarly, for coastal Projects, A CRZ map duly authenticated by one of the authorized agencies demarcating LTL. HTL, CRZ area, location of the mine lease w.r.t CRZ, coastal features such as mangroves, if any, should be furnished. (Note: The Mining Projects falling under CRZ would also need to obtain approval of the concerned Coastal Zone Management Authority).	Not Applicable. The project doesn't attract The C. R. Z. Notification, 2018.
21	R&R Plan/compensation details for the Project Affected People (PAP) should be furnished. While preparing the R&R Plan, the relevant	Not Applicable. There are no approved habitations within a radius of 300

	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.	meters. Therefore, R&R Plan / Compensation details for the Project Affected People (PAP) is not anticipated and Not Applicable for this project.
22	One season (non-monsoon) [i.e. March-May (Summer Season); October-December (post monsoon season) ; December-February (winter season)]primary baseline data on ambient air quality as per CPCB Notification of 2009, water quality, noise level, soil and flora and fauna shall be collected and the AAQ and other data so compiled presented date-wise in the EIA and EMP Report. Site-specific meteorological data should also be collected. The location of the monitoring stations should be such as to represent whole of the study area and justified keeping in view the pre-dominant downwind 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.	Baseline Data were collected for One Season (Winter) Dec– Feb 2023 as per CPCB Notification and MoEF & CC Guidelines. Details in Chapter No. 3.
23	Air quality modelling should be carried out for prediction of impact of the project on the air quality of the area. It should also take into account the impact of movement of vehicles for transportation of mineral. The details of the model used and input parameters used for modelling should be provided. The air quality contours may be shown on a location map clearly indicating the location of the site, location of sensitive receptors, if any, and the habitation. The wind roses showing 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	Total Water Requirement: 2.5 KLD -P1

	detailed water balance should also be provided. Fresh water requirement for the Project should be indicated.	Total Water Requirement: 2.5 KLD -P2 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 76m 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 875m to 805m AMSL-P1 Ultimate depth of the mine is 76m(66m AGL+10m BGL)-P1

		Water level of the area is 65-70m BGL-P1 Highest elevation of the project area is 915m to 845m AMSL-P2 Ultimate depth of the mine is 76m-P2 Water level of the area is 65-70m BGL-P2
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 Impact of Transportation study as per Indian Road Congress Guidelines.	Traffic density survey was carried out to analyse the impact of Transportation in the study area as per IRC guidelines 1961 and it is inferred that there is no significant impact due to the proposed transportation from the project area. Details in Chapter 2.
33	Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.	Infrastructure & other facilities will be provided to the Mine Workers after the grant of quarry lease and the same has been discussed in the Chapter No.2 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	Occupational Health Impacts of the project and preventive measures are detailed under Chapter 4.

	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.	
36	Public health implications of the Project and related activities for the population in the impact zone should be systematically evaluated and the proposed remedial measures should be detailed along with budgetary allocations.	No Public Health Implications anticipated due to this project. Details of CER and CSR are discussed under Chapter 8.
37	Measures of socio-economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	No Negative Impact on Socio Economic Environment on the Study Area is anticipated and this project shall benefit the Socio-Economic Environment by ways of employment for 86 people directly and 30 people indirectly.
38	Detailed environmental management plan (EMP) to mitigate the environmental impacts which, should inter-alia include the impacts of change of land use, loss of agricultural and grazing land, if any, occupational health impacts besides other impacts specific to the proposed Project.	Detailed Environment Management Plan for the project to mitigate the anticipated impacts described under Chapter 4 is discussed under Chapter 10.
39	Public Hearing points raised and commitment of the Project Proponent on the same along with time bound Action Plan with budgetary provisions to implement the same should be provided and also incorporated in the final EIA/EMP Report of the Project.	The outcome of public hearing will be updated in the final EIA/AMP report.
40	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.	No litigation is pending in any court against this project.
41	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	Project Cost is Rs. 2,39,71,000/- -P1 Project Cost is Rs. 2,75,60,000/--P2 CER Cost is Rs 5,00,000/- -P1 CER Cost is Rs 5,00,000/- -P2
42	A Disaster management Plan shall be prepared and included in the EIA/EMP Report.	Details in Chapter 7.
43	Benefits of the Project if the Project is implemented should be spelt out. The benefits of the Project shall clearly indicate environmental, social, economic, employment potential, etc.	Details in Chapter 8.

44	**Besides the above, the below mentioned general points are also to be followed: -**	
a	Executive Summary of the EIA/EMP Report	Enclosed as separate booklet.
b	All documents to be properly referenced with index and continuous page numbering.	All the documents are properly referenced with index and continuous page numbering.
c	Where data are presented in the Report especially in Tables, the period in which the data were collected and the sources should be indicated.	List of Tables and source of the data collected are indicated.
d	Project Proponent shall enclose all the analysis/testing reports of water, air, soil, noise etc. using the MoEF & CC/NABL accredited laboratories. All the original analysis/testing reports should be available during appraisal of the Project	Baseline monitoring reports are enclosed with This report in Chapter 3. Original Baseline monitoring reports will be submitted in the final EIA report during appraisal.
e	Where the documents provided are in a language other than English, an English translation should be provided.	Not Applicable.
f	The Questionnaire for environmental appraisal of mining projects as devised earlier by the Ministry shall also be filled and submitted.	Will be enclosed along with Final EIA /EMP Report.
g	While preparing the EIA report, the instructions for the Proponents and instructions for the Consultants issued by MoEF&CC vide O.M. No. J-11013/41/2006-IA. II(I) Dated: 4th August, 2009, which are available on the website of this Ministry, should be followed.	Noted & agreed. Instructions issued by MoEF & CC O.M. No. J-11013/41/2006-IA. II (I) Dated: 4th August, 2009 are followed.
h	Changes, if any made in the basic scope and project parameters (as submitted in Form-I and the PFR for securing the TOR) should be brought to the attention of MoEF&CC with reasons for such changes and permission should be sought, as the TOR may also have to be altered. Post Public Hearing changes in structure and content of the draft EIA/EMP (other than modifications arising out of the P.H. process) will entail conducting the PH again with the revised documentation	Noted & agreed.
i	As per the circular no. J-11011/618/2010-IA. II(I) Dated: 30.5.2012, certified report of the status of compliance of the conditions stipulated in the environment clearance for the existing operations of the project, should be obtained from the Regional Office of Ministry of Environment, Forest and Climate Change, as may be applicable.	Not Applicable.

j	The EIA report should also include (i) surface plan of the area indicating contours of main topographic features, drainage and mining area, (ii) geological maps and sections and (iii) sections of the mine pit and external dumps, if any, clearly showing the land features of the adjoining area.	Surface Plan – Figure No. 2.2. Geological Plan – Figure No 2.9. Working Plan – Figure No 2.9. Closure Plan – Figure No.2.10.

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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 quarry are the major requirements for construction industry. This EIA report is prepared by considering Cumulative load of all proposed & existing quarries of Thiyaranadurgam Rough Stone quarry Cluster Quarries consisting of two Proposed quarrie with total extent of Cluster of 8.26.5 Ha in Thiyaranadurgam Village, Shoolagiri Taluk, Krishnagiri 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 Dec2022 -Feb2023

TABLE 1.1: ToR OBTAINED PROJECTS

CODE	Name of the proponent	Extent (Ha)	Terms of Reference (ToR)
P1	Thiru. N.Narayanan	4.24.5	Lr.No.SEIAA-TN/F.No.9104/ToR-1177/2022 Dated:13.06.2022
P2	Thiru.T.Kesavamoorthy	4.02.0	Lr.No.SEIAA-TN/F.No.9103/SEAC/ToR-1173/2022 Dated:14.06.2022
	Total	**8.26.5**	

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 Government Poramboke Land., no forest land is involved

TABLE 1.2: PROPOSED PROJECTS IN THE CLUSTER

Description	P1	P2
Name of the Project	**Thiru. N.Narayanan** Rough Stone quarry	**Thiru.T.Kesavamoorthy** Rough Stone quarry
S.F. No.	940/1 (P-2)	940/1 (P-1)
Extent	**4.24.5 Ha**	**4.02.0 Ha**
Village Taluk and	Thiyaranadurgam Village, Shoolagiri Taluk	
District	Krishnagiri 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. N. Narayanan**
Address	S/o. Nallappa, D.No.3/38, Chikkagoundanoor, Nagamangalam Village, Denkanikottai Taluk, Krishnagiri District-635 113
Mobile	+91 94448 95079
Status	Proprietor
PROPOSAL – P2	
Name of the Company	**Thiru.T. Kesavamoorthy**
Address	S/o Thimarayappa, D. No 2/38, Varaganapalli, Nagamangalam Post, Denkanikottai Taluk, Krishnagiri District-635 113
Mobile	+91 94448 95079
Status	Proprietor

Source: Approved Mining Plan of the respective projects

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. N. Narayanan Rough Stone Quarry Project	
Land Type	It is a Government Land.	
S.F. Nos	940/1 (P-2)	
Extent	**4.24.5 Ha**	
Previous quarry operation details	It is a fresh Lease area.	
Geological Reserves	Rough Stone quarry	TopSoil
	20,24,000m^3	42,450m^3
Mineable Reserves	Rough Stone quarry	TopSoil
	14,45,070m^3	39,300 m^3

Proposed production for First Five years	7,45,070m^3 (Depth 51m AGL)	
Proposed production for Second Five years	7,00,000m^3	
Mining Plan Period / Lease Period	10 Years	
Depth of mining	76m (66m Agl+10m Bgl)	
Ultimate Pit Dimension	273m(L) x 150m (W) x76m(D) (66m Agl+ 10m Bgl)	
Toposheet No	57 H/14	
Latitude	12°36'14.45"N to 12°36'21.97"N	
Longitude	77°53'57.46"E to 77°54'07.76"E	
Highest elevation	875-805m AMSL	
Machinery proposed	Jack Hammer	8
	Compressor	2
	Wagon Drill	1
	Excavator	3
	Tippers	6
Blasting	Usage of Slurry Explosive with MSD detonators	
Manpower Deployment	40 Nos	
Total Project Cost	Operational Cost	Rs. 2,32,11,000/-
	EMP Cost	Rs. 7,60,000/-
	Total	Rs. 2,39,71,000/-
CER Cost	Rs.5,00,000/-	
SALIENT FEATURES OF PROPOSAL "P2"		
Name of the Mine	Thiru.T. Kesavamoorthy Roughstone quarry Project	
Land Type	It is a Government Land.	
S.F. No.	940/1 (P-1)	
Extent	4.02.0 Ha	
Previous quarry operation details	It is a fresh lease application	
Depth of Mining	76m (66m Agl+10m Bgl)	
Geological Resources	Rough Stone quarry	Topsoil
	21,29,000m3	40,217m3
Mineable Reserves	Rough Stone quarry	Topsoil
	18,50,770m3	31,857m3
Proposed production for First Five years	9,39,510 m^3 (Maximum depth 46m below from the existing ground)	
Proposed production for Second Five years	9,11,260 m^3	
Mining Plan Period / Lease Period	10 Years	
Ultimate Pit Dimension	307m (L) X 131m (W) X 76m (D)	
Toposheet No	57 -H/14	
Latitude	12°36'17.33"N to 12°36'24.06"N	
Longitude	77°53'47.76"E to 77°53'58.80"E	
Highest Elevation	915m to 845m AMSL	
Machinery	Jack Hammer	10
	Compressor	3
	Excavator with Bucket and Rock Breaker	4
	Wagon Drill	1
	Tippers	8
Blasting	Usage of Slurry Explosive with MSD detonators	
Manpower Deployment	46 Nos	
Total Cost	Operational Cost	Rs. 2,68,00,000/-
	EMP Cost	Rs. 7,60,000/-
	Total	Rs. 2,75,60,000/-

CER Cost	Rs.5,00,000/-

Source: Approved Mining Plan of the respective proposals

1.3.2 Location of the project

The lease applied area is about 28km Northwestern side of Krishnagiri 12km Southwestern side of Shoolagiri and 2.0km Southwest side of Thiyaranadurgam Village.

28km		12km		2km	
Krishnagiri	→ Shoolagiri		→ Thiyaranadurgam		→ Lease Applied area
Northwest		Southwest		Southwest	

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

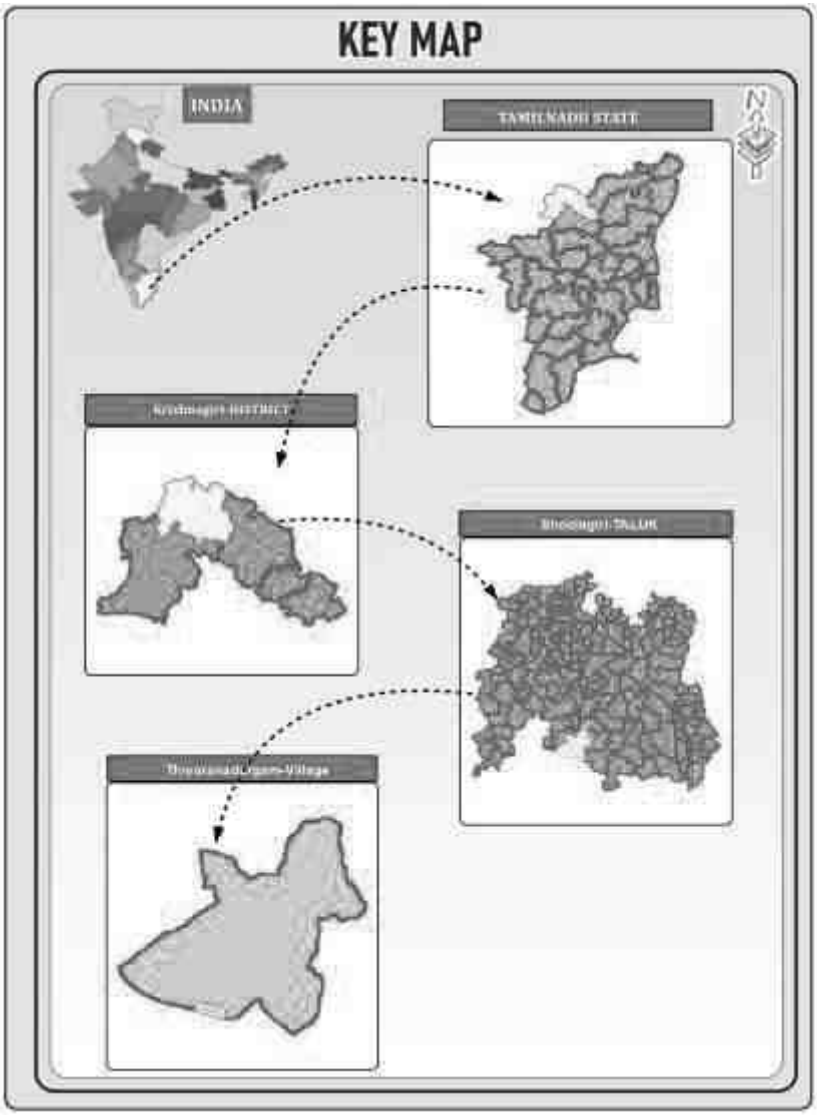
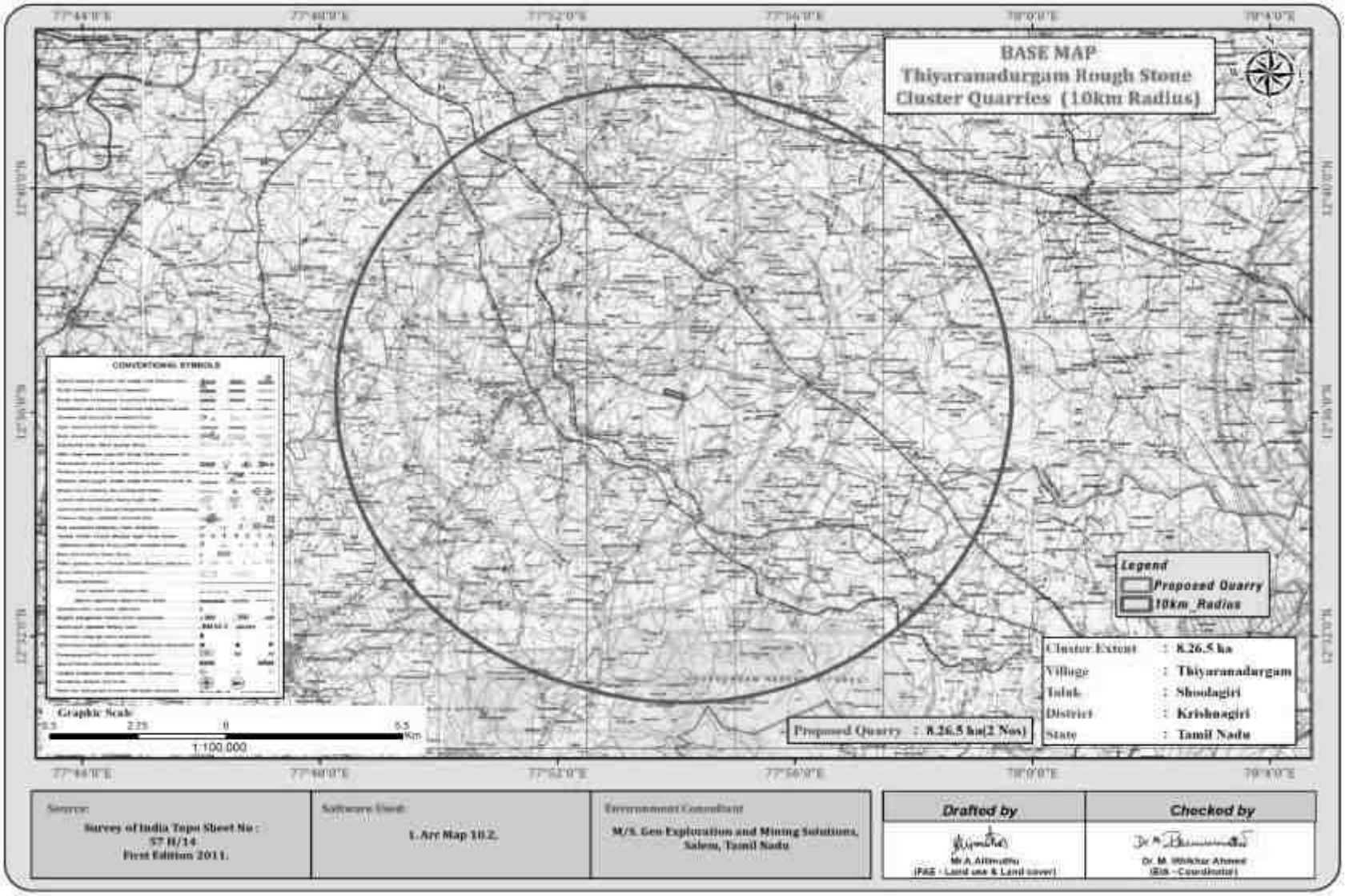


FIGURE 1.2: TOPOSHEET SHOWING LOCATION OF THE PROJECT SITE AROUND 10 KM RADIUS



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 –

Project – P1 –

- The proponent applied for Rough Stone quarry Lease Dated: 08.03.2019.
- Precise Area Communication was issued by the District Collector, Krishnagiri vide Rc.No.229/2019/Mines, Dated:13.06.2019 for a period of 10 Years and the Mining plan prepared for the period of ten years.
- The mining plan was approved by the Deputy Director, Department of Geology and Mining, Krishnagiri District vide Rc.No. 229/2019/Mines, Dated: 30.07.2019.
- Proponent applied for ToR for Environmental Clearance vides online Proposal No. **SIA/TN/MIN/73796/2022, Dated:17.03.2022.**

Project – P2 –

- The proponent applied for Rough Stone quarry Lease Dated: 08.03.2019.
- Precise Area Communication was issued by the District Collector, Krishnagiri District vide Rc.No.228/2019/Mines, Dated:13.06.2019. for a period of 10 Years and the Mining plan prepared for the period of ten years.
- The mining plan was approved by the Deputy Director, Department of Geology and Mining, Krishnagiri District vide Rc.No.228/2019/Mines Dated: 30.07.2019.
- Proponent applied for ToR for Environmental Clearance vides online Proposal No. **SIA/TN/MIN/73797/2022, Dated:17.03.2022.**

SCOPING –

Project – P1 –

- 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 519th SEIAA meeting held on 13.06.2022 and issued ToR vide **Lr.No. SEIAA-TN/F.No.9104/ToR-1177/2022 Dated:13.06.2022**

Project – P2 –

- The proposal was placed in 274th SEAC meeting held on 19.05.2022 and the committee recommended for issue of ToR.
- The proposal was considered in 519th SEIAA meeting held on 14.06.2022 and issued ToR vide **Lr.No. SEIAA-TN/F.No.9103/SEAC/ToR-1173/2022Dated:14.06.2022**

- **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 vide Lr.No. SEIAA-TN/F.No.9104/ToR-1177/2022 Dated:13.06.2022 - P1
- ToR vide Lr.No. SEIAA-TN/F.No.9103/SEAC/ToR-1173/2022 Dated:14.06.2022 - P2

Approved Mining of P1 to P2 the Rough Stone quarry projects

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	Presents the Identification, Prediction and Evaluation of overall Environmental Impacts due to the Proposed

		Measures	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 8 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, Krishnagiri
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 8 locations data monitored once for 24 hours during EIA study.
6	Soil Characteristics	Physical and Chemical Parameters	Once at 6 locations during study period
7	Land use	Existing land use for different categories	Based on Survey of India topographical sheet and satellite imagery and primary survey.
8	Socio-Economic Aspects	Socio-economic and demographic characteristics, worker characteristics	Based on primary survey and secondary sources data like census of India 2011.
9	Hydrology	Drainage pattern of the area, nature of streams, aquifer characteristics, recharge and discharge areas	Based on data collected from secondary sources as well as hydro-geology study report prepared.
10	Risk assessment and Disaster Management Plan	Identify areas where disaster can occur by fires and explosions and release of toxic substances	Based on the findings of Risk 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 quarry has been approved under Rule 41 & 42 as amended of Tamil Nadu Minor Mineral Concession Rules, 1959
- ToR vide Lr.No. SEIAA-TN/F.No.9104/ToR-1177/2022 Dated:13.06.2022 - P1
- Tor vide Lr.No. SEIAA-TN/F.No.9103/SEAC/ToR-1173/2022 Dated:14.06.2022 - P2

Approved Mining of P1 to P2 the Rough Stone quarry projects

CHAPTER – 2: PROJECT DESCRIPTION

2.0 General

The Proposed Rough Stone Quarries requires Environmental Clearance. There are two proposed quarries forming a cluster; calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016 and the total extent of cluster is 8.26.50 ha.

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

2.1 Description of the Project

The proposed 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 all the proposed quarries in the cluster. Rough Stone quarries 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 quarry from pithead to the needy crushers and rock breakers to avoid secondary blasting.

2.2 Location of the Project

- The Cluster quarries are located in Thiyanadurgam village, Shoolagiri taluk, Krishnagiri District, Tamil Nadu State.
- The project falls in Toposheet No: 57 H/14. The cluster areas fall in the Latitude between 12^0 36’14.45” N to 12^0 36’24.60” N and Longitude between 77^0 53’47.76” E to 77^0 54’07.76” E
- The projects under the cluster are classified as Poramboke 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	The National Highway (NH-7) Bangalore – Salem -10.0Km – Northern side. SH17 - Shoolagiri – Dharmapuri -4.0km- NE
Nearest Village	Thiyaranadurgam – 2.0Km- NE
Nearest Town	Hosur – 15.0Km – NW
Nearest Railway	Kelamangalam Railway station – 4.0Km - West
Nearest Airport	Bangalore Airport – 53Km - NW

Source: Google image, Survey of India Toposheet

The cluster quarries coners coordinates are given below.

TABLE 2.2 – BOUNDARY CO-ORDINATES OF PROPOSED PROJECTS

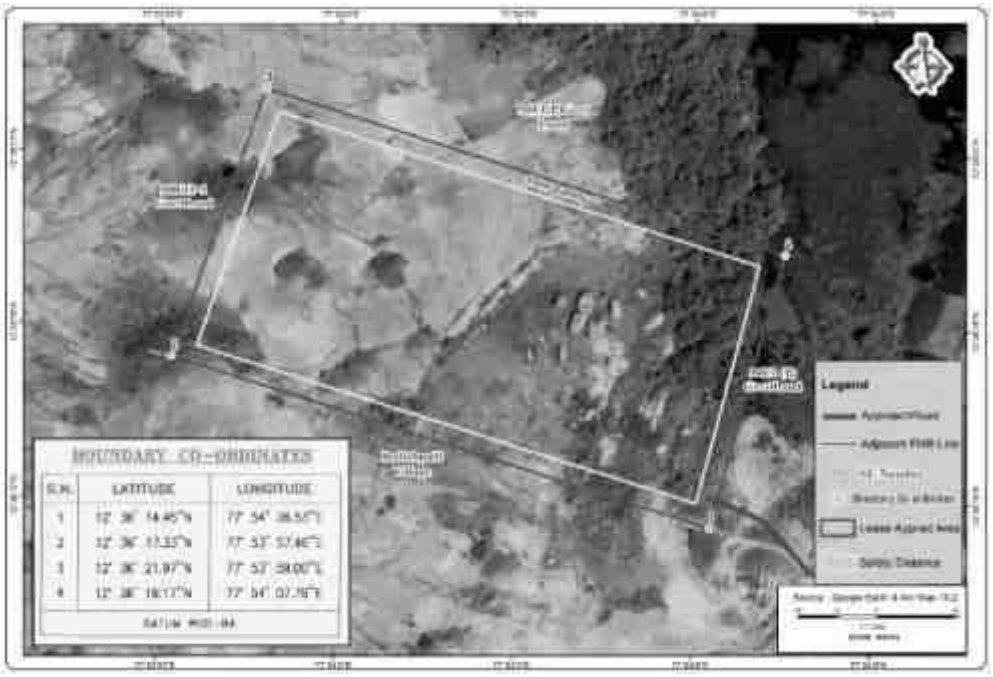
BOUNDARY CO-ORDINATES OF PROJECT – P1		
Corner Nos.	**Latitude**	**Longitude**
1	12^0 36’14.45”N	77^0 54’06.53”E
2	12^0 36’17.33”N	77^0 53’57.46”E
3	12^0 36’21.97”N	77^0 53’59.00”E
4	12^0 36’19.17”N	77^0 54’07.76”E
BOUNDARY CO-ORDINATES OF PROJECT – P2		
Corner Nos.	**Latitude**	**Longitude**
1	12^0 36’20.59”N	77^0 53’47.76”E
2	12^0 36’24.60”N	77^0 53’49.12”E
3	12^0 36’21.35”N	77^0 53’58.80”E
4	12^0 36’17.33”N	77^0 53’57.46”E
5	12^0 36’18.77”N	77^0 53’52.89”E
6	12^0 36’19.22”N	77^0 53’51.56”E
7	12^0 36’19.66”N	77^0 53’50.46”E

Source: Mine Lease Plan Plate of the respective proposals

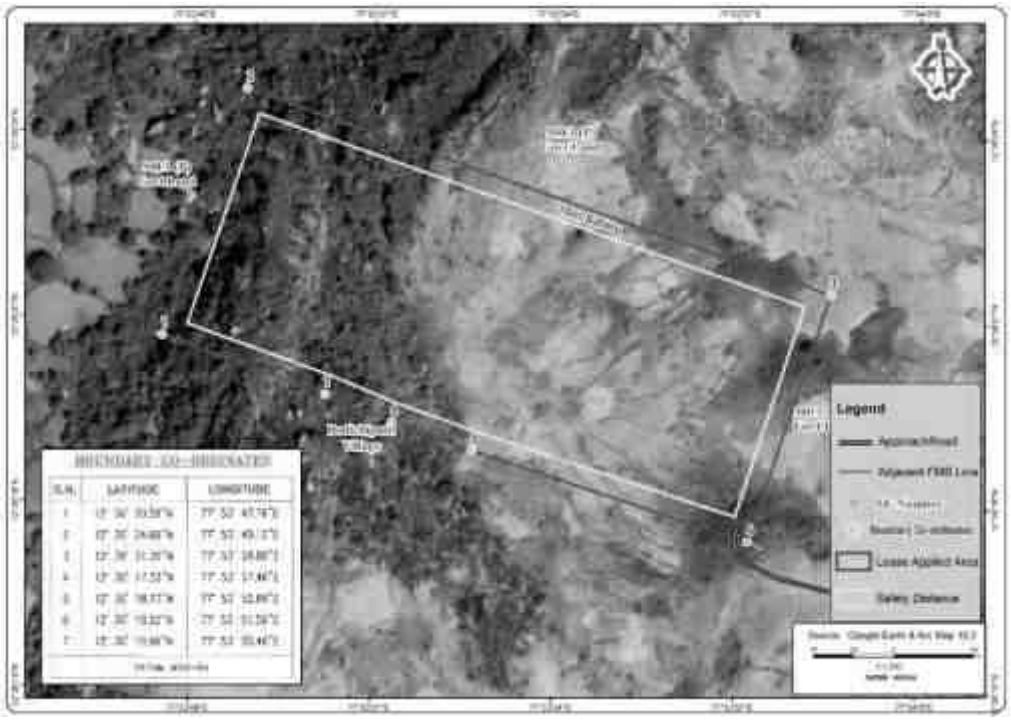
FIGURE 2.1: TOPOGRAPHICAL VIEW OF THE PROJECT SITE-P1

FIGURE 2.1A: TOPOGRAPHICAL VIEW OF THE PROJECT SITE-P2

FIGURE 2.2: SHOWING GOOGLE IMAGE ROUGH STONE QUARRY PROJECT AREAS



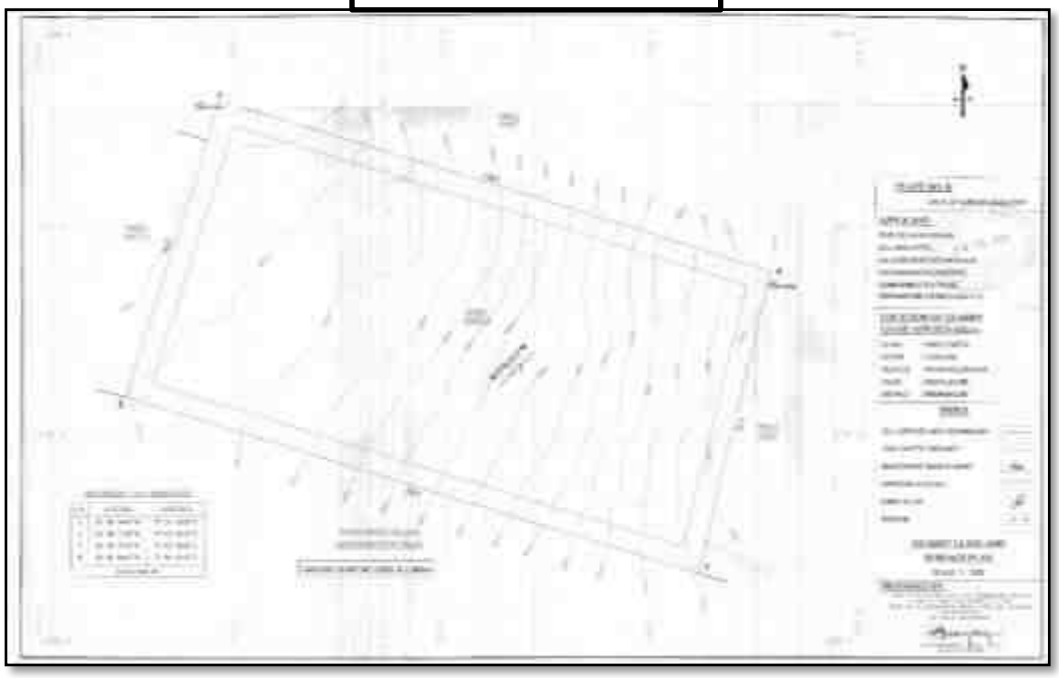
SATELLITE IMAGERY OF P1



SATELLITE IMAGERY OF P2

FIGURE 2.3: QUARRY LEASE PLAN

P1– Thiru. N.Narayanan



P2– Thiru.T.Kesavamoorthy

FIGURE 2.4: SATELLITE IMAGERY OF CLUSTER QUARRIES

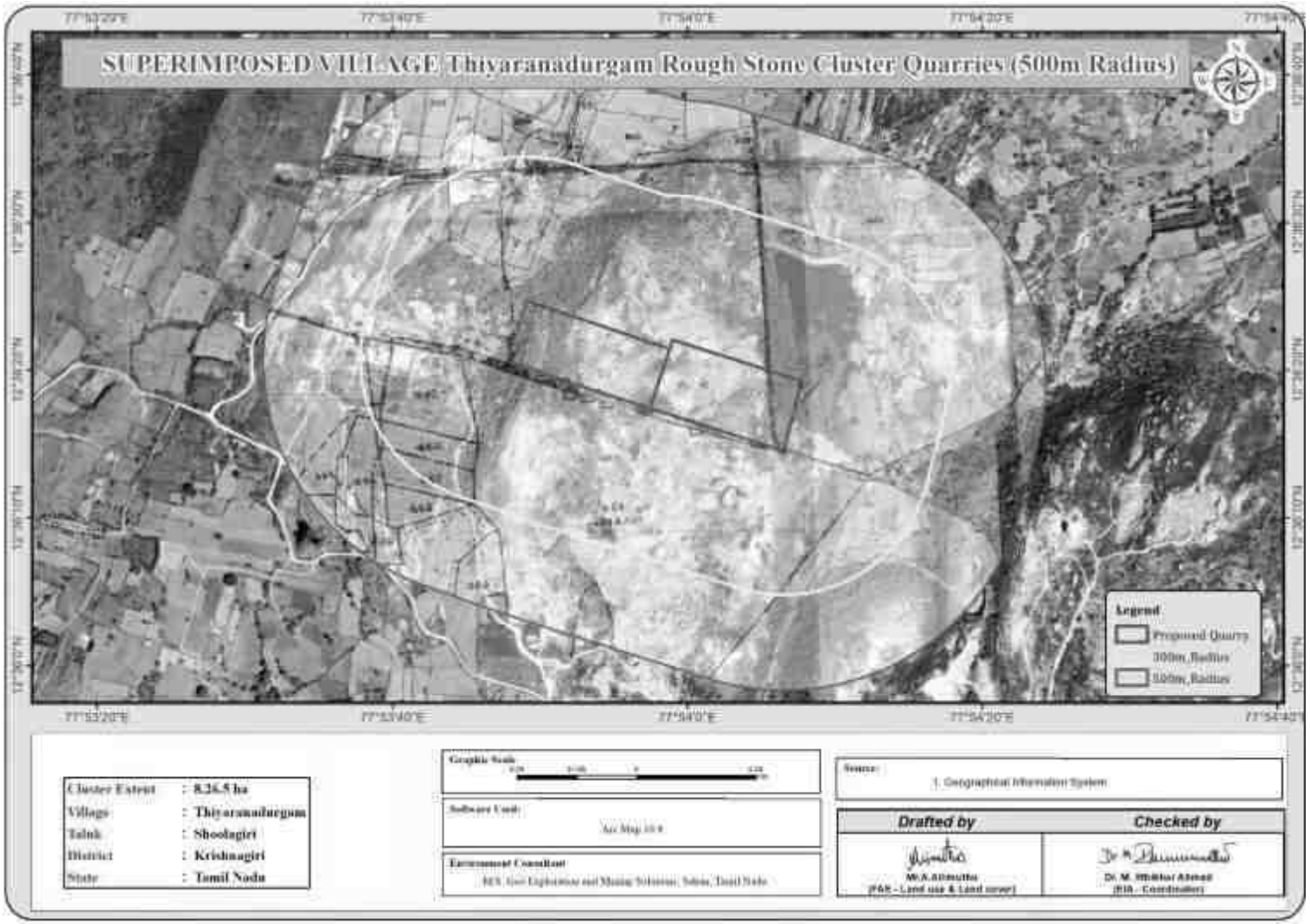


FIGURE 2.5: DIGITIZED MAP OF THE STUDY AREA (10 KM RADIUS FROM PROJECT SITE)

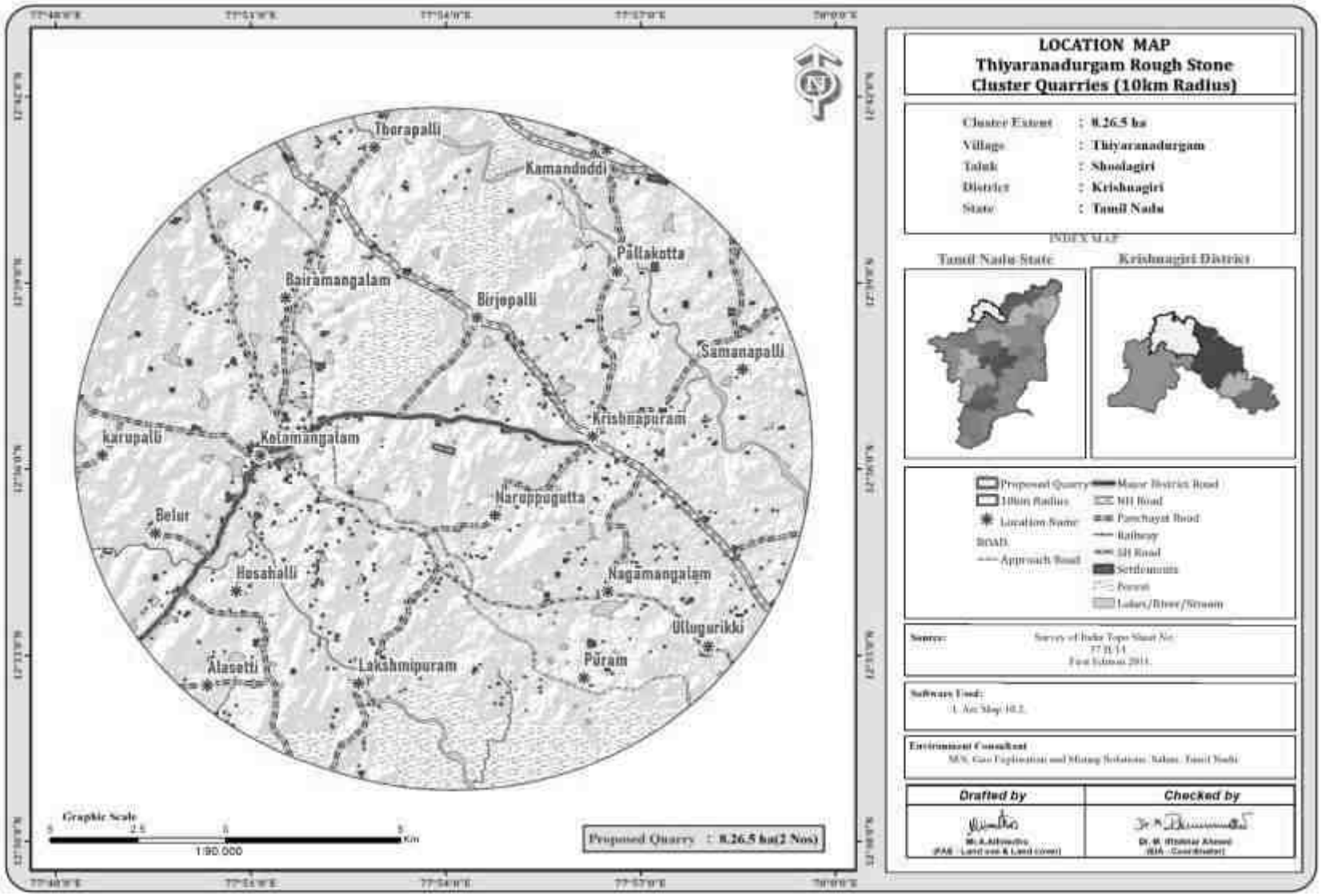


FIGURE 2.6: DIGITIZED MAP OF THE STUDY AREA (5 KM RADIUS FROM PROJECT SITE)

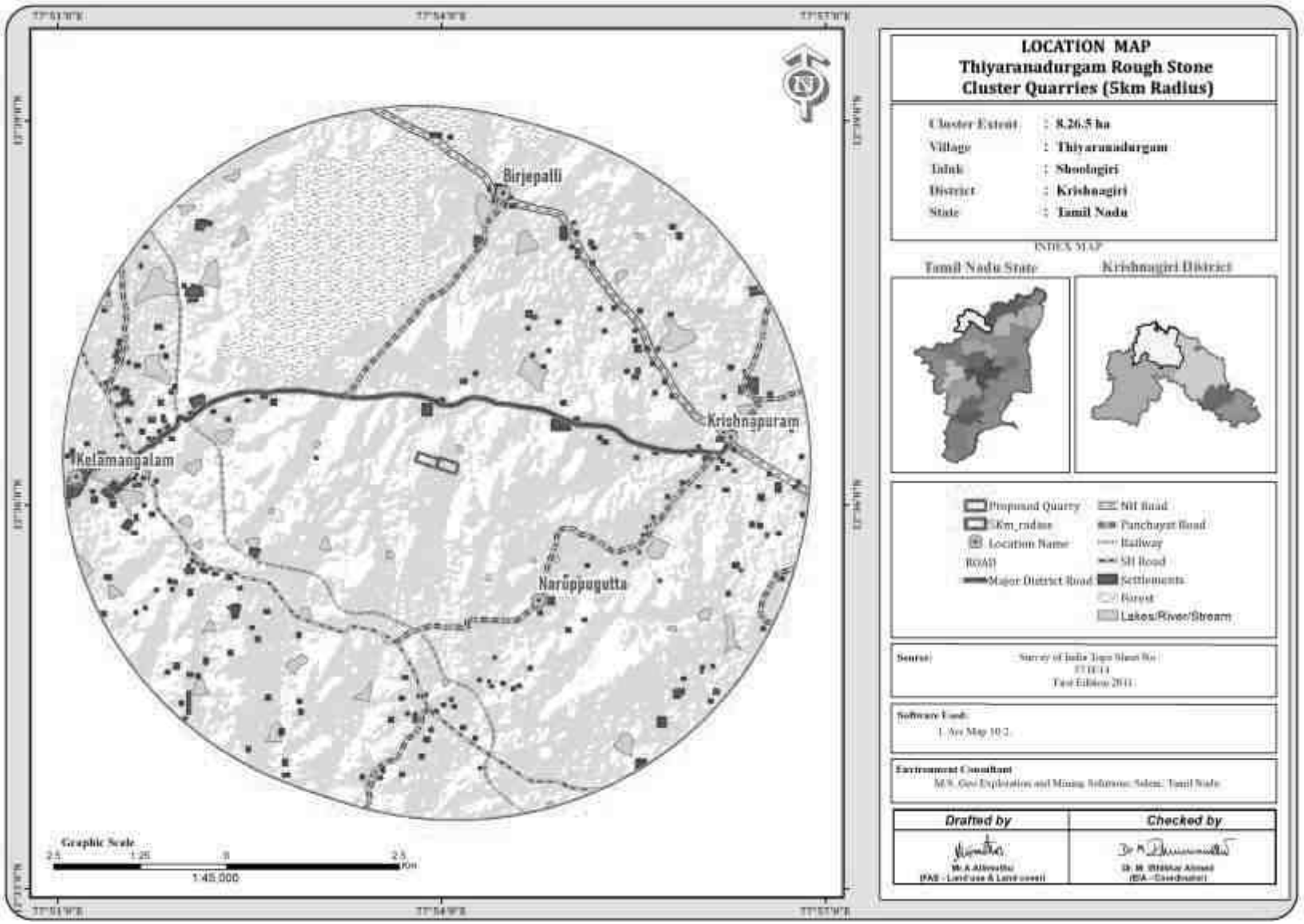
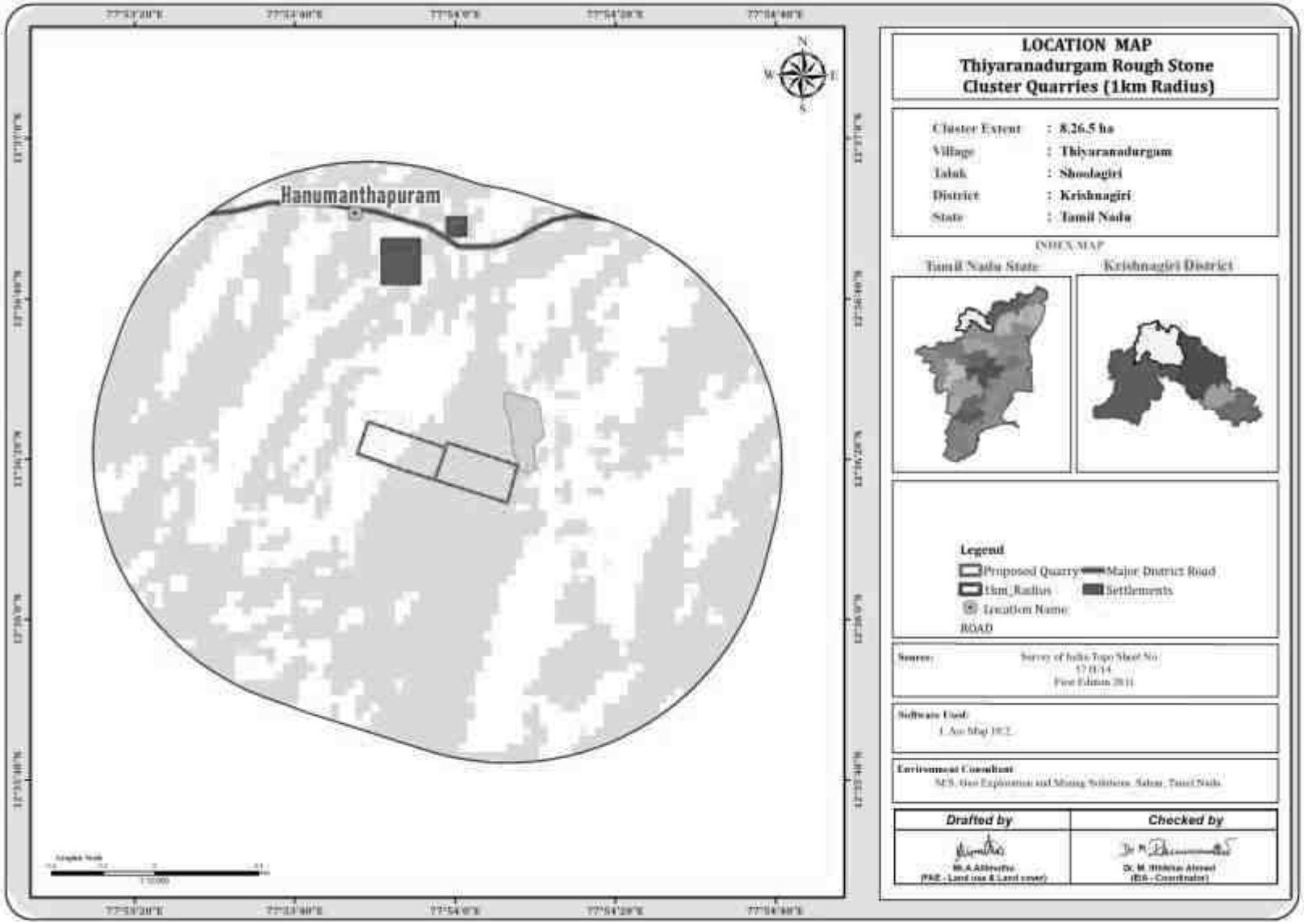


FIGURE 2.7: DIGITIZED MAP OF THE STUDY AREA (1 KM RADIUS FROM PROJECT SITE)



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 PROJECTS

LAND USE PATTERN OF PROJECT – P1	
Description	**Present area in (ha)**
Area under Quarrying	Nil
Infrastructure	Nil
Roads	Nil
Green Belt	Nil
Un – utilized area	4.24.5
Grand Total	**4.24.5**
LAND USE PATTERN OF PROJECT – P2	
Description	**Present area in (ha)**
Quarrying Pit	Nil
Infrastructure	Nil
Road	Nil
Green Belt	Nil
Unutilized area	4.02.0
Grand Total	**4.02.0**

Source: Approved Mining Plan

2.2.2 Size or Magnitude of Operation

TABLE 2.4: OPERATIONAL DETAILS FOR PROPOSED PROJECTS

OPERATIONAL DETAILS FOR PROJECT – P1		
PARTICULARS	**DETAILS**	
	Rough Stone quarry (m^3) (10 Year Plan period)	**Top Soil (m^3) (1 Years Plan period)**
Geological Resources	20,24,000m^3	42,450m^3
Mineable Reserves	14,45,070m^3	39,300 m^3
Production for five-year plan period After bench reduction	**7,45,070** m^3	
Production for Next five-year plan period After bench reduction	**7,00,000** m^3	
Mining Plan Period / Lease Applied Period	10 Years	
Number of Working Days	300 Days	
Production per day	482	131
No of Lorry loads (12m^3 per load)	40	11
Total Depth of Mining	76m (66m Agl+10m Bgl)	
OPERATIONAL DETAILS FOR PROJECT – P2		
PARTICULARS	**DETAILS**	
	Rough Stone quarry (m^3) (10 Year Plan period)	**Top Soil (m^3) (1 Years Plan period)**
Geological Resources	21,29,000m^3	40,217m^3
Mineable Reserves	18,50,770m^3	31,857m^3
Production for five years Plan After bench reduction	**9,39,510** m^3	
Production for Next five-year plan	**9,11,260** m^3	

period After bench reduction		
Mining Plan Period / Lease Applied Period	10 Years	
Number of Working Days	300 Days	
Production per day	617	106
No of Lorry loads ($12m^3$ per load)	51	9
Total Depth of mining	76m Agl	

Source: approved mining plan
* Topsoil formation are proposed to excavate for first year only

2.3 GEOLOGY

2.3.1 Regional Geology

The geological formations of the district belong mainly to Archaean age along with rock of Proterozoic age. The former is rerpresented by Khondalite Group of rocks, Charnockite Group of rocks, Migmatites Complex, Sathyamangalam Group of rocks, while the latter is represented by alkaline rocks. The Khondalite Group includes garnet sillimanite gneiss and quartzite which occur as small patches. The migmatite complex includes garnetiferous quartzofeldspathic gneiss and hornblends biotite gneiss, the former exposed on the western part of the district. The Sathyamangalam Group includes fuchsite quartzite, sillimanite mica schist and amphibolites. The Bhavani Group in this area includes fissile hornblende-biotite gneiss, granitoid gneiss and pink migmatite. Amphibolites with barbed ferruginous quartzite and associated quartzo-feldspathic rocks (Champion Gneiss) represent the Kolar group and are found west and southwest of Veppanapalli. Following this there are basic intrusions occurring as dykes. The Charnockite Group occupies a major part of the south-west portion of this district with small bands of garnetiferous quartzo-feldspathic gneiss, Granite gneiss and dolerite dykes. The North-East and Northern part of the district mainly consist of granite gneiss with small patches of Pink Migmatite, hornblende-biotite gneiss and dolerite dykes. The Eastern part of the district consists of Epidote-Hornblende Gneiss, Ultra Mafics, Syenite and Carbonatite.

