DRAFT ENVIRONMENTAL IMPACT ASSESSMENT
&
ENVIRONMENT MANAGEMENT PLAN

"B1" CATEGORY – MINOR MINERAL

MELATHATTAPPARAI ROUGH STONE AND GRAVEL QUARRIES

IN CLUSTER OVER AN EXTENT OF 7.03.5 ha

At

Melathattapparai Village, Thoothukudi Taluk, Thoothukudi District, Tamil Nadu State.

For Obtaining

Environmental Clearance under EIA Notification – 2006

Schedule Sl. No. 1 (a) (i): Mining Project

ToR obtained vide

1. Lr.No. SEIAA-TN/F.No.9016/SEAC/ToR- 1159/2022 Dated: 06.06.2022– P1

2. Lr No. SEIAA-TN/F.No.9156/SEAC/ToR-1184/2022 Dated:06.07.2022 – P2

S. Nos	Name of Proposed Proponent	Extent
1	Thiru. P. Ananthakumar,	3.86.0 ha
2	Tmt.P. Ananthammal	1.62.0 ha

Environmental Consultant

GEO EXPLORATION AND MINING SOLUTIONS

Old No. 260-B, New No. 17
Advaitha Ashram Road, Alagapuram
Salem – 636 004, Tamil Nadu, India
Accredited for sector 1 Cat 'A' & 31,38 Cat 'B'
Certificate No : NABET/EIA/2225/RA 0276
Phone: 0427-2431989
Email: ifthiahmed@gmail.com, geothangam@gmail.com
Web: www.gemssalem.com

Baseline Monitoring Period – Oct to Dec 2022

APRIL 2023

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

CLUSTER QUARRIES				
PROPOSED QUARRIES				
Code	**Name and address of the project proponent**	**S.F. Nos & Village**	**Extent**	**Status**
P1	Thiru. P. Ananthakumar, S/o. Perumal No. 1/39, North Street, Athimarapatti, Thoothukudi -628005	452/2, 452/3A, 452/3B and 452/4 Melathattapparai Village,	3.86.0 ha	Obtained ToR Vide Letter No. SEIAA-TN/F.No.9016/SEAC/ToR-1159/2022 Dated: 06.06.2022
P2	Tmt. P. Ananthammal, W/o. Paranjothi No. 22/3A, Briyant Nagar 8th Street, Thoothukudi District, Tamil Nadu State – 628 008	457/5 of Melathattapparai Village,	1.62.0 ha	Obtained ToR Vide Letter No. SEIAA-TN/F.No.9156/SEAC/ToR-1184/2022 Dated:06.07.2022
P3	Thiru. I. Sankaralingam, S/o. Iyyappan, No. 23/4, Keelathattaparai Village, Thattaparai Post-628 304 Thoothukudi	447/1, 448/3 of Melathattapparai Village,	1.55.5	EC Granted Vide Letter No. SEIAA-TN/F.No.8449/EC No.4992/2021 Dated:18.02.2022
Total			**7.03.5 ha**	
EXISTING QUARRY				
Code	**Name of the Owner**	**S.F. Nos & Village**	**Extent**	**Lease Period**
NIL				
ABANDONED QUARRY				
Code	**Name of the Owner**	**S.F. Nos & Village**	**Extent**	**Lease Period**
A1	**Thiru.A.A. Samy**	456/1, 460/1 B1, 460/2B1 Melathattapparai Village,	**1.18.5**	G.M.1/389/2010 dt:14.02.2011 14.02.2011 to 13.02.2016
A2	**Thiru.Paranjothi,**	455/1, 455/2 Melathattapparai Village,	**3.11.0**	G.M.1/07/2010 dt:13.04.2010 28.04.2010 to 12.04.2015
A3	**Tmt.Palavesammal**	448/1, 448/2 Melathattapparai Village,	**1.15.5**	G.M.1/78/2008 dt:29.03.2010 29.03.2010 to 28.03.2015
A4	**Thiru.Sethupillai**	453/2, 454 Melathattapparai Village,	**1.22.0**	G.M.1/130/2012 dt:30.03.2012 30.03.2012 to 29.03.2017
***Total Cluster Extent**			**7.03.5 ha**	

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

TERMS OF REFERENCE (ToR) COMPLIANCE

P1 – Thiru. P. Ananthakumar

"ToR issued vide Letter No. SEIAA-TN/F.No.9016/SEAC/ToR- 1159/2022

Dated: 06.06.2022"

<table>
<tr><th colspan="3">SPECIFIC CONDITIONS</th></tr>
<tr><td>1</td><td>The Proponent shall carry out the cumulative & comprehensive impact study due to mining operations carried out in the quarry cluster specifically with reference to the environment in terms of air pollution, water pollution & health impacts, accordingly the Environment Management plan should be prepared keeping the concerned quarry and the surrounding habitations in the mind.</td><td>Noted and agreed</td></tr>
<tr><td>2</td><td>The PP shall EIA Report include the certified compliance report on existing EC issued.</td><td>Noted and agreed</td></tr>
<tr><td>3</td><td>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.</td><td>It is Existing Quarry
Existing pit dimension
<table><tr><th colspan="4">Existing Pit dimension</th></tr><tr><th>Pit No.</th><th>Length (m)</th><th>Width (m)</th><th>Depth(m)</th></tr><tr><td>Pit-1</td><td>149</td><td>134</td><td>16</td></tr><tr><td>Pit-2</td><td>128</td><td>82</td><td>5</td></tr><tr><td>Pit-3</td><td>110</td><td>28</td><td>6</td></tr></table></td></tr>
<tr><td>4</td><td>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).</td><td>Noted and agreed.
Project area boundary coordinates superimposed on Toposheet – Figure No. 1.3.</td></tr>
<tr><td>5</td><td>he PP shall carry out Drone video survey covering the cluster, Green belt, fencing etc.,</td><td>Noted and agreed</td></tr>
<tr><td>6</td><td>The proponent shall fumish photographs of adequate fencing, green belt along the periphery including replantation of existing trees & safety</td><td>Noted and agreed</td></tr>
</table>

	distance between the adjacent quarries & water bodies nearby provided as per the approved mining plan.	
7	The Project Proponent shall provide the details of mineral reserves and mineable reserves, planned production capacity, proposed working methodology 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.
8	The Project Proponent shall provide the organization chart indicating the appointment of various statutory officials and other competent persons to be appointed as per the provisions of Mines Act'1952 and the MMR, 1961 for carrying out the quarrying operations scientifically and systematically in order to ensure safety and to protect the environment.	Discussed about Organization chart in Chapter 6,
9	The project proponent shall conduct the hydro-geological study considering the contour map of the water table detailing the number of ground water pumping & open wells, and surface water bodies such as rivers, tanks, canals, ponds etc. within 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.
10	The proponent shall furnish the baseline data for the environmental and ecological parameters with regard to surface water/ground water quality, air quality, soil quality & Flora/fauna including traffic/vehicular movement study.	Baseline Data were collected for One Season (Post Monsoon) Oct to Dec 2022 as per CPCB Notification and MoEF & CC Guidelines. Details in Chapter No. 3.
11	A tree survey study shall be carried out (nos., name of the species, age, diameter etc.,) both within the mining lease applied area & 300m buffer zone and its management during mining activity.	Details of the trees in the buffer zone given in Chapter No.3.
12	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.
13	The Public hearing advertisement shall be published in one major National daily and one most circulated vernacular daily.	Noted and agreed
14	The PP shall produce/display the EIA report, Executive summary and other related information with respect to public hearing io Tamil Language	Noted and agreed

	also.	
15	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.1l22/2016, 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
16	The purpose of green belt around the project is to capture the fugitive emissions. Carbon sequestration and to attenuate the noise generated, in addition to improving the aesthetics. A wide range of indigenous plant species should be planted as given in the appendix in consultation with the DFO, State Agriculture University. The plant species with dense/moderate canopy of native origin should.	Species are proposed to plant in the safety barrier as mentioned in the ToR appendix. Proposed species are given in the Chapter No 4
17	Taller/one year old Saplings raised in appropriate size of bags, preferably eco-friendly bags should be planted as per the advice of local forest authorities / botanist / Horticulturist with regard to site specific choices. The proponent shall earmark the greenbelt area with GPS coordinates all along the boundary of the project site with at least 3 meters wide and in between blocks in an organized manner.	It is a Existing Lease. Around 2300 trees are proposed to plant
18	A Disaster management Plan shall be prepared and included in the EIA/EMP Report.	Disaster management Plan details in Chapter-7
19	A Risk Assessment and management Plan shall be prepared and included in the EIA/EMP Report.	A Risk Assessment and management Plan Chapter-7
20	The specific flora & fauna studies shall be carry out with the help of local School/College students and the same shall be included in EIA Report.	Noted and Agreed
21	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.
22	If any quarrying operations were carried out in the proposed quarrying site for which now the EC is	It is an Existing Lease

	sought, the Project Proponent shall furnish the detailed compliance to EC conditions given in the previous EC with the site photographs which shall duly be certified by MoEF&CC, Regional Office, Chennai (or) the concerned DEE/TNPCB.	
23	Concealing any factual information or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this Terms of Reference besides attracting penal provisions in the Environment (Protection) Act, 1986.	Noted and agreed
ADDITIONAL CONDITION		
1	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 Shanmuga River, Alikulam Lake, odai etc.,
2	The project proponent shall fumish VAO certificate with reference to 300m radius regard to approved habitations, schools, Archaeological structures etc.	VAO certificate is Obtained
3	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
4	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
5	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.
6	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.
7	The project proponent shall study impact on fish habitats and food WEB/food chain in the water body and Reservoir.	Nearest water bodies are Gounda River, Melanesaneri Kanmoi, etc.,

8	The Terms of Reference should specifically study impact on soil health, soil erosion. the soil physical, chemical components and microbial components.	There is no Top soil in the project area, the overburden in the form of Gravel formation. The Gravel has been removed during the previous lease period. No proposal for the removal of Top soil in this plan period. Details of impact on soil environment is detailed in Chapter No.4.
9	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.
10	The Environmental Impact Assessment should study impact on standing trees and the existing trees should be numbered and action suggested for protection.	About 2300 trees is planted in safety and along roads
11	The Environmental Impact Assessment should study on wetlands, water bodies, rivers streams, lakes and farmer sites.	Details are discussed in the Chapter No 3.
12	The Environmental Impact Assessment should hold detailed study on EMP with budget for green belt development and mine closure plan including disaster management plan.	Detailed Environmental Management plan with budgetary allocations given in the Chapter No. 10,
13	The Environmental Impact Assessment should study impact on climate change, temperature rise, pollution and above soil & below soil carbon stock.	The project will not cause significant impact on climatic change. Description about the project and climatic changes is described in Chapter No.3.
14	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
15	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.
16	The project proponent shall study and furnish the details on potential fragmentation impact of natural environment, by the activities.	Noted and agreed
17	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
18	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	Plastic waste management plan has been suggested in Chapter:7.

	environment and fresh water systems due to activities, contemplated during mining may be investigated and reported.	
19	The project proponent shall detail study on impact of mining on Reserve forests free ranging wildlife.	Noted and agreed
20	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
21	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
22	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
23	To fumish risk assessment and management plan including anticipated vulnerabilities during operational and post operational phases of Mining.	Details given in Chapter:7
24	Detailed Mine Closure Plan covering the entire mine lease period as per precise area communication order issued.	Details given in Chapter:2
25	Detailed Environment Management plan along with adaptation, mitigation & remedial strategies	Details given in Chapter:10

	covering the entire mine leas€ period as per precise area communication order issued.	

TERMS OF REFERENCE (ToR) COMPLIANCE

P2 – Tmt. P. Ananthammal,

"ToR issued vide Letter No. SEIAA-TN/F.No.9156/SEAC/ToR-1184/2022 Dated:06.07.2022"

SPECIFIC CONDITIONS		
1	The PP shall include the letter received from DFO concerned stating the proximity details Of Reserve Forests, Protected Areas, Sanctuaries, Tiger reserve etc., up to a radius of 25 km from the proposed site.	Obtained DFO Letter. Nearest Forest is Salikulam Forest -11.6031km -NW
2	Details of odai (water course), viz nature of odai, origin, category etc.,	Odai-10m Safety East, Madagiri Odai-1.7km SW Shanmuga River- 2.7km SW, Korampallam Tank -7.80km SE Allikulam Lake-5.5km South
3	TDS survey of ground water sampling collected ftom bore wells/open wells located within l0 Km radius from the project site towards sea side and the same shall be included in the EIA report.	Noted and agreed
4	The PP shall conduct a survey regarding the structures/wind mill etc., located in 500m radius from the project site and the same shall be included in the EIA report.	Noted and agreed
5	In the case of proposed lease in an existing (or old) quarry where the benches are not formed (or) partially formed as per the approved Mining Plan, the Project Proponent (PP) shall prepare and submit an 'Action Plan' for carrying out the realignment of the benches in the proposed quarry lease after it is approved by the concerned Asst. Director of Geology and Mining during the time of appraisal for obtaining the EC.	Noted and agreed
6	The Proponent shall submit a conceptual 'Slope Stability Plan' for the proposed quarry during the appraisal while obtaining the EC, when the depth of the working is extended beyond 30 m below ground level.	Noted and agreed
7	The PP shall furnish the affidavit stating that the blasting operation in the proposed quarry is carried out by the statutory competent person as per the MMR 1961 such as blaster, mining mate, mine foreman, II/lst Class mines manager appointed by the proponent	Noted and agreed
8	The EIA Coordinators shall obtain and fumish the	Noted and agreed

	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.	
9	If the proponent has already carried out the mining activity in the proposed mining lease area after 15.01.2016, then the proponent shall furnish the following details from AD/DD, mines	Noted and agreed
10	what was the period of the operation and stoppage of the earlier mines with last work permit issued by the AD/DD mines? a) Quantity of minerals mined out b) Highest production achieved in any one year c) Detail of approved depth of mining d) Actual depth of the mining achieved earlier e) Name of the person already mined in that leases area f) If EC and CTO already obtained' the copy of the same shall be submitted g) whether the mining was carried out as per the approved mine plan (or EC if issued) with stipulated benches	It is a fresh lease
11	All corner coordinates of the mine lease area, superimposed on a High-Resolution Imagery/Topo sheet, topographic sheet, geomorphology, lithology and geology of the mining lease area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).	Map showing – Project area is superimposed on Satellite imagery is enclosed in Figure No. 2.1 Project area boundary coordinates superimposed on Toposheet – Figure No. 1.3, Surface Features around the project area covering 10km radius – Figure No. 2.4 Geology map of the project area covering 10km radius - Figure No. 2.7 Geomorphology Map of the Study Area covering 10 km radius – Figure No. 2.8
12	The PP shall carry out Drone video survey covering the cluster, Green belt , fencing etc.,	Noted and agreed
13	The proponent shall furnish photographs of adequate fencing, green belt along the periphery including replantation of existing trees & safety distance between the adjacent quarries & water bodies nearby provided as per the approved mining plan.	Noted and agreed
14	The Project Proponent shall provide the details of mineral reserves and mineable reserves, planned production capacity, proposed working methodology with justifications, the anticipated	Details of Geological Resources and Proposed reserves are discussed under Chapter No. 2.

	impacts of the mining operations on the surrounding environment and the remedial measures for the same.	
15	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
16	The project proponent shall conduct the hydro-geological study considering the contour map of the water table detailing the number of ground water pumping & open wells, and surface water bodies such as rivers, tanks, canals, ponds etc. within 1km (radius) along with the collected water level data for both monsoon and non-monsoon seasons from the PWD/TWAD so as to assess the impacts on the wells due to mining activity. Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation 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.
17	The proponent shall furnish the baseline data for the environmental and ecological parameters with regard to surface water/ground water quality, air quality, soil quality & Flora/fauna including traffic/vehicular movement study.	Baseline Data were collected for One Season (Post Monsoon) Oct to Dec 2022 as per CPCB Notification and MoEF & CC Guidelines. Details in Chapter No. 3. including traffic/vehicular movement study. (Chapter-2)
18	The Proponent shall carry out the Cumulative impact study due to mining operations carried out in the quarry specifically with reference to the specific environment in terms of 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
19	Rain water harvesting management with recharging details along with water balance (both monsoon & non-monsoon) be submitted.	Noted and agreed
20	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
21	Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological	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

	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.	Chapter No. 2, Table No 2.3.
22	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
23	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
24	Proximity to Areas declared as 'Critically Polluted' (or) the Project areas which attracts the court restrictions for mining operations, should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the TNPCB (or) Dept. of Geology and Mining should be secured and furnished to the effect that the proposed mining activities could be considered.	Not Applicable. Project area / Study area is not declared in 'Critically Polluted' Area and does not come under 'Aravalli Range.
25	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
26	Impact on local transport infrastructure due to the Project should be indicated.	Transportation details mentioned in Chapter -2
27	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.
28	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.
29	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
30	The Public hearing advertisement shall be published in one major National daily and one most circulated vernacular daily	Noted and agreed

31	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
32	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
33	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.1l22/2016, 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
34	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.	Species are proposed to plant in the safety barrier as mentioned in the ToR appendix. Proposed species are given in the Chapter No 4
35	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 980 trees are proposed to plant
36	A Disaster management Plan shall be prepared and included in the EIA/EMP Report.	Disaster management Plan details in Chapter-7
37	A Risk Assessment and management Plan shall be prepared and included in the EIA/EMP Report.	A Risk Assessment and management Plan Chapter- 7
38	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 impacts chapter- 10

	occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	
39	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.	It is explained in Chapter -3
40	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.	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.
41	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.
42	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	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
43	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.	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.
44	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.	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.
ADDITIONAL CONDITIONS		
1	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 Shanmuga River, Alikulam Lake etc.,
2	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
3	The Environmental Impact Assessment shall study in detail the carbon emission and also suggest the	Details of carbon emission and mitigation activities are given int the Chapter No.4

	measures to mitigate carbon emission including development of carbon sinks and temperature reduction including control of other emission and climate mitigation activities.	
4	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.	Details of biodiversity, the natural ecosystem, the soil micro flora, fauna and soil seed banks are given int the Chapter No. 3
5	Action should specifically suggest for sustainable management of the area and restoration of ecosystem for flow of goods and services.	Noted and agreed
6	The project proponent shall study impact on fish habitats and the food WEB/ food chain in the water body and Reservoir.	There is no perennial river and reservoir within the 10km radius of the proposed project There are few seasonal odai passing within 5km radius, it's most of period is dry conditions, hence the no fish habitants within the 10km radius
7	The Terms of Reference should specifically study impact on soil health, soil erosion. the soil physical, chemical components and microbial components.	Detailed under Chapter 3.
8	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.
9	The Environmental Impact Assessment should study impact on standing trees and the existing trees should be numbered and action suggested for protection.	About 980trees is planted in safety and along roads
10	The Environmental Impact Assessment should study on wetlands, water bodies, rivers streams, lakes and farmer sites.	Details are discussed in the Chapter No 3.
11	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,
12	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
13	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
14	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 on the East, crusher located on North west side. dry agriculture land is situated Norther 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.
15	The project proponent shall study and furnish the details on potential fragmentation impact of natural environment, by the activities.	Noted and agreed
16	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
17	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.
18	The project proponent shall detail study on impact of mining on Reserve forests free ranging wildlife.	Noted and agreed
19	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
20	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
21	To fumish disaster management plan and disaster mitigation measures in regard to all aspects to avoid/reduce vulnerability to hazards & to cope	Details given in Chapter:7

	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.	
22	To fumish risk assessment and management plan including anticipated vulnerabilities during operational and post operational phases of Mining.	Details given in Chapter:7
23	Detailed Mine Closure Plan covering the entire mine lease period as per precise area communication order issued.	Details given in Chapter:2
24	Detailed Environment Management plan along with adaptation, mitigation & remedial strategies cove ng the entire mine lease period as per precise area communication order issued.	Details given in Chapter:10
STANDARD TERMS OF REFERENCE		
1	Year-wise production details since 1994 should be given, clearly stating the highest production achieved in any one year prior to 1994. It may also be categorically informed whether there had been any increase in production after the EIA Notification 1994 came into force, w.r.t. the highest production achieved prior to 1994.	Not applicable. This is Not a violation category project. This proposal falls under B1 Category (Cluster Condition).
2	A copy of the document in support of the fact that the Proponent is the rightful lessee of the mine should be given.	The applied land for quarrying is a Patta Land. Document is enclosed along with Approved Mining Plan as Annexure Volume 1.
3	All documents including approved mine plan, EIA and Public Hearing should be compatible with one another in terms of the mine lease area, production levels, waste generation and its management, mining technology etc. and should be in the name of the lessee.	Noted & agreed.
4	All corner coordinates of the mine lease area, superimposed on a High-Resolution Imagery/ toposheet, topographic sheet, geomorphology and geology of the area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).	Map showing – Project area is superimposed on Satellite imagery is enclosed in Figure No. 2.1 Project area boundary coordinates superimposed on Toposheet – Figure No. 1.3. Surface Features around the project area covering 10km radius – Figure No. 2.4. Geology map of the project area covering 10km radius - Figure No. 2.7. Geomorphology Map of the Study Area covering 10 km radius – Figure No. 2.8.
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	Map showing – Geology map of the project area covering 10km radius - Figure No. 2.7.

	the area, existing minerals and mining history of the area, important water bodies, streams and rivers and soil characteristics.	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 formation is a hard, compact and homogeneous body. The height and width of the bench will be maintained as 5m with 90^0 bench angles. Quarrying activities will be carried out under the supervision of Competent Persons like Mines Manager, Mines Foreman and Mining Mate. Necessary permissions will be obtained from DGMS after obtaining Environmental Clearance.
9	The study area will comprise of 10 km zone around the mine lease from lease periphery and the data contained in the EIA such as waste generation etc., should be for the life of the mine / lease period.	Noted & agreed. The study area considered for this study is 10 km radius and all data contained in the EIA report such as waste generation etc., is for the Life of the Mine / lease period.
10	Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given.	Land use and land cover of the study area is discussed in Chapter No. 3. Land use plan of the project area showing pre-operational, operational and post-operational phases are discussed in Chapter No. 2, Table No 2.3.

11	Details of the land for any Over Burden Dumps outside the mine lease, such as extent of land area, distance from mine lease, its land use, R&R issues, if any, should be given	Not Applicable. There is no mineral waste anticipated during this quarry operation. The entire quarried out Rough stone will be transported to the needy crushers.
12	A Certificate from the Competent Authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area. In the event of any contrary claim by the Project Proponent regarding the status of forests, the site may be inspected by the State Forest Department along with the Regional Office of the Ministry to ascertain the status of forests, based on which, the Certificate in this regard as mentioned above be issued. In all such cases, it would be desirable for representative of the State Forest Department to assist the Expert Appraisal Committees.	Not Applicable. There is no Forest Land involved in the proposed project area. The proposed project area is a patta land. It is inferred from the secondary sources TNGIS website and Toposheet the Nearest Reserved forest is Salikulam Reserve forest is about 11.6031 km North west side from the project area.
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 (10km Radius).
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. The Nearest wild life Sanctuary is Vellanadu Black Buck wild life Sanctuary 18km South West.
17	Location of National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/ Elephant Reserves/(existing as well as proposed), if any, within 10.0Km 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.	Detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine

	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.	lease)] was carried out and discussed under Chapter No. 3. There is no schedule I species of animals observed within study area as per Wildlife Protection Act 1972 as well as no species is in vulnerable, endangered or threatened category as per IUCN. There is no endangered red list species found in the study area.
19	Proximity to Areas declared as 'Critically Polluted' or the Project areas likely to come under the 'Aravalli Range', (attracting court restrictions for mining operations), should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the SPCB or State Mining Department should be secured and furnished to the effect that the proposed mining activities could be considered.	Not Applicable. Project area / Study area is not declared in 'Critically Polluted' Area and does not come under 'Aravalli Range.
20	Similarly, for coastal Projects, A CRZ map duly authenticated by one of the authorized agencies demarcating LTL. HTL, CRZ area, location of the mine lease w.r.t CRZ, coastal features such as mangroves, if any, should be furnished. (Note: The Mining Projects falling under CRZ would also need to obtain approval of the concerned Coastal Zone Management Authority).	Not Applicable. The project doesn't attract The C. R. Z. Notification, 2018.
21	R&R Plan/compensation details for the Project Affected People (PAP) should be furnished. While preparing the R&R Plan, the relevant State/National Rehabilitation & Resettlement Policy should be kept in view. In respect of SCs /STs and other weaker sections of the society in the study area, a need-based sample survey, family-wise, should be undertaken to assess their requirements, and action programmes prepared and submitted accordingly, integrating the sectoral programmes of line departments of the State Government. It may be clearly brought out whether the village(s) located in the mine lease area will be shifted or not. The issues relating to shifting of village(s) including their R&R and socio-economic aspects should be discussed in the Report.	Not Applicable. There are no approved habitations within a radius of 300 meters. Therefore, R & R Plan / Compensation details for the Project Affected People (PAP) is not anticipated and Not Applicable for this project.
22	One season (non-monsoon) [i.e. March-May (Summer Season); October-December (post monsoon season); December-February (winter season)]primary baseline data on ambient air quality as per	Baseline Data were collected for One Season (Post Monsoon) October – December 2022 as per CPCB Notification and MoEF & CC Guidelines. Details in Chapter No. 3.

	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.	
23	Air quality modelling should be carried out for prediction of impact of the project on the air quality of the area. It should also take into account the impact of movement of vehicles for transportation of mineral. The details of the model used and input parameters used for modelling should be provided. The air quality contours may be shown on a location map clearly indicating the location of the site, location of sensitive receptors, if any, and the habitation. The wind roses showing pre-dominant wind direction may also be indicated on the map.	Air Quality Modelling for prediction of incremental GLC's of pollutant was carried out using AERMOD view 9.6.1 Model. Details in Chapter No. 4.
24	The water requirement for the Project, its availability and source should be furnished. A detailed water balance should also be provided. Fresh water requirement for the Project should be indicated.	Total Water Requirement: 4.0 KLD Discussed under Chapter 2, Table No 2.15.
25	Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the Project should be provided.	Not Applicable. Water for dust suppression, greenbelt development and domestic use will be sourced from accumulated rainwater/seepage water in mine pits and purchased from local water vendors through water tankers on daily requirement basis. Drinking water will be sourced from the approved water vendors.
26	Description of water conservation measures proposed to be adopted in the Project should be given. Details of rainwater harvesting proposed in the Project, if any, should be provided.	Part of the working pit will be allowed to collect rain water during the spell of rain will be used for greenbelt development and dust suppression. The Mine Closure Plan is prepared for converting the excavated pit into rain water harvesting structure and serve as water reservoir for the project village during draught season.
27	Impact of the Project on the water quality, both surface and groundwater, should be assessed and necessary safeguard measures, if any required,	Impact Studies and Mitigation Measures of Water Environment including Surface Water and Ground Water are discussed in Chapter 4.

	should be provided.	
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 47-52m below ground level. The ultimate depth of quarry is 37m bgl. The ultimate depth of quarry is 45m bgl. This proposal of 45m below ground level will not intersect the ground water table, which is inferred from the hydro-geological carried out at the project site.
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 100m AMSL. Ultimate depth of the mine is 37m BGL-P1 Ultimate depth of the mine is 45m BGL-P2 Water level of the area is 47-52 m BGL
31	A time bound Progressive Greenbelt Development Plan shall be prepared in a tabular form (indicating the linear and quantitative coverage, plant species and time frame) and submitted, keeping in mind, the same will have to be executed up front on commencement of the Project. Phase-wise plan of plantation and compensatory afforestation should be charted clearly indicating the area to be covered under plantation and the species to be planted. The details of plantation already done should be given. The plant species selected for green belt should have greater ecological value and should be of good utility value to the local population with emphasis on local and native species and the species which are tolerant to pollution.	Greenbelt Development Plan is discussed under Chapter 4, Table No 4.14.
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	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.

	Congress Guidelines.	
33	Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.	Infrastructure & other facilities will be provided to the Mine Workers after the grant of quarry lease and the same has been discussed in the Chapter No. 2.
34	Conceptual post mining land use and Reclamation and Restoration of mined out areas (with plans and with adequate number of sections) should be given in the EIA report.	Discussed under Chapter 2. Mine Closure Plan is a part of Approved Mining Plan enclosed as Annexure Volume – 1.
35	Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	Occupational Health Impacts of the project and preventive measures are detailed under Chapter 4.
36	Public health implications of the Project and related activities for the population in the impact zone should be systematically evaluated and the proposed remedial measures should be detailed along with budgetary allocations.	No Public Health Implications anticipated due to this project. Details of CER and CSR are discussed under Chapter 8,
37	Measures of socio-economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	No Negative Impact on Socio Economic Environment on the Study Area is anticipated and this project shall benefit the Socio-Economic Environment by ways of employment for 56 people directly and 16 people indirectly. Details in Chapter 4.
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/EMP report
40	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.	No litigation is pending in any court against this project.
41	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	Project Cost is Rs.14,41,800/- (two mines) CER Cost is Rs.10,00,000/-(two mines)
42	A Disaster management Plan shall be prepared	Details in Chapter 7.3.

	and included in the EIA/EMP Report.	
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 after covering public hearing points.
g	While preparing the EIA report, the instructions for the Proponents and instructions for the Consultants issued by MoEF&CC vide O.M. No. J-11013/41/2006-IA.II(I) Dated: 4th August, 2009, which are available on the website of this Ministry, should be followed.	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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1. INTRODUCTION

1.0 PREAMBLE

Environmental Impact Assessment (EIA) is the management tool to ensure the sustainable development and it is a process, used to identify the environmental, social and economic impacts of a project prior to decision-making. It is a decision-making tool, which guides the decision makers in taking appropriate decisions for any project. EIA systematically examines both beneficial and adverse consequences of the project and ensures that these impacts are taken into account during the project designing. It also reduces conflicts by promoting community participation, information, decision makers, and helps in developing the base for environmentally sound project.

Rough Stone and Gravel are the major requirements for construction industry. This EIA report is prepared by considering Cumulative load of proposed & existing quarries of Melathattapparai Rough Stone and Gravel Cluster Quarries consisting of Two Proposed and no existing Quarries with total extent of Cluster of 7.03.5 ha in Melathattapparai Village, Thoothukudi Taluk, Thoothukudi 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 vide-

- Lr.No.. SEIAA-TN/F.No.9016/SEAC/ToR- 1159/2022 Dated: 06.06.2022 for P1
- Lr No. SEIAA-TN/F.No.9156/SEAC/ToR-1184/2022 Dated:06.07.2022 for P2

Baseline Monitoring study has been carried out during the period of Oct– Dec 2022

1.1 PURPOSE OF THE REPORT

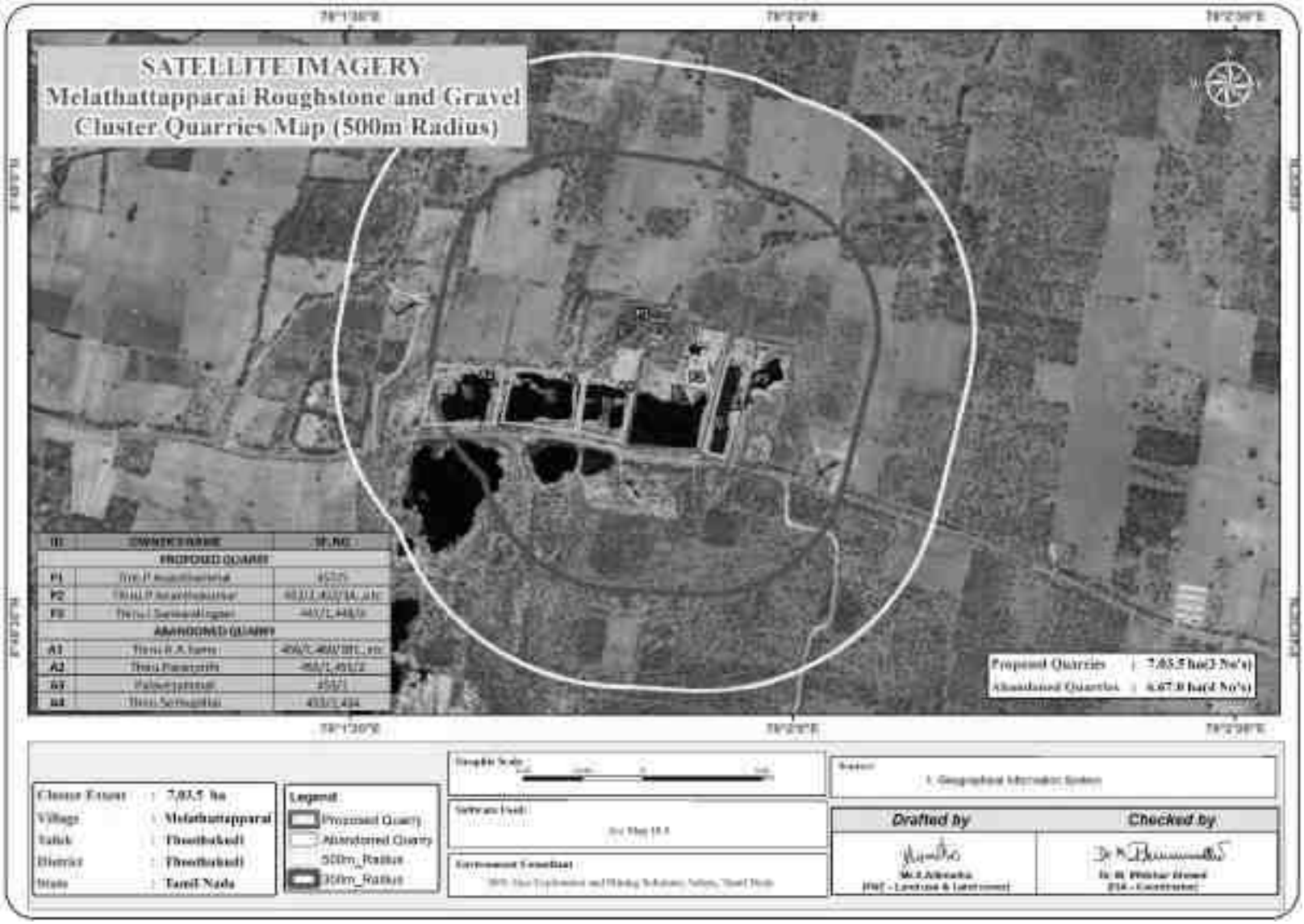
The Ministry of Environment and Forests, Govt. of India, through its EIA notification S.O. 1533(E) of 14th September 2006 and its subsequent amendments as per Gazette Notification S.O. 3977 (E) of 14thAugust 2018, Mining Projects are classified under two categories i.e. A (> 100 Ha) and B (≤ 100 Ha), 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 B - 1 and appraised by SEAC/ SEIAA as well as for cluster situation.

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

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

FIG 1.1SATELLITE IMAGERY OF CLUSTER QUARRIES



1.2 IDENTIFICATION OF PROJECT AND PROJECT PROPONENT

1.2.1 Identification of Project

TABLE 1.1: PROPOSED PROJECT IN THE CLUSTER

CODE	P1	P2
Name of the Project	Thiru. P. Ananthakumar, Rough stone and Gravel quarry project	Tmt. P. Ananthammal, Rough stone and Gravel quarry project
S.F. Nos	452/2, 452/3A, 452/3B and 452/4	457/5
Extent	3.86.0 ha	1.62.0 ha
Land Type	Patta Land	
Village Taluk and District	Melathattapparai Village, Thoothukudi Taluk and Thoothukudi District	

Source: Approved Mining Plan of the respective projects

1.2.2 Identification of Project Proponent

TABLE 1.2: DETAILS OF PROJECT PROPONENT

CODE	P1	P2
Name and address of the project proponent	Thiru. P. Ananthakumar, S/o. Perumal No. 1/39, North Street, Athimarapatti, Thoothukudi -628005	Tmt. P. Ananthammal, No. 22/3A, Briyant Nagar 8th Street, Thoothukudi -628008 +91 90252 73347, 90805 15945
Status	Individual	

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 1.3: SALIENT FEATURES OF THE PROPOSED PROJECTS IN CLUSTER

SALIENT FEATURES OF PROPOSAL "P1"			
Name of the Quarry	Thiru. P. Ananthakumar, Rough Stone and Gravel Quarry		
Land Type	Patta Land		
S.F. Nos	452/2, 452/3A, 452/3B and 452/4		
Village	Melathattapparai		
Extent	3.86.0 ha		
Geological Resources	Rough Stone	Weatherd Rock	Gravel
	13,69,454 m^3	22,086	14,724 m^3
Mineable Reserves	Rough Stone	Weatherd Rock	Gravel
	6,57,283 m^3	8,184	5,456 m^3

Proposed production for five years plan period	Rough Stone	Weatherd Rock	Gravel
	6,57,283 m^3	8,184	5,456 m^3
Previous quarry details	It is a fresh lease application but, favour of Tmt. P. Poopiratti, W/o. Thiru. Perumal for over an extent of **1.27.5 hectares of Patta lands, Rc.No. G.M.1/237/2009, Dated: 29.03.2010** for the period of five years from **29.03.2010 to 28.03.2015** favour of Thiru. P. Ponraj, S/o. P. Perumal for over an extent **of 2.58.5 hectares of Patta lands in S.F.Nos. 452/2 and 452/4 Rc.No. GM.1/107/2011, Dated: 30.03.2012** for the period of five years from **30.03.2012 to 29.03.2017**		
Existing pit dimension and Excavated quantity	Pit-1 149m (L) x 134m (W) x 16m (D) Pit-1I 128m (L) x 82m (W) x 5m (D) Pit-III 110m (L) x 28m (W) x 6m (D)		
Mining Plan Period / Lease Period	5 Years		
Ultimate Pit Dimension	262m (L) x 149m (W) x 45m (D)		
Toposheet No	58 L/01		
Latitude between	08°48'41.90"N to 08°48'50.61"N		
Longitude between	78°01'48.56"E to 78°01'55.97"E		
Highest Elevation	100 m AMSL		
Machinery proposed	Jack Hammer	8 Nos	
	Compressor	2 No	
	Hydraulic Excavator	2 No	
	Trucks	5 Nos	
	Wagon Drill	1 Nos	
Blasting Method	Usage of Slurry Explosive with Milli second delay detonator (MSD) detonators		
Nearest Water Body	**S. No**	**Water Bodies**	**Distance and Direction**
	1	Odai	50m NW
	2	Madagiri Odai	1.8km SW
	3	Shanmuga River	2.6km SW
	4	Korampallam Tank	7.80km SW
	5	Allikulam Lake	5.5km SW
Greenbelt Development Plan	Proposed to plant 2,320 trees in safety barrier, Village Road and un utilized area.		
Proposed Manpower Deployment	37 Nos		
Project Cost	A. Project cost Rs 1,14,34,000/-		
	B. EMP cost Rs. 3,80,000/-		
	Total Project cost Rs. 1,18,14,000/-		
CER Cost	Rs.5,00,000/-		
SALIENT FEATURES OF PROPOSAL "P2"			
Name of the Quarry	Tmt. P. Ananthammal, Rough Stone & Gravel Quarry		
Land Type	Patta Land		
S.F. Nos	457/5		
Village	Melathattapparai Village		
Extent	1.62.0 ha		
Geological Reserves	Rough Stone		Gravel
	5,67,000 m^3		32,400 m^3
Mineable Reserves	Rough Stone		Gravel

	1,55,120 m^3		20,592 m^3
Proposed production for five years plan period	Rough Stone		Gravel
	1,55,120 m^3		20,592 m^3
Mining Plan Period / Lease Period	5 Years		
Ultimate Pit Dimension	133 m (L) * 80 m (W) * 37m (D)		
Toposheet No	58 L/01		
Latitude Between	08°48'47.64"N to 08°48'52.49"N		
Longitude Between	78°01'45.27"E to 78°01'51.97"E		
Highest Elevation	100 m AMSL		
Machinery proposed	Jack Hammer		4
	Compressor		1
	Hydraulic Excavator		1
	Tippers		2
Blasting Method	Usage of Slurry Explosive with MSD detonators		
Nearest Water Body	S. No	Water Bodies	Distance and Direction
	1	Odai	10m NW
	2	Madagiri Odai	1.7km SW
	3	Shanmuga River	2.7km SW
	4	Korampallam Tank	7.80km SW
	5	Allikulam Lake	5.5km SW
Proposed Manpower Deployment	19 Nos		
Project Cost	Land & Machinery Cost		Rs. 29,84,000/-
	EMP Cost		Rs.3,80,000/-
	Total		Rs. 33,64,000/-
CER Cost	Rs.5,00,000/-		

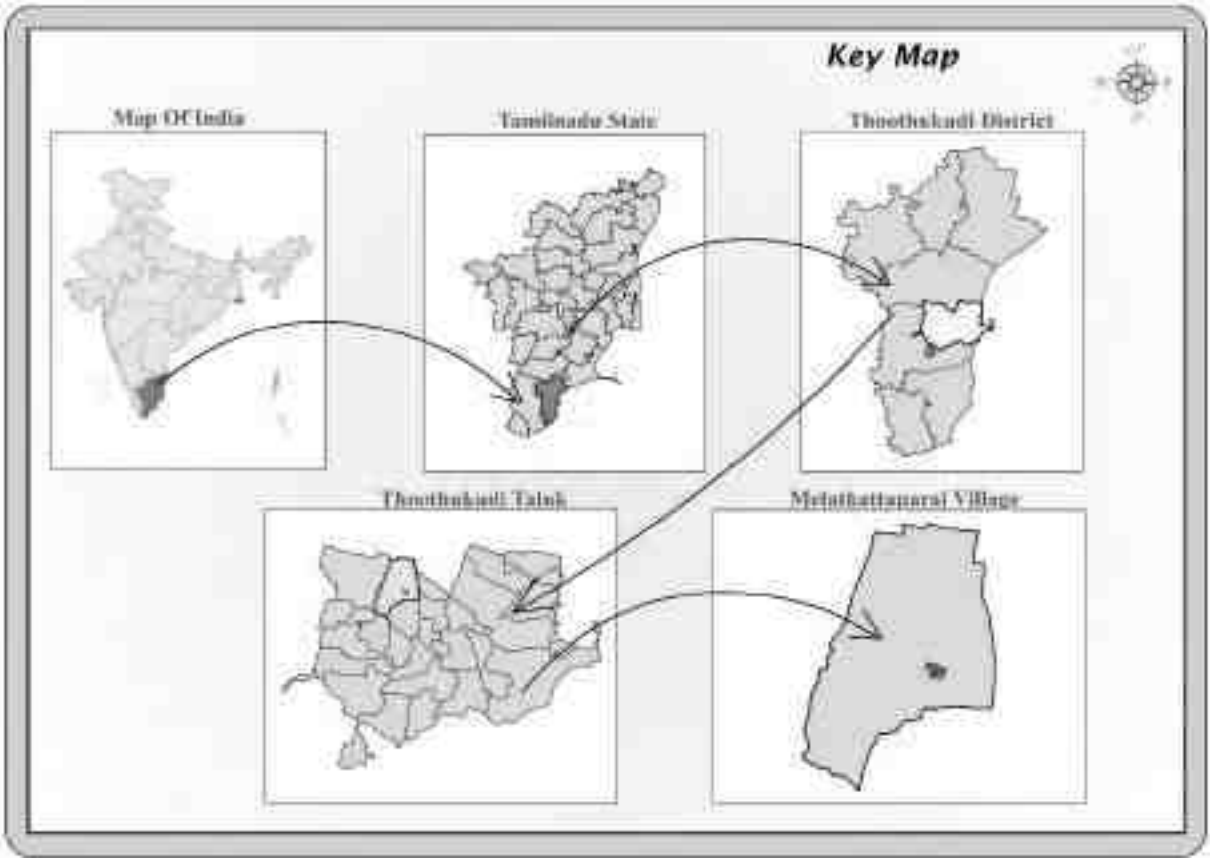
Source: Approved Mining Plan of the respective project

1.3.2 Location of the Project

The cluster quarry project falls in Melathattapparai Village. Thoothukudi Taluk and Thoothukudi District.

This cluster project is located – 14 km West of Thoothukudi Town and 2km Eastern side of Melathattapparai Village.