The Alkaline Complex is represented by epidote-hornblende gneiss, ultramafics, syenite and carbonatite and these are distributed in the eastern part of the district. Innumerable basic dykes and felsites, quartz, barites and pegmatite veins form part of the Alkali Complex.

Peninsular gneiss forms the oldest rock formations, in which the massive formation of Charnockite lies over with rich accumulation of recent quaternary formation. On regional scale the Charnockite body N15°E – S15°W with vertical dipping

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

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

2.3.2 Local Geology:

The study area follows the regional trend and mainly comprises of Hard Rock Formation as a homogeneous formation / Batholith formation of Charnockite. The project area is hilly terrain, sloping toward South with a highest altitude of 915m AMSL. The project area is covered with topsoil formation of 1m to 2m thickness; Massive Charnockite formation is found after 2 m topsoil formation which is clearly inferred from the existing quarry pit.

2.3.3 Hydrogeology

The origin, occurrence and movement of groundwater are controlled by geological setup of a terrain. During the study it is inferred that the entire cluster area is a Hard rock terrain and the low -resistance encountered at the depth between 65-70 m bgl, hence it is assumed that the possibility of Ground water occurrence will be below this level and it also proved that this hard batholith above 60 m will not encounter any subsurface water.

In the geophysical study it has been clearly inferred that the depth of the quarrying operation will not intersect the ground water table.

TABLE 2.5: GROUND WATER LEVEL VARIATIONS OF KRISHNAGIRI 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
12.1	14.9	6.3	8.1	11.0	12.7	8.9	11	8.4	10.6	9.5	7.9

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

FIGURE 2.8: REGIONAL GEOLOGY MAP

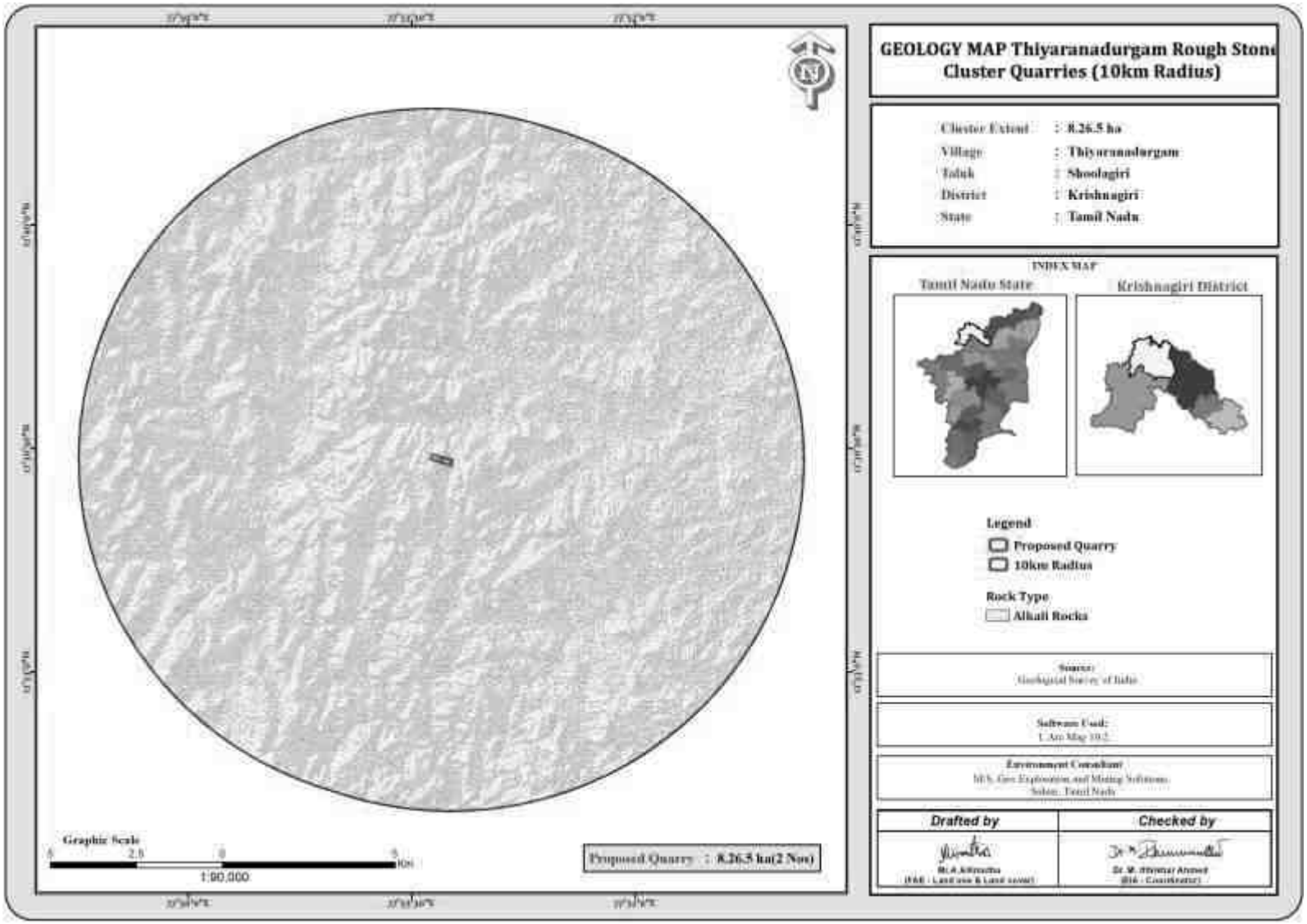


FIGURE 2.9: GEOMORPHOLOGY MAP

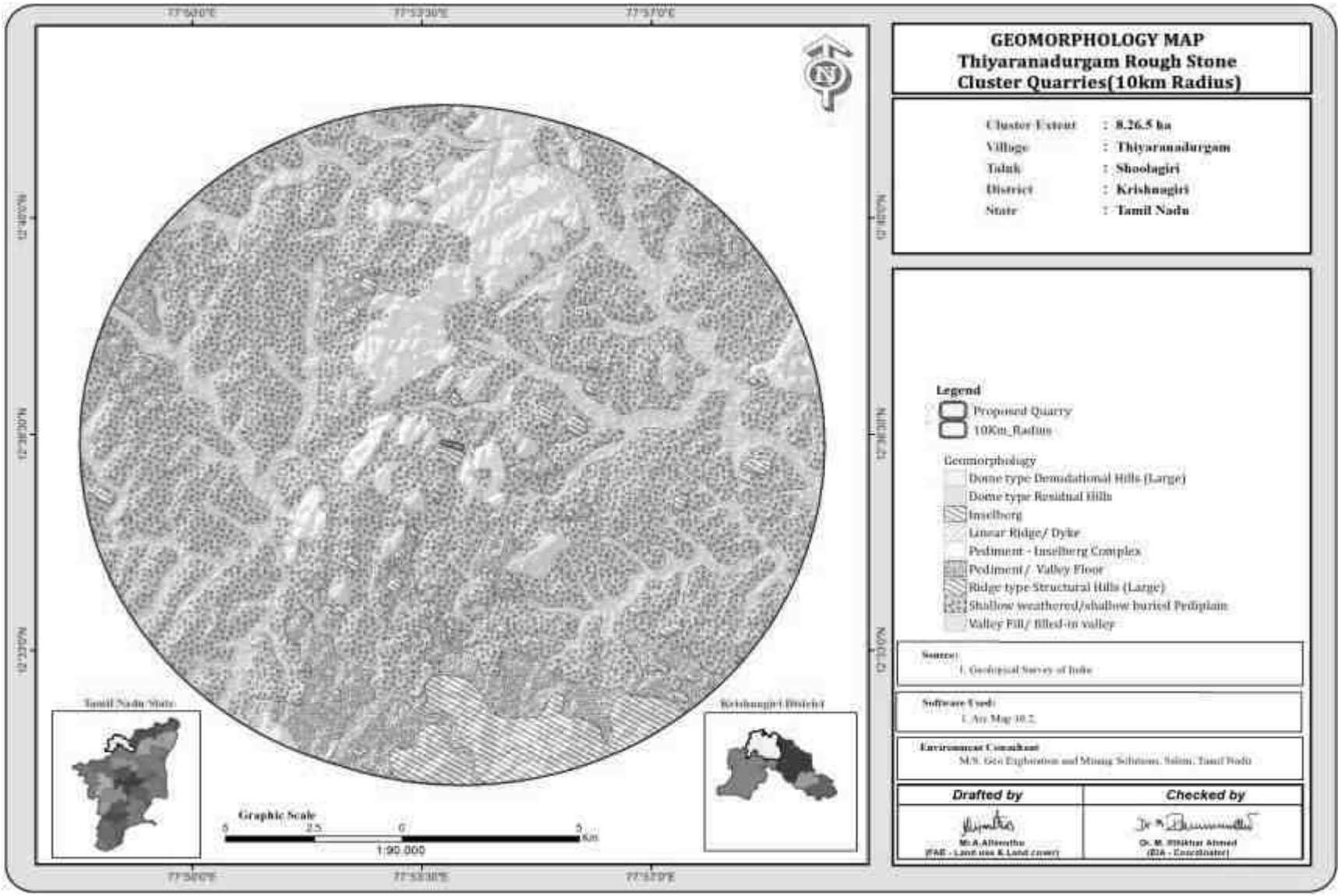
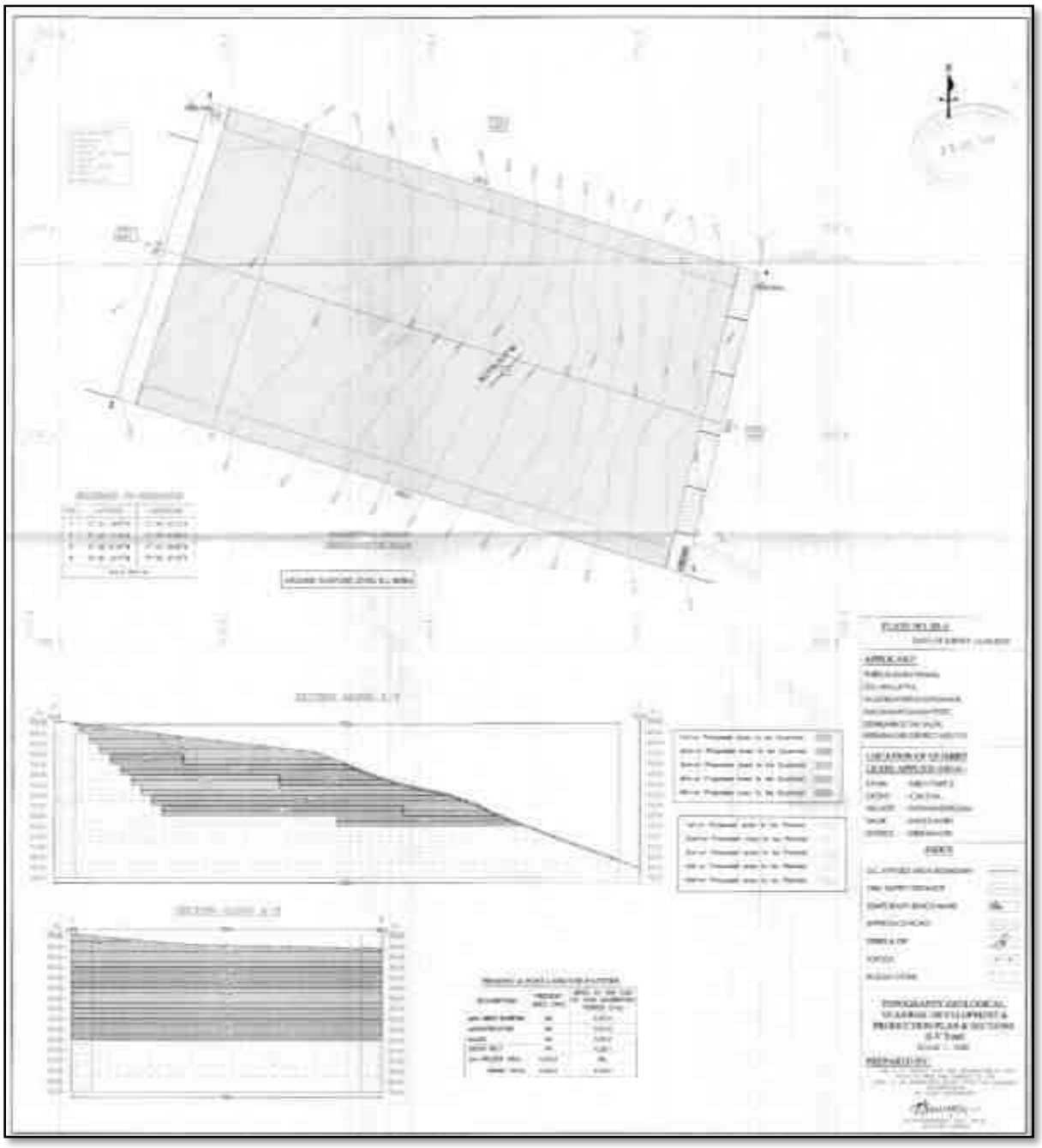
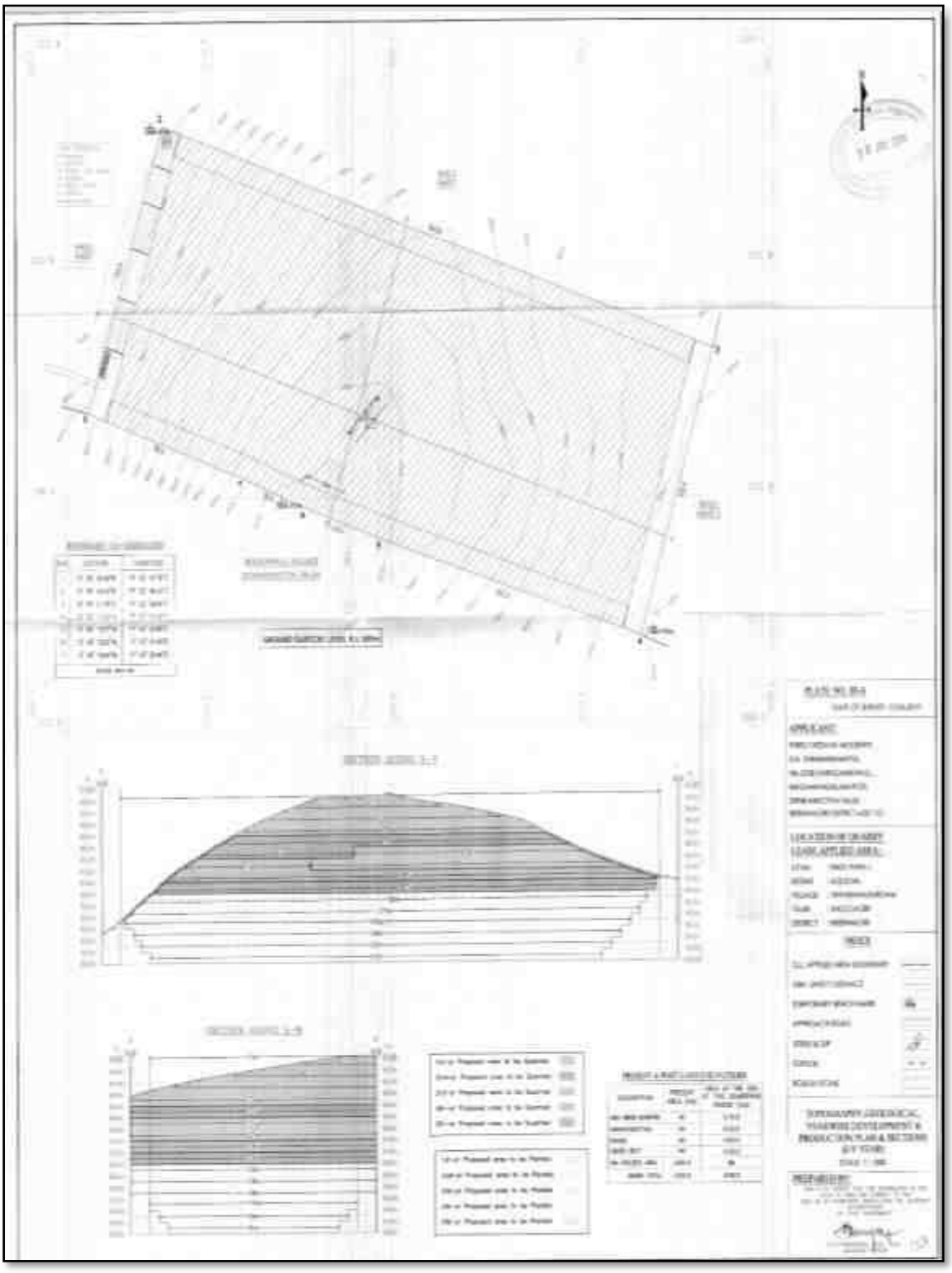


FIGURE 2.10: TOPOGRAPHY, GEOLOGICAL, YEARWISE DEVELOPMENT PRODUCTION PLAN AND SECTION

Thiru. N.Narayanan – P1



Thiru.T.Kesavamoorthy -P2



2.4 RESOURCES AND RESERVES

The Resources and Reserves of Rough Stone quarry and Topsoil were calculated based on Cross-Section Method by plotting sections to cover the maximum lease 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 2.6: AVAILABLE GEOLOGICAL RESOURCES OF PROPOSED PROJECTS- P1 & P2

Description	P1		P2	
	Rough Stone quarry	Topsoil	Rough Stone quarry	Topsoil
Geological Resource	20,24,000m^3	42,450m^3	21,29,000m^3	40,217m^3
Mineable Reserves	14,45,070m^3	39,300 m^3	18,50,770m^3	31,857m^3

Source: Approved Mining Plan

TABLE 2.7: YEAR-WISE PROPOSAL FOR FIRST FIVE YEARS PRODUCTION PLAN-P1

YEAR	ROUGH STONE QUARRY (m^3)	TOPSOIL (m^3)
I	1,48,070	39,300
II	1,48,500	-
III	1,56,000	-
IV	1,42,500	-
V	1,50,000	-
FIRST FIVE YEARS TOTAL	**7,45,070**	**39,300**
VI	1,42,500	-
VII	1,35,750	-
VIII	1,34,250	-
IX	1,42,000	-
X	1,45,500	-
SECOND FIVE YEARS TOTAL	**7,00,000**	**-**

Source: Approved Mining Plan

TABLE 2.8: YEAR-WISE PROPOSAL FOR FIRST FIVE YEARS PRODUCTION PLAN-P2

YEAR	ROUGH STONE QUARRY (m^3)	TOPSOIL (m^3)
I	2,00,670	31,857
II	1,69,645	-
III	1,84,710	-
IV	2,09,600	-
V	1,74,885	-
FIRST FIVE YEARS TOTAL	**9,39,510**	**31,857**
VI	1,76,195	-

VII	1,77,505	-
VIII	1,76,850	-
IX	1,44,300	-
X	2,36,410	-
SECOND FIVE YEARS TOTAL	**9,11,260**	**37,857**

Source: Approved Mining Plan

Disposal of Waste

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

Conceptual Mining Plan/ Final Mine Closure Plan

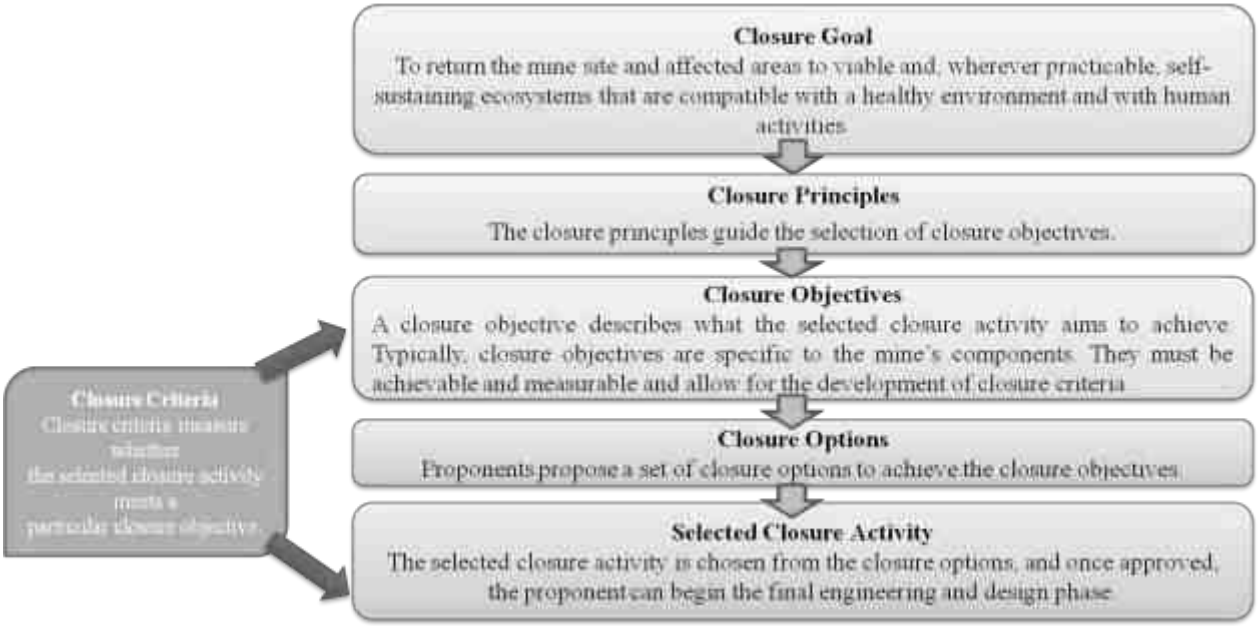
The ultimate pit size is designed based on certain practical parameters such as economical depth of mining, safety zones, permissible area, etc.

TABLE 2.9: ULTIMATE PIT DIMENSIONS- P1& P2

Pit	Length (Max) (m)	Width (Max) (m)	Depth (Max) (m)
I	273	150	76 m (66 m AGL+ 10 m BGL)
Pit	**Length (Max) (m)**	**Width (Max) (m)**	**Depth (Max) (m)**
I	307	131	76 m Agl

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 principle 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.



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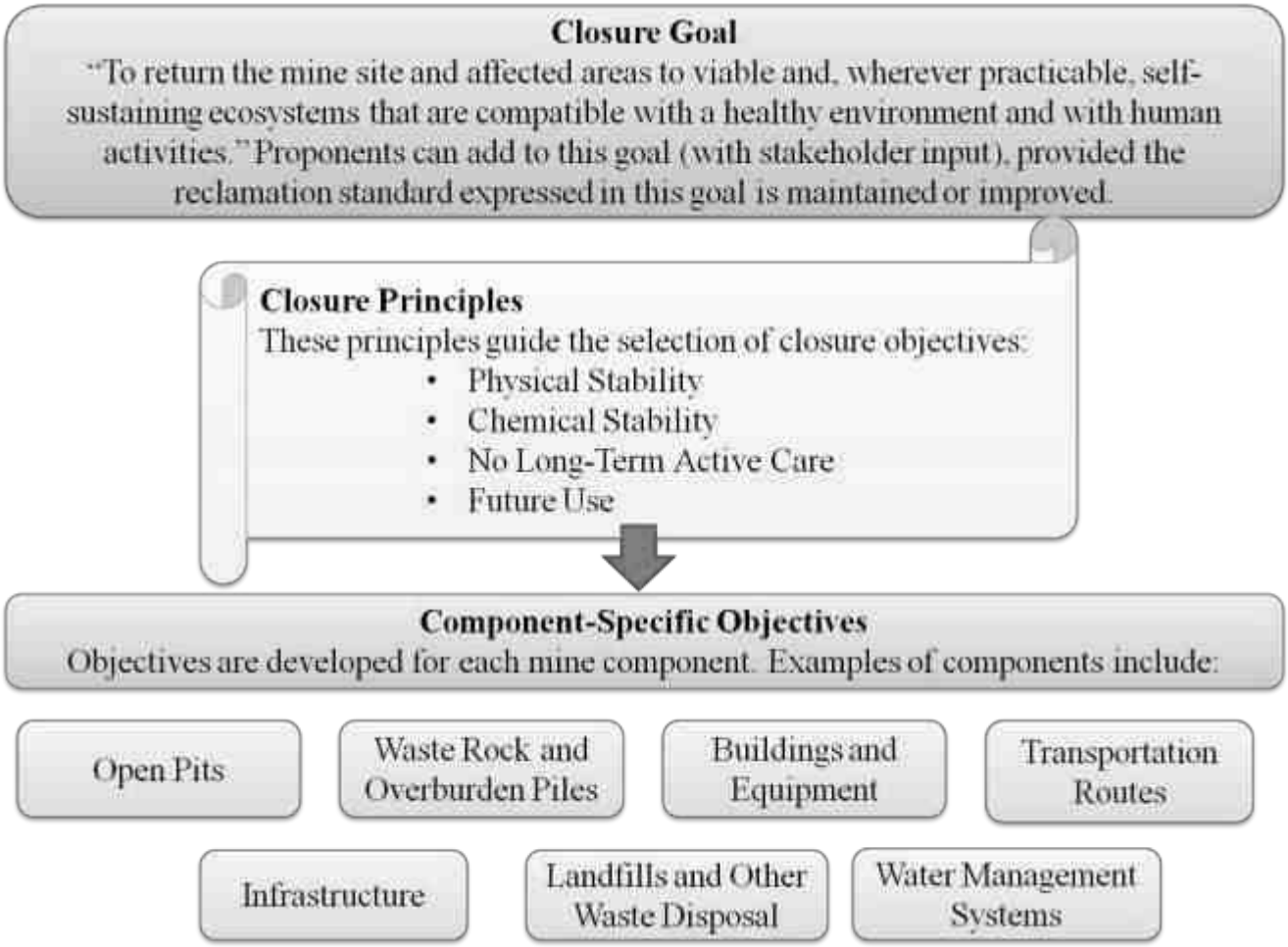
Closure Objectives

- 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 2.10: MINE CLOSURE BUDGET-P1

ACTIVITY	YEAR										RATE	COST (Rs.)
	I	II	III	IV	V	VI	VII	VIII	IX	X		
Plantation under safety zone	31	31	31	31	31	31	31	31	31	31	@100 Rs Per sapling Including Maintenance	31,000
	3100	3100	3100	3100	3100	3100	3100	3100	3100	3100		
Plantation in the quarried out top benches, approach road and panchayat road	20	20	20	20	20	20	20	20	20	20		20,000
	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000		
Wire Fencing for 860 Mtrs length	258000	-	-	-	-	-	-	-	-	-	@300 Rs Per Meter	2,58,000
Garland Drain with settling traps for 540 Mtrs length	162000	-	-	-	-	-	-	-	-	-	@300 Rs Per Meter	1,62,000
Total												**4,66,000**

TABLE 2.11: MINE CLOSURE BUDGET-P2

ACTIVITY	YEAR										RATE	COST (Rs.)
	I	II	III	IV	V	VI	VII	VIII	IX	X		
Plantation under safety zone	26	26	26	26	26	26	26	26	26	26	@100 Rs Per sapling Including Maintenance	26,000
	2600	2600	2600	2600	2600	2600	2600	2600	2600	2600		
Plantation in the quarried out top benches, approach road and panchayat road	20	20	20	20	20	20	20	20	20	20		20,000
	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000		
Wire Fencing for 870 Mtrs length	261000	-	-	-	-	-	-	-	-	-	@300 Rs Per Meter	2,61,000
Garland Drain with settling traps for 810 Mtrs length	243000	-	-	-	-	-	-	-	-	-	@300 Rs Per Meter	2,43,000
Total												**5,55,000**

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 quarry 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 (Topsoil) will be Excavate directly by Hydraulic Excavators and loaded into tippers directly and sold to needy customers. The Rough Stone quarry 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 quarry 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 – 50grams

  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 quarry will be excavated from one hole	=	3 Tonnes
Total Volume from two proposed quarries	=	**32,95,840**m^3
	=	**32,95,840**/10
	=	**3,29,584**/300
	=	1099* 2.6
	=	2,856Tonnes per day
Therefore, Number of Holes per day	=	2,856 /3
	=	952 Holes per day (for 2 Quarries)

Type of Explosives to be used –

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

2.5.3 Extent of Mechanization

TABLE 2.12 PROPOSED MACHINERY DEPLOYMENT

PROPOSAL – P1				
S.NO.	**TYPE**	**NOS**	**SIZE/CAPACITY**	**MOTIVE POWER**
1	Jack hammers	8	1.2m to 2.0m	Compressed air
2	Compressor	2	400psi	Diesel Drive
3	Excavator with Bucket / Rock Breaker	3	300 HP	Diesel Drive
4	Tippers	9	20 Tonnes	Diesel Drive
5	Wagon Drill	1	300 HP	Diesel Drive
PROPOSAL – P2				
S.NO.	**TYPE**	**NOS**	**SIZE/CAPACITY**	**MOTIVE POWER**
1	Jack hammers	10	1.2m to 2.0m	Compressed air
2	Compressor	3	400psi	Diesel Drive
3	Excavator with Bucket / Rock Breaker Unit 4	4	300 HP	Diesel Drive
4	Tippers	8	20 Tonnes	Diesel Drive
5	Wagon Drill	1	300 HP	Diesel Drive

Source: Approved Mining Plan of the respective projects.

2.6 General Features

2.6.1 Existing Infrastructures

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

2.6.1 Drainage Pattern

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

2.6.2 Traffic Density

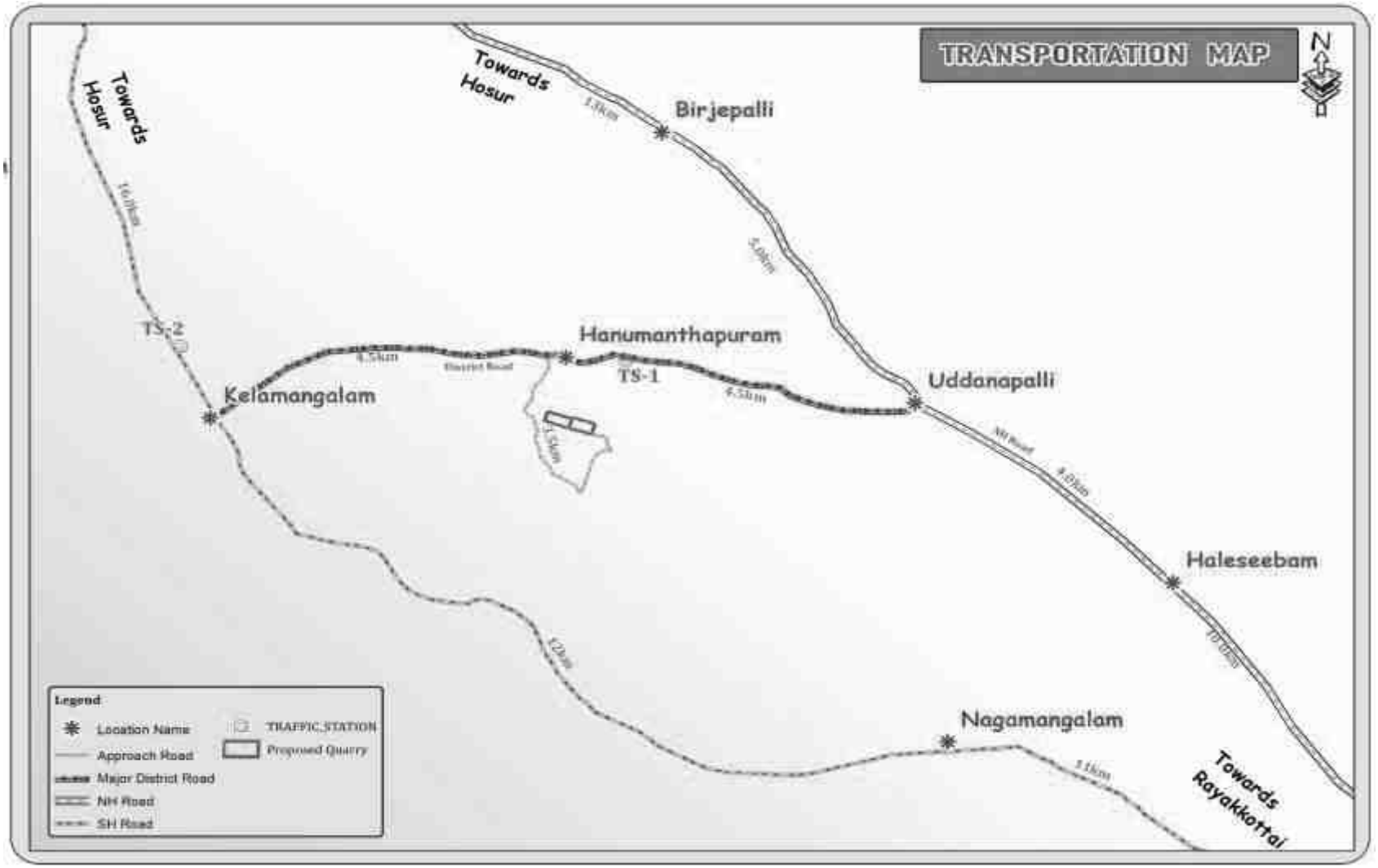
Traffic density measurements were performed as per IRC 1960 Guidelines at three locations based on the transportation route. Traffic density measurement were made continuously for 24 hours by visual observation and counting of vehicles under three categories, viz., heavy motor vehicles, light motor vehicles 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	Uddanapalli-Kelamangalam	1Km	Major District Road
TS2	Hosur-Rayakottai(SH Road)	2Km	SH Road

Source: On-site monitoring by GEMS FAE & TM

FIGURE 2.11: 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	85	255	20	20	90	45	320
TS2	155	465	45	45	165	83	593

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 quarry per day		
Capacity of trucks	Cumulative Trips	Volume in PCU
10/20 tonnes	51Trips	153

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
Major District Road	320	153	473	500
SH Road	593	153	746	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.

2.6.3 Mineral Beneficiation and Processing

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

2.6.4 Existing Infrastructure

It is a new quarry, no infrastructural facility available within the project area. The infrastructural facilities to be made after the start of the quarrying operations will be prepared outside limit as per the rules and safe distance to be adopted.

2.6.2 Drainage Pattern

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

2.7 Project Requirement

2.7.1 Water Source & Requirement

Detail of Total water requirements in KLD as given below:

TABLE 2.17 – WATER REQUIREMENT FOR THE CLUSTER PROJECT -P1& P2

PROPOSAL – P1

*Purpose	Quantity	Source
Dust Suppression	0.6 KLD	From Existing bore wells from nearby area
Green Belt development	1.5 KLD	From Existing bore wells from nearby area
Drinking and Domestic purpose	0.4 KLD	From existing, bore wells and drinking water will be sourced from Approved water vendors.
Total	**2.5 KLD**	
PROPOSAL – P2		
*Purpose	Quantity	Source
Dust Suppression	0.6 KLD	From Existing bore wells from nearby area
Green Belt development	1.3 KLD	From Existing bore wells from nearby area
Domestic purpose	0.8 KLD	From existing, bore wells and drinking water will be sourced from Approved water vendors.
Total	**2.7 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 -P1

Fuel is to be used inform of diesel for quarrying operations, compressors and running of tippers and other transportation vehicles. Quantity for fuel will depend upon the usage of transportation vehicle and other machineries and level of achievement of estimated production. Diesel will be out sourced from nearby diesel pumps.

1. For Topsoil:

Per hour Excavator will consume = 10 liters / hour

Per hour Excavator will excavate = 60$m^3$of Topsoil

Topsoil quantity = 39,300/60 = 655hours

Diesel consume = 655hours x 10 liters

Total diesel consumption = **6550** Liters of HSD will be utilized for Topsoil

2. For Rough Stone quarry:

Per hour Excavator will consume = 16 liters / hour

Per hour Excavator will excavate = 20m^3 of Rough Stone quarry

Rough Stone quarry quantity = 14,45,070 /20 = 72,254 hours

Diesel consume = 72,254 hours x 16 liters

Total diesel consumption = **1,156,064** Liters of HSD will be utilized for Rough Stone quarry

Total diesel consumption = **1,162,614** Liters of HSD will be utilized for entire project life.

Fuel Requirement -P2

1. For Topsoil:

Per hour Excavator will consume = 10 liters / hour

Per hour Excavator will excavate = 60$m^3$of Topsoil

Topsoil quantity = 31,857/60 = 531 hours

Diesel consume = 531 hours x 10 liters

Total diesel consumption = **5310** Liters of HSD will be utilized for Topsoil

2. For Rough Stone quarry:

Per hour Excavator will consume = 16 liters / hour

Per hour Excavator will excavate = 20$m^3$of Rough Stone quarry

Rough Stone quarry quantity = 18,50,770/20 = 92,539 hours

Diesel consume = 92,539 hours x 16 liters

Total diesel consumption = **1,480,616** Liters of HSD will be utilized for Rough Stone quarry

Total diesel consumption = **1,485,926** Liters of HSD will be utilized for entire project life.

2.7.4 Employment Requirement:

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

TABLE 2.18: EMPLOYMENT POTENTIAL FOR PROPOSED QUARRIES

Identification code	Employment in Nos
P1	40
P2	46
Total	**86**

A total of 86 people will get employment due to these 2 quarries in the cluster quarries.

2.7.5 Project Cost

TABLE 2.19 – PROJECT COST OF PROPOSED PROJECTS

Identification code	Project Cost
P1	Rs. 2,39,71,000/-
P2	Rs. 2,75,60,000/-
Total	**Rs. 5,15,31,000 /-**

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

2.8 Project Implementation Schedule

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

TABLE 2.20 – 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 EHS 360 Labs Private Limited, – An accredited by ISO/IEC 17025:2017 (NABL) Laboratory, – for the below attributes-

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

Study Area

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

Study Period

The baseline study was conducted during the pre-monsoon season i.e., Dec2022, Jan & 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	Data from census handbook 2011 and from the satellite imagery	Study Area	Satellite Imagery Primary Survey
*Soil	Physio-Chemical Characteristics	Once during the study period	6 (1 core & 5 buffer zone)	IS 2720 Agriculture Handbook - Indian Council of Agriculture Research, New Delhi
*Water Quality	Physical, Chemical and Bacteriological Parameters	Once during the study period	6 (2 surface water & 4 ground water)	IS 10500& CPCB Standards
Meteorology	Wind Speed Wind Direction Temperature Cloud cover Dry bulb temperature Rainfall	1 Hourly Continuous Mechanical/Automatic Weather Station	1	Site specific primary data& Secondary Data from IMD Station
*Ambient Air Quality	PM_{10} $PM_{2.5}$ SO_2 NO_X Fugitive Dust	24 hourly twice a week (Dec –Feb 2023)	8 (1 core & 7 buffer)	IS 5182 Part 1-23 National Ambient Air Quality Standards, CPCB

*Noise Levels	Ambient Noise	Hourly observation for 24 Hours per location	8 (1 core & 7 buffer zone)	IS 9989 As per CPCB Guidelines
Ecology	Existing Flora and Fauna	Through field visit during the study period	Study Area	Primary Survey by Quadrate & Transect Study Secondary Data – Forest Working Plan
Socio Economic Aspects	Socio–Economic Characteristics, Population Statistics and Existing Infrastructure in the study area	Site Visit & Census Handbook, 2011	Study Area	Primary Survey, census handbook & need based assessments.

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

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

3.1 LAND ENVIRONMENT

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

3.1.1 LAND USE/ LAND COVER

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

Point No. 4 All comer coordinates of the mine lease area, superimposed on a High-Resolution Imagery/ topo sheet. topographic sheet, geomorphology and geology of the area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features ofthe study area (core and buffer zone).

Point No. 10. Lard use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary. national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted.

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

3.1.2 OBJECTIVE

The objectives of the LULC study are as follow:

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

Technical specification of Satellite imagery Data Used:

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

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

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

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

TABLE 3.2: Resourcesat1-LISSIII SENSOR characteristics

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

Source: NRSC, Hyderabad

3.1.3 METHODOLOGY

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

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

- Geo-Referencing of satellite Imagery with the help of Geo-Referenced Toposheets
- Enhancement of the Satellite Imagery
- Base Map layer creation (Roads, Railway, Village Names, and other Secondary data, etc.)
- Data analysis and Classification using Digital interpretation techniques.
- Ground truth studies or field Verification.
- Error fixing / Reclassification
- Final Map Generation.

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

Land Use Pattern of the Buffer Zone (Study area)

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

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

S.No	CLASSIFICATION	AREA_HA	AREA_%
	BUILTUP		
1	RURAL	66.31	0.21
2	MINING	511.10	1.61
	AGRICULTURAL LAND		
3	CROP LAND	19331.00	60.89
4	PLANTATION	1918.55	6.04
5	FALLOW LAND	3209.47	10.11
	FOREST		
6	FOREST	2869.37	9.04
	BARREN/WASTE LANDS		
7	SCRUB LAND	2035.85	6.41
8	BARREN ROCKY	993.04	3.13
	WETLANDS/ WATER BODIES		
9	WATER BODIES/LAKE	811.51	2.56
TOTAL		31746.19	100.00

Source: Bhuvan, NRSC.

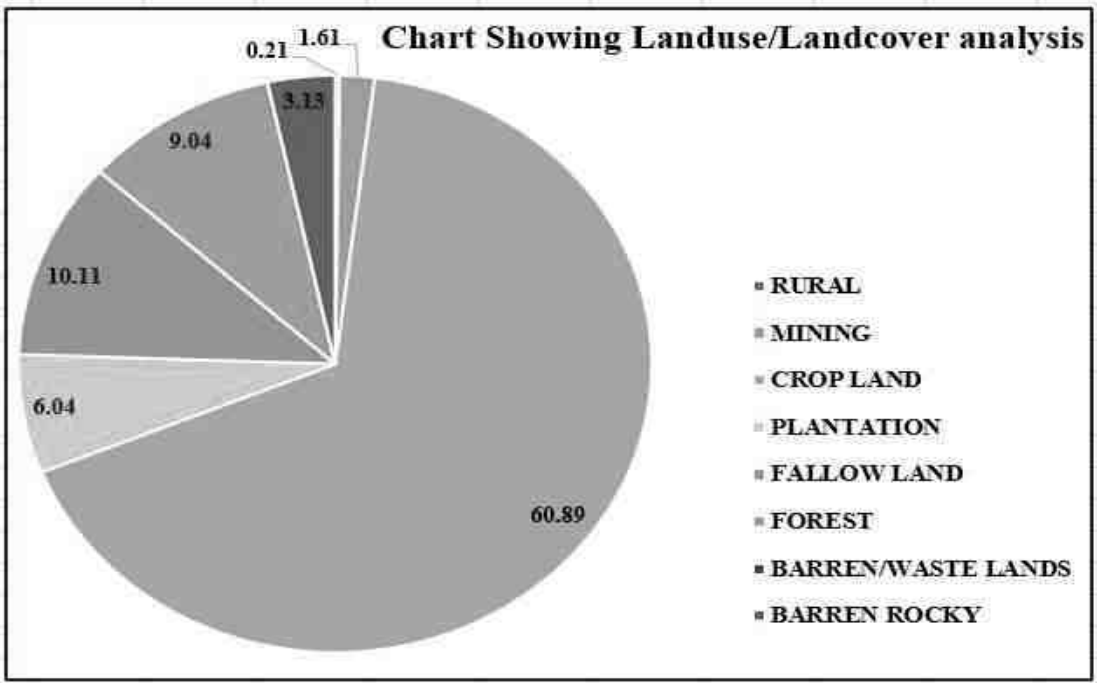


FIGURE 3.1: CHART SHOWING LANDUSE/LANDCOVER ANALYSIS USING LISS III Data

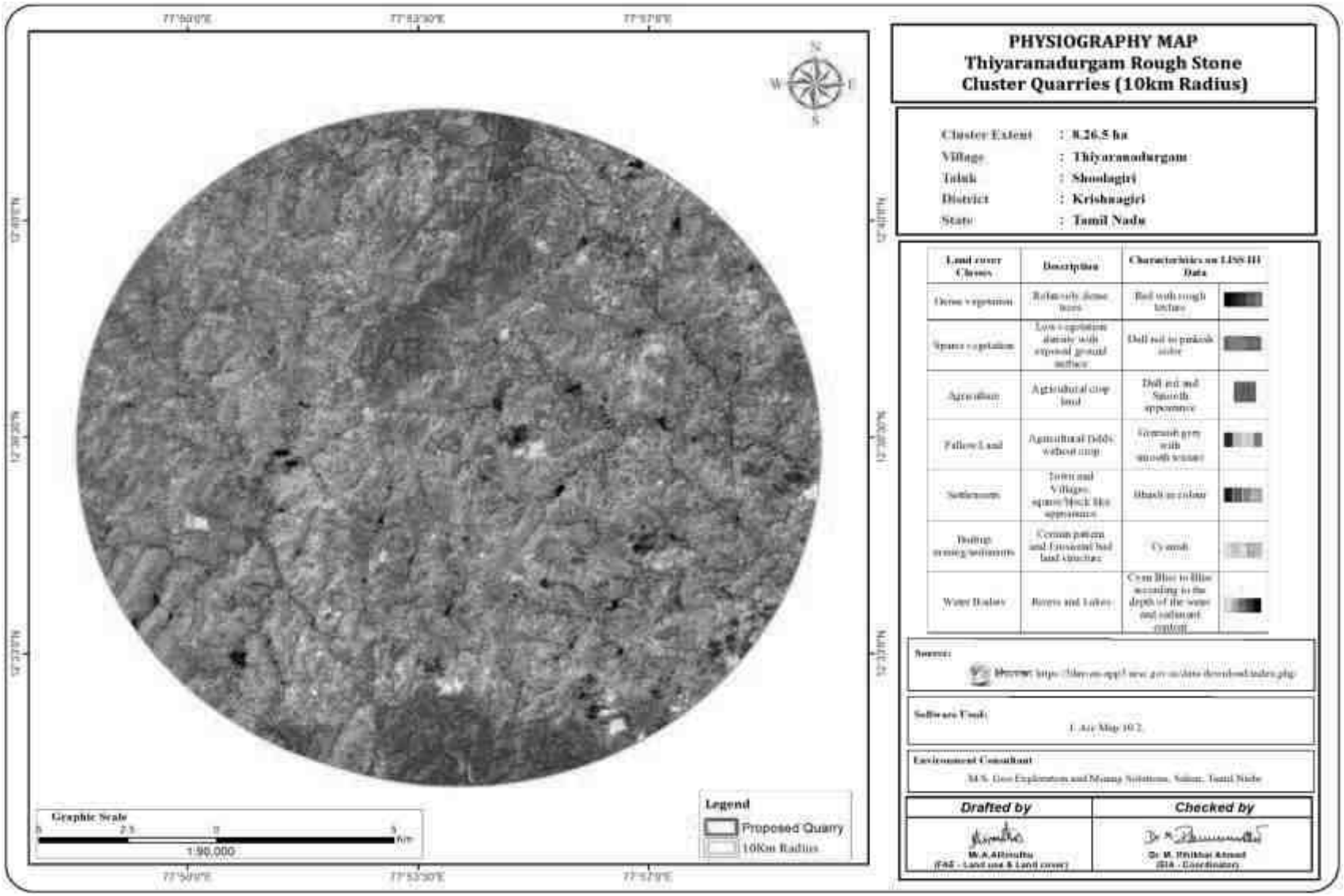
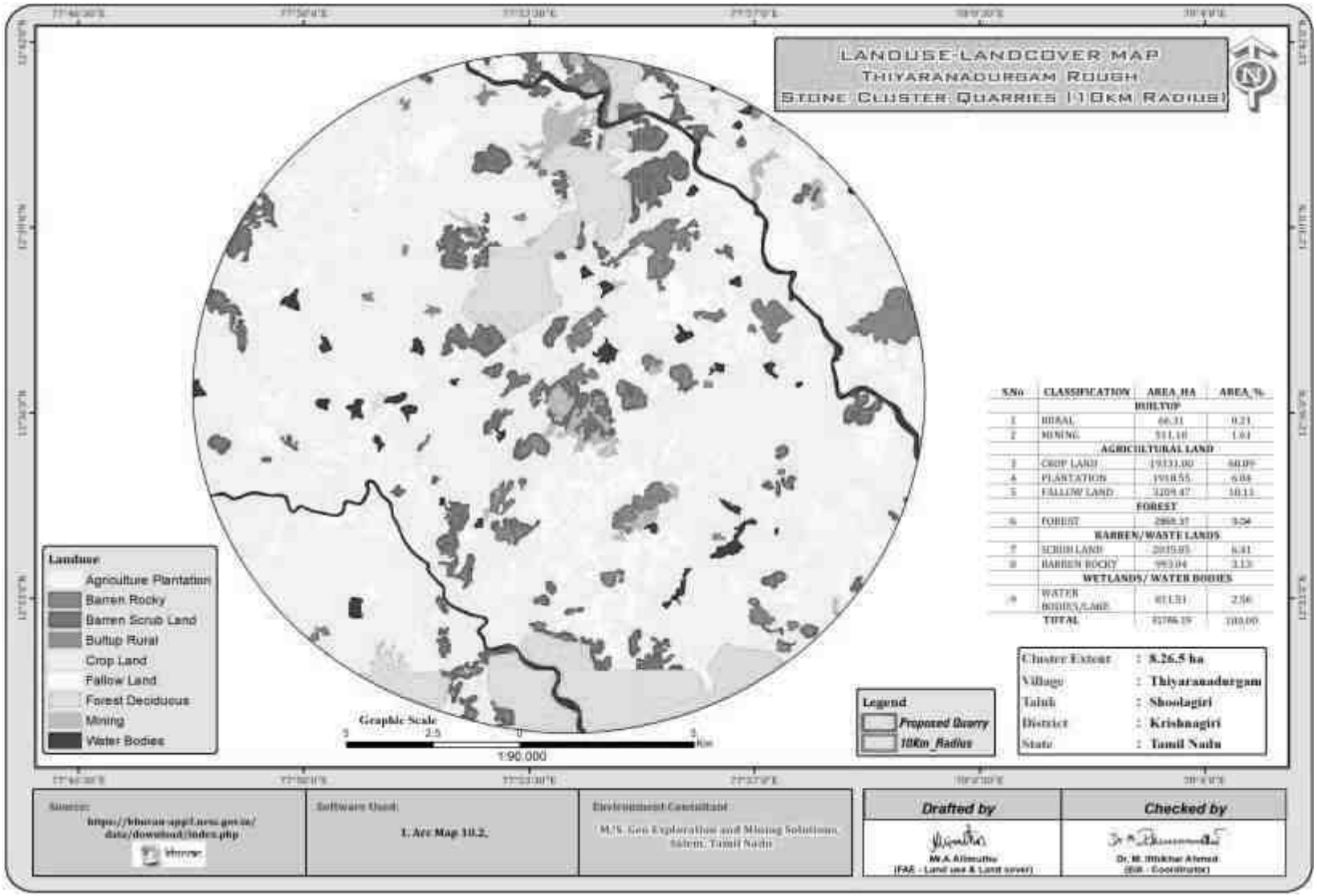


FIGURE 3.2: MAP SHOWING FALSE COLOR COMPOSITE (3,2,1) SATELLITE IMAGERY OF THE STUDY AREA



SNo	CLASSIFICATION	AREA_HA	AREA_%
	BUILTUP		
1	RURAL	66.31	0.21
2	MINING	511.10	1.61
	AGRICULTURAL LAND		
3	CROP LAND	19331.00	60.89
4	PLANTATION	1918.55	6.04
5	FALLOW LAND	3209.47	10.11
	FOREST		
6	FOREST	2868.37	9.04
	BARREN/WASTE LANDS		
7	SCRUB LAND	2035.85	6.41
8	BARREN ROCKY	993.04	3.13
	WETLANDS/ WATER BODIES		
9	WATER BODIES/LAKE	811.51	2.56
	TOTAL	31796.19	100.00

FIGURE 3.3: LAND USE LAND COVER MAP 10KM RADIUS

3.1.4 Interpretation

- The 10 km radius study area mainly comprises of crop land & Agriculture Plantation land accounting of 60.89% & 6.04% of the total study area. The study area also consists of fallow land of 10.11%.
- The buffer zone studied has no ecological sensitive area (National Park, Wildlife Sanctuary, Biosphere Reserve/ etc.).
- Water Bodies such as ponds/ lakes comprises of 3% of the total buffer area. The two seasonal rivers such as Ponnaiyar river at 7 Km in NE direction, Tank 2.6km in N and Chinnatti River at 4km in SW direction of the total study area.
- The Scrub land accounts of 6%. As per the primary survey, it was observed the scrub land is mainly occupied by the stony waste and left-over domestic waste generated by the nearby areas.
- The R.F area (Sanamav R.F), Perandapalli Forest, Udedurgam R.F area coverd is about 9.04% in buffer zone.
- 2% of the total study area is occupied by the mine industries of captive mines. The area occupied by Mainly Roughstone of the total buffer area. As also observed within the primary survey, the 10 km buffer area is also occupied by the medium scaled granite and small Brick kiln industries also located in the study area.
- 0.21% of the area is covered under the Builtup Land. The nearest village within the 3 km radius from the project site boundary is observed to be villages Kendurg, Thyranadurgam, Anchetty Durgam, Kelamangalam Town Panchayat etc.,

3.1.5 Cropping Pattern of the Buffer Zone

Krishnagiri district is one of the potential districts for cultivation of agricultural and horticultural crops. total cultivated area of 224767 Hectares, out of which 180902 Ha Net cultivated area against the 5,14,325 Ha. of total geographical area.

It is one of the potential districts for agricultural and horticultural crop production. The major agricultural crops in the district are grown Paddy, Ragi, Redgram, Cowpea, Maize, Cumbu, Groundnut, Horsegram and minor millets. The major cultivated area of agricultural crops occupied by rainfed agriculture. The major horticultural crops grown in the district are fruit crops like Mango, Banana and Guava, Vegetable like eggplant, okra, capsicum, onion and chilli, spices like Turmeric, Black pepper and flower crops like Rose, Gerbera and Carnations.

Source: https://www.agrifarming.in/district-wise-crop-production-in-tamil-nadu#krishnagiri

3.1.6 Interpretation and Conclusion

- Thiyaranadurgam village Roughstone quarries has proposed Project. It is a government poramboke land.
- Total project area is 31746.19 ha around 10km radius.
- As new Proposed mine is coming in the area, percentage of human settlement will be increased in surrounding of project site and Infrastructure facilities also will be developed on the basis of requirement.
- The 10 km study area mostly covers of crop land 60.89%. As per current study area is occupied by scrub land 6.41%, Barren rocky land 3.13% in 10 km radius from the study area land use into quarrie purpose for this proposed project.

- The R.F area (Sanamav R.F), Perandapalli Forest, Udedurgam R.F area coverd is about 9.04% in buffer zone.
- The project site falls under the Roughstone region. Therefore, the area is appropriate for developing Road development and building etc., it shows that the region has good prospects in the future. Due to proposed Roughstone in this region, economic condition of locals is expected to be improved directly & indirectly. Hence project will prove to be the best economic proposal for the coming times.

3.1.7 TOPOGRAPHY

The lease applied area is exhibits flat terrain. The area has gentle sloping towards North eastern side from Krishnagiri district. The altitude of the area is 875-805m AMSL The area is covered by 2m thickness of Topsoil formation. Massive Charnockite which is clearly inferred from the proposed quarry pits.

3.1.7 DIGITAL ELEVATION MODEL

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

Data Used

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

Methodology

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

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

1st Stage:

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

2nd Stage:

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

3rd Stage:

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

4th Stage:

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

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

Slope

The slope map was derived from SRTM DEM data of the study area. The slope of the study area was classified into four classes: less than 2Percent/degree Flat to almost flat, and no meaningful denudation process. More gentle low speed ground motion, sheet erosion and soil rosion in the 4^0 to 7^0 more gentle the same as above but with a higher magnitude and 7^0 to 12^0 is slightly steep, a lot of ground movement and erosion especially landslides that are flat. Slope zone 5 class divide 0-2º, 2-4º, 4-7^0, 7-12^0, and above-12º (Fig.3.5)

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

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

Interpretation *& Conclusion*

It is very clear from the DEM that the elevation varies from 647m to 947m in the whole study area, thus having an elevation difference of 300m. The areas in the Northern, Southerneastern portion have higher elevation which is covered by plain land while the low-lying areas are generally used for agricultural purpose with builtup land. The contour over the DEM shows that the project site is 850-860m in the elevation range of 10 m interval present on the flat land in the study area.

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

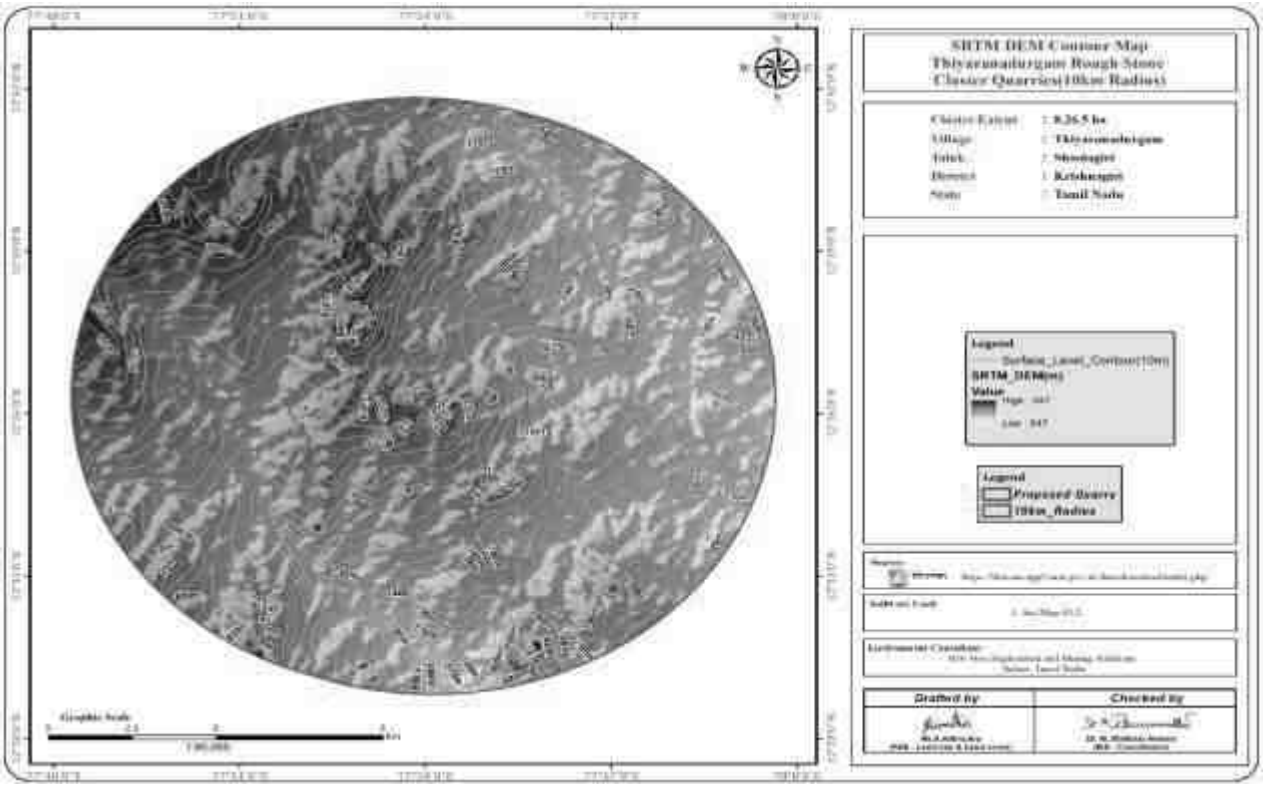
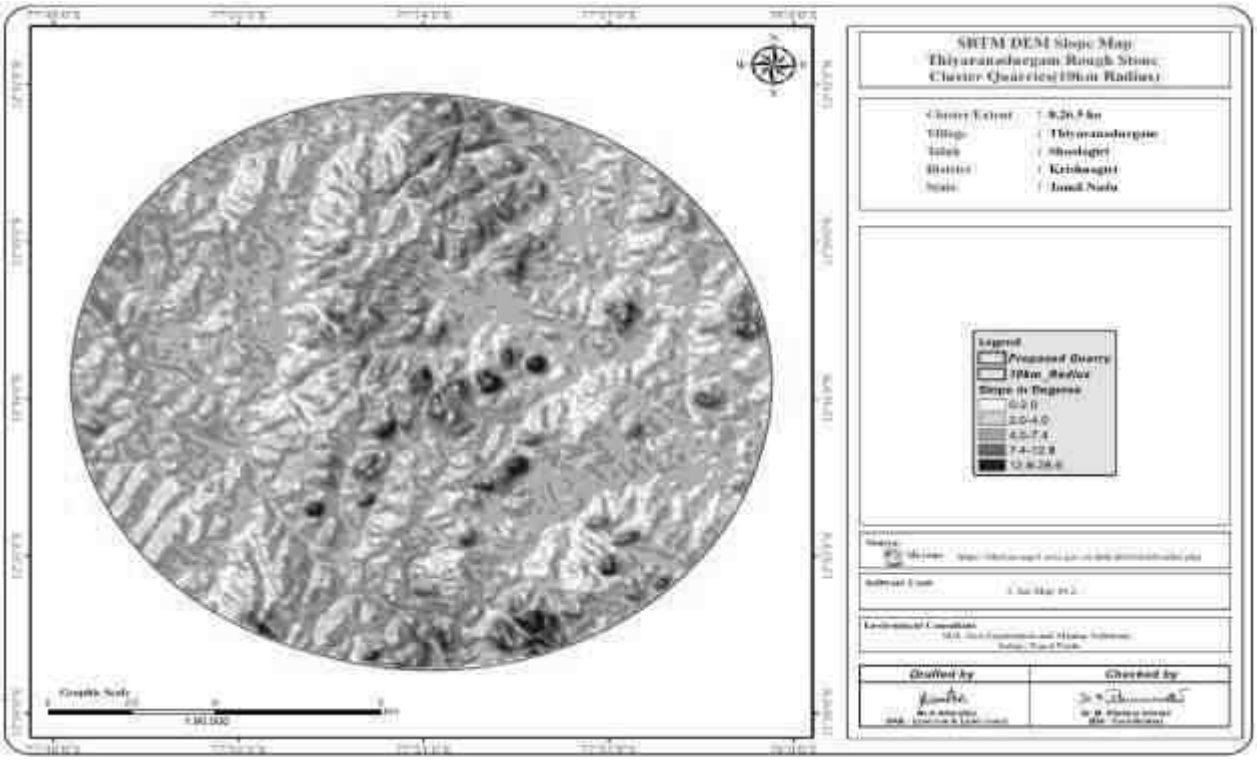


FIGURE 3.5: SLOPE MAP AROUND 10KM RADIUS



3.1.2 Topography

The project area is almost plain terrain with gentle gradient towards North – Southeastern, Easterm side, maximum elevation of the area is 915-845m above Mean Sea level there are no hilly regions in and around the area.

3.1.3 Drainage Pattern of the Area

There are no developed surface drainage channels in the study area. Ponnaiyar River a perennial pass 7km-North East from the project site. The area is studded with few tanks that serve as the source of drinking water and also their surplus feeds adjoining tanks. The area is mostly dry in all seasons except rainy seasons.

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

3.1.2 Environmental Features in the Study Area

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

3.1.5 Seismic Sensitivity

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

TABLE 3.4 – DETAILS OF ENVIRONMENT SENSITIVITY AROUND THE PROJECT AREA

Sl. No	Sensitive Ecological Features	Name	Arial Distance in km from Mine Lease Boundary
1	National Park / Wild life Sanctuaries	Cauvery Wildlife Santuary	6.8km-S
2	Reserve Forest	Sanamav R.F Udedugam R.F Denkanikottai R.F	2km-NW 6.8km-S 8.8km-S
3	Tiger Reserve/ Elephant Reserve/ Biosphere Reserve	None	Nil within 10Km Radius
4	Critically Polluted Areas	None	Nil within 10Km Radius
5	Mangroves	None	Nil within 10Km Radius
6	Mountains/Hills	None	Nil within 10Km Radius
7	Notified Archaeological Sites	None	Nil within 10Km Radius
8	Defence Installation	None	Nil within 10Km Radius

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

TABLE 3.5 – WATER BODIES WITHIN THE CLUSTER FROM PROPOSED QUARRIES

P1			
S.No	**LABEL**	**DISTANCE & DIRECTION**	**Habitation**
1	Tank	50m NE	650m NW
2	Odai	1km North	
3	Tank	1.4km NE	
4	Dholasetti Cheruvu Lake	2.6km SW	
5	Chinnar Stream	5.6km SW	
6	Nagamangalam Lake	6.3km SE	
7	Ponnaiyar River	7.0km NE	
P2			
S.No	**LABEL**	**DISTANCE & DIRECTION**	**Habitation**
1	Tank	250m NE	580m N
2	Odai	970m North	
3	Tank	1.6km NE	
4	Dholasetti Cheruvu Lake	2.5km SW	
5	Chinnar Stream	5.5km SW	
6	Nagamangalam Lake	6.3km SE	
7	Ponnaiyar River	7.0km NE	

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 3.6 – SOIL SAMPLING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	S-1	Core Zone	Project Area	12°36'20.03"N 77°53'51.41"E
2	S-2	Hanumanthapuram	660m North	12°36'43.00"N 77°53'59.21"E
3	S-3	Krishnapuram	3.6km NE	12°36'24.12"N 77°56'6.22"E
4	S-4	Varanaganapalli	5km SE	12°33'49.16"N 77°55'31.49"E
5	S-5	Anusonai	3.3km South	12°34'26.16"N 77°53'54.46"E
6	S-6	Beerjepalli	3.8km NE	12°38'23.90"N 77°54'35.80"E

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

FIGURE 3.6: 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. six (6) locations were selected for soil sampling on the basis of soil types, vegetative cover, industrial & residential activities including infrastructure facilities, which would accord an overall idea of the soil characteristics. The samples were analysed for physical and chemical characteristics. The sealed samples were sent to laboratory for analysis. The samples were filled in Polythene bags, coded and sent to laboratory for analysis and the details of methodology in respect are given in below Table 3.5.

TABLE 3.7 – METHODOLOGY OF SAMPLING COLLECTION

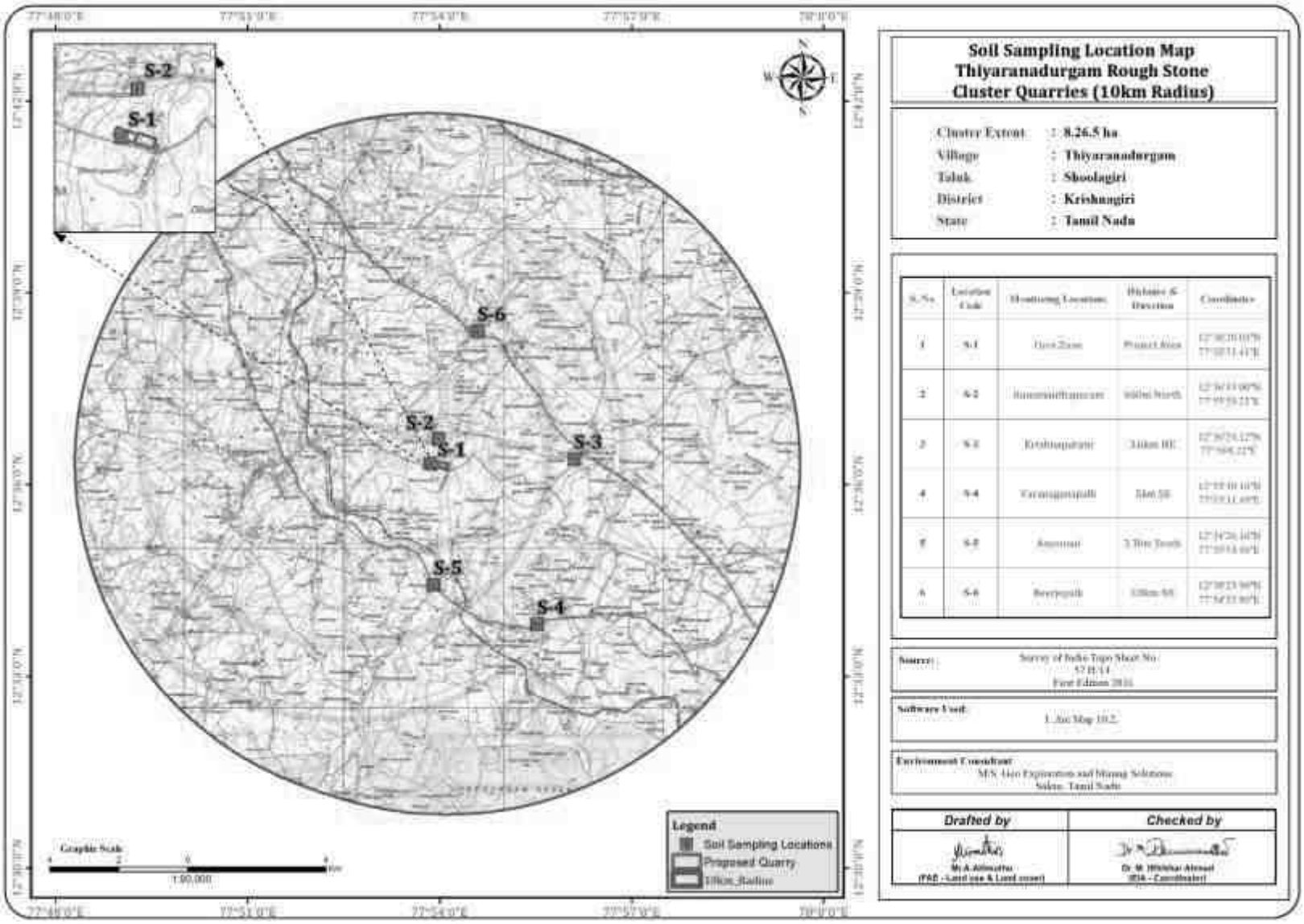
Particulars	Details
Frequency	One grab sample from each station-once during the study period
Methodology	Composite grab samples of the topsoil were collected from 3 depths, and mixed to provide a representative sample for analysis. They were stored in airtight Polythene bags and analysed at the laboratory.

Source: On-site monitoring/sampling by EHS 360 Labs 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 3.7: SOIL SAMPLING LOCATIONS AROUND 10 KM RADIUS



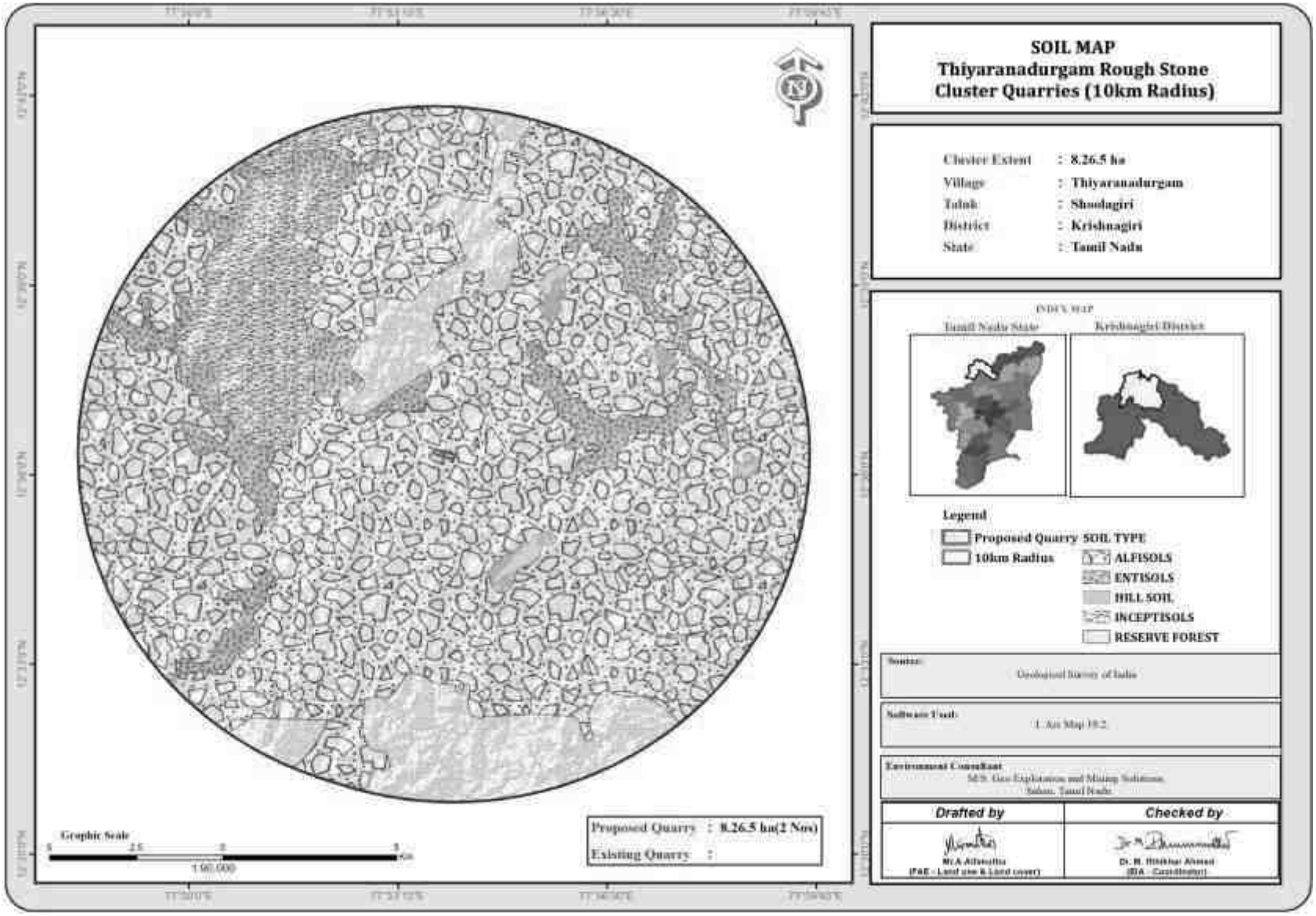


FIGURE 3.8: SOIL MAP

TABLE 3.8 – SOIL QUALITY MONITORING DATA

S.No	Test Parameters	Protocols	S1-Core Zone	S2-Hanumanthapuram	S3-Krishnapuram	S4-Varanaganapalli	S5-Anusonai	S6-Beerjepalli
1	pH @ 25°C	IS 2720 Part 26 - 1987 (Reaff:2016)	8.89	8.01	8.22	8.3	7.25	8.15
2	Conductivity @ 25°C	IS 14767 - 2000 (Reaff : 2016)	510 µmhos/cm	486 µmhos/cm	443 µmhos/cm	481 µmhos/cm	400 µmhos/cm	488 µmhos/cm
3	Water Holding Capacity	By Gravimetric Method	0.479	0.468	0.453	44.8. %	0.466	0.467
4	Bulk Density	By Cylindrical Method	1.05 g/cm^3	1.13 g/cm^3	1.19 g/cm^3	1.24 g/cm^3	0.97 g/cm^3	1.07 g/cm^3
5	Porosity	By Gravimetric Method	0.426	0.402	0.437	0.431	0.416	0.424
6	Calcium as Ca	Food and Agriculture organization of the united Nation Rome 2007 : 2018	145 mg/kg	143.7 mg/kg	99.1 mg/kg	167.2 mg/kg	130 mg/kg	130 mg/kg
7	Magnesium as Mg		70.8 mg/kg	97 mg/kg	81.8 mg/kg	70 mg/kg	74.5 mg/kg	78.3 mg/kg
8	Chloride as Cl	APHA 23rd Edn 2019 4500 Cl B	110.5 mg/kg	123.4 mg/kg	130 mg/kg	90.4 mg/kg	130 mg/kg	100.5 mg/kg
9	Soluble Sulphate as SO_4	IS 2720 Part 27 : 1977 (Reaff:2015)	0.00011	0.000011	0.00012	0.000055	0.00004	0.000032
10	Total Phosphorus as P	IS 10158 : 1982 (Reaff: 2019)	1.65 mg/kg	2.6 mg/kg	1.97 mg/kg	1.10 mg/kg	2.3 mg/kg	1.6 mg/kg
11	Total Nitrogen as N	IS 14684 : 1999 (Reaff:2019)	388 mg/kg	260 mg/kg	379 mg/kg	366.2 mg/kg	354.2 mg/kg	300 mg/kg
12	Organic Matter	IS : 2720 Part 22: 1972 (Reaff: 2015)	0.0183	0.014	0.031	0.0188	0.0156	0.0215
13	Organic Carbon	IS : 2720 Part 22: 1972 (Reaff: 2015)	0.0106	0.0081	0.018	0.0109	0.0091	0.0125
14	Texture :							
	Clay	Gravimetric Method	0.354	0.34	0.375	0.308	0.315	0.338
	Sand		0.331	0.331	0.352	0.387	0.388	0.374
	Silt		0.315	0.329	0.273	0.305	0.297	0.288
15	Manganese as Mn	USEPA 3050 B – 1996 &	22.4 mg/kg	30.5 mg/kg	25.6 mg/kg	22.2 mg/kg	14 mg/kg	20.2 mg/kg
16	Zinc as Zn	USEPA 6010 C - 2000	1.3 mg/kg	1.5 mg/kg	1.24 mg/kg	1.32 mg/kg	1.3 mg/kg	1.16 mg/kg
17	Boron as B		2.44 mg/kg	1.10 mg/kg	2.67 mg/kg	1.05 mg/kg	1.3 mg/kg	1.01 mg/kg
18	Potassium as K		31.6 mg/kg	34.5mg/kg	41 mg/kg	45.5 mg/kg	25.4 mg/kg	30.5 mg/kg
19	Cadmium as Cd		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	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)
21	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)
22	Lead as Pb		0.65 mg/kg	0.53 mg/kg	0.66 mg/kg	0.49 mg/kg	0.8 mg/kg	0.51 mg/kg
23	Iron as Fe		2.01 mg/kg	1.10 mg/kg	1.39 mg/kg	1.65 mg/kg	2.97 mg/kg	2.26 mg/kg
24	Cation Exchange Capacity	USEPA 9080 – 1986	40.0 meq/100g of soil	37.2 meq/100g of soil	36.6 meq/100g of soil	42.2 meq/100g of soil	36 meq/100g of soil	33.06 meq/100g of soil

Source: Sampling Results by EHS 360 Labs 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 0.97– 1.24 g/cc. The Water Holding Capacity (0.466-44.8) and Porosity of the soil samples is found to be medium i.e., ranging from 0.402 – 0.437%.

Chemical Characteristics –

- The nature of soil is slightly alkaline to strongly alkaline in nature with pH range 7.25 to 8.15
- The available Nitrogen content range between 260 to 388 mg/kg
- The available Phosphorus content range between 1.10 to 2.6 mg/kg
- The available Potassium range between 25.4 to 45.5mg/kg

Whereas, the micronutrient as zinc (Zn), iron (Fe) and copper (Cu) were found in the range of 1.16 to 1.5 mg/kg; 1.10 to 2.97 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:

Ponnaiyar river lies at 7 Km North from the project cluster. The area is studded with few tanks that serve as the source for agriculture and also their surplus feeds adjoining tanks. The rainfall over the area is moderate, the rainwater storage in open wells, trenches is in practice over the area and the stored water acts as source of freshwater for couple of months after rainy season.

3.2.2 Ground Water Resources:

The terrain is underlain by hard rock formations, Fissured and fractured crystalline rocks constitute the important aquifer systems in the Krishnagiri 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 Shoolagiri 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

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

TABLE 3.9 – WATER SAMPLING LOCATIONS

S. No	Location code	Monitoring Locations	Distance & Direction	Coordinates
1	SW-1	Ponnaiyar River	6.8km NE	12°38'25.84"N 77°57'11.12"E
2	SW-2	Nanjappan Kodigai Eri	4.5km SW	12°36'10.66"N 77°51'21.53"E
3	WW-1	Anchetty Durgam	1.2km SW	12°35'43.27"N 77°53'33.88"E
4	WW-2	Krishnapuram	3.8km East	12°36'15.47"N 77°56'15.00"E
5	BW-1	Hanumanthapuram	660m North	12°36'42.68"N 77°53'54.64"E
6	BW-2	Onnagurukki	4.8km SW	12°34'23.97"N 77°52'1.69"E

Source: On-site monitoring/sampling by EHS 360 Labs Private Limited.