FIG 1.1 KEY MAP SHOWING THE LOCATION OF THE CLUSTER SITE



Source: Survey of India Toposheet 58 L/01

FIGURE 1.2: TOPOSHEET MAP OF THE STUDY AREA 10 KM RADIUS

Source: Survey of India Toposheet 58-L/01

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 and Gravel Quarry Lease Dated: 13.07.2021
- Precise Area Communication Letter was issued by the District Collector, Thoothukudi Rc.No. G.M.1/285/2021, Dated: 17.12.2021
- The Mining Plan was prepared by Recognized Qualified Person and approved by Assistant Director, Geology and Mining, Thoothukudi District, vide Rc.No. G.M.1/285/2021, Dated: 11.01.2022
- Proponent applied for ToR for Environmental Clearance vide online Proposal No. SIA/TN/MIN/72390/2022 Dated: 18.02.2022

Project – P2 –

- The proponent applied for Rough Stone and Gravel Quarry Lease Dated: 03.03.2021
- Precise Area Communication Letter was issued by the District Collector, Thoothukudi Rc.No. G.M.1/141/2021, Dated: 07.12.2021
- The Mining Plan was prepared by Recognized Qualified Person and approved by Assistant Director, Geology and Mining, Thoothukudi District, vide Roc.No. G.M.1/141/2021, Dated: 11.01.2022
- Proponent applied for ToR for Environmental Clearance vide online Proposal No. SIA/TN/MIN/74746/2022 Dated: 04.04.2022

SCOPING –

Project – P1 –

- The proposal was placed in 273rd SEAC meeting held on 14.05.2022 and the committee recommended for issue of ToR.
- The proposal was considered in 518th SEIAA meeting held on 06.06.2022 and issued ToR vide Letter No SEIAA-TN/F.No.9016/SEAC/ToR-1159/2022 Dated 06.06.2022

Project – P2 –

- The proposal was placed in 284th SEAC meeting held on 10.06.2022 and the committee recommended for issue of ToR.
- The proposal was considered in 529th SEIAA meeting held on 06.07.2022 and issued ToR vide Letter No SEIAA-TN/F.No.9156/SEAC/ToR-1184/2022 Dated:06.07.2022

Public Consultation –

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

Appraisal –

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

- Guidance Manual of Environmental Impact Assessment for Mining of Minerals, Ministry of Environment and Forests, 2010
- EIA Notification, 14th September, 2006
  - Lr.No. SEIAA-TN/F.No.9016/SEAC/ToR-1159/2022 Dated 06.06.2022– P1
  - Lr No. SEIAA-TN/F.No.9156/SEAC/ToR-1184/2022 Dated:06.07.2022 – P2

Approved Mining Plan of the respective projects.

1.6 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.

1.7 GENERIC STRUCTURE OF EIA DOCUMENT

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

1.8 THE SCOPE OF THE STUDY

The main scope of the EIA study is to quantify the cumulative impact in the study area due to cluster quarries and formulate the effective mitigation measures for each individual leases. A detailed account of the emission sources, emissions control equipment, background Air quality levels, Meteorological measurements, Dispersion model and all other aspects of pollution like effluent discharge, Dust generation etc., have been discussed in this report. The baseline monitoring study has been carried out during the Pre monsoon season (March to May) 2021 for various environmental components so as to assess the anticipated impacts of the cluster quarry projects on the environment and suggest suitable mitigation measures for likely adverse impacts due to the proposed project.

TABLE 1.4: ENVIRONMENT ATTRIBUTES

Sl.No.	Attributes	Parameters	Source and Frequency
1	Ambient Air Quality	PM10, PM 2.5, SO2, NO2	Continuous 24 hourly samples twice a week for three months at 8 locations (2 Core & 6 Buffer)
2	Meteorology	Wind speed and direction, temperature, relative humidity and rainfall	Near project site continuous for three months with hourly recording and from secondary sources of IMD station
3	Water quality	Physical, Chemical and Bacteriological parameters	Grab samples were collected at 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)	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	Based on Survey of India topographical sheet and satellite imagery and primary

		categories	survey.
8	Socio-Economic Aspects	Socio-economic and demographic characteristics, worker characteristics	Based on primary survey and secondary sources data like census of India 2011.
9	Hydrology	Drainage pattern of the area, nature of streams, aquifer characteristics, recharge and discharge areas	Based on data collected from secondary sources as well as hydro-geology study report prepared.
10	Risk assessment and Disaster Management Plan	Identify areas where disaster can occur by fires and explosions and release of toxic substances	Based on the findings of Risk analysis done for the risk associated with mining.

Source: Onsite Monitoring Data/Sampling by Chennai Mettest Pvt Ltd.

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

1.8.1 Regulatory Compliance & Applicable Laws/Regulations

- Application for Quarrying Lease as per Tamil Nadu Minor Mineral Concession Rules, 1959
- Obtained Precise Area Communication Letter as per Tamil Nadu Minor Mineral Concession Rules, 1959 for Preparation of Mining Plan and obtaining Environmental Clearance
- The Mining Plan of Rough Stone and Gravel quarry has been approved under Rule 41 & 42 as amended of Tamil Nadu Minor Mineral Concession Rules, 1959
- ToR from SEIAA - TN for the project P1 & P2 was granted on 06.06.2022 & 06.07.2022

2. PROJECT DESCRIPTION

2.0 GENERAL

Two Proposed Quarries in Melathattapparai Village, Thoothukudi Taluk, Thoothukudi District and Tamil Nadu State fall under Cluster Situation as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016 and the total extent of cluster is 7.03.5 ha consisting of two proposed quarries.

As the extent of cluster is 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 applied areas in the cluster are rocky barren patta land, no major vegetation or trees within the project areas and green belt development is been carried out in the existing quarry, the projects are site specific and there is no additional area required for these projects. There is no effluent generation/discharge from the proposed quarries.

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

2.2 LOCATION OF THE PROJECTS

- All the proposed quarry projects are located in Melathattapparai village, Thoothukudi taluk, Thoothukudi District.
- This cluster project is located – 14 km West of Thoothukudi Town and 2km Eastern side of Melathattapparai Village..

The projects under the cluster are classified as patta land (Non-Forest Land) & does not fall within 10 km radius of any Eco – sensitive zone, Wild life Sanctuary, National Park, Tiger Reserve, Elephant Corridor and Biosphere Reserves.

TABLE 2.1: SITE CONNECTIVITY TO THE CLUSTER QUARRIES

Nearest Roadway	NH - 38 – Madurai – Thoothukudi – 6km – E SH-75 – Tirunelveli – Vaippar – 10km – NW
Nearest Village	Melathattapparai – 2km – W
Nearest Town	Thoothukudi – 14km – E
Nearest Railway	Thoothukudi Railway station –14km – E
Nearest Airport	Thoothukudi Airport – 10km – S
Seaport	Thoothukudi chidambaranar 14 km South East side

Source: Survey of India Toposheet

TABLE 2.2: BOUNDARY CO-ORDINATES OF PROPOSED PROJECTS

BOUNDARY CO-ORDINATES OF PROJECT – P1		
Boundary Pillar No.	**Latitude**	**Longitude**
1	08º48’42.22” N	78º01’48.56” E
2	08º48’45.01” N	78º01’49.17” E
3	08º48’46.95” N	78º01’49.56” E
4	08º48’48.21” N	78º01’49.71” E
5	08º48’48.08” N	78º01’50.88” E
6	08º48’47.93” N	78º01’52.02” E
7	08º48’50.61” N	78º01’52.62” E
8	08º48’50.14” N	78º01’55.97” E
9	08º48’46.13” N	78º01’54.94” E
10	08º48’41.90” N	78º01’53.92” E
11	08º48’42.08” N	78º01’50.90” E
12	08º48’42.15” N	78º01’49.76” E
BOUNDARY CO-ORDINATES OF PROJECT – P2		
1	08º48’47.64” N	78º01’45.27” E
2	08º48’52.49” N	78º01’46.24” E
3	08º48’52.48” N	78º01’46.33” E
4	08º48’51.70” N	78º01’51.97” E
5	08º48’50.66” N	78º01’51.84” E
6	08º48’50.76” N	78º01’50.50” E
7	08º48’47.66” N	78º01’46.49” E

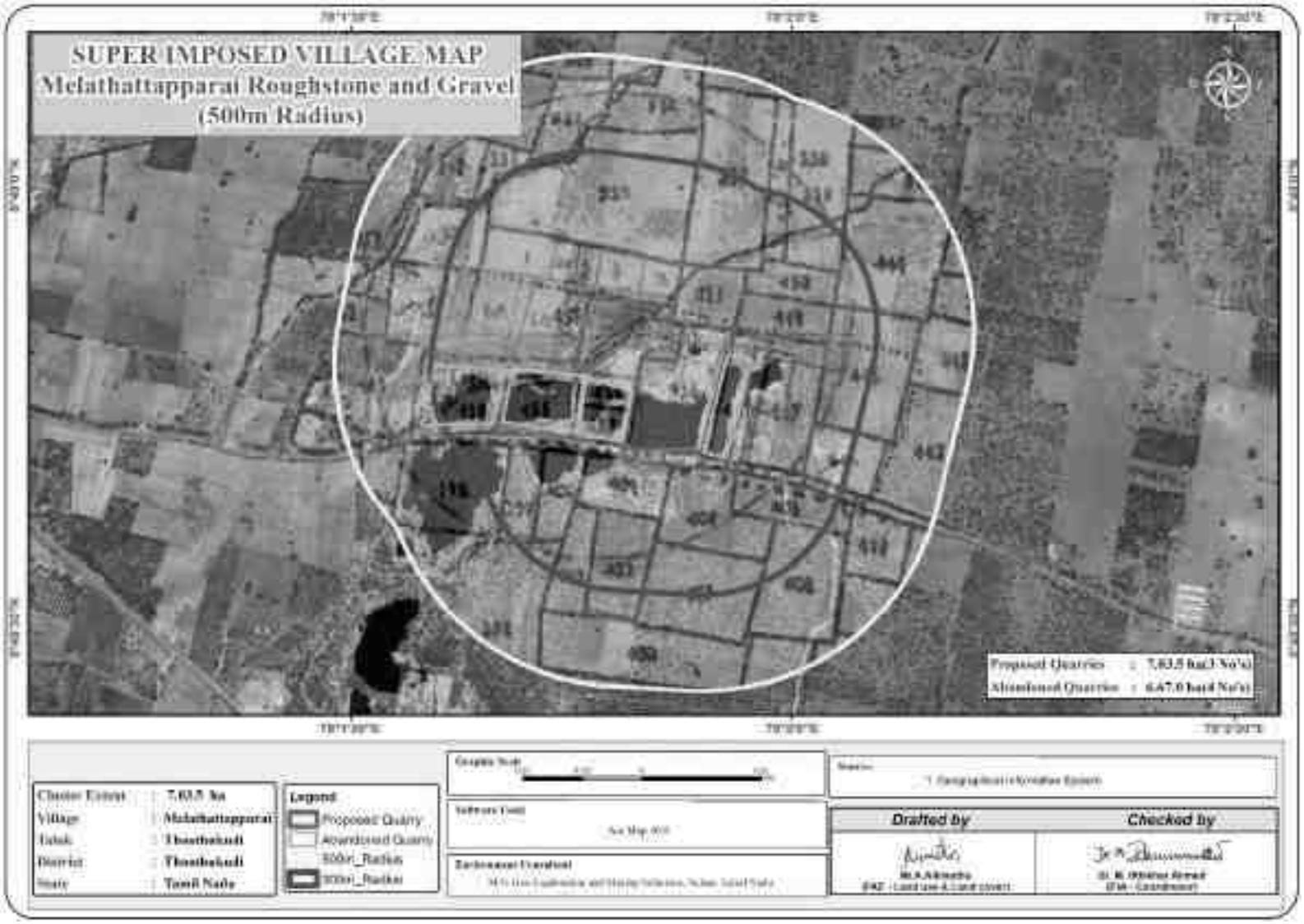
Source: Approved Mining Plan of the respective projects

FIGURE 2.1: PHOTOGRAPHS OF THE CLUSTER QUARRIES

Proposed – P1

Proposed -P2

FIGURE 2.2: GOOGLE IMAGE SUPERIMPOSED ON VILLAGE MAP



GOOGLE IMAGE SHOWING PROJECT AREA

SATELLITE IMAGERY OF P1 – Thiru. P. ANANTHAKUMAR,

SATELLITE IMAGERY OF P2- Tmt. P. ANANTHAMMAL,

FIGURE 2.3: QUARRY LEASE PLAN & SURFACE PLAN – P1

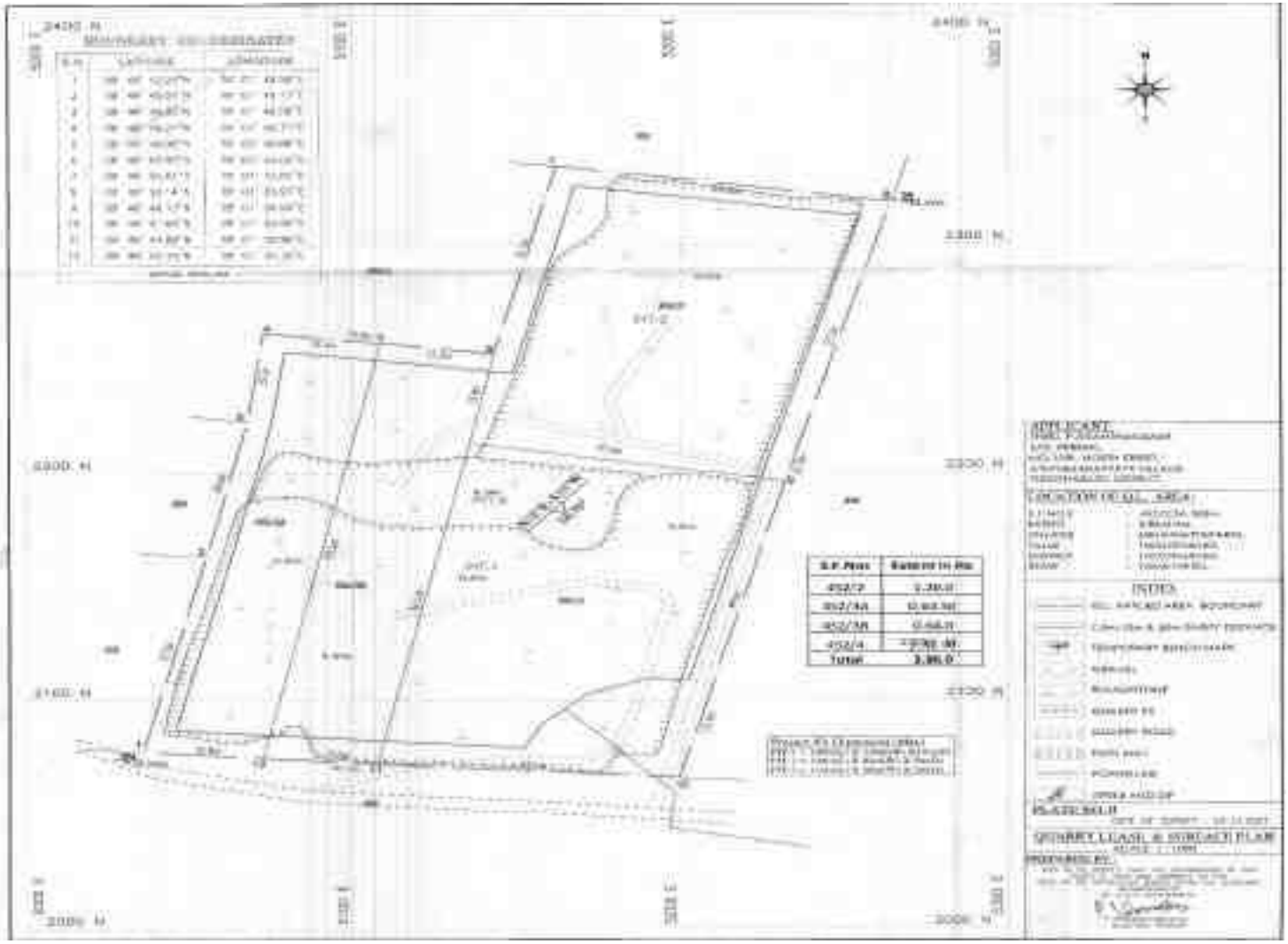


FIGURE 2.4: QUARRY LEASE PLAN & SURFACE PLAN – P2

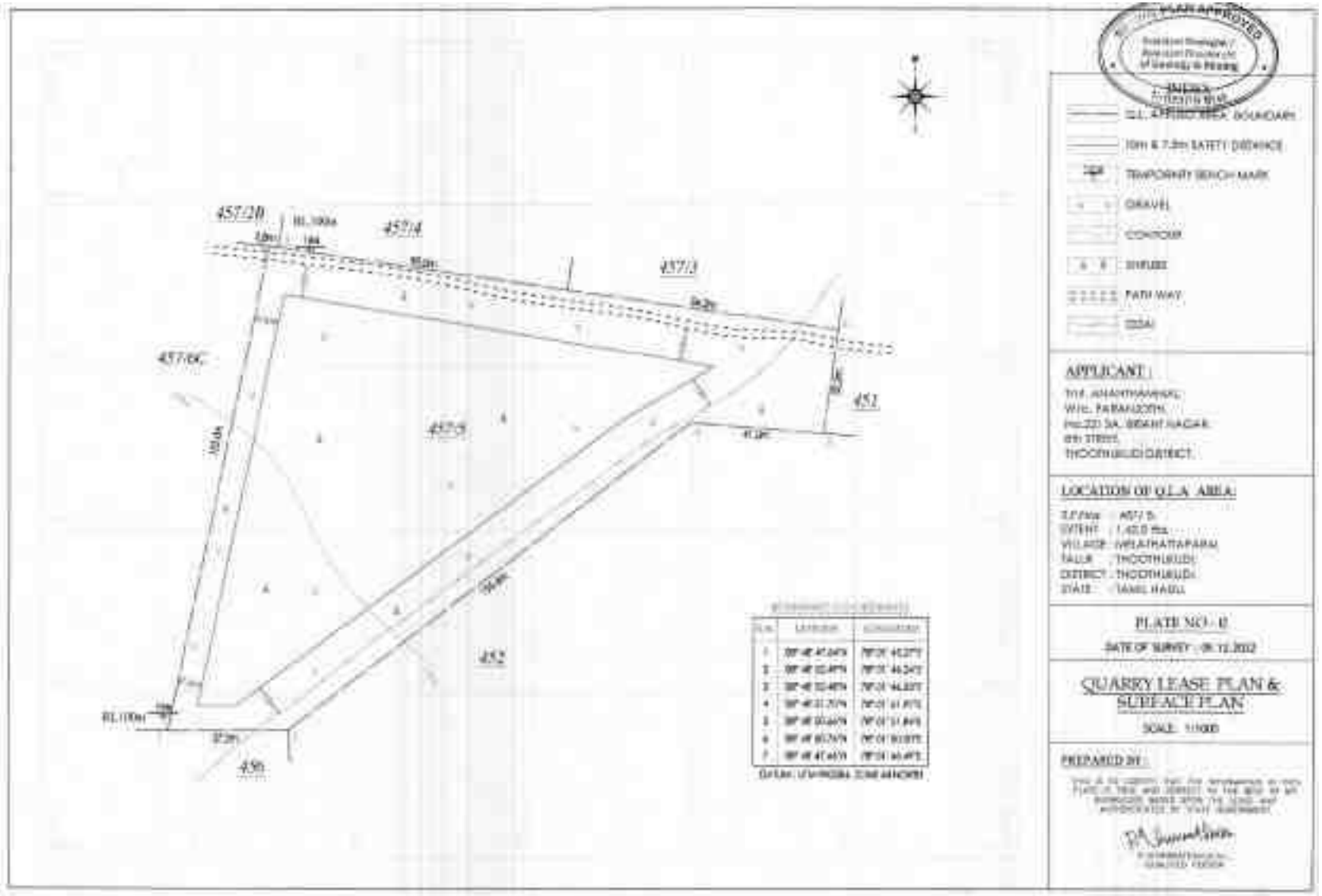
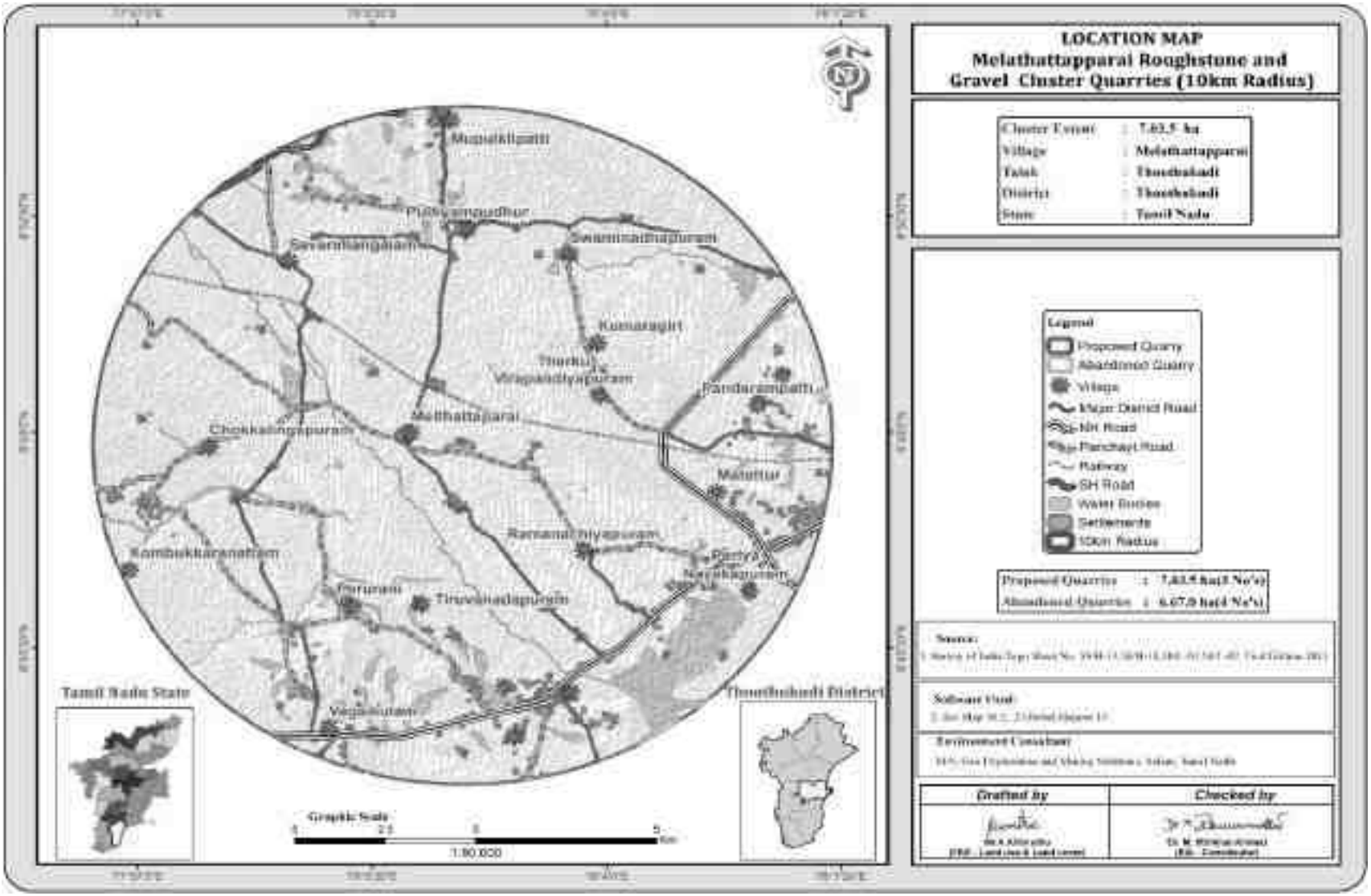
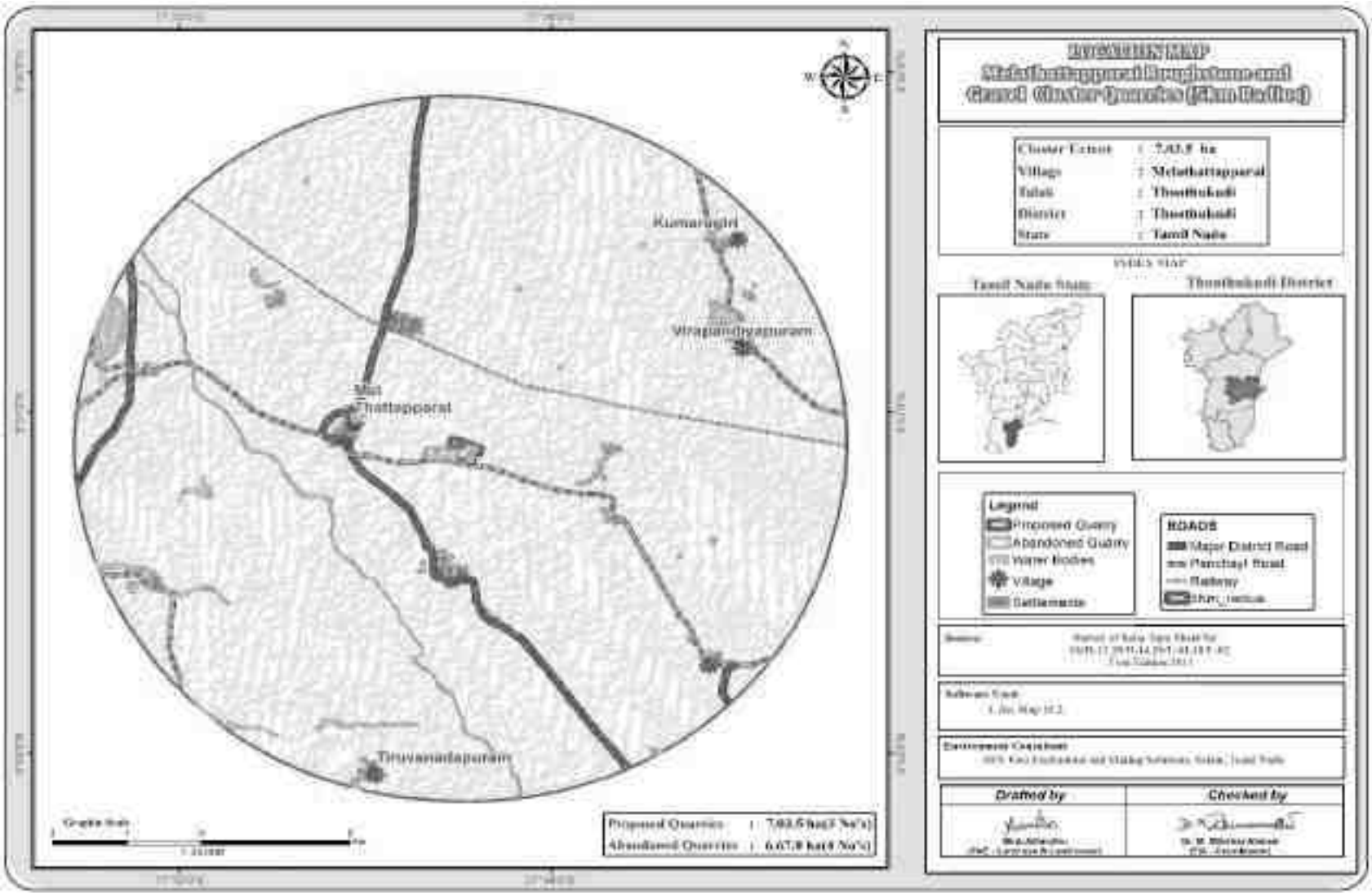


FIGURE 2.5: IMAGE SHOWING SURFACE FEATURES AROUND 10 KM RADIUS FROM CLUSTER QUARRIES



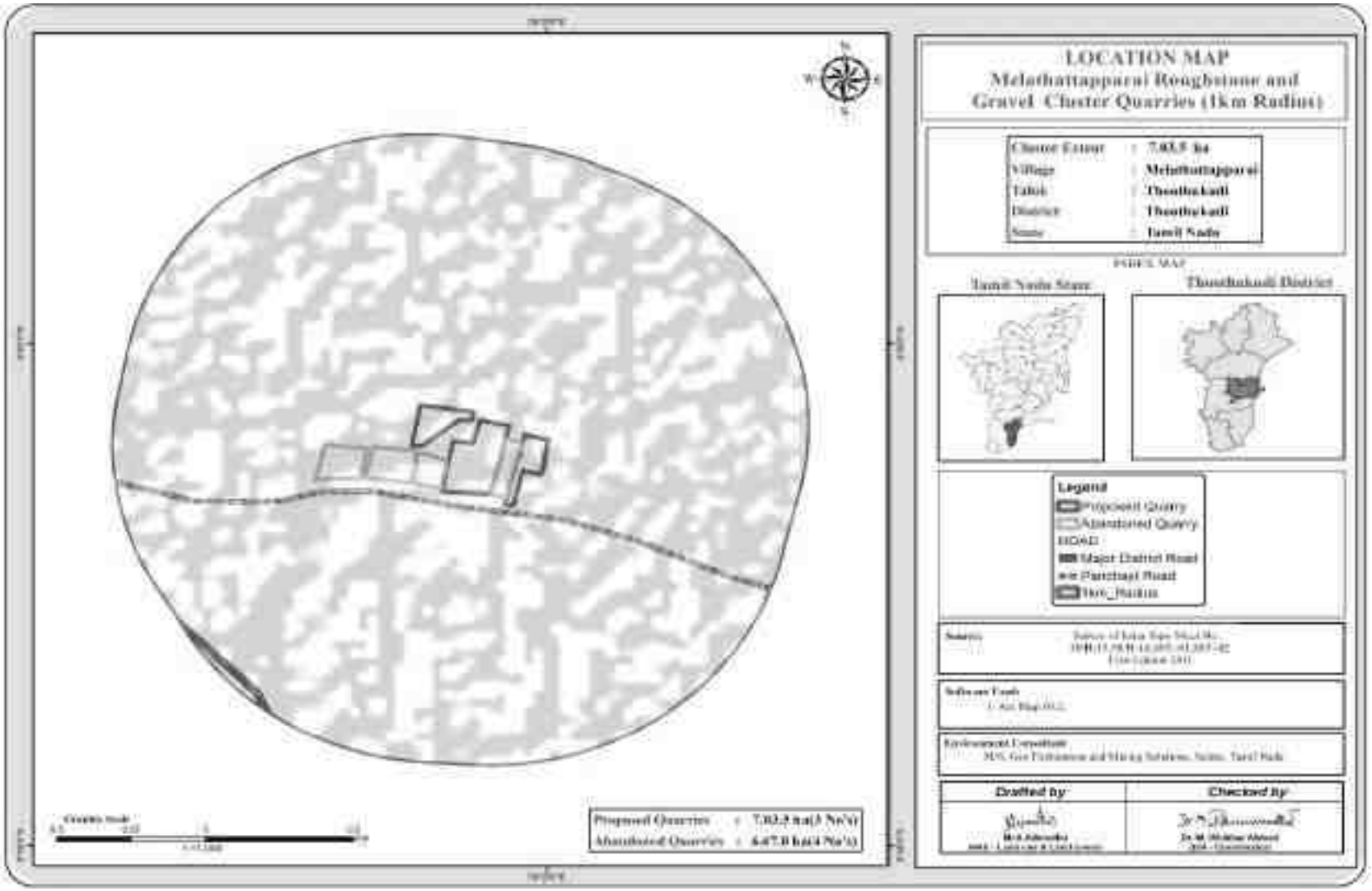
Source:SOI, Toposheet

FIGURE 2.6: IMAGE SHOWING SURFACE FEATURES AROUND 5KM RADIUS FROM CLUSTER QUARRIES



Source:SOI, Toposheet

FIGURE 2.7: IMAGE SHOWING SURFACE FEATURES AROUND 1 KM RADIUS FROM THE CLUSTER AREA



Source:SOI, Toposheet

2.2.1 Project Area

- All the projects under cluster are site specific
- There is No beneficiation or processing proposed inside the project area.
- 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

Description	Present area in (ha)	Area at the end of lease period (ha)
Area under quarry	3.00.0	3.29.0
Infrastructure	0.01.0	0.01.0
Roads	Nil	0.02.0
Green Belt	Nil	0.20.1
Unutilized	0.85.0	0.33.9
Grand Total	**3.86.0**	**3.86.0**

Description	Present area in (ha)	Area at the end of lease period (ha)
Area under quarry	Nil	0.89.0
Infrastructure	Nil	0.01.0
Roads	Nil	0.02.0
Green Belt	Nil	0.10.0
Unutilized Area	1.62.0	0.60.0
Grand Total	**1.62.0**	**1.62.0**

Source: Approved Mining plan of the respective projects

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 (5Year Plan period)	Gravel (1 Years Plan period)	Weathered Rock (1 Years Plan period)
Geological Resources	13,69,454 m^3	14,724 m^3	22,086 m^3
Mineable Reserves	6,57,283 m^3	5,456 m^3	8184 m^3
Mining Plan Period	5 years	5 years	5 years
Number of Working Days	300 Days	300 Days	300 days
Production per day	438 m^3	18 m^3	27 m^3
No of Lorry loads (12 m^3 per load)	37 Nos	2 No	2 No
Proposed Depth for Mining Plan Period	40 m	2 m	3 m

Total Depth of Mining	45 meters		
OPERATIONAL DETAILS FOR PROJECT – P2			
PARTICULARS	**DETAILS**		
	Rough Stone (5Year Plan period)	**Gravel (3 Years Plan period)**	
Geological Resources	5,67,000 m^3	32,400 m^3	
Mineable Reserves	1,55,120 m^3	20,592 m^3	
Mining Plan Period / Lease Applied Period	5 Years		
Number of Working Days	300 Days		
Production per day	103 m^3	23 m^3	
No of Lorry loads (12m^3 per load)	9 No	2 Nos	
Proposed Depth for Mining Plan Period	35m	2 m	
Total Depth of Mining	37meters		

Source:PFR of the respective projects

2.3 GEOLOGY

2.3.1 Regional Geology

The geology of the district is mainly underlain by the rocks belonging to hard crystalline rock masses of Archaean age. The Archaean rocks in this area are represented by rocks of eastern ghat complex comprising Charnockites, Migmatite complex of composite gneiss. The entire area is covered by metamorphic crystalline rocks of Charnockite, composite gneiss of Archaean age. The other rock type is encountered by composite granitic gneiss of epidote hornblende biotite gneiss and hornblende biotite gneiss are occupy in the middle portion of the basin. Charnockite group occupies the high ground as well as plain and it is poorly weathered and jointed. They are generally black grey to dark grey in colour medium to coarse grained texture, and generally massive and un-foliated. These rocks are highly metamorphosed and have been subjected to very severe folding, crushing and faulting. The crystalline rocks are subjected to tectonic activities under various orogenic cycles resulting in the development of secondary structures such as joints, fissures and cleavages.

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 N – S with vertical dip.

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

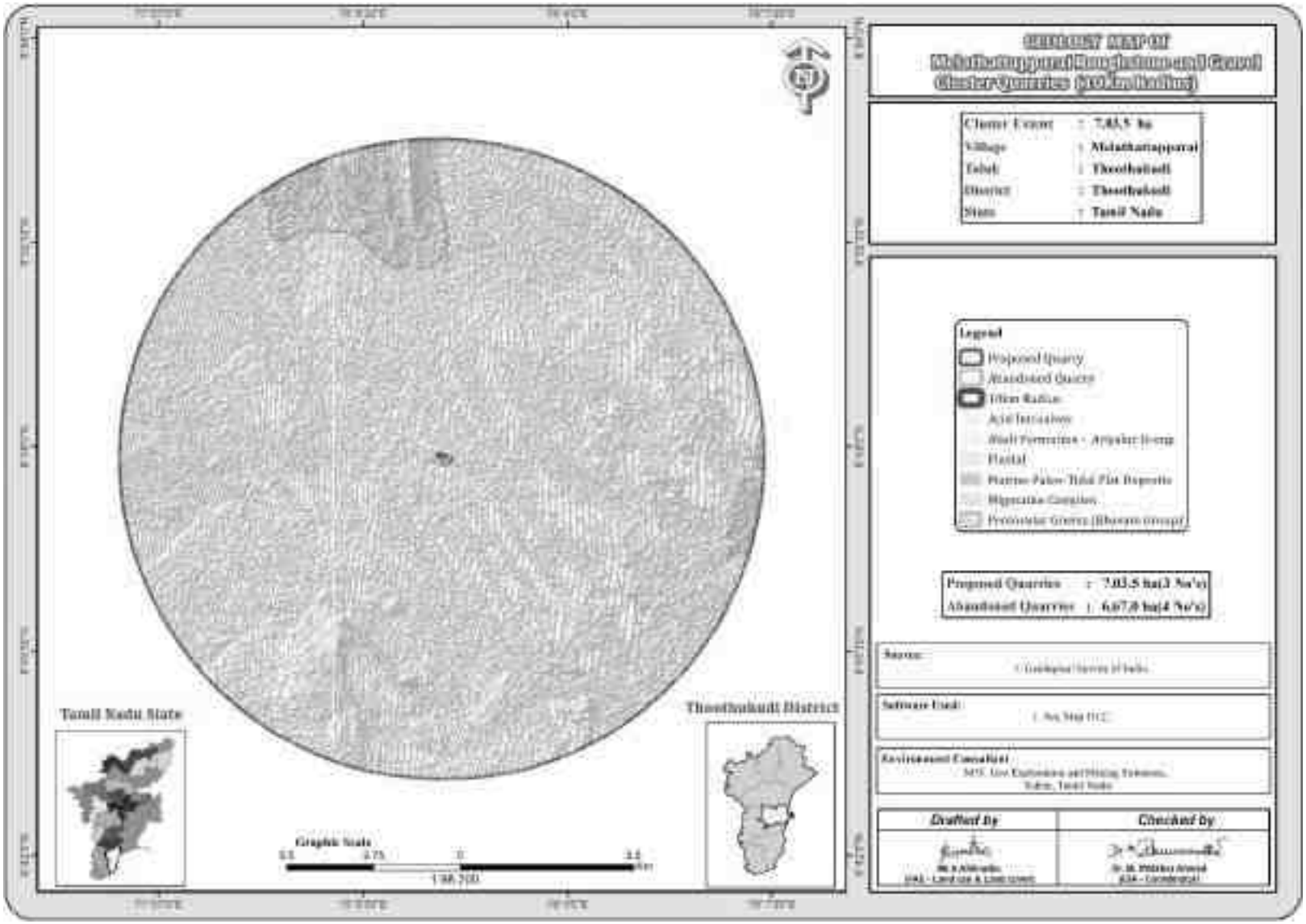
2.3.2 Local Geology

The study area follows the regional trend and mainly comprises of Hard Rock Formation as a homogeneous formation / Batholith formation of Charnockite. The cluster area is a plain terrain, with gentle slope toward South with a highest altitude of 100m AMSL. The proposed project areas in the cluster are covered with Gravel formation of 1m to 2m thickness followed by Massive Charnockite formation.

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 50 – 55m, 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 50m will not encounter any subsurface water. There is possibility of seepage water from the surface levels i.e., below 10m and this seepage water will be collected in the mine pits and used for dust suppression and greenbelt development within the respective proposed projects. In the geophysical study it has been clearly inferred that the depth of the quarrying operation will not intersect the ground water table.

FIGURE 2.8: REGIONAL GEOLOGY MAP



Source: NRSC, Bhuvan

FIGURE 2.9 A: TOPOGRAPHY, GEOLOGICAL, YEAR-WISE DEVELOPMENT PRODUCTION PLAN AND SECTIONS OF CLUSTER QUARRIES-P1-Ananthakumar

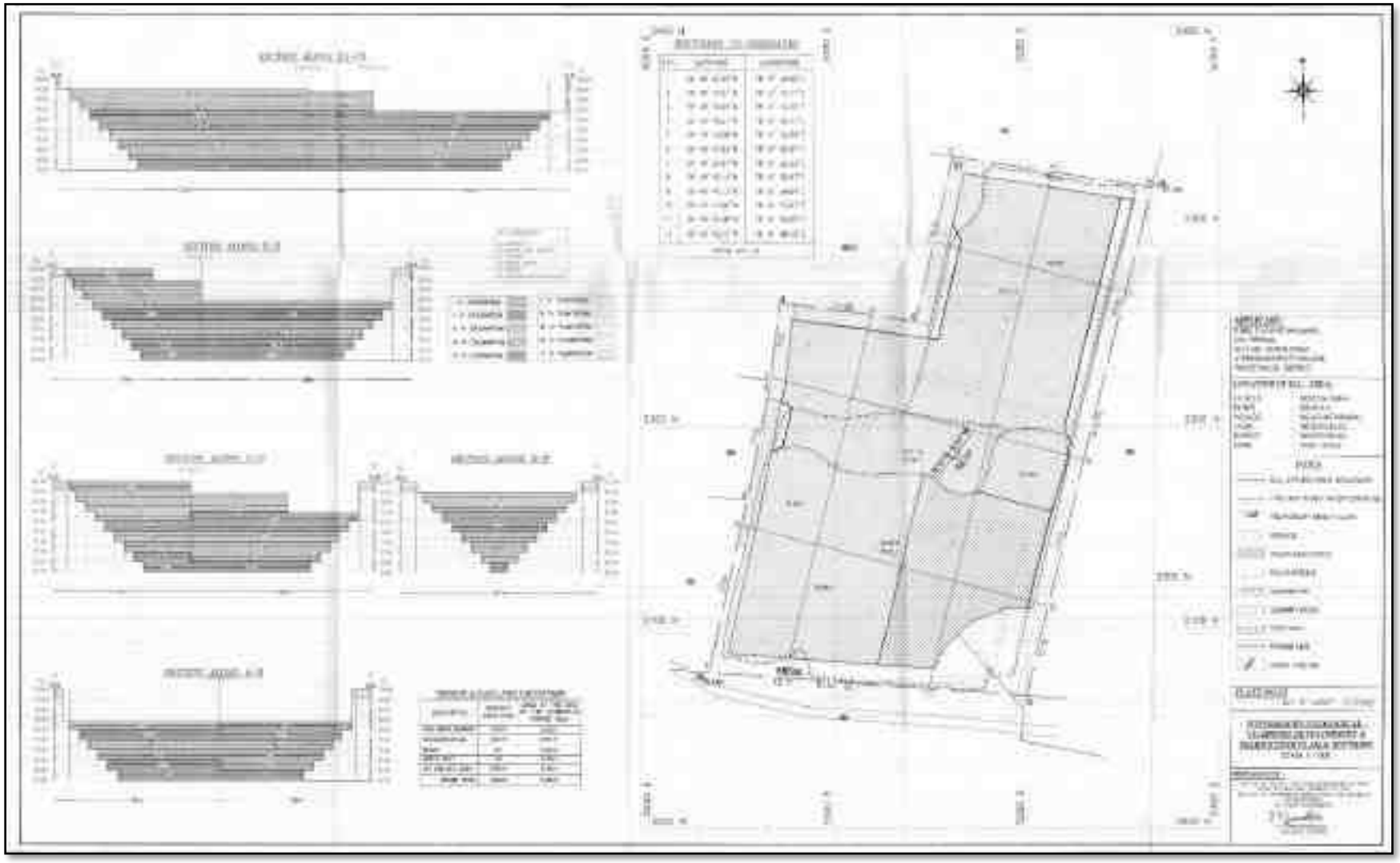
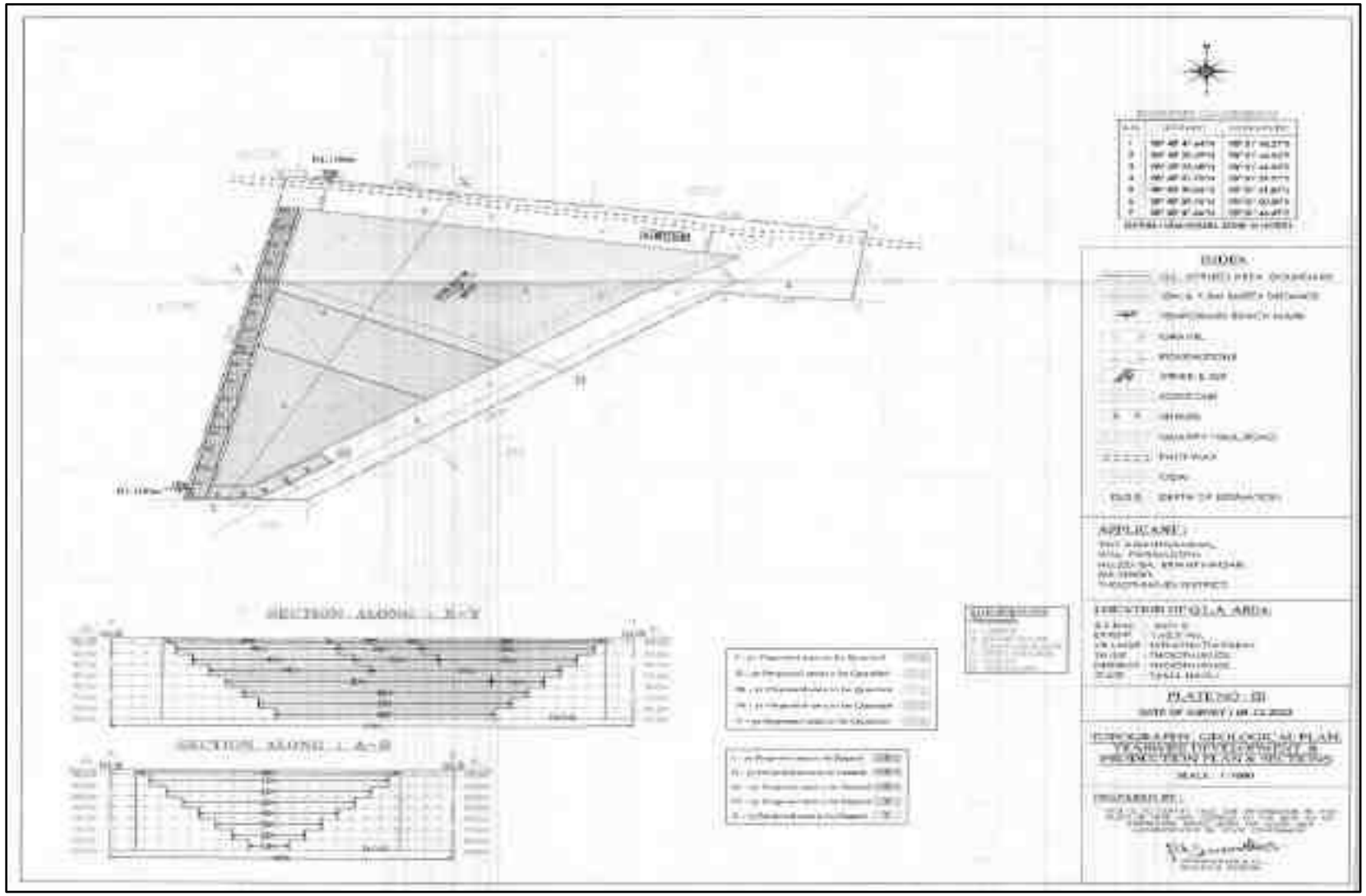