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

FIGURE 3.9: SITE PHOTOGRAPHS OF WATER SAMPLING LOCATIONS

TABLE 3.10 – SURFACE WATER ANALYSIS RESULTS

SNO	TEST	PROTOCOL	Surface Water (SW-1) - Ponnaiyar River	Surface Water (SW-2) – Nanjappan Kodigai Eri
1	Colour	IS 3025 Part 4:1983 (Reaff:2017)	15 Hazen	10 Hazen
2	Odour	IS 3025 Part 5:2018	Agreeable	Agreeable
3	pH at 25°C	IS 3025 Part 11:1983 (Reaff:2017)	7.55	7.05
4	Conductivity @ 25°C	IS 3025 Part 14:2013 (Reaff:2019)	1242 µmhos/cm	980 µmhos/cm
5	Turbidity	IS 3025 Part 10:1984 (Reaff:2017)	3.5 NTU	2.4 NTU
6	Total Dissolved Solids	IS 3025 Part 16:1984 (Reaff:2017)	732 mg/l	578 mg/l
7	Total Hardness as $CaCO_3$	IS 3025 Part 21:2009 (Reaff:2019)	234.4 mg/l	184.85 mg/l
8	Calcium as Ca	IS 3025 Part 40:1991 (Reaff:2019)	40.9 mg/l	32.4 mg/l
9	Magnesium as Mg	IS 3025 Part 46:1994 (Reaff:2019)	32.2 mg/l	25.3 mg/l
10	Total Alkalinity as $CaCO_3$	IS 3025 Part 23:1986 (Reaff:2019)	270 mg/l	201 mg/l
11	Chloride as Cl	IS 3025 Part 32:1988 (Reaff:2019)	210 mg/l	147.5 mg/l
12	Sulphate as SO_4	IS 3025 Part 24:1986 (Reaff:2019)	70.5 mg/l	70.1 mg/l
13	Iron as Fe	IS 3025 Part 53:2003 (Reaff:2019)	0.11 mg/l	0.13 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	0.16 mg/l	0.13 mg/l
16	Nitrate as NO_3	IS 3025 Part 34:1988 (Reaff:2019)	10.5 mg/l	6.6 mg/l
17	Copper as Cu	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
18	Manganese as Mn	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)
19	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)
20	Cadmium as Cd	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)	BDL (DL:0.001 mg/l)
21	Selenium as Se	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
22	Aluminium as Al	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
23	Lead as Pb	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
24	Zinc as Zn	IS 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)
25	Total Chromium as Cr	IS 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.02 mg/l)	BDL(DL : 0.02 mg/l)
26	Boron as B	IS 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)
27	Mineral Oil	IS 3025 Part 39-1991 (Reaff. 2019)	BDL(DL : 0.01 mg/l)	BDL(DL : 0.01 mg/l)
28	Phenolic compounds as C_6H_5OH	IS 3025 Part 43-1992(Reaff: 2019)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)
29	Anionic Detergents (as MBAS)	IS 13428 – 2005 (Reaff:2019) (Annex K)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
30	Cyanide as CN	IS 3025 Part 27-1986 (Reaff. 2019)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
31	BOD @ 27°C for 3 days	IS 3025 Part 44:1993 (Reaff:2019)	7.5 mg/l	5.8 mg/l
32	Chemical Oxygen Demand	IS 3025 Part 58:2006 (Reaff:2017)	44 mg/l	28 mg/l
33	Dissolved Oxygen	IS 3025 Part 38:1989 (Reaff:2019)	5.7 mg/l	5.2 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)	1.9 mg/l	1.8 mg/l
36	Sulphide as H_2S	IS 3025 Part 29-1986 (Reaff: 2019)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
37	Molybdenum as Mo	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)
38	Total Arsenic as As	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
39	Total Suspended Solids	IS 3025 Part 17 -1984 (Reaff:2017)	18.8 mg/l	20.5 mg/l
40	**Total Coliform**	**APHA 23rd Edn. 2017:9221B**	900 MPN/100ml	840 MPN/100ml
41	***Escherichia coli***	**APHA 23rd Edn. 2017:9221F**	140 MPN/100ml	100 MPN/100ml
Note : APHA – American Public Health Association, BDL – Below Detection Limit, DL – Detection Limit, MPN – Most Probable Number				

TABLE 3.11 – GROUND WATER ANALYSIS RESULTS

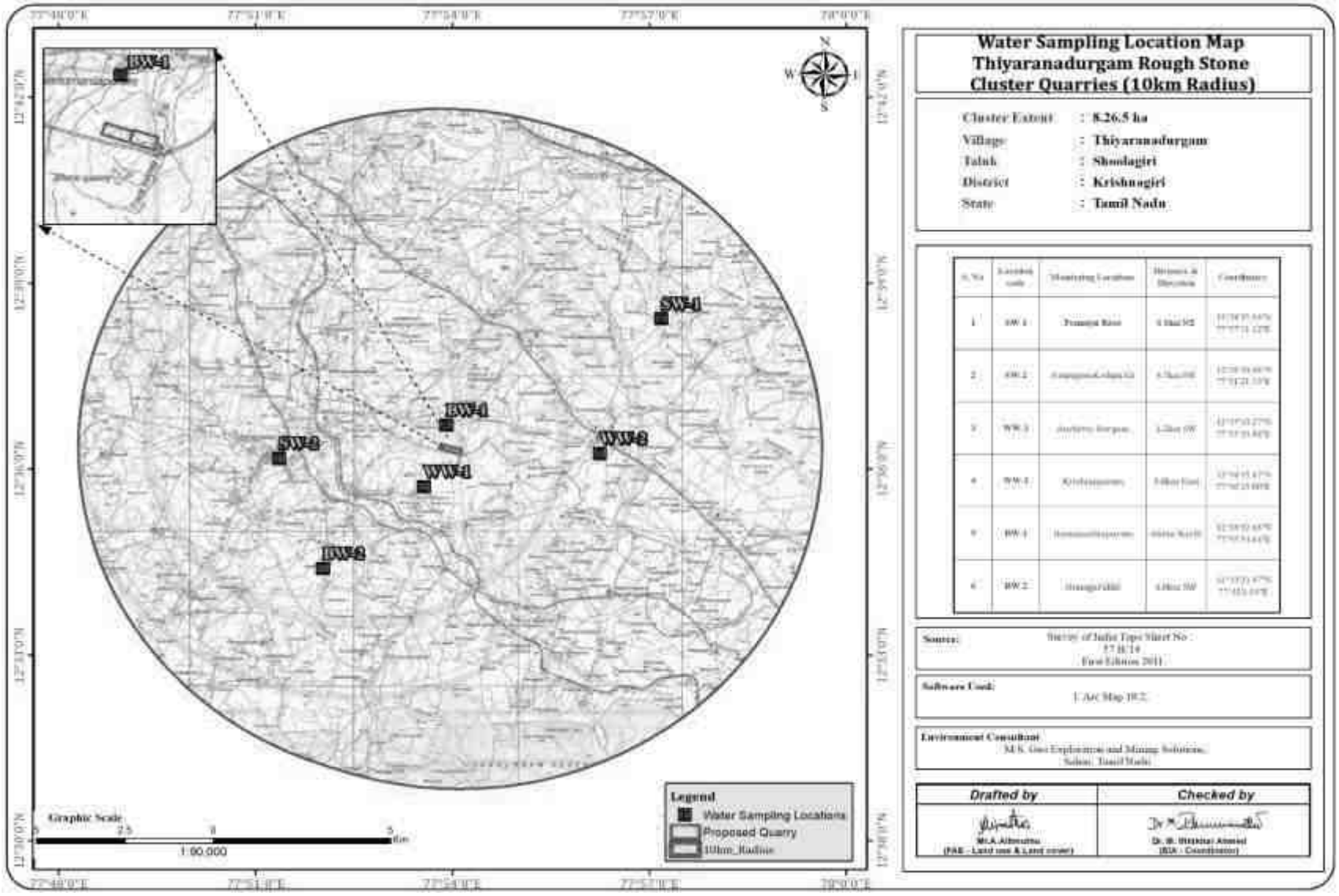
Sno	Test	Protocol	Ground Water (WW-1) – Anchetty Durgam	Ground Water (WW-2) – Krishnapuram	Ground Water (BW-1) – Hanumanthapuram	Ground Water (BW-2) – Sengappadai
1	Colour	IS 3025 Part 4:1983 (Reaff:2017)	5	5	5	5
2	Odour	IS 3025 Part 5:2018	Agreeable	Agreeable	Agreeable	Agreeable
3	pH at 25°C	IS 3025 Part 11:1983 (Reaff:2017)	6.87	7.22	7.77	7.79
4	Conductivity @ 25°C	IS 3025 Part 14:2013 (Reaff:2019)	773 µmhos/cm	841 µmhos/cm	800 µmhos/cm	775 µmhos/cm
5	Turbidity	IS 3025 Part 10:1984 (Reaff:2017)	1.2 NTU	1.3 NTU	1.8 NTU	1.0 NTU
6	Total Dissolved Solids	IS 3025 Part 16:1984 (Reaff:2017)	456 mg/l	496 mg/l	472 mg/l	457 mg/l
7	Total Hardness as $CaCO_3$	IS 3025 Part 21:2009 (Reaff:2019)	155.15 mg/l	177.24 mg/l	163.62 mg/l	186.80 mg/l
8	Calcium as Ca	IS 3025 Part 40:1991 (Reaff:2019)	28.9 mg/l	30.5 mg/l	25.7 mg/l	31.2 mg/l
9	Magnesium as Mg	IS 3025 Part 46:1994 (Reaff:2019)	20.2 mg/l	24.6 mg/l	24.2 mg/l	26.5 mg/l
10	Total Alkalinity as $CaCO_3$	IS 3025 Part 23:1986 (Reaff:2019)	145 mg/l	158 mg/l	134.5 mg/l	135 mg/l
11	Chloride as Cl	IS 3025 Part 32:1988 (Reaff:2019)	112 mg/l	122 mg/l	120 mg/l	122 mg/l
12	Sulphate as SO_4	IS 3025 Part 24:1986 (Reaff:2019)	61 mg/l	70.5 mg/l	71.5 mg/l	56.4 mg/l
13	Iron as Fe	IS 3025 Part 53:2003 (Reaff:2019)	0.15 mg/l	0.18 mg/l	0.18 mg/l	0.10 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	0.15 mg/l	0.13 mg/l	0.11 mg/l	0.13 mg/l
16	Nitrate as NO_3	IS 3025 Part 34:1988 (Reaff:2019)	3.4 mg/l	5.1 mg/l	3.5 mg/l	4.4 mg/l
17	Copper as Cu	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
18	Manganese as Mn	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)
19	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)
20	Cadmium as Cd	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)	BDL (DL:0.001 mg/l)	BDL (DL:0.001 mg/l)	BDL (DL:0.001 mg/l)
21	Selenium as Se	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
22	Aluminium as Al	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)

23	Lead as Pb	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
24	Zinc as Zn	IS 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)
25	Total Chromium as Cr	IS 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.02 mg/l)	BDL(DL : 0.02 mg/l)	BDL(DL : 0.02 mg/l)	BDL(DL : 0.02 mg/l)
26	Boron as B	IS 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)
27	Mineral Oil	IS 3025 Part 39-1991 (Reaff. 2019)	BDL(DL : 0.01 mg/l)	BDL(DL : 0.01 mg/l)	BDL(DL : 0.01 mg/l)	BDL(DL : 0.01 mg/l)
28	Phenolic compounds as C_6H_5OH	IS 3025 Part 43-1992(Reaff: 2019)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)
29	Anionic Detergents (as MBAS)	IS 13428 – 2005 (Reaff:2019) (Annex K)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
30	Barium as Ba	IS 3025 Part 27-1986 (Reaff. 2019)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
31	Ammonia (as total ammonia-N)	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	Sulphide as H_2S	IS 3025 Part 58:2006 (Reaff:2017)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
33	Molybdenum as Mo	IS 3025 Part 38:1989 (Reaff:2019)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
34	Total Arsenic as As	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 Suspended Solids	IS 3025 Part 17 -1984 (Reaff:2017)	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	110 MPN/100ml	160 MPN/100ml	280 MPN/100m
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 EHS 360 Labs Private Limited.

FIGURE 3.10: WATER SAMPLING LOCATIONS AROUND 10 KM RADIUS


Water Sampling Location Map
Thiyaranadurgam Rough Stone
Cluster Quarries (10km Radius)
Cluster Extent : 8.26.5 ha
Village : Thiyaranadurgam
Taluk : Shoolagiri
District : Krishnagiri
State : Tamil Nadu
Source:
Survey of India Toposheet No : 57 H/14
First Edition 2011
Software Used:
Environment Consultant
Drafted by
Checked by
Legend
Water Sampling Locations
Proposed Quarry
10km_Radius
Graphic Scale
1:60,000
SW-1
SW-2
SW-3
SW-4
WW-1
WW-2
BW-1
BW-2

3.2.4 Interpretation& Conclusion

Surface Water

The pH of surface 7.05-7.55 while turbidity found within the standards. Total Dissolved Solids 578-732mg/l and Chloride 147-210 mg/l. Nitrates 6.6-10.5 mg/l, while sulphates 70.1-70.5 mg/l.

Ground Water

The pH of the water samples collected ranged from 6.87 to 7.79 and within the acceptable limit of 6.5 to 8.5. pH, Sulphates and Chlorides of water samples from all the sources are within the limits as per the Standard. on Turbidity, the water samples meet the requirement. Total Dissolved Solids were found in the range of 456 – 496mg/l in all samples. The Total hardness varied between 155.15 – 186.80 mg/l for all samples.

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

3.2.5 Hydrology and Hydrogeological studies

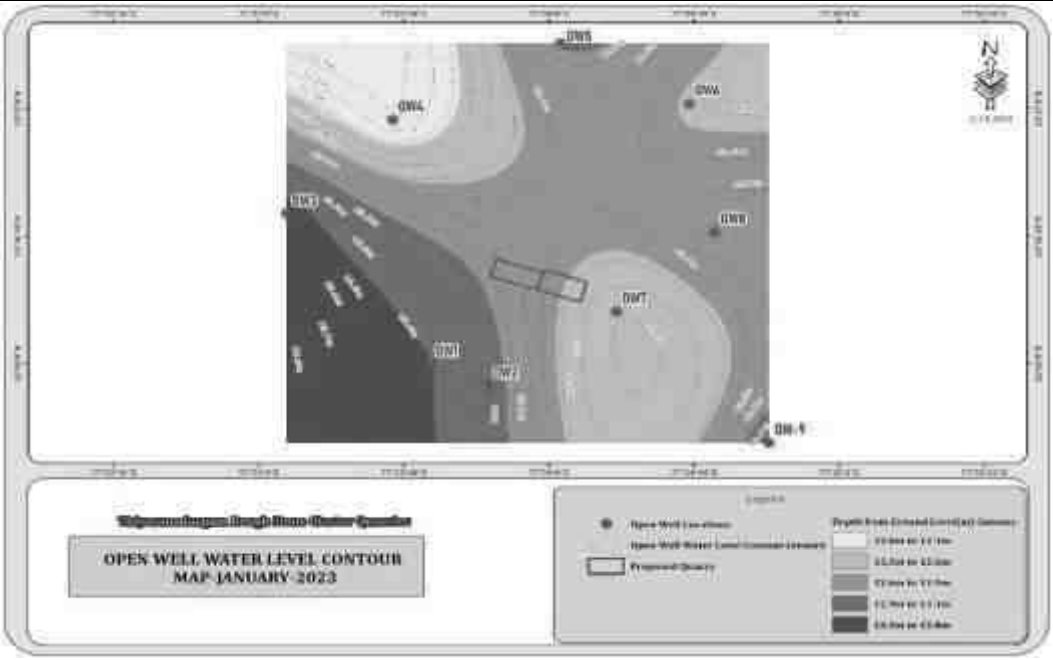
The district is underlain by hard rock formation Fissured and Fractured crystalline rocks constitute the important aquifer systems in the district. Geophysical prospecting was carried out in that area by SSRMP-80 Instrument by qualified Geo physicist with the help of IGIS software and it was inferred that the low resistance encountered at the depth between 60 -65m. the 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 3.12: POST MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS

S.No	Name	LONGITUDE	LATITUDE	Dec-22	Jan-23	Feb-23
1	OW1	77° 53' 35.31"E	12° 35' 59.99"N	12.8	13.4	14.1
2	OW2	77° 53' 47.27"E	12° 35' 54.82"N	12.5	13.1	13.8
3	OW3	77° 53' 05.75"E	12° 36' 35.33"N	13	13.6	14.3
4	OW4	77° 53' 27.68"E	12° 36' 57.40"N	11.5	12.1	12.8
5	OW5	77° 54' 02.48"E	12° 37' 15.45"N	12.4	13	13.7
6	OW6	77° 54' 29.07"E	12° 37' 01.25"N	12	12.6	13.3
7	OW7	77° 54' 13.95"E	12° 36' 12.31"N	11.8	12.4	13.1
8	OW8	77° 54' 34.33"E	12° 36' 31.02"N	12.3	12.9	13.6
9	OW9	77°54'45.48"E	12°35'41.44"N	12.6	13.2	13.9

FIGURE 3.11: CONTOUR MAP OF OPEN WELL WATER LEVEL



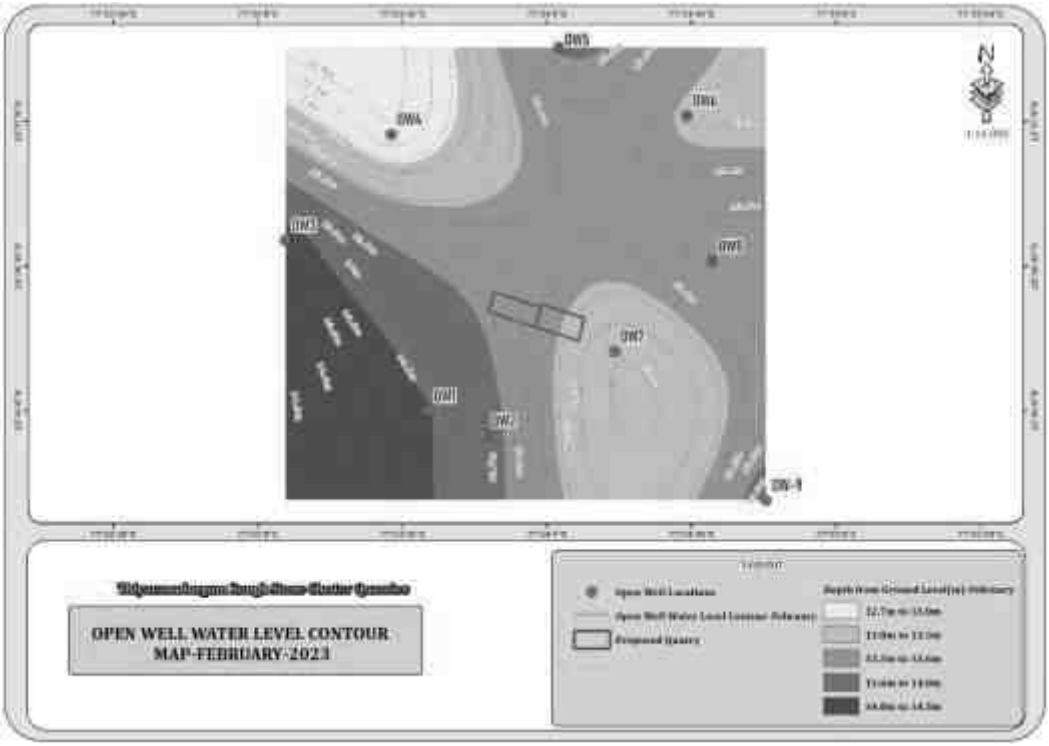
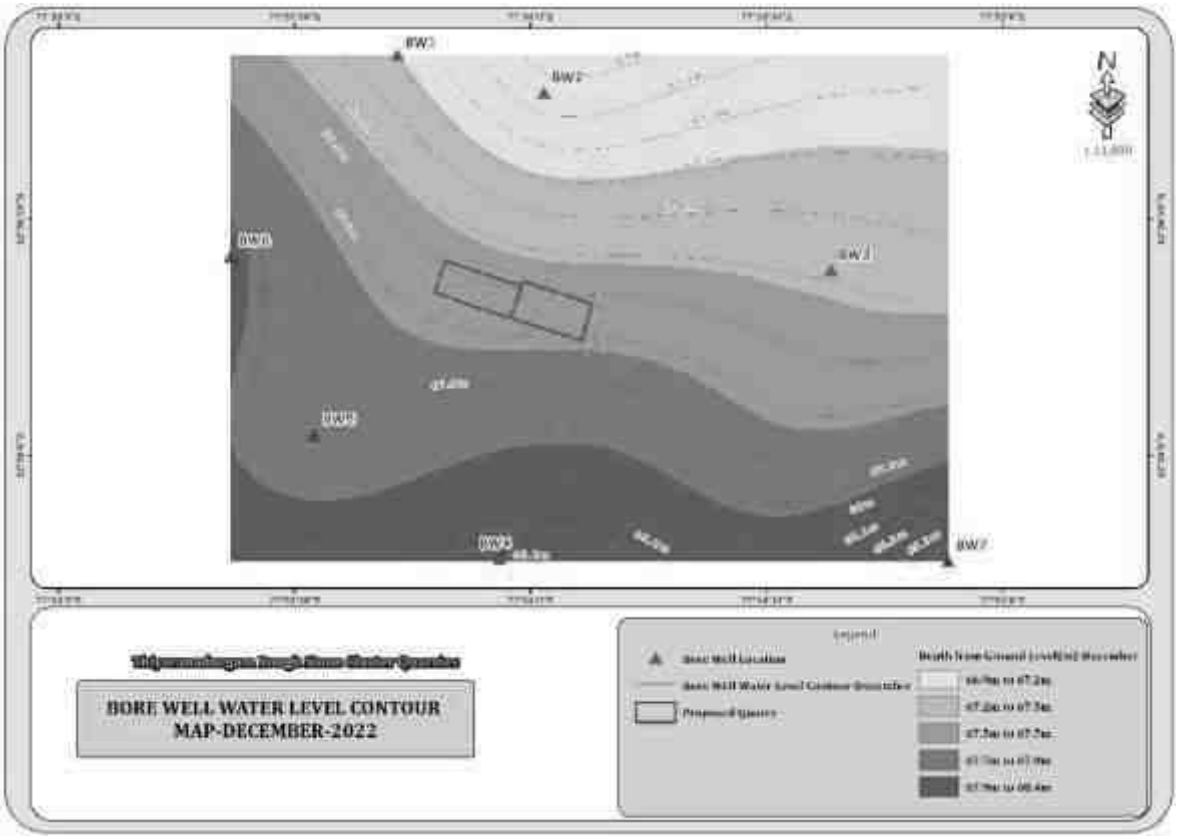


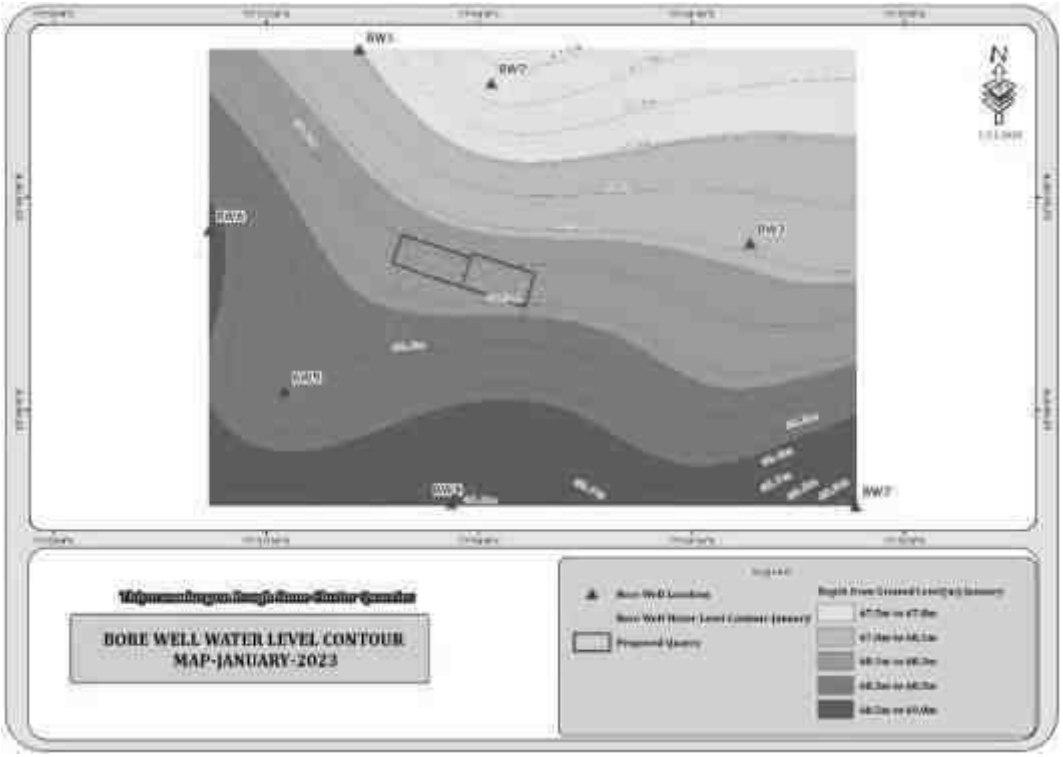
TABLE 3.13: POST MONSOON WATER LEVEL OF BOREWELLS 1 KM RADIUS

S.No	LABEL	LATITUDE	LONGITUDE	DEC 2022	JAN 2023	FEB 2023
1	BW_1	77° 53' 43.07"E	12° 36' 50.86"N	67.3	67.9	68.6
2	BW_2	77° 54' 01.72"E	12° 36' 46.04"N	67	67.6	68.3
3	BW_3	77° 54' 38.22"E	12° 36' 23.49"N	67.5	68.1	68.8

4	BW_4	77° 53' 56.05"E	12° 35' 46.82"N	68.2	68.8	69.5
5	BW_5	77° 53' 32.59"E	12° 36' 02.62"N	67.8	68.4	69.1
6	BW_6	77° 53' 21.86"E	12° 36' 25.30"N	68	68.6	69.3
7	BW_7	77° 54' 53.13"E	12° 35' 46.52"N	68.5	69.1	69.8

FIGURE 3.12: CONTOUR MAP OF BORE WELL WATER LEVEL




BW1
BW2
BW3
BW4
BW5
BW7
N
BORE WELL WATER LEVEL CONTOUR
MAP-JANUARY-2023

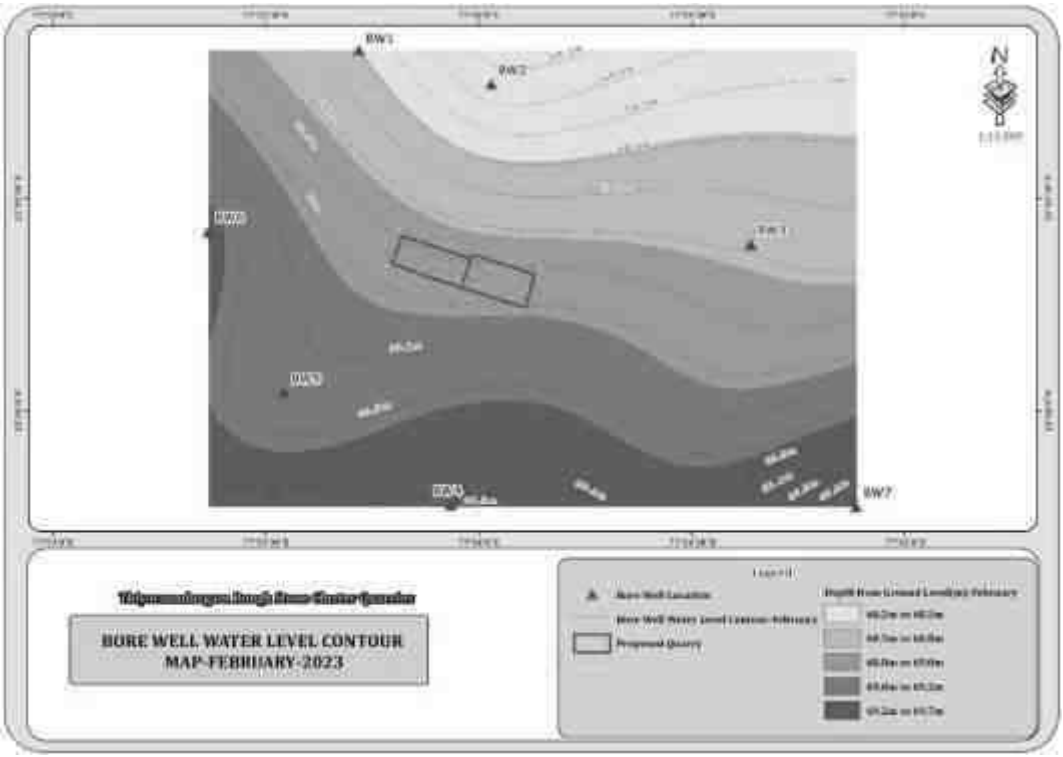

BW1
BW2
BW3
BW4
BW5
BW7
N
BORE WELL WATER LEVEL CONTOUR
MAP-FEBRUARY-2023

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

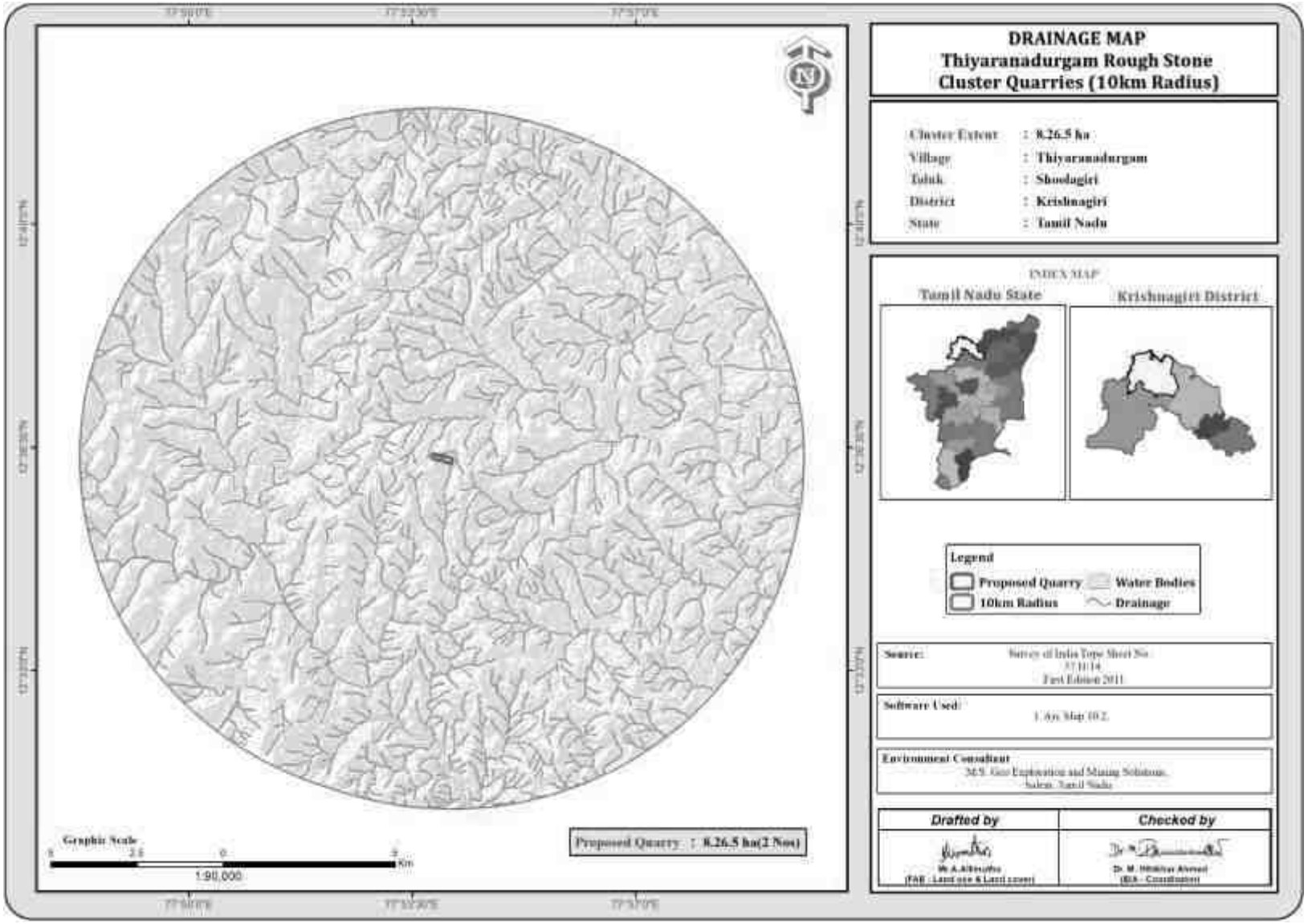
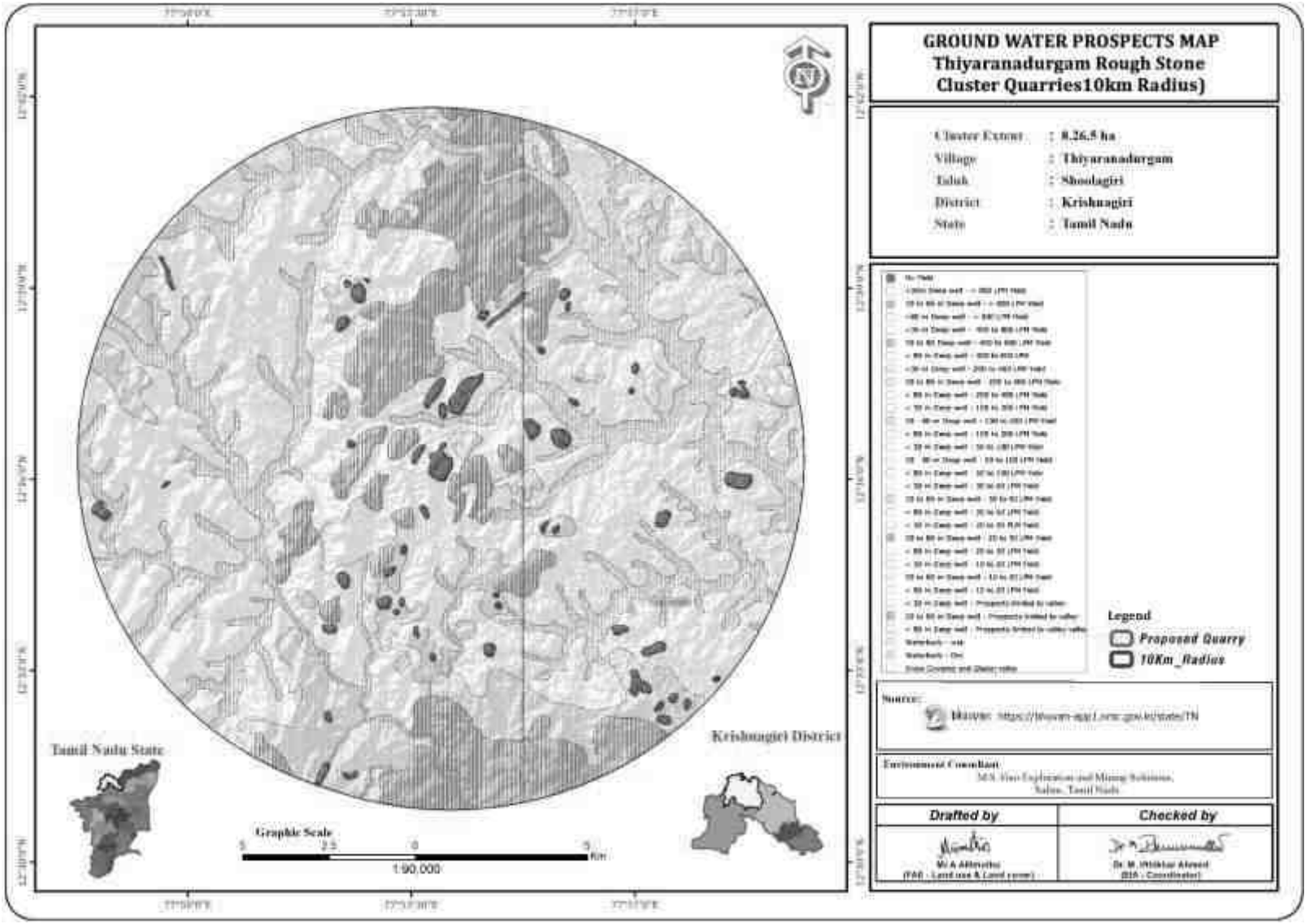


FIGURE 3.14: GROUND WATER PROSPECTS MAP



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

$\emptyset$ = Fractional pore volume

A = Constants with values ranging from 0.5 to 2.5

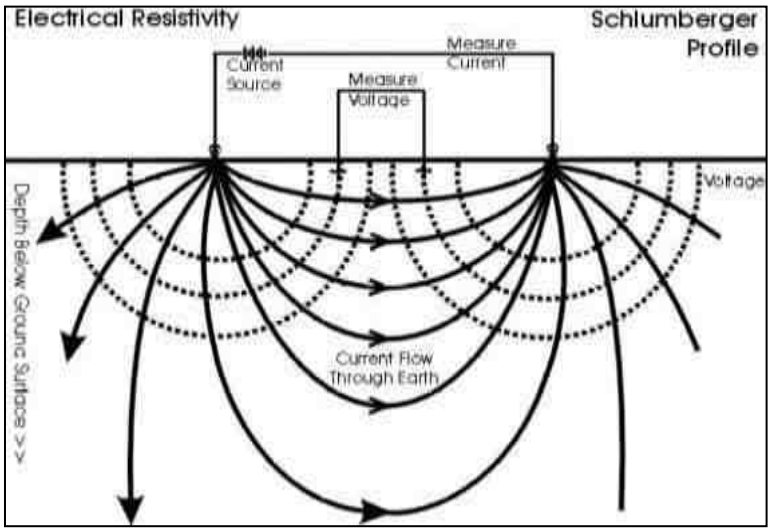
3.2.5.2 Survey Layout

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

The field equipment deployed for the study is in a deep resistivity meter with a model of SSR – MP – AT. This Signal stacking Resistivity meter is a high-quality data acquisition system incorporating several innovation

features for Earth resistivity. In the presence of random earth Noises the signal to nose ration can be enhanced by √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 65-70m. The maximum depth proposed out of proposed projects is76 m AGL. 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 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 is tropical in Krishnagiri. The summers are much rainier than the winters in Krishnagiri. This climate is considered to be Aw according to the Köppen-Geiger climate classification. The temperature here averages 25.5 °C | 77.9 °F.
- Precipitation here is about 773 mm | 30.4 inch per year.
- Because Krishnagiri is located near the equator, the summers are not easy to define.
- The most opportune time to visit are January, February, March, April, May, June, July, August, September, October, November.
- The driest month is February. There is 6 mm | 0.2 inch of precipitation in February. The greatest amount of precipitation occurs in October, with an average of 144 mm | 5.7 inch. With an average of 29.0 °C | 84.2 °F, April is the warmest month.
- The lowest average temperatures in the year occur in December, when it is around 21.9 °C | 71.4 °F. https://en.climate-data.org/asia/india/tamil-nadu/krishnagiri-34157/

Rainfall –

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

TABLE 3.14 – RAINFALL DATA

Actual Rainfall in mm					Normal Rainfall in mm
2017	2018	2019	2020	2021	
1145.6	510.4	730.0	798.6	985.4	985

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

TABLE 3.15 – METEOROLOGICAL DATA RECORDED AT SITE

S.No	Parameters		Dec–2022	Jan–2023	Feb-2023
1	Temperature (^{0}C)	Max	22.71	22.26	23.58
		Min	18.66	17.29	21.87
		Avg	20.68	19.77	22.72
2	Relative Humidity (%)	Avg	87.15	78.88	59.72
3	Wind Speed (m/s)	Max	4.6	4.16	4.37
		Min	1.52	2.04	1.62
		Avg	3.06	3.1	2.99
4	Cloud Cover (OKTAS)		0-8	0-8	0-8
5	Wind Direction		ENE,E	ENE,E	ENE,E

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

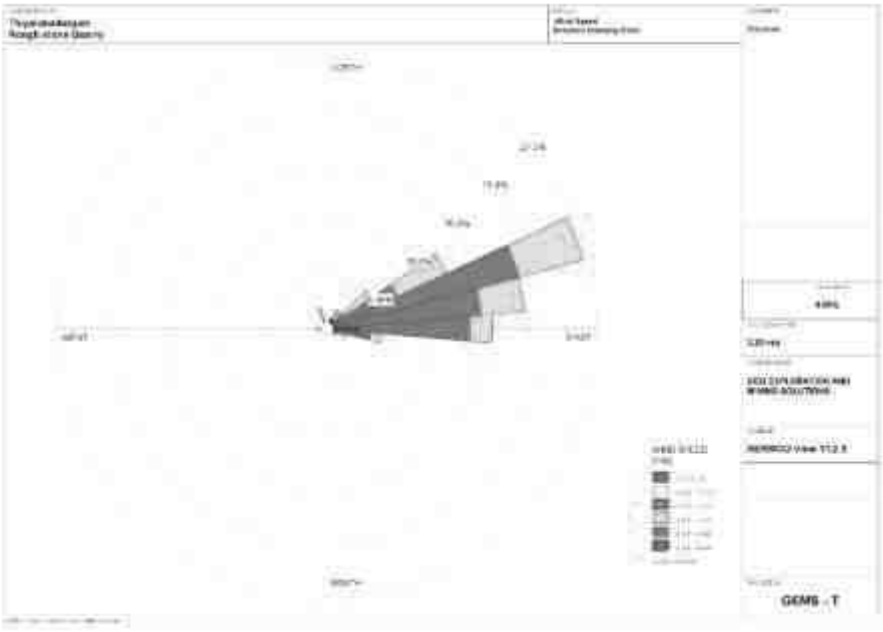
Correlation between Secondary and Primary Data

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

- The average maximum and minimum temperatures of IMD, Krishnagiri agro showed a higher in respect of on-site data i.e. in Thiyanadurgam village.
- The relative humidity levels were lesser at site as compared to IMD, Krishnagiri agro.
- The wind speed and direction at site shows similar trend that of IMD, Krishnagiri 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 3.15: 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 ENE, ENE, E, ENE
2. Wind velocity readings were recorded between 0.50 to 5.70 km / hour
3. Calm conditions prevail of about 0.00% of the monitoring period
4. Temperature readings ranging from 17.29-23.58^{0}C
5. Relative humidity ranging from 58 to 87%
6. The monitoring was carried out continuously for three months

3.3.2 Methodology and Objective

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

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

3.3.3 Sampling and Analytical Techniques

TABLE 3.16 – METHODOLOGY AND INSTRUMENT USED FOR 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 EHS 360 Labs Private Limited & CPCB Notification

TABLE 3.17 – NATIONAL AMBIENT AIR QUALITY STANDARDS

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

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

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

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

3.3.4 Frequency & Parameters for Sampling

Ambient air quality monitoring has been carried out with a frequency of two samples per week at Eight (8) locations, adopting a continuous 24 hourly (3 shift of 8-hour) schedule for the period Dec2022-Feb2023. The baseline data of ambient air has been generated for PM_{10}, $PM_{2.5}$, Sulphur Dioxide (SO_2) & Nitrogen Dioxide (NO_2).

3.3.5 Ambient Air Quality Monitoring Stations

Eight (8) monitoring stations were set up in the study area as depicted in Figure 3.17 for assessment of the Proposed ambient air quality. Details of the sampling locations are as per given below.

TABLE 3.18 – AMBIENT AIR QUALITY (AAQ) MONITORING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	AAQ-1	Core Zone	Project Area	12°36'18.50"N 77°53'58.27"E
2	AAQ-2	Hanumanthapuram	660m North	12°36'44.01"N 77°53'58.81"E
3	AAQ-3	Krishnapuram	3.6km NE	12°36'21.70"N 77°56'7.88"E
4	AAQ-4	Onnagurukki	4.8km SW	12°34'25.18"N 77°51'59.74"E
5	AAQ-5	Sankaranarayanapuram	5.8km NW	12°37'41.01"N 77°50'51.26"E
6	AAQ-6	Varanaganapalli	5km SE	12°33'53.12"N 77°55'35.29"E
7	AAQ-7	Anusonai	3.3km South	12°34'27.66"N 77°53'51.79"E
8	AAQ-8	Beerjepalli	3.8km NE	12°38'20.17"N 77°54'31.31"E

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

FIGURE 3.16: SITE PHOTOGRAPHS OF AMBIENT AIR MONITORING

Source: Monitoring photographs from the FAE and Team Members

FIGURE 3.17 AMBIENT AIR QUALITY LOCATIONS AROUND 10 KM RADIUS

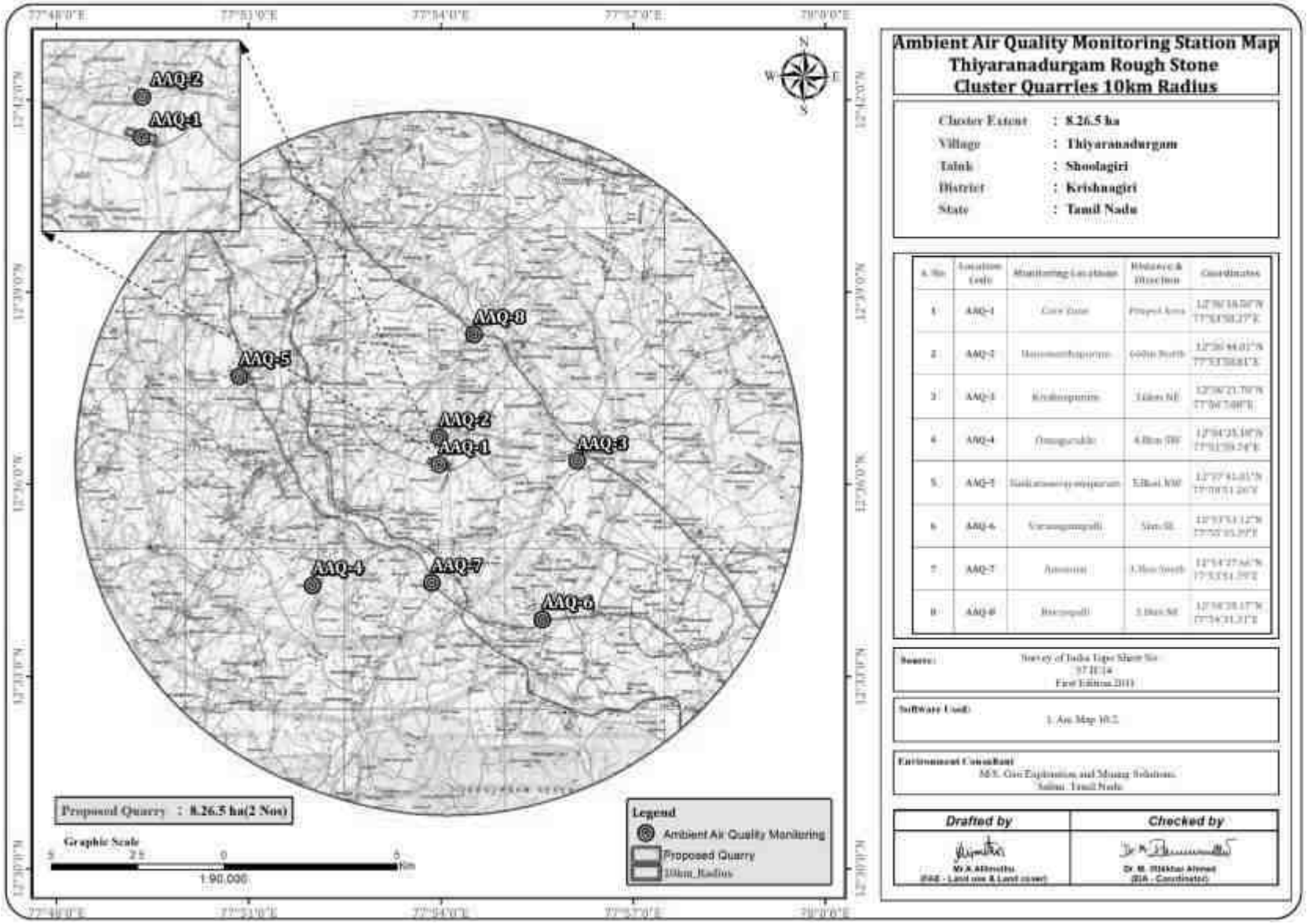


TABLE 3.19 – AAQ1- CORE ZONE

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

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	µg/m³	ng/m³	ng/m³	µg/m³	ng/m³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
05.12.2022	7:00-7:00	66.5	45.5	22.3	8.0	26.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	67.2	44.2	22.1	8.2	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	68.3	43.1	23.4	7.8	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	65.3	42.0	24.3	7.6	25.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	64.2	43.5	21.3	8.0	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	63.1	44.1	22.0	8.4	25.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.12.2022	7:00-7:00	64.3	45.3	22.3	7.6	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.12.2022	7:15-7:15	66.5	46.1	23.1	8.2	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.01.2023	7:00-7:00	67.2	42.2	21.3	7.4	25.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.01.2023	7:15-7:15	65.4	43.0	23.0	8.6	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.01.2023	7:00-7:00	64.1	44.6	22.3	8.1	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.01.2023	7:15-7:15	65.4	45.2	24.1	7.8	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.01.2023	7:00-7:00	66.8	46.3	25.3	8.3	25.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.01.2023	7:15-7:15	67.2	47.0	22.3	7.4	26.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.01.2023	7:00-7:00	65.8	45.3	23.4	8.4	27.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.01.2023	7:15-7:15	66.2	44.2	22.6	8.2	26.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.01.2023	7:00-7:00	67.2	42.1	21.0	7.3	27.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.01.2023	7:15-7:15	68.3	43.5	22.3	7.2	25.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.02.2023	7:00-7:00	66.4	44.2	22.6	8.6	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.02.2023	7:15-7:15	65.3	45.6	22.4	8.4	25.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.02.2023	7:00-7:00	66.4	46.3	22.1	7.6	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.02.2023	7:15-7:15	67.8	47.0	23.5	8.1	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.02.2023	7:00-7:00	68.0	46.1	23.2	7.2	25.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.02.2023	7:15-7:15	65.4	45.2	22.1	8.6	25.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.02.2023	7:00-7:00	66.5	44.3	22.6	8.2	26.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.02.2023	7:15-7:15	67.2	43.1	22.1	7.3	26.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

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

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

TABLE 3.20 – AAQ2 – HANUMANTHAPURAM

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

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	mg/m^3	µg/m^3	ng/m^3	ng/m^3	µg/m^3	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
05.12.2022	7:00-7:00	65.3	45.5	22.5	6.3	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	64.2	43.2	23.3	6.4	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	61.2	44.3	22.1	6.8	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	64.3	45.3	22.3	6.5	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	65.3	44.2	22.0	6.0	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	66.4	45.6	22.2	6.2	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.12.2022	7:00-7:00	65.3	46.3	21.4	7.1	25.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.12.2022	7:15-7:15	65.1	45.3	22.1	7.5	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.01.2023	7:00-7:00	66.4	44.2	21.3	6.8	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.01.2023	7:15-7:15	64.3	45.3	21.2	6.6	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.01.2023	7:00-7:00	64.4	45.1	22.3	6.4	25.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.01.2023	7:15-7:15	65.3	44.3	22.1	6.2	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.01.2023	7:00-7:00	65.2	45.3	22.3	6.4	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.01.2023	7:15-7:15	65.2	46.2	22.0	6.8	25.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.01.2023	7:00-7:00	64.1	45.1	22.2	5.3	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.01.2023	7:15-7:15	65.5	44.3	22.5	5.2	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.01.2023	7:00-7:00	64.2	45.2	22.6	5.5	24.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.01.2023	7:15-7:15	65.6	42.1	22.1	5.4	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.02.2023	7:00-7:00	66.0	43.0	22.3	5.1	23.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.02.2023	7:15-7:15	65.3	45.6	21.1	6.8	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.02.2023	7:00-7:00	64.1	44.2	22.0	6.5	23.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.02.2023	7:15-7:15	65.3	45.3	21.3	6.5	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.02.2023	7:00-7:00	64.2	42.1	22.3	6.4	21.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.02.2023	7:15-7:15	65.4	45.3	22.4	6.3	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.02.2023	7:00-7:00	66.3	44.2	22.1	5.2	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.02.2023	7:15-7:15	65.4	45.1	23.1	5.6	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1.0); **Pb**: BDL (DL:0.1); **Ni**: BDL (DL:1.0); **As**: BDL (DL:1.0); **C_6H_6**: BDL (DL:1.0); **BaP**: BDL (DL:0.1)
Remarks: The values observed for the pollutants given above are within the CPCB standards.