FIGURE 2.9 B: TOPOGRAPHY, GEOLOGICAL, YEAR-WISE DEVELOPMENT PRODUCTION PLAN AND SECTIONS OF CLUSTER QUARRIES P2-Ananthammal



2.4 RESOURCES AND RESERVES

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

TABLE 2.5: AVAILABLE GEOLOGICAL RESOURCES OF PROPOSED PROJECTS

Geological Resources	Roughstone	Weathered Rock	Gravel
P1	13,69,454 m^3	22,086	14,724 m^3
P2	5,67,000 m^3	-	32,400 m^3

Source: Approved Mining Plan of the respective projects

Now 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, 10m and 50m safety distances as per the 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 MINEABLE RESERVES OF PROPOSED PROJECTS

Mineable Resources	Roughstone	Weathered Rock	Gravel
P1	6,57,283 m^3	8184	5,456 m^3
P2	1,55,120 m^3	-	20,592 m^3

Source: Approved Mining Plan of the respective projects

Disposal of Waste

There is no waste anticipated in this Rough Stone and Gravel 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 2.8: ULTIMATE PIT DIMENSION

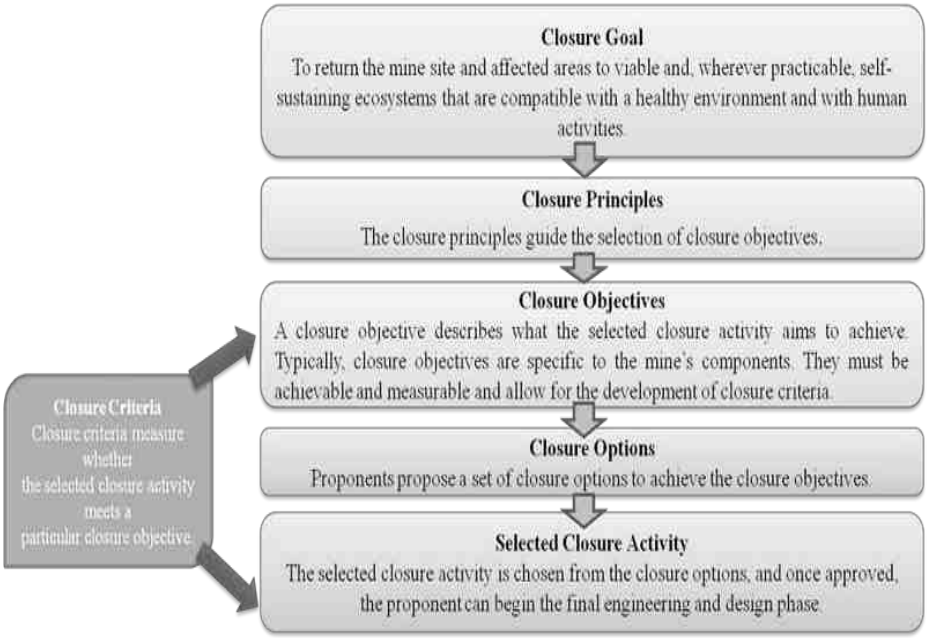
PROPOSAL – P1	
Pit I	262m (L) x 149m (W) x 45m (D)
PROPOSAL – P2	
Pit-I	133 m (L) * 80 m (W) * 37m (D)

Source: Approved Mining Plan

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

Closure Objectives –

- Access to be limited, for the safety of humans and wildlife.
- The open pit mine workings and pit boundary are physically and geo-technically stable.
- Discharge of contaminated drainage has been minimized and controlled.
- Original or desired new surface drainage patterns have been established.
- Fishy culture activities will be carried out in the mine pit after the closure



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 canal about 100m on Western side of the cluster project area. This river canal will not be hindered by any of mine closure activities
- The project proponent as a part of social responsibilities assures to supply the stored mine pit water to the nearby villages after effective treatment process as per the standards of TNPCB & TWAD
- Native species will be planted in 3 row patterns on the boundary barriers and 1st bench, a full-time sentry will be appointed at the gate to prevent inherent entry of public & cattle.
- The access road to the quarry will be cut-off immediately after the closure
- The layout design shall be prepared and get approved from Department of Geology and Mining.
- The proponent is instructed to construct as per the layout approved
- Physical and chemical stability of structures left in place at the site, the natural rehabilitation of a biologically diverse, stable environment, the ultimate land use is optimized and is compatible with the surrounding area and

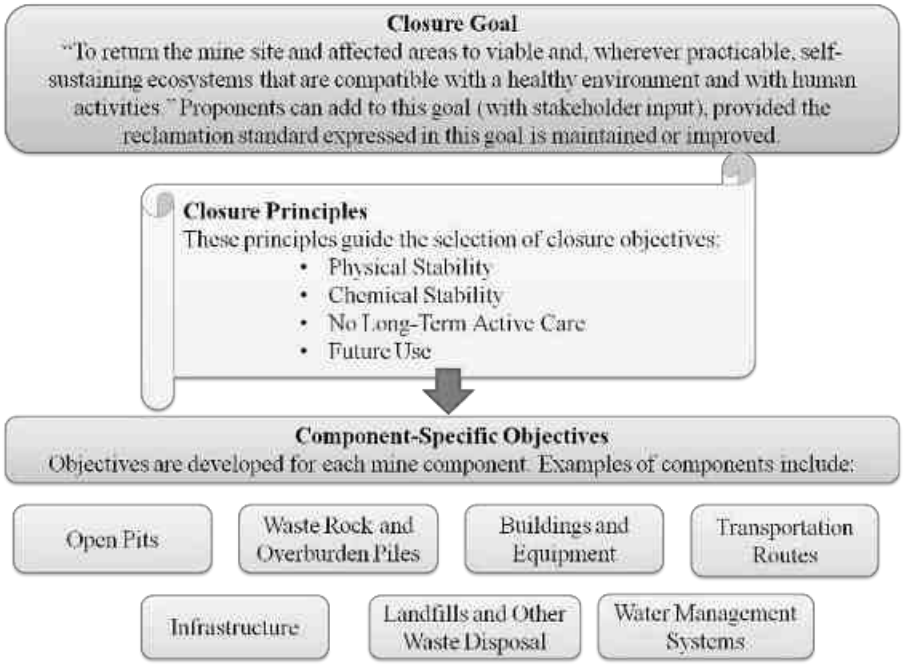
the requirements of the local community, and taking the needs of the local community into account and minimizing the socio-economic impact of closure

- There will be a positive change in the environmental and ecology due to the mine closure.

Post-Closure Monitoring –

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

- Monitor physical and geotechnical stability of remnant pit walls.
- Monitor the ground regime in pit walls to confirm achievement of design objectives.



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

TABLE 2.9: MINE CLOSURE BUDGET
P1-Ananthakumar

ACTIVITY		YEAR					RATE	AMOUNT (INR)
		I	II	III	IV	V		
Plantation under safety zone	Nos.	50	50	50	50	50	@100 Rs Per sapling	Rs.25,000/-
	Cost	5,000	5,000	5,000	5,000	5,000		
Plantation in the quarried out top bench and approach road	Nos.	50	50	50	50	50		Rs.25,000/-
	Cost	5,000	5,000	5,000	5,000	5,000		
Wire Fencing (In Mtrs) 850 Mtrs		2,55,000	-	-	-	-	@300 Rs Per Meter	Rs.2,55,000/-

Garland drain (In Mtrs) 850 Mtrs	2,55,000	-	-	-	-	@300 Rs Per Meter	Rs.2,55,000/-
TOTAL							**Rs. 5,60,000/-**

P2-Ananthammal

ACTIVITY		**YEAR**					**RATE**	**AMOUNT (INR)**
		I	**II**	**III**	**IV**	**V**		
Plantation under safety zone	Nos.	30	30	30	30	30	@100 Rs Per sapling	Rs.15,000/-
	Cost	3,000	3,000	3,000	3,000	3,000		
Plantation in the quarried out top bench and approach road	Nos.	50	50	50	50	50		Rs.25,000/-
	Cost	5,000	5,000	5,000	5,000	5,000		
Wire Fencing (In Mtrs) 600 Mtrs		1,80,000	-	-	-	-	@300 Rs Per Meter	Rs.1,80,000/-
Garland drain (In Mtrs) 450 Mtrs		1,35,000	-	-	-	-	@300 Rs Per Meter	Rs.1,35,000/-
TOTAL								**Rs. 3,55,000/-**

Source: Mining plan

2.5 METHOD OF MINING

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

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

2.5.1 Drilling & Blasting Parameters

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

Spacing	–	1.2m
Burden	–	1.0 m
Depth of hole	–	1.5 m
Charge per hole	–	0.50 – 0.75kg
Powder factor	–	6.0 tonnes/kg
Diameter of hole	–	30-32 mm

No of Holes to be drilled per day:-

Volume of Rough Stone will be excavated from one hole	=	6 Tonnes
Total Volume from two proposed quarries	=	16,90,013 m^3
	=	16,90,013 /5
	=	338002 /300
	=	1126m^3 * 2.6 (Specific Gravity)
	=	2,929 Tonnes per day
Therefore, Number of Holes per day	=	2,929/6
	=	488 Holes per day for two projects

Type of Explosives to be used –

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

Storage of Explosives –

No proposal for storage of explosives within the project area, the proponent has made agreement with authorized explosives agencies for carrying out blasting activities and competent person as per DGMS guidelines will be employed for safety and supervision of overall quarrying activities.

The explosives will be sourced from the blasting agency on daily basis and the blasting will be carried out under the supervision of competent qualified Blaster and it will be ensured that there shall be no balance of explosive stock; any balance stock will be taken back by the supplier.

2.5.2 Extent of Mechanization

TABLE 2.7 MACHINERY DETAILS FOR PROPOSED PROJECTS

PROJECT – P1				
S.NO.	**TYPE**	**NOS**	**SIZE/CAPACITY**	**MOTIVE POWER**
1	Jack hammers	8	1.2m to 2.0m	Compressed air
2	Compressor	2	400 psi	Diesel Drive
3	Excavator with Bucket / Rock Breaker Unit	2	300	Diesel Drive
4	Trucks	5	40 Tonnes	Diesel Drive
5	Wagon Drill	1	60 HP	Diesel Drive
PROJECT – P2				
S.NO.	**TYPE**	**NOS**	**SIZE/CAPACITY**	**MOTIVE POWER**
1	Jack hammers	4	1.2m to 2.0m	Compressed air
2	Compressor	1	400 psi	Diesel Drive
3	Excavator with Bucket / Rock Breaker Unit	1	300	Diesel Drive
4	Tippers	2	20 Tonnes	Diesel Drive

Source: Approved Mining Plan of the respective projects

2.6 GENERAL FEATURES

2.6.1 Existing Infrastructures

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

2.6.2 Drainage Pattern

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

2.6.3 Traffic Density

The traffic survey conducted based on the transportation route of material, the Rough Stone and Gravel is proposed to be transported mainly through the Panchayat Road (Vadakkusilukanpatti-Melathattapparai) road located

1km West side of the area and District Road (Ottapidaram-Thoothukudi) road located Northwest side of the project area.

Traffic density measurements were performed at three locations

1. Panchayat road – 1km West side of the project area
2. Ottapidaram-Thoothukudi (Major District road) located 2.3km Northwest

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.

FIGURE.2.10: MINERAL TRANSPORTATION ROUTE MAP

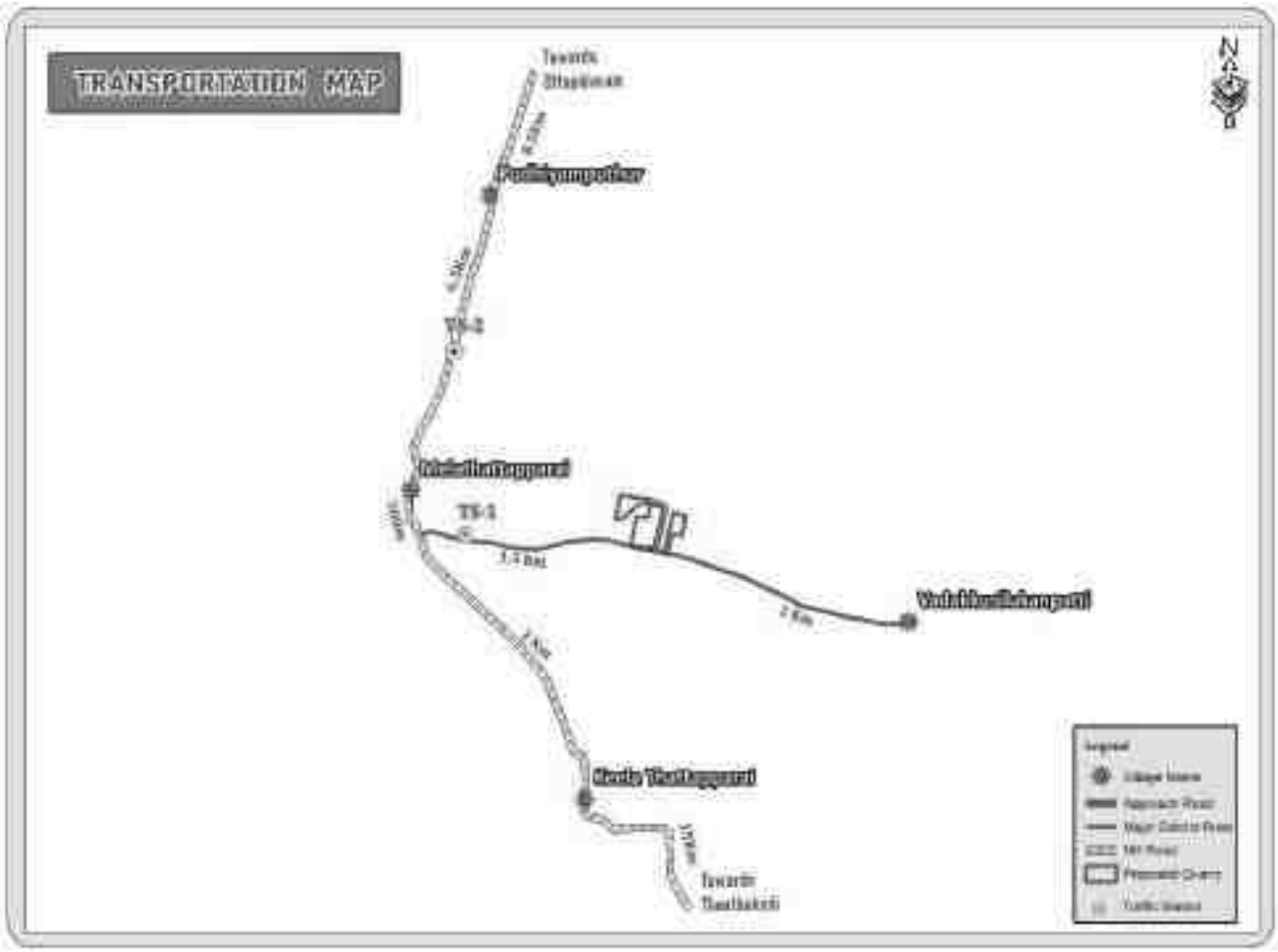


TABLE.2.8: TRAFFIC SURVEY LOCATIONS

Station Code	Road Name	Distance and Direction	Type of Road
TS1	Vadakkusilukanpatti-Melathattaparai	1km West side of the project area	Panchayat road single lane

TS2	Major District road Ottapidaram-Thoothukudi	2.3 km North west	Major district road

Source: On-site monitoring by GEMS FAE & TM

TABLE 2.9: EXISTING TRAFFIC VOLUME

Station code	HMV		LMV		2/3 Wheelers		Total PCU
	No	PCU	No	PCU	No	PCU	
TS1	35	105	50	50	60	30	185
TS2	130	390	275	275	225	112	777

Source: On-site monitoring by GEMS FAE & TM

* PCU conversion factor: HMV (Trucks and Bus) = 3, LMV (Car, Jeep and Auto) = 1 and 2/3 Wheelers = 0.5

TABLE 2.10: ROUGH STONE HOURLY TRANSPORTATION REQUIREMENT

Transportation of Rough Stone and Gravel per day			
Capacity of trucks	**No Trips per day Cumulatively from the proposed projects**	**Volume in PCU**	**PCU Per hour considering 8 HOURS**
20 tonnes	68	204	26

Source: Data analysed from Approved Mining plan

TABLE 2.11: SUMMARY OF TRAFFIC VOLUME

Route	Existing Traffic volume in PCU	Incremental traffic due to the project	Total traffic volume	Hourly Capacity in PCU as per IRC – 1960 guidelines
Panchayat road Vadakkusilukanpatti-Melathattaparai	185	26	1193	1200
Major District road Ottapidaram-Thoothukudi	777	26	341	1500

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

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

2.6.4 Mineral Beneficiation and Processing

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

2.7 PROJECT REQUIREMENT

2.7.1 Water Source & Requirement

Detail of water requirements in KLD as given below:

TABLE 2.12 WATER REQUIREMENT FOR THE PROJECT

Proposal - 1		
***Purpose**	**Quantity**	**Source**
Dust Suppression	2.0 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Green Belt development	0.5 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Domestic purpose	0.5 KLD	Water Tankers
Total	**3.0 KLD per proposal**	
Proposal - 2		
***Purpose**	**Quantity**	**Source**
Dust Suppression	1.0 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Green Belt development	0.6 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Domestic purpose	0.4 KLD	Water Tankers
Total	**2.0 KLD per proposal**	

Source: Prefeasibility report

* Drinking water will be sourced from Approved Water Vendors

2.7.2 Power and Other Infrastructure Requirement

The project does not require power supply for the mining operations. The quarrying activity is proposed during day time only (General Shift 8 AM – 5 PM, Lunch Break 1 PM – 2 PM). Electricity for use in office and other internal infrastructure will be obtained from TNEB.

No workshops are proposed inside the project area hence there will not be any process effluent generation from the project area. Domestic effluent from the mine office will be discharged to septic tank and soak pit. There is no toxic effluent expected to generate in the form of solid, liquid or gaseous form hence there is no requirement of waste treatment plant.

2.7.3 Fuel Requirement

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

Average diesel consumption is around = 500 Liters of HSD / day per project

= Total of 1,000 Liters of HSD per day

2.7.4 Project Cost

TABLE 2.13 PROJECT COST OF PROPOSED PROJECTS

Project Name	**Project Cost**
P1	Rs 1,14,34,000/-
P2	Rs 29,84,000/-
Total	**Rs 1,44,18,000/-**

Source: Approved Mining Plan & Prefeasibility Report

2.8 EMPLOYMENT REQUIREMENT:

The skilled, competent qualified statutory persons will be engaged for quarrying operation, preference will be given to the local community. The proposed manpower deployment for P1 = 37, P2 = 19 total of 56 people will get employment due to these 2 proposed quarries in the cluster.

2.9 PROJECT IMPLEMENTATION SCHEDULE

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

TABLE 2.14 EXPECTED TIME SCHEDULE

Sl.No.	Particulars	Time Schedule (In Month)					Remarks if any
		1st	2nd	3rd	4th	5th	
1	Environmental Clearance						
2	Consent to Operate						Production Start Period
Time line may vary; subjected to rules and regulations /& other unforeseen circumstances							

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

3. DESCRIPTION OF ENVIRONMENT

3.0 GENERAL

This chapter presents a regional background to the baseline data at the very onset, which will help in better appreciation of micro-level field data, generated on several environmental and ecological attributes of the study area. The baseline status of the project environment is described section wise for better understanding of the broad-spectrum conditions. The baseline environment quality represents the background environmental scenario of various environmental components such as Land, Water, Air, Noise, Biological and Socio-economic status of the study area. Field monitoring studies to evaluate the base line status of the project site were carried out covering Oct - Dec, 2022 with CPCB guidelines. Environmental data has been collected with reference to cluster quarries by Chennai Mettex Lab Private Limited, for the below attributes –

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

Study Area

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

Study Period

The baseline study was conducted during the Pre-monsoon season i.e. Oct - Dec, 2022

Study Methodology

- The project area was surveyed in detail with the help of Total Station and the boundary pillars were picked up with the help of GPS. The boundary coordinates were superimposed on the satellite imagery to understand the relief of the area, besides Land use pattern of the area was studied through the Bhuvan (ISRO)
- Soil samples were collected and analysed for relevant physio-chemical characteristics, exchangeable Cations, nutrients & micro nutrients etc., in order to assess the impact due to mining activities and to recommend saplings for Greenbelt development
- Ground water samples were collected during the study period from the existing borewells, while surface water was collected from ponds in the buffer zone. The samples were analysed for parameters necessary to determine water quality (based on IS: 10500:2012 criteria) and those which are relevant from the point of view of environmental impact of the proposed mines
- A onsite meteorological station was setup in cluster area, to collect data about wind speed, wind direction, temperature, relative humidity, rainfall and general weather conditions were recorded throughout the study period
- In order to assess the Ambient Air Quality (AAQ), samples of ambient air were collected by installation of Respiratory Dust Samplers (RDS) for Fugitive dust, 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
- The Noise level measurements were also made at various locations in different intervals of time with the help of sound level meter to establish the baseline noise levels in the impact zone

- Baseline biological studies were carried out to assess the ecology of the study area to study the existing flora and fauna pattern of the area
- Socio-Economic survey was conducted at village and household level in the study area to understand the present socio-economic conditions and assess the extent of impact due to the proposed mining project

The sampling methodologies for the various environmental parameters required for the study, frequency of sampling, method of samples analysis, etc., are given below Table 3.1.

TABLE 3.1: MONITORING ATTRIBUTES AND FREQUENCY OF MONITORING

Attribute	Parameters	Frequency of Monitoring	No. of Locations	Protocol
Land-use Land cover	Land-use Pattern within 10 km radius of the study area	Data from census handbook 2011 and from the satellite imagery	Study Area	Satellite Imagery Primary Survey
*Soil	Physio-Chemical Characteristics	Once during the study period	6 (2 core & 4 buffer zone)	IS 2720 Agriculture Handbook - Indian Council of Agriculture Research, New Delhi
*Water Quality	Physical, Chemical and Bacteriological Parameters	Once during the study period	6 (2 surface water & 4 ground water)	IS 10500& CPCB Standards
Meteorology	Wind Speed Wind Direction Temperature Cloud cover Dry bulb temperature Rainfall	1 Hourly Continuous Mechanical/Automatic Weather Station	1	Site specific primary data & Secondary Data from IMD Station
*Ambient Air Quality	PM10 PM2.5 SO2 NOX Fugitive Dust	24 hourly twice a week (March – May 2021)	8 (2 core & 6 buffer)	IS 5182 Part 1-23 National Ambient Air Quality Standards, CPCB
*Noise Levels	Ambient Noise	Hourly observation for 24 Hours per location	8 (2 core & 6 buffer zone)	IS 9989 As per CPCB Guidelines
Ecology	Existing Flora and Fauna	Through field visit during the study period	Study Area	Primary Survey by Quadrate & Transect Study Secondary Data – Forest Working Plan
Socio Economic Aspects	Socio–Economic Characteristics, Population Statistics and Existing Infrastructure in the study area	Site Visit & Census Handbook, 2011	Study Area	Primary Survey, census handbook & need based assessments.

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

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

3.1 LAND ENVIRONMENT

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

3.1.1 Land Use/ Land Cover

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

TABLE 3.2: LAND USE / LAND COVER TABLE 10 KM RADIUS

S.No	Classification	Area_Ha	Area_%
BUILTUP			
1	Builtup Urban	1517.78	4.66
2	Builtup Rural	633.91	1.95
3	Mining	205.70	0.63
AGRICULTURAL LAND			
4	Crop Land	24827.31	76.26
5	Agricultural Land	906.74	2.79
6	Fallow Land	1718.40	5.28
BARREN/WASTELAND			
7	Scrub Land	993.93	3.05
8	Barren Rocky	80.40	0.25
WATERBODIES			
9	Waterbodies	1615.53	4.96
10	Coastal Wetland	57.68	0.18
Total		**32557.39**	**100**

Source: Survey of India Toposheet and Landsat Satellite Imagery

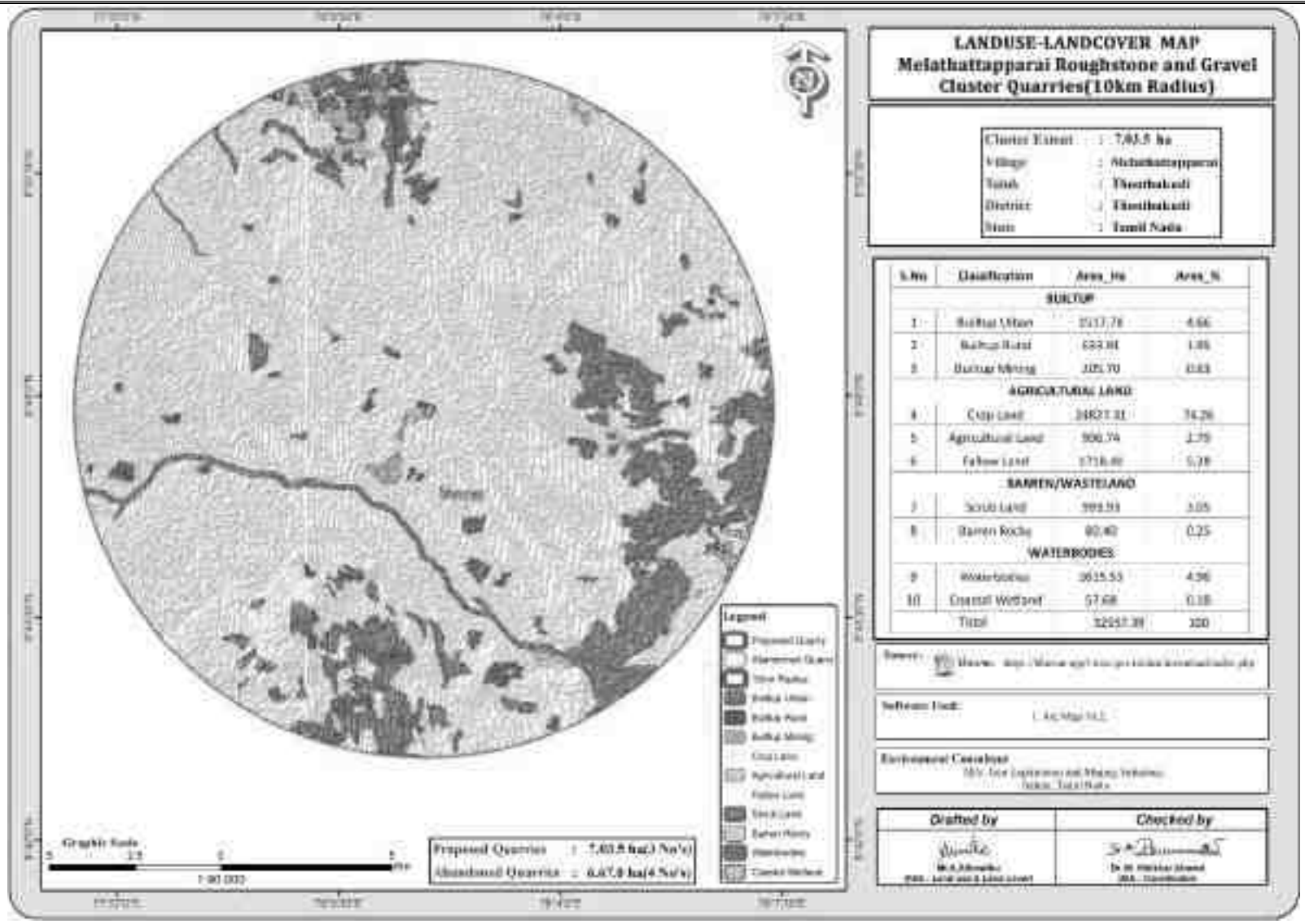
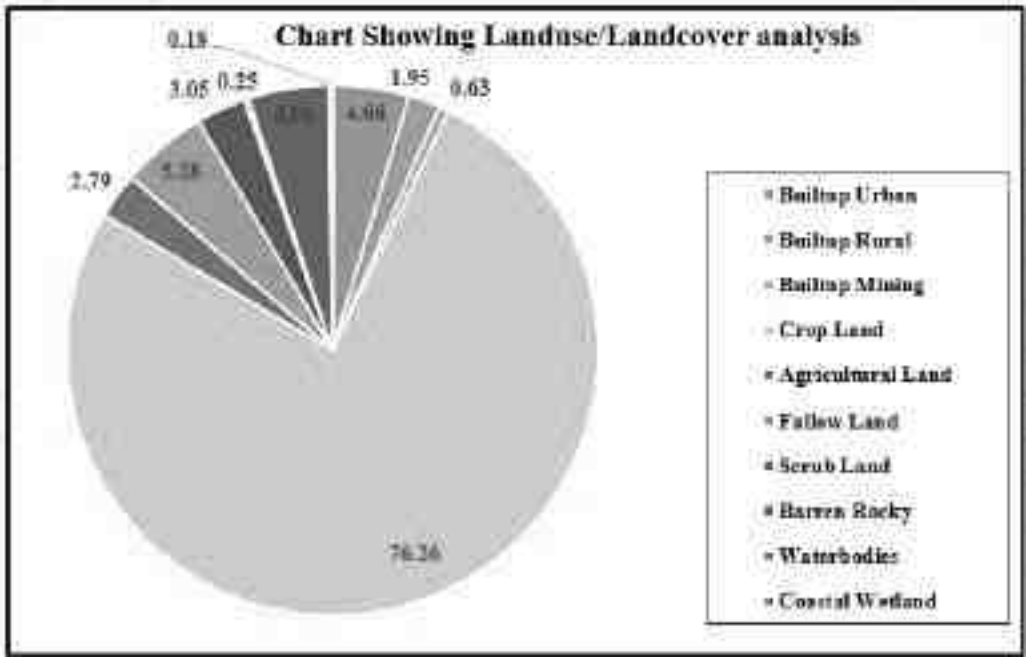


FIGURE 3.1: LAND USE LAND COVER MAP 10KM RADIUS

FIGURE 3.2: PIE DIAGRAM OF LAND USE AND LAND COVER IN STUDY AREA



Source: Table 3.2

LU/LC Interpretation:

- The 10 km radius study area mainly comprises of crop land & Agriculture Plantation land accounting of 76% & 2.79% of the total study area. The study area also consists of fallow land of 5.28%.
- The buffer zone studied has no ecological sensitive area (National Park, Wildlife Sanctuary, Biosphere Reserve/ etc.).
- Water Bodies such as ponds/ lakes comprises of 5% of the total buffer area. The two seasonal rivers such as Shanmuga river at 3 Km in SW direction, Odai 10m NW and Allikulam Lake at 5.5km SW direction of the total study area.
- The Scrub land accounts of 3.05%. As per the primary survey, it was observed the scrub land is mainly occupied by the stony waste and left-over domestic waste generated by the nearby areas.
- 0.63% of the total study area is occupied by the mine industries of captive mines. The area occupied by Mainly Roughstone and gravel of the total buffer area. As also observed within the primary survey, the 10 km buffer area is also occupied by the medium scaled granite and marble and small Brick kiln industries also located in the study area.
- 6.61% of the area is covered under the human Settlement. The nearest village within the 3 km radius from the project site boundary is observed to be villages Melathattapparai , Keela thattapparai, Chettyar etc.,

3.1.2 Topography

The project area is almost plain terrain with gentle gradient towards North maximum elevation of the area is 50m above AMSL. 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. There are no major rivers within the radius of 10km from the project site. The area is studded with few tanks that serve as the source of drinking water and also their surplus feeds adjoining tanks. The area is mostly dry in all seasons except rainy seasons.

The general drainage pattern of the area is of sub dendritic and dendritic pattern. No prominent water course or nallah is inferred. During rainy season the surface runoff flows in N to S 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.

3.1.4 Seismic Sensitivity

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

3.1.5 Environmental Features in the Study Area

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

TABLE 3.3: DETAILS OF ENVIRONMENT SENSITIVITY AROUND THE CLUSTER

Sl.No	Sensitive Ecological Features	Name	Arial Distance in km from Cluster
1	National Park / Wild life Sanctuaries	None	Nil within 10 km Radius
2	Reserve Forest	None	Nil within 10KM Radius
3	Tiger Reserve/ Elephant Reserve/ Biosphere Reserve	None	Nil within 10KM Radius
4	Critically Polluted Areas	None	Nil within 10 km Radius
5	Mangroves	None	Nil within 10 km Radius
6	Mountains/Hills	None	Nil within 10 km Radius
7	Notified Archaeological Sites	None	Nil within 10 km Radius
8	Industries/ Thermal Power Plants	None	Nil within 10 km Radius
9	Defence Installation	None	Nil within 10 km Radius

Source: Survey of India Toposheet

TABLE 3.4: WATER BODIES WITHIN THE CLUSTER FROM RESPECTIVE PROPOSALS

FOR PROJECT – P1		
Sl.No.	**Water Bodies**	**Distance and direction**
1	Odai	50m NW
2	Madagiri Odai	1.8km SW
3	Shanmuga River	2.6km SW
4	Korampallam Tank	7.80km SW
5	Allikulam Lake	5.5km SW
FOR PROJECT – P2		
Sl.No.	**Water Bodies**	**Distance and direction**
1	Odai	10m NW
2	Madagiri Odai	1.7km SW
3	Shanmuga River	2.7km SW
4	Korampallam Tank	7.80km SW
5	Allikulam Lake	5.5km SW

Source: Village Cadastral Map and Field Survey

TABLE 3.5: LIST OF INDUSTRIES AROUND THE CLUSTER

Industries	Distance and Direction
SIPCOT Industrial complex	5.5 Km NE
Sri Sathya Technosoft India P Ltd	8.0 km SE

Small scale match industries is situated within the radius of 10km, No major factories, industries in the study area
Source: Satellite Imageries and Field Survey.

3.1.6 Soil Environment

Soil quality of the study area is one of the important components of the land environment. The composite soil samples were collected from the study area and analysed for different parameters. The locations of the monitoring sites are detailed in Table 3.6 and Figure 3.3.

The objective of the soil sampling is -

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

TABLE 3.6: SOIL SAMPLING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	S-1	Project Area	Core Zone	8°48'47.09"N 78° 1'50.04"E
2	S-2	Project Area	Core Zone	8°48'51.07"N 78° 1'49.26"E
3	S-3	Melathattaparai	720m West	8°48'49.61"N 78° 1'9.68"E
4	S-4	KP Thalavaipuaram	5.5km SW	8°47'53.06"N 77°58'32.01"E
5	S-5	Sendilampannai	4.5km SE	8°46'15.54"N 78° 3'11.02"E
6	S-6	S. Kailasapuram	4.8km NW	8°50'49.98"N 77°59'36.11"E

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

Methodology –

For studying soil quality, sampling locations were selected to assess the existing soil conditions in and around the project site representing various land use conditions. The samples were collected by auger boring into the soil up to 90-cm depth. Six (6) locations were selected for soil sampling on the basis of soil types, vegetative cover, industrial & residential activities including infrastructure facilities, which would accord an overall idea of the soil characteristics. The samples were analysed for physical and chemical characteristics. The samples were sent to laboratory for analysis. The samples were filled in Polythene bags, coded and sent to laboratory for analysis and the details of methodology in respect are given in below Table 3.5.

TABLE 3.7: 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 Chennai Mettext Laboratory Pvt Ltd in association with GEMS

Soil Testing Result –

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

FIGURE 3.3: SOIL SAMPLING LOCATIONS AROUND 10 KM RADIUS

Source:SOI,

FIGURE 3.4: SOIL MAP

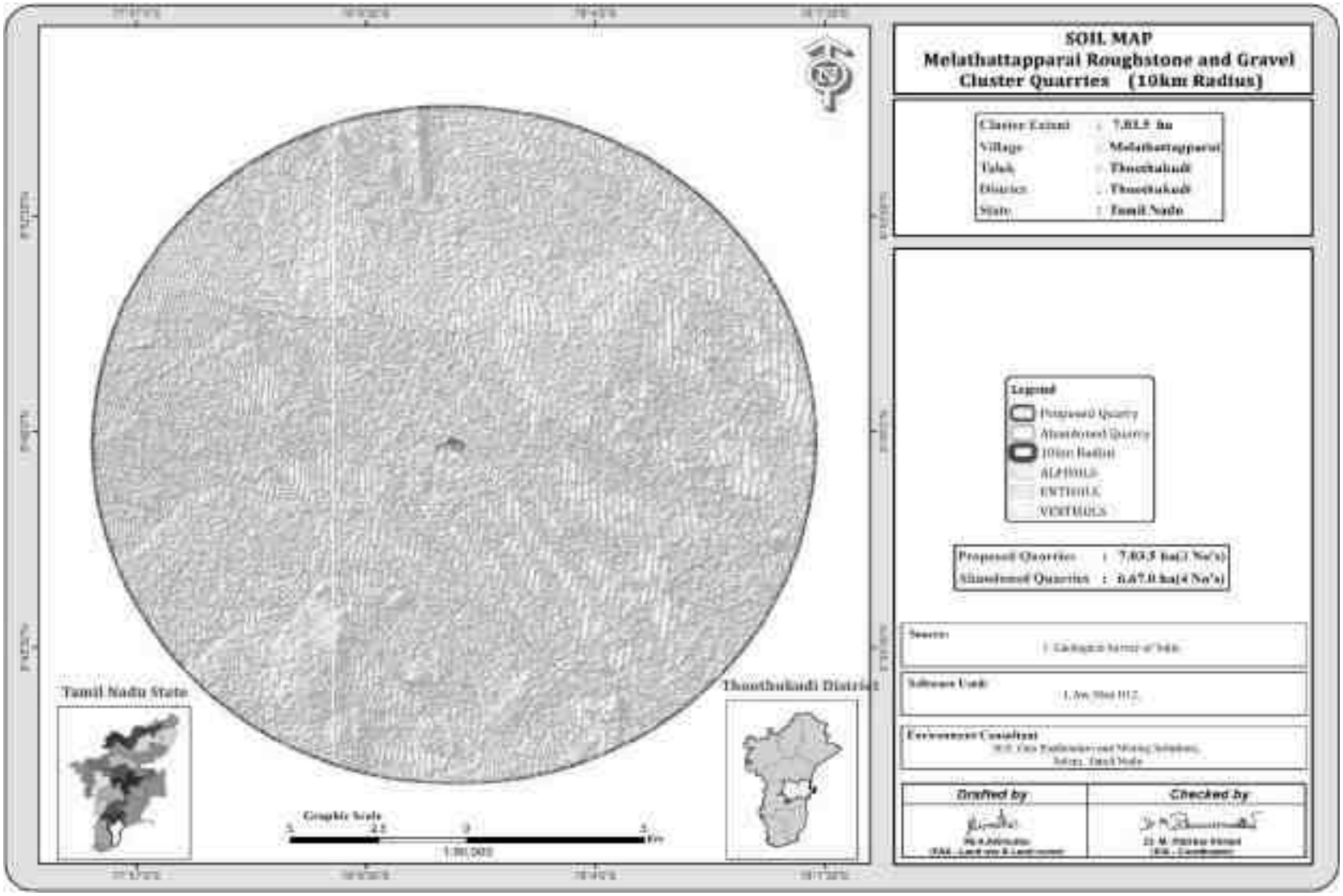


TABLE 3.8: SOIL QUALITY OF THE STUDY AREA

Sno	Test Parameters	Protocols	S1-core Zone	S2-core Zone	S3- Melathattaparai	S4- Thalavaipuaram	S5- Sendilampannai	S6- Kailasapuram
1	pH @ 25°C	IS 2720 Part 26 - 1987	8.44	8.55	8.73	8.59	8.37	8.97
2	Conductivity @ 25°C	IS 14767 - 2000 (Reaff : 2016)	520 µmhos/cm	624 µmhos/cm	658 µmhos/cm	600 µmhos/cm	672 µmhos/cm	650 µmhos/cm
3	Texture :							
	Clay	Gravimetric Method	38.1 %	34.8 %	36.8 %	30.8 %	35.1 %	32.7 %
	Sand		45.4 %	45.1 %	40.6 %	42.9 %	37.5 %	38.4 %
	Silt		16.5 %	20.1 %	22.6 %	26.3 %	27.4 %	28.9 %
4	Water Holding Capacity	By Gravimetric Method	47.6 %	46.7 %	48.0 %	43.2 %	48.7 %	43.8 %
5	Bulk Density	By Cylindrical Method	1.12 g/cm^3	1.18 g/cm^3	1.15 g/cm^3	1.14 g/cm^3	1.24 g/cm^3	1.12 g/cm^3
6	Porosity	By Gravimetric Method	42.3 %	36.2 %	43.5 %	39.3 %	40.5 %	38.6 %
7	Calcium as Ca	USEPA 3050 B – 1996 &	186 mg/kg	214 mg/kg	256 mg/kg	201 mg/kg	186.1 mg/kg	220 mg/kg
8	Magnesium as Mg	USEPA 6010 C - 2000	115.6 mg/kg	126.3 mg/kg	98.7 mg/kg	122 mg/kg	150 mg/kg	110 mg/kg
9	Manganese as Mn		24.1 mg/kg	22.4 mg/kg	16.2 mg/kg	18.3 mg/kg	21.3 mg/kg	20.6 mg/kg
10	Zinc as Zn		1.06 mg/kg	1.06 mg/kg	1.6 mg/kg	1.41 mg/kg	1.03 mg/kg	1.13 mg/kg
11	Boron as B		1.10 mg/kg	1.47 mg/kg	1.42 mg/kg	1.93 mg/kg	1.9 mg/kg	1.55 mg/kg
12	Chloride as Cl	APHA 23rd Edn 2019 4500 Cl B	145 mg/kg	208 mg/kg	170 mg/kg	177 mg/kg	194.5 mg/kg	170 mg/kg
13	Total Soluble Sulphate as SO_4	IS 2720 Part 27 : 1977 (Reaff:2015)	0.014 %	0.021 %	0.16 %	0.016 %	0.017 %	0.20 %
14	Potassium as K	USEPA 3050 B – 1996 & USEPA 6010 C - 2000	32.2 mg/kg	32.7 mg/kg	31.8 mg/kg	32.7 mg/kg	33.6 mg/kg	31.4 mg/kg
15	Total Phosphorus as P	IS 10158 : 1982 (Reaff: 2019)	1.50 mg/kg	1.45 mg/kg	1.26 mg/kg	1.22 mg/kg	1.58 mg/kg	1.16 mg/kg
16	Total Nitrogen as N	IS 14684 : 1999 (Reaff:2019)	210 mg/kg	274 mg/kg	188 mg/kg	243 mg/kg	166 mg/kg	255 mg/kg
17	Cadmium as Cd	USEPA 3050 B – 1996 &	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)
18	Total Chromium as Cr	USEPA 6010 C - 2000	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)
19	Copper as Cu		BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)
20	Lead as Pb		0.31 mg/kg	0.31 mg/kg	0.28 mg/kg	0.32 mg/kg	0.31 mg/kg	0.39 mg/kg
21	Iron as Fe		1.99 mg/kg	2.06 mg/kg	2.03 mg/kg	2.5 mg/kg	1.95 mg/kg	2.13 mg/kg
22	Organic Matter	IS : 2720 Part 22: 1972 (Reaff: 2015)	2.69 %	3.24 %	1.98 %	2.62 %	3.67 %	2.86 %
23	Organic Carbon	IS : 2720 Part 22: 1972 (Reaff: 2015)	1.56 %	1.88 %	1.15 %	1.52 %	2.13 %	1.66 %
24	Cation Exchange Capacity	USEPA 9080 – 1986	37.6 meq/100g of soil	35.6 meq/100g of soil	35.7 meq/100g of soil	40.5 meq/100g of soil	37.2 meq/100g of soil	36.2 meq/100g of soil

Source: Sampling Results by Chennai Mettex Lab Private Limited

Interpretation & Conclusion

Physical Characteristics –

The physical properties of the soil samples were examined for texture, bulk density, porosity and water holding capacity. The soil texture found in the study area is

Clay Loam Soil and Bulk Density of Soils in the study area varied between 1.12 – 1.24 g/cc. The Water Holding Capacity and Porosity of the soil samples is found to be medium i.e. ranging from 43.2 - 48.7 %. & 36.2 – 43.5 %

Chemical Characteristics –

- The nature of soil is slightly alkaline to strongly alkaline with pH range 8.37 to 8.97
- The available Nitrogen content range between 166to 274 kg/ha
- The available Phosphorus content range between 1.16 to 1.58 kg/ha
- The available Potassium range between 31.4 to 33.6 mg/kg

Whereas, the micronutrient as zinc (Zn), iron (Fe) and copper (Cu) were found in the range of 1.03 to 1.41 mg/kg; 1.95 to 2.5 mg/kg and ND

3.2 WATER ENVIRONMENT

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

3.2.1 Surface Water Resources:

There is no major river within 10km radius. The area is studded with few tanks that serve as the source of drinking water and also their surplus feeds adjoining tanks. The rainfall over the area is moderate, the rainwater storage in open wells and trenches are in practice over the area and the stored water acts as source of freshwater for couple of months after rainy season.

3.2.2 Ground Water Resources:

The terrain is underlain by hard rock formation. Fissured and fractured crystalline rocks constitute the important aquifer systems in the Thoothukudi region.

The district is underlain by both porous and fissured formations. The important aquifer systems in the district are constituted by i) unconsolidated & semi consolidated formations and ii) weathered and fractured crystalline rocks The porous formations in the district include sandstones and clays of Recent to subrecent and Tertiary age (Quaternary). The Recent formations comprising mainly sands, clays and gravels are confined to major drainage courses in the district.

The maximum thickness of alluvium is 45.0 m bgl, whereas the average thickness is about 25.0 m. Ground water occurs under water table and confined conditions in these formations and is being developed by means of dug wells and filter points. The productive zones are encountered in the depth range of 29.5 to 62 m bgl. Alluvium, which forms a good aquifer system along the Vaippar and Gundar river bed which is one of the major sources of water supply to the villages (source CGWB report 2009)

The study area falls in the Thoothukudi taluk which is categorized as semi critical block (70%-90%) as per G.O (MS) No 113 dated 09.06.2016. Ground water extraction is not proposed for projects in cluster.

TABLE 3.8 : DETAILS OF BORE WELL IN 1km RADIUS

Label	Latitude	Longitude	OCT	NOV	DEC
BW1	8° 48' 45.645"N	78° 01' 27.24"E	56.5	57.1	57.7
BW2	8° 49' 04.745"N	78° 01' 16.27"E	57	57.6	58.2
BW3	8° 49' 30.413"N	78° 01' 21.62"E	58	58.6	59.2
BW4	8° 48' 49.732"N	78° 02' 52.44"E	57.1	57.7	58.3
BW5	8° 48' 30.501"N	78° 02' 42.82"E	58.3	58.9	59.5
BW6	8° 48' 04.155"N	78° 01' 36.24"E	56.8	57.4	58
BW7	8° 48' 24.613"N	78° 01' 24.20"E	57.3	57.9	58.5

FIGURE 3.5:POST MONSOON WATER LEVEL OF BORE WELLS 1 KM RADIUS

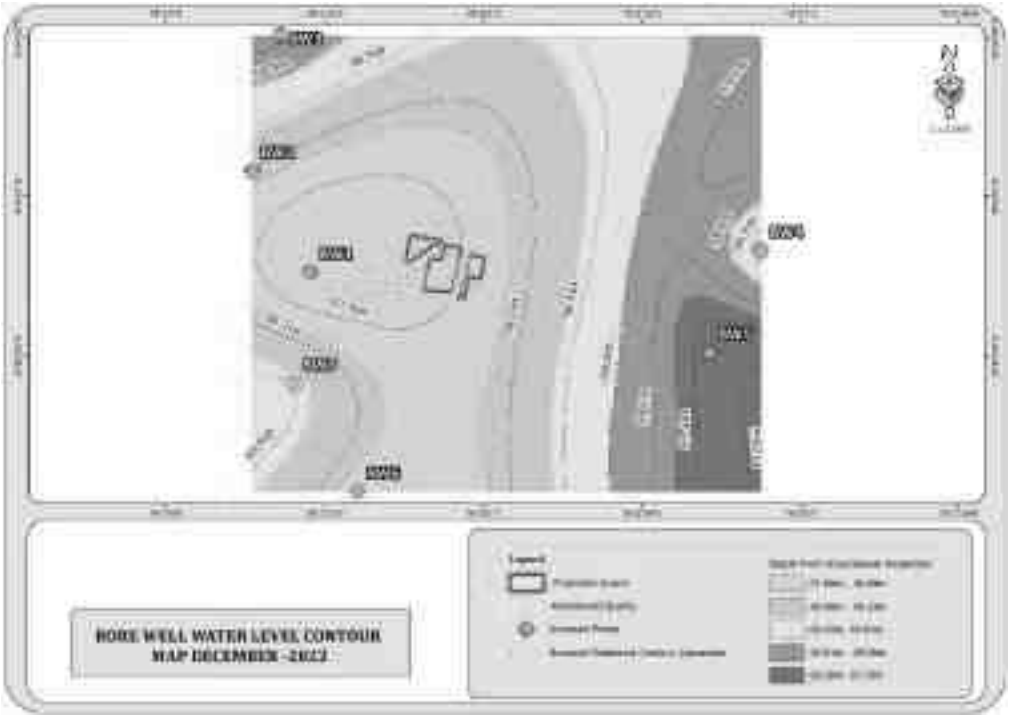
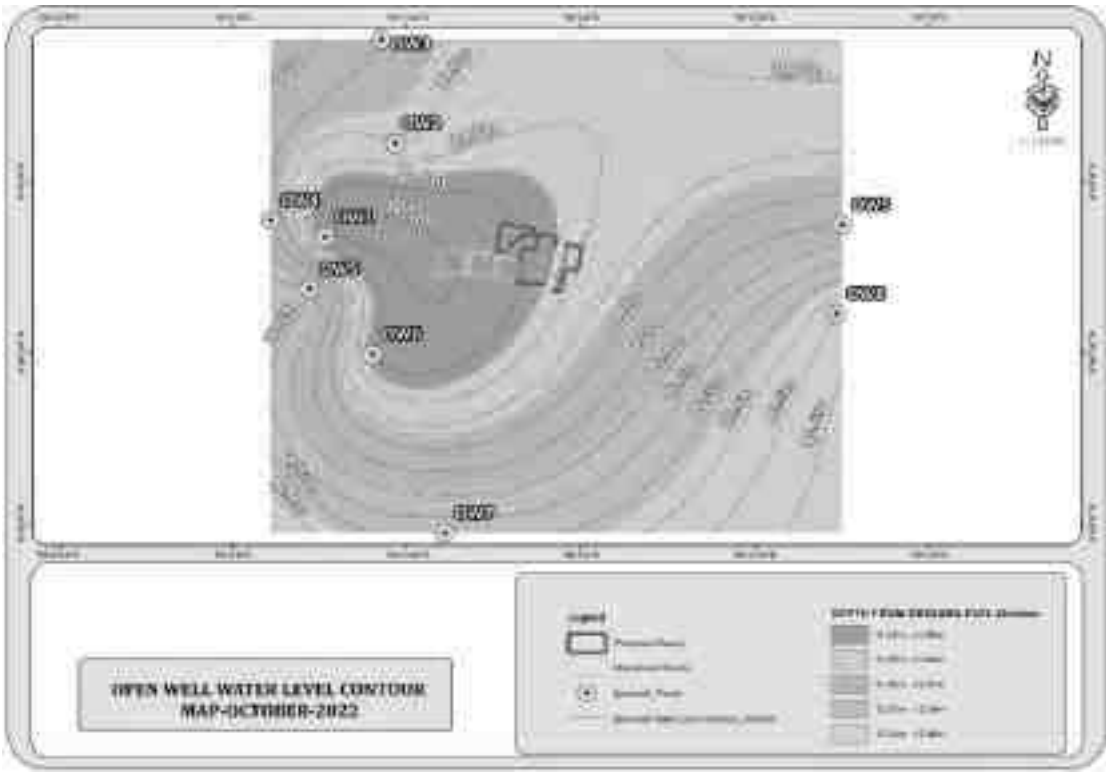
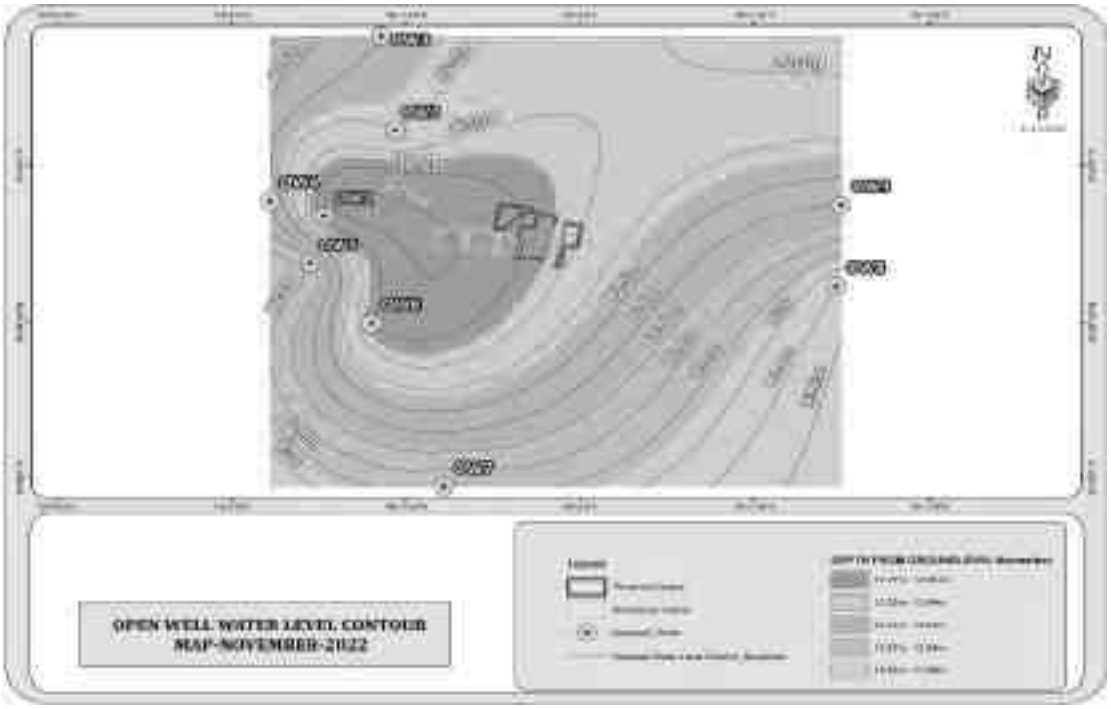


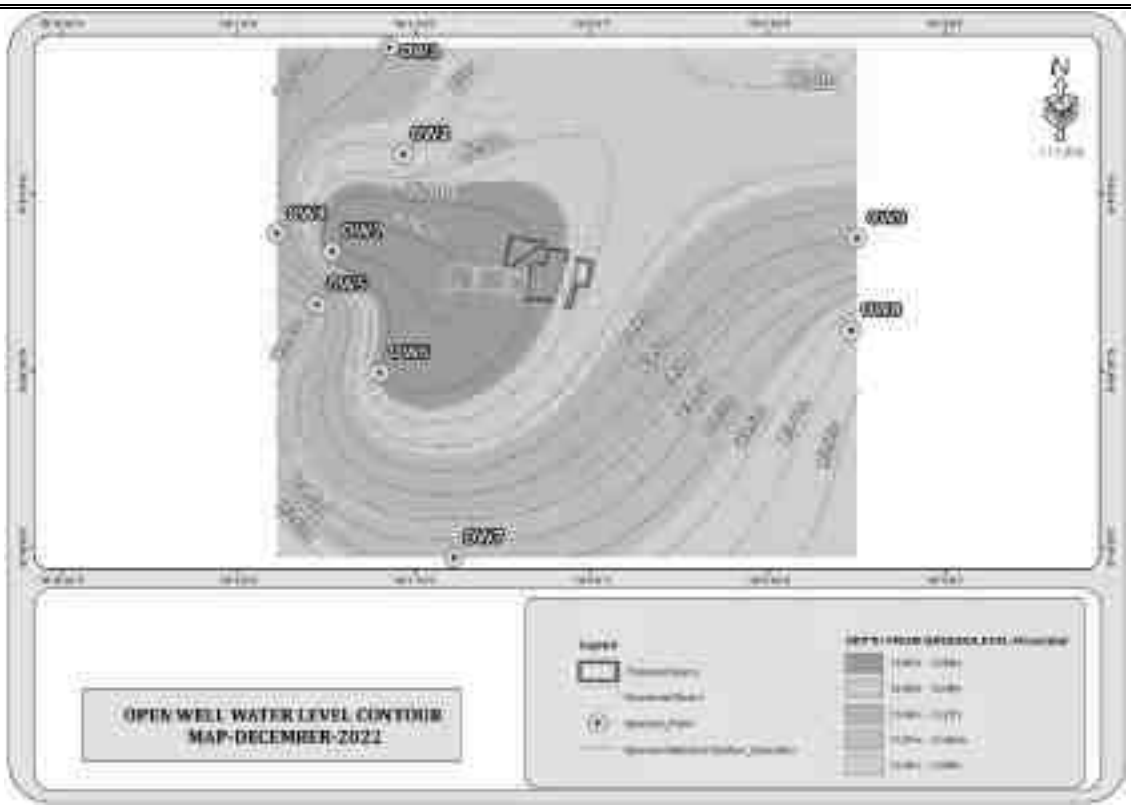
TABLE 3.9: DETAILS OF OPEN WELL IN 1KM RADIUS

S.No	Name	LATITUDE	LONGITUDE	OCT	NOV	DEC
1	OW1	8° 48' 50.238"N	78° 01' 15.96"E	11.5	12.1	12.7
2	OW2	8° 49' 06.757"N	78° 01' 28.05"E	11.8	12.4	13
3	OW3	8° 49' 24.917"N	78° 01' 25.65"E	11.9	12.5	13.1
4	OW4	8° 48' 53.253"N	78° 01' 06.58"E	12	12.6	13.2
5	OW5	8° 48' 41.209"N	78° 01' 13.32"E	12.2	12.8	13.4
6	OW6	8° 48' 29.685"N	78° 01' 24.07"E	11.6	12.2	12.8
7	OW7	8° 47' 58.271"N	78° 01' 36.58"E	12.3	12.9	13.5
8	OW8	8° 48' 36.820"N	78° 02' 44.04"E	12.5	13.1	13.7
9	OW9	8° 48' 52.437"N	78° 02' 44.97"E	12	12.6	13.2

FIGURE 3.6: POST MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS







3.2.3Methodology

Reconnaissance survey was undertaken and monitoring locations were finalized based on;

- Drainage pattern;
- Location of Residential areas representing different activities/likely impact areas; and
- Likely areas, which can represent baseline conditions

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

TABLE 3.9: WATER SAMPLING LOCATIONS

S. No	Location code	Monitoring Locations	Distance & Direction	Coordinates
1	**SW-1**	Project Area (Pit Water)	Core Zone	8°48'43.95"N 78° 1'52.15"E
2	**SW-2**	Tank Near Umarikottai	4.2km NW	8°49'33.43"N 77°59'17.44"E
3	**WW-1**	Melathattaparai	400m West	8°48'50.29"N 78° 1'15.98"E
4	**WW-2**	Therku Veerapandiyapuram	3.7km NE	8°49'44.04"N 78° 4'3.69"E
5	**BW-1**	Keela Thattaparai	900m South	8°47'57.22"N 78° 1'39.85"E
6	**BW-2**	Sendilampannai	4.5km SE	8°46'13.56"N 78° 3'8.08"E

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

FIGURE 3.7: SITE PHOTOGRAPHS OF WATER SAMPLING LOCATIONS

Source:Fieldsurvey

TABLE 3.10: SURFACE WATER SAMPLING RESULTS

SNO	TEST	PROTOCOL	Surface Water (SW-1) - Project Area (Pit Water) – Core Zone	Surface Water (SW-2) – Tank Near Umarikottai
1	Colour	IS 3025 Part 4:1983 (Reaff:2017)	10 Hazen	5 Hazen
2	Odour	IS 3025 Part 5:2018	Agreeable	Agreeable
3	pH at 25°C	IS 3025 Part 11:1983 (Reaff:2017)	7.28	7.68
4	Conductivity @ 25°C	IS 3025 Part 14:2013 (Reaff:2019)	883µmhos/cm	923 µmhos/cm
5	Turbidity	IS 3025 Part 10:1984 (Reaff:2017)	2.3 NTU	2.7 NTU
6	Total Dissolved Solids	IS 3025 Part 16:1984 (Reaff:2017)	520mg/l	544 mg/l
7	Total Hardness as $CaCO_3$	IS 3025 Part 21:2009 (Reaff:2019)	164.9mg/l	193.8 mg/l
8	Calcium as Ca	IS 3025 Part 40:1991 (Reaff:2019)	37.1 mg/l	40.6 mg/l
9	Magnesium as Mg	IS 3025 Part 46:1994 (Reaff:2019)	17.6 mg/l	22.5 mg/l
10	Total Alkalinity as $CaCO_3$	IS 3025 Part 23:1986 (Reaff:2019)	211 mg/l	194 mg/l
11	Chloride as Cl	IS 3025 Part 32:1988 (Reaff:2019)	120.3 mg/l	124.6 mg/l
12	Sulphate as SO_4	IS 3025 Part 24:1986 (Reaff:2019)	51.6 mg/l	48.3 mg/l
13	Iron as Fe	IS 3025 Part 53:2003 (Reaff:2019)	0.19 mg/l	0.15 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	0.33 mg/l	0.35 mg/l
16	Nitrate as NO_3	IS 3025 Part 34:1988 (Reaff:2019)	12.7 mg/l	9.4 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)
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)	4.7 mg/l	5.1
32	Chemical Oxygen Demand	IS 3025 Part 58:2006 (Reaff:2017)	20 mg/l	24 mg/l
33	Dissolved Oxygen	IS 3025 Part 38:1989 (Reaff:2019)	5.6 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)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 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)	21.6 mg/l	20.8 mg/l
40	**Total Coliform**	**APHA 23rd Edn. 2017:9221B**	1800 MPN/100ml	1600 MPN/100ml
41	***Escherichia coli***	**APHA 23rd Edn. 2017:9221F**	155 MPN/100ml	170 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

TABLE 3.11: GROUND WATER SAMPLING RESULTS

Sno	Test	Protocol	Ground Water (WW-1) – Melathattaparai	Ground Water (WW-2) – TherkuVeerapandiyapuram	Ground Water (BW1) Keela Thattaparai	Ground Water (BW-2) – Sendilampannai
1	Colour	IS 3025 Part 4:1983 (Reaff:2017)	Less than 5 Hazen	5 Hazen	4 Hazen	5 Hazen
2	Odour	IS 3025 Part 5:2018	Agreeable	Agreeable	Agreeable	Agreeable
3	pH at 25°C	IS 3025 Part 11:1983 (Reaff:2017)	7.42	7.19	7.80	7.67
4	Conductivity @ 25°C	IS 3025 Part 14:2013 (Reaff:2019)	920 µmhos/cm	933 µmhos/cm	968 µmhos/cm	1019 µmhos/cm
5	Turbidity	IS 3025 Part 10:1984 (Reaff:2017)	1.1 NTU	1.2 NTU	2.6 NTU	2.9 NTU
6	Total Dissolved Solids	IS 3025 Part 16:1984 (Reaff:2017)	542 mg/l	550 mg/l	571 mg/l	601 mg/l
7	Total Hardness as $CaCO_3$	IS 3025 Part 21:2009 (Reaff:2019)	157.89 mg/l	172.4 mg/l	206.7 mg/l	195.56 mg/l
8	Calcium as Ca	IS 3025 Part 40:1991 (Reaff:2019)	32.8 mg/l	35.5 mg/l	45.3 mg/l	35.7 mg/l
9	Magnesium as Mg	IS 3025 Part 46:1994 (Reaff:2019)	18.5 mg/l	20.4 mg/l	22.8 mg/l	25.9 mg/l
10	Total Alkalinity as $CaCO_3$	IS 3025 Part 23:1986 (Reaff:2019)	172.6 mg/l	225 mg/l	180 mg/l	202 mg/l
11	Chloride as Cl	IS 3025 Part 32:1988 (Reaff:2019)	168 mg/l	125.7 mg/l	137 mg/l	178 mg/l
12	Sulphate as SO_4	IS 3025 Part 24:1986 (Reaff:2019)	50.3 mg/l	48.1 mg/l	54.6 mg/l	60.7 mg/l
13	Iron as Fe	IS 3025 Part 53:2003 (Reaff:2019)	0.21 mg/l	0.27 mg/l	0.37 mg/l	0.23 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	0.42 mg/l	0.25 mg/l	0.51 mg/l	0.21 mg/l
16	Nitrate as NO_3	IS 3025 Part 34:1988 (Reaff:2019)	11.9 mg/l	11.5 mg/l	12.7 mg/l	14.4 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:0.05 mg/l)	BDL(DL:0.05 mg/l)	BDL(DL:0.05 mg/l)
31	Ammonia (as total ammonia-N)	IS 3025 Part 44:1993 (Reaff:2019)	BDL(DL:0.05 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
32	Sulphide as H_2S	IS 3025 Part 58:2006 (Reaff:2017)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
33	Molybdenum as Mo	IS 3025 Part 38:1989 (Reaff:2019)	BDL (DL:0.01 mg/l)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)
34	Total Arsenic as As	IS 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
35	Total Suspended Solids	IS 3025 Part 17 -1984 (Reaff:2017)	BDL (DL:0.005 mg/l)	BDL (DL:1.0 mg/l)	BDL (DL:1.0 mg/l)	BDL (DL:1.0 mg/l)
36	**Total Coliform**	APHA 23rd Edn. 2017:9221B	210 MPN/100ml	110 MPN/100ml	190 MPN/100ml	320 MPN/100ml
37	***Escherichia coli***	APHA 23rd Edn. 2017:9221F	< 1.8 MPN/100ml	< 1.8 MPN/100ml	< 1.8 MPN/100ml	< 1.8 MPN/100ml

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

IS: 10500:2012-Drinking Water Standards; # within the permissible limit as per the WHO Standard. The water can be used for drinking purpose in the absence of alternate sources. Note: SW- Surface water, GW – Ground water

3.2.4 Interpretation & Conclusion

Surface Water

Ph:

The pH varied from 7.28 to 7.68 while turbidity found within the standards (Optimal pH range for sustainable aquatic life is 6.5 to 8.5 pH).

Total Dissolved Solids:

Total Dissolved Solids varied from 520 to 544 mg/l, the TDS mainly composed of carbonates, bicarbonates, Chlorides, phospates and nitrates of calcium, magnesium, sodium and other organic matter.

Other parameters:

Chloride varied between 120.3 mg/l and 124.6 mg/l. Nitrates varied from 9.4 to 12.7 mg/l, while sulphates varied from 48.3 mg/l and 51.6 mg/l.

Ground Water

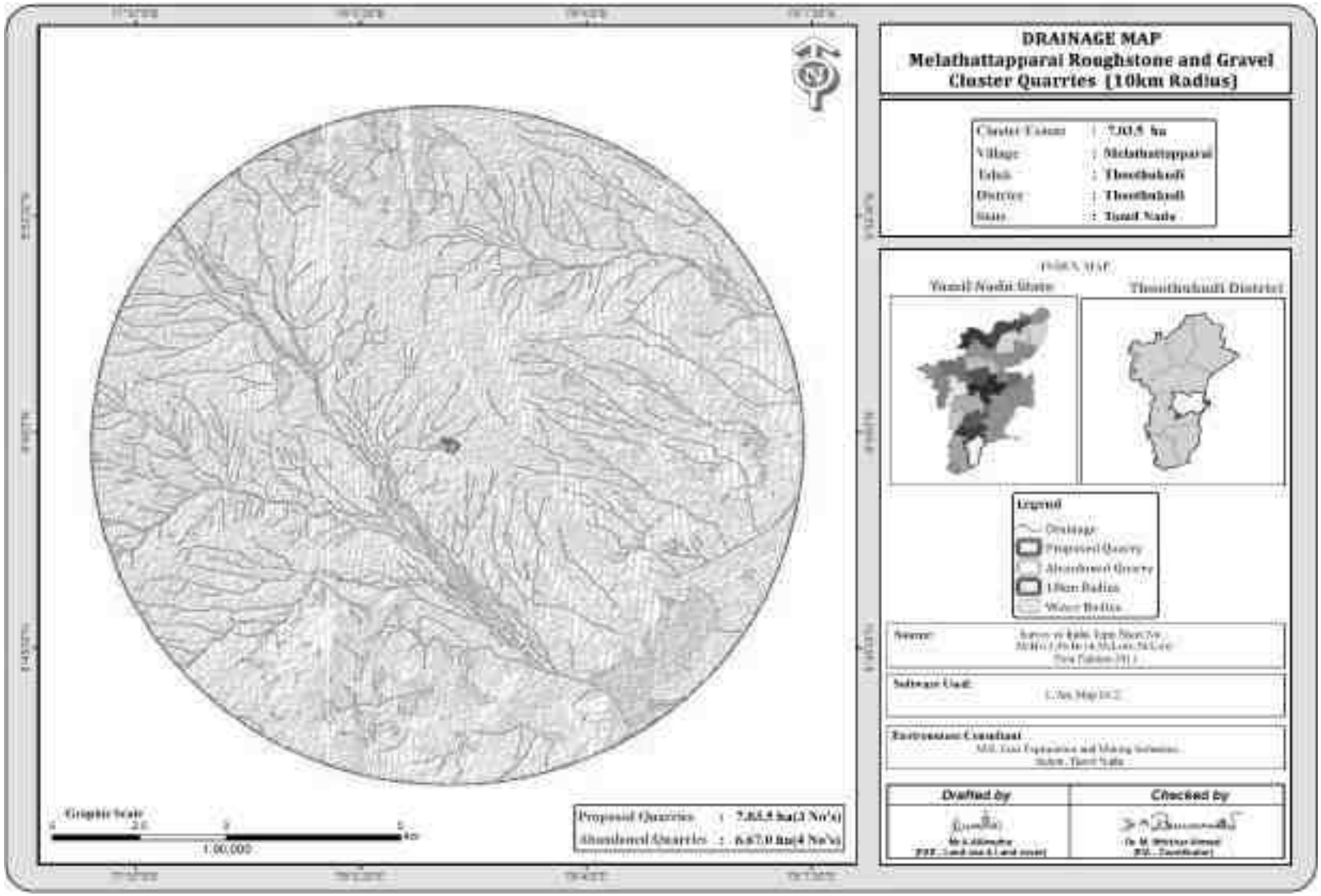
The pH of the water samples collected ranged from 7.19 to 7.80 and within the acceptable limit of 6.5 to 8.5. pH, Sulphates and Chlorides of water samples from all the sources are within the limits as per the Standard. On Turbidity, the water samples meet the requirement. The Total Dissolved Solids were found in the range of 542-601 mg/l in all samples. The Total hardness varied between 157.89- 206.7 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 50 -55m. The maximum depth proposed out of proposed projects is 37 m bgl. Hence there is no possibilities of water table intersection during the entire mine life period besides it is also inferred topographically that there are no major water bodies intersecting the project area. There is no necessity of stream, channel diversion due to these proposed projects.

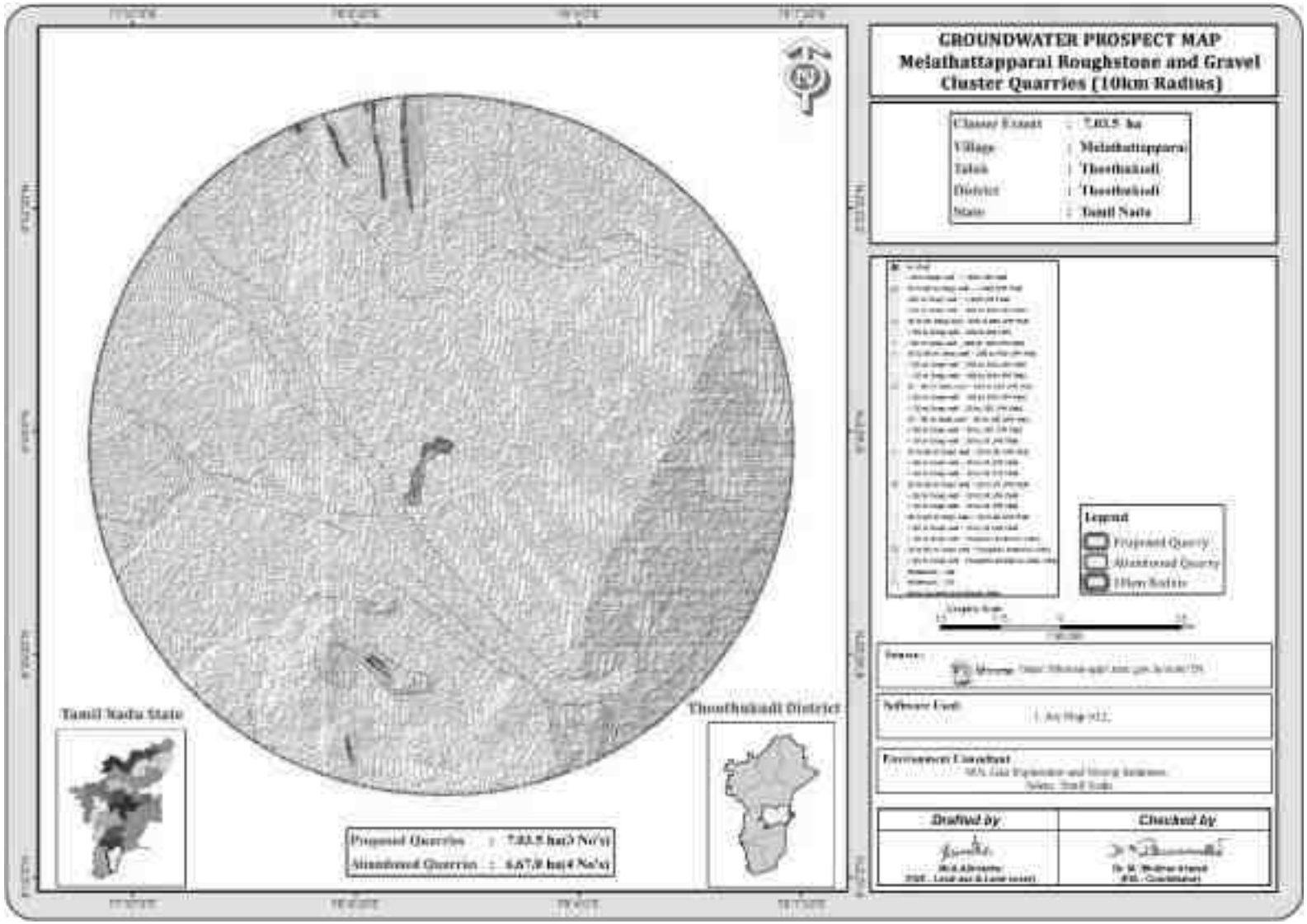
During the rainy season there is a possibility of collection of seepage water from the subsurface levels this is due to the high intensity of fracture and weathered portion upto a depth of 10m thus the collected seepage water will be stored in the mine sump pits and will be used for dust suppression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

FIGURE 3.8: DRAINAGE MAP AROUND 10 KM RADIUS FROM PROJECT SITE



Source:Bhuvan, NRSC

FIGURE 3.9: GROUND WATER PROSPECT MAP



Source:Bhuvan

3.3 AIR ENVIRONMENT

The existing ambient air quality of the area is important for evaluating the impact of mining activities on the ambient air quality.

The baseline studies on air environment include identification of specific air pollution parameters and their existing levels in ambient air. The ambient air quality with respect to the study zone of 10 km radius around the cluster forms the baseline information. The sources of air pollution in the region are mostly due to vehicular traffic, dust arising from unpaved village road and domestic & agricultural activities. The prime objective of the baseline air quality study was to establish the existing ambient air quality of the study area. These will also be useful for assessing the conformity to standards of the ambient air quality during the operation of proposed projects in cluster.

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

3.3.1 Meteorology & Climate

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

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

Climate –

- ✓ Tuticorin lies on 8m above sea level. The climate is tropical in Tuticorin. The Summers are much rainier than the winter. This climate is considered to be Aw according to the Köppen-Geiger climate classification.
- ✓ The average annual temperature is 27.9°C | 82.3 °F.
- ✓ The precipitation here is around 818 mm | 32.2 inch per year.
- ✓ The driest month is July, with 5 mm | 0.2 inch. The greatest amount of precipitation occurs in November, with an average of 270 mm | 10.6 inch.
- ✓ The warmest month of the year is May, with an average temperature of 30.1°C | 86.2°F.
- ✓ The lowest average temperatures in the year occur in January, when it is around 25.6°C | 78.0°F.
- ✓ The difference in precipitation between the driest month and the wettest month is 265 mm | 10inch. The variation in temperatures throughout the year is 4.6°C | 8.2°F.

Source: **https://en.climate-data.org/asia/india/tamil-nadu/tuticorin-2785/**

Rainfall –

TABLE 3.11: RAINFALL DATA

Actual Rainfall in mm						Normal Rainfall in mm
2013	2014	2015	2016	2017	2018	
410.8	825.20	876.90	230.4	514.6	561.6	656.3

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

TABLE 3.12: METEOROLOGICAL DATA RECORDED AT SITE

S.No	Parameters		Oct–2022	Nov–2022	Dec–2022
1	Temperature (^{0}C)	Max	28.95	26.87	26.5
		Min	26.42	24.37	24.22
		Avg	27.68	25.62	25.36
2	Relative Humidity (%)	Avg	80.03	83.03	84.40
3	Wind Speed (m/s)	Max	6.29	4.16	4.99
		Min	1.79	1.12	1.95
		Avg	4.04	2.64	3.47
4	Cloud Cover (OKTAS)		0-8	0-8	0-8
5	Wind Direction		SW,W	NE,NNE	NE,NNE

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

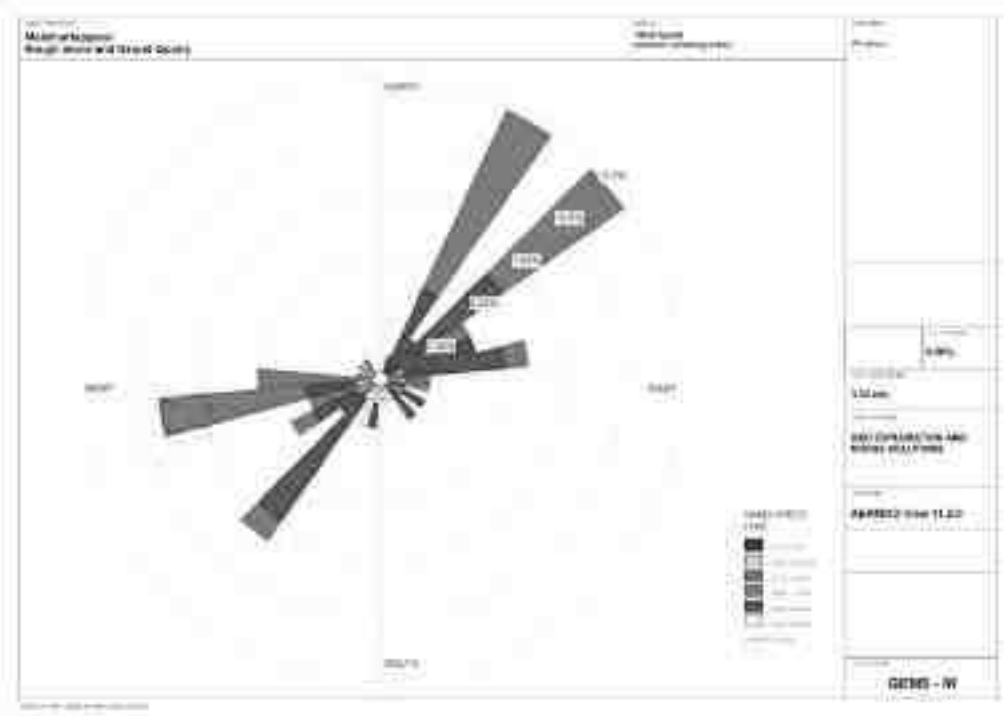
Correlation between Secondary and Primary Data

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

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

Windrose diagram of the study site is depicted in Figure. 3.15. Predominant downwind direction of the area during study season is South-East to North West.

FIGURE 3.10: WIND ROSE DIAGRAM



Source: Wind Rose plot view, Lake Environmental Software

In the abstract of collected data wind rose were drawn on presented in figure No.3.7A during the monitoring period in the study area

1. Predominant winds were from SW, W, NE, NNE,
2. Wind velocity readings were recorded between 0.50 to 8.80 m/s
3. Calm conditions prevail of about 13.4% of the monitoring period
4. Temperature readings ranging from 24.22 to 28.95 °C
5. Relative humidity ranging from 80.3 to 84.40%
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 3.13: METHODOLOGY AND INSTRUMENT USED FOR AIR QUALITY ANALYSIS

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

Source: Sampling Methodology followed by Chennai Mettex Lab Private Limited in association with GEMS & CPCB Notification

TABLE 3.14: 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/m3)	Annual Avg.*	50.0	20.0
		24 hours**	80.0	80.0
2	Nitrogen Dioxide (µg/m3)	Annual Avg.	40.0	30.0
		24 hours	80.0	80.0
3	Particulate matter (size less than 10µm) PM10 (µg/m3)	Annual Avg.	60.0	60.0
		24 hours	100.0	100.0
4	Particulate matter (size less than 2.5 µm PM2.5 (µg/m3)	Annual Avg.	40.0	40.0
		24 hours	60.0	60.0

Source: NAAQS CPCB Notification No. B-29016/20/90/PCI-I Dated: 18th Nov 2009
*Annual Arithmetic mean of minimum 104 measurements in a year taken twice a Week 24 hourly at uniform interval,
** 24 hourly / 8 hourly or 1 hourly monitored values as applicable shall be complied with 98 % of the time in a year. However, 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

3.3.4 Frequency & Parameters for Sampling

Ambient air quality monitoring has been carried out with a frequency of two samples per week at Eight (8) locations, adopting a continuous 24 hourly (3 shift of 8-hour) schedule for the period March to May, 2021. The baseline data of ambient air has been generated for PM_{10}, $PM_{2.5}$, Sulphur Dioxide (SO_2) & Nitrogen Dioxide (NO_2) Monitoring has been carried out as per the CPCB, MoEF guidelines and notifications.

It was ensured that the equipment was placed preferably at a height of at least 3 ± 0.5m above the ground level at each monitoring station, for negating the effects of wind-blown ground dust. The equipment was placed at

open space free from trees and vegetation which otherwise act as a sink of pollutants resulting in lower levels in monitoring results.