TABLE 3.21 – AAQ3 – KRISHNAPURAM

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

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	mg/m^3	µg/m^3	ng/m^3	ng/m^3	µg/m^3	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
05.12.2022	7:00-7:00	68.2	46.5	21.5	5.5	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	68.1	46.2	22.5	5.2	21.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	68.0	46.1	23.6	5.3	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	67.5	47.2	24.2	5.2	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	68.7	47.3	23.2	5.0	24.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	69.0	47.5	22.5	5.5	25.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.12.2022	7:00-7:00	69.2	47.2	24.6	5.3	21.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.12.2022	7:15-7:15	68.4	47.2	25.1	6.2	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.01.2023	7:00-7:00	67.2	45.5	22.3	7.4	22.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.01.2023	7:15-7:15	67.5	45.2	23.1	7.3	22.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.01.2023	7:00-7:00	69.3	45.3	24.5	7.2	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.01.2023	7:15-7:15	68.2	46.5	25.6	6.2	25.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.01.2023	7:00-7:00	67.3	46.2	26.3	6.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.01.2023	7:15-7:15	68.2	45.2	25.0	6.3	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.01.2023	7:00-7:00	68.3	44.3	24.1	7.8	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.01.2023	7:15-7:15	67.2	44.2	23.2	7.5	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.01.2023	7:00-7:00	67.5	42.2	22.1	7.6	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.01.2023	7:15-7:15	68.2	42.5	24.5	7.2	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.02.2023	7:00-7:00	68.4	43.3	25.6	7.0	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.02.2023	7:15-7:15	69.2	43.5	21.3	6.8	23.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.02.2023	7:00-7:00	69.0	43.2	24.3	5.5	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.02.2023	7:15-7:15	68.8	45.3	25.3	5.4	22.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.02.2023	7:00-7:00	68.5	45.6	22.1	5.2	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.02.2023	7:15-7:15	67.8	45.2	26.3	5.0	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.02.2023	7:00-7:00	67.5	45.1	24.5	5.8	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.02.2023	7:15-7:15	67.1	44.0	22.3	5.2	24.0	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 3.22– AAQ4 – ONNAGURUKKI

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

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	mg/m^3	µg/m^3	ng/m^3	ng/m^3	µg/m^3	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
05.12.2022	7:00-7:00	65.5	43.5	22.2	6.5	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	66.2	43.6	21.3	6.2	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	64.3	43.2	21.1	6.3	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	62.3	44.0	22.0	6.0	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	61.3	44.2	22.1	5.8	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	66.4	44.3	23.5	5.5	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.12.2022	7:00-7:00	65.3	43.2	23.4	5.3	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.12.2022	7:15-7:15	64.2	44.1	24.0	5.2	24.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.01.2023	7:00-7:00	65.8	43.8	23.6	7.0	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.01.2023	7:15-7:15	64.2	42.3	22.1	7.5	21.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.01.2023	7:00-7:00	63.1	44.1	24.5	7.4	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.01.2023	7:15-7:15	63.0	43.6	23.6	7.2	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.01.2023	7:00-7:00	63.5	42.8	22.4	7.1	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.01.2023	7:15-7:15	65.2	41.9	21.0	6.8	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.01.2023	7:00-7:00	66.4	42.6	22.5	6.4	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.01.2023	7:15-7:15	64.2	43.8	22.6	6.2	23.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.01.2023	7:00-7:00	64.0	44.9	23.5	6.0	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.01.2023	7:15-7:15	63.5	43.6	24.1	5.6	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.02.2023	7:00-7:00	62.4	42.5	23.6	5.4	22.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.02.2023	7:15-7:15	62.8	43.2	22.1	7.3	21.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.02.2023	7:00-7:00	63.4	44.5	21.3	6.8	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.02.2023	7:15-7:15	64.3	44.6	22.6	6.5	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.02.2023	7:00-7:00	65.1	42.3	23.5	5.2	22.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.02.2023	7:15-7:15	66.5	44.5	24.3	5.2	23.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

27.02.2023	7:00-7:00	64.7	43.8	23.4	6.2	22.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.02.2023	7:15-7:15	63.1	44.5	22.8	6.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

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

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

TABLE 3.23 – AAQ5 – SANKARANARAYANAPURAM

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

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	µg/m³	ng/m³	ng/m³	µg/m³	ng/m³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
05.12.2022	7:00-7:00	68.5	45.5	24.1	8.5	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	67.1	44.3	22.3	7.0	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	67.5	45.1	21.0	8.1	25.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	66.2	44.3	22.0	8.2	24.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	67.8	42.1	21.3	7.3	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	68.0	43.2	22.1	8.1	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.12.2022	7:00-7:00	69.2	44.0	22.0	7.5	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.12.2022	7:15-7:15	68.5	45.1	24.3	8.8	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.01.2023	7:00-7:00	69.3	41.0	23.0	7.6	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.01.2023	7:15-7:15	68.2	42.3	21.3	7.4	23.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.01.2023	7:00-7:00	67.5	43.1	22.0	8.2	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.01.2023	7:15-7:15	68.0	44.5	23.4	7.8	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.01.2023	7:00-7:00	69.5	45.6	24.5	8.0	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.01.2023	7:15-7:15	69.3	43.2	21.0	7.5	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.01.2023	7:00-7:00	67.2	42.1	22.3	8.5	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.01.2023	7:15-7:15	68.1	42.0	22.0	7.3	25.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.01.2023	7:00-7:00	67.3	43.6	24.2	8.2	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.01.2023	7:15-7:15	66.5	44.2	22.1	7.0	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.02.2023	7:00-7:00	68.3	45.1	23.3	8.3	25.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.02.2023	7:15-7:15	67.2	44.3	22.1	7.4	22.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.02.2023	7:00-7:00	67.0	42.1	21.5	8.2	22.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.02.2023	7:15-7:15	68.3	43.6	21.3	7.2	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.02.2023	7:00-7:00	67.5	44.2	22.5	8.6	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

21.02.2023	7:15-7:15	68.0	45.1	21.5	7.5	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.02.2023	7:00-7:00	69.3	43.1	23.0	8.5	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.02.2023	7:15-7:15	67.3	42.5	23.5	7.6	22.1	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 3.24 – AAQ 6 - VARANAGANAPALLI

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

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	mg/m^3	$\mu g/m^3$	ng/m^3	ng/m^3	$\mu g/m^3$	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
05.12.2022	7:00-7:00	66.3	41.5	22.3	7.5	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	67.2	40.2	20.1	6.2	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	68.3	41.2	22.1	7.3	25.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	69.5	42.3	21.3	6.5	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	66.3	40.5	24.0	7.0	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	67.1	41.3	22.2	6.8	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.12.2022	7:00-7:00	67.0	40.6	20.3	5.2	23.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.12.2022	7:15-7:15	68.1	41.8	22.0	5.6	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.01.2023	7:00-7:00	69.6	39.5	21.6	6.4	25.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.01.2023	7:15-7:15	66.0	41.2	21.4	5.8	25.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.01.2023	7:00-7:00	67.3	39.2	22.6	6.2	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.01.2023	7:15-7:15	68.1	40.3	20.1	7.6	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.01.2023	7:00-7:00	69.3	41.5	21.6	8.0	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.01.2023	7:15-7:15	65.3	39.2	22.3	7.5	25.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.01.2023	7:00-7:00	66.0	40.2	23.8	8.3	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.01.2023	7:15-7:15	67.3	41.3	24.0	6.0	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.01.2023	7:00-7:00	68.1	39.5	21.5	7.2	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.01.2023	7:15-7:15	69.4	40.5	22.3	8.2	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.02.2023	7:00-7:00	68.2	41.0	24.6	6.2	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.02.2023	7:15-7:15	66.0	39.6	22.4	7.0	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.02.2023	7:00-7:00	67.3	40.8	21.0	6.5	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.02.2023	7:15-7:15	65.4	41.2	20.3	7.2	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.02.2023	7:00-7:00	66.5	40.6	20.1	6.3	25.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

21.02.2023	7:15-7:15	68.0	41.3	21.5	7.5	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.02.2023	7:00-7:00	69.2	40.6	20.3	7.2	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.02.2023	7:15-7:15	68.3	41.6	21.6	8.2	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

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

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

TABLE 3.25 – AAQ7 - ANUSONAI

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

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	mg/m^3	µg/m^3	ng/m^3	ng/m^3	µg/m^3	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
05.12.2022	7:00-7:00	66.3	41.2	22.5	7.2	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	67.2	42.3	21.2	6.5	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	68.8	43.5	23.5	6.8	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	67.5	42.5	21.4	7.3	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	66.2	43.0	22.0	6.5	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	67.3	41.5	21.3	7.2	25.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.12.2022	7:00-7:00	66.4	42.3	22.4	6.0	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.12.2022	7:15-7:15	67.2	42.0	21.0	7.1	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.01.2023	7:00-7:00	68.0	43.8	22.4	7.0	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.01.2023	7:15-7:15	67.8	44.5	20.3	7.2	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.01.2023	7:00-7:00	66.3	45.2	22.1	6.5	25.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.01.2023	7:15-7:15	67.2	42.1	21.0	7.1	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.01.2023	7:00-7:00	68.3	43.3	22.4	6.8	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.01.2023	7:15-7:15	67.0	44.6	20.3	7.2	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.01.2023	7:00-7:00	68.2	45.3	22.6	6.7	21.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.01.2023	7:15-7:15	67.5	42.5	21.3	7.5	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.01.2023	7:00-7:00	68.5	43.0	20.5	6.9	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.01.2023	7:15-7:15	67.4	45.1	21.6	7.3	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.02.2023	7:00-7:00	66.3	43.2	22.3	6.5	21.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.02.2023	7:15-7:15	67.1	44.5	23.5	6.8	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.02.2023	7:00-7:00	66.3	43.6	22.0	7.2	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.02.2023	7:15-7:15	68.2	45.6	23.5	6.4	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.02.2023	7:00-7:00	67.3	42.3	23.8	6.0	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

21.02.2023	7:15-7:15	68.4	43.1	21.2	7.3	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.02.2023	7:00-7:00	66.5	44.8	23.0	6.3	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.02.2023	7:15-7:15	67.2	43.6	23.4	7.2	24.5	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 – AAQ8 - BEERJEPALLI

Period: Dec – Feb 2023 *Location: AAQ98– Beerjepalli* Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	mg/m^3	$\mu g/m^3$	ng/m^3	ng/m^3	$\mu g/m^3$	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
05.12.2022	7:00-7:00	58.5	40.5	20.5	6.5	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.12.2022	7:15-7:15	60.5	41.2	21.3	6.8	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.12.2022	7:00-7:00	62.3	39.5	19.5	5.0	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.12.2022	7:15-7:15	59.1	42.5	21.3	5.5	25.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.12.2022	7:00-7:00	61.5	44.3	22.4	7.0	24.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.12.2022	7:15-7:15	62.3	45.6	22.3	7.2	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.12.2022	7:00-7:00	61.8	43.1	22.0	6.8	22.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.12.2022	7:15-7:15	62.5	44.2	22.1	6.8	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.01.2023	7:00-7:00	60.0	43.0	23.4	7.0	20.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.01.2023	7:15-7:15	62.3	45.5	21.6	7.5	22.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.01.2023	7:00-7:00	63.4	42.1	22.6	6.2	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.01.2023	7:15-7:15	61.2	40.2	23.4	7.8	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.01.2023	7:00-7:00	62.3	41.0	22.1	6.3	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.01.2023	7:15-7:15	63.5	44.3	22.3	6.0	21.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.01.2023	7:00-7:00	61.5	42.5	21.2	5.2	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.01.2023	7:15-7:15	62.5	43.6	22.4	6.3	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.01.2023	7:00-7:00	63.1	44.5	22.6	5.5	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.01.2023	7:15-7:15	60.5	42.1	21.5	6.2	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.02.2023	7:00-7:00	62.4	40.8	20.4	5.6	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.02.2023	7:15-7:15	61.5	39.2	40.2	6.3	24.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.02.2023	7:00-7:00	62.3	41.6	21.3	5.5	20.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.02.2023	7:15-7:15	63.5	42.5	22.3	5.3	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.02.2023	7:00-7:00	59.8	43.6	24.6	6.8	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

21.02.2023	7:15-7:15	58.5	44.1	23.5	5.4	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.02.2023	7:00-7:00	60.5	45.2	24.2	6.2	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.02.2023	7:15-7:15	62.3	44.3	22.1	6.5	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

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

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

TABLE 3.27: SUMMARY OF AAQ

PM2.5	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	22.7	22.1	23.8	22.8	22.4	22.4	22.0	22.8
Minimum	21.0	21.1	21.3	21.0	21.0	20.1	20.3	19.5
Maximum	25.3	23.3	26.3	24.5	24.5	24.6	23.8	40.2
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	44.6	44.7	45.3	43.6	22.4	21.8	43.4	42.7
Minimum	42.0	42.1	42.2	41.9	41.0	39.2	41.2	39.2
Maximum	47.0	46.3	47.5	44.9	45.6	42.3	45.6	45.6
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	22.1	6.2	22.8	7.9	6.9	6.9	6.3
Minimum	7.2	21.1	5.0	21.0	7.0	5.2	6.0	5.0
Maximum	8.6	23.3	7.8	24.5	8.8	8.3	7.5	7.8
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	25.4	6.2	23.0	6.3	23.9	24.4	23.8	23.2
Minimum	23.2	5.1	21.0	5.2	22.0	23.0	21.0	20.3
Maximum	27.4	7.5	25.3	7.5	25.6	25.6	25.8	25.2
NAAQ Norms	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0

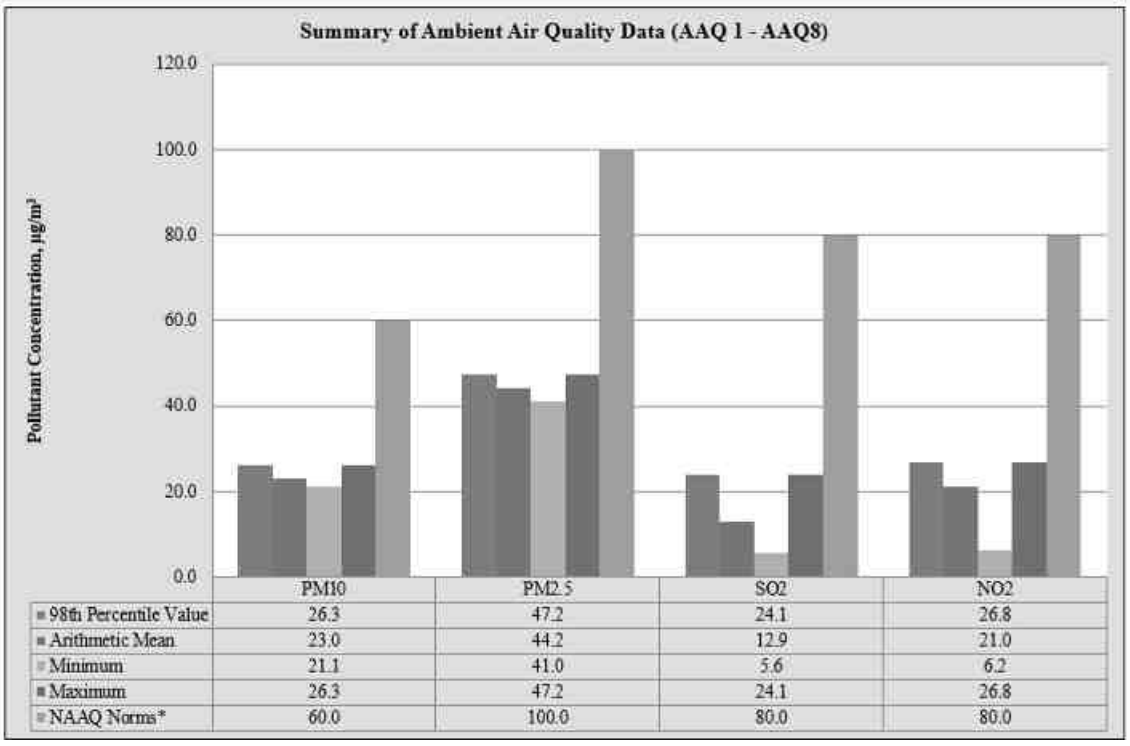
TABLE 3.28 – ABSTRACT OF AMBIENT AIR QUALITY DATA

1	**Parameter**	**PM2.5**	**PM10**	**SO_2**	**NO_2**
2	No. of Observations	260	260	260	260
3	10^{th} Percentile Value	21.1	41.0	5.6	6.2
4	20^{th} Percentile Value	21.3	42.1	6.3	6.8
5	30^{th} Percentile Value	22.0	42.5	6.8	21.6
6	40^{th} Percentile Value	22.1	43.2	7.2	22.5
7	50^{th} Percentile Value	22.3	43.8	7.4	23.4
8	60^{th} Percentile Value	22.5	44.2	8.0	24.0
9	70^{th} Percentile Value	23.0	44.6	8.5	24.3
10	80^{th} Percentile Value	23.5	45.2	22.0	24.6
11	90^{th} Percentile Value	24.3	45.6	22.5	25.4
12	95^{th} Percentile Value	24.9	46.5	23.5	25.8
13	98^{th} Percentile Value	26.3	47.2	24.1	26.8
14	Arithmetic Mean	23.0	44.2	12.9	21.0
15	Geometric Mean	23.0	44.1	10.8	19.1
16	Standard Deviation	1.6	1.9	8.1	7.3
17	Minimum	21.1	41.0	5.6	6.2
18	Maximum	26.3	47.2	24.1	26.8
19	**NAAQ Norms***	**100.0**	**60.0**	**80.0**	**80.0**
	% Values exceeding Norms*	0.0	0.0	0.0	0.0

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

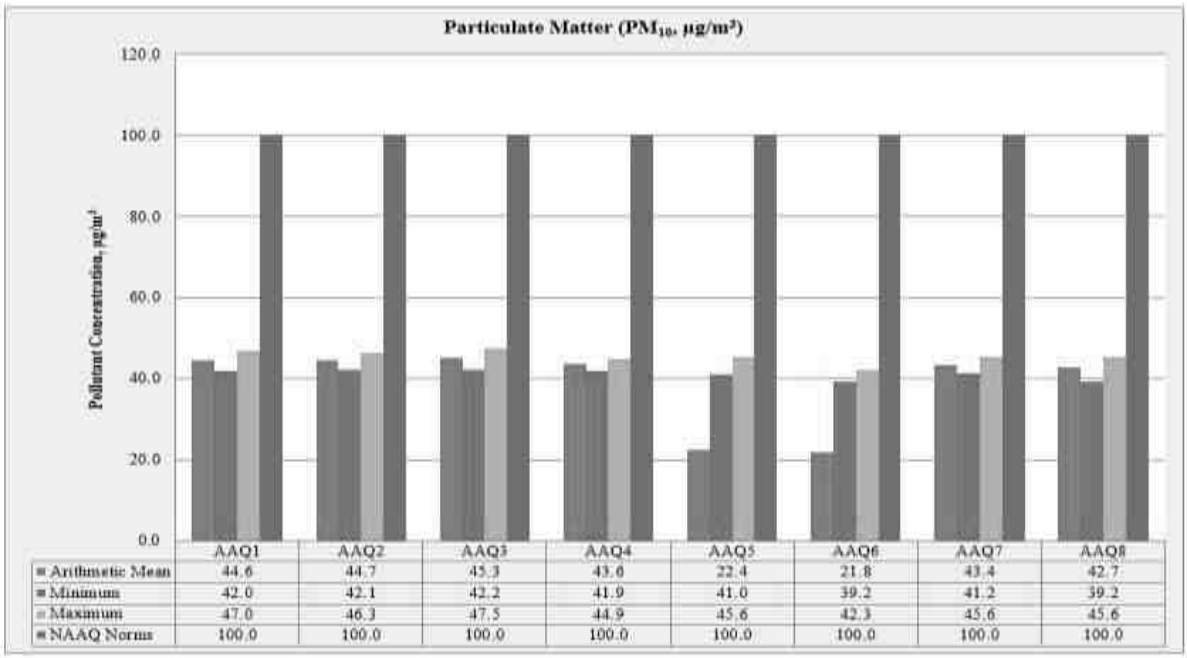
* NAAQ Norms-National Ambient Air Quality Norms-Revised as per GSR 826(E) dated 16.11.2009 for Industrial, Residential, Rural and other Area.

FIGURE 3.18 : BAR DIAGRAM OF SUMMARY OF AAQ 1 – AAQ 8



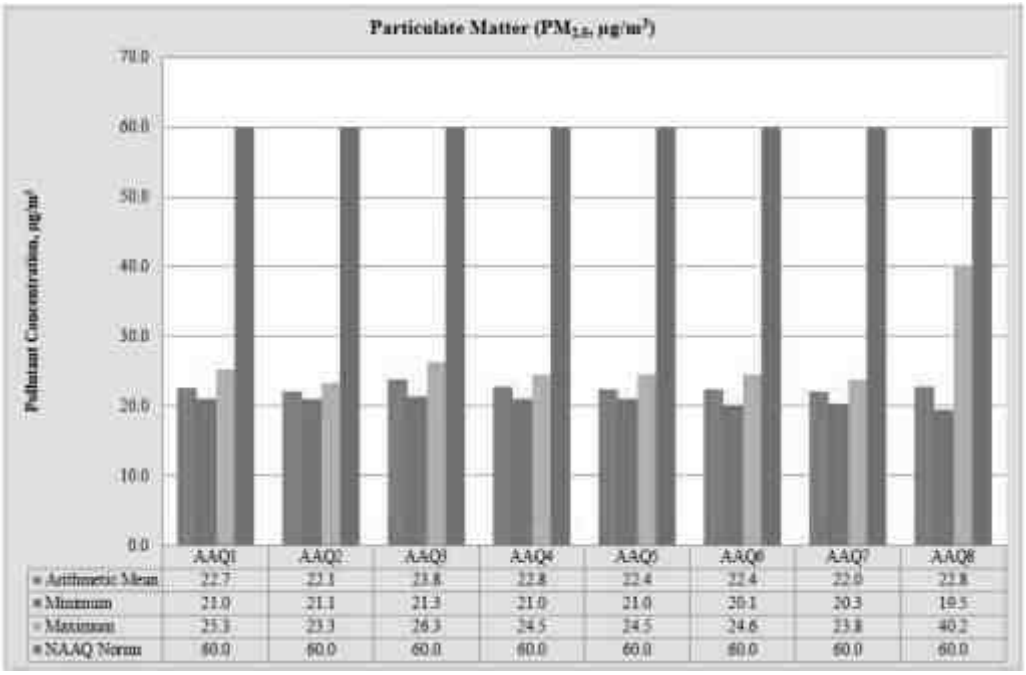
	PM10	PM2.5	SO2	NO2
98th Percentile Value	26.3	47.2	24.1	26.8
Arithmetic Mean	23.0	44.2	12.9	21.0
Minimum	21.1	41.0	5.6	6.2
Maximum	26.3	47.2	24.1	26.8
NAAQ Norms*	60.0	100.0	80.0	80.0

FIGURE 3.19 : BAR DIAGRAM OF PARTICULATE MATTER (PM_{10})



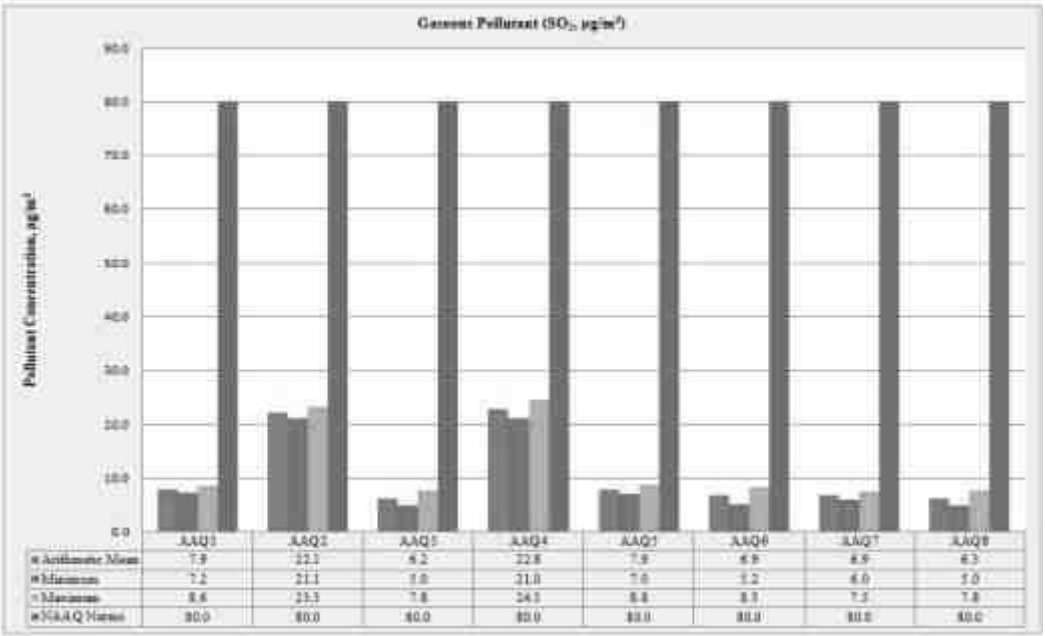
	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	44.6	44.7	45.3	43.6	22.4	21.8	43.4	42.7
Minimum	42.0	42.1	42.2	41.9	41.0	39.2	41.2	39.2
Maximum	47.0	46.3	47.5	44.9	45.6	42.3	45.6	45.6
NAAQ Norms	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

FIGURE 3.20 A : BAR DIAGRAM OF PARTICULATE MATTER ($PM_{2.5}$)



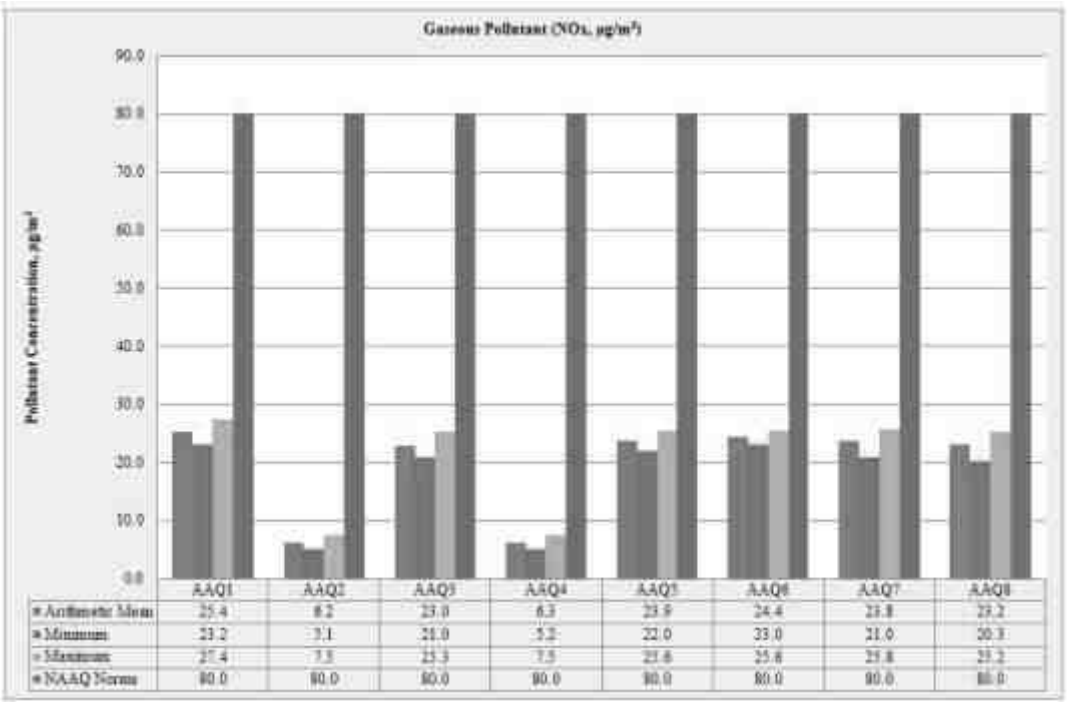
	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	22.7	22.1	23.8	22.8	22.4	22.4	22.0	22.8
Minimum	21.0	21.1	21.3	21.0	21.0	20.1	20.3	10.5
Maximum	25.3	23.3	26.3	24.5	24.5	24.6	23.8	40.2
NAAQ Norm	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0

FIGURE 3.21 BAR DIAGRAM OF PARTICULATE MATTER (SO_2)



	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	7.9	22.1	6.2	22.8	7.9	6.9	6.9	6.3
Minimum	7.2	21.1	5.0	21.0	7.0	5.2	6.0	5.0
Maximum	8.6	23.3	7.8	24.5	8.8	8.3	7.5	7.8
NAAQ Norm	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0

FIGURE 3.22 : BAR DIAGRAM OF PARTICULATE MATTER (NO_2)



3.3.6 Interpretations & Conclusion

As per monitoring data, PM_{10} ranges from 39.2µg/m^3 to 47.5 µg/m^3, $PM_{2.5}$ data ranges from 19.5 µg/m^3 to 40.2 µg/m^3, SO_2 ranges from 5.0 µg/m^3 to 24.5 µg/m^3 and NO_2 data ranges from 5.1 µg/m^3 to 27.4 µg/m^3. The concentration levels of the above criteria pollutants were observed to be well within the limits of NAAQS prescribed by CPCB. The minimum & maximum concentrations of PM_{10} were found to be 42 µg/m^3 in core zone area & 39.2 µg/m^3 in Beerjepalli Village respectively. The minimum & maximum concentrations of $PM_{2.5}$ were found to be 21.0 µg/m^3 in Core zone & 21.3 µg/m^3 in Krishnapuram area respectively. The maximum concentration in the core zone is due to the cluster of quarries situated within 500m radius.

3.3.7 FUGITIVE DUST EMISSION

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

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

AAQ Locations	Avg SPM (µg/m^3)
AAQ 1	66.23
AAQ 2	64.97
AAQ 3	68.17
AAQ 4	64.26
AAQ 5	67.95
AAQ 6	67.50
AAQ 7	67.32
AAQ 8	61.52

Source: Line Diagram of Table 3.29

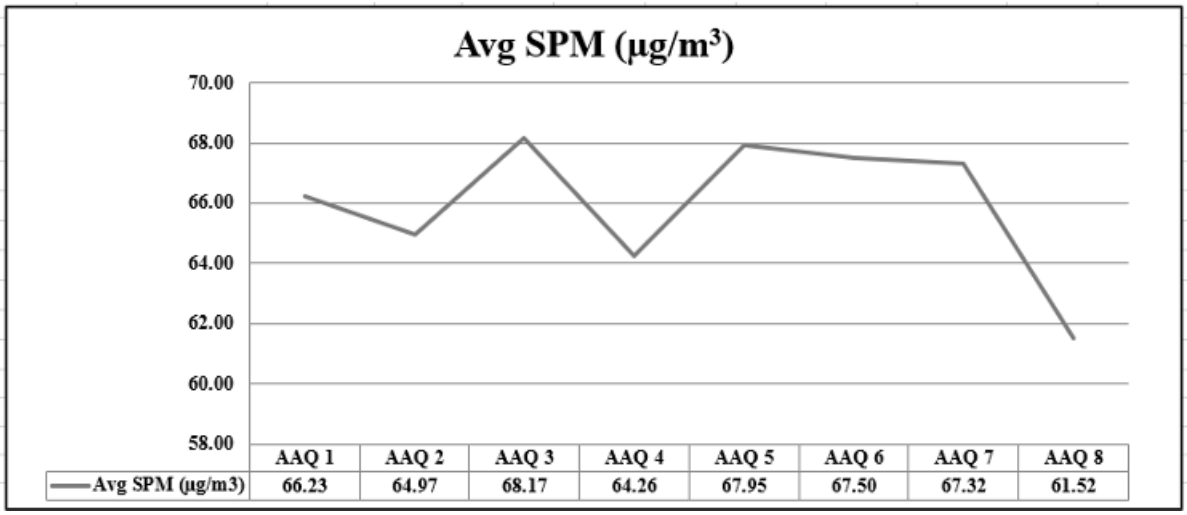
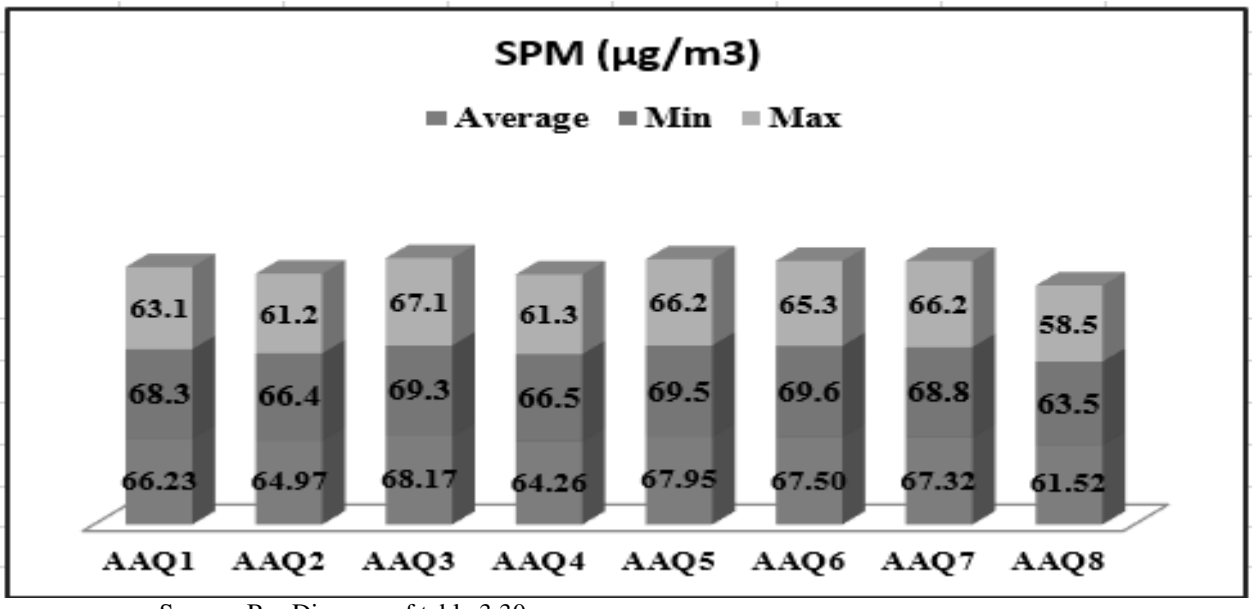


TABLE 3.30– FUGITIVE DUST SAMPLE VALUES IN µg/m^3

SPM (µg/m^3)	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Average	66.23	64.97	68.17	64.26	67.95	67.50	67.32	61.52
Min	68.3	66.4	69.3	66.5	69.5	69.6	68.8	63.5
Max	63.1	61.2	67.1	61.3	66.2	65.3	66.2	58.5

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 3.31 – DETAILS OF SURFACE NOISE MONITORING LOCATIONS

S. No	Location code	Monitoring Locations	Distance & Direction	Coordinates
1	N-1	Core Zone	Project Area	12°36'16.29"N 77°54'3.15"E
2	N-2	Hanumanthapuram	660m North	12°36'43.71"N 77°53'58.74"E
3	N-3	Krishnapuram	3.6km NE	12°36'23.02"N 77°56'7.43"E
4	N-4	Onnagurukki	4.8km SW	12°34'25.33"N 77°52'0.40"E
5	N-5	Sankaranarayanapuram	5.8km NW	12°37'41.17"N 77°50'51.58"E
6	N-6	Varanaganapalli	5km SE	12°33'52.87"N 77°55'35.14"E
7	N-7	Anusonai	3.3km South	12°34'27.41"N 77°53'51.84"E
8	N-8	Beerjepalli	3.8km NE	12°38'21.54"N 77°54'32.45"E

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

FIGURE 3.23: SITE PHOTOGRAPHS OF NOISE MONITORING IN CLUSTER

P1

P2

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 3.32 – NOISE MONITORING RESULTS IN CORE AND BUFFER ZONE

S. No	Locations	Noise level (dB (A) Leq)		Ambient Noise Standards
		Day Time	Night Time	
1	Core Zone	43.1	35.3	**Industrial Day Time- 75 dB (A) Night Time- 70 dB (A)**
2	Hanumanthapuram	41.6	36.4	
3	Krishnapuram	40.7	35.3	
4	Onnagurukki	39.3	34.3	
5	Sankaranarayanapuram	37.6	36.5	**Residential Day Time– 55 dB (A) Night Time- 45 dB (A)**
6	Varanaganapalli	38.0	35.5	
7	Anusonai	39.7	34.0	
8	Beerjepalli	37.9	35.1	

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

FIGURE 3.24: NOISE MONITORING STATIONS AROUND 10 KM RADIUS

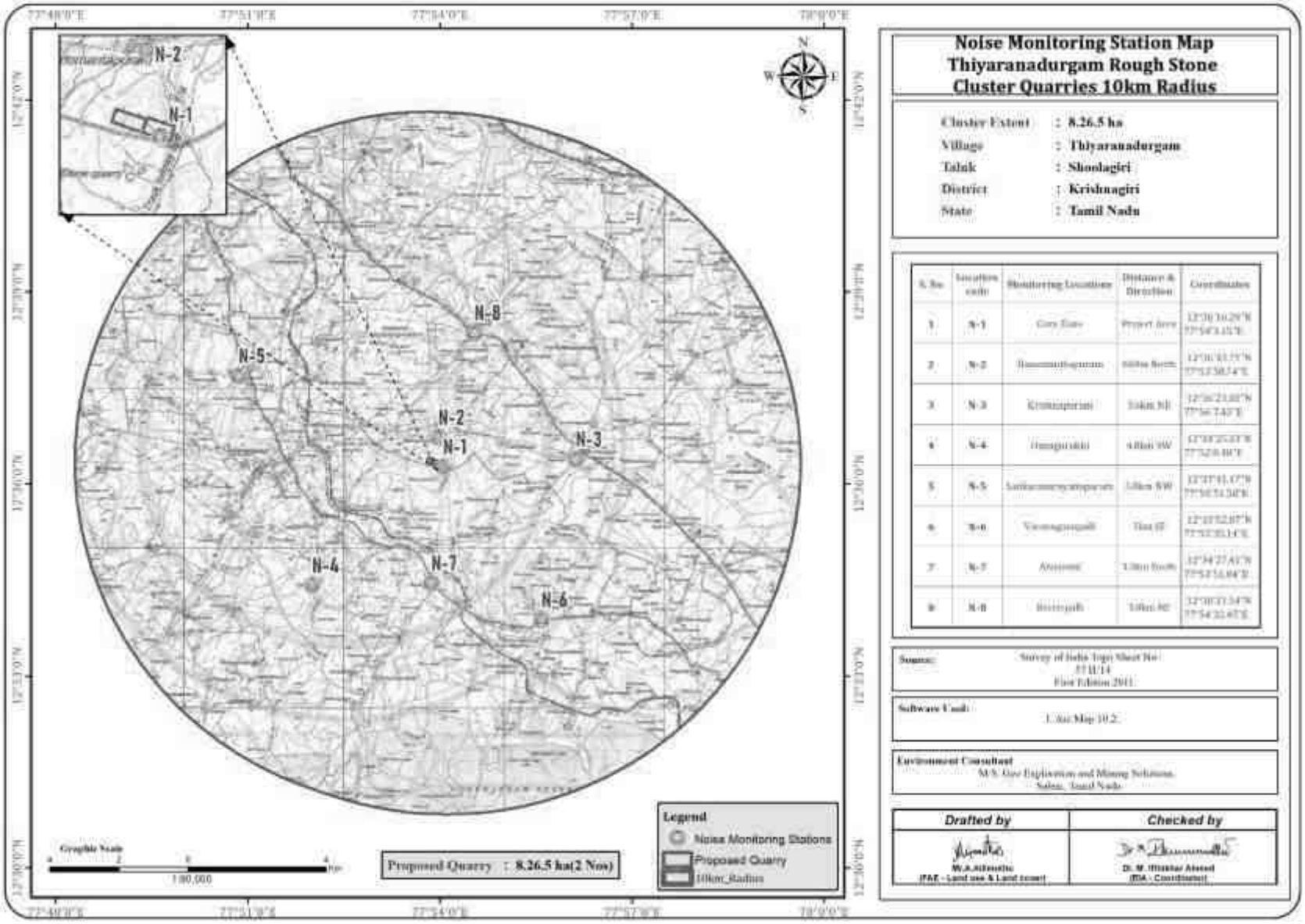
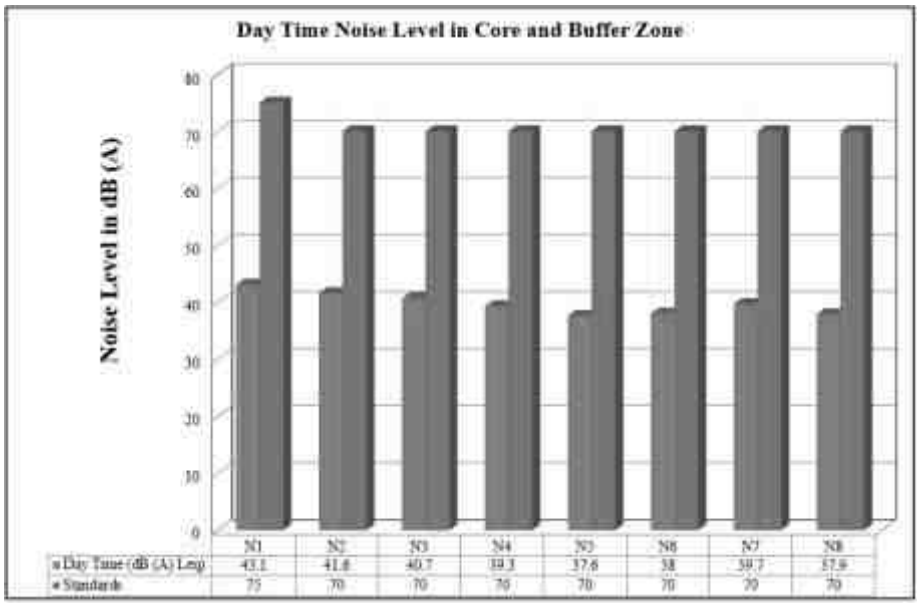
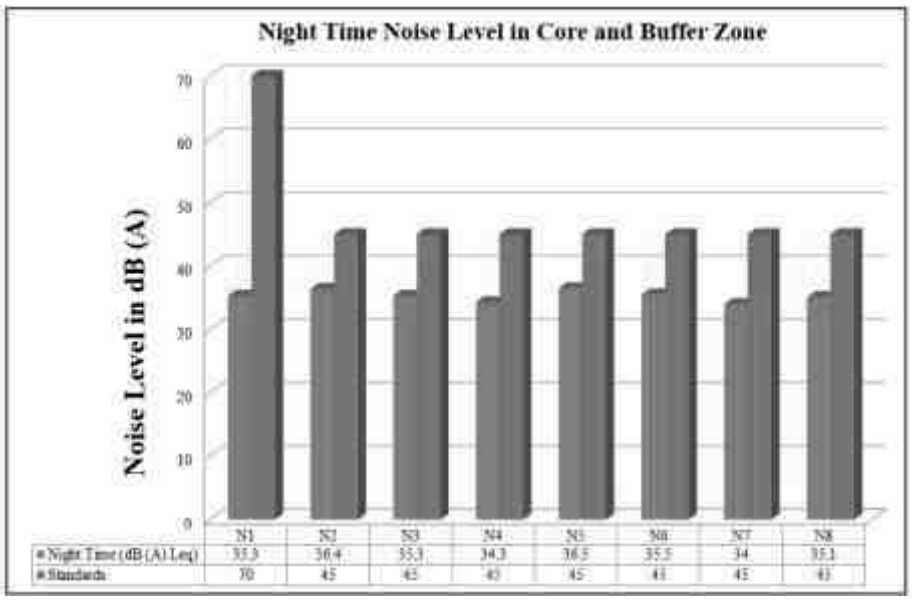


FIGURE 3.25: DAY & NIGHT TIME NOISE LEVELS IN CORE AND BUFFER ZONE





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 43.1 dB (A) Leq and during night time were from 35.3 (A) Leq. Noise levels recorded in buffer zone during day time were from 37.6 – 41.6 dB (A) Leq and during night time were from 34– 36.5 dB (A) Leq.