3.3.5 Ambient Air Quality Monitoring Stations

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

TABLE 3.15: AMBIENT AIR QUALITY (AAQ) MONITORING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	AAQ1	Project Area	Core Zone	8°48'47.64"N 78° 1'50.13"E
2	AAQ2	Project Area	Core Zone	8°48'48.28"N 78° 1'46.49"E
3	AAQ3	Melathattaparai	720m West	8°48'51.37"N 78° 1'5.35"E
4	AAQ4	Keela Thattaparai	970m South	8°47'52.98"N 78° 1'45.55"E
5	AAQ5	Therku Veerapandiyapuram	3.4km NE	8°49'35.57"N 78° 3'56.16"E
6	AAQ6	KP Thalavaipuaram	5.5km SW	8°47'53.58"N 77°58'30.79"E
7	AAQ7	Sendilampannai	4.5km SE	8°46'14.63"N 78° 3'11.19"E
8	AAQ8	S. Kailasapuram	4.8km NW	8°50'50.11"N 77°59'35.65"E

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

FIGURE 3.11: SITE PHOTOGRAPHS OF AMBIENT AIR QUALITY MONITORING

P1-Ananthakumar

P2-Ananthammal

FIGURE 3.12: AMBIENT AIR QUALITY LOCATIONS AROUND 10 KM RADIUS

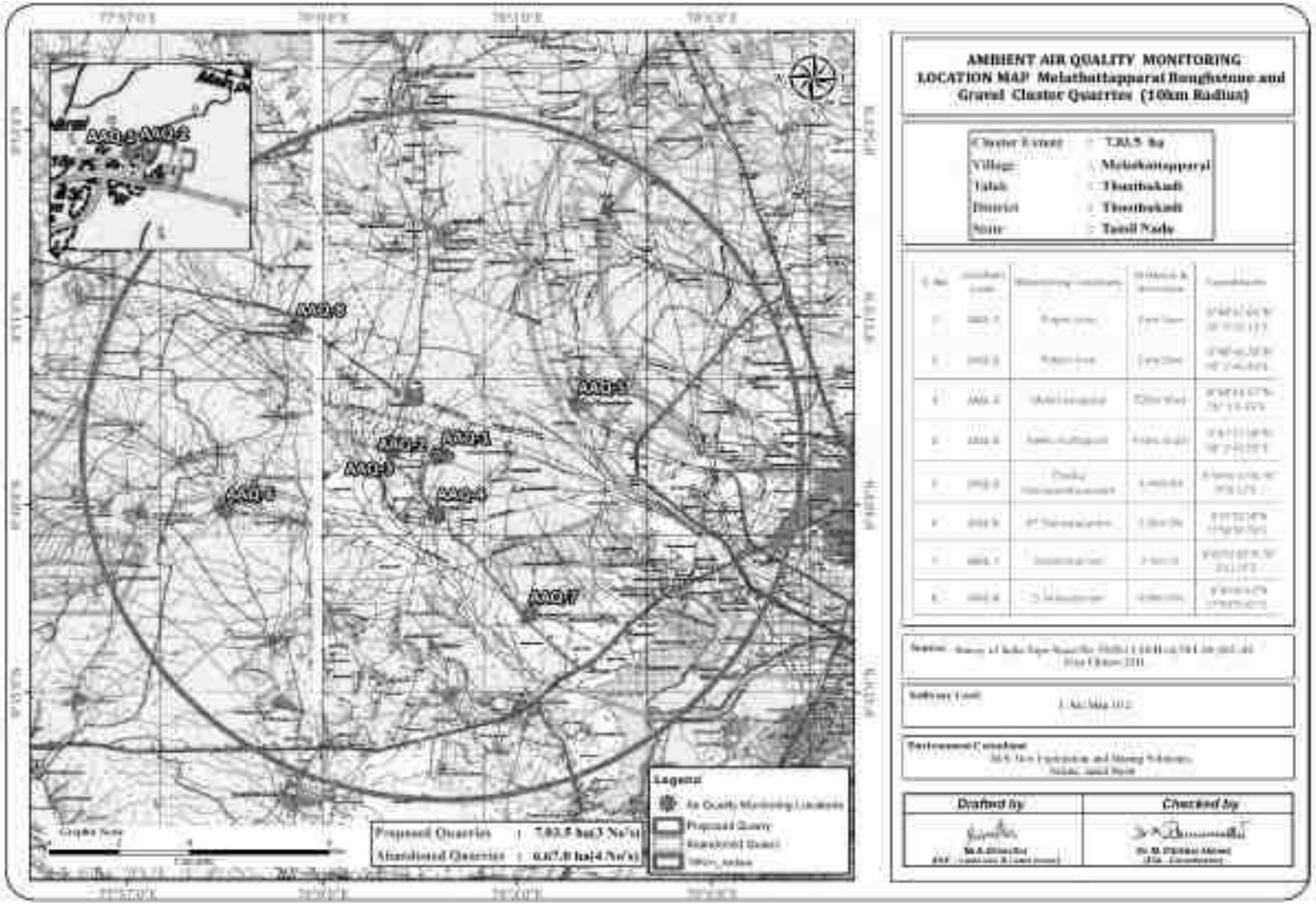


TABLE 3.16 AAQ1- PROJECT AREA

Period:Oct – Dec-2022 *Location: AAQ1- Project Area* 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
05.10.2022	7:00-7:00	57.4	41.6	19.5	6.3	19.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.10.2022	7:15-7:15	55.1	42	18.2	6.7	21.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.10.2022	7:00-7:00	60	40.7	20.4	7.4	22	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.10.2022	7:15-7:15	59.7	40.2	21	8	20.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.10.2022	7:00-7:00	58.2	41.6	19.7	7.6	19.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.10.2022	7:15-7:15	56.9	42	20.3	6.9	19.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.10.2022	7:00-7:00	59.2	40.8	18.6	6.3	21.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.10.2022	7:15-7:15	58.7	40.2	18.2	7.5	22	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.11.2022	7:00-7:00	55.3	41.6	19.7	8	21.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.11.2022	7:15-7:15	57.5	40.7	21	7.7	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.11.2022	7:00-7:00	59.2	41.5	20.5	6.3	19.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.11.2022	7:15-7:15	57.6	41.3	18.3	6.9	19.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.11.2022	7:00-7:00	60.3	42	19.8	7.6	20.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.11.2022	7:15-7:15	57.2	40.8	18.7	8	21.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.11.2022	7:00-7:00	58.6	40.2	20.3	6.5	22	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.11.2022	7:15-7:15	55.1	41.6	21	7.8	19.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.11.2022	7:00-7:00	56.4	42	19.6	7.1	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.12.2022	7:15-7:15	59.7	40.8	20.5	6.9	22	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.12.2022	7:00-7:00	58.4	40.3	18.5	8	20.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.12.2022	7:15-7:15	60	41.7	21	6.4	19.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.12.2022	7:00-7:00	58.5	41.2	20.3	7.5	21.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.12.2022	7:15-7:15	56.3	40.6	18.7	7.2	22	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.12.2022	7:00-7:00	57.6	42	19.4	8.9	19.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.12.2022	7:15-7:15	57.1	41.5	18.2	6.4	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.12.2022	7:00-7:00	56.8	40.8	18.5	6.1	20.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.12.2022	7:15-7:15	58.6	41.2	21.3	7.6	22	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 3.16 AAQ2 – PROJECT AREA

Period:Oct – Dec-2022 *Location: AAQ2- Project Area* 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
05.10.2022	7:00-7:00	61.7	47.3	22.7	7.5	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.10.2022	7:15-7:15	63.4	46.7	25	6.9	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.10.2022	7:00-7:00	65	49	24.3	8.2	24.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.10.2022	7:15-7:15	64.8	47.6	24.9	9	23.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.10.2022	7:00-7:00	62.8	48.3	23.2	7.3	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.10.2022	7:15-7:15	60.7	46.5	22.6	7.8	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.10.2022	7:00-7:00	63.5	49	25	6.3	24.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.10.2022	7:15-7:15	64.8	47.6	24.3	8.3	23.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.11.2022	7:00-7:00	62.7	47.1	22.9	6.7	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.11.2022	7:15-7:15	64.7	46.3	23.6	7.4	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.11.2022	7:00-7:00	61.5	48.2	24.7	9	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.11.2022	7:15-7:15	63.8	49	25	8.3	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.11.2022	7:00-7:00	65	47.5	23.7	6.2	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.11.2022	7:15-7:15	63.7	46.2	22.4	7.6	24.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.11.2022	7:00-7:00	61.7	46.7	24.5	8.1	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.11.2022	7:15-7:15	64.5	48.4	23.8	9	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.11.2022	7:00-7:00	62.5	47.9	23.2	7.5	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.12.2022	7:15-7:15	63.7	49	22.6	8.9	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.12.2022	7:00-7:00	63.1	48.5	24.3	6.4	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.12.2022	7:15-7:15	61.8	46.5	25	9	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.12.2022	7:00-7:00	60.5	48.6	23.5	7.8	24.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.12.2022	7:15-7:15	62.7	47.4	22.8	8.7	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.12.2022	7:00-7:00	65	46.3	22.3	6.7	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.12.2022	7:15-7:15	63.8	46.8	24.8	7.4	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.12.2022	7:00-7:00	61.3	48.7	23.6	9	24.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.12.2022	7:15-7:15	60.7	49	25	8.7	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

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

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

TABLE 3.16 AAQ3 - MELATHATTAPARAI VILLAGE (BUFFER ZONE)

Period:Oct – Dec-2022 *Location: AAQ2- Melathattaparai* 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
05.10.2022	7:00-7:00	63.5	44.3	21.7	7.6	22.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.10.2022	7:15-7:15	64	46.7	21.3	8.2	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.10.2022	7:00-7:00	62.4	47	23	9	24	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.10.2022	7:15-7:15	62.9	45.2	22.8	7.1	22.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.10.2022	7:00-7:00	63.5	45.6	22.4	8.7	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.10.2022	7:15-7:15	63.1	44.2	21.2	8.3	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.10.2022	7:00-7:00	64	46.8	21.7	7.5	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.10.2022	7:15-7:15	62.3	45.8	23	9	24	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.11.2022	7:00-7:00	62.7	47	22.5	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.11.2022	7:15-7:15	63.5	46.3	22.1	7.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.11.2022	7:00-7:00	63	44.8	21.6	7.8	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.11.2022	7:15-7:15	62.8	45.2	23	8.5	24	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.11.2022	7:00-7:00	62.2	45.9	22.8	8.9	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.11.2022	7:15-7:15	64	47	21.4	9	22.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.11.2022	7:00-7:00	63.7	46.5	22.7	7.7	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.11.2022	7:15-7:15	63.2	44.2	21.2	7.3	23.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.11.2022	7:00-7:00	62.5	44.8	23	8.5	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.12.2022	7:15-7:15	62.8	45.7	22.6	9	24	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.12.2022	7:00-7:00	64	47	21.7	8.2	22.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.12.2022	7:15-7:15	63.7	46.3	21.1	7.9	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.12.2022	7:00-7:00	62.4	44.5	22.6	7.5	23.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.12.2022	7:15-7:15	62.9	45.8	23	8.4	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.12.2022	7:00-7:00	63.5	45.1	22.8	9	24	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.12.2022	7:15-7:15	64	46.5	23	8.1	22.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.12.2022	7:00-7:00	62.3	47	21.6	8.7	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.12.2022	7:15-7:15	62.9	45.8	22.4	7.6	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

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

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

TABLE 3.16 AAQ4 – KEELA THATTAPARAI VILLAGE (BUFFER ZONE)

Period:Oct – Dec-2022 Location: AAQ4 - Keela Thattaparai 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
05.10.2022	7:00-7:00	57.4	41.3	18.5	6.3	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.10.2022	7:15-7:15	57.9	40.7	21	7.5	26.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.10.2022	7:00-7:00	60	42	20.7	8	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.10.2022	7:15-7:15	57.8	41.6	19.5	8.1	25.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.10.2022	7:00-7:00	56.3	40.2	18.1	7.6	27	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.10.2022	7:15-7:15	58.6	41.1	18.7	6.4	26.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.10.2022	7:00-7:00	57.3	40.7	20.5	6.9	24.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.10.2022	7:15-7:15	59.4	42	21	7.8	24.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.11.2022	7:00-7:00	60	41.8	19.7	8.4	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.11.2022	7:15-7:15	58.7	41.3	19.2	9	25.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.11.2022	7:00-7:00	56.5	40.9	18.6	8.7	26.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.11.2022	7:15-7:15	57.3	40.4	20	7.3	24.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.11.2022	7:00-7:00	59.7	41.1	18.7	6.5	26	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.11.2022	7:15-7:15	60	42	20.3	6.9	27.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.11.2022	7:00-7:00	56.8	40.8	21	7.2	28.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.11.2022	7:15-7:15	57.4	41.6	19.4	7.7	24	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.11.2022	7:00-7:00	59.8	40.2	18.3	6.9	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.12.2022	7:15-7:15	56.2	41.3	18.9	8.2	26.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.12.2022	7:00-7:00	58.3	42	20.7	9	25.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.12.2022	7:15-7:15	60	40.8	21	8.5	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.12.2022	7:00-7:00	57.7	40.2	20.8	7.3	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.12.2022	7:15-7:15	59.3	41.6	18.7	9	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.12.2022	7:00-7:00	56.8	42	20.2	6.7	22.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.12.2022	7:15-7:15	56.2	40.6	19.6	7	25.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.12.2022	7:00-7:00	58.5	41.7	19	8.3	26	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.12.2022	7:15-7:15	60	41.2	18.7	8.7	27.3	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 3.16 AAQ5 - THERKU VEERAPANDIYAPURAM VILLAGE (BUFFER ZONE)

Period:Oct – Dec-2022 location *: AAQ5- Therku Veerapandiyapuram* 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
05.10.2022	7:00-7:00	58.6	46.2	25.2	6.3	22.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.10.2022	7:15-7:15	60.3	45.8	27	7.4	24	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.10.2022	7:00-7:00	61.7	48	26.3	9	23.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.10.2022	7:15-7:15	63	47.6	26.7	8.7	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.10.2022	7:00-7:00	60.8	46.3	25.6	8.1	22.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.10.2022	7:15-7:15	59.7	46	27	6.6	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.10.2022	7:00-7:00	59	45.7	26.5	7.2	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.10.2022	7:15-7:15	62.3	48	25.9	7	24	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.11.2022	7:00-7:00	63	46.2	27	8.4	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.11.2022	7:15-7:15	60.5	47.4	26.8	7.9	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.11.2022	7:00-7:00	59.8	45.3	25.4	9	22.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.11.2022	7:15-7:15	61.7	45	25.9	8.5	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.11.2022	7:00-7:00	59.5	46.1	27.9	8.1	24	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.11.2022	7:15-7:15	62.6	47.4	26.2	7.9	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.11.2022	7:00-7:00	63	48	25.7	7	22.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.11.2022	7:15-7:15	58.3	47.3	27	6.8	22	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.11.2022	7:00-7:00	60.7	45.8	26.8	6.1	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.12.2022	7:15-7:15	59.2	45.1	26.1	8.5	24	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.12.2022	7:00-7:00	61.8	46.3	27	7.7	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.12.2022	7:15-7:15	58.4	46.9	25.4	6.9	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.12.2022	7:00-7:00	59.2	48	25.9	6	22.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.12.2022	7:15-7:15	59.6	47.4	26.1	8.6	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.12.2022	7:00-7:00	63	46.5	25.8	8.1	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.12.2022	7:15-7:15	61.6	46	26.7	9	23.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.12.2022	7:00-7:00	59.5	45.8	26	8.8	24	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.12.2022	7:15-7:15	60	45	25.8	7.3	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 3.16 AAQ6 – KP THALAVAIPUARAM- VILLAGE (BUFFER ZONE)

Period:Oct – Dec-2022 *Location: AAQ6 – KP Thalavaipuaram-* 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
05.10.2022	7:00-7:00	64.2	46.2	23.8	7.5	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.10.2022	7:15-7:15	67	45.9	23	9	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.10.2022	7:00-7:00	65.8	49	24.5	8.6	24.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.10.2022	7:15-7:15	64.2	48.5	26.7	8.1	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.10.2022	7:00-7:00	63.8	48.2	25.8	7.6	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.10.2022	7:15-7:15	63	46.7	23.1	8.2	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.10.2022	7:00-7:00	64.5	45	23.9	7.9	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.10.2022	7:15-7:15	65.2	45.7	24.6	8	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.11.2022	7:00-7:00	66	48.6	24.2	8.7	23.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.11.2022	7:15-7:15	64.2	48.2	23.7	9	24.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.11.2022	7:00-7:00	65.6	49	25.8	7.4	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.11.2022	7:15-7:15	66.2	46.3	26	7	23.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.11.2022	7:00-7:00	67	45.4	25.4	8.6	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.11.2022	7:15-7:15	64.8	48.7	23.1	8.1	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.11.2022	7:00-7:00	63	48.1	23.9	7.3	24.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.11.2022	7:15-7:15	66.2	46.3	24.6	8.4	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.11.2022	7:00-7:00	63.5	46	26	9	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.12.2022	7:15-7:15	66.8	47.4	25.8	7.6	23.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.12.2022	7:00-7:00	64.2	47.9	25.1	7.2	24.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.12.2022	7:15-7:15	65.6	45.2	24.9	8.5	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.12.2022	7:00-7:00	67	46.3	24.2	8	23.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.12.2022	7:15-7:15	64.5	49	23.7	7.6	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.12.2022	7:00-7:00	63.2	48.6	23.1	7	24.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.12.2022	7:15-7:15	66.7	48.1	25.7	8.9	24	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.12.2022	7:00-7:00	65.3	46.3	26	8.2	23.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.12.2022	7:15-7:15	64.8	45.7	25.4	7.4	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

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

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

TABLE 3.16 AAQ7 - SENDILAMPANNAI VILLAGE (BUFFER ZONE)

Period:Oct – Dec-2022 *Location: AAQ7– Sendilampannai* 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
05.10.2022	7:00-7:00	63.8	44.8	25.8	6.2	24.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.10.2022	7:15-7:15	61.1	46	28	7.8	25.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.10.2022	7:00-7:00	64.8	45.3	27.6	6	26	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.10.2022	7:15-7:15	65	45.9	27.1	6.7	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.10.2022	7:00-7:00	62.8	43.2	24.5	7.4	24.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.10.2022	7:15-7:15	61.6	43	24.9	7.1	24	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.10.2022	7:00-7:00	61	44.6	25.3	8.7	25.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.10.2022	7:15-7:15	63.7	45.6	26.8	6.2	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.11.2022	7:00-7:00	64.2	43.2	28	6.6	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.11.2022	7:15-7:15	64.8	44.8	27.6	7	25.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.11.2022	7:00-7:00	65	44	27.2	7.9	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.11.2022	7:15-7:15	61.3	45.6	24.5	6.3	26	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.11.2022	7:00-7:00	61.8	46	25.6	6.8	24.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.11.2022	7:15-7:15	62.7	45.1	25.1	6	24.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.11.2022	7:00-7:00	65	44.8	28.4	7.2	25.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.11.2022	7:15-7:15	64.6	44.2	27.4	7.8	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.11.2022	7:00-7:00	63.2	43.8	27.1	6.5	26	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.12.2022	7:15-7:15	62.7	43	24.3	6.1	25.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.12.2022	7:00-7:00	63.6	43.9	25.8	7.8	24.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.12.2022	7:15-7:15	63.1	44.6	25.1	7.2	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.12.2022	7:00-7:00	65	46	26.2	6.8	25.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.12.2022	7:15-7:15	61.7	45.8	26.9	6.3	26	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.12.2022	7:00-7:00	63.6	45.1	28	7	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.12.2022	7:15-7:15	64.5	43.8	27.4	7.4	25.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.12.2022	7:00-7:00	65	43.2	27.9	7.9	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.12.2022	7:15-7:15	63.8	44.6	26.5	6.7	25.8	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 3.16 AAQ8 – S. KAILASAPURAM VILLAGE (BUFFER ZONE)

Period:Oct – Dec-2022 *Location: AAQ8– S. Kailasapuram* 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
05.10.2022	7:00-7:00	67.9	43.6	21.5	6.9	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.10.2022	7:15-7:15	68.5	40.7	22.9	6.5	24.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.10.2022	7:00-7:00	67.9	41.1	23.6	6.1	24.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.10.2022	7:15-7:15	67.6	43.8	21.2	6.1	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.10.2022	7:00-7:00	68.5	43	23.7	6.4	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.10.2022	7:15-7:15	67.5	41.4	23.9	7.2	25.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.10.2022	7:00-7:00	68.2	43.5	21.2	7.7	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.10.2022	7:15-7:15	68.2	42.8	23.8	7.8	24.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.11.2022	7:00-7:00	68.8	41.4	24.3	7.3	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.11.2022	7:15-7:15	67.4	42.5	23.5	7.3	24.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.11.2022	7:00-7:00	67.5	45.6	21.7	7.4	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.11.2022	7:15-7:15	67.2	43.7	22.7	7.6	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.11.2022	7:00-7:00	67.1	42.4	23.2	8.2	23.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.11.2022	7:15-7:15	66.5	43.3	22.4	8.1	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.11.2022	7:00-7:00	66.7	42	23.5	8.4	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.11.2022	7:15-7:15	65.3	43.7	22.8	8.6	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.11.2022	7:00-7:00	66.6	43.3	23.4	6.9	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.12.2022	7:15-7:15	76.6	42.5	21.5	6.2	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.12.2022	7:00-7:00	76.2	42.7	23.3	6.7	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.12.2022	7:15-7:15	76.3	41.6	23.2	6.9	22.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.12.2022	7:00-7:00	66.5	42.5	21.4	6.8	22.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.12.2022	7:15-7:15	64.7	41.4	20.5	7.1	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.12.2022	7:00-7:00	64.8	42.5	21.4	7.9	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.12.2022	7:15-7:15	64.8	43.6	23.6	7.6	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.12.2022	7:00-7:00	74.6	41.5	23.3	7.8	24.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.12.2022	7:15-7:15	73.3	41.3	23.4	7.1	24.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

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

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

TABLE 3.16 : 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	19.4	40.8	6.4	22.0
4	20^{th} Percentile Value	20.7	41.6	6.8	22.6
5	30^{th} Percentile Value	21.5	42.5	7.1	23.2
6	40^{th} Percentile Value	22.8	44.0	7.4	23.6
7	50^{th} Percentile Value	23.3	45.1	7.6	23.9
8	60^{th} Percentile Value	24.2	45.8	7.9	24.1
9	70^{th} Percentile Value	25.0	46.3	8.1	24.7
10	80^{th} Percentile Value	25.8	47.1	8.5	25.0
11	90^{th} Percentile Value	26.9	48.2	9.0	25.8
12	95^{th} Percentile Value	27.4	48.7	9.0	26.0
13	98^{th} Percentile Value	28.0	49.0	9.0	27.3
14	Arithmetic Mean	24.1	45.4	7.9	24.4
15	Geometric Mean	23.9	45.3	7.8	24.3
16	Standard Deviation	2.8	2.9	0.9	1.6
17	Minimum	19.4	40.8	6.4	22.0
18	Maximum	28.0	49.0	9.0	27.3
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 3.13: BAR DIAGRAM OF SUMMARY OF AAQ (AAQ1-AAQ-8)

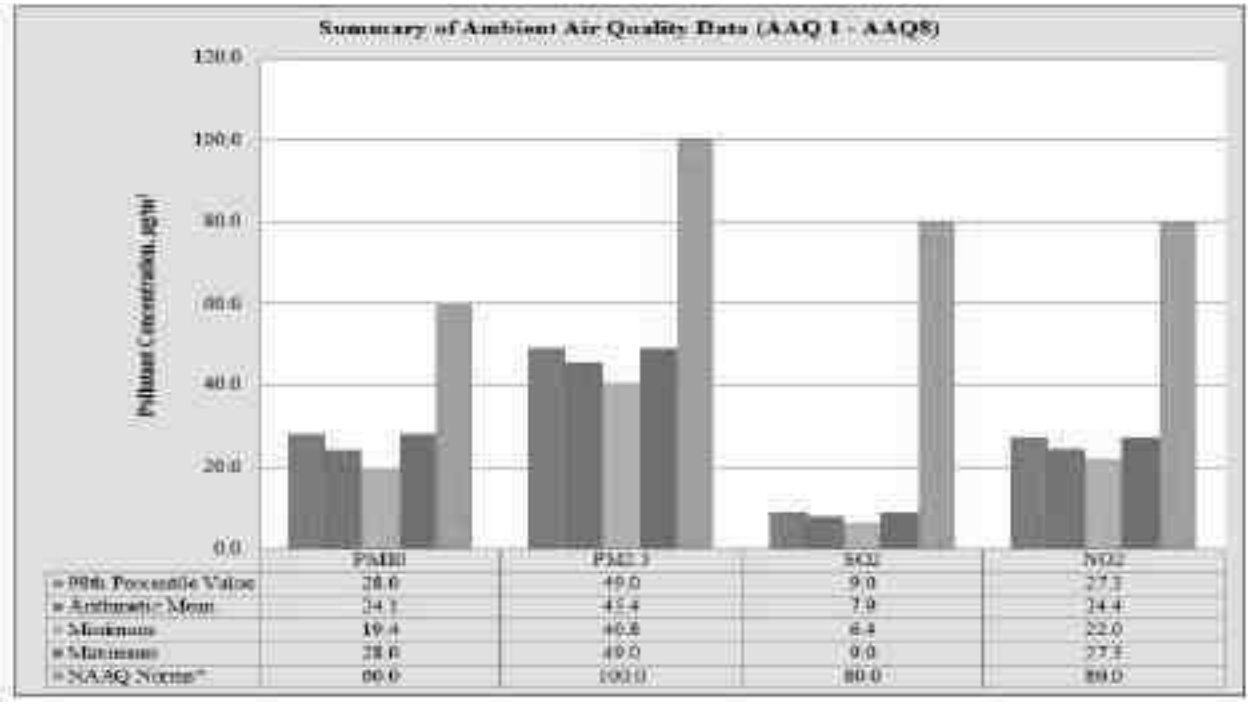
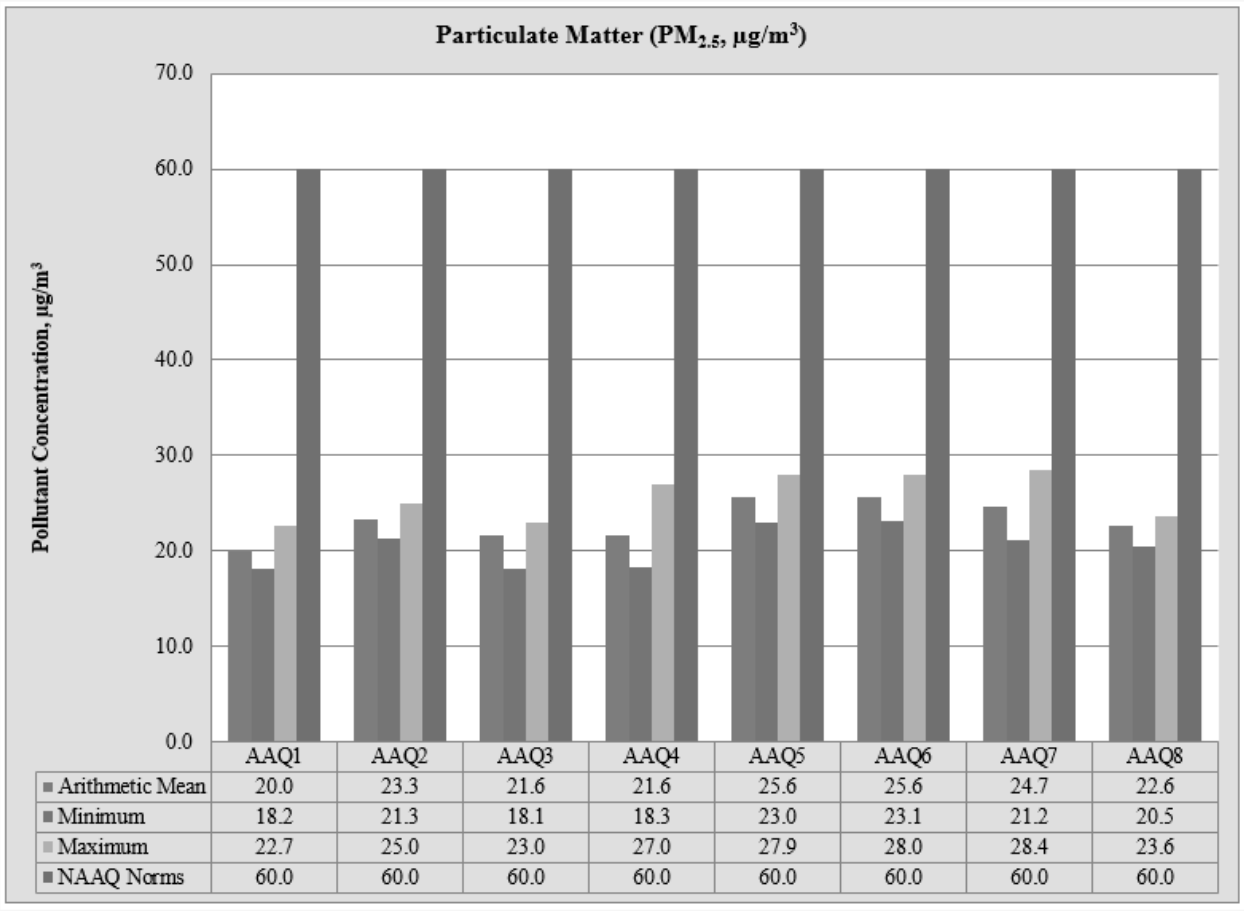


FIGURE 3.14: BAR DIAGRAM OF PARTICULATE MATTER ($PM_{2.5}$ &PM_{10})



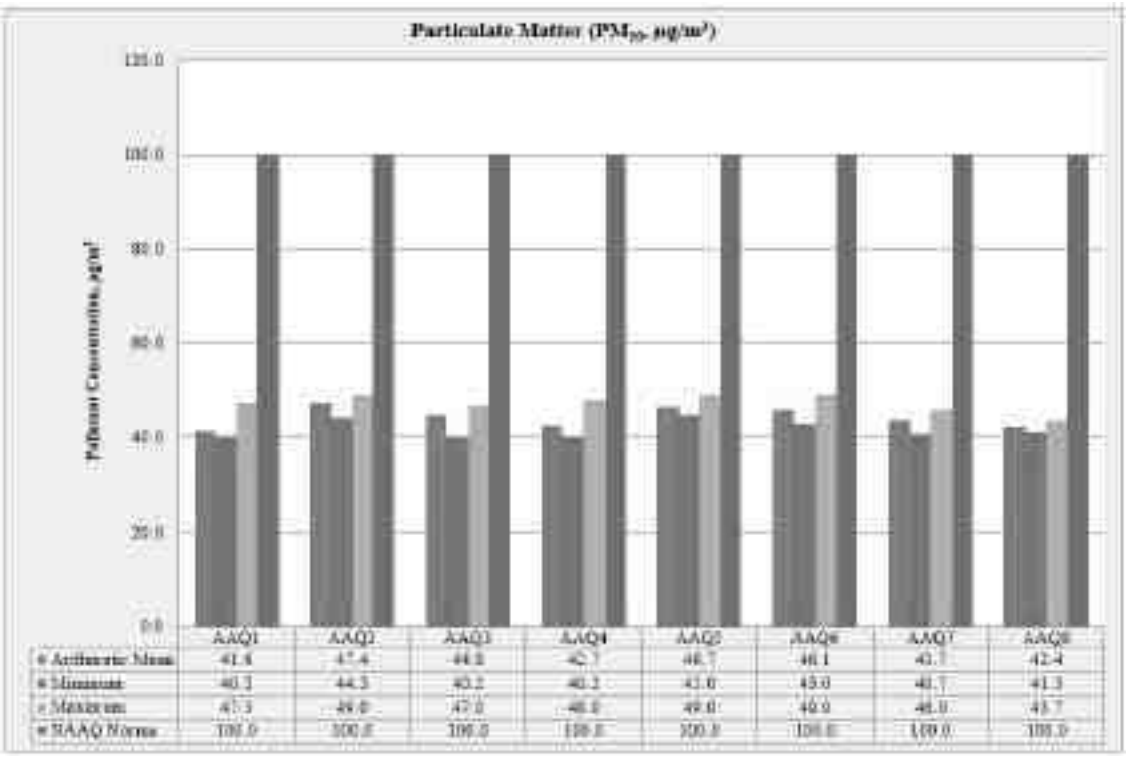
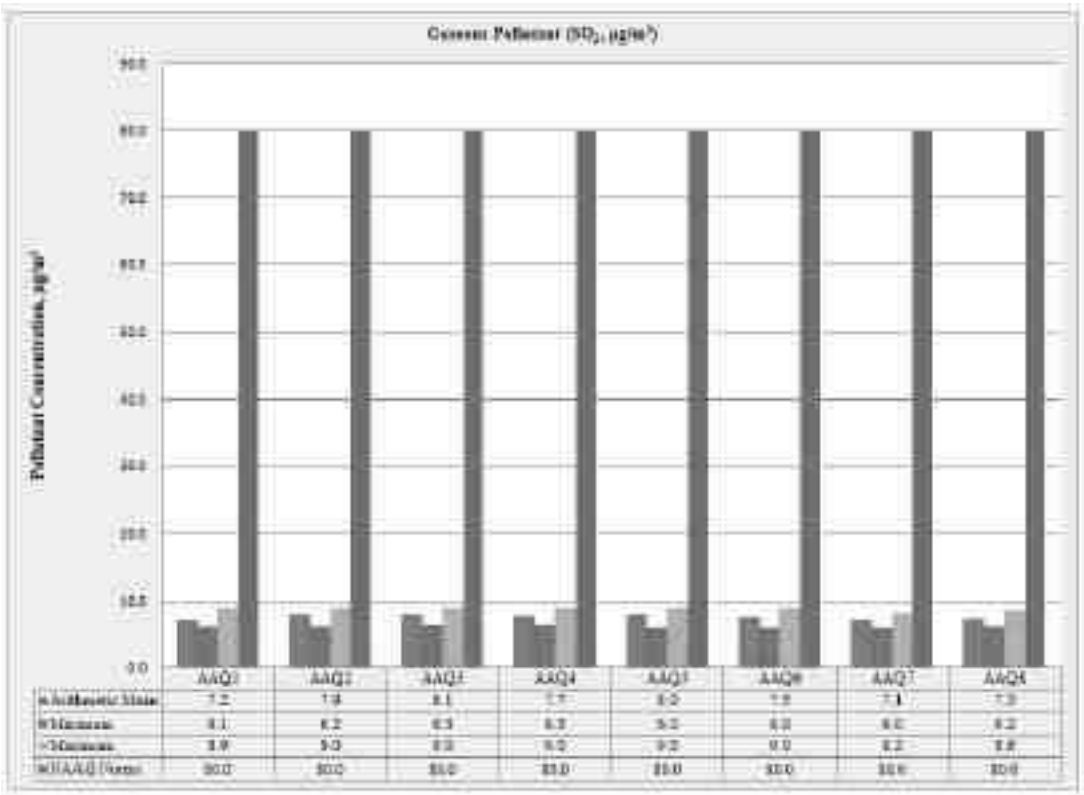
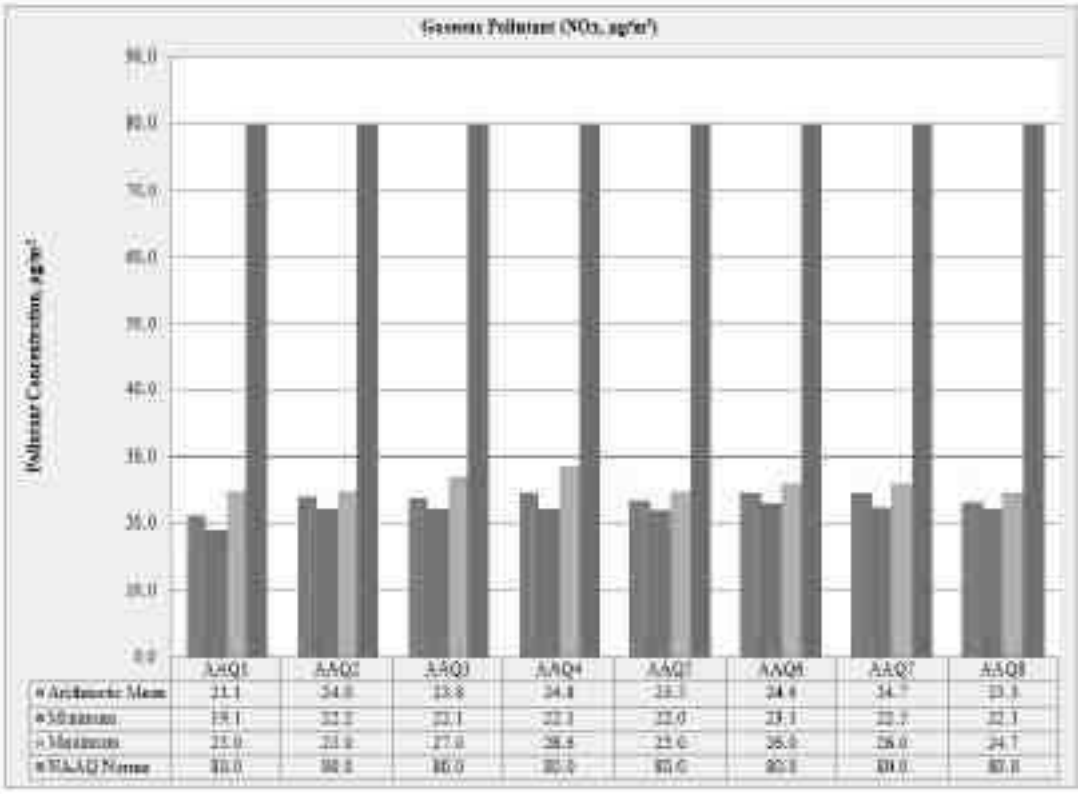


FIGURE 3.15: BAR DIAGRAM OF (SO_2 & NO_2)





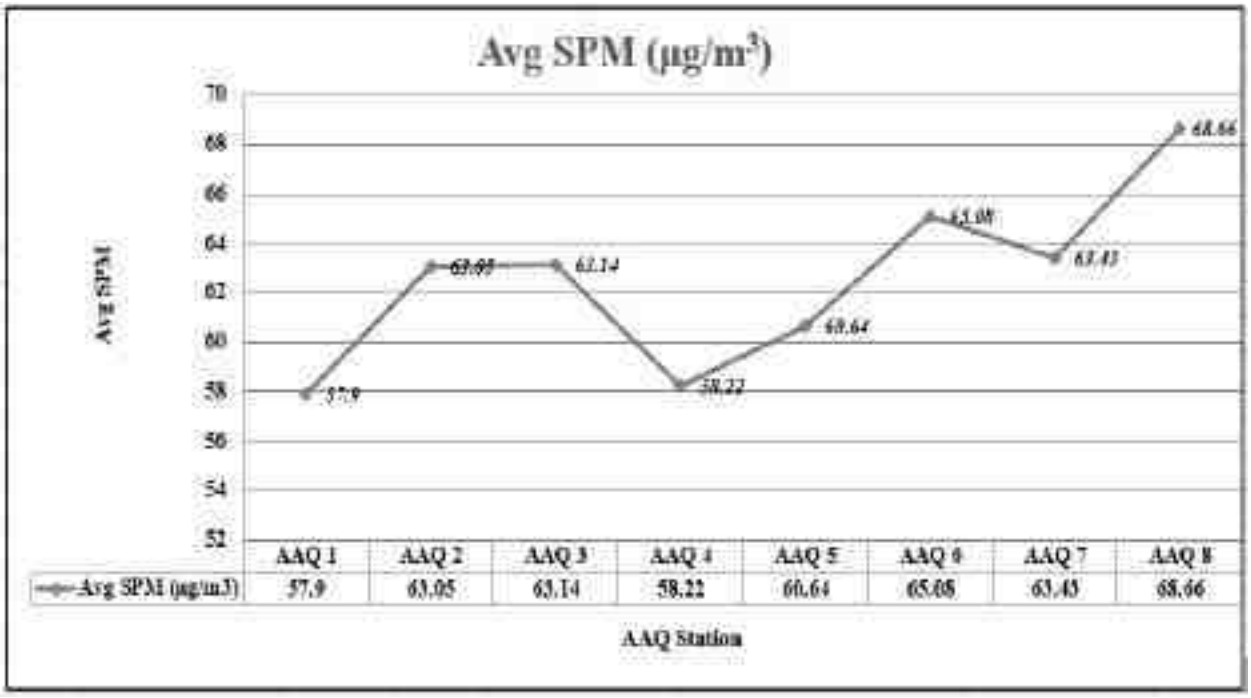
3.3.7 FUGITIVE DUST EMISSION –

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

Table 3.16 I: AVERAGE FUGITIVE DUST SAMPLE VALUES IN µg/m³

AAQ Locations	Avg SPM (µg/m³)
AAQ 1	57.9
AAQ 2	63.05
AAQ 3	63.14
AAQ 4	58.22
AAQ 5	60.64
AAQ 6	65.08
AAQ 7	63.43
AAQ 8	68.66

Source: Onsite monitoring/ sampling by Chennai Mettex Lab Private Limited

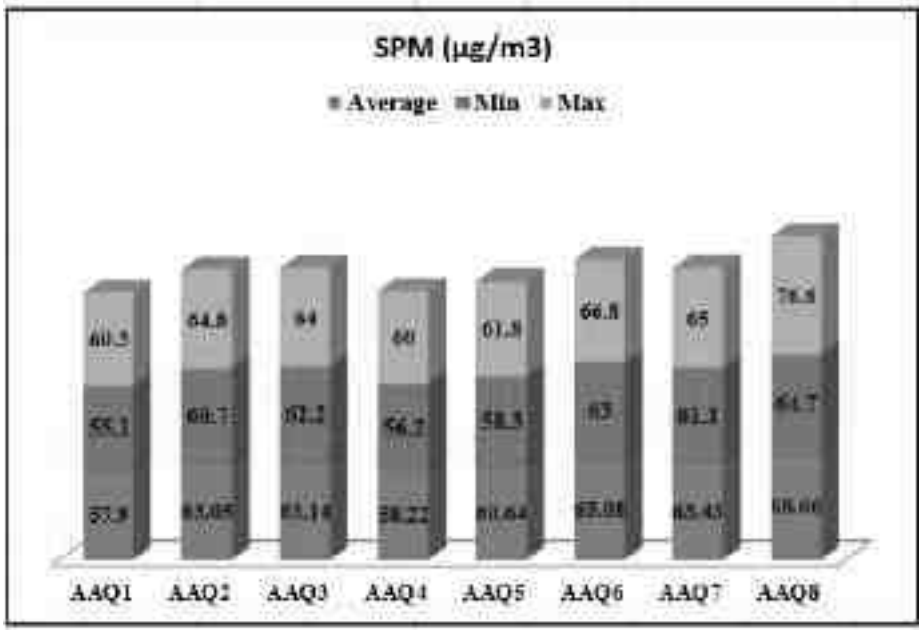


Source: Line Diagram of Table 3.16 I

Table 3.16 .1: FUGITIVE DUST SAMPLE VALUES IN µg/m³ –

SPM (µg/m3)	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Average	57.9	63.05	63.14	58.22	60.64	65.08	63.43	68.66
Min	55.1	60.7	62.2	56.2	58.3	63	61.1	64.7
Max	60.3	64.8	64	60	61.8	66.8	65	76.6

Source: Calculations from Lab Analysis Reports



3.3.6 Interpretations & Conclusion

As per monitoring data, PM_{10} ranges from 40.2 µg/m^3 49 µg/m^3, $PM_{2.5}$ data ranges from 18.1 µg/m^3 to 28.4 µg/m^3, SO_2 ranges from 6.0 µg/m^3 to 9.0 µg/m^3 and NO_2 data ranges from 19.1 µg/m^3 to 28.6 µg/m^3.

The minimum & maximum concentrations of PM_{10} were found to be 40.2 µg/m^3 in Project area & 49.0 µg/m^3 in KP Thalavaipuaram Village. The minimum & maximum concentrations of $PM_{2.5}$ were found to be 18.1 µg/m^3 in Keela Thattaparai village & 28.4 µg/m^3 in Sendilampannai village.

Fugitive dust is ranging from 55.1 µg/m^3 to 76.6 µg/m^3. The maximum concentrated recorded at Buffer zone quarry is under operation north side of the project area. The maximum concentration in the core zone is due to the Existing quarrying activity located north side of the area. The concentration levels of the above criteria pollutants were observed to be well within the limits of NAAQS prescribed by CPCB.

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 10 km. A noise monitoring methodology was chosen such that it best suited the purpose and objectives of the study.

TABLE 3.17: DETAILS OF SURFACE NOISE MONITORING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	N-1	Project Area	Core Zone	8°48'47.51"N 78° 1'51.89"E
2	N-2	Project Area	Core Zone	8°48'49.54"N 78° 1'48.36"E
3	N-3	Melathattaparai	720m West	8°48'51.42"N 78° 1'5.23"E
4	N-4	Keela Thattaparai	970m South	8°47'53.23"N 78° 1'45.37"E
5	N-5	Therku Veerapandiyapuram	3.4km NE	8°49'35.99"N 78° 3'56.45"E
6	N-6	KP Thalavaipuaram	5.5km SW	8°47'53.80"N 77°58'30.57"E
7	N-7	Sendilampannai	4.5km SE	8°46'15.07"N 78° 3'9.75"E
8	N-8	S. Kailasapuram	4.8km NW	8°50'49.95"N 77°59'35.53"E

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

3.4.2 Method of Monitoring

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

level, 'Leq', can be obtained from variable sound pressure level, 'L', over a time period by using following equation. The equivalent noise level is defined mathematically as

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

Leq = 10 Log L / T∑ (10Ln/10)

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

T = Time interval of observation

P-1Ananthakumar

P2-Ananthammal

FIGURE 3.16: NOISE MONITORING STATIONS AROUND 10 KM RADIUS

3.4.3 Analysis of Ambient Noise Level in the Study Area

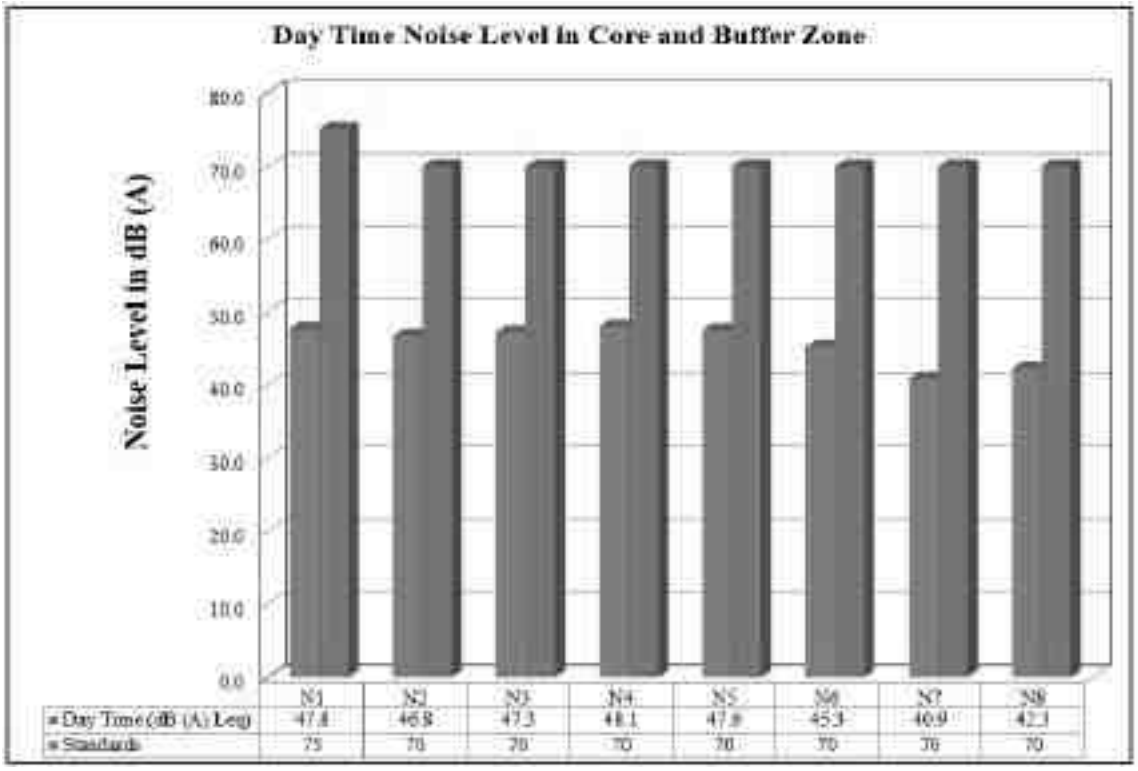
The Digital Sound pressure level have been measured by a sound level meter (Model : HTC SL-1352)
An analysis of the different Leq data obtained during the study period has been made. Variation was noted during the day-time as well as night-time. The results are presented in below Table 3.6
Day time: 6:00 hours to 22.00 hours.
Night time: 22:00 hours to 6.00 hours.

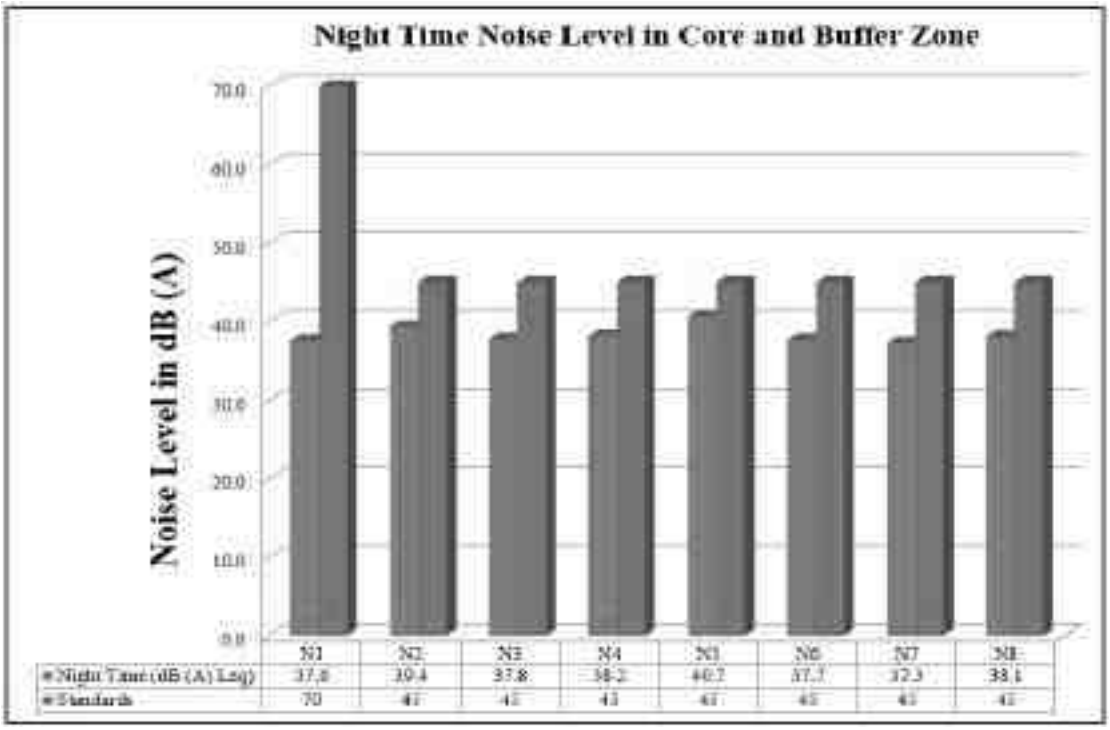
TABLE 3.18: AMBIENT NOISE QUALITY RESULT

S. No	Locations	Noise level (dB (A) Leq)		Ambient Noise Standards
		Day Time	Night Time	
1	Project Area	46.0	37.6	**Industrial** **Day Time- 75 dB (A)** **Night Time- 70 dB (A)**
2	Project Area	47.0	38.5	
3	Melathattaparai	46.0	38.2	**Residential** **Day Time– 55 dB (A)** **Night Time- 45 dB (A)**
4	Keela Thattaparai	45.3	38.1	
5	Therku Veerapandiyapuram	45.9	39.2	
6	KP Thalavaipuaram	47.7	38.0	
7	Sendilampannai	46.0	37.5	
8	S. Kailasapuram	46.8	38.7	

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

FIGURE 3.17: DAY AND NIGHT TIME NOISE LEVELS IN CORE AND BUFFER ZONE





3.4.4 Interpretation & Conclusion:

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

The values of noise observed in some of the areas are primarily owing to quarrying activities due to cluster of quarries within 500m radius, movement of vehicles and other anthropogenic activities. Noise monitoring results reveal that the maximum & minimum noise levels at day time were recorded in the range of 48.1dB(A) in Keela Thattaparai village and 47.8 dB(A) in Core area and 47.3 dB(A) in Melathattapparai village & 37.6 dB(A) in Core areavillage at night time.

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

3.5 ECOLOGICAL ENVIRONMENT

There is no Forest land, National Parks, Eco sensitive areas, Wild life sanctuaries within the radius of 10 km. An ecological survey of the study area was conducted particularly with reference to the listing of species and assessment of the existing baseline ecological (terrestrial) condition in the study area.

3.5.1 Methodology Adopted & Objective

To achieve the above objective, a detailed study of the area was undertaken in 10 km radius from the proposed project 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) Undertake intensive field survey to assess the status of floral & faunal component in different habitats in the core and buffer areas of the project site.
c) Identification and listing of flora and fauna which are important as per the Wildlife (Protection) Act 1972.
d) Suggest Wildlife conservation (species specific/habitat specific) and management plan for the threatened (critically endangered & endangered species - schedule I) faunal species if any reported within the study area.
e) To identify the impacts of mining on agricultural lands and how it affects.

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

g) Devise management & conservation measures for biodiversity.

TABLE 3.19: FLORA IN CORE AND BUFFER ZONE

SI.No	English Name	Vernacular Name	Scientific Name	Family Name
Trees				
1.	Neem or Indian lilac	Vembu maram	*Azadirachta indica*	Meliaceae
2.	Velvet mesquite	Mullu maram	*Prosopis juliflora*	Fabaceae
3.	River tamarind	Soundal maram	*Leucaena leucocephala*	Fabaceae
4.	Indian plum	Elanthai maram	*Ziziphus mauritiana*	Rhamnaceae
5.	Bitter Albizia	Arappu Tree	*Albizia amara*	Fabaceae
Shrubs				
6.	West Indian Lantana	Unni chedi	*Lantana camara*	Verbenaceae
7.	Avaram	Avarai	*Senna auriculata*	Fabaceae
8.	Milk Weed	Erukku	*Calotropis gigantea*	Apocynaceae
9.	Pala indigo plant	Pala maram	*Wrightia tinctoria*	Apocynaceae
Herbs				
10.	Indian nettle	Nayuruvi	*Achyranthes aspera*	Amaranthaceae
11.	Coat buttons	Thatha poo	*Tridax procumbens*	Asteraceae
12.	Indian doab	Arugampul	*Cynodon dactylon*	Poaceae
13.	Holy basil	Thulasi	*Ocimum tenuiflorum*	Lamiaceae
14.	Common leucas	Thumbai	*Leucas aspera*	Lamiaceae
Climber				
15.	Stemmed vine	Perandai	*Cissus quadrangularis*	Vitaceae
16.	Stinking passionflower	Poonai puduku chedi	*Passiflora foetida L*	Passifloraceae
Grasses				
17.	Eragrostis	Pullu	*Eragrostis ferruginea*	Poaceae
18.	Narrowleaf cattail	Sambu	*Typha angustifolia*	Typhaceae
19.	Great brome	Thodappam	*Bromus diandrus*	Poaceae
Cactus				
20.	Prickly pear	Nagathali	*Opuntia*	Cactaceae
21.	Triangular spruge	Chaturakalli	*Euphorbia antiquorum*	Euphorbiaceae



a. Typha angustifolia *b. Vachellia nilotica* *c. Azadirachta indica*

d. Morinda tinctoria

e. Prosopis juliflora

f. Passiflora foetida L

g. Cynodon dactylon

h. Calotropis gigantea

i. Bromus diandrus

Fig No: 3.18. Flora species observation in the Core zone area

Table No: 3.2. Flora in Buffer Zone, Melathattapparai Village, Rough stone and gravel quarry

SI.No	English Name	Vernacular Name	Scientific Name	Family Name	Resource use type *(E,M,EM)
Trees					
1.	Gum arabic tree	Karuvelam	*Vachellia nilotica*	Fabaceae	E
2.	Neem or Indian lilac	Vembu	*Azadirachta indica*	Meliaceae	M
3.	Horsetail She-oak	Chavuku	*Casuarina litorea*	Casuarinaceae	E
4.	Velvet mesquite	Mullu maram	*Prosopis juliflora*	Fabaceae	M
5.	Portia tree	Poovarasan	*Thespesia Populnea*	Malvaceae	E
6.	Lemon	Ezhumuchaipalam	*Citrus lemon*	Rutaceae	EM
7.	Chinese chaste tree	Nochi	*Vitex negundo*	Verbenaceae	E
8.	Asian Palmyra palm	Panai maram	*Borassus flabellifer*	Arecaceae	E
9.	Indian mulberry	Nuna maram	*Morinda tinctoria*	Rubiaceae	E
10.	Pongamia pinnata	Pongam	*Millettia pinnata*	Fabaceae	M
11.	Agati	Agathi keerai	*Sesbania grandiflora*	Fabaceae	EM
12.	Guava	Koyya	*Psidium guajava*	Myrtaceae	EM
13.	Tamarind	Puliyamaram	*Tamarindus indica*	Legumes	EM
14.	Drumstick tree	Murunga maram	*Moringa oleifera*	Moringaceae	EM
15.	Papaya	Pappali maram	*Carica papaya L*	Caricaceae	EM
16.	Banana tree	Vazhaimaram	*Musa acuminata*	Musaceae	EM
Shrubs					
1.	Fish poison	Kolingi	*Tephrosia purpurea*	Fabaceae	M
2.	Broom creeper	Kattukodi	*Cocculus hirsutus*	Menispermaceae	M
3.	Avaram	Avarai	*Senna auriculata*	Fabaceae	M
4.	Castor bean	Amanakku	*Ricinus communis*	Euphorbiaceae	M
5.	Shoe flower	Chemparuthi	*Hibiscu rosa-sinensis*	Malvaceae	EM
6.	Milk Weed	Erukku	*Calotropis gigantea*	Apocynaceae	M
7.	Touch-me-not	Thottalchinungi	*Mimosa pudica*	Mimosaceae	M
8.	Indian mallow	Thuthi	*Abutilon indicum*	Meliaceae	M

9.	West Indian Lantana	Unni chedi	*Lantana camara*	Verbenaceae	E
Herbs					
1.	Tropical fimbry	-	*Fimbristylis cymosa*	Cyperaceae	NE
2.	Watergrass	Mukkutikorei	*Bulbostylis barbata*	Cyperaceae	NE
3.	Chamber bitter	Malai Kizhanelli	*Phyllanthus urinaria L.*	Euphorbiaceae	M
4.	Sand Herbage	Manal keerai	*Gisekia pharnaceoides*	Aizoaceae	M
5.	Carrot grass	Parttiniyam	*Parthenium hysterophorus*	Asteraceae	NE
6.	Aloe barbadensis	Katrazhai	*Aloe vera*	Asphodelaceae	EM
7.	Indian Mercury	Kuppamani	*Acalypha indica*	Euphorbiaceae	EM
8.	Indian nettle	Nayuruvi	*Achyranthes aspera*	Amaranthaceae	M
9.	Indian doab	Arugampul	*Cynodon dactylon*	Poaceae	E
10.	Large Caltrops	Yanai nerunji	*Pedalium murex L.*	Pedaliaceae	E
11.	Common leucas	Thumbai	*Leucas aspera*	Lamiaceae	M
12.	Holy basil	Thulasi	*Ocimum tenuiflorum*	Lamiaceae	M
13.	Tridax daisy	Thatha poo	*Tridax procumbens*	Asteraceae	M
Climber					
1.	Ivy gourd	Kovai	*Coccinia grandis*	Cucurbitaceae	M
2.	Bitter apple	Peikkumatti	*Citrullus colocynthis*	Cucurbitaceae	M
3.	Wild water lemon	Poonai puduku chedi	*Passiflora foetida*	Passifloraceae	M
4.	Stemmed vine	Perandai	*Cissus quadrangularis*	Vitaceae	M
Creeper					
1.	Nut grass	Korai	*Cyperus rotandus*	Poaceae	M
2.	Cucumis maderaspatanus	Musumusukkai	*Mukia maderaspatana*	Cucurbitaceae	M
3.	Grona triflora	Siru puladi	*Desmodium triflorum*	Fabaceae	EM
Grass					
1.	Eragrostis	Pullu	*Eragrostis ferruginea*	Poaceae	E
2.	Windmill grass	Chevvarakupul	*Chloris barbata*	Amaranthaceae	NE
Cactus					
1.	Indian fig opuntia	Sapathikalli	*Opuntia ficus-indica*	Cactaceae	M

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

3.6 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.

3.6.1. Fauna Composition in the Core Zone

A total of 32 varieties of species were observed in the Core zone of Melathattapparai village, Rough stone and gravel quarry (Table No.3.4) among them numbers of Insects 9, Reptiles 5, Mammals 4, and Avian 16. None of these species are threatened or endemic in the study area and surroundings. There is no Schedule I species and twenty-two species are under schedule IV according to the Indian wildlife Act 1972. A total of 16 species of bird were sighted in the mining lease area. There are no critically endangered, endangered, vulnerable, and endemic species were observed.

TABLE 3.20: LIST OF FAUNA

SI. No	Common Name	Scientific Name	Schedule list WLPA, 1972	IUCN Red List data
Insects				
1.	Dragonfly	*Agriansp*	-	-
2.	Colotis danae	*Colotis danae*	-	-
3.	Common sailor	*Neptis hylas*	-	-
4.	Common tiger	*Danaus genutia*	-	-
5.	House fly	*Musca domestica*	-	-
6.	Grasshopper	*Hieroglyphus sp*	NL	LC
7.	Common emigrant	*Catopsilia pomona*	NL	NL
8.	Honey Bee	*Apisindica*	-	-
9.	Termite	*Hamitermes silvestri*	NE	LC
Reptiles				
1.	Garden lizard	*Calotes versicolor*	NL	LC
2.	Keeled grass skink	*Mabuya carinata*	Schedule IV	LC
3.	Common skink	*Mabuya carinatus*	NL	LC
4.	Green vine snake	*Ahaetulla nasuta*	Schedule IV	NL
5.	Spotted house gecko	*Hemidactylus macalatus*	Schedule IV	NL
Mammals				
1.	Indian Field Mouse	*Mus booduga*	Schedule IV	NL
2.	Asian Small Mongoose	*Herpestes javanicus*	Schedule (Part II)	LC
3.	Striped Squirrel	*Funambulus palmarum*	Schedule IV	NL
4.	Indian Hare	*Lepus nigricollis*	Schedule IV	NL
Aves				
1.	Paddy Bird	*Ardea grayii grayii*	Schedule IV	LC
2.	Indian House sparrow	Passer domesticus indicus	Schedule IV	LC
3.	Common myna	*Acridotheres tristis*	Schedule IV	LC
4.	Shikra	*Laniusexcubitor*	Schedule IV	LC
5.	Crow Pheasant	*Centropus sinensis*	Schedule IV	LC
6.	Strentopelia chinensis	*Spotted dove*	Schedule IV	LC
7.	Ceylon house crow	*Corvus spelndens portugatus*	Schedule IV	LC
8.	Sunbird	*Cinnyrisasiaticus*	Schedule IV	LC
9.	Koel	*Eudynamys*	Schedule IV	LC
10.	Rose-ringed parkeet	*Psittacula krameri*	Schedule IV	LC
11.	Common quail	*Coturnix coturnix*	Schedule IV	LC
12.	Black drongo	*Dicrurus macrocercus*	Schedule IV	LC
13.	Cattle egret	*Bubulcus ibis*	Schedule IV	LC
14.	Rock pigeon	*Columbidae*	Schedule IV	LC
15.	Indian Robin	*Saxicoloides fulicata*	Schedule IV	LC
16.	Pond-Heron	*Ardeo labacchus*	Schedule IV	LC

*NL- Not listed, LC- Least Concern

Table 3.21 List of Avian Species Recorded in the Study Area

Avian (*directly sighted species & Secondary data)

SI. No	Common Name	Scientific Name	Schedule list WLPA, 1972	IUCN Red List data
1.	Koel	*Eudynamys*	Schedule IV	LC
2.	Grey Francolin	*Francolinus pondicerianus*	Schedule IV	LC
3.	House crow	*Corvus splendens*	Schedule IV	LC
4.	House sparrow	*Passer domesticus*	Schedule IV	LC
5.	Indian Robin	*Saxicoloides fulicatus*	Schedule IV	LC
6.	Indian Roller	*Coracias benghalensis*	Schedule IV	LC

7.	Indian Silver bill	*Lonchura malabarica*	Schedule IV	LC
8.	Jungle crow	*Corvus levaillantii*	Schedule IV	LC
9.	Jungle babbler	*Turdoides striata*	Schedule IV	LC
10.	Intermediate Egret	*Ardea intermedia*	Schedule IV	LC
11.	Laughing dove	*Spilopelia senegalensis*	Schedule IV	LC
12.	Little Cormorant	*Microcarbo niger*	Schedule IV	LC
13.	Little Egret	*Egretta garzetta*	Schedule IV	LC
14.	Paddy field pipit	*Anthus rufulus*	Schedule IV	LC
15.	Pond Heron	*Ardeola grayii*	Schedule IV	LC
16.	Purple Sunbird	*Nectarinia asiatica*	Schedule IV	LC
17.	Red Rumped Swallow	*Hirundo daurica*	Not Yet Scheduled	LC
18.	Red Vented Bulbul	*Pycnonotus cafer*	Schedule IV	LC
19.	Red Wattled Lapwing	*Vanellus indicus*	Schedule IV	LC
20.	Rose Ringed parakeet	*Psittacula krameri*	Schedule IV	LC
21.	Rosy Starling	*Sturnus roseus*	Schedule IV	LC
22.	White Throated Kingfisher	*Halcyon smyrnensis*	Schedule IV	LC
23.	Common Babbler	*Turdoides caudata*	Schedule IV	LC
24.	Black-headed Munia	*Lonchuramalacca*	Schedule IV	LC
25.	Cattle egret	*Bubulcus ibis*	Schedule IV	LC
26.	Common Sandpiper	*Actitis hypoleucos*	Schedule IV	LC
27.	Rock pigeon	*Columbidae*	Schedule IV	LC
28.	Common myna	*Acridotheres tristis*	Schedule IV	LC
29.	Sunbird	*Nectariniidae*	NL	LC
30.	Indian blue robin	*Muscicapidae*	Schedule IV	LC
31.	Asian green bee-eater	*Meropsorientalis*	NL	LC
32.	Hoopoe	*Upupaepops*	Schedule IV	LC
33.	Small blue Kingfisher	*Alcedo atthis*	Schedule IV	LC
34.	White Breasted king fisher	*Halcyon smyrnensis*	Schedule IV	LC
35.	Common quail	*Coturnix coturnix*	Schedule IV	LC
36.	Cuckoo	Cuculuscanorus	Schedule IV	LC
37.	Black drongo	*Dicrurus macrocercus*	Schedule IV	LC
38.	Woodpecker bird	*Picidae*	Schedule IV	LC
39.	Two-tailed Sparrow	*Dicrurus macrocercus*	Schedule IV	LC
40.	House Sparrow	*Passer domesticus*	Schedule IV	LC

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

Table 3.22. List of Reptiles either spotted or reported from the study area.

(*indicates direct observations & Secondary data)

SI. No	Common Name/English Name	Scientific Name	Schedule list wildlife Protection act 1972	IUCN Red List data
1.	Oriental garden lizard	*Calotes versicolor*	NL	LC
2.	House lizards	*Hemidactylus flaviviridis*	Schedule IV	NL
3.	Indian cobra	*Naja naja*	Sch II (Part II)	LC
4.	Green vine snake	*Ahaetulla nasuta*	Schedule IV	NL
5.	Rat snake	*Ptyas mucosa*	Sch IV (Part II)	LC
6.	Common krait	*Bungarus caeruleus*	Schedule IV	NL
7.	Common skink	*Mabuya carinatus*	NL	LC
8.	Russell's viper	*Vipera russseli*	Sch II (Part II)	LC

Table.3.23. List of Butterflies and insect reported from the study area

SI. No	Common Name	Scientific Name	WLPA, 1972
1.	Blue tiger	*Tirumala limniacae*	-
2.	Common emigrant	*Catopsilia pomona*	-
3.	Common grass yellow	*Eurema hecabe*	-
4.	Dark grass blue	*Zizeera knysna*	-
5.	Indian cabbage white	*Pieris canidae*	-
6.	Common grass dart	*Taractrocera maevius*	-
7.	Common jezebel	*Delias eucharis*	-
8.	Common mormon	*Papilio polytes*	-
9.	Lemon pansy	*Junonia lemonias*	-
10.	Common sailor	*Neptis hylas*	-
11.	Common tiger	*Danaus genutia*	-
Insect-Odonates (dragon flies)			
1.	Common Club tail	*Ictinogomphus rapax*	-
2.	Green Marsh Hawk	*Orthetrum sabina*	-
3.	Ground Skimmer	*Diplacodes trivialis*	-

3.5.2 Interpretation& Conclusion:

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

3.6 SOCIO ECONOMIC ENVIRONMENT

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

3.6.1 Objectives of the Study

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

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

3.6.2 Scope of Work

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

3.6.3 Methodology

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

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

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

3.6.4 Sources of Information and Data Base

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

3.6.5 Primary Survey

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

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

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

3.6.6 Collection of Data from Secondary Sources

Data from secondary sources were collected on following aspects:

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

Table 3.6.1 Type of Information and Sources

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

b) Data Presentation and Analysis

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

3.7 Background Information of the Area

Tamil Nadu is the 11th largest states in India in terms of area. The state is the seventh most populous state in the country and its main language Tamil has origins that date back to 500 BC. Chennai is the capital of Tamil Nadu and lies on the eastern coast line of India. Tamil Nadu is famous for its wonderful temples and monuments that have been built 1000s of years ago and has places that have been marked as heritage sites by the United

Nations. In a 180-degree paradigm shift, this state with a rich historical importance is also one of the fastest developing centres for technology and trade.

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

3.8 Geography of the Area

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

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

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

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

3.9 Population Growth Rate

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

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

3.10 Thoothukudi District

Traditionally known as "Pearl City" on account of the prevailing Pearl fish in the past in the area, Thoothukudi has a fascinating History. Forming part of the Pandian kingdom between 7th and 9th Century A.D., Thoothukudi remained in the hands of the Cholas during the period between 9th and 12th century.

Thoothukudi District was bi-furcated from the erstwhile composite Tirunelveli District on October 20, 1986 with Two Revenue Divisions viz., Thoothukudi and Kovilpatti Seven Taluks. The district was restructured by creating one more Revenue Division namely Tiruchendur and three more Taluks viz., Ettayapuram, Kayathar and Eral to provide better services to the public.

The area of the district is **4707 sq.km.** The district has 3 Revenue Divisions, 10 Taluks, 480 Revenue Villages, 12 Blocks, 1 Corporation, 3 Municipalities, 18 Town Panchayats and 403 Village Panchayats. The district has Six Assembly Constituencies and One Lok Sabha Constituency.

The district has vast mineral resources. Gypsum, limestone, beach sand, kankar and shell limestone are the economic (major) minerals available abundance in the district. Rough stone, Jelly, Sand, Gravel, Clay, Earth and Granite are the minor minerals and leases are granted for quarrying of the said minerals in Thoothukudi district.

3.11 Study Area

Detailed socio-economic survey was conducted in the study area (Core and buffer zone) within 10 km radius of the area at Srimoolakarai Village, Srivaikuntam Taluk, Thoothukudi 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	Thoothukudi District	Study Area (10km Radius)
Area (in sq. km.)	3,287,263	130058	4707	329
Population Density/ sq. Km.	368	554	372	241
No. of Households	249454252	13357027	462010	20794
Population	1210569573	72147030	1750176	79440
Male	623121843	36137975	865021	39938
Female	587447730	36009055	885155	39502
Scheduled Tribes	104281034	794697	4911	108
Scheduled Castes	201378086	14438445	347895	21402
Literacy Rate	**72.99%**	**80%**	**77%**	**88%**

Particular	India	Tamil Nadu	Thoothukudi District	Study Area (10km Radius)
Sex Ratio (Females per 1000 Males)	**943**	**996**	**1023**	**989**

Source: Census of India, 2011

Table no 3.12.1 show demographic pattern of India, Tamil Nadu, Thoothukudi District & Study area (10km Radius). In India had total area of 3.2 sqkm, State of Tamil Nadu area was 130058 sqkm, District of Thoothukudi area was 4707 sqkm and study area is about 329 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 372 sqkm and study area density is about 241 sqkm. As per Census 2011, about 5.96percent of population in the state lives in areas. Thoothukudi had comparing state wise 2.43 percent of population lives in the district. In study area has 4.54% around 10km radius. State, District and study area. In Tamil Nadu state SC categories people had about 19 %, district of Thoothukudi about 16 % it has increasing to Study area about 27% increasing in the total population Similarly ST population is about 1.10%, 0.28% and 0.14 % of the total population in the study area. State level Literacy rate is 80%, district level is 77% but study area has increased about 88%. 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 1023 and study area is 989.

The study area has population density 241 persons per sq.km of total population about 79440 as per census 2011. There were about 50.27 percent male and 49.73% female population. Study area has literate rate is about 88%, District had about 77% of literate rate as per census 2011.

3.13 Population Projection of the Study Area

Thoothukkudi Population 2022 – 2023

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

Year	Projected Population
2001	**1,572,273**
2011	**1,750,176**
2021	1,910,000
2025	1,960,000
2031	2,000,000

Source: https://www.census2011.co.in/census/district/49-thoothukkudi.html

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

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

Table 3.13.1 Total Population of Study Area

Sl No.	Population in 2001	Population in 2011
1	67764	79440

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

Table 3.13.2 Population Projection of Study Area

S. No	Year	Projected Population (Approximately)
1.	2021	91116
2.	2031	102792
3.	2041	114468
4.	2051	126144

Source: Calculated by Excel Sheet-Forecast Method.

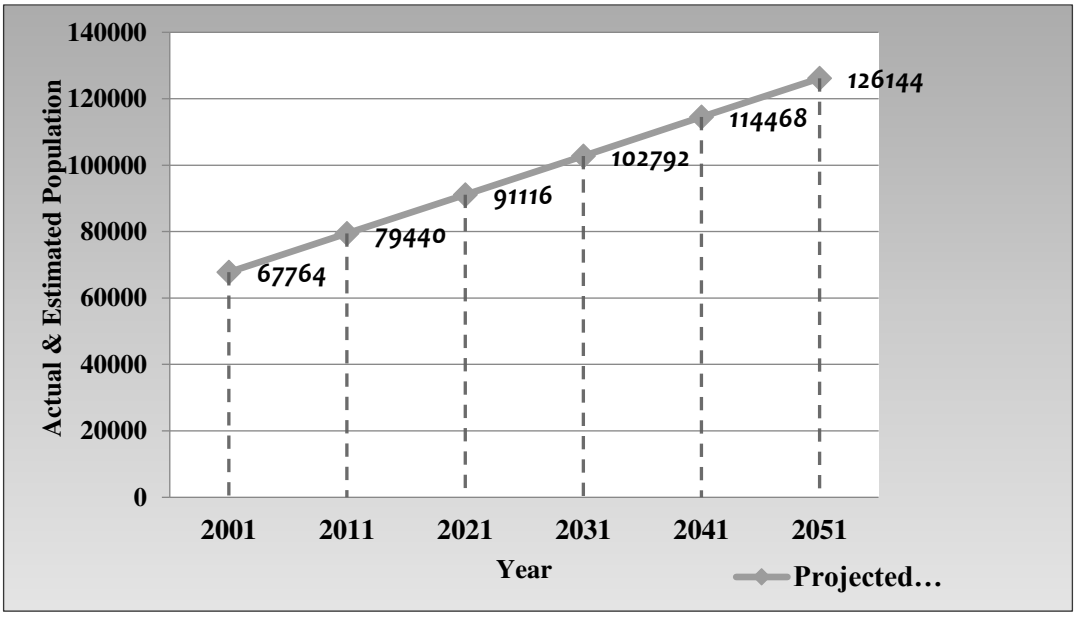


Fig 3.19 Graph Showing Population Projection

Following formula has been used for the projection of population.

$$Y=a+b_t$$

Where: Y= Dependent variable (Population)

a=Intercept

b=Slope

t=Interdependent variables (Time)

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

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

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

3.14 Population Growth of the Study Area

Table 3.14.1 Population Growth rate in Study area

Year	Actual Population	Growth Rate %
2001	67764	-
2011	79440	11.72
2021	91116	11.47
2031	102792	11.28
2041	114468	11.14
2051	126144	11.02

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 67764 and 2011 it was 79440 if the population growth rate is 11.72%, it will approximately gradually an increase about 91116in year 2021 and 126144 in the year of 2051. It has approximately population growth rate decline will be 11.02%.

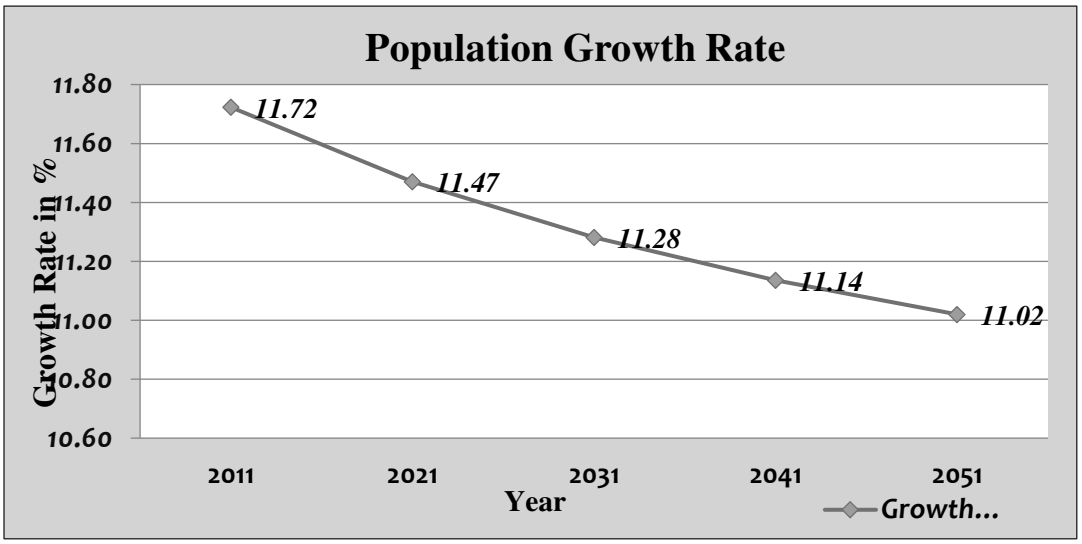


Fig.3.14.2 Graph Showing Population Growth Rate

Planning Analysis:

Calculating Growth Rates

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

Where:

PR=Percent Rate

$V_{Present}$ =Present or Future Value

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

V_{Past} = Past or Present Value

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

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

3.15 Population Distribution and Composition of Study Area

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

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

Table 3.15.1 Zone wise Demographic Profile of Study Area

Zone	No. of Villages	Total Household	Total Population	Male Population	%	Female Population	%
Primary Zone (0 - 3 Km)	3	1108	4009	2001	49.91	2008	50.09
Secondary Zone (3 - 7 Km)	13	6321	24386	12214	50.09	12172	49.91
Tertiary Zone (7 - 10 km)	11	13365	51045	25723	50.39	25322	49.61
Study Area (0-10 km)	**27**	**20794**	**79440**	**39938**	**50.27**	**39502**	**49.73**

Source: Census of India, 2011

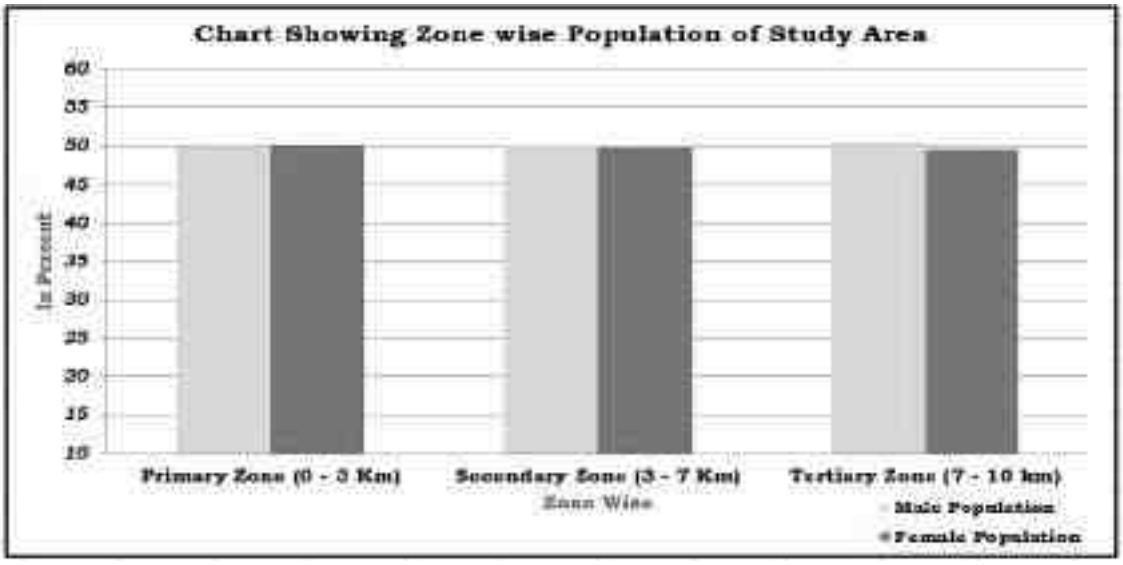


Figure 3.15.2 Population of study area

- ✓ 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 3 villages where as much as 1108 households with 4009 population are located. Mostly lying on Built-up land for their livelihood and substance.
- ✓ Secondary and tertiary zone both comprise of 13 and 11 villages having a total population of 24386 and 51045 respectively.

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

Sno	Name	TRU	No Household	Total Population	Male Population	Female Population	Person 0-6 yrs	Male 0-6 yrs	Female 0-6yrs	SC Persons	ST Person	Literate Person	Male Literate	Female Literate	Total Workers	Main Workers	Marginal workers	Non Workers
0-3km																		
1	Mela Thattaparai	Rural	617	2154	1066	1088	263	128	135	493	0	1595	858	737	1068	166	902	1086
2	Vadakkusilukkanpatti	Rural	123	473	247	226	71	40	31	140	0	341	196	145	211	74	137	262
3	**Keelathattapparai**	Rural	368	1382	688	694	193	110	83	918	0	744	424	320	689	687	2	693
	Total		**1108**	**4009**	**2001**	**2008**	**527**	**278**	**249**	**1551**	**0**	**2680**	**1478**	**1202**	**1968**	**927**	**1041**	**2041**
3-7km																		
1	Pudiyamputhur (Part)	Rural	223	825	419	406	92	44	48	39	0	697	362	335	276	268	8	549
2	Swaminatham	Rural	651	2598	1349	1249	323	176	147	1195	0	1901	1072	829	1274	542	732	1324
3	Therkuveerapandiyapuram	Rural	406	1567	785	782	182	87	95	360	0	1176	648	528	635	535	100	932
4	Umarikottai	Rural	506	1838	904	934	195	103	92	607	0	1279	700	579	1025	902	123	813
5	Ayyanadaippu	Rural	1168	4693	2380	2313	634	332	302	2661	21	3416	1820	1596	1752	1416	336	2941
6	Muthuswamipuram	Rural	244	886	421	465	103	51	52	377	0	615	325	290	408	346	62	478
7	Ramaswamipuram	Rural	71	234	112	122	16	10	6	4	0	212	102	110	74	70	4	160
8	Perurani	Rural	469	1764	887	877	222	115	107	500	0	1418	743	675	938	771	167	826
9	Allikkulam	Rural	371	1468	737	731	169	94	75	1076	0	1154	599	555	639	376	263	829
10	Terkusilukkanpatti	Rural	187	681	327	354	88	41	47	397	0	489	252	237	304	286	18	377
11	Maravanmatam	Rural	661	2664	1312	1352	340	170	170	136	0	1985	1021	964	1133	1091	42	1531
12	Sendilampannai	Rural	30	103	53	50	9	7	2	12	0	81	45	36	50	43	7	53
13	Kuttudankadu	Rural	1334	5065	2528	2537	601	305	296	1515	16	3930	2088	1842	1801	1505	296	3264
	Total		**6321**	**24386**	**12214**	**12172**	**2974**	**1535**	**1439**	**8879**	**37**	**18353**	**9777**	**8576**	**10309**	**8151**	**2158**	**14077**
7-10km																		
1	Pulippanjankulam	Rural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Dalvaypuram	Rural	370	1287	665	622	118	60	58	514	0	1047	587	460	562	185	377	725
3	Korampallam (Part)	Rural	1276	4912	2486	2426	621	318	303	1611	0	3773	1978	1795	1895	1860	35	3017
4	Varthakareddipatti	Rural	567	1990	967	1023	197	101	96	344	0	1575	842	733	887	772	115	1103
5	Sankaraperi (CT)	Urban	5057	19844	10001	9843	2259	1105	1154	3086	51	16194	8504	7690	7282	6705	577	12562
6	Kumaragiri (CT)	Urban	3428	13344	6735	6609	1595	795	800	1443	20	10815	5643	5172	4835	4094	741	8509
7	Savarimangalam	Rural	660	2201	1104	1097	159	77	82	573	0	1779	958	821	1223	1058	165	978
8	Jambulingapuram	Rural	589	2036	1007	1029	214	112	102	800	0	1498	808	690	1144	940	204	892
9	Sillanatham	Rural	424	1594	795	799	161	77	84	116	0	1180	649	531	847	844	3	747
10	Pudur pandiyapuram	Rural	431	1764	900	864	218	109	109	1591	0	1168	659	509	911	891	20	853
11	Kila Mudiman	Rural	563	2073	1063	1010	206	112	94	894	0	1593	881	712	987	976	11	1086
	Total		**13365**	**51045**	**25723**	**25322**	**5748**	**2866**	**2882**	**10972**	**71**	**40622**	**21509**	**19113**	**20573**	**18325**	**2248**	**30472**
	G.Total		**20794**	**79440**	**39938**	**39502**	**9249**	**4679**	**4570**	**21402**	**108**	**61655**	**32764**	**28891**	**32850**	**27403**	**5447**	**46590**

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

3.16 Gender and Sex Ratio

Sex ratio is used to describe the number of females per 1000 of males. Sex ratio is a valuable source for finding the population of women in India and what is the ratio of women to that of men in India. In the Population Census of 2011, it was revealed that the population ratio in India 2011 is 940 females per 1000 of males. The study area has 989 females per 1000 males. Gender and sex ratio determine the Human Development Index (HDI) of an area thereby understanding the status of women in that region. Following table entails information about sex ratio of 27 villages lying in study area (buffer zone) as primary, secondary and tertiary zone.

Table 3.16.1 Sex ratio of the study area

S. No.	Buffer Zone	Sex Ratio of Study area Female/ 1000 Male
1	Primary Zone (0-3 km)	1003
2	Secondary zone (3-7 km)	997
3	Tertiary Zone (7-10 km)	984

Source: Census of India, 2011

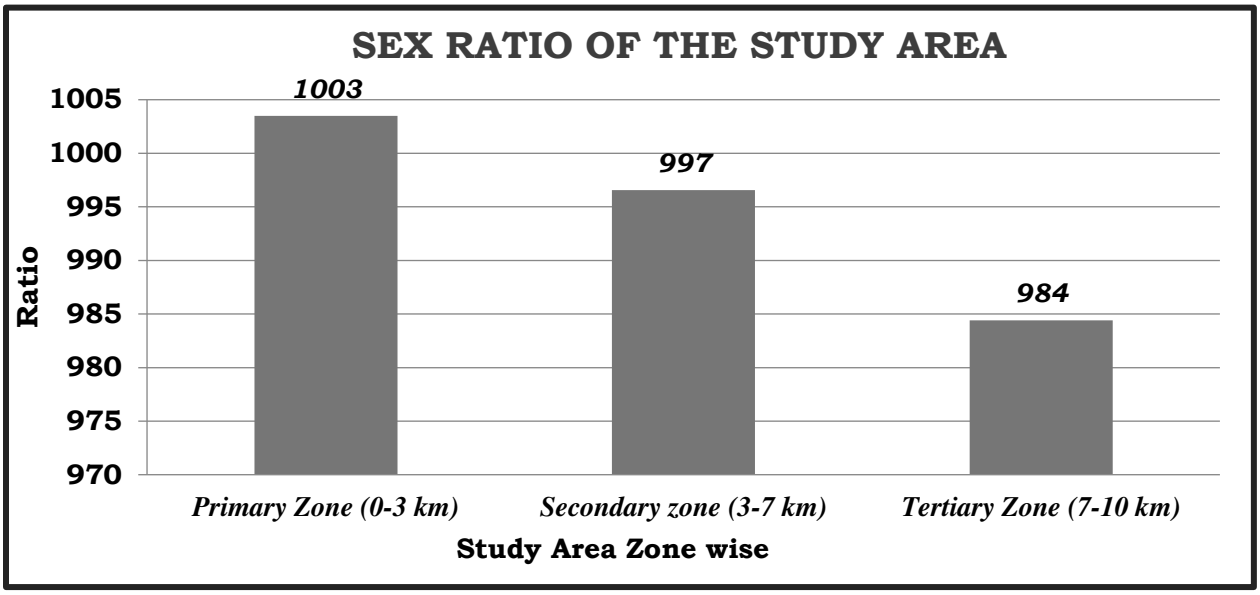


Figure 3.16.2 Sex Ratio within 10 Km study area

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)	896
2	Secondary zone (3-7 km)	937
3	Tertiary Zone (7-10 km)	1006

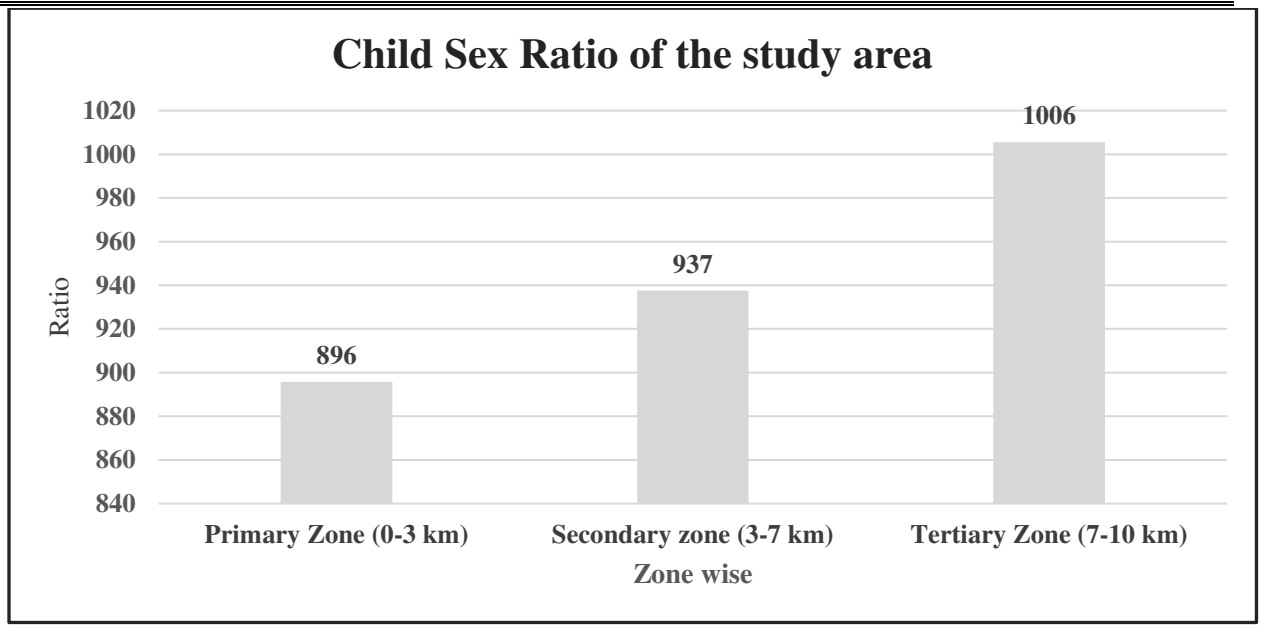


Figure 3.16.2-b Child Sex Ratio within 10 Km study area

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 87.84% as per census data 2011. The male literacy rate in the study area indicates 92.92% whereas the female literacy rate, which is an important indicator for social change, is observed to be 82.71% as per the census data 2011. This needs to focus on the study area and enhance further development focusing on education. (Table no 3.17.1).

Table 3.17.1 Literacy Rate of the Study Area

Zone	No. of Villages	Male Literacy Population	Male literacy Rate	Female Literacy Population	Female literacy Rate	Total Literacy	Total Literacy Rate
Primary Zone (0 - 3 Km)	3	**1478**	85.78	**1202**	68.33	**2680**	76.97
Secondary Zone (3 - 7 Km)	13	**9777**	91.55	**8576**	79.90	**18353**	85.71
Tertiary Zone (7 - 10 Km)	11	**21509**	94.10	**19113**	85.17	**40622**	89.68
Study Area (0-10km)	**27**	**32764**	**92.92**	**28891**	**82.71**	**61655**	**87.84**

Source: Census of India, 2011

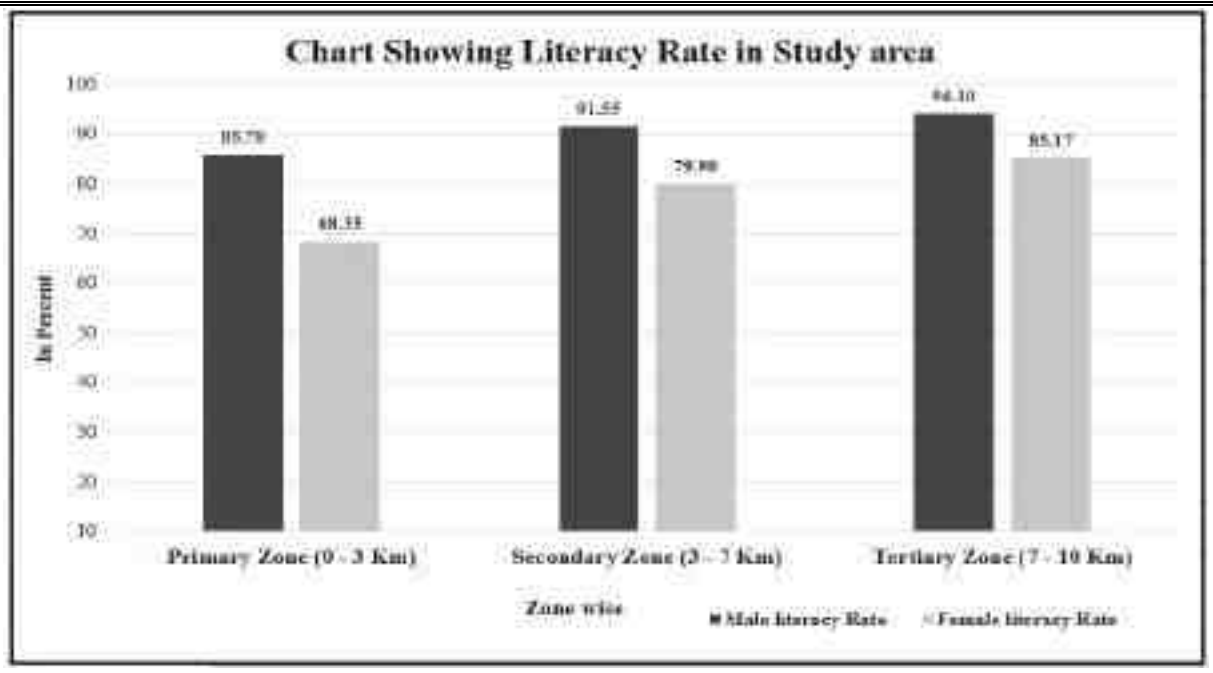


Figure 3.17.2 Gender wise Literacy Rate in the study area

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 26.9% and Schedule Tribe population 0.14 %, Other Population is 72.92% in total study area.

Table 3.19.1 vulnerable groups of the study area

Zone	No. of Villages	Vulnerable Groups					
		SC Population	%	ST Population	%	Other Population	%
Primary Zone (0 - 3 Km)	3	1551	38.69	0	0.00	2458	61.31
Secondary Zone (3 - 7 Km)	13	8879	36.41	37	0.15	15470	63.44
Tertiary Zone (7 - 10 Km)	11	10972	21.49	71	0.14	40002	78.37
Total area (10km)	**27**	**21402**	**26.94**	**108**	**0.14**	**57930**	**72.92**

Source: Census of India, 2011

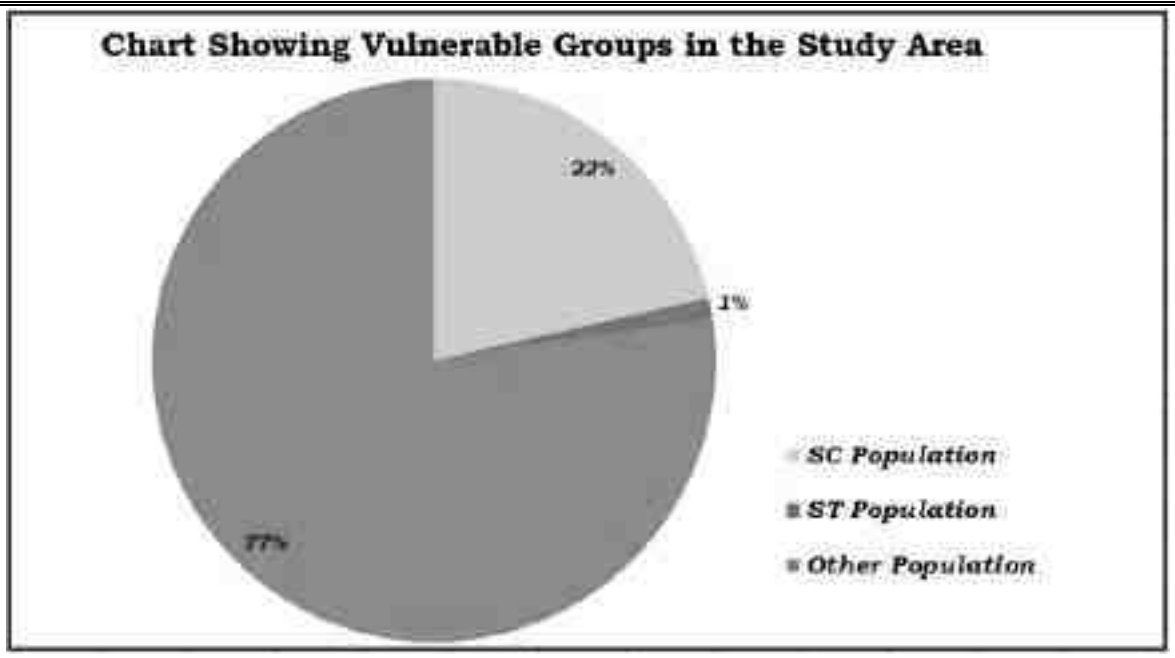


Figure 3.19.2 vulnerable groups

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)	3	1968	49.09	927	23.12	1041	25.97	2041	50.91
Secondary Zone (3 - 7 Km)	13	10309	42.27	8151	33.42	2158	8.85	14077	57.73
Tertiary Zone (7 - 10 Km)	11	20573	40.30	18325	35.90	2248	4.40	30472	59.70
Study Area (10 Km)	**27**	**32850**	**41.35**	**27403**	**34.50**	**5447**	**6.86**	**46590**	**58.65**

Source: Census of India, 2011

The above table shows that out of the total working population, the percentage of main workers is 34.5% while 6.86% are marginal workers. Number of working populations is 41.35% and non-working population is 58.65% 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.

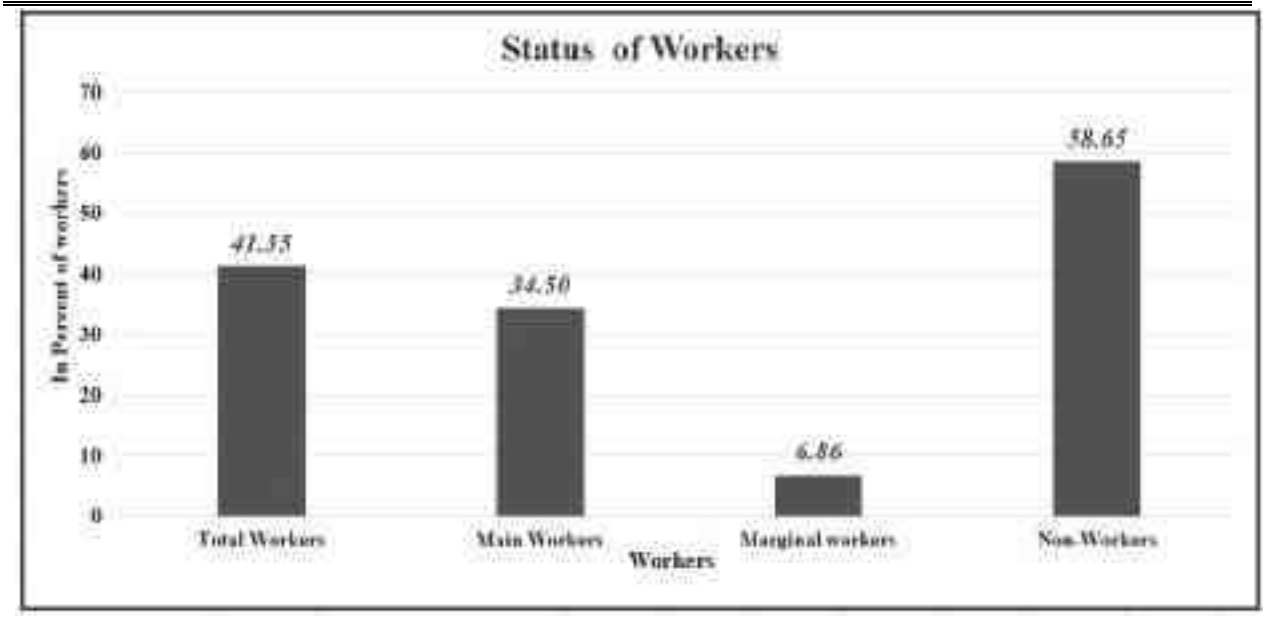


Figure 3.20.2. Working population in the study area

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, Thoothukudi district (8km-SE) from site which by local transport. Arnon River southern side 3km-S from mine lease boundary and Perungulam lake 17km-Southern side from mine lease boundary.
- **Availability of** Government school Thattaparai Village (NW-2.0 km), Government Primary school, Kailasapuram village (SE-6km), Nee prasanna higher Secondary school, Thoothukudi, Government higher secondary School, Sorispuram Village (SE-8 km), Government Higher secondary school, Ramachandrapuram village (S-9km), Ottapidaram, Srivaikuntam and Thoothukudi Taluks many Pre-primary school, Elementary school, Engineering college and Training institute found in study area.
- **Health facilities** covered in the area Pudiyamputhur PHC (6km-N), Pudukottai Village Government PHC (8km-SE), Madathur PHC (7.5km-E), Government Hospital, Savarimangalam Village (6km-NW) Buffer zone area like Government Hospital, Thoothukudi, Srivaikuntam Government Hospital and Thoothukudi Taluks. Other private clinics and Pharmacy available in the buffer zone.

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	Mela Thattaparai	2	1	2	0	0	0	0	0	0	0
2	Vadakkusilukkanpatti	1	0	0	0	0	0	0	0	0	0
3	Keelathattapparai	5	297	0	0	0	2	0	0	0	0
	Total	**8**	**298**	**2**	**0**	**0**	**2**	**0**	**0**	**0**	**0**
3-7km											
1	Pudiyamputhur (Part)	3	1	2	1	0	1	0	1	0	1
2	Swaminatham	1	0	1	0	0	0	0	0	0	0
3	Therkuveerapandiyapuram	2	0	1	0	0	0	0	0	0	0
4	Umarikottai	4	0	1	0	0	0	0	0	0	0
5	Ayyanadaippu	3	0	2	0	1	0	0	0	0	0
6	Muthuswamipuram	1	0	0	0	0	0	0	0	0	0
7	Ramaswamipuram	1	0	0	0	0	0	0	0	0	0
8	Perurani	2	1	0	1	0	0	0	0	0	0
9	Allikkulam	1	1	1	0	0	0	0	0	0	0
10	Terkusilukkanpatti	1	0	0	0	0	0	0	0	0	0
11	Maravanmatam	0	4	0	1	0	0	0	0	0	0
12	Sendilampannai	0	0	0	0	0	0	0	0	0	0
13	Kuttudankadu	2	1	0	0	0	0	0	0	0	0
	Total	**21**	**8**	**8**	**3**	**1**	**1**	**0**	**1**	**0**	**1**
7-10km											
1	Kila Mudiman	1	1	0	1	0	1	0	1	0	1
2	Melapandiyapuram	0	1	0	0	0	0	0	0	0	0
3	Savarimangalam	0	3	0	1	0	1	0	1	0	0
4	Sillanatham	2	0	0	0	0	0	0	0	0	0
5	Pudur pandiyapuram	2	1	0	1	0	0	0	0	0	0
6	Pulippanjankulam	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	0
7	Dalvaypuram	1	0	0	0	0	0	0	0	0	0
8	Korampallam (Part)	1	3	0	1	0	0	0	0	0	0
9	Varthakareddipatti	1	0	1	0	0	0	0	0	0	0
10	Sankaraperi (CT)	5	3	1	5	0	3	0	3	0	0
11	Kumaragiri (CT)	5	0	6	4	1	4	1	4	0	0
	Total	**18**	**12**	**8**	**13**	**1**	**9**	**1**	**9**	**0**	**1**
	Grant total	**47**	**318**	**18**	**16**	**2**	**12**	**1**	**10**	**0**	**2**

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	Mela Thattaparai	0	0	1	0	0	0	1	0	1
2	Vadakkusilukkanpatti	0	0	0	0	0	0	0	0	0
3	Keelathattapparai	NIL								
	Total	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**1**
3-7km										
1	Pudiyamputhur (Part)	0	0	1	1	0	0	0	0	0
2	Swaminatham	0	0	0	0	0	0	0	0	0
3	Therkuveerapandiyapuram	0	0	1	1	0	0	0	0	0
4	Umarikottai	0	0	0	0	0	0	1	0	0
5	Ayyanadaippu	0	0	1	0	0	0	0	0	1
6	Muthuswamipuram	0	0	1	0	0	0	0	0	0
7	Ramaswamipuram	0	0	0	0	0	0	0	0	0
8	Perurani	0	0	0	0	0	0	1	0	0
9	Allikkulam	0	0	0	0	0	0	0	0	0
10	Terkusilukkanpatti	0	0	0	0	0	0	0	0	0
11	Maravanmatam	0	0	0	0	0	0	0	0	0
12	Sendilampannai	0	0	0	0	0	0	0	0	0
13	Kuttudankadu	0	0	1	0	0	0	0	0	1
	Total	**0**	**0**	**5**	**2**	**0**	**0**	**3**	**0**	**1**
7-10km										
1	Kila Mudiman	0	0	1	0	0	0	0	0	0
2	Melapandiyapuram	0	0	0	0	0	0	0	0	0
3	Savarimangalam	0	1	1	1	0	1	0	1	0
4	Sillanatham	0	0	1	1	0	0	0	0	0
5	Pudur pandiyapuram	0	0	0	0	0	0	0	0	0
6	Pulippanjankulam	NIL								
7	Dalvaypuram	0	0	0	0	0	0	0	0	0
8	Korampallam (Part)	0	0	1	0	0	0	1	0	1
9	Varthakareddipatti	0	0	1	1	0	0	0	0	0
10	Sankaraperi (CT)	1	1	1	1	0	1	0	0	1
11	Kumaragiri (CT)	1	1	0	1	1	1	0	0	5
	Total	**2**	**3**	**6**	**5**	**1**	**3**	**7**	**1**	**7**
	G.Total	**2**	**3**	**12**	**7**	**1**	**3**	**11**	**1**	**9**

Source: DCHB Census 2011, Tamil Nadu

Table 3.21.3 Water & Drainage Facilities in the Surveyed Area

Sno	Village Name	Tap Water-Treated (Status A(1)/NA(2))	Tap Water Untreated (Status A(1)/NA(2))	Covered Well (Status A(1)/NA(2))	Uncovered Well (Status A(1)/NA(2))	Hand Pump (Status A(1)/NA(2))	Tube Wells/Borehole (Status A(1)/NA(2))	Spring (Status A(1)/NA(2))	River/Canal (Status A(1)/NA(2))	Tank/Pond/Lake (Status A(1)/NA(2))	Others (Status A(1)/NA(2))	Closed Drainage (Status A(1)/NA(2))	Open Drainage (Status A(1)/NA(2))	No Drainage (Status A(1)/NA(2))
0-3km														
1	Mela Thattaparai	1	1	2	2	2	2	1	2	2	2	1	1	2
2	Vadakkusilukkanpatti	1	2	2	2	2	2	2	2	2	2	1	1	2
3	Keelathattapparai	NIL												
	Total	**2**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**2**	**2**	**0**
3-7km														
1	Pudiyamputhur (Part)	1	1	2	2	2	2	2	2	2	2	1	1	2
2	Swaminatham	1	1	2	2	2	2	2	2	2	2	1	1	2
3	Therkuveerapandiyapuram	1	1	2	2	1	1	2	1	2	1	2	1	2
4	Umarikottai	1	1	2	1	2	2	2	2	2	2	1	1	2
5	Ayyanadaippu	1	1	1	1	2	1	2	2	2	2	1	1	2
6	Muthuswamipuram	2	1	1	2	2	2	2	2	2	2	2	2	1
7	Ramaswamipuram	1	1	2	2	2	2	2	2	2	2	1	1	2
8	Perurani	1	1	1	2	2	1	2	2	2	2	1	1	2
9	Allikkulam	1	1	2	2	1	1	2	2	2	2	2	1	2
10	Terkusilukkanpatti	2	1	2	2	2	2	2	2	2	2	1	1	2
11	Maravanmatam	1	1	2	2	1	1	2	2	2	1	1	1	2
12	Sendilampannai	2	2	2	2	2	1	2	2	2	2	1	2	2
13	Kuttudankadu	1	1	1	2	1	1	2	2	2	2	1	1	2
	Total	**10**	**12**	**4**	**2**	**4**	**7**	**1**	**3**	**0**	**2**	**10**	**11**	**1**
7-10km														
1	Kila Mudiman	1	1	2	2	1	1	2	2	2	1	1	1	2
2	Melapandiyapuram	1	1	2	2	2	2	2	2	2	1	1	1	2
3	Savarimangalam	1	1	2	2	2	2	2	2	2	2	1	1	2
4	Sillanatham	1	1	2	2	2	2	2	2	2	2	1	1	2
5	Pudur pandiyapuram	1	1	2	2	2	2	2	2	2	2	1	1	2
6	Pulippanjankulam	NIL												
7	Dalvaypuram	1	1	2	2	2	2	2	2	2	2	1	1	2
8	Korampallam (Part)	1	1	2	1	2	2	2	2	2	1	1	1	2
9	Varthakareddipatti	1	1	1	1	1	1	2	2	2	2	1	1	2
10	Sankaraperi (CT)	1	1	2	2	2	2	2	2	2	2	1	1	2
11	Kumaragiri (CT)	1	1	2	2	2	2	2	2	2	2	1	1	2
	Total	**16**	**16**	**7**	**8**	**10**	**14**	**4**	**5**	**2**	**6**	**14**	**15**	**2**
	G.Total	**28**	**29**	**11**	**10**	**14**	**21**	**6**	**8**	**2**	**8**	**26**	**28**	**3**

Source: DCHB Census 2011, Tamil Nadu

3.21.4 Transport and Other Infrastructure Facilities in the Surveyed Area

Sno	Village	Post Office (Status A(1)/NA(2))	Sub Post Office (Status A(1)/NA(2))	Post And Telegraph Office (Status A(1)/NA(2))	Private Courier Facility (Status A(1)/NA(2))	Public Bus Service (Status A(1)/NA(2))	Private Bus Service (Status A(1)/NA(2))	Railway Station (Status A(1)/NA(2))	Auto/Modified Autos (Status A(1)/NA(2))	Taxi (Status A(1)/NA(2))	Vans (Status A(1)/NA(2))	Tractors (Status A(1)/NA(2))	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	Mela Thattaparai	1	1	1	2	1	1	1	1	1	1	2	2	2	2	1	1	1
2	Vadakkusilukkanpatti	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	1	1
3	Keelathattapparai	NIL																
3-7km																		
1	Pudiyamputhur (Part)	2	2	2	2	1	1	2	2	1	1	2	2	2	2	2	1	1
2	Swaminatham	1	1	1	2	1	1	2	2	2	2	2	2	2	2	1	2	2
3	Therkuveerapandiyapuram	2	1	2	2	1	1	2	2	2	2	2	2	2	2	1	1	1
4	Umarikottai	2	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2
5	Ayyanadaippu	1	2	1	1	1	1	2	1	1	1	2	2	2	1	1	1	1
6	Muthuswamipuram	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	1	1
7	Ramaswamipuram	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	1	1
8	Perurani	2	2	2	2	1	1	2	1	1	1	2	2	2	2	1	1	2
9	Allikkulam	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	1	1
10	Terkusilukkanpatti	2	1	2	2	1	1	2	1	2	1	2	2	2	2	1	1	1
11	Maravanmatam	2	1	2	2	1	1	2	2	2	2	2	2	2	1	1	1	1
12	Sendilampannai	2	2	2	1	1	1	2	2	2	2	2	2	2	2	1	1	1
13	Kuttudankadu	2	1	2	2	1	2	2	1	1	1	2	2	2	1	1	1	2
7-10km																		
1	Kila Mudiman	2	1	2	2	1	1	2	2	2	2	2	2	2	2	1	1	2
2	Melapandiyapuram	2	1	2	2	1	1	1	2	2	2	2	2	2	2	2	1	1
3	Savarimangalam	1	1	1	2	1	1	1	1	1	2	2	2	2	1	1	1	1
4	Sillanatham	2	1	2	2	1	1	2	2	2	2	2	2	2	2	2	1	1
5	Pudur pandiyapuram	2	2	2	2	1	1	2	2	2	2	2	2	2	1	1	1	1
6	Pulippanjankulam	NIL																
7	Dalvaypuram	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	1	1
8	Korampallam (Part)	2	2	2	2	1	1	2	1	1	1	2	2	2	1	1	2	2
9	Varthakareddipatti	2	1	2	2	1	1	2	1	2	2	2	2	2	2	2	1	1
10	Sankaraperi (CT)	1	1	1	1	1	1	2	1	1	1	2	2	2	2	1	1	1
11	Kumaragiri (CT)	1	1	1	1	1	1	2	1	1	1	2	2	2	2	1	1	1

Source: DCHB Census 2011, Tamil Nadu.

3.22. Other Issues in the Study Area

1. Deforestation of Land (Cutting Trees or Plant etc.)
2. Agriculture Land decreases
3. Lack of awareness among vulnerable groups for their welfare
4. Medical/Clinic facilities and PHC need for the Core 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 Arnon 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 88%.
- The study area had average educational facilities. The overall status depicts that the education is limited to primary and middle level.
- The schedule tribe community forms 0.14% and Scheduled Caste forms 26.94% of the total population of study area.
- The Other Population forms 72.9% of the total population of study area.
- The study area is well connected by Taluk/Village Road.
- The study area not well health facilities of primary level.
- Considering the above facts, the proposed project will boost the socio-economic development activities in the area and hence will leave positive impact.
- The study area has mobile connectivity.

3.24 Recommendation and Suggestions

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

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

3.25 Conclusion

To evaluate the impacts of proposed rough stone and gravel quarry project on the surrounding area, it is vital to assess the baseline status of the environmental quality in the locality of the site. Hence it can be concluded that the

present environment status of the study area will not be affected by the project as **Melathattapparai rough stone and gravel Cluster quarry** will adopt adequate control measures to protect the surrounding environment and will contribute in development of the study areas.

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

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

4. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.0 GENERAL

Environmental impacts both direct and indirect on various environmental attributes due to cluster quarries will be created in the surrounding environment, during the operational and post–operational phases. The occurrence of mineral deposits, being site specific, their exploitation, often, does not allow for any choice except adoption of eco-friendly operation. The methods are required to be selected in such a manner, so as to maintain environmental equilibrium ensuring sustainable development.

In order to maintain the environmental commensuration with the mining operation, it is essential to undertake studies on the existing environmental scenario and assess the impact on different environmental components. This would help in formulating suitable management plans sustainable resource extraction.

The following parameters are of significance in the Environmental Impact Assessment and are being discussed in detail

Land environment
Soil environment
Water Environment
Air Environment
Noise Environment
Socio economic environment
Biological Environment

Based on the baseline environmental status at the project site, the environmental factors that are likely to be affected (Impacts) are identified, quantified and assessed.

4.1 LAND ENVIRONMENT

4.1.1 Anticipated Impact

The main anticipated impact on the Land Environment due to quarrying operation is change in Landscape, change in Land – use Pattern. The total extent of the cluster quarries is 7.03.5 ha including existing and proposed quarries in patta land. The ultimate depth of the quarrying is varying from 37m to 45m Maximum below the ground level and will not intersect the ground water table. The project is site specific.

- Permanent or temporary change on land use and land cover.
- Change in Topography: Topography of the project 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 Mitigation measures

- The mining activity will be gradual confined in blocks and excavation will be undertaken progressively along with other mitigate 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 cluster 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.,
- 7.5m, 10m and 50m 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

Mining operations routinely modify the surrounding landscape by exposing previously undisturbed earthen materials. Erosion of top layer (top soil), extracted fine material can result in substantial sediment loading to surface waters and drainage ways. During rainy season surface run off may cause siltation in low lying areas. Particularly this project areas covering rough stone boulders, no top soil anticipated within the project area hence removal of top soil is not anticipated.

4.1.5 Mitigation measures for Soil Erosion and Soil Conservation

- However, Garland drains will be constructed around the project areas with silt traps to control the soil erosion during rainy seasons.
- Greenbelt development all along the periphery of the project area (i.e., 7.5 m, 10 m and 50m safety barriers) will ensure binding strength and minimizes soil erosion.
- Soil sampling will be carried out every six months to ensure the soil quality is not affected due to the quarrying activities.

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 quarrying is proposed in the cluster quarries is 52m - 47m 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 rough stone processing.

Detail of water requirements in KLD as given below:

TABLE 4.1: WATER REQUIREMENTS FOR THE CLUSTER

Proposal - 1		
***Purpose**	**Quantity**	**Source**
Dust Suppression	2.0 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Green Belt development	0.5 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Domestic purpose	0.5 KLD	Water Tankers
Total	**3.0 KLD per proposal**	
Proposal - 2		
***Purpose**	**Quantity**	**Source**
Dust Suppression	1.0 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Green Belt development	0.6 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Domestic purpose	0.4 KLD	Water Tankers
Total	**2.0 KLD per proposal**	

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

4.2.2 Mitigation measures

The following mitigation measures are suggested for water management. The following mitigation measures are suggested for water management for the cluster quarries Rainwater will be collected in lower part of the quarry pit by construction of garland drains to divert surface run-off and will be connected to setting tank of 5 m (l) x 5m (w) x 3m (d) to allow suspended solids to settle down if any. This collected water will act as a rain water harvesting system and will be used for dust suppression and greenbelt development.

Six months once analysis of quarry pit water and ground water quality in nearby villages will be carried out to ensure the water quality is not affected due to the quarrying activities.

Domestic sewage from site office & urinals/latrines provided in project area will be discharged through septic tank followed by soak pit system.

Only clear and settled water free from silt content will be used for dust suppression and plantation purposes.

De-silting will be carried out before and immediately after the monsoon season and the settling tank and drains will be cleaned weekly, especially during monsoons.

Tippers & HEMM will be washed in a designated area and the washed water will be routed through drains to a settling tank, which has an oil & grease trap, only clear water will be reused for greenbelt development.

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 and Gravel.

4.3.1. Anticipated Impact

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 and Gravel, wind erosion of the exposed area and movement of light vehicles will be a cause of pollution due to quarrying activities within a radius of 500 meters from the project area. This leads to a cumulative 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.

4.3.2.1 Emission Estimation

An emissions factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant.
The general equation for emissions estimation is:

$$E = A \times EF \times (1-ER/100)$$

Where:
E = emissions;
A = activity rate;
EF = emission factor, and
ER =overall emission reduction efficiency, %

The proposed mining activity includes various activities like ground preparation, excavation, handling and transport of ore. These activities have been analysed systematically basing on USEPA-Emission Estimation

Technique Manual, for Mining AP-42, to arrive at possible emissions to the atmosphere and estimated emissions are given in Table 4-2.

TABLE 4.2: ESTIMATED EMISSION RATE FOR PM_{10}

Activity	Source type	Value		Unit
		P1	P2	
Drilling	Point Source	0.112162663	0.128445598	g/s
Blasting	Point Source	0.004293941	0.008456888	g/s
Mineral Loading	Point Source	0.045678405	0.047880410	g/s
Haul Road	Line Source	0.002502843	0.00251528	g/s
Overall Mine	Area Source	0.045755648	0.047844906	g/s

TABLE 4.3: ESTIMATED EMISSION RATE FOR SO_2

Activity	Source type	Value		Unit
		P1	P2	
Overall Mine	Area Source	0.001339738	0.002074398	g/s

TABLE 4.4: ESTIMATED EMISSION RATE FOR NO_X

Activity	Source type	value		Unit
		P1	P2	
Overall Mine	Area Source	0.000042532	0.000067853	g/s

4.3.2 Frame work of Computation & Model details

By using the above-mentioned inputs, ground level concentrations due to the quarrying activities have been estimated to know the incremental concentration in ambient air quality and impact in the study area. The effect of air pollutants upon receptors are influenced by concentration of pollutants and their dispersion in the atmosphere. Air quality modelling is an important tool for prediction, planning and evaluation of air pollution control activities besides identifying the requirements for emission control to meet the regulatory standards and to apply mitigation measures to reduce impact caused by quarrying activities. PM10 was the major pollutant occurred during quarrying activities. 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 PM10 was observed close to the source due to low to moderate wind speeds. Incremental value of PM10 was superimposed on the base line data monitored at the proposed site to predict total GLC of PM10 due to combined impacts

FIGURE 4.1: AERMOD TERRAIN MAP

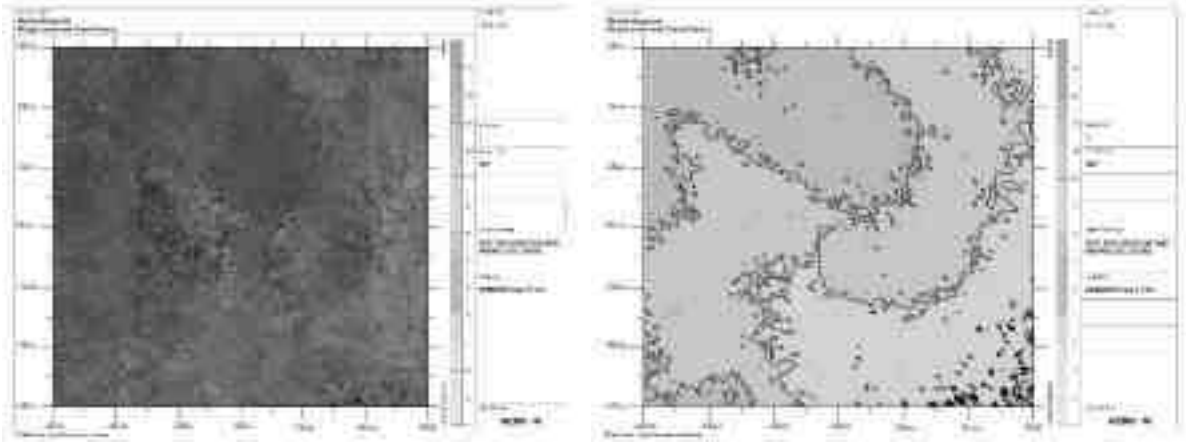


FIGURE 4.2: PREDICTED INCREMENTAL CONCENTRATION OF PM_{10}

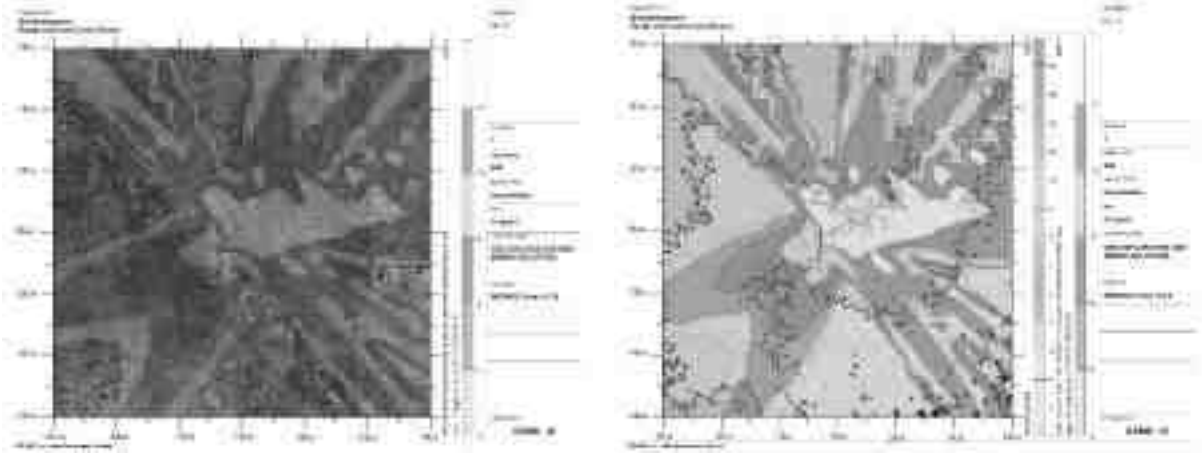


FIGURE 4.3: PREDICTED INCREMENTAL CONCENTRATION OF $PM_{2.5}$

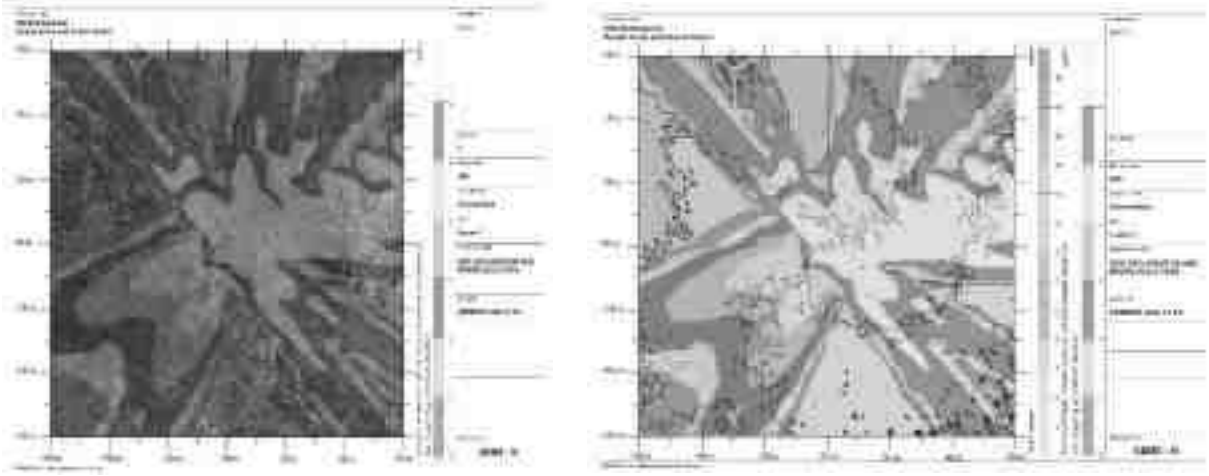


FIGURE 4.4: PREDICTED INCREMENTAL CONCENTRATION OF SO_2

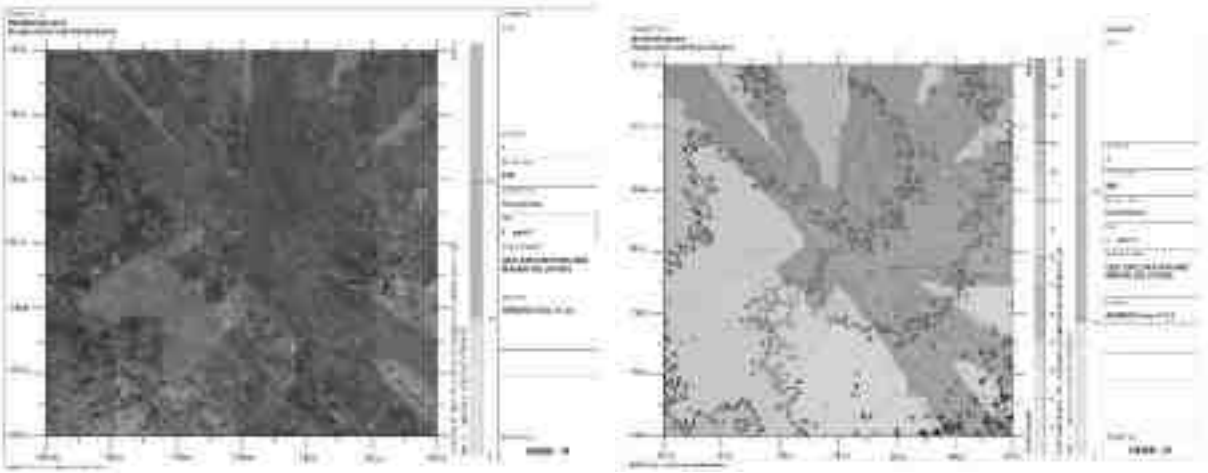


FIGURE 4.4: PREDICTED INCREMENTAL CONCENTRATION OF NOx

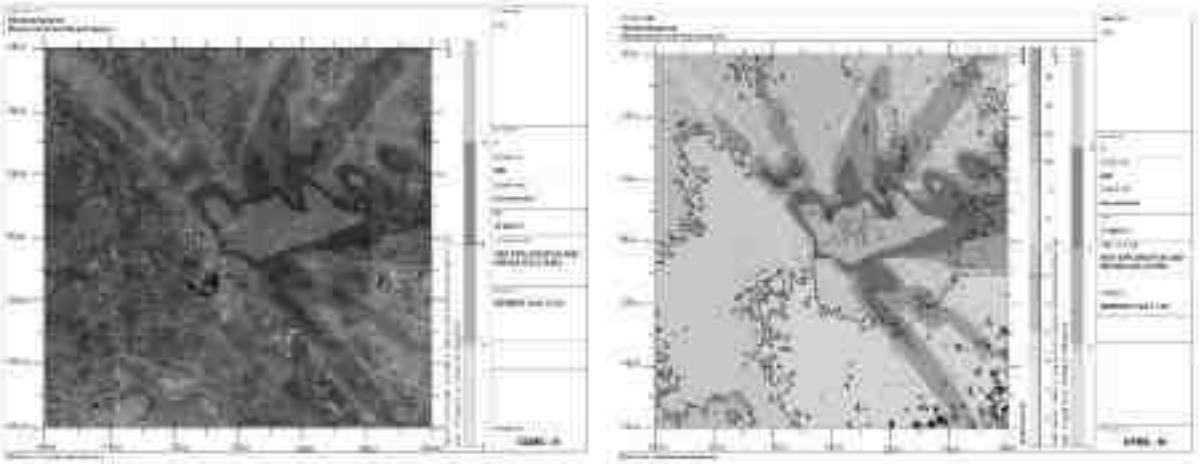
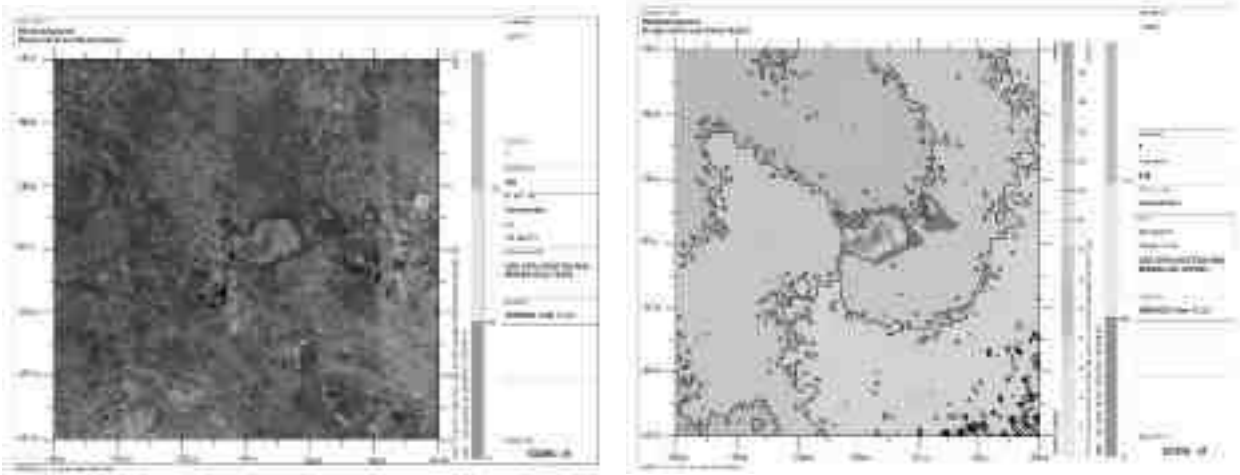


FIGURE 4.5: PREDICTED INCREMENTAL CONCENTRATION OF FUGITIVE DUST EMISSION



4.3.2.1 Model Results

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

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

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline PM_{10} ($\mu g/m^3$)	Incremental value of PM_{10} due to mining ($\mu g/m^3$)	Total PM_{10} ($\mu g/m^3$) (5+6)
AAQ1	8°48'47.64"N 78° 1'50.13"E	-68	30	41.18	17.80	58.98
AAQ2	8°48'48.28"N 78° 1'46.49"E	-185	51	47.69	17.23	64.92
AAQ3	8°48'59.18"N 78° 1'3.07"E	-1525	387	45.80	5.00	50.8
AAQ4	8°47'52.98"N 78° 1'45.55"E	-211	-1660	41.19	7.90	49.09
AAQ5	8°49'35.57"N 78° 3'56.16"E	3812	1512	46.50	16.01	62.51
AAQ6	8°47'53.41"N 77°58'42.14"E	-5858	-1644	47.16	3.43	50.59
AAQ7	8°46'15.73"N 78° 3'11.91"E	2449	-4667	44.61	0	44.61
AAQ8	8°50'46.29"N 77°59'30.22"E	-4377	3703	42.59	1.50	44.09

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	8°48'47.64"N 78° 1'50.13"E	-68	30	19.61	9.87	29.48
AAQ2	8°48'48.28"N 78° 1'46.49"E	-185	51	23.83	9.24	33.07
AAQ3	8°48'59.18"N 78° 1'3.07"E	-1525	387	22.23	4.00	26.23
AAQ4	8°47'52.98"N 78° 1'45.55"E	-211	-1660	19.64	6.40	26.04
AAQ5	8°49'35.57"N 78° 3'56.16"E	3812	1512	26.29	8.00	34.29
AAQ6	8°47'53.41"N 77°58'42.14"E	-5858	-1644	24.69	2.55	27.24
AAQ7	8°46'15.73"N 78° 3'11.91"E	2449	-4667	26.5	0.39	26.89
AAQ8	8°50'46.29"N 77°59'30.22"E	-4377	3703	22.72	1.23	23.95

TABLE 4.5: INCREMENTAL & RESULTANT GLC OF SO_2

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline So_2 ($\mu g/m^3$)	Incremental value of So_2 due to mining ($\mu g/m^3$)	Total So_2 ($\mu g/m^3$) (5+6)
AAQ1	8°48'47.64"N 78° 1'50.13"E	-68	30	7.21	3.49	10.7
AAQ2	8°48'48.28"N 78° 1'46.49"E	-185	51	7.83	3.30	11.13
AAQ3	8°48'59.18"N 78° 1'3.07"E	-1525	387	8.21	0	8.21
AAQ4	8°47'52.98"N 78° 1'45.55"E	-211	-1660	7.68	0.95	8.63
AAQ5	8°49'35.57"N 78° 3'56.16"E	3812	1512	7.72	3.05	10.77
AAQ6	8°47'53.41"N 77°58'42.14"E	-5858	-1644	8.03	0	8.03
AAQ7	8°46'15.73"N 78° 3'11.91"E	2449	-4667	6.97	0	6.97
AAQ8	8°50'46.29"N 77°59'30.22"E	-4377	3703	7.25	0	7.25

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	8°48'47.64"N 78° 1'50.13"E	-68	30	20.88	12.78	33.66
AAQ2	8°48'48.28"N 78° 1'46.49"E	-185	51	24.12	12.19	36.31
AAQ3	8°48'59.18"N 78° 1'3.07"E	-1525	387	23.17	0	23.17
AAQ4	8°47'52.98"N 78° 1'45.55"E	-211	-1660	25.48	0	25.48
AAQ5	8°49'35.57"N 78° 3'56.16"E	3812	1512	23.19	6.30	29.49
AAQ6	8°47'53.41"N 77°58'42.14"E	-5858	-1644	24.09	0	24.09
AAQ7	8°46'15.73"N 78° 3'11.91"E	2449	-4667	25.2	0	25.2
AAQ8	8°50'46.29"N 77°59'30.22"E	-4377	3703	23.80	0	23.8

TABLE 4.7: INCREMENTAL & RESULTANT GLC OF FUGITIVE DUST EMISSION

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	8°48'47.64"N 78° 1'50.13"E	-68	30	57.9	123.80	181.7
AAQ2	8°48'48.28"N 78° 1'46.49"E	-185	51	63.05	123	186.05
AAQ3	8°48'59.18"N 78° 1'3.07"E	-1525	387	63.14	0	63.14
AAQ4	8°47'52.98"N 78° 1'45.55"E	-211	-1660	58.22	0	58.22
AAQ5	8°49'35.57"N 78° 3'56.16"E	3812	1512	60.64	0	60.64
AAQ6	8°47'53.41"N 77°58'42.14"E	-5858	-1644	65.08	0	65.08
AAQ7	8°46'15.73"N 78° 3'11.91"E	2449	-4667	63.43	0	63.43
AAQ8	8°50'46.29"N 77°59'30.22"E	-4377	3703	68.65	0	68.65

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. Mitigation Measures

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

Advantages of Wet Drilling:-

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

Blasting –

- Establish time of blasting to suit the local conditions and water sprinkling on blasting face
- Avoid blasting i.e., when temperature inversion is likely to occur and strong wind blows towards residential areas

- Controlled blasting includes Adoption of suitable explosive charge and short delay detonators, adequate stemming of holes at collar zone and restricting blasting to a particular time of the day i.e. at the time lunch hours, controlled charge per hole as well as charge per round of hole
- Before loading of Rough stone into the tippers water will be sprayed to eliminate the dust

Haul Road & Transportation –

- Water will be sprinkled on haul roads, Loading Points 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.
- 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 road 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 area

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 month once to assess effectiveness of mitigation measures proposed

4.4 NOISE ENVIRONMENT

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

Predictions have been carried out to compute the noise level at various distances around the working pit due to these major noise-generating sources. Noise modelling has been carried out to assess the impact on surrounding ambient noise levels.

Basic phenomenon of the model is the geometric attenuation of sound. Noise at a point generates spherical waves, which are propagated outwards from the source through the air at a speed of 1,100 ft/sec, with the first wave making an ever-increasing sphere with time. As the wave spreads the intensity of noise diminishes as the fixed amount of energy is spread over an increasing surface area of the sphere. The assumption of the model is based on point source relationship i.e., for every doubling of the distance the noise levels are decreased by 6 dB (A).

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

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

Where:

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

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

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

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)	48.6	55.9	52.6	51.6	51.5	57.2	53.1	52.1
Incremental Value dB(A)	60.1	54.1	43.0	40.4	29.5	25.3	27.0	26.5
Total Predicted Noise level dB(A)	60.4	58.1	53.0	51.9	51.5	57.2	53.1	52.1
NAAQ Standards	**Industrial**	**Day Time- 75 dB (A) & Night Time- 70 dB (A)**						
	Residential	**Day Time– 55 dB (A) & Night Time- 45 dB (A)**						

The incremental noise level is found within the range of 54.1 – 60.1dB (A) in Core Zone and 43 dB (A) in Buffer zone. The noise level at different receptors in buffer zone is lower due to the distance involved and other topographical features adding to the noise attenuation. The resultant Noise level due to monitored values and calculated values at the receptors are based on the mathematical formula considering attenuation due to Green Belt as 4.9 dB (A) the barrier effect. From the above table, it can be seen that the ambient noise levels at all the locations are within permissible limits of Industrial area (core zone) & Residential area (buffer zone) as per THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 (The Principal Rules were published in the Gazette of India, vide S.O. 123(E), dated 14.2.2000 and subsequently amended vide S.O. 1046(E), dated 22.11.2000, S.O. 1088(E), dated 11.10.2002, S.O. 1569 (E), dated 19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment (Protection) Act, 1986.).