The values of noise observed in some of the areas are primarily owing to quarrying activities due to cluster of quarries within 500m radius, movement of vehicles and other anthropogenic activities. Noise monitoring results reveal that the maximum & minimum noise levels at day time were recorded in the range of 43.1 dB(A) in core zone and 37.6dB(A) in Sankaranarayanapuram village and 36.4dB(A) in Hanumanthapuram area & 34 dB(A) in Anusonai area respectively in night time. Thus, the noise level for Industrial and Residential area meets the requirements of CPCB.

3.5 Ecological Environment

In this project, the total area of the Cluster within 10km radius from the periphery of this quarry is reported as 8.26.5 Ha with 2 No. of quarries. In such Cluster situation, a common Ecology and Biodiversity study for the entire cluster of quarries is enough to capture all the possible externalities. The common EIA/EMP data can be used for all quarries that fall under this cluster but the present work was carried out on the detailed study of the impacts Thiyaranadurgam village cluster area Rough Stone quarry on the ecology and biodiversity of the core lease area with the proper mitigation and sustainable management plan. The proposed mine lease area is exhibits a hilly topography. The following methods were applied during the baseline study of flora, fauna and diversity assessment.

3.5.1 Methodology Adopted & Objective

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

a) To study the likely impact of the proposed mining project on the local biodiversity and to suggest mitigation measures, if required, for vulnerable biota.

b) To assess the nature and distribution of vegetation Terrestrial in and around the mining activity.

c) To identify the impacts of mining on agricultural lands and how it affects.

d) Detail of flora and fauna, Endemic, Rare, Endangered and Threatened (RET Species) separately for core and buffer area based on such primary field survey and clearly indicating the Schedule of fauna present. In case of any schedule- I fauna found in the study area, the necessary plan along with budgetary provisions for their conservation should be prepared in consultation with State Forest and Wildlife Department and details furnished.

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

f) Devise management & conservation measures for biodiversity.

3.5.2 Methodology of Sampling

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

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

3.5.3 Quadrats method

Quadrats of 10 × 10-m were laid down randomly within the core and 5-km buffer area; each quadrat was laid to assess the trees (>5 cm GBH) and one, 5 × 5-m sub-quadrat nested within the quadrat for shrubs. The quadrats were laid randomly to cover the area to maximize the sampling efforts and minimize the species homogeneity, such as small stream areas, trees in agricultural bunds, tank bunds, farm forestry plantations,

wildlife areas, and natural forest area, avenue plantations, house backyards, etc. In each quadrat individuals belonging to tree (10 × 10-m) and shrub (5 × 5-m) were recorded separately and have been identified on the field.

3.5.4 Flora Composition in the Core Zone

Taxonomically a total of 18 species belonging to 10 families have been recorded from the core zone mining lease area. The lease-applied area is exhibit hilly topography. The area has gentle sloping towards the Southern side. Based on the habitat classification of the enumerated plants the majority of species were Herbs 5, followed by Trees 5, Shrubs 3, Creeper 1, Grass 3 and Cactus 1. Details of flora with the scientific name were mentioned in Table No. 3.1. The result of the core zone of flora studies shows that Fabaceae and Poaceae are the main dominating species in the study area mentioned in Table No.3.33. No species were found as a threatened category (Table No. 3.33).

3.5.5 Flora Composition in the Buffer Zone

The buffer zone study area contains a total of 94 species have been recorded from the buffer zone. The floral (94) varieties among them Trees 38, herbs 16, shrubs 23, Climbers 11, Grasses 2, Creepers 2, and Cactus 2 were identified. The result of the buffer zone of flora studies shows that Fabaceae and Solanaceae, Euphorbiaceae is the main dominating species in the study area mentioned in Table No.3.33 There are no impacts due to this mining activity. There are no Rare, Endangered, and Threatened Flora species in the mining area and their surrounding study area. Details of flora with the scientific name were mentioned in Table No.3.33. The diversity of flora families is given in Fig No.3.34.

However, the information required as per the Standard Terms of Reference (ToR)

Tor No: 10. Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, National Park, migratory routes of fauna, water bodies, human settlements, and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given.

The lease-applied area is exhibiting a hilly topography. The area has gentle sloping towards Eastern side. Sanamavu R.F is located about 2km on the Northwest followed by Udedurgam R.F is located about 7km on the South side and Dekanikottai R.F is located about 8.5km on the Southwest side. 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. Even in the 10 Km buffer zone around the 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. There are no impacts due to this mining activity.

Tor No: 12) A Certificate from the Competent Authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area. In the event of any

contrary claim by the Project Proponent regarding the status of forests, the site may be inspected by the State Forest Department along with the Regional Office of the Ministry to ascertain the status of forests, based on which, the Certificate in this regard as mentioned above be issued. In all such cases, it would be desirable for representative of the State Forest Department to assist the Expert Appraisal Committees.

There are neither reserved (RF) nor protected (PF) forests either in the mine lease area or in the buffer zone. Thus, no forest land is involved in any manner. Hence, no certificate from the Forest department is required.

Tor No: 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.

As stated earlier, no forest land is involved in the proposed project in any manner. Hence no forest clearance is required.

Tor No: 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.

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.

Tor No: 15) The vegetation in the RF / PF areas in the study area, with necessary details, should be given.

Sanamavu R.F is located about 2km on the Northwest followed by Udedurgam R.F is located about 7km on the South side and Dekanikottai R.F is located about 8.5km on the Southwest side. There are no Protected Forests (PF) in the study area. Detailed list of flora found in the mine lease area and the buffer zone have been collected during Dec2022 - Feb 2023 based on primary survey. In each quadrat individuals belonging to tree (10 × 10-m) and shrub (5 × 5-m) were recorded separately and have been identified on the field. But no quadrat analysis was done in seasonal croplands. Vegetation and flora of the Mine lease area is given in below Table No.3.33.

TABLE 3.33 – FLORA

SI. No	English Name	Vernacular Name	Scientific Name	Family Name
Trees				
1.	Neem	Vembu	*Azadirachta indica*	Meliaceae
2.	Mesquite	Mullu maram	*Prosopis juliflora*	Fabaceae
3.	Millettia pinnata	Pongam oiltree	*Pongamia pinnata*	Fabaceae
4.	Pala indigo	Pala maram	*Wrightia tinctoria*	Apocynaeceae
5.	Bitter Albizia	Arappu Tree	*Albizia amara*	Fabaceae
Shrubs				
1.	Milk Weed	Erukku	*Calotropis gigantea*	Apocynaceae

2.	Hopbush	Virali	*Dodonaea viscosa*	Soapberry
3.	Tanner's cassia	Avaram	*Senna auriculata*	Fabaceae
Herbs				
1.	Common leucas	Thumbai	*Leucas aspera*	Lamiaceae
2.	Indian doab	Arugampul	*Cynodon dactylon*	Poaceae
3.	Coat buttons	Thatha poo	*Tridax procumbens*	Asteraceae
4.	Bindii	Nerunji mullu	*Tribulus terrestris*	Zygophyllaceae
5.	Prickly chaff flower	Nayuruv	*Achyranthes aspera*	Amaranthaceae
Creeper /Climbers				
1.	Stemmed vine	Perandai	*Cissus quadrangularis*	Vitaceae
Grass				
1.	Eragrostis	Pullu	*Eragrostis ferruginea*	Poaceae
2.	Great brome	Thodappam	*Bromus diandrus*	Poaceae
3.	Nut grass	Korai	*Cyperus rotandus*	Poaceae
Cactus				
1.	Triangular spruge	Chaturakalli	*Euphorbia antiquorum*	Euphorbiaceae

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

a. Wrightia tinctoria b. Cissus quadrangularis c. Albizia amara

d. Euphorbia antiquorum e. Dodonaea viscosa f. Senna auriculata

g. Bromus diandrus h. Pongamia pinnata i. Calotropis gigantea

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

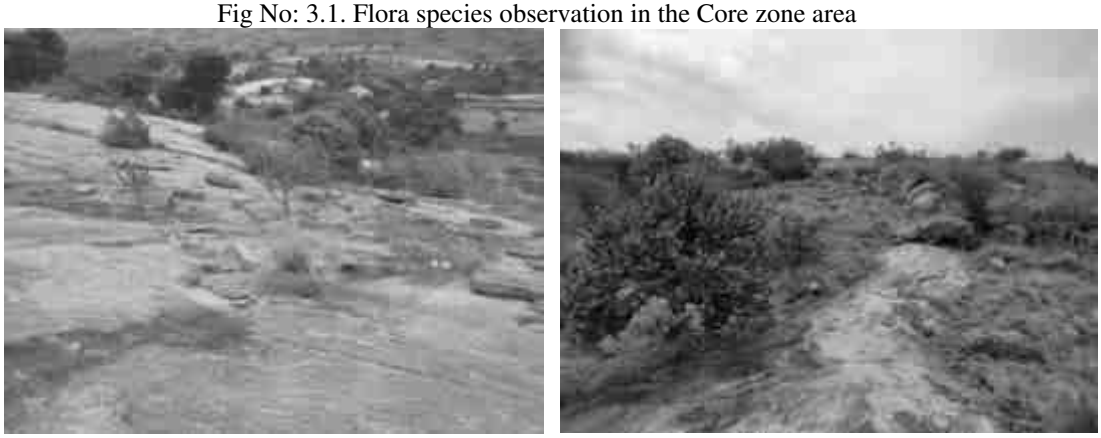


Fig No: 3.2. Site Location

Fig No: 3.26. Flora species observation in the Core zone area

Table No: 3.34 Flora in Buffer Zone of the cluster Rough Stone quarry quarry

S.No.	English Name	Vernacular Name	Scientific Name	Family Name
Trees				
1.	Mango	Manga	*Mangifera indica*	Anacardiaceae
2.	Blue gum	Thayala maram	*Eucalyptus*	Myrtaceae
3.	Indian ash tree	Odiya maram	*Lannea coromandelica*	Anacardiaceae
4.	Neem	Vembu	*Azadirachta indica*	Meliaceae
5.	Tamarind	Puliyamaram	*Tamarindus indica*	Legumes
6.	Mesquite	Mullu maram	*Prosopis juliflora*	Fabaceae
7.	Asian Palmyra palm	Panai maram	*Borassus flabellifer*	Arecaceae
8.	Bamboo	Moonghil	*Bambusa bambo*	Poaceae
9.	Indian almond	Padam maram	*Terminalia catappa*	Combretaceae
10.	Banana tree	Vazhaimaram	*Musa acuminata*	Musaceae
11.	Indian ash tree	Odiya maram	***Lannea coromandelica***	Anacardiaceae
12.	Curry leaves	Karuveppali	*Murraya koenigii*	Rutaceae
13.	Lemon	Ezhumuchaipalam	*Citrus lemon*	Rutaceae
14.	Bidi leaf tree	Thiruvathi Plant	*Bauhinia racemosa*	Fabaceae
15.	Bitter Albizia	Arappu Tree	*Albizia amara*	Fabaceae

16.	Peepal	Arasanmaram	*Ficus religiosa*	Moraceae
17.	Yellow flame tree	Perunkondrai	*Peltophorum pterocarpum*	Fabaceae
18.	Custard apple	Seethapazham	*Annona reticulata*	Annonaceae
19.	Flamboyant	Cemmayir-konrai	*Delonix regia*	Fabaceae
20.	Teak	Thekku	*Tectona grandis*	Verbenaceae
21.	Indian gooseberry	Nelli	*Emblica officinalis*	Phyllanthaceae
22.	Henna	Marudaani	*Lawsonia inermis*	Lythraceae
23.	Madras thorn	Kudukapuli	*Pithecellobium dulce*	Fabaceae
24.	Malayan Cherry	Ten Pazham	*Muntingia calabura*	Muntingiaceae
25.	Pomegranate	Mathulai	*Punica granatum*	Lythraceae
26.	Banyan tree	Alamaram	*Ficus benghalensis*	Moraceae
27.	Chinese chaste tree	Nochi	*Vitex negundo*	Verbenaceae
28.	Millettia pinnata	Pongam oiltree	*Pongamia pinnata*	Fabaceae
29.	Coconut	Thennai maram	*Cocos nucifera*	Arecaceae
30.	Guava	Koyya	*Psidium guajava*	Myrtaceae
31.	Pala indigo	Pala maram	*Wrightia tinctoria*	Apocynaeceae
32.	River tamarind	Savundal maram	*leucaena leucocephala*	Fabaceae
33.	Portia tree	Poovarasan	*Thespesia populnea*	Malvaceae
34.	Drumstick tree	Murunga maram	*Moringa oleifera*	Moringaceae
35.	Sacred Tree	Porasu	*Butea monosperma*	Fabaceae
36.	Mesquite	Mullu maram	*Prosopis juliflora*	Fabaceae
37.	Papaya	Pappali maram	*Carica papaya L*	Caricaceae
38.	White Bark Acacia	Vela maram	*Vachellia leucophloea*	Fabaceae
Shrubs				
1.	Tanner's cassia	Avaram	*Senna auriculata*	Fabaceae
2.	Milk Weed	Erukku	*Calotropis gigantea*	Apocynaceae
3.	Lantana	Unni chedi	*Lantana camara*	Verbenaceae
4.	Triangular spruge	Chaturakalli	*Euphorbia antiquorum*	Euphorbiaceae
5.	Night shade plan	Sundaika	*Solanum torvum*	Solanaceae
6.	Broom creeper	Kattukodi	*Cocculus hirsutus*	Menispermaceae
7.	Solanum pubescens	Malaisundai	*Solanum pubescens Willd*	Solanaceae
8.	Indian Oleander	Arali	*Nerium indicum*	Apocynaceae
9.	Shoe flower	Chemparuthi	*Hibiscu rosa-sinensis*	Malvaceae
10.	Puriging nut	Kattamanakku	*Jatropha curcas*	Euphorbiaceae
11.	Touch-me-not	Thottalchinungi	*Mimosa pudica*	Mimosaceae
12.	Thorn apple	Oomathai	*Datura stramonium*	Solanaceae
13.	Malabar catmint	Pei veratti	*Anisomeles malabarica*	Lamiaceae

14.	Indian mallow	Thuthi	*Abutilon indicum*	Meliaceae
15.	Castor oil plant	Amanakku	*Ricinus communis*	Euphorbiaceae
16.	Flame of the Woods	Idlipoo	*Xoracoc cinea*	Rubiaceae
Herbs				
1.	Eggplant	Kathrikkai	*Solanum melongena*	Solanaceae
2.	Aloe barbadensis	Katrazhai	*Aloe vera*	Asphodelaceae
3.	Commelina benghalensis	Kanavazha	*Commelina benghalensis*	Commelinaceae
4.	Coat buttons	Thatha poo	*Tridax procumbens*	Asteraceae
5.	Indian doab	Arugampul	*Cynodon dactylon*	Poaceae
6.	Chilli	Milakai	*Capsicum annuum*	Solanaceae
7.	Indian Copperleaf	Kuppaimeni	*Acalypha indica*	Euphorbiaceae
8.	Asthma-plant	Amman pacharisi	*Euphorbia hirta*	Euphorbiaceae
9.	Tomato	Thakkali	*Solanum lycopersicum*	Solanaceae
10.	Cleome viscosa	Nai kadugu	*Celome viscosa*	Capparidaceae
11.	Bindii	Nerunji mullu	*Tribulus terrestris*	Zygophyllaceae
12.	Prickly chaff flower	Nayuruv	*Achyranthes aspera*	Amaranthaceae
13.	Field beans	Avarai	*Hyacinth Beans*	Fabaceae
14.	Common leucas	Thumbai	*Leucas aspera*	Lamiaceae
15.	Spiny amaranth	Mullu keerai	*Amaranthus spinosus*	Amaranthaceae
16.	Holy basil	Thulasi	*Ocimum tenuiflorum*	Lamiaceae
17.	Ban Tulsi	Melakai poondu	*Croton bonplandianus*	Euphorbiaceae
18.	Europeanblack nightshade	Manathakkali	*Solanumnigrum*	Solanaceae
19.	ladies' fingers	Vendakkai	*Abelmoschus esculentus*	Malvaceae
20.	Vigna mungo	Ulunthu	*Vigna mungo*	Fabaceae
21.	Bright eyes	Nithiyakalyani	*Catharanthus roseus*	Apocynaceae
22.	Carrot grass	Parttiniyam	*Parthenium hysterophorus*	Asteraceae
23.	Indian mint	Karpura valli	*Coleus amboinicus*	Lamiaceae
Climber				
1.	Stemmed vine	Perandai	*Cissus quadrangularis*	Vitaceae
2.	Ivy gourd	Kovai	*Coccinia grandis*	Cucurbitaceae
3.	Bitter apple	Peikkumatti	*Citrullus colocynthis*	Cucurbitaceae
4.	Butterfly pea	Sangu poo	*Clitoria ternatea*	Fabaceae
5.	Wild jasmine	Malli	*Jasminum augustifolium*	Oleaceae
6.	Betel	Vetrilai	*Piper betle*	Piperaceae
7.	Pointed gourd	Kovakkai	*Trichosanthes dioica*	Cucurbitaceae
8.	Wild bitter	Pavarkai	*Momordica charantia*	Cucurbitaceae
9.	Bottle Guard	Sorakkai	*Lagenaria siceraria*	Cucurbitaceae

10.	White pumpkin	Poosanaikkaai	*Cucurbitaceae*	Cucurbitaceae
11.	Rosary Pea	Gundumani	*Abrus precatorius*	Fabaceae
Creeper				
1.	Nut grass	Korai	*Cyperus rotandus*	Poaceae
2.	Cucumis maderaspatanus	Musumusukkai	*Mukia maderaspatana*	Cucurbitaceae
Grass				
1.	Eragrostis	Pullu	*Eragrostis ferruginea*	Poaceae
2.	Windmill grass	Chevvarakupul	*Chloris barbata*	Amaranthaceae
Cactus				
1.	Prickly pear	Nagathali	*Opuntia dillenii*	Cactaceae
2.	Triangular spruge	Chaturakalli	*Euphorbia antiquorum*	Euphorbiaceae

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

(Sources: Species observation in the field study)

3.5.6. FAUNA

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

Table No: 3.35 Methodology applied during the survey of fauna

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

3.5.7. Fauna Composition in the Core Zone

A total of 22 varieties of species were observed in the Core zone of Thiyaranadurgam Village, Rough Stone quarry quarry (Table No.3.36) among them numbers of Insects 5, Reptiles 4, Mammals 2, and Avian 11. A total of 22 species have been recorded from the core mining lease area. None of these species are threatened or endemic in the study area and surroundings. There is no Schedule I species and 11 species are under Schedule IV 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. Details of fauna in the core zone with the scientific name were mentioned in Table No. 3.37.

Table No: 3.36 Fauna in the Core zone of Thiyaranadurgam Village, Cluster area, Rough Stone quarry, and gravel quarry

SI. No	Common name/English Name	Family Name	Scientific Name	Schedule list wildlife Protection act 1972	IUCN Red List data
Insects					
1	Striped tiger	Nymphalidae	*Danaus plexippus*	Schedule IV	LC
2	Grasshopper	Acrididae	*Hieroglyphus sp*	NL	LC
3	Common Tiger	Nymphalidae	*Danaus genutia*	NL	NL
4	Termite	Blattodea	*Hamitermes silvestri*	NE	LC
5	Red-veined darter	Libellulidae	*Sympetrum fonscolombii*	NL	LC

Reptiles					
1	Garden lizard	Agamidae	*Calotes versicolor*	NL	LC
2	Common skink	Scincidae	*Mabuya carinatus*	NL	LC
3	Rat snake	Colubridae	*Ptyas mucosa*	Sch II (Part II)	LC
4	Green vine snake	Colubridae	*Ahaetulla nasuta*	Schedule IV	NL
Mammals					
1	Indian Field Mouse	Muridae	*Mus booduga*	Schedule IV	NL
2	Common rat	Muridae	*Rattus rattus*	Schedule IV	LC
Aves					
1.	Common myna	Sturnidae	*Acridotheres tristis*	NL	LC
2.	Shikra	Laniidae	*Laniusexcubitor*	Schedule IV	LC
3.	House crow	Corvidae	*Corvussplendens*	NL	LC
4.	Sunbird	Nectariniidae	*Cinnyrisasiaticus*	Schedule IV	LC
5.	Koel	Cucalidae	*Eudynamys*	Schedule IV	LC
6.	Rose-ringed parkeet	Psittaculidae	*Psittacula krameri*	NL	LC
7.	Common quail	Phasianidae	*Coturnix coturnix*	Schedule IV	LC
8.	Black drongo	Dicruridae	*Dicrurus macrocercus*	Schedule IV	LC
9.	Cattle egret	Ardeidae	*Bubulcus ibis*	NE	LC
10.	Rock pigeon	Columba livi	*Columbidae*	Schedule IV	LC
11.	Indian Robin	Turdinae	*Saxicoloides fulicata*	Schedule IV	LC

*NL- Not listed, LC- Least Concern

(Sources: Species observation in the field study)

Table 3.37 Faunal Diversity in Buffer Zone of Thiyaranadurgam Village, Cluster area, Rough Stone quarry, and gravel quarry

SI. No	Common Name/English Name	Family Name	Scientific Name	Schedule list wildlife Protection act 1972	IUCN Red List data
Insects					
1	Indian honey bee	Apidae	*Apis cerana*	Schedule IV	LC
2	Common Tiger	Nymphalidae	*Danaus genutia*	Schedule IV	LC
3	Striped tiger	Nymphalidae	*Danaus plexippus*	Schedule IV	LC
4	Milkweed butterfly	Nymphalidae	*Danainae*	NL	LC

5	Termite	Blattodea	*Hamitermes silvestri*	NE	LC
6	Grasshopper	Acrididae	*Hieroglyphus sp*	NL	LC
7	Red-veined darter	Libellulidae	*Sympetrum fonscolombii*	NL	LC
8	Ant	Formicidae	*Camponotus Vicinus*	NL	NL
9	Tawny coster	Nymphalidae	*Danaus chrysippus*	Schedule IV	LC
10	Dragonfly	Gomphidae	*Ceratogomphus pictus*	Schedule IV	LC
11	Common Indian crow	Nymphalidae	*Euploea core*	Schedule IV	LC
12	Grass yellow	Pieridae	Eurema hecabe	NL	LC
13	Lesser grass blue	Lycaenidae	Zizina Otis indica	Schedule IV	LC
14	Chocolate pansy	Nymphalidae	Junonia iphita	NL	LC
Reptiles					
1	Chameleon	Chamaelenidae	*Chameleon zeylanicus*	Sch II (Part II)	LC
2	Fan-Throated Lizard	Agamidae	*Sitanaponticeriana*	NL	LC
3	Indian cobra	Elapid snakes	*Naja naja*	Sch II (Part II)	LC
4	Green vine snake	Colubridae	*Ahaetulla nasuta*	Schedule IV	NL
5	Rat snake	Colubridae	*Ptyas mucosa*	Sch II (Part II)	LC
6	Common krait	Elapid snakes	*Bungarus caeruleus*	Schedule IV	NL
7	Indian wall lizard	Gekkonidae	*Hemidactylus flaviviridis*	Schedule IV	NL
8	Garden lizard	Agamidae	*Calotes versicolor*	NL	LC
9	Russell's viper	Viperidae	*Vipera russseli*	Sch II (Part II)	LC
Mammals					
1	Indian palm squirrel	Sciuridae	*Funambulus palmarum*	Schedule IV	LC
2	Asian Small Mongoose	Herpestidae	*Herpestes javanicus*	Schedule (Part II)	LC
3	Indian Field Mouse	Muridae	*Mus booduga*	Schedule IV	LC
4	Brown rat	Muridae	*Rattus norwegicus*	Schedule IV	LC
5	Indian hare	Leporidae	*Lepus nigricollis*	Schedule (Part II)	LC
Aves					
1.	Koel	Cucalidae	*Eudynamys*	Schedule IV	LC
2.	Black-headed Munia	Estrildidae	*Lonchuramalacca*	Schedule IV	LC
3.	Cattle egret	Ardeidae	*Bubulcus ibis*	NL	LC

4.	Indian Roller	Coraciidae	*Coracias benghalensis*	Schedule IV	LC
5.	Rock pigeon	Columba livi	*Columbidae*	Schedule IV	LC
6.	Indian Robin	Turdinae	*Saxicoloides fulicata*	Schedule IV	LC
7.	Pond-Heron	Ardeidae	*Ardeo labacchus*	Schedule IV	LC
8.	Common myna	Sturnidae	*Acridotheres tristis*	NL	LC
9.	House crow	Corvidae	*Corvussplendens*	NL	LC
10.	Cattle Egret	Ardeidae	*Bubulcus ibis*	-	-
11.	Sunbird	Nectariniidae	*Nectariniidae*	NL	LC
12.	Indian blue robin	Larvivorabrunnea	*Muscicapidae*	Schedule IV	LC
13.	Asian green bee-eater	Meropidae	*Meropsorientalis*	NL	LC
14.	Hoopoe	Upupidae	*Upupaepops*	Schedule IV	LC
15.	Small blue Kingfisher	Alcedinidae	*Alcedo atthis*	Schedule IV	LC
16.	Rose-ringed parkeet	Psittaculidae	*Psittacula krameri*	NL	LC
17.	White Breasted king fisher	Alcedinidae	*Halcyon smyrnensis*	Schedule IV	LC
18.	Red-vented Bulbul	Pycnonotidae	*Pycnonotus cafer*	Schedule IV	LC
19.	Common quail	Phasianidae	*Coturnix coturnix*	Schedule IV	LC
20.	Cuckoo	Cuculidae	Cuculuscanorus	Schedule IV	LC
21.	Black drongo	Dicruridae	*Dicrurus macrocercus*	Schedule IV	LC
22.	Woodpecker bird	Picidae	*Picidae*	Schedule IV	LC
23.	Two-tailed Sparrow	Dicruridae	*Dicrurus macrocercus*	Schedule IV	LC
24.	Grey Francolin	Phasianidae	*Francolinus pondicerianus*	Schedule IV	LC
25.	House Sparrow	Passerinae	*Passer domesticus*	Schedule IV	LC
Amphibians					
1	Indian Burrowing frog	Dicroglossidae	*Sphaerotheca breviceps*	Schedule IV	LC

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

3.5.8 Aquatic Vegetation

There are several small village tanks on all sides within the 10 Km buffer zone. Most tanks were either totally or partially dry during the period of the survey. The present survey is confined to freshwater environment

only. Apart from the tanks, the aquatic environment is also represented by paddy fields, and a few stagnant water ponds. In addition to these village tanks, drains, and paddy fields provide the aquatic habitat for a variety of very common aquatic plants and animals. Colocassia esculenta can be found growing all along the drains of villages, small water-logged depressions, and agricultural fields lacking water but containing enough moisture to support its growth. And where water is present, Eichhornia crassipes has taken its roots and covers the entire water surface by its sprawl and invasion. All the aquatic plant species listed in Table 3.38.

Table No: 3.38 List of aquatic plants observed in the study area

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

***LC- Least Concern, NA-Not yet assessed**

Tor No: 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.

Blasting, noise and vibrations, and other disturbances including dust generation are likely to have an adverse impact on wildlife. But these impacts are unlikely to extend beyond 500 m from the actual mine area. There are six Schedule II species and 32 are under Schedule IV according to the Indian Wildlife Act 1972. A total of 25 species of bird were sighted in the buffer zone 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.

Tor No: 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.

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 reserved of even protected forests within the project area. Hence submission of clearance from the National Board of Wildlife does not arise.

Tor No: 18) A detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET Species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the Schedule of the fauna present. In case of any scheduled-I fauna found in the study area, the necessary plan along with budgetary provisions for their conservation should be prepared in consultation with State Forest and Wildlife Department and details furnished. Necessary allocation of funds for implementing the same should be made as part of the project cost.

A detailed biological study of the study area [core zone and buffer zone of 10 km radius of the periphery of the mine lease] has been carried out and the results are presented in Tables 3.37to 3.38 There are six Schedule II species, and 32 species are under Schedule IV according to the Indian Wildlife Act 1972. A total of 25 species of bird were sighted in the study area. The main threat to the bird is the use of pesticides in agriculture. There are no endangered, endemic, and RET Species. There is no Schedule I species in the 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.

Tor No: 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.

The plantation along the Lease boundary and avenues as well as over non-active dumps and preparation of green belt details are given in Table No.4.1.

3.5.9. Conclusion

The observations and assessment of the overall ecological scenario involve details such as classification of Biogeographic zone, eco-region, habitat types and land cover, distances from natural habitats, vegetation/forest types, and sensitive ecological habitats such as Wetlands sites, Important Bird areas, migration corridors of important wildlife etc. Such baseline information provides better understanding of the situation and overall ecological importance of the area. This baseline information viewed against proposed project activities help in

predicting their impacts on the wildlife and their habitats in the region. Data collected and information gathered from secondary literature on flora, fauna, protected area, natural habitats, and wildlife species etc., and consulted and discussed with local people, from the villages, herders and farmers who inhabit close to the proposed project area.

3.6 SOCIO ECONOMIC ENVIRONMENT

The major developmental activities in mining /Industrial sector are required for economic development as well as creation of employment opportunities (direct and indirect) and to meet the basic/modern needs of the society, which ultimately results in overall improvement of the quality of life through upliftment of social, economic, health, education and nutritional status in the project region, state as well as the country. In this manner all developmental projects have direct as well as indirect relationships with socioeconomic aspects, which also include public acceptability for new developmental projects. Thus, the study of socioeconomic component incorporating various facets related to prevailing social and cultural conditions and economic status of the Rough Stone 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 region.

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 assess the impact on socio-economic environment due to Rough Stone quarry quarry project region.

f) 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 Thiyaranadurgam Village, Shoolagiri Taluk, Krishnagiri District, Tamil Nadu State. in the field survey has been divided into three major segments namely Primary Zone (0 - 3 km), Secondary Zone (3 - 7 km) and tertiary Zone (7 - 10 km).

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

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

3.6.6 Collection of Data from Secondary Sources

Data from secondary sources were collected on following aspects:

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

Table 3.6.1 Type of Information and Sources

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

b) Data Presentation and Analysis

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

3.7 Background Information of the Area

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

The State can be divided broadly into two natural divisions (a) the Coastal plains of South India and (b) the hilly western area. Parallel to the coast and gradually rising from it is the broad strip of plain country. It can further be subdivided into Coromandal plains comprising the districts of Kancheepuram, Krishnagiri, Cuddalore and Vellore. The alluvial plains of the Cauvery Delta extending over Thanjavur and part of Tiruchirappalli districts and dry southern plains in Krishnagiri, 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 – Krishnagiri, 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 Krishnagiri District

Krishna' refers to 'black' and 'giri' refers to 'hill'. This district is gifted with black granite hillocks and named as "krishnagiri". The region came under the rule of Krishna Deva Raya and hence it might have been named after this king.

Krishnagiri district is bounded by Vellore and Thiruvannamalai districts in the East, Karnataka state in the west, State of Andhra Pradesh in the North Dharmapuri District in the south. Its area is **5143 Sq. Kms.** This district is elevated from 300m to 1400m above the mean sea level. Source: https://krishnagiri.nic.in/about-district/district-at-a-glance/

It is located between 11º 12'N to 12º 49'N Latitude,77º 27'E to 78º 38'E Longitude.

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 Thiyaranadurgam Village, Shoolagiri Taluk, Krishnagiri District, Tamil Nadu State. In order to determine the impact of the proposed project on nature and inhabitant. To get an overview of the villagers and their perspectives about this proposed activity, different demographic parameters and social aspects such population density, sex ratio, literacy rate, worker ratio etc. has been identified, analyzed, studied together. These impacts may be beneficial or disadvantageous. If disadvantageous anticipated suggestions measures are advocated in order to have collective development.

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

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

Particular	India	Tamil Nadu	Krishnagiri District	Study Area (10km Radius)
Area (in sq. km.)	3,287,263	130058	5143	317
Population Density/ sq. Km.	368	554	370	413
No. of Households	249454252	13357027	448053	29967
Population	1210569573	72147030	1879809	130667
Male	623121843	36137975	960232	66549
Female	587447730	36009055	919577	64118
Scheduled Tribes	104281034	794697	22388	2500
Scheduled Castes	201378086	14438445	267386	17780

Particular	India	Tamil Nadu	Krishnagiri District	Study Area (10km Radius)
Literacy Rate	**73%**	**80%**	**72%**	**66%**
Sex Ratio (Females per 1000 Males)	**943**	**996**	**956**	**963**

Source: Census of India, 2011

Table no 3.12.1 show demographic pattern of India, Tamil Nadu, Krishnagiri District & Study area (10km Radius). In India had total area of 3.2 sqkm, State of Tamil Nadu area was 130058 sqkm, District of Krishnagiri area was 5143 sqkm and study area is about 317 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 370 sqkm and study area density is about 413sqkm. As per Census 2011, about 5.96percent of population in the state lives in areas. Krishnagiri had comparing state wise 2.61percent of population lives in the district. In study area has 6.95% around 10km radius. State, District and study area. In Tamil Nadu state SC categories people had about 19 %, district of Krishnagiri about 14.22 % it had decreasing to Study area about 14% increasing in the total population Similarly ST population is about 1.10%, 1.19 % and 1.91 % of the total population in the study area. State level Literacy rate is 80%, district level is 75% but study area had decreased about 72%. 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 956 and study area is 963.

The study area has population density 413 persons per sq.km of total population about 130667as per census 2011. There were about 51 percent male and 49% female population. Study area has literate rate is about 66%, District had about 72% of literate rate as per census 2011.

3.13 Population Projection of the Study Area

Krishnagiri Population 2001 – 2030

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

Year	Projected Population (Estimation)
2001	**105924**
2011	**130667**
2021	155410
2025	180153
2030	204896

Source: ***https://www.census2011.co.in***

A population projection is an estimation of the number of people expected to be alive at a future date that is made based on assumptions of population structure, fertility, mortality and migration. It is an essential to assess the

need for new jobs, schools, doctors and nurses, planning urban housing, foods, clothing and requirements of energy and resources. It is also needed for policy discourse i.e., helps to the policy-makers to understand the existing problems and finally supports to develop the suitable solutions.

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

Table 3.13.1 Total Population of Study Area

Sl No.	Population in 2001	Population in 2011
1	105924	130667

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

Table 3.13.2 Population Projection of Study Area

S. No	Year	Projected Population (Approximately)
1.	2021	155410
2.	2031	180153
3.	2041	204896
4.	2051	229639

Source: Calculated by SPSS V23 -Linear Regression Method.

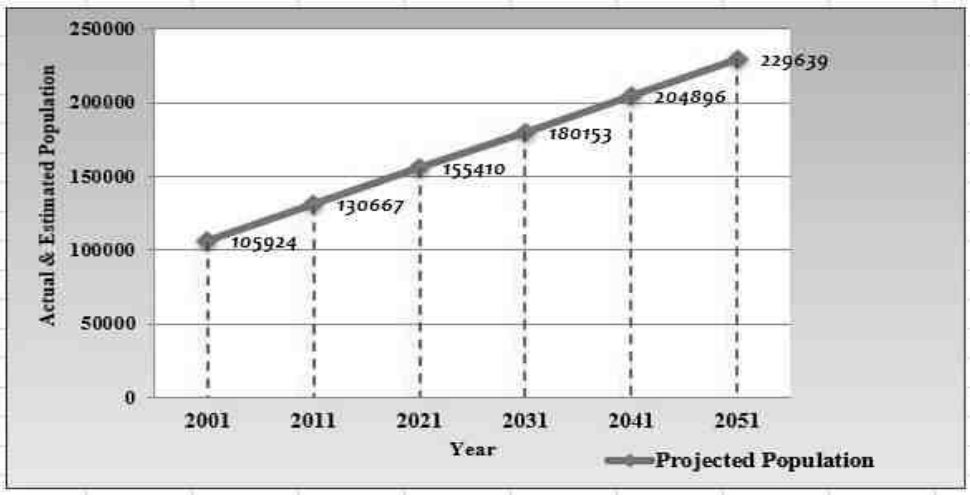


Fig 3.13.3 Graph Showing Population Projection

Following formula has been used for the projection of population.

$$Y=a+b_t$$

Where: Y= Dependent variable (Population)

a=Intercept

b=Slope

t=Interdependent variables (Time)

Above formula is applied to project population for the years (2021, 2031,2041,2051). Due to avoid the errors in manual calculation the statistical software SPSS (demo version 23) is used to calculate the intercept and the slope.

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

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

3.14 Population Growth of the Study Area

Table 3.14.1 Population Growth rate in Study area

Year	Actual Population	Growth Rate %
2001	105924	-
2011	130667	12.34
2021	155410	11.89
2031	180153	11.59
2041	204896	11.37
2051	229639	11.21

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 105924 and 2011 it was 130667 if the population growth rate is 12.34%, it will approximately gradually an increase about 155410 in year 2021 and 229639 in the year of 2051. It has approximately population growth rate decline will be 11.21%.

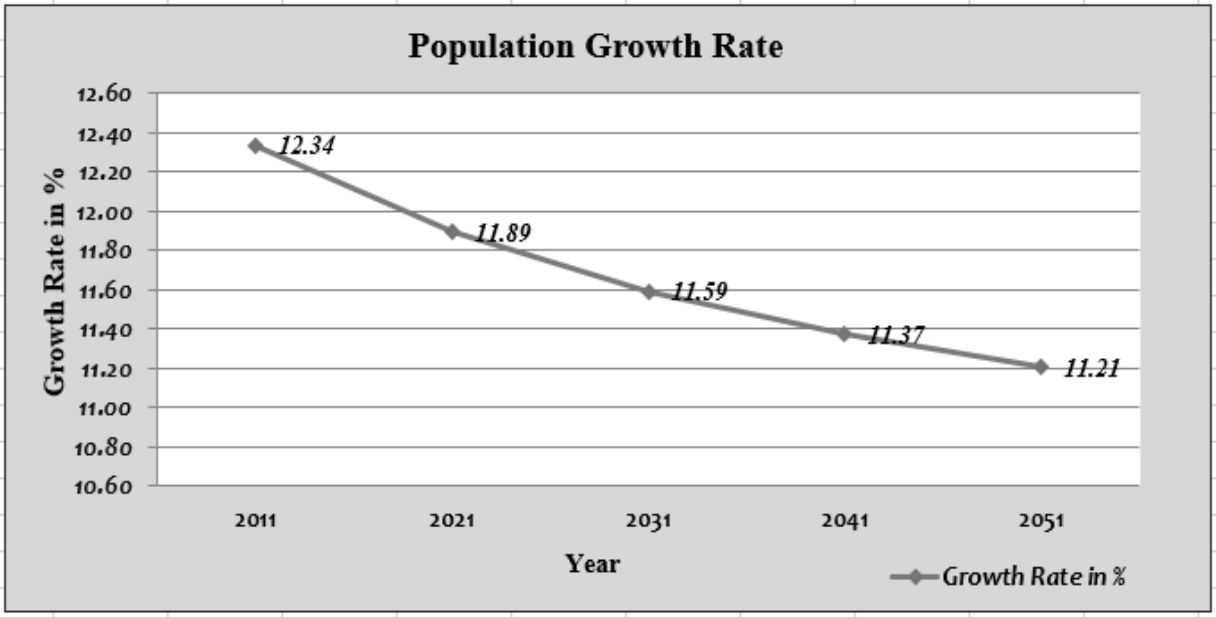


Fig.3.14.2 Graph Showing Population Growth Rate

Planning Analysis:

Calculating Growth Rates

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

Where:

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

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 130667 (for 10 km radius buffer zone). Total no. of household is 4669, 15060 and 10238 respectively, in primary, secondary and tertiary zone. Sex ratio is 931,962 and 981 (females per 1000 males) observed in primary, secondary and tertiary zone respectively. SC population distribution is 2558, 9647 and 5575 respectively in primary, secondary and tertiary zone. ST population distribution is very less 201,1488 and 811 respectively in primary, secondary and tertiary. Average household size is 4. Zone wise Demographic profile of study area is given in the table 3.15.1 below:

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

Table 3.15.1 Zone wise Demographic Profile of Study Area

Zone	No. of Villages	Total Household	Total Population	Male Population	%	Female Population	%

Primary Zone (0 - 3 Km)	2	4669	20721	10732	51.79	**9989**	48.21
Secondary Zone (3 - 7 Km)	15	15060	65552	33412	50.97	**32140**	49.03
Tertiary Zone (7 - 10 km)	12	10238	44394	22405	50.47	**21989**	49.53
Study Area (0-10 km)	**29**	**29967**	**130667**	**66549**	**50.93**	**64118**	**49.07**

Source: Census of India, 2011

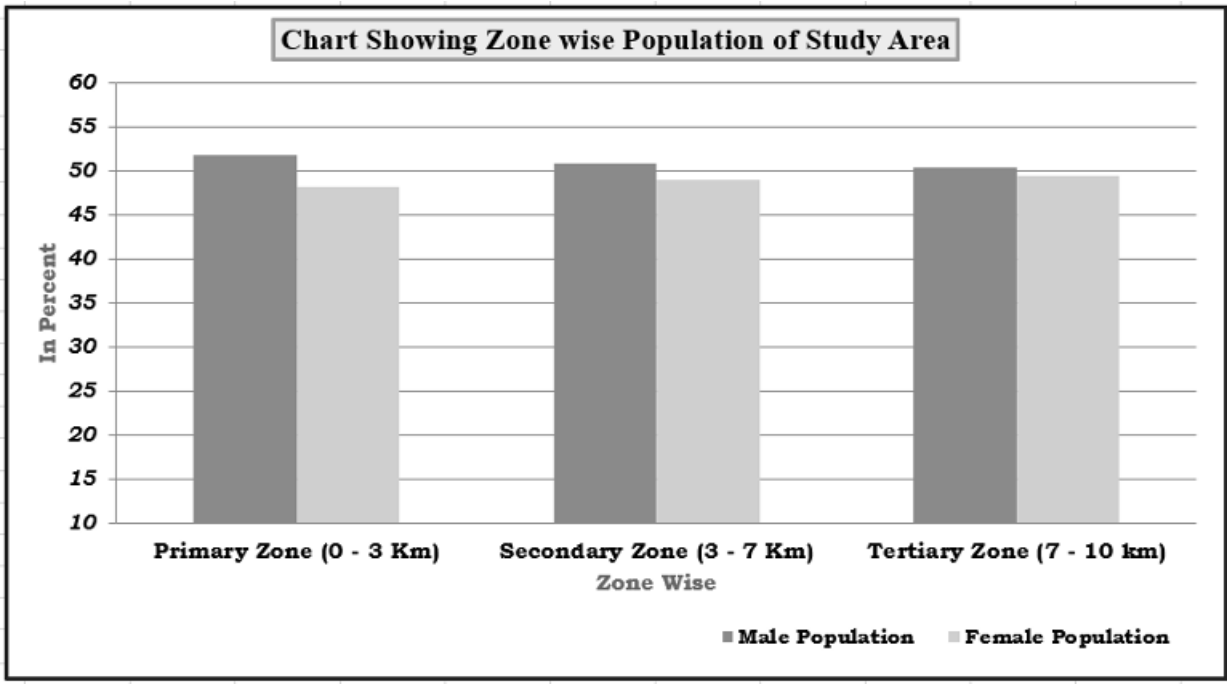


Figure 3.15.2 Population of study area

- ✓ Above table identifies the presence of villages and their subsequent population divided under three zones from plant boundary (i.e., Primary, secondary and tertiary zone).
- ✓ Primary zone has 2 villages where as much as 4669 households with 20721 population are located. Mostly lying on Built-up land for their livelihood and substance.
- ✓ Secondary and tertiary zone both comprise of 15 and 12 villages having a total population of 65552 and 44394 respectively.

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

Sno	Name	No.of Households	Total population	Total Male	Total Female	Population below 6	Male below 6	Female below 6	SC population	SC Male	SC Female	ST population	ST Male	ST Female	Literate population	Male Literate	Female Literate	Total workers	Main workers	Marginal workers	Nonworkers
0-3km																					
1	Thiyarandurgam	919	4143	2136	2007	463	223	240	442	232	210	82	40	42	2245	1337	908	2137	1692	445	2006
2	Anchetty	3750	16578	8596	7982	2136	1115	1021	2116	1135	981	119	59	60	8439	4948	3491	8836	6948	1888	7742
	Total	**4669**	**20721**	**10732**	**9989**	**2599**	**1338**	**1261**	**2558**	**1367**	**1191**	**201**	**99**	**102**	**10684**	**6285**	**4399**	**10973**	**8640**	**2333**	**9748**
3-7km																					
1	Kothapalli	411	1624	845	779	162	91	71	581	302	279	0	0	0	1000	578	422	754	689	65	870
2	Beerepalli	176	789	392	397	84	43	41	0	0	0	0	0	0	458	259	199	287	245	42	502
3	Enusonai	620	2709	1414	1295	289	150	139	512	271	241	6	3	3	1557	932	625	1362	1355	7	1347
4	Uddanapalli	1091	4691	2387	2304	555	308	247	648	326	322	58	28	30	2779	1563	1216	2306	1820	486	2385
5	Kelamangalam (TP)	3098	13321	6684	6637	1542	745	797	1782	910	872	27	15	12	8861	4822	4039	5522	5242	280	7799
6	Kurubarapalli	1171	5354	2760	2594	742	396	346	502	250	252	0	0	0	3100	1766	1334	2235	1524	711	3119
7	Karukkanahalli	1369	6006	3103	2903	776	415	361	414	203	211	74	26	48	3113	1838	1275	3497	3021	476	2509
8	Bodichipalli	1176	4982	2549	2433	558	271	287	432	210	222	0	0	0	2850	1638	1212	2108	1674	434	2874
9	Immidinayaganapalli	133	568	278	290	60	27	33	115	57	58	0	0	0	337	191	146	237	230	7	331
10	Thuppuganapalli	989	4281	2192	2089	501	248	253	1201	616	585	0	0	0	2328	1340	988	2395	2322	73	1886
11	Ayaranapalli	1171	4986	2578	2408	558	277	281	768	392	376	702	362	340	2923	1734	1189	2628	2422	206	2358
12	Nagamangalam	1115	4948	2502	2446	577	298	279	650	322	328	57	25	32	2675	1559	1116	2617	2326	291	2331
13	Udedurgam	763	3441	1780	1661	412	225	187	818	429	389	206	113	93	1792	1041	751	2079	1844	235	1362
14	Pachapanatti	863	3895	1959	1936	446	232	214	380	186	194	231	117	114	2098	1183	915	1772	935	837	2123
15	Jakkeri	914	3957	1989	1968	383	190	193	844	420	424	127	67	60	2347	1337	1010	2088	1735	353	1869
	Total	**15060**	**65552**	**33412**	**32140**	**7645**	**3916**	**3729**	**9647**	**4894**	**4753**	**1488**	**756**	**732**	**38218**	**21781**	**16437**	**31887**	**27384**	**4503**	**33665**
7-10km																					
1	Subbagiri	158	656	333	323	81	46	35	0	0	0	0	0	0	360	194	166	208	208	0	448
2	Halekotta	707	2990	1535	1455	301	148	153	209	103	106	83	46	37	1831	1071	760	1263	1098	165	1727
3	Samanapalli	721	3198	1635	1563	389	217	172	304	165	139	0	0	0	1652	922	730	1630	1585	45	1568
4	Varatanapalli	1693	7102	3586	3516	777	394	383	365	187	178	97	51	46	4622	2560	2062	3404	3107	297	3698
5	Bairamangalam	1207	4932	2569	2363	520	258	262	1213	638	575	11	5	6	3376	1940	1436	2330	1723	607	2602
6	T. Gollahalli	305	1255	653	602	148	81	67	183	94	89	0	0	0	780	446	334	554	297	257	701
7	Bithireddi	693	3076	1585	1491	327	166	161	419	210	209	96	47	49	1574	914	660	1655	1586	69	1421
8	Kottur	637	2712	1415	1297	252	148	104	458	248	210	6	4	2	1534	904	630	1194	862	332	1518
9	Thorapalli Agraharam	2177	9849	4669	5180	1328	694	634	1178	581	597	10	3	7	6149	3014	3135	3855	3157	698	5994
10	Sanamavu	925	4248	2182	2066	513	270	243	659	322	337	183	100	83	2549	1487	1062	1913	1661	252	2335
11	Muthanhalli	727	3157	1623	1534	333	180	153	456	223	233	302	161	141	1999	1171	828	1771	1676	95	1386
12	Agaram Agraharam	288	1219	620	599	126	68	58	131	71	60	23	9	14	687	389	298	741	692	49	478
	Total	**10238**	**44394**	**22405**	**21989**	**5095**	**2670**	**2425**	**5575**	**2842**	**2733**	**811**	**426**	**385**	**27113**	**15012**	**12101**	**20518**	**17652**	**2866**	**23876**
	G.Total	**29967**	**130667**	**66549**	**64118**	**15339**	**7924**	**7415**	**17780**	**9103**	**8677**	**2500**	**1281**	**1219**	**76015**	**43078**	**32937**	**63378**	**53676**	**9702**	**67289**

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 963 females per 1000 males. Gender and sex ratio determine the Human Development Index (HDI) of an area thereby understanding the status of women in that region. Following table entails information about sex ratio of 29 villages lying in study area (buffer zone) as primary, secondary and tertiary zone.

Table 3.16.1 Sex ratio of the study area

S. No.	Buffer Zone	Sex Ratio of Study area Female/ 1000 Male
1	Primary Zone (0-3 km)	931
2	Secondary zone (3-7 km)	962
3	Tertiary Zone (7-10 km)	981

Source: Census of India, 2011

Figure 3.16.2 Sex Ratio within 10 Km study area

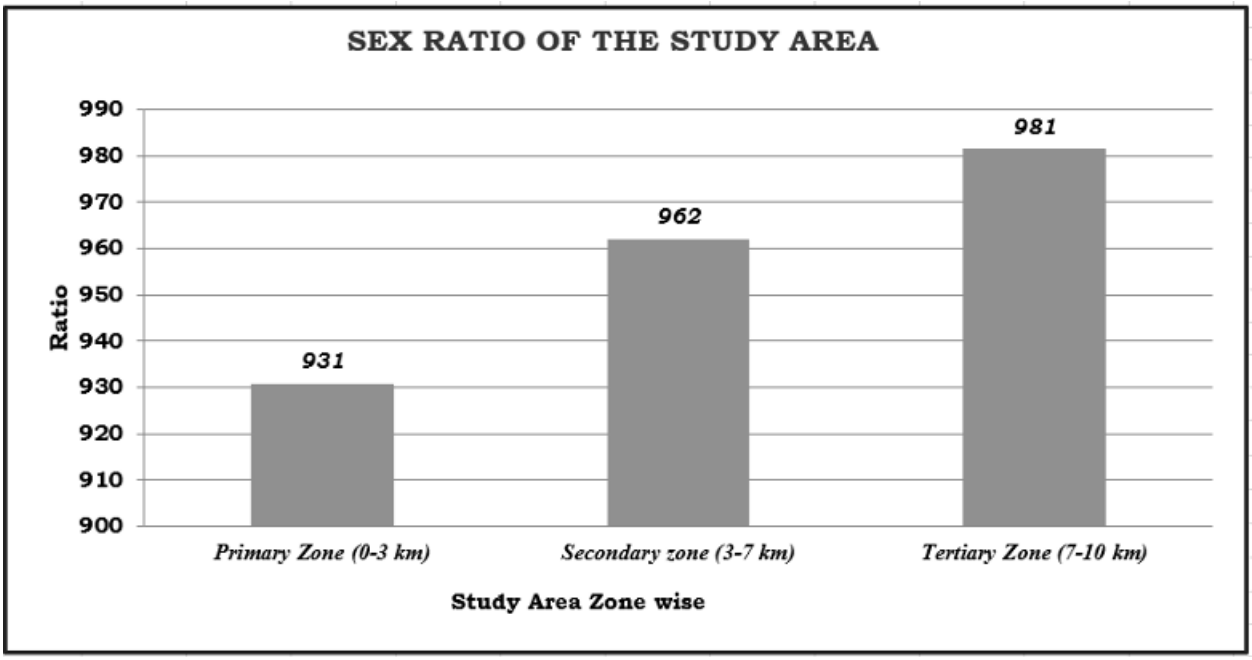


Table 3.16.1-b Child Sex ratio of the study area

S. No.	Buffer Zone	Sex Ratio of Study area Female/ 1000 Male
1	Primary Zone (0-3 km)	942
2	Secondary zone (3-7 km)	952
3	Tertiary Zone (7-10 km)	908

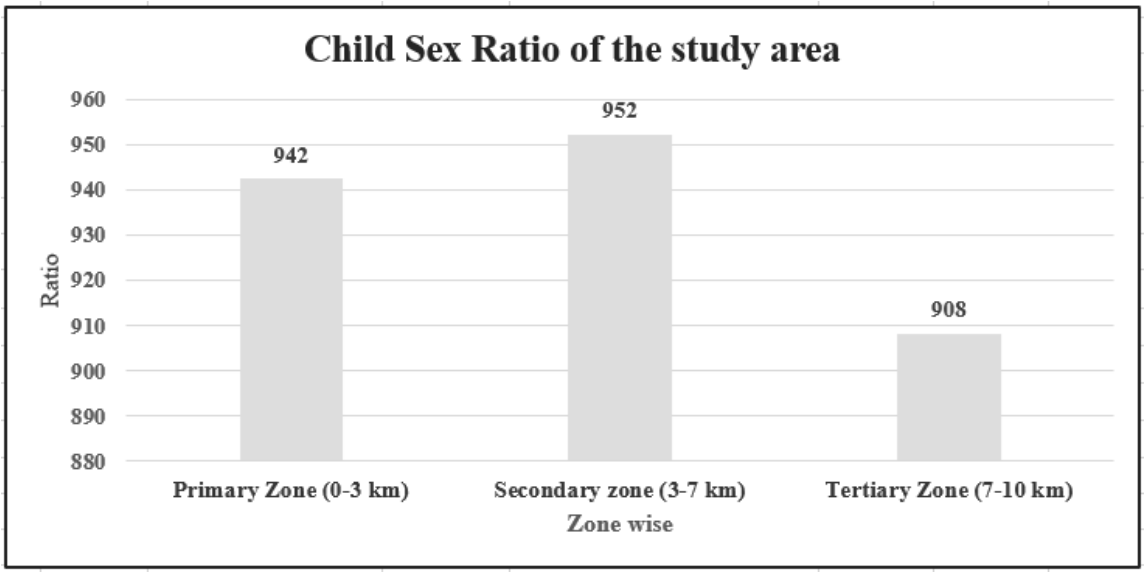


Figure 3.16.2-b Child Sex Ratio within 10 Km study area

3.17 Literacy Rate in Study Area

Literacy Rate is the percentage of people in a country with the ability to read and write. The analysis of the literacy levels is done in the study area. The 10 km radius of study area demonstrates a literacy rate of 65.91% as per census data 2011. The male literacy rate in the study area indicates 73.48% whereas the female literacy rate, which is an important indicator for social change, is observed to be 58.09% as per the census data 2011. This needs to focus on the study area and enhance further development focusing on education. (Table no 3.17.1).

Table 3.17.1 Literacy Rate of the Study Area

Zone	No. of Villages	Male Literacy Population	Male literacy Rate	Female Literacy Population	Female literacy Rate	Total Literacy	Total Literacy Rate
Primary Zone (0 - 3 Km)	2	**6285**	66.90	**4399**	50.40	**10684**	58.96
Secondary Zone (3 - 7 Km)	15	**21781**	73.84	**16437**	57.85	**38218**	66.00
Tertiary Zone (7 - 10 Km)	12	**15012**	76.07	**12101**	61.85	**27113**	68.99

Study Area (0-10km)	**29**	43078	**73.48**	32937	**58.09**	76015	**65.91**

Source: Census of India, 2011

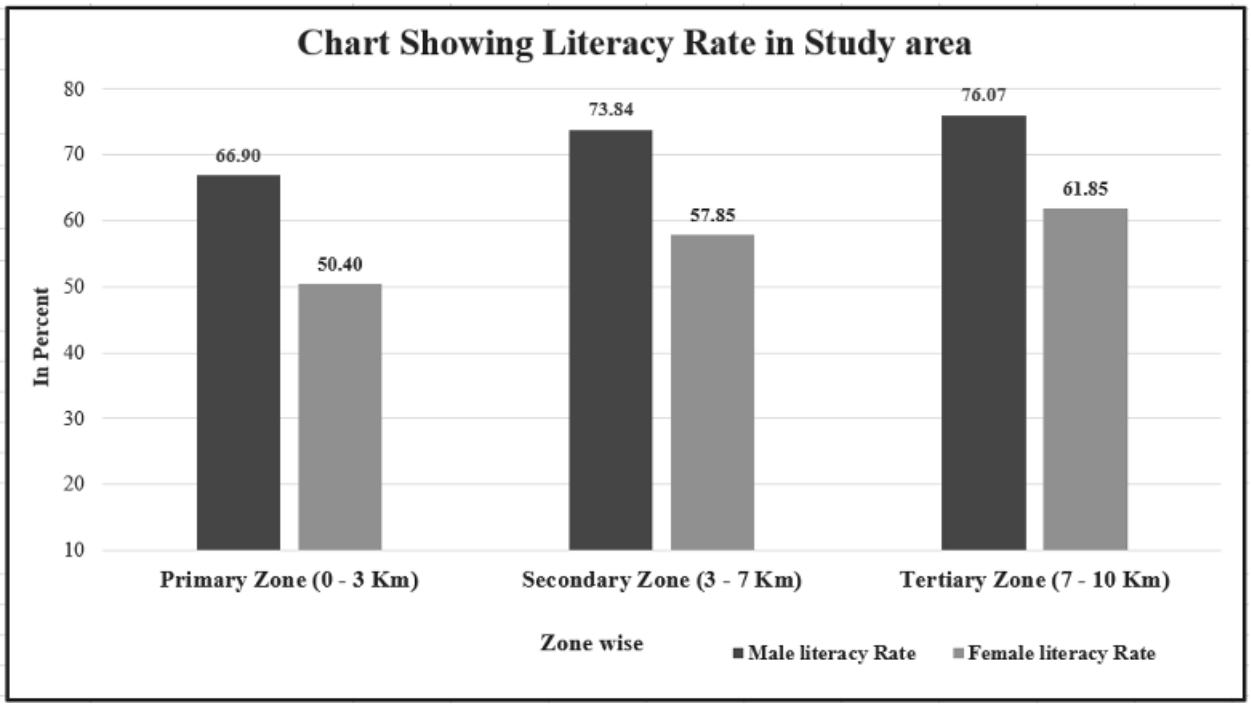


Figure 3.17.2 Gender wise Literacy Rate in the study area

3.18 Family Size

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

3.19 Vulnerable Group

While developing an action plan, it is very important to identify the population who fall under the marginalized and vulnerable groups and special attention has to be given towards these groups while making action plans. Special provisions should be made for them. In the observed villages schedule caste (SC) population is 13.61% and Schedule Tribe population 1.91 %, Other Population is 84% in total study area.

Table 3.19.1 vulnerable groups of the study area

Zone	No. of Villages	Vulnerable Groups					
		SC Population	%	ST Population	%	Other Population	%
Primary Zone (0 - 3 Km)	2	2558	12.34	201	0.97	17962	86.69

Secondary Zone (3 - 7 Km)	15	9647	14.72	1488	2.27	54417	83.01
Tertiary Zone (7 - 10 Km)	12	5575	12.56	811	1.83	38008	85.62
Total area (10km)	**29**	**17780**	**13.61**	**2500**	**1.91**	**110387**	**84.48**

Source: Census of India, 2011

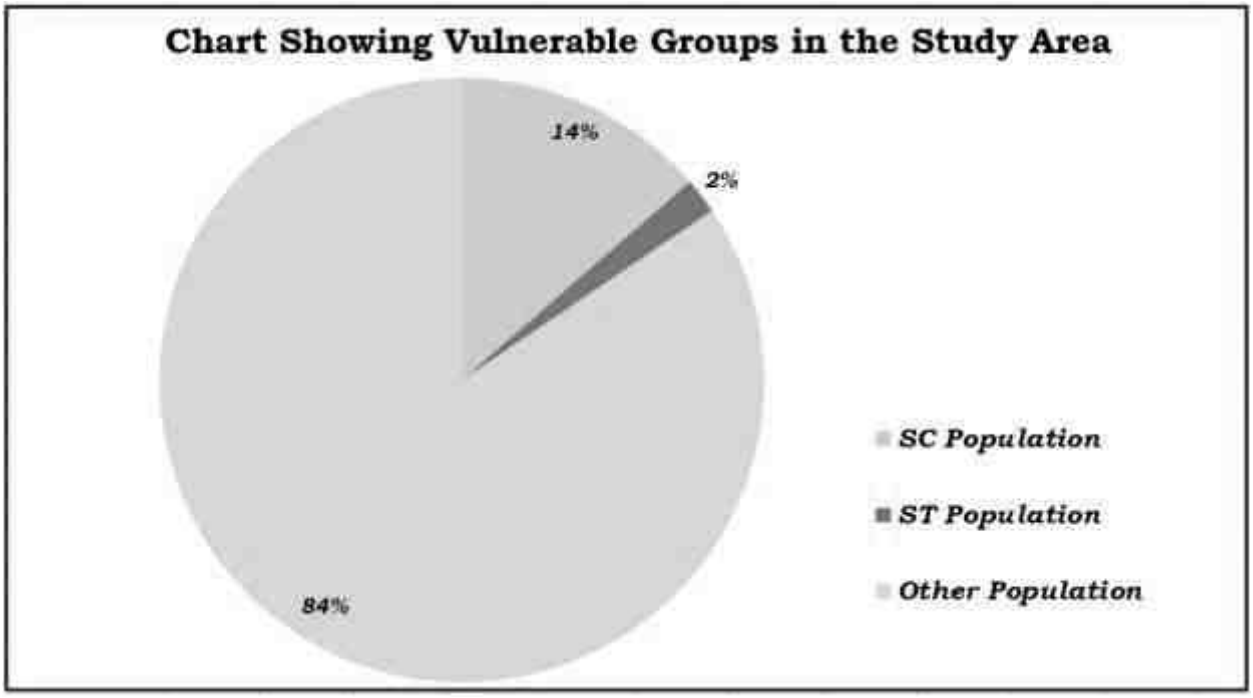


Figure 3.19.2 vulnerable groups

3.20 Economic Activities

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

Table 3.20.1 shows the work force of the study area

Zone	No. of Villages	Total Workers	%	Main Workers	%	Marginal Workers	%	Non-Workers	%
Primary Zone (0 - 3 Km)	2	10973	52.96	8640	41.70	2333	11.26	9748	47.04
Secondary Zone (3 - 7 Km)	15	31887	48.64	27384	41.77	4503	6.87	33665	51.36
Tertiary Zone (7 - 10 Km)	12	20518	46.22	17652	39.76	2866	6.46	23876	53.78
Study Area (10 Km)	**29**	**63378**	**48.50**	**53676**	**41.08**	**9702**	**7.42**	**67289**	**51.50**

Source: Census of India, 2011

The above table shows that out of the total working population, the percentage of main workers is 41.08% while 7.42% are marginal workers. Number of working populations is 48.50% and non-working population is 51.50% in the study area. As per the data obtained from the survey (as mentioned previously in occupational structure) most of these people are employed for major period of the year. Also, to mention the natural environment also restricts the people in finding stable business is performed for only certain months. Thus, proposed project will act as possible exposure for them to get enrol and earn sustain livelihood.

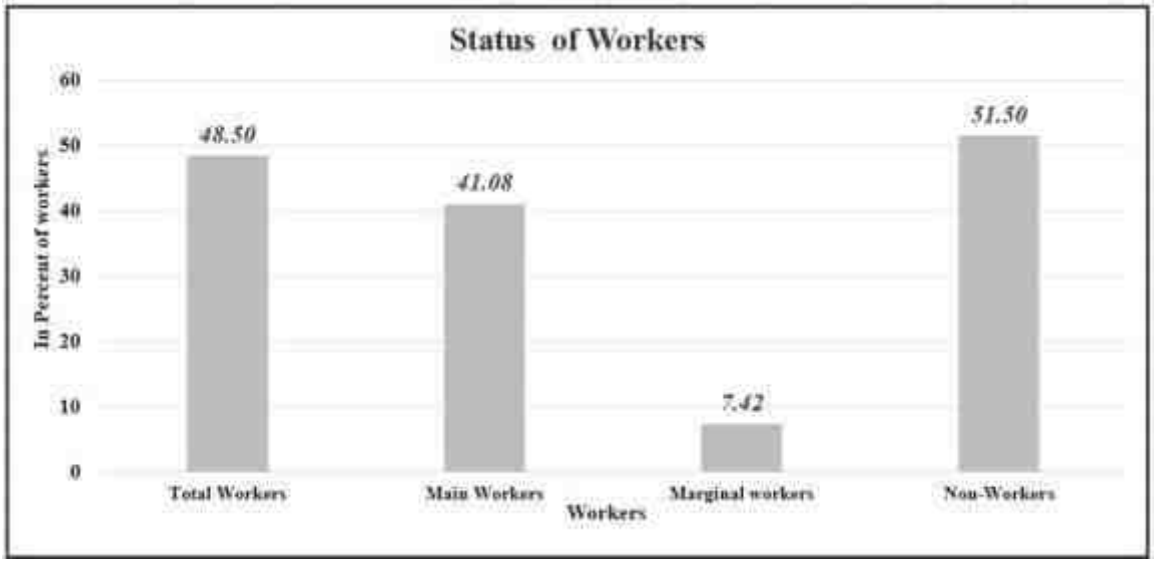


Figure 3.20.2. Working population in the study area

3.21 Infrastructure Base

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

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, Krishnagiri District (32km-E) from site which by local transport.
- **Chinnati Dam** southern side 6km-SW from mine lease boundary this dam requires people around the village and Anchetty Durgam 1.5km-SW side, **Ponnaiyar River** 7.0km-NE, some Nanjappan kodigai Eri – (5km -W), Pathakotta Village and Nayakanpalli Village people require water and Kadudhanapalli-3km-SW, Uddanapalli Village from mine lease boundary, require people in the study area.
- **Availability of** PUM Government Elementary school, Kothapalli Village (4.0km-NW), Government Boys Higher secondary school, Kelamangalam Town Panchayat (5.5km-SW), Government High school, Uddanapalli Village (4km-NE), Government High school, Sanamavu Village (5km-NW), many Pre-primary school, Elementary school, Engineering college, Medical and Training institute found in study area.
- **Health facilities** covered in the area GPHC Kelamangalam Town Panchayat (5.5km-SW), Government Hospital, Karukkanahalli Village, (4.5km-E), Government Hospital Nagamangalam and Koothanapalli Village (7km-SE) Other private clinics and Pharmacy available in the study area and district level.

Table 3.21.1 Educational Facilities in the Surveyed Area

Sno	Village Name	Govt Primary School (Numbers)	Private Primary School (Numbers)	Govt Middle School (Numbers)	Private Middle School (Numbers)	Govt Secondary School (Numbers)	Private Secondary School (Numbers)	Govt Senior Secondary School (Numbers)	Private Senior Secondary School (Numbers)	Govt Arts and Science Degree College (Numbers)	Private Arts and Science Degree College (Numbers)
0-3km											
1	Anchetty	11	2	7	0	1	0	1	0	0	0
2	Thiyarandurgam	1	0	1	0	0	0	0	0	0	0
	Total	**12**	**2**	**8**	**0**	**1**	**0**	**1**	**0**	**0**	**0**
3-7km											
1	Kothapalli	1	0	0	0	0	0	0	0	0	0
2	Beerepalli	1	0	1	0	0	0	0	0	0	0
3	Enusonai	1	0	1	0	1	0	0	0	0	0
4	Immidinayaganapalli	1	0	1	0	1	0	1	0	0	0
5	Thuppuganapalli	4	0	0	0	0	0	0	0	0	0
6	Uddanapalli	4	1	1	0	1	0	1	0	0	0
7	Ayaranapalli	3	0	1	0	1	0	1	0	0	0
8	Kurubarapalli	6	0	1	0	1	0	1	0	0	0
9	Bodichipalli	5	0	2	0	0	0	0	0	0	0
10	Nagamangalam	5	0	1	0	1	0	1	0	0	0
11	Udedurgam	3	0	1	0	0	0	0	0	0	0
12	Karukkanahalli	4	0	1	0	0	0	0	0	0	0
13	Pachapanatti	4	0	2	0	0	0	0	0	0	0
14	Jakkeri	6	1	2	0	0	0	0	0	0	0
15	Kelamangalam (TP)	4	4	1	1	1	3	1	3	0	0
	Total	**52**	**6**	**16**	**1**	**7**	**3**	**6**	**3**	**0**	**0**
7-10km											
1	Thorapalli Agraharam	5	0	3	0	0	0	0	0	0	0
2	Subbagiri	0	0	0	0	0	0	0	0	0	0
3	Sanamavu	4	0	2	0	0	0	0	0	0	0
4	Halekotta	3	0	1	0	0	0	0	0	0	0

5	Samanapalli	2	0	2	0	0	0	0	0	0	0
6	Agaram Agraharam	0	0	0	0	0	0	0	0	0	0
7	Varatanapalli	4	0	1	0	1	0	1	0	0	0
8	Bairamangalam	4	0	1	0	1	0	0	0	0	0
9	Muthanhalli	3	0	0	0	0	0	0	0	0	0
10	T.Gollahalli	1	0	0	0	0	0	0	0	0	0
11	Bithireddi	4	0	1	0	0	0	0	0	0	0
12	Kottur	2	0	1	0	0	0	0	0	0	0
	Total	**32**	**0**	**12**	**0**	**2**	**0**	**1**	**0**	**0**	**0**
	Grant total	**96**	**8**	**36**	**1**	**10**	**3**	**8**	**3**	**0**	**0**

Source: DCHB Census 2011, Tamil Nadu

Table 3.21.2Health/ 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	Anchetty	1	1	8	1	0	1	1	1	4
2	Thiyarandurgam	0	0	1	0	0	0	0	0	0
	Total	**1**	**1**	**9**	**1**	**0**	**1**	**1**	**1**	**4**
3-7km										
1	Kothapalli	0	0	0	0	0	0	0	0	0
2	Beerepalli	0	0	0	0	0	0	0	0	0
3	Enusonai	0	0	1	0	0	0	0	0	0
4	Immidinayaganapalli	0	0	0	0	0	0	0	0	0
5	Thuppuganapalli	0	0	1	0	0	0	0	0	0
6	Uddanapalli	0	1	1	1	0	1	1	1	0
7	Ayaranapalli	0	0	1	1	0	0	0	0	0
8	Kurubarapalli	0	1	1	1	0	1	1	1	1
9	Bodichipalli	0	0	2	0	0	0	0	0	0
10	Nagamangalam	0	1	1	1	0	1	0	1	0

11	Udedurgam	0	1	1	1	0	1	1	1	0
12	Karukkanahalli	0	0	1	0	0	0	1	0	0
13	Pachapanatti	0	0	1	0	0	0	0	0	0
14	Jakkeri	0	0	2	0	0	0	0	0	0
15	Kelamangalam (TP)	0	0	0	0	0	1	1	1	4
	Total	**0**	**4**	**13**	**5**	**0**	**5**	**5**	**5**	**5**
7-10km										
1	Thorapalli Agraharam	0	0	3	0	0	0	1	0	1
2	Subbagiri	0	0	0	0	0	0	0	0	0
3	Sanamavu	0	0	1	0	0	0	0	0	0
4	Halekotta	0	0	0	0	0	0	0	0	0
5	Samanapalli	0	0	1	0	0	0	0	0	0
6	Agaram Agraharam	0	0	0	0	0	0	0	0	0
7	Varatanapalli	0	0	1	0	0	0	1	0	0
8	Bairamangalam	0	0	1	0	0	0	0	0	0
9	Muthanhalli	0	0	1	0	0	0	0	0	0
10	T.Gollahalli	0	0	0	0	0	0	0	0	0
11	Bithireddi	0	0	1	1	0	0	0	0	0
12	Kottur	0	0	1	2	0	0	1	0	0
	Total	**0**	**0**	**10**	**3**	**0**	**0**	**7**	**0**	**7**
	G.Total	**1**	**5**	**32**	**9**	**0**	**6**	**13**	**6**	**16**

Source: DCHB Census 2011, Tamil Nadu

Table 3.21.3 Water & Drainage Facilities in the Surveyed Area

Sno	Village Name	Treated (Status A(1)/NA(2)	Untreated (Status A(1)/NA(2)	Well (Status A(1)/NA(2)	Well (Status A(1)/NA(2)	Pump (Status A(1)/NA(2)	hole (Status A(1)/NA(2)	(Status A(1)/NA(2)	al (Status A(1)/NA(2)	/Lake (Status A(1)/NA(2)	(Status A(1)/NA(2)	Drainage (Status A(1)/NA(2)	Drainage (Status A(1)/NA(2)	Drainage (Status A(1)/NA(2)
0-3km														
1	Anchetty	1	1	1	1	1	1	1	1	1	2	1	1	2
2	Thiyarandurgam	1	1	2	1	1	1	2	2	2	2	1	1	2
3-7km														
1	Kothapalli	1	1	2	2	2	1	2	2	2	2	2	1	2
2	Beerepalli	2	1	2	2	2	1	2	2	2	2	2	2	1
3	Enusonai	1	1	2	2	2	2	2	2	2	2	2	1	2
4	Immidinayaganapalli	1	1	1	1	1	2	2	2	2	1	1	1	2
5	Thuppuganapalli	1	1	1	1	1	1	2	2	2	2	1	1	2
6	Uddanapalli	1	1	1	1	2	1	1	2	1	1	1	1	2
7	Ayaranapalli	1	1	1	1	1	1	2	2	2	2	2	1	2
8	Kurubarapalli	1	1	1	1	1	1	1	2	2	1	2	1	2
9	Bodichipalli	1	1	1	1	1	1	2	2	2	2	2	1	2
10	Nagamangalam	1	1	1	1	1	1	2	2	1	2	2	2	1
11	Udedurgam	1	1	2	1	2	1	2	2	2	1	2	2	1
12	Karukkanahalli	1	1	1	1	1	1	1	2	2	2	2	1	2
13	Pachapanatti	1	1	2	1	1	1	2	1	2	2	2	1	2
14	Jakkeri	1	1	1	1	1	2	2	2	2	2	2	1	2
15	Kelamangalam (TP)	1	1	2	2	1	1	2	1	1	2	2	1	2
7-10km														
1	Thorapalli Agraharam	1	1	2	1	1	1	2	2	2	1	2	1	2

2	Subbagiri	2	1	1	2	1	1	2	1	2	2	2	2	1
3	Sanamavu	1	1	2	2	2	1	2	2	2	1	1	1	2
4	Halekotta	1	1	2	1	2	1	2	2	2	2	2	2	1
5	Samanapalli	1	1	1	1	1	1	2	2	2	1	2	1	2
6	Agaram Agraharam	1	1	1	1	1	1	2	2	2	1	2	2	1
7	Varatanapalli	1	1	1	1	1	1	1	1	2	1	1	1	2
8	Bairamangalam	1	1	1	1	1	1	1	2	2	1	2	1	2
9	Muthanhalli	1	1	1	1	2	1	2	2	2	1	2	1	2
10	T. Gollahalli	1	1	1	2	2	1	2	2	2	2	2	2	1
11	Bithireddi	1	1	2	2	1	1	2	2	2	2	2	1	2
12	Kottur	1	1	2	1	1	2	2	2	2	1	2	1	2

Source: DCHB Census 2011, Tamil Nadu

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

3.21.4 Transport and Other Infrastructure Facilities in the Surveyed Area

Sno	Village Name	Post Office (Status A(1)/NA(2))	Sub Post Office (Status A(1)/NA(2))	Post And Telegraph Office (Status A(1)/NA(2))	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	Anchetty	1	1	1	1	1	1	2	1	1	1	2	2	2	2	2	1	1
2	Thiyarandurgam	2	2	2	2	1	1	2	2	1	1	2	2	2	2	2	1	1
3-7km																		
1	Kothapalli	2	2	2	2	1	1	2	2	1	1	2	2	2	1	2	1	2
2	Beerepalli	2	1	2	2	1	2	2	2	2	2	2	2	2	2	1	2	2
3	Enusonai	2	1	2	2	1	1	2	2	2	2	2	2	2	2	1	1	1
4	Immidinayaganapalli	2	2	2	2	1	1	2	2	2	2	2	2	2	1	2	2	2
5	Thuppuganapalli	2	1	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2
6	Uddanapalli	1	1	1	2	1	1	2	1	1	1	2	2	2	1	1	1	1
7	Ayaranapalli	2	1	2	2	1	1	2	2	2	2	2	2	2	2	1	1	1
8	Kurubarapalli	2	1	2	2	1	1	2	1	1	1	2	2	2	1	1	1	1
9	Bodichipalli	2	1	2	2	1	1	1	2	2	2	2	2	2	2	2	2	2
10	Nagamangalam	2	1	2	2	1	1	2	2	2	1	2	2	2	2	2	1	1
11	Udedurgam	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2
12	Karukkanahalli	2	2	2	1	1	2	2	2	1	1	2	2	2	2	1	1	1
13	Pachapanatti	2	1	2	2	1	1	2	2	2	2	2	2	2	2	2	1	1
14	Jakkeri	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
15	Kelamangalam (TP)	1	1	2	1	1	1	1	1	1	1	2	2	2	2	1	1	1
7-10km																		
1	Thorapalli Agraharam	2	1	2	2	1	1	2	2	2	2	2	2	2	1	1	1	1
2	Subbagiri	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	Sanamavu	2	1	2	2	1	1	2	2	2	2	2	2	2	2	1	1	1
4	Halekotta	2	1	2	2	1	2	2	2	2	2	2	2	2	2	1	1	1
5	Samanapalli	2	1	2	2	1	2	2	2	2	2	2	2	2	2	2	1	1
6	Agaram Agraharam	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
7	Varatanapalli	1	1	1	2	1	1	2	1	2	1	2	2	2	1	1	1	1

8	Bairamangalam	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1
9	Muthanhalli	2	2	2	1	1	1	2	2	2	2	2	2	2	2	1	1	1
10	T.Gollahalli	2	1	2	2	1	1	2	2	2	2	2	2	2	2	1	1	1
11	Bithireddi	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	1	1
12	Kottur	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	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 very less in the study area. (Dry with barren land or scrub with grass Land).
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 Ponnaiyar river, Lake, pond avoid dust emission.

3.23 Interpretation

Based on the data, following inferences could be drawn:

- Total literacy rate in the study area is 66%.
- The study area had average educational facilities. The overall status depicts that the education is limited to primary and middle level.
- The schedule tribe community forms 1.91% and Scheduled Caste forms 14% of the total population of study area.
- The Other Population forms 84% 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.
- **Ponnaiyar River.** southern side 7km-NE, Chinnatti Dam-6km-SW from mine lease boundary.
- **Sanamavu R.F** boundary 2km-NW 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 n 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 quarry 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 **Thiyaranadurgam Rough Stone quarry Cluster quarries** 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 all Proposed Projects

- 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 Respective Individual Proposed Projects

- 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 topsoil formation, it will be directly loaded into tippers for the filling and levelling of low-lying areas. There is no disposal of topsoil. The excavated Rough Stone quarry 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 Respective Individual Proposed Projects

- 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 quarrying operation. The entire quarried out materials will be utilized (100%).

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 76m agl &10m bgl and water table is found at a depth of 70-65m 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	1.5 KLD	from bore well and open well from nearby area through tankers
Green Belt development	0.7 KLD	From Existing bore wells from nearby area
Drinking and Domestic purpose	0.8 KLD	From existing, bore wells and drinking water will be sourced from Approved water vendors.
Total	**3.0 KLD**	
PROPOSAL – P2		
*Purpose	Quantity	Source
Dust Suppression	0.5 KLD	From Existing bore wells from nearby area
Green Belt development	0.9 KLD	From Existing bore wells from nearby area
Domestic purpose	0.7 KLD	From existing, bore wells and drinking water will be sourced from Approved water vendors.
Total	**2.1 KLD**	

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

Source: Approved Mining Plan Pre-Feasibility Report

Total water requirement in the cluster quarries is about 5.1 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 quarry 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 all Proposed Projects

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 quarry, 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 quarry, 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 QUARRY "P1"				
	Activity	**Source type**	**Value**	**Unit**
Estimated Emission Rate for PM_{10}	Drilling	Point Source	0.230240042	g/s
	Blasting	Point Source	0.156501583	g/s
	Mineral Loading	Point Source	0.058128699	g/s
	Haul Road	Line Source	0.002712529	g/s/m
	Overall Mine	Area Source	0.130406929	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.011056569	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.001542874	g/s
EMISSION ESTIMATION FOR QUARRY "P2"				
	Activity	**Source type**	**Value**	**Unit**
Estimated Emission Rate for PM_{10}	Drilling	Point Source	0.247981867	g/s
	Blasting	Point Source	0.226837098	g/s

	Mineral Loading	Point Source	0.059526838	g/s
	Haul Road	Line Source	0.002774337	g/s/m
	Overall Mine	Area Source	0.144176136	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.012689932	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.001856669	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 has been measured at 2 locations in the cluster and 6 locations within the buffer zone of the study area. The 24 - hourly average samples of particulate matters (PM_{10} and $PM_{2.5}$), SO_2 and NO_x were measured following the National Ambient Air Quality Standards (NAAQS), 2009. Monitoring data of 8 sampling stations are given below –

Meteorological Data –

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

A temporary meteorological station was installed at project site and monitored continually for study period without break. The station was installed at a height of 4 m above the ground level in such a way that there are no obstructions facilitating flow of wind, wind speed, wind direction, humidity and temperature are recorded on hourly basis. A weather data was collected from IMD, Krishnagiri agro for the month of Dec22 – Feb2023 to correlate with site data and found not much of change in the parameters.

FIGURE 4.1: AERMOD TERRAIN MAP

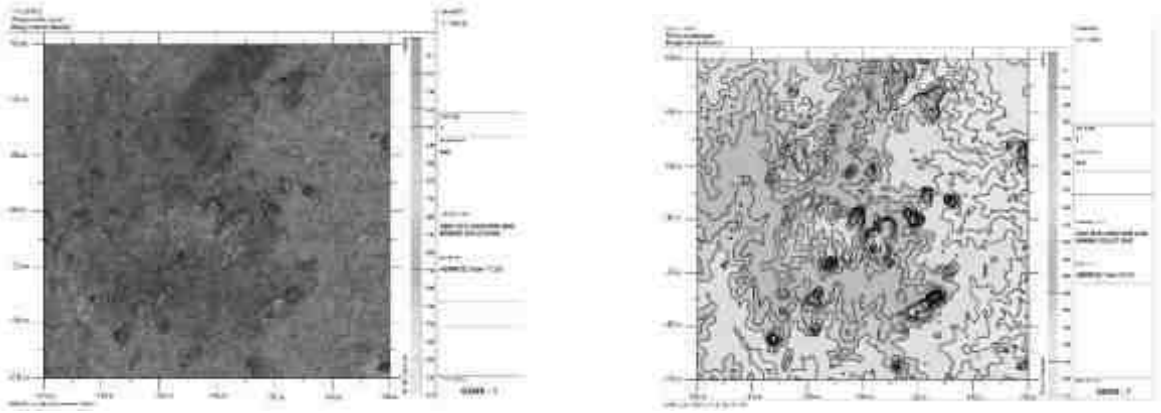


FIGURE 4.2: PREDICTED INCREMENTAL CONCENTRATION OF PM_{10}

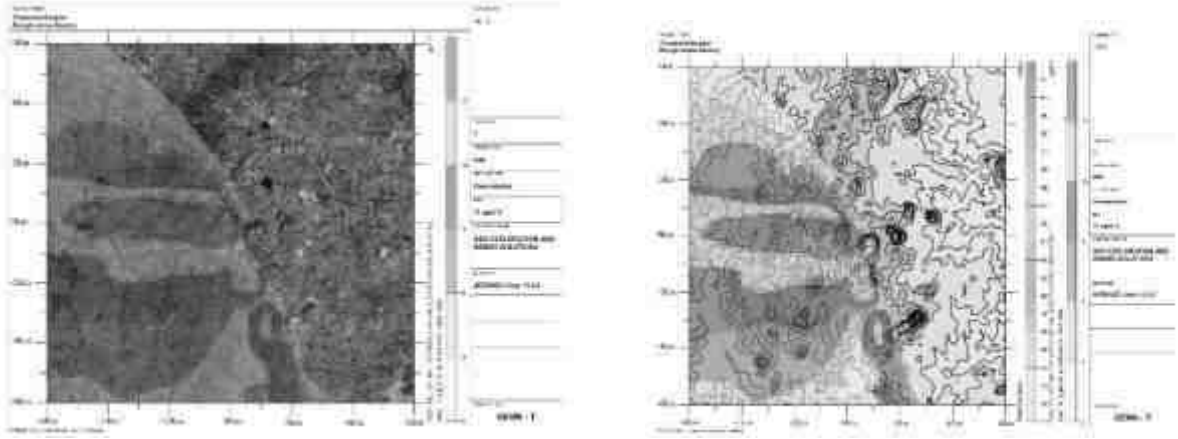


FIGURE 4.3: PREDICTED INCREMENTAL CONCENTRATION OF PM_{25}

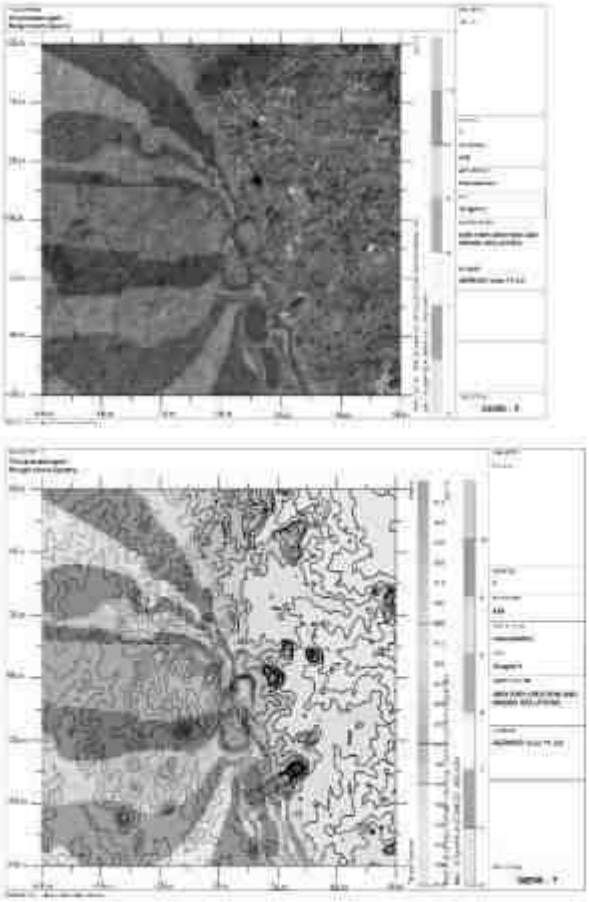
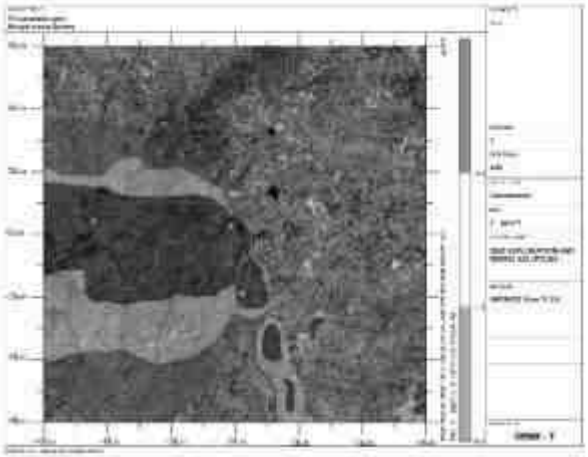


FIGURE 4.4: PREDICTED INCREMENTAL CONCENTRATION OF SO_2



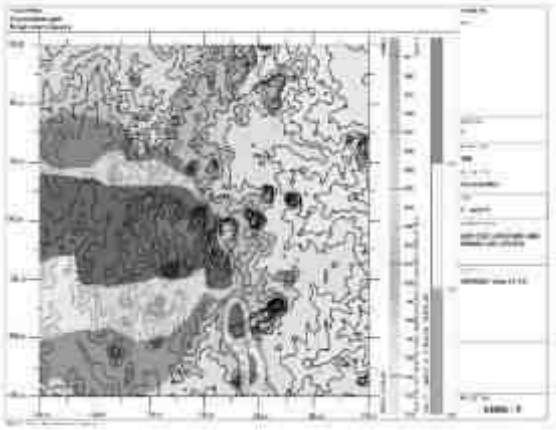


FIGURE 4.5: PREDICTED INCREMENTAL CONCENTRATION OF NO_x

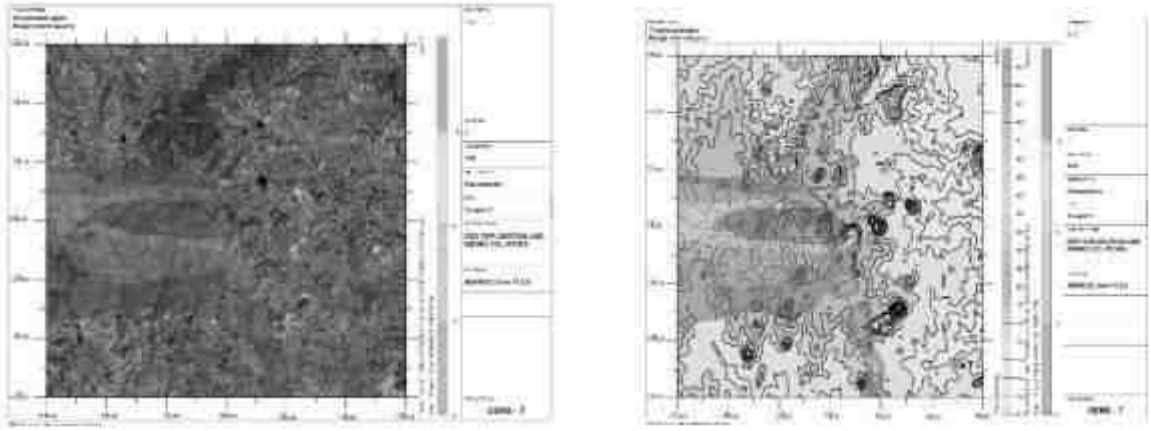
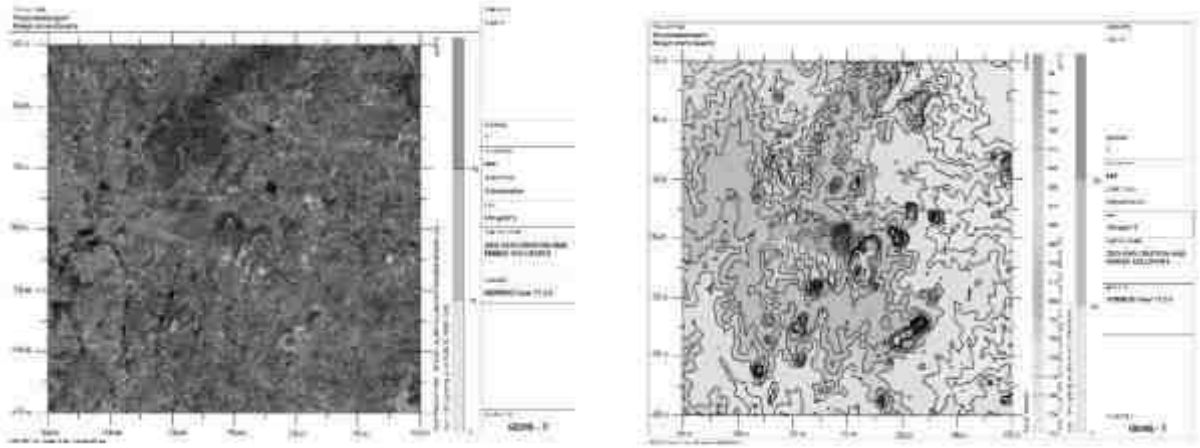


FIGURE 4.6: PREDICTED INCREMENTAL CONCENTRATION OF FUGITIVE DUST



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	12°36'18.50"N 77°53'58.27"E	-134	2	44.6	17.90	62.5
AAQ2	12°36'43.15"N 77°53'55.89"E	-207	772	44.7	12.00	56.7
AAQ3	12°36'21.70"N 77°56'7.88"E	3822	108	45.3	0	45.3
AAQ4	12°36'23.83"N 77°51'37.06"E	-4443	175	43.6	17.20	60.8
AAQ5	12°37'41.01"N 77°50'51.26"E	-5845	2565	22.4	7.15	29.55
AAQ6	12°33'51.33"N 77°55'33.58"E	2775	-4570	21.8	0	21.8
AAQ7	12°35'9.81"N 77°54'10.52"E	240	-2128	43.4	15.00	58.4
AAQ8	12°38'8.58"N 77°52'9.01"E	-3470	3426	42.7	4.50	47.2

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

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline $PM_{2.5}$ ($\mu g/m^3$)	Incremental value of $PM_{2.5}$ due to mining ($\mu g/m^3$)	Total $PM_{2.5}$ ($\mu g/m^3$) (5+6)
AAQ1	12°36'18.50"N 77°53'58.27"E	-134	2	22.7	10.88	33.58
AAQ2	12°36'43.15"N 77°53'55.89"E	-207	772	22.1	7.30	29.4
AAQ3	12°36'21.70"N 77°56'7.88"E	3822	108	23.8	0	23.8
AAQ4	12°36'23.83"N 77°51'37.06"E	-4443	175	22.8	10.38	33.18
AAQ5	12°37'41.01"N 77°50'51.26"E	-5845	2565	22.4	5.00	27.4
AAQ6	12°33'51.33"N 77°55'33.58"E	2775	-4570	22.4	0.23	22.63
AAQ7	12°35'9.81"N 77°54'10.52"E	240	-2128	22.0	8.95	30.95
AAQ8	12°38'8.58"N 77°52'9.01"E	-3470	3426	22.8	3.07	25.87

TABLE 4.5: INCREMENTAL & RESULTANT GLC OF SO_2

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline So_2 ($\mu g/m^3$)	Incremental value of So_2 due to mining ($\mu g/m^3$)	Total So_2 ($\mu g/m^3$) (5+6)
AAQ1	12°36'18.50"N 77°53'58.27"E	-134	2	7.9	3.48	11.38
AAQ2	12°36'43.15"N 77°53'55.89"E	-207	772	22.1	2.40	24.5
AAQ3	12°36'21.70"N 77°56'7.88"E	3822	108	6.2	0	6.2
AAQ4	12°36'23.83"N 77°51'37.06"E	-4443	175	22.8	3.24	26.04
AAQ5	12°37'41.01"N 77°50'51.26"E	-5845	2565	7.9	1.03	8.93
AAQ6	12°33'51.33"N 77°55'33.58"E	2775	-4570	6.9	0	6.9
AAQ7	12°35'9.81"N 77°54'10.52"E	240	-2128	6.9	3.02	9.92
AAQ8	12°38'8.58"N 77°52'9.01"E	-3470	3426	6.3	0.31	6.61

TABLE 4.6: INCREMENTAL & RESULTANT GLC OF NO_X

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline Nox ($\mu g/m^3$)	Incremental value of Nox due to mining ($\mu g/m^3$)	Total Nox ($\mu g/m^3$) (5+6)
AAQ1	12°36'18.50"N 77°53'58.27"E	-134	2	24.4	13.00	37.4
AAQ2	12°36'43.15"N 77°53'55.89"E	-207	772	6.2	2.19	8.39
AAQ3	12°36'21.70"N 77°56'7.88"E	3822	108	23.0	0	23
AAQ4	12°36'23.83"N 77°51'37.06"E	-4443	175	6.3	11.69	17.99
AAQ5	12°37'41.01"N 77°50'51.26"E	-5845	2565	23.9	0	23.9
AAQ6	12°33'51.33"N 77°55'33.58"E	2775	-4570	24.4	0	24.4
AAQ7	12°35'9.81"N 77°54'10.52"E	240	-2128	23.8	6.00	29.8
AAQ8	12°38'8.58"N 77°52'9.01"E	-3470	3426	23.2	0	23.2

TABLE 4.7: INCREMENTAL & RESULTANT GLC OF FUGITIVE DUST

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline Fugitive ($\mu g/m^3$)	Incremental value of Fugitive due to mining ($\mu g/m^3$)	Total Fugitive ($\mu g/m^3$) (5+6)
AAQ1	12°36'18.50"N 77°53'58.27"E	-134	2	66.23	159	225.23
AAQ2	12°36'43.15"N 77°53'55.89"E	-207	772	64.97	0	64.97
AAQ3	12°36'21.70"N 77°56'7.88"E	3822	108	68.17	0	68.17
AAQ4	12°36'23.83"N 77°51'37.06"E	-4443	175	64.26	0	64.26
AAQ5	12°37'41.01"N 77°50'51.26"E	-5845	2565	67.95	0	67.95
AAQ6	12°33'51.33"N 77°55'33.58"E	2775	-4570	67.50	0	67.5
AAQ7	12°35'9.81"N 77°54'10.52"E	240	-2128	67.32	0	67.32
AAQ8	12°38'8.58"N 77°52'9.01"E	-3470	3426	61.52	0	61.52

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 Respective Individual Proposed Projects

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)	43.1	41.6	40.7	39.3	37.6	38.0	39.7	37.9
Incremental Value dB(A)	66.1	43.7	29	26.5	24.8	26.1	29.7	28.5
Total Predicted Noise level dB(A)	66.14	45.79	40.98	39.52	37.82	38.27	40.12	38.37
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 Respective Individual Proposed Projects

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

- Time intervals for each quarry during blasting.
- Use of personal protective devices i.e., earmuffs and earplugs by workers, who are working in high noise generating areas.
- Limiting time exposure of workers to excessive noise.
- Proper and regular maintenance of vehicles, machinery and other equipment's.
- The noise generated by the machinery will be reduced by proper lubrication of the machinery and other equipment's.