4.4.2 Mitigation measures for Control of Noise

The following noise mitigation measures are proposed for control of Noise

- Usage of sharp drill bits while drilling which will help in reducing noise;
- Secondary blasting will be totally avoided and hydraulic rock breaker are utilized for breaking boulders;
- Controlled blasting with proper spacing, burden, stemming and optimum charge/delay will reduce noise;
- The blasting will be carried out during favourable atmospheric condition and less human activity timings by using nonelectrical initiation system;
- Proper maintenance, oiling and greasing of machines will be done every week to reduce generation of noise;
- Provision of sound insulated chambers for the workers working on machines (HEMM) producing higher levels of noise;
- Silencers / mufflers will be installed in all machineries;
- Green Belt will be developed around the project areas and along the haul roads. The plantation minimizes propagation of noise;
- Personal Protective Equipment (PPE) like ear muffs/ear plugs will be provided to the operators of HEMM and persons working near HEMM and their use will be ensured though training and awareness.
- Regular medical check–up and proper training to personnel to create awareness about adverse noise level effects

.4.4.3 Ground Vibrations

Ground vibrations due to mining activities in the project area 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 proposed mine 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 west in **Melathattapparai** 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)

FIGURE 4.5: GROUND VIBRATION PREDICTION

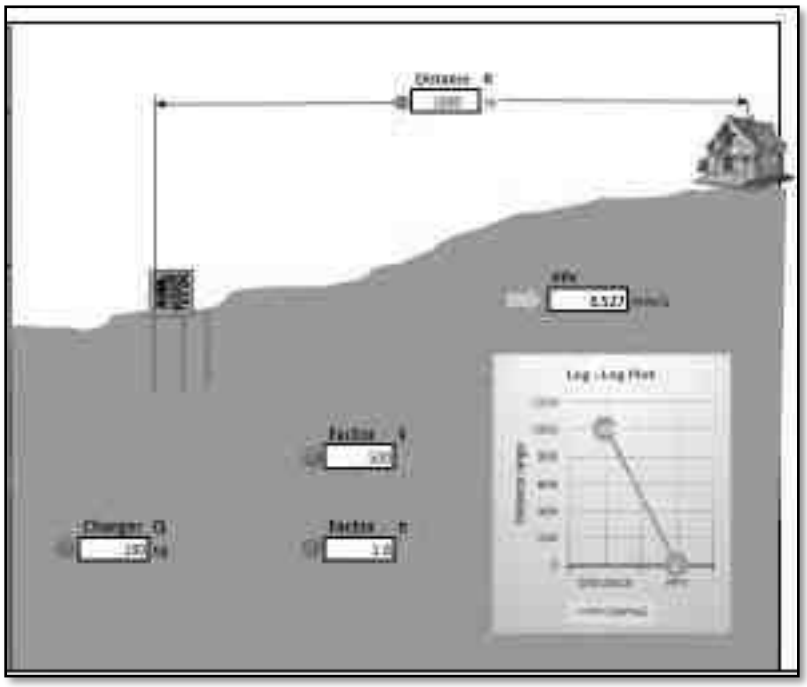


TABLE 4.10: PREDICTED PPV VALUES DUE TO BLASTING

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in m/ms
P1	190	1000	0.527
P2	298	1000	0.756

From the above graph, the charge per blast of 58kg 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 58kg 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 Mitigation measures for Control of Vibration

- The blasting operations in the mine are proposed to be carried out by jackhammer drilling and blasting using delay detonators, which reduces the ground vibrations;
- Proper quantity of explosive, suitable stemming materials and appropriate delay system should be adopted to avoid overcharging and for safe blasting;
- Adequate safe distance from blasting should be maintained as per DGMS guidelines;
- Blasting shelter should be provided as per DGMS guidelines;
- Blasting operations shall be carried out only during day time;
- The charge per delay shall be minimized and preferably more number of delays will be used per blasts;
- During blasting, other activities in the immediate vicinity shall 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 should be carried out every 6 months to check the efficacy of blasting practices.

4.5. Impact on Biological Environment

The developmental programs, policies, and projects operated or managed by government or private bodies can cause potentially significant changes in the physical, biological, and socio-economic environment. In some cases, the changes may be beneficial while in others it may be detrimental to the environment. Accordingly, environmental impact studies are required for systematic identification, qualification, and interpretation of the anticipated changes.

The main environmental problems associated with mining activities are deforestation, land degradation (change in topography, soil erosion), visual intrusion, disturbance to the hydrological system, and water, air, and noise pollution which ultimately impact upon the floral and faunal status of the project area.

4.5.1. Impact Identification and Evaluation

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

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

4.5.2. Impact on Flora

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

4.5.2.1. Anticipated Impact on agricultural land associated with flora

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

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

4.5.3 Mitigation Measures

4.5.3.1. General Guidelines for Green Belt Development

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

After the operation of mining production capacity, Green belt and Plantation species should be in accordance with the Terms and Conditions of the Environmental Clearance Green belt is created not only for the purpose of protecting sensitive areas or maintaining the ecological balance but because they also act as efficient biological filters or sinks for particulate and gaseous emissions, generated by vehicular movements and various industrial and mining activities. Optimally designed green belts can be effective in reducing the impact of fugitive emissions and pollutants accidentally or otherwise released at ground levels.

4.5.3.2. Green Belt Development Plan

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

4.5.3.3. Proposed Green Belt

Extensive green belt development will be started during the construction phase, which will continue till the operation of the plant. About 800-2000 trees will be planted per hectare all around the plant, approach roads, and township premises. Locally available types of trees which are resistant to pollutants will be planted. In addition to the above, all open spaces available within the premises will be developed as nursery, park, gardens and other forms of greenery. 5 m wide greenbelt will be developed along the plant premises, as per land available.

4.5.3.4. Guidelines & Techniques for Green Belt Development

Extensive survey in the project area was undertaken to observe the structure and composition of vegetation. Hence a combination of plant is selected depending upon the topographical suitability and species selected as per SPCB Guideline and ToR. The soil characteristics were kept in mind. Based on this survey and environmental conditions suitable native plants species have been proposed for green belt development plan.

4.5.3.5. Development of Green Belt

The plantation matrix adopted for the green belt development includes pit of 0.3 m x 0.3 m size with a spacing of 2 m x 2 m. In addition, earth filling and manure may also be required for the proper nutritional balance and nourishment of the sapling. It is also recommended that the plantation has to be taken up randomly and the landscaping aspects could be taken into consideration. Multi-layered plantations comprising of medium height trees (7 m to 10 m) and shrubs (5 m height) are proposed for the green belt.

Greenbelt is a set of rows of trees planted in such a fashion, to create an effective barrier between the project and its surroundings. The greenbelt helps to capture fugitive emissions, attenuate the noise levels in the existing project, and simultaneously improving aesthetics of the surroundings.

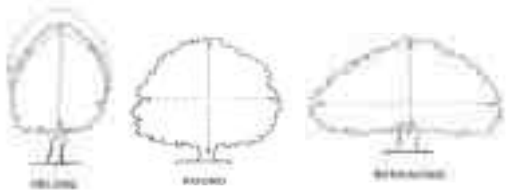
4.5.3.6. Design of Green Belt

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

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

- Plant species should be perennial and evergreen with thick canopy cover.

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



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

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

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

(***Source:** Term of Reference-ToR)

Table No 4.2.Species suitable for abatement of noise and dust pollution

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

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

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

These species need to be planted along the periphery of lease area for absorb fugitive emissions and noise levels which is generated during mining activities. All the open spaces, where tree plantation may not be possible, should be covered with shrubs and grass to prevent erosion of topsoil.

Some of the important aspects to be considered are:

- ✓ Planting of trees in each row will be in staggered orientation.
- ✓ In the front row, shrubs will be grown.

- ✓ Since the trunks of the tall trees are generally devoid of foliage, it will be useful to have shrubs in front of the trees so as to give coverage to this portion.
- ✓ The spacing between the trees will be maintained slightly less than the normal spaces, so that the trees may grow vertically and slightly increase the effective height of the green belt.

4.5.4. Anticipated Impact on Fauna

- Since the terrestrial fauna in the study area are distributed away from the mine site, the impacts of project are likely to be much low on terrestrial fauna of the region. The proposed mining lease area is devoid of any significant vegetation, it is not suitable for permanent habitat for any specific wildlife.
- Habitat degradation and disturbance to faunal group due to ground vibration and increase in noise level will be minimize or resolved by modern technologies. So, from above facts it is revealed that there will be no impact on fauna. No threatened fauna species reported in the core and buffer study area.

4.5.4.1. Measures for protection and conservation of wildlife species

- Topsoil has a large number of seeds of native plant species in the mining area.
- Topsoil will be used for restoration and suitable surfaces for planted seedlings.
- Checks and controls the movement of vehicles in and out of the mine.
- Undertaking mitigative measures for a conducive environment to the flora and fauna in consultation with Forest Department.
- A dust suppression system will be installed within the mine and periphery of the mine.
- Plantation around the mine area will help in creating habitats for small faunal species and create a better environment for various fauna. Creating and developing awareness for nature and wildlife in the adjoining villages.

4.5.5. Impact on Aquatic Biodiversity

Mining activities will not disturb the aquatic ecology as there is no effluent discharge proposed from the rough stone and gravel quarry. There is no natural perennial surface water body within the mine lease area, like wetlands, rivers streams, Odai, Vaari, Canal, Channel, lakes, ponds, tanks, and farmer sites. There is no impact on fish habitats and the food WEB/ food chain in the water body and Reservoir. There are no nearby water bodies. Aquatic biodiversity is not observed in the study area.

TABLE 4.17: ANTICIPATED IMPACT OF ECOLOGY AND BIODIVERSITY

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

			habitat structure for unique flora or fauna.		
Mining phase					
2	Excavation of mineral using machine and labours, Transportation activities will generate noise.	Site-specific disturbance to normal faunal movements at the site due to noise.(Partial impact)	Site does not form unique / critical habitat structure for unique flora or fauna.	Less severe	Mining activity should not be operated after 5PM. Excavation of dump and transportation work should stop before 7PM.
3	Vehicular Movement for transportation of materials will result in generation of dust (SPM) due to haul roads and emission of SO2,NO2,CO etc.	Impact on surrounding agriculture and associated fauna due to deposition of dust and Emission of CO. (Indirect impact)	Impact is less as the agricultural land far from core area.	Less severe	All vehicles will be certified for appropriate Emission levels. More plantation has been suggested Upgrade the vehicles with alternative fuel such biodiesel, methanol and biofuel around the mining area.

4.6 SOCIO ECONOMIC

4.6.1 Construction Phase

Anticipated Impacts:

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

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

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

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

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

Mitigation measures:

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

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

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

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

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

4.6.2 Operation Phase:

Anticipated Impacts:

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

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

Mitigation Measures:

♣ In order to mitigate the long-term health impacts, efficient Air Pollution Control Equipment (APCE) like Bag House / Bag Filter / ESP will be installed at all major stacks to keep the emissions within the permissible limits. To reduce the gaseous emission, Pyro-process itself acts as a long SO2 scrubber and De - 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 4.3.1 Impact Evaluation Impact evaluation is given in table below.

<table>
<tr><td>Impact Evaluation Element</td><td colspan="4">Impact on socio economics due to the applied for Melathattapparai rough stone and Gravel cluster quarry over an extent of 7.03.5 ha of Patta lands of Melathattapparai Village, Thoothukudi Taluk, Thoothukudi District, Tamil Nadu State</td></tr>
<tr><td>Potential Effect/ Concern</td><td colspan="4">Proposed project will provide direct & indirect employment opportunities to the local residents, which will help to increase their earning and better living standard as well as further up-liftment of socio-economic status of the area.</td></tr>
<tr><td colspan="5">Characteristics of Impacts</td></tr>
<tr><td rowspan="2">Nature</td><td colspan="2">Positive</td><td>Nagative</td><td>Netural</td></tr>
<tr><td colspan="2">✓</td><td></td><td></td></tr>
<tr><td rowspan="2">Type</td><td>Direct</td><td>Indirect</td><td colspan="2">Cumulative</td></tr>
<tr><td></td><td></td><td colspan="2">✓</td></tr>
<tr><td rowspan="2">Extent</td><td>Project area</td><td>Local</td><td>Zonal</td><td>Regional</td></tr>
<tr><td></td><td>✓</td><td></td><td></td></tr>
<tr><td rowspan="2">Duration</td><td colspan="2">Short time</td><td colspan="2">Long term</td></tr>
<tr><td colspan="2"></td><td colspan="2">✓</td></tr>
<tr><td rowspan="2">Intensity</td><td colspan="2">Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="2"></td><td>✓</td><td></td></tr>
</table>

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/ Silicosis 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

As per approved mining plan there is practically no solid waste and overburden in present mining area. The mining area lies on plain terrain having rocky exposure and has no soil cover; therefore storage of soil is not required. And the proposed recovery is 100% and there is no waste anticipated for storage or removal.

4.9 MINE CLOSURE

Mine closure plan is the most important environmental requirement in mineral 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 every five years in the scheme of mining. As progressive mine closure is a continuous series of activities, it is obvious that the proposals of scientific mining have included most of the activities to be included in the closure plan. While formulating the closure objectives for the site, it is important to consider the existing or the pre-mining land use of the site; and how the operation will affect this activity.

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

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

4.9.1 Mine Closure criteria

The criteria involved in mine closure are discussed below:

4.9.1.1 Physical Stability

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

4.9.1.2 Chemical Stability

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

4.9.1.3 Biological Stability

The stability of the surrounding environment is primarily dependent upon the physical and chemical characteristics of the site, whereas the biological stability of the mine site itself is closely related to rehabilitation and

final land use. Nevertheless, biological stability can significantly influence physical or chemical stability by stabilizing soil cover, prevention of erosion/wash off, leaching, etc.,

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

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

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

5. ANALYSIS OF ALTERNATIVES (TECHNOLOGY AND SITE)

5.1 INTRODUCTION

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

5.2 FACTORS BEHIND THE SELECTION OF PROJECT SITE

Melathattapparai Rough Stone and Gravel Cluster Quarry Project at Melathattapparai Village is a mining project for excavation of Rough stone and Gravel, which is 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 are 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, firefighting, education, transportation, communication and infrastructural facilities are well connected and accessible.
- The mining operations will not intersect the ground water level. Hence, no impact on ground water environment.
- Study area falls in seismic zone – III, there is no major history of landslides, earthquake, subsidence etc., recorded in the past history

5.3 ANALYSIS OF ALTERNATIVE SITE

No alternatives are suggested as the mine site is mineral specific

5.4 FACTORS BEHIND SELECTION OF PROPOSED TECHNOLOGY

Mechanized open cast mining operation with drilling and blasting method will be used to extract Rough Stone and Gravel in the area. The applied mining lease area 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

5.5 ANALYSIS OF ALTERNATIVE TECHNOLOGY

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

6. ENVIRONMENTAL MONITORING PROGRAMME

6.0 GENERAL

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

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

6.1 METHODOLOGY OF MONITORING MECHANISM

Implementation of EMP and periodic monitoring will be carried out by respective Project Proponents. A comprehensive monitoring mechanism has been devised for monitoring of impacts due to proposed projects; Environmental protection measures like dust suppression, control of noise and blast vibrations, maintenance of machinery and vehicles, housekeeping in the mine premises, plantation, implementation of Environmental Management Plan and environmental clearance conditions will be monitored by the Mine Management. On the other hand, implementation of area level protection measures like green belt development, environmental quality monitoring etc., are taken up by a senior executive who reports Mine Management.

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

The responsibilities of this cell will be:

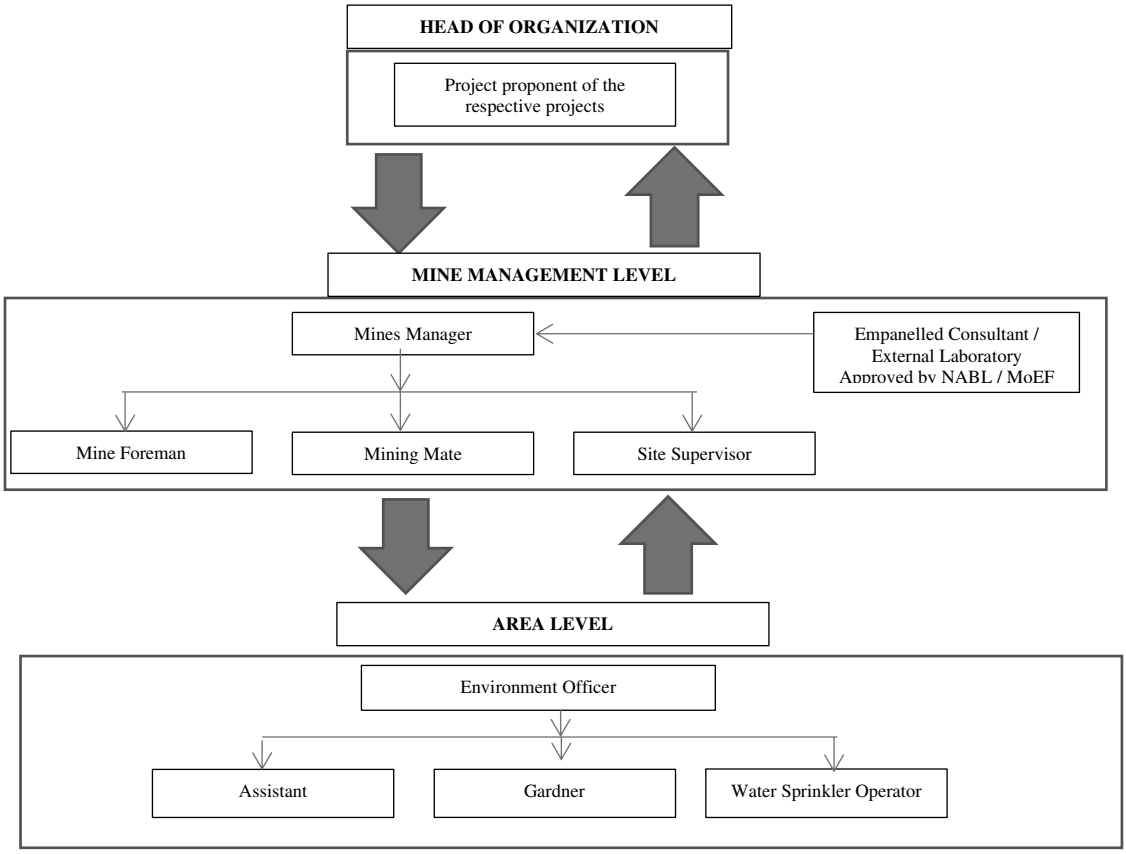
- Implementation of pollution control measures
- Monitoring programme implementation
- Post-plantation care
- To check the efficiency of pollution control measures taken
- Any other activity as may be related to environment
- Seeking expert's advice when needed.

The environmental monitoring cell will co-ordinate all monitoring programs at site and data thus generated will be regularly furnished to the State regulatory agencies as compliance status reports.

The sampling and analysis report of the monitored environmental attributes will be submitted to the Tamil Nadu Pollution Control Board (TNPCB) at a frequency of half-yearly and yearly. The half-yearly reports are submitted to Ministry of Environment and Forest, Regional Office and SEIAA as well.

The sampling and analysis of the environmental attributes will be as per the guidelines of Central Pollution Control Board (CPCB)/Ministry of Environment, Forest and Climate Change (MoEF & CC).

FIGURE 6.1: ENVIRONMENTAL MONITORING CELL FOR INDIVIDUAL LEASES



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 project
2	Soil Quality Control Measures	Before commissioning of the project	Immediately after the commencement of project
3	Water Pollution Control Measures	Before commissioning of the project and along with mining operation	Immediately and as project progress
4	Air Pollution Control Measures	Before commissioning of the project and along with mining operation	Immediately and as project progress
5	Noise Pollution Control Measures	Before commissioning of the project and along with mining operation	Immediately and as project progress
6	Ecological Environment	Phase wise implementation every year along with mine operations	Immediately and as project progress

6.3 MONITORING SCHEDULE AND FREQUENCY

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

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

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

The details of monitoring are detailed in Table 6.2

TABLE 6.2: MONITORING SCHEDULE FOR THE PROJECT AREA

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, PM2.5, PM10, SO2 and NOx.
2	Meteorology	At mine site before start of Air Quality Monitoring & IMD Secondary Data	Hourly / Daily	Continuous online monitoring	Wind speed, Wind direction, Temperature, Relative humidity and Rainfall
3	Water Quality Monitoring	2 Locations (1 SW & 1GW)	-	Once in 6 months	Parameters specified under IS:10500, 1993 & CPCB Norms
4	Hydrology	Water level in open wells in buffer zone around 1 km at specific wells	-	Once in 6 months	Depth in bgl
5	Noise	2 Locations (1 Core & 1 Buffer)	Hourly – 1 Day	Once in 6 months	Leq, Lmax, Lmin, Leq Day & Leq Night
6	Vibration	At the nearest habitation (in case of reporting)	–	During blasting Operation	Peak Particle Velocity
7	Soil	2 Locations (1 Core & 1 Buffer)	–	Once in six months	Physical and Chemical Characteristics
8	Greenbelt	Within the Project Area	Daily	Monthly	Maintenance

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

6.4 BUDGETARY PROVISION FOR EMP

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

The proposed capital cost for Environmental Monitoring Programme for two proposed quarries in cluster is **Rs 3,05,000/-**

TABLE 6.3 ENVIRONMENT MONITORING BUDGET

Parameter	Code	Capital Cost
Air Quality,Meteorology Water Quality, Hydrology Soil Quality, Noise Quality Vibration Study, Greenbelt	P1	Rs 2,37,000/-
	P2	Rs. 68,000/-
Total		**Rs 3,05,000/-**

Source: Approved Mining Plan of the respective projects

6.5 REPORTING SCHEDULES OF MONITORED DATA

The monitored data on air quality, water quality, noise levels and other environmental attributes will be periodically examined by the Cluster Mine Management Coordinator and Respective Head of Organization for taking necessary corrective measures. The monitoring data will be submitted to Tamil Nadu State Pollution Control Board in the Compliance to CTO Conditions & environmental audit statements every year to MoEF & CC and Half-Yearly Compliance Monitoring Reports to MoEF & CC Regional Office and SEIAA.

Periodical reports to be submitted to: -

- MoEF & CC – Half yearly status report
- TNPCB - Half yearly status report
- Department of Geology and Mining: quarterly, half yearly annual reports

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

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

7. ADDITIONAL STUDIES

7.0 GENERAL

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

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

7.1. PUBLIC CONSULTATION

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

7.2 RISK ASSESSMENT

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

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

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

TABLE 7.1 RISK ASSESSMENT & CONTROL MEASURES

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

			done in order to avoid any overhang or undercut; Handling of explosives, charging and firing shall be carried out by competent statutory persons only under the supervision of a Mine Manager; Maintenance and testing of all mining equipment as per manufacturer‘s guidelines.
2	Drilling	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 wornout accessories in the compressor and drill equipment as per operator manual. Drills unit shall be provided with wet drilling to ensure efficient working. Operator shall regularly use all the personal protective equipment.
4	Blasting	Fly rock, ground vibration, Noise and dust. Improper charging, stemming & Blasting/ fining of blast holes Vibration due to movement of vehicles	Restrict maximum charge per delay as per regulations and by optimum blast hole pattern, vibrations will be controlled within the permissible limit and blasting can be conducted safely. SOP for Charging, Stemming & Blasting/Firing of Blast Holes will be followed by blasting crew during initial stage of operation Shots are fired during designated timings only. All holes charged on any one day shall be fired on the same day. The danger zone will be distinctly demarcated (by means of red flags)

5	Transportation	Potential hazards and unsafe workings contributing to accident and injuries Overloading of material While reversal & overtaking of vehicle Operator of truck leaving his cabin when it is loaded.	Before commencing work, drivers personally check the dumper/truck/tipper for oil (s), fuel and water levels, tyre inflation, general cleanliness and inspect the brakes, steering system, warning devices including automatically operated audio visual reversing alarm, rear view mirrors, side indicator lights etc., are in good condition. Unauthorized person will not be allowed to operate or ride on the vehicle Loading according to the vehicle capacity Periodical maintenance of vehicles as per operator manual
6	Natural calamities	Unexpected happenings	Escape Routes will be provided to prevent inundation of storm water Fire Extinguishers & Sand Buckets in the designated areas
7	Failure of Mine Benches and Pit Slope	Slope geometry, Geological structure	Ultimate or over all pit slope shall be below 60° and each bench height shall be 5m height.

7.3 DISASTER MANAGEMENT PLAN

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

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

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

Rescue and medical treatment of casualties;

Safeguard other people;

Minimize damage to property and the environment;

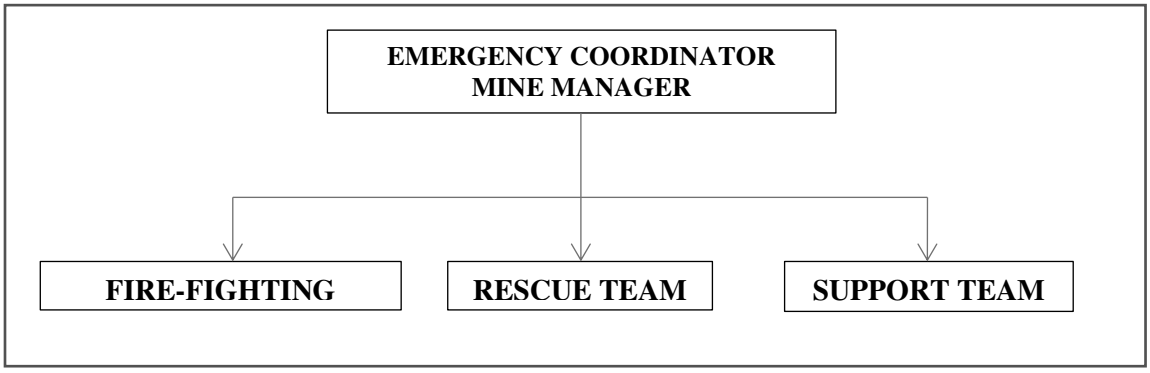
Initially contain and ultimately bring the incident under control;

Secure the safe rehabilitation of affected area; and

Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the emergency.

In case a disaster takes place, despite preventive actions, disaster management will have to be done in line with the descriptions below. There is an organization proposed for dealing with the emergency situations and the coordination among key personnel and their team has been shown in Fig 7.1.

FIGURE 7.1: DISASTER MANAGEMENT TEAM LAYOUT



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

TABLE 7.2: PROPOSED TEAMS TO DEAL WITH EMERGENCY SITUATION

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

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

Roles and responsibilities of emergency team –

(a) Emergency coordinator (EC)

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

(b) Incident controller (IC)

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

(c) Communication and advisory team

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

(d) Roll call coordinator

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

(e) Search and rescue team

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

(f) Emergency security controller

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

Emergency control procedure –

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

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

Proposed fire extinguishers at different locations –

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

TABLE 7.3: PROPOSED FIRE EXTINGUISHERS AT DIFFERENT LOCATIONS

LOCATION	TYPE OF FIRE EXTINGUISHERS
Electrical Equipment's	CO_2 type, foam type, dry chemical powder type
Fuel Storage Area	CO_2 type, foam type, dry chemical powder type, Sand bucket
Office Area	Dry chemical type, foam type

Alarm system to be followed during disaster –

On receiving the message of disaster from Site Controller, fire-fighting team, the mine control room attendant will sound siren wailing for 5 minutes. Incident controller will arrange to broadcast disaster message through public address system.

On receiving the message of "Emergency Over" from Incident Controller the emergency control room attendant will give "All Clear Signal", by sounding alarm straight for 2 minutes.

The features of alarm system will be explained to one and all to avoid panic or misunderstanding during disaster.

In order to prevent or take care of hazard / disasters if any the following control measures have been adopted.

All safety precautions and provisions of Metalliferous Mines Regulations (MMR), 1961 is strictly followed during all mining operations.

Observance of all safety precautions for blasting and storage of explosives as per MMR 1961.

Entry of unauthorized persons into mine & allied areas is completely prohibited.

Fire-fighting and first-aid provisions in the mines office complex and mining area are provided.

Provisions of all the safety appliances such as safety boot, helmets, goggles, dust masks, ear plugs and ear muffs etc. are made available to the employees and the use of same is strictly adhered to through regular monitoring.

Training and refresher courses for all the employees working in hazardous premises.

Working of mine, as per approved plans and regularly updating the mine plans.

Cleaning of mine faces is regularly done.

Handling of explosives, charging and blasting are carried out only by qualified persons following SOP.

Provision of high capacity standby pumps with generator sets with enough quantity of diesel for emergency pumping especially during monsoon.

A blasting SIREN is used at the time of blasting for audio signal.

Before blasting and after blasting, red and green flags are displayed as visual signals.

Warning notice boards indicating the time of blasting and NOT TO TRESPASS are displayed at prominent places.

Regular maintenance and testing of all mining equipment were carried out as per manufacturer's guidelines.

7.4 CUMULATIVE IMPACT STUDY

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

TABLE 7.3: CLUSTER QUARRY DETAILS

CLUSTER QUARRIES				
PROPOSED QUARRIES				
Code	**Name and address of the project proponent**	**S.F. Nos & Village**	**Extent**	**Status**
P1	Thiru. P. Ananthakumar, S/o. Perumal No. 1/39, North Street, Athimarapatti, Thoothukudi -628005	452/2, 452/3A, 452/3B and 452/4 Melathattapparai Village,	3.86.0 ha	Obtained ToR Vide Letter No. SEIAA-TN/F.No.9016/SEAC/ToR-1159/2022 Dated: 06.06.2022
P2	Tmt. P. Ananthammal, W/o. Paranjothi No. 22/3A, Briyant Nagar 8th Street, Thoothukudi District, Tamil Nadu State – 628 008	457/5 of Melathattapparai Village,	1.62.0 ha	Obtained ToR Vide Letter No. SEIAA-TN/F.No.9156/SEAC/ToR-1184/2022 Dated:06.07.2022
P3	Thiru. I. Sankaralingam, S/o. Iyyappan, No. 23/4, Keelathattaparai Village, Thattaparai Post, Thoothukudi Taluk Thoothukudi District - 628304	447/1, 448/3 of Melathattapparai Village,	1.55.5	Grant of EC Vide Letter No. SEIAA-TN/F.No.8449/EC No.4992/2021 Dated:18.02.2022
Total			**7.03.5 ha**	
EXISTING QUARRY				
Code	**Name of the Owner**	**S.F. Nos & Village**	**Extent**	**Lease Period**
-	-	-	-	-
ABANDONED QUARRY				
Code	**Name of the Owner**	**S.F. Nos & Village**	**Extent**	**Lease Period**
A1	**Thiru.A.A.Samy**	456/1, 460/1 B1, 460/2B1 Melathattapparai Village,	**1.18.5**	G.M.1/389/2010 dt:14.02.2011 14.02.2011 to 13.02.2016
A2	**Thiru.Paranjothi,**	455/1, 455/2 Melathattapparai Village,	**3.11.0**	G.M.1/07/2010 dt:13.04.2010 13.04.2010 28.04.2010 to 12.04.2015
A3	**Tmt.Palavesammal**	448/1, 448/2 Melathattapparai Village,	**1.15.5**	G.M.1/130/2012 dt:29.03.2010 29.03.2010 to 28.03.2015
A4	**Thiru.Sethupillai**	453/2, 454 Melathattapparai Village,	**1.22.0**	G.M.1/130/2012 dt:30.03.2012 30.03.2012 to 29.03.2017
***Total Cluster Extent**			**7.03.5 ha**	

TABLE 7.5: SALIENT FEATURES OF PROPOSAL "P1"

SALIENT FEATURES OF PROPOSAL "P1"			
Name of the Quarry	Thiru. P. Ananthakumar, Rough Stone and Gravel Quarry		
Land Type	Patta Land		
S.F. Nos	452/2, 452/3A, 452/3B and 452/4		
Village	Melathattapparai		
Extent	3.86.0 ha		
Geological Resources	Rough Stone	Weatherd Rock	Gravel
	13,69,454 m^3	22,086	14,724 m^3
Mineable Reserves	Rough Stone	Weatherd Rock	Gravel
	6,57,283 m^3	8,184	5,456 m^3
Proposed production for five years plan period	Rough Stone	Weatherd Rock	Gravel
	6,57,283 m^3	8,184	5,456 m^3
Previous quarry details	It is a fresh lease application but, favour of Tmt. P. Poopiratti, W/o. Thiru. Perumal for over an extent of **1.27.5 hectares of Patta lands, Rc.No. G.M.1/237/2009, Dated: 29.03.2010** for the period of five years from **29.03.2010 to 28.03.2015**		

	favour of Thiru. P. Ponraj, S/o. P. Perumal for over an extent **of 2.58.5 hectares of Patta lands in S.F.Nos. 452/2 and 452/4 Rc.No. GM.1/107/2011, Dated: 30.03.2012** for the period of five years from **30.03.2012 to 29.03.2017**		
Existing pit dimension and Excavated quantity	Pit-1 149m (L) x 134m (W) x 16m (D) Pit-1I 128m (L) x 82m (W) x 5m (D) Pit-1II 110m (L) x 28m (W) x 6m (D)		
Mining Plan Period / Lease Period	5 Years		
Ultimate Pit Dimension	262m (L) x 149m (W) x 45m (D)		
Toposheet No	58 L/01		
Latitude between	08°48'41.90"N to 08°48'50.61"N		
Longitude between	78°01'48.56"E to 78°01'55.97"E		
Highest Elevation	100 m AMSL		
Machinery proposed	Jack Hammer	8 Nos	
	Compressor	2 No	
	Hydraulic Excavator	2 No	
	Trucks	5 Nos	
	Wagon Drill	1 Nos	
Blasting Method	Usage of Slurry Explosive with Milli second delay detonator (MSD) detonators		
Nearest Water Body	S.No	Water Bodies	Distance and Direction
	1	Odai	50m NW
	2	Madagiri Odai	1.8km SW
	3	Shanmuga River	2.6km SW
	4	Korampallam Tank	7.80km SW
	5	Allikulam Lake	5.5km SW
Greenbelt Development Plan	Proposed to plant 2.320 trees in safety barrier, Village road and un utilized area.		
Proposed Manpower Deployment	37 Nos		
Project Cost	A. Project cost Rs 1,14,34,000/-		
	B. EMP cost Rs. 3,80,000/-		
	Total Project cost Rs. 1,18,14,000/-		
CER Cost	Rs.2,37,000/-		
SALIENT FEATURES OF PROPOSAL "P2"			
Name of the Quarry	Tmt. P. Ananthammal, Rough Stone & Gravel Quarry		
Land Type	Patta Land		
S.F. Nos	457/5		
Village	Melathattapparai Village		
Extent	1.62.0 ha		
Quarry details	It is a Patta land, registered in the name of Thiru. A.P. Ilamaran vide Patta No. 2679, The applicant has obtained consent from pattadar for the period of eleven years from 26.02.2021 to 25.02.2032		
Geological Reserves	Rough Stone	Gravel	
	5,67,000 m^3	32,400 m^3	
Mineable Reserves	Rough Stone	Gravel	
	1,55,120 m^3	20,592 m^3	
Proposed production for five years plan period	Rough Stone	Gravel	
	1,55,120 m^3	20,592 m^3	
Mining Plan Period / Lease Period	5 Years		
Ultimate Pit Dimension	133 m (L) * 80 m (W) * 37m (D)		
Toposheet No	58 L/01		
Latitude Between	08°48'47.64"N to 08°48'52.49"N		

Longitude Between	78°01'45.27"E to 78°01'51.97"E		
Highest Elevation	100 m AMSL		
Machinery proposed	Jack Hammer		4
	Compressor		1
	Hydraulic Excavator		1
	Tippers		2
Blasting Method	Usage of Slurry Explosive with MSD detonators		
Nearest Water Body	S.No	Water Bodies	Distance and Direction
	1	Odai	10m NW
	2	Madagiri Odai	1.7km SW
	3	Shanmuga River	2.7km SW
	4	Korampallam Tank	7.80km SW
	5	Allikulam Lake	5.5km SW
Proposed Manpower Deployment	19 Nos		
Project Cost	Land & Machinery Cost		Rs. 29,84,000/-
	EMP Cost		Rs.3,80,000/-
	Total		Rs. 33,64,000/-
CER Cost	Rs.68,000/-		
SALIENT FEATURES OF PROPOSAL "P3"			
Name of the Quarry	Thiru.I.Sankaralingam, Rough Stone & Gravel Quarry		
Land Type	Patta Land		
S.F. Nos	447/1 &448/3		
Village	Melathattapparai Village		
Extent	1.49.5 ha		
Previous quarry details	EC granted		
Geological Reserves	Rough Stone		Gravel
	4,57,847.50 m^3		36,305.25 m^3
Mineable Reserves	Rough Stone		Gravel
	91,365 m^3		18,537 m^3
Proposed production for five years plan period	Rough Stone		Gravel
	91,365 m^3		18,537 m^3
Mining Plan Period / Lease Period	5 Years		
Ultimate Pit Dimension	84 m (L) * 16 m (W) * 10m (D)-S 114m (L) *73m (W) *35m (D)-N		
Toposheet No	58 L/01		
Latitude Between	08°48'41.3"N to 08°48'49.0"N		
Longitude Between	78°01'55.4"E to 78°01'59.9"E		
Highest Elevation	100 m AMSL		
Machinery proposed	Dewatering Pump		1
	Tractor compressor for drilling		2
	Hydraulic Excavator		1
	Tippers		3
Blasting Method	Usage of Slurry Explosive with MSD detonators		
Nearest Water Body	S.No	Water Bodies	Distance and Direction
	1	Odai	10m NW
	2	Madagiri Odai	1.7km SW
	3	Shanmuga River	2.7km SW
	4	Korampallam Tank	7.80km SW
	5	Allikulam Lake	5.5km SW
Proposed Manpower Deployment	16 Nos		
Project Cost	Land & Machinery Cost		Rs. 1,53,63,898/-
	EMP Cost		Rs.2,25,000/-
	Total		Rs. 1,55,88,898/-
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 and existing) within the cluster and major impact anticipated is on Air & Noise Environment and Ground Vibrations due to blasting.

Air Environment –

Calculating the Cumulative Load of Mining within the cluster is as shown in table 7.12 & 7.13.

TABLE 7.5: CUMULATIVE PRODUCTION LOAD OF ROUGH STONE

Quarry	Mineable Reserve	Per Year Production	Per Day Production	Number of Lorry Load Per Day @ 12m^3 per load
P1	6,57,283 m^3	1,31,456 m^3	438 m^3	37 Trips/day
P2	1,55,120 m^3	31,042 m^3	103 m^3	9 Trips/day
Existing Quarries NIL				
TOTAL	**8,12,493 m^3**	**1,62,498 m^3**	**541 m^3**	**46 Trips/day**

TABLE 7.6: CUMULATIVE PRODUCTION LOAD OF GRAVEL

Quarry	Mineable Reserve	Per Year Production	Per Day Production	Number of Lorry Load Per Day
P1	5,456 m^3	1091 m^3	4 m^3	1Trips/day
P2	20,592 m^3	4,118 m^3	14m^3	1 Trips/day
Existing Quarries NIL				
TOTAL	**26,048 m^3**	**5,209 m^3**	**18 m^3**	**2 Trips/day**

On a cumulative basis considering in 2 quarries, it can be seen that the overall production of Rough Stone is 1,126 m^3 per day and overall production of Gravel is 29m^3 per day with a capacity of 94 trips of Rough Stone per day and 3Trips per day of Gravel from the cluster.

Note: Per day production of Rough Stone is calculated for 5 Years Lease Period and for Gravel production with variable of 1, 2 and 3 years of production period. And the load of existing quarries will not be of major impact as these quarries.

Based on the above production quantities the emissions due to various activities in these mines includes various activities like ground preparation, excavation, handling and transport of ore. These activities have been analysed systematically basing on USEPA-Emission Estimation Technique Manual, for Mining AP-42, to arrive at possible emissions to the atmosphere and estimated emissions are given in Table 7.14.

TABLE 7.7: EMISSION ESTIMATION FROM QUARRIES WITHIN 500 METER RADIUS

EMISSION ESTIMATION FOR QUARRY "P1"				
	Activity	**Source type**	**Value**	**Unit**
Estimated Emission Rate for PM_{10}	Drilling	Point Source	0.112162663	g/s
	Blasting	Point Source	0.004293941	g/s
	Mineral Loading	Point Source	0.045678405	g/s

	Haul Road	Line Source	0.002502843	g/s
	Overall Mine	Area Source	0.045755648	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.001339738	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000042532	g/s
EMISSION ESTIMATION FOR QUARRY "P2"				
	Activity	**Source type**	**Value**	**Unit**
Estimated Emission Rate for PM_{10}	Drilling	Point Source	0.128445598	g/s
	Blasting	Point Source	0.008456888	g/s
	Mineral Loading	Point Source	0.047880410	g/s
	Haul Road	Line Source	0.00251528	g/s
	Overall Mine	Area Source	0.047844906	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.002074398	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000067853	g/s

Source: Emission Calculations

TABLE 7.8: INCREMENTAL & RESULTANT GLC WITHIN CLUSTER

PM_{10} in µg/m^3	
Location	CORE
Background	41.18
Highest Incremental	17.80
Resultant	58.98
NAAQ Norms	100 µg/m^3
$PM_{2.5}$ in µg/m^3	
Location	CORE
Background	19.66
Highest Incremental	9.87
Resultant	29.53
NAAQ Norms	80 µg/m^3
NO_x in µg/m^3	
Location	CORE
Background	20.88
Incremental	12.78
Resultant	33.66
NAAQ Norms	80 µg/m^3

SO_2 in µg/m^3	
Location	CORE
Background	7.21
Incremental	3.49
Resultant	10.7
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)
Habitation Near P1	47.8	40.1	48.5	55
Habitation Near P2	46.8	40.1	47.6	

Source: Lab Monitoring Data

The incremental noise level is found within the range of 47.6– 48.5 dB (A) in Buffer zone. The noise level at different receptors in buffer zone is lower due to the distance involved and other topographical features adding to the noise attenuation. The resultant Noise level due to monitored values and calculated values at the receptors are based on the mathematical formula considering attenuation due to Green Belt as 4.9 dB (A) the barrier effect. From the above table, it can be seen that the ambient noise levels at all the locations 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 3 quarries within cluster are anticipated due to operation of Mining Machines like Excavators, drilling and blasting, transportation vehicles, etc. However, the major source of ground vibration from the three mines is blasting. The major impact of the ground vibrations is observed on the

domestic houses located in the villages nearby the mine lease area. The kuchha houses are more prone to cracks and damage due to the vibrations induced by blasting whereas RCC framed structures can withstand more ground vibrations. Apart from this, the ground vibrations may develop a fear factor in the nearby settlements.

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

Nearest Habitations from 8 mines respectively are as in below Table 7.17

TABLE 7.10: NEAREST HABITATION FROM EACH MINE

Location ID	Distance in Meters
Habitation Near P1	1000
Habitation Near P2	1000

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 FROM CLUSTER QUARRIES

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in m/ms
P1	190	1000	0.527
P2	298	1000	0.756

Source: Blasting Calculations

From the above table, the charge per blast is considered as maximum of 100kg 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 8 mines shall provide employment and revenue will be created to government

TABLE 7.12: SOCIO ECONOMIC BENEFITS FROM CLUSTER QUARRIES

Location ID	Employment	Project Cost	CER
P1	37	Rs 1,14,34,000/-	Rs 2,37,000/-
P2	19	Rs 29,84,000/-	Rs 68,000/-
Total		**Rs 1,44,18,000/-**	**Rs 3,05,000/-**

A total of 86 people will get employment due to 2 mines in cluster and already employed at existing mines. 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 and the total CER amount from the 2 mines is Rs 3,05,000/-.

8. PROJECT BENEFITS

8.0 GENERAL

In Melathattapparai Rough Stone and Gravel Cluster – Proposed Quarries aims to produce about **16,90,013 m^3** Rough Stone over a period of 5 years & **26,048 m^3**of Gravel over a period of 3Years. 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 56 persons (from the 2 proposed quarries) 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 on the socio-economic environment in the immediate project impact area. The employment opportunities both direct and indirect will contribute to enhanced money incomes to job seekers with minimal skill sets especially among the local communities.

8.3 IMPROVEMENT IN PHYSICAL INFRASTRUCTURE

The proposed quarries are located in Melathattapparai Village, Thoothukudi Taluk and Thoothukudi District of Tamil Nadu and the area have communications, roads and other facilities already well established. The following physical infrastructure facilities will further improve due to proposed mine.

- Road Transport facilities
- Communications
- Medical, Educational and social benefits will be made available to the nearby civilian population in addition to the workmen employed in the mine.

8.4 IMPROVEMENT IN SOCIAL INFRASTRUCTURE

Employment is expected during civil construction period, in trade, garbage lifting, sanitation and other ancillary services, Employment in these sectors will be primarily temporary or contractual and involvement of unskilled labour will be more. A major part of the labour force will be mainly from local villagers who are expected to engage themselves both in agriculture and mining activities. This