- Speed of trucks entering or leaving the quarry will be limited to moderate speed to prevent undue noise from empty vehicles...
- Noise levels will be controlled by using optimum explosive charge, proper delay detonators and proper stemming to prevent blow out of holes (occasionally).
- Providing proper noise proof enclosure for the workers separated from the noise source and noise prone equipment.
- Provision of Quiet areas, where employees can get relief from workplace noise.
- The development of green belts around the periphery of the quarry site to attenuate noise.
- Regular medical check–up and proper training to personnel to create awareness about adverse noise level effects.

4.4.3 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

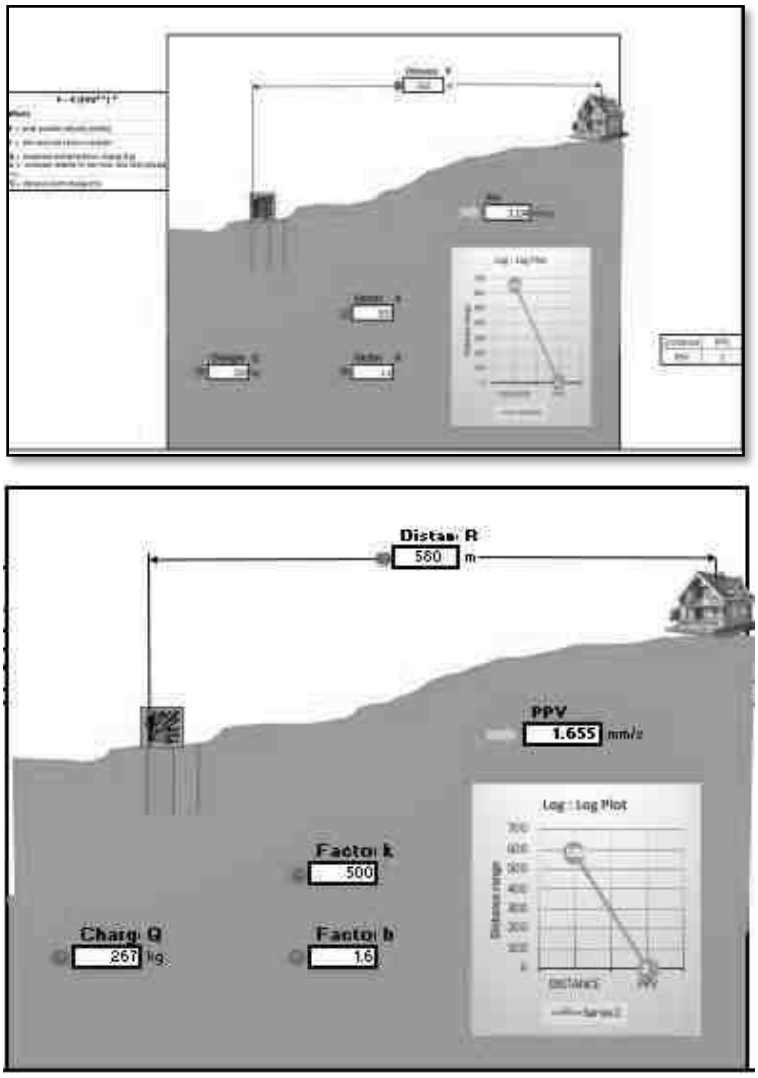
Q = maximum instantaneous charge (kg)

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	209	650	1.134
P2	267	580	1.655



From the above, the charge per blast of 267 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 Individual Proposed Projects

- The blasting operations in the cluster quarries are carried out without deep hole drilling and blasting using delay detonators, which reduces the ground vibrations;
- Proper quantity of explosive, suitable stemming materials and appropriate delay system will be adopted to avoid overcharging and for safe blasting;
- Adequate safe distance from blasting will be maintained as per DGMS guidelines;
- Blasting shelter will be provided as per DGMS guidelines;

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

4.5 Ecology and Biodiversity

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

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

4.5.2 Mitigation Measures

4.5.2.1. Green Belt Development Plan

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

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

4.5.2.2. Environmental Management Plan - Flora and Fauna

ToR No: 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.

a. Afforestation

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

4.5.2.3 Species Recommendation for Plantation granted in the district.

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

- The natural growth of existing species and the survival rate of various species.
- Suitability of a particular plant species for a particular type of area.
- Creating biodiversity.
- Fast-growing, thick canopy copy, perennial and evergreen large leaf area.
- Efficient in absorbing pollutants without major effects on natural growth.

- The following species may be considered primary for plantations best suited for the prevailing climate condition in the area.

Table No 4.11 List of plant species proposed for Greenbelt development

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

4.5.3. Anticipated Impact on Fauna

- No rare, endemic & endangered species are reported in the buffer zone. However, during the course of mining, the management will practice the scientific method of mining with a proper Environmental Management Plan including pollution control measures especially for air and noise, to avoid any adverse impact on the surrounding wildlife.
- Fencing around the mine lease area to restrict the entry of stray animals.
- Green belt development will be carried out which will help in minimizing adverse impact on the flora found in the area.

4.5.3.1. Measures for protection and conservation of wildlife species

- Topsoil has a large number of seeds of native plant species in the mining area.
  Topsoil will be used for restoration and suitable surfaces for planted seedlings.
- Checks and controls the movement of vehicles in and out of the mine.
- Undertaking mitigative measures for a conducive environment for the flora and fauna in consultation with Forest Department.
- A dust suppression system will be installed within the mine and periphery of the mine.
- 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.

4.5.3.2. Mitigation Measures

- A suitable plan for the conservation of Schedule-I Species have been prepared and the necessary fund for implementation for the same will be made.
- All the preventive measures will be taken for the growth & development of fauna.

- Creating and developing awareness for nature and wildlife in the adjoining villages.
- The workers shall be trained to not harm any wildlife, should it come near the project site. No work shall be carried out after 6.00 pm.

4.5.3.3. Impact on Aquatic Biodiversity

Mining activities will not disturb the aquatic ecology as there is no effluent discharge proposed from the Rough Stone quarry quarry. There is no natural perennial surface water body within the mine lease area, like wetlands, rivers streams, lakes, and farmer sites. There is no impact on fish habitats and the food WEB/ food chain in the water body and Reservoir. Aquatic biodiversity is observed in the study area.

4.5.3.5 Impact Assessment on Biological Environment

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

4.5.6. Anticipated Environmental Impacts and Mitigation Measures of Thiyaranadurgam Village, Cluster area, Rough Stone quarry, Krishnagiri District, Tamil Nadu.

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

Table No: 4.12. Anticipated impact of Ecology and Biodiversity in Thiyaranadurgam Village, Cluster area, Rough Stone quarry

S. No	Aspect Description	Likely Impacts on Ecology and Biodiversity (EB)	Impact Consequence Probability Description Justification	Significance	Mitigation Measures
Pre-mining phase					
1	Uprooting of vegetation of lease area	Site specific loss of common floral diversity (Direct impact)	The site possesses Common floral (not tree) species. Clearance of these species will not result in loss of flora.	Less severe	No immediate action is required. However, a Greenbelt /plantation will be developed on the project site and on the periphery of the project boundary, which will improve the floral and faunal diversity of the project area.
		Site specific loss of associated faunal diversity (Partial impact)	The site supports only common species, which use a wide variety of habitats of the buffer zone reserve forest area. So, there is no threat of Faunal diversity		
		Loss of Habitat (Direct impact)	Site does not for unique / critical habitat structure for unique flora or fauna.		

Mining phase					
2	Excavation of mineral using machine and labours, transportation Activities will Generate noise.	Site-specific disturbance to normal faunal movements at the site due to noise. (Partial impact)	Site does not form unique / critical habitat structure for unique flora or fauna.	Less severe	-Mining activity should not be operated after 5PM. -Excavation of dump and transportation work should stop before 7PM.
3	Vehicular movement for transportation of materials will result in the generation of dust (Particulate matter) due to haul roads and emission of Sulphur Dioxide, Nitrogen Dioxide, Carbon monoxide, etc.	Impact on Surrounding agriculture and associated fauna due to deposition of dust and emission of CO. (Indirect impact)	Impact is less as the agricultural land is far from the core area.	Less severe	All vehicles will be certified for appropriate Emission levels. More plantations have been suggested Upgrade the vehicles with alternative fuels such biodiesel, methanol, and biofuel around the mining area.

Table No. 4.13. Overall Ecological impact assessments of Thiyaranadurgam Village, Cluster area, Rough Stone quarry, and gravel quarry, Krishnagiri District, Tamil Nadu.

S.No	Attributes	Assessment
1	Impact of mining activity on agricultural land nearby the proposed project site.	Agricultural land is located away from the proposed project site. There are no impacts on the agricultural land & Horticulture. Kindly refer to the conclusion.
	Activities of the project affect the breeding/nesting sites of birds and animals	No breeding and nesting site was identified in the mining lease site. The fauna sighted mostly migrated from the buffer area.
2	Located near an area populated by rare or endangered species	No Endangered, Critically Endangered, or vulnerable species were sighted in the core mining lease area.
3	Proximity to national park/wildlife sanctuary/reserve forest /mangroves/ coastline/estuary/sea	Sanamavu R.F is located about 2km on the Northwest followed by Udedurgam R.F is located about 7km on the South side and Dekanikottai R.F is located about 8.5km on the Southwest side. There is no Eco Sensitive zone/ Critically polluted area/ HACA/CRZ located within 10 km radius of the area.
4	The proposed project restricts access to waterholes for wildlife	'No '

5	Proposed mining project impact surface water quality that also provides water to wildlife	'No 'scheduled or threatened wildlife animals sighted regularly core in the core area.
6	Proposed mining project increase siltation that would affect nearby biodiversity areas.	Surface runoff management such as drains is constructed properly so there will be no siltation effect in the nearby mining area.
7	Risk of fall/slip or cause death to wild animals due to project activities.	'No'
8	The project release effluents into a water body that also supplies water to a wildlife.	No water body near to core zone so the chances of water becoming polluted is low.
9	Mining projects affect the forest-based livelihood/ any specific forest product on which local livelihood depended.	'No'
10	The project likely to affect migration routes.	'No 'migration route observed during the monitoring period.
11	The project is likely to affect the flora of an area, which have medicinal value	'No'
12	Forestland is to be diverted, has carbon high sequestration.	'No 'There was no forest land diverted.
13	The project is likely to affect wetlands, Fish breeding grounds, and marine ecology.	'No'. Wetland was not present in the near core Mining lease area. No breeding and nesting ground is present in the core mining area.

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

4.5.3.2.Proposed Green Belt

TABLE 4.12: GREENBELT DEVELOPMENT PLAN

PROPOSAL FOR P1 – Thiru. N. Narayanan				
Year	**No. of trees proposed to be planted**	**Survial %**	**Area to be planted**	**Name of the species**
I	It is proposed to plant 2200 **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.T. Kesavamoorthy				
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, etc.,

TABLE 4.13: BUDGET FOR GREEBELT DEVELOPMENT PLAN-P1- Thiru. N.Narayanan

ACTIVITY	**YEAR**										**RATE**	**COST (Rs.)**
	I	II	III	IV	V	VI	VII	VIII	IX	X		
Plantation under safety zone	31	31	31	31	31	31	31	31	31	31	@100 Rs Per sapling	31,000
	3100	3100	3100	3100	3100	3100	3100	3100	3100	3100		

Plantation in the quarried out top benches, approach road and panchayat road	20	20	20	20	20	20	20	20	20	20	Including Maintenance	20,000
	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000		
Wire Fencing for 860 Mtrs length	258000	-	-	-	-	-	-	-	-	-	@300 Rs Per Meter	2,58,000
Garland Drain with settling traps for 540 Mtrs length	162000	-	-	-	-	-	-	-	-	-	@300 Rs Per Meter	1,62,000
Total												**4,66,000**

TABLE 4.14: BUDGET FOR GREEBELT DEVELOPMENT PLAN-P2- Thiru.T. Kesavamoorthy

ACTIVITY	**YEAR**										**RATE**	**COST (Rs.)**
	I	II	III	IV	V	VI	VII	VIII	IX	X		
Plantation under safety zone	26	26	26	26	26	26	26	26	26	26	@100 Rs Per sapling Including Maintenance	26,000
	2600	2600	2600	2600	2600	2600	2600	2600	2600	2600		
Plantation in the quarried out top benches, approach road and panchayat road	20	20	20	20	20	20	20	20	20	20		20,000
	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000		
Wire Fencing for 870 Mtrs length	261000	-	-	-	-	-	-	-	-	-	@300 Rs Per Meter	2,61,000
Garland Drain with settling traps for 810 Mtrs length	243000	-	-	-	-	-	-	-	-	-	@300 Rs Per Meter	2,43,000
Total												**5,55,000**

Source: Approved Mining Plan

TABLE 4.15: ECOLOGICAL IMPACT ASSESSMENTS

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 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/reserveforest /mangroves/coastline/estuary/sea	No national park or eco-sensitive zone around 10km radius.
4	Proposed project restricts access to waterholes for wildlife	'NO'
5	Proposed mining project impact surface water quality that also provide water to wildlife	'NO 'scheduled or threatened wildlife animal sighted regularly core in core area.
6	Proposed mining project increase siltation that would affect nearby biodiversity area.	Surface runoff management such as drains is constructed properly so there will be no siltation affect in nearby mining area.
7	Risk of fall/slip or cause death to wild animals due to project activities	'NO'
8	The project release effluents into a water body that also supplies water to a wildlife	No water body near to core zone so chances of water become polluted is low.
9	Mining project effect the forest based livelihood/ any specific forest product on which local livelihood depended	'NO'
10	Project likely to affect migration routes	'NO 'migration route observed during monitoring period.
11	Project likely to affect flora of an area, which have medicinal value	'NO '
12	Forestland is to be diverted, has carbon high sequestration	'NO 'There was no forest land diverted.
13	The project likely to affect wetlands, Fish breeding grounds, marine ecology	'NO'. Wetland was not present in near core Mining lease area. No breeding and nesting ground present in core mining area.

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

4.6 Socio Economic Impats

4.6.1 Construction Phase

Anticipated Impacts:

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

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

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

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

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

Mitigation measures:

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

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

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

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

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

4.6.2 Operation Phase:

Anticipated Impacts:

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

♣ Other impacts, associated with the applied for Rough Stone 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.

4.6.3 Impact Evaluation:

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

Impact Evaluation Element	Impact on socio economics due to the applied for Thiyaranadurgam Rough Stone quarry cluster quarry over an extent of 8.26.5 ha of Poramboke land of Thiyaranadurgam Village, Shoolagiri Taluk, Krishnagiri 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 barriers

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

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

5.0 Introduction:

Consideration of alternatives to a project proposal is a requirement of EIA process. This quarry is site specific. The site has been selected based on geological investigation and exploration from the Proposed quarry 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 Quarry Projects at Thiyaranadurgam 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 quarry 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.

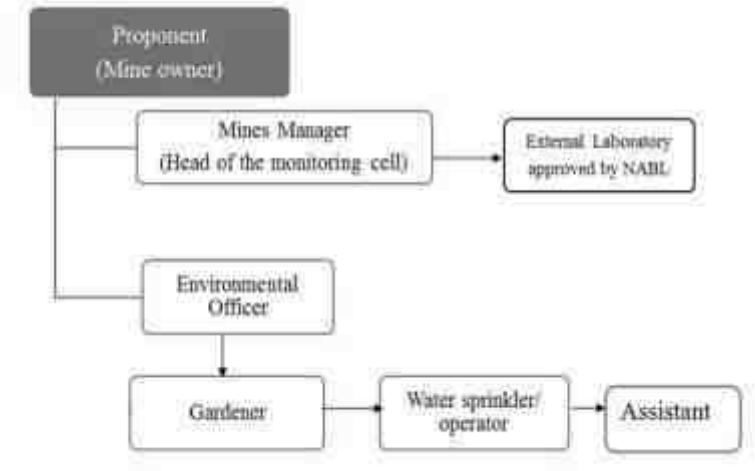
The monitoring and evaluation of environmental parameters indicates potential changes occurring in the environment, which paves way for implementation of rectifying measures wherever required to maintain the status of the natural environment. Evaluation is also a very effective tool to judge the effectiveness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

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 Four proposed quarries in cluster for the mining plan period is Rs 15,20,000/-.

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/-
	P2	Rs.7,60,000/-
	Total	**Rs. 15,20,000/-**

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

7.1. Public Consultation:

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

7.2 Risk Assessment

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

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

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

TABLE 7.1 RISK ASSESSMENT & CONTROL MEASURES

S. No	Risk factors	Causes of risk	Control measures
1	Accidents due to explosives and heavy mining machineries	Improper handling and unsafe working practice	▪ All safety precautions and provisions of Mine Act, 1952, Metalliferrous Mines Regulation, 1961 and Mines Rules, 1955 will be strictly followed during all mining operations; ▪ Entry of unauthorized persons will be prohibited; ▪ Fire fighting and first-aid provisions in the mine office complex and mining area;

			▪ Provisions of all the safety appliances such as safety boot, helmets, goggles etc. will be made available to the employees and regular check for their use. ▪ Working of quarry, as per approved plans and regularly updating the mine plans; ▪ Cleaning of mine faces shall be daily done in order to avoid any overhang or undercut; ▪ Handling of explosives, charging and firing shall be carried out by competent persons only under the supervision of a Mine Manager; ▪ Maintenance and testing of all mining equipment as per manufacturer 's guidelines.
2	Drilling& Blasting	Due to improper and unsafe practices Due to high pressure of compressed air, hoses may burst Drill Rod may break	▪ Safe operating procedure established for drilling (SOP) will be strictly followed. ▪ Only trained operators will be deployed. ▪ No drilling shall be commenced in an area where shots have been fired until the blaster/blasting foreman has made a thorough Examination of all places. ▪ Drilling shall not be carried on simultaneously on the benches at places directly one above the other. ▪ Periodical preventive maintenance and replacement of worn-out accessories in the compressor and drill equipment as per operator manual. ▪ All drills unit shall be provided with wet drilling shall be maintained in efficient working in condition. ▪ Operator shall regularly use all the personal protective equipment.
3	Blasting	Fly rock, ground vibration, Noise and dust. Improper charging, stemming & Blasting/ fining of blast holes Vibration due to movement of vehicles	▪ The maximum charge per delay and by optimum blast hole pattern, vibrations will be controlled within the permissible limit and blast can be conducted safely. ▪ SOP for Charging, Stemming & Blasting/Firing of Blast Holes will be followed by blasting crew during initial stage of operation ▪ Shots are fired during daytime only. ▪ All holes charged on any one day shall be fired on the same day. ▪ The danger zone is and will be distinctly demarcated (by means of red flags)
4	Transportation	Potential hazards and unsafe workings	▪ Before commencing work, drivers personally check the dumper/truck/tipper

		contributing to accident and injuries Overloading of material While reversal & overtaking of vehicle Operator of truck leaving his cabin when it is loaded.	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

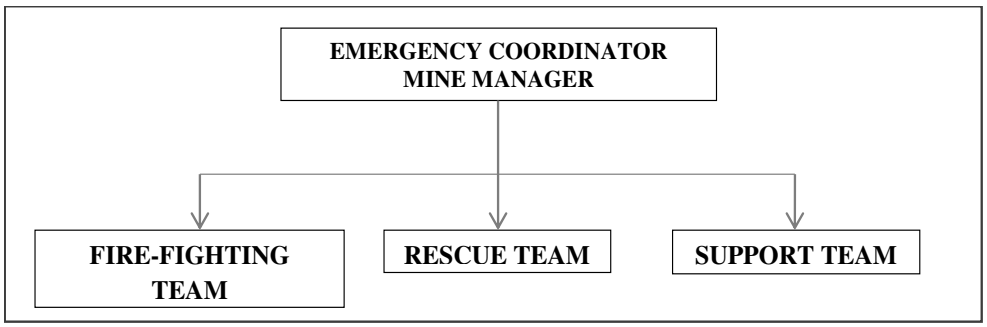
Natural disasters like Earthquake, Land slides has not been recorded in the past history as the terrain is categorized under seismic zone III. The area is far away from the sea hence the disaster due to heavy floods and tsunamis are not anticipated. The Disaster Management Plan is aimed to ensure safety 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 & P2



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 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**	**G.O. No & Date**	**Status**
P1	**Thiru. N.Narayanan** S/o. Nallappa, D.No.3/38, Chikkagoundanoor, Nagamangalam Village, Denkanikottai Taluk, Krishnagiri District, Tamil Nadu State.	940/1 (P-2) of Thiyanadurgam Village, Shoolagiri Taluk	4.24.5ha	Roc.229/2019/Mines dated: 13.06.2019	**Lr.No. SEIAA-TN/F.No.9104/SEAC/ToR-1177/2022Dated:13.06.2022**
P2	**Thiru.T.Kesavamoorthy** S/o Thimarayappa, D.No 2/38, Varaganapalli, Nagamangalam Post, Denkanikottai Taluk,	940/1 (P-1) of Thiyanadurgam Village, Shoolagiri Taluk	4.02.0 Ha	Roc.228/2019/Mines dated: 13.06.2019	**Lr.No. SEIAA-TN/F.No.9103/SEAC/ToR-1173/2022Dated:14.06.2022**

	Krishnagiri District				
	Total Extent		**8.26.5 Ha**		
EXISTING QUARRIES					
CODE	**Name of the Proponent and Address**	**S.F. Nos, Village & Taluk**	**Extent in Ha**		**-**
NIL					
ABANDONED/EXPIRED QURRIES					
CODE	**Name of the Proponent and Address**	**S.F. Nos, Village & Taluk**	**Extent in Ha**		**-**
NIL					
TOTAL CLUSTER EXTENT			**8.26.5 Ha**		

Source :500m Cluster letter by AD, G&M,Krishnagiri.

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. N. Narayanan** Rough Stone quarry Project	
Land Type	It is a Government Poramboke Land.	
S.F. Nos	940/1 (P-2)	
Extent	**4.24.5 Ha**	
Previous quarry operation details	It is a fresh Lease area.	
Geological Reserves	Rough Stone quarry	TopSoil
	20,24,000m^3	42,450m^3
Mineable Reserves	Rough Stone quarry	TopSoil
	14,45,070m^3	39,300 m^3
Proposed production for First Five years	7,45,070m^3 (Depth 51m AGL)	
Proposed production for Second Five years	7,00,000m^3	
Mining Plan Period / Lease Period	10 Years	
Depth of mining	76m (66m Agl+10m Bgl)	
Ultimate Pit Dimension	273m(L) x 150m (W) x76m(D) (66m Agl+ 10m Bgl)	
Toposheet No	57 H/14	
Latitude	12°36'14.45"N to 12°36'21.97"N	
Longitude	77°53'57.46"E to 77°54'07.76"E	
Highest elevation	875-805m AMSL	
Machinery proposed	Jack Hammer	8
	Compressor	2
	Wagon Drill	1
	Excavator	3
	Tippers	6
Blasting	Usage of Slurry Explosive with MSD detonators	
Manpower Deployment	40 Nos	
Total Project Cost	Operational Cost	Rs. 2,32,11,000/-
	EMP Cost	Rs. 7,60,000/-
	Total	Rs. 2,39,71,000/-
CER Cost	Rs.5,00,000/-	
SALIENT FEATURES OF PROPOSAL "P2"		

Name of the Mine	**Thiru.T. Kesavamoorthy** Roughstone quarry	
Land Type	It is a Government Poramboke Land.	
S.F. No.	940/1 (P-1)	
Extent	4.02.0 Ha	
Previous quarry operation details	It is a fresh lease application	
Depth of Mining	76m (66m Agl+10m Bgl)	
Geological Resources	Rough Stone quarry	Topsoil
	21,29,000m^3	40,217m^3
Mineable Reserves	Rough Stone quarry	Topsoil
	18,50,770m^3	31,857m^3
Proposed production for First Five years	9,39,510 m^3 (Maximum depth 46m below from the existing ground)	
Proposed production for Second Five years	9,11,260 m^3	
Mining Plan Period / Lease Period	10 Years	
Ultimate Pit Dimension	307m (L) X 131m (W) X 76m (D)	
Toposheet No	57 -H/14	
Latitude	12°36'17.33"N to 12°36'24.06"N	
Longitude	77°53'47.76"E to 77°53'58.80"E	
Highest Elevation	915m to 845m AMSL	
Machinery	Jack Hammer	10
	Compressor	3
	Excavator with Bucket and Rock Breaker	4
	Wagon Drill	1
	Tippers	8
Blasting	Usage of Slurry Explosive with MSD detonators	
Manpower Deployment	46 Nos	
Total Cost	Operational Cost	Rs. 2,68,00,000/-
	EMP Cost	Rs. 7,60,000/-
	Total	Rs. 2,75,60,000/-
CER Cost	Rs.5,00,000/-	

Source: Approved Mining Plan

The Cumulative Impact is mainly anticipated due to drilling & blasting and excavation and transportation activities in all the quarries (proposed) 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 QUARRY IN CLUSTER

Quarry	Production for Ten-year plan period 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	14,45,070	1,44,507	482	40 Trips /Day
P2	18,50,770	1,85,077	617	51Trips /Day
Total	**32,95,840**	**3,29,584**	**1099**	**91Trips /Day**

TABLE 7.6: CUMULATIVE PRODUCTION OF TOP SOIL IN CLUSTER

Quarry	Mineable	Per Year	Per Day	Number of Lorry Load @ 12m^3 per load

	Reserves in m^3	Production in m^3	Production in m^3	
P1	39,300	39,300	131	11Trips /Day
P2	31,857	31,857	106	9 Trips /Day
Total	**71,157**	**71,157**	**237**	**20 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 proposal 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"				
	Activity	**Source type**	**Value**	**Unit**
Estimated Emission Rate for PM_{10}	Drilling	Point Source	0.230240042	g/s
	Blasting	Point Source	0.156501583	g/s
	Mineral Loading	Point Source	0.058128699	g/s
	Haul Road	Line Source	0.002712529	g/s/m
	Overall Mine	Area Source	0.130406929	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.011056569	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.001542874	g/s
EMISSION ESTIMATION FOR QUARRY "P2"				
	Activity	**Source type**	**Value**	**Unit**
Estimated Emission Rate for PM_{10}	Drilling	Point Source	0.247981867	g/s
	Blasting	Point Source	0.226837098	g/s
	Mineral Loading	Point Source	0.059526838	g/s
	Haul Road	Line Source	0.002774337	g/s/m
	Overall Mine	Area Source	0.144176136	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.012689932	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.001856669	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)	44.6
Highest Incremental	17.90
Resultant	62.5
NAAQ Norms	100 $\mu g/m^3$
PM2.5 in $\mu g/m^3$	
Background (average)	22.7
Highest Incremental	10.88
Resultant	33.58
NAAQ Norms	80 $\mu g/m^3$
SO_2 in $\mu g/m^3$	
Location	AAQ1 – CORE
Background (average)	7.90
Highest Incremental	3.48
Resultant	11.38
NAAQ Norms	80 $\mu g/m^3$
NO_x in $\mu g/m^3$	

Location	AAQ1 – CORE
Background (average)	24.4
Incremental	13.0
Resultant	37.4
NAAQ Norms	80 µg/m^3

Noise Environment

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

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

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

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	43.1	66.1	66.1	Residential (A) Day Time– 55 dB Night Time- 45 dB (A)
N2	41.6	43.7	45.8	
N3	40.7	29.0	41.0	
N4	39.3	26.5	39.5	
N5	37.6	24.8	37.8	
N6	38.0	26.1	38.3	
N7	39.7	29.7	40.1	
N8	37.9	28.5	38.4	

Source: Lab Monitoring Data

The incremental noise level is found within the range of 26.1– 43.7 dB (A) in Buffer zone. The noise level at different receptors in buffer zone is lower due to the distance involved and other topographical features adding to the noise attenuation. The resultant Noise level due to monitored values and calculated values at the receptors are based on the mathematical formula considering attenuation due to Green Belt as 4.9 dB (A) the barrier effect. From the above table, it can be seen that the ambient noise levels at all the locations near habitations are within permissible limits of Residential Area (buffer zone) as per THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 (The Principal Rules were published in the Gazette of India, vide S.O. 123(E), dated 14.2.2000 and subsequently amended vide S.O. 1046(E), dated 22.11.2000, S.O. 1088(E), dated 11.10.2002, S.O. 1569 (E), dated 19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment (Protection) Act, 1986.).

Ground Vibrations

Ground vibrations due to mining activities in the all the 2-proposal quarry 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-proposal 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 areas and may cause injury to persons or damage to the structures. Nearest Habitations from 2 mines respectively are as in below Table 7.10

TABLE 7.10: NEAREST HABITATION FROM EACH MINE

Location ID	Distance in Meters
Habitation Near P1	650
Habitation Near P2	580

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	650	1.134
P2	267	580	1.655

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 2 MINES

Location Code	Employment	Project Cost	CER Cost
P1	40	Rs. 2,39,71,000/-	Rs.5,00,000/-
P2	46	Rs. 2,75,60,000/-	Rs.5,00,000/-
Grand Total	**86**	**Rs. 5,15,31,000**	**Rs.10,00,000/-**

A total of 86 people will get employment due to 2 mines in cluster. 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. Rs.10,00,000/-**

TABLE 7.13: GREENBELT DEVELOPMENT BENEFITS FROM 2MINES

PROPOSAL FOR P1				
Year	**No. of trees proposed to be planted**	**Survial %**	**Area to be planted**	**Name of the species**
I	It is proposed to plant 2200 **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				
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, 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% over an area of all proposed quarries.

7.5 PLASTIC WASTE MANAGEMENT PLAN FOR P1 TO P2

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

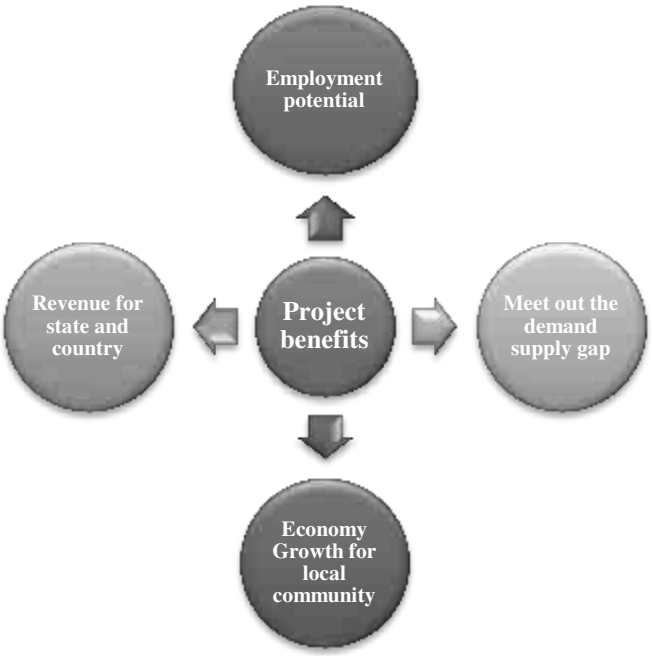
Source: Proposed by FAE's and EC

CHAPTER – 8: PROJECT BENEFITS

8.0 General

The two Proposed Projects for Quarrying Rough Stone quarry at Thiyaranadurgam Village Cluster Quarries Village aims to produce cumulatively **32,95,840** m^3 Rough Stone quarry over period of 10 Years & **71,157** m^3 of Topsoil over a period of 1 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 86 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 Thiyaranadurgam Village, Shoolagiri Taluk, Krishnagiri 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 Thiyaranadurgam 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 2% of Capital Investment towards CER as per directions of EAC/SEAC and the total CER amount from the 2 proposed mines is Rs **Rs 10,00,000/-**

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. N. Narayanan** 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 topsoil for this project site. 39,300 m^3

Overburden / Waste and Side Burden Management –

- The overburden in the form of topsoil formation, the topsoil 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 (66m AGL + 10m BGL), the water table in the area is 70m – 65m below ground level, hence the proposed projects will not intersect the Ground water table during entire quarry period.

TABLE 10.3: PROPOSED CONTROLS FOR WATER ENVIRONMENT

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

Source: Proposed by FAE's & EIA Coordinator

10.6 Air Quality Management

The 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 2200 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 10 YEAR PLAN PERIOD – P1

PROPOSAL FOR P1				
Year	**No. of trees proposed to be planted**	**Survial %**	**Area to be planted**	**Name of the species**
I	It is proposed to plant 2200 **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	42450	42450
	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 -8Units	200000	20000
	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	84900
	Installing wheel wash system near gate of quarry	Installation + Maintenance +	50000	20000

		Supervision		
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	3757182
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	42450	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	849000	10000
	3. Progressive Closure Activity Green belt development - 500 trees per one hectare - Proposal for 2200 Trees - (600 Inside Lease Area & 1600 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)	120000	18000
		Avenue Plantation @ 300 per plant (capital) for plantation outside the lease area and @ 30 per plant maintenance (recurring)	480000	48000
	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	69900	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	8525913	0

		necessarily implemented in the Project Site		
Implementation of EC, Mining Plan & DGMS Condition	Scientific Study Report	Study report of Hydrogeolgical, Slope Stability and Vibration	300000	0
	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) - 40 Employees	160000	40000
	Health check up for workers will be provisioned	IME & PME Health check up @ Rs. 1000/- per employee	0	40000
	First aid facility will be provided	Provision of 2 Kits per Hectare @ Rs. 2000/-	0	8490
	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	212250	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			**3896150**	**5042522**

In order to implement the environmental protection measures, an amount of Rs.38.96 lakhs as capital cost and recurring cost as Rs. 50.42 lakhs as recurring cost is proposed considering present market price considering present market scenario for the proposed project.

Year Wise Break Up	
1st Year	₹ 89,38,672
2nd Year	₹ 52,94,648
3rd Year	₹ 55,59,381
4 th Year	₹ 58,37,350
5 th Year	₹ 61,29,217
6 th Year	₹ 83,83,753
7 th Year	₹ 68,54,865
8 th Year	₹ 71,97,609
9 th Year	₹ 75,57,489
10 th Year	₹ 80,05,264
Total	**698 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 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 - 10: ENVIRONMENTAL MANAGEMENT PLAN – P2

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.T. Kesavamoorthy** will –

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

Description of the Administration and Technical Setup –

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

The said team will be responsible for:

- Monitoring of the water/ waste water quality, air quality and solid waste generated
- Analysis of the water and air samples collected through external laboratory

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

10.3 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
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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 topsoil avail for this project site-31,857 m^3 for one year

Overburden / Waste and Side Burden Management –

- The overburden in the form of topsoil formation, the topsoil 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 restricted upto a depth of 76 m AGL as per the ToR, the water table in the area is 70 m –65 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	Mines Manager

and systems	
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 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 2000 nos. of saplings is proposed to be planted for the Mining plan period in safety barrier of applied mine lease area with survival rate 80%. The greenbelt development plan has been prepared keeping in view the land use changes that will occur due to mining operation in the area.

TABLE 10.7 PROPOSED GREENBELT ACTIVITIES FOR 5 YEAR PLAN PERIOD – P2

PROPOSAL FOR P2			
It is proposed to plant **2000Nos** of trees in the 1st year	80%	Safety barrier, Un utilized area's 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 – P2

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 10.9: MEDICAL EXAMINATION SCHEDULE – P2

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 – P2

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: LIST OF PERIODICAL TRAININGS PROPOSED FOR EMPLOYEES – P2

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 10.11: EMP BUDGET FOR PROPOSED PROJECT – P2

	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	40200	40200
	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 -10 Units	250000	25000
	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 - 8 Units	40000	2000
	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	80400

	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	4812002
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	40200	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	804000	10000
	3. Progressive Closure Activity Green belt development - 500 trees per one hectare - Proposal for 2000 Trees - (600 Inside Lease Area & 1400 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)	120000	18000
		Avenue Plantation @ 300 per plant (capital) for plantation outside the lease area and @ 30 per plant maintenance (recurring)	420000	42000
	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	83250	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	10919543	0
Implementation of EC, Mining Plan & DGMS Condition	Scientific Study Report	Study report of Hydrogeolgical, Slope Stability and Vibration	300000	0
	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) - 46 Employees	184000	46000
	Health check up for workers will be provisioned	IME & PME Health check up @ Rs. 1000/- per employee	0	46000
	First aid facility will be provided	Provision of 2 Kits per Hectare @ Rs. 2000/-	0	8040
	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	201000	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			**3859400**	**6101642**

In order to implement the environmental protection measures, an amount of Rs.38.59 lakhs as capital cost and recurring cost as Rs. 61.01 lakhs as recurring cost is proposed considering present market price considering present market scenario for the proposed project.

Year Wise Break Up	
1st Year	₹ 99,61,042
2nd Year	₹ 64,06,724
3rd Year	₹ 67,27,060
4 th Year	₹ 70,63,413
5 th Year	₹ 74,16,584
6 th Year	₹ 97,17,113
7 th Year	₹ 82,73,269
8 th Year	₹ 86,86,932
9 th Year	₹ 91,21,279
10 th Year	₹ 96,60,593
Total	**830 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

Thiyaranadurgam Rough Stone quarry Quarry (Extent 8.26.5 ha) falls under "B" category as per MoEF & CC Notification (S.O. 3977 (E)).

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

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 quarry & Gravel as per market demand.

Sustainable and modern mining leads us to see positive impact of mining operation and providing consistent employment for nearly 86 people directly in the cluster and indirectly around 150 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 Thiyaranadurgam Rough Stone quarry & Gravel (Extent: 8.26.5 ha).

CHAPTER 12: DISCLOSURE OF CONSULTANTS

The Project Proponent's –

1. **Thiru. N.Narayanan**
2. **Thiru.T.Kesavamoorthy**

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 quarry Cluster Quarries over an Extent of **8.26.5 ha** in Thiyaranadurgam Village, Shoolagiri Taluk, Krishnagiri 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**

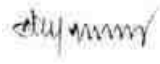
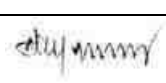
Date & Signature: 

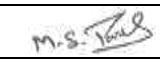
Period of Involvement: **January 2022 to till date**

Associated Team Member with EIA Coordinator:

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

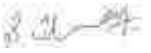
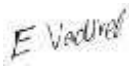
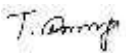
FUNCTIONAL AREA EXPERTS ENGAGED IN THE PROJECT

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 ▪ Corporate Environment Responsibility.	Mrs. K. Anitha	

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

LIST OF TEAM MEMBERS ENGAGED IN THIS PROJECT

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

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

DECLARATION BY THE HEAD OF THE ACCREDITED CONSULTANT ORGANIZATION

I, Dr. M. Ifthikhar Ahmed, Managing Partner, Geo Exploration and Mining Solutions, hereby, confirm that the above-mentioned Functional Area Experts and Team Members prepared the EIA/EMP for Rough Stone quarry Cluster Quarries over an Extent of 8.26.5 ha in Thiyaranadurgam Village, Shoolagiri Taluk, Krishnagiri 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:	**NABET/EIA/2225/RA 0276 Dated: 20-02-2023**
Validity:	**Valid till 06.8.2025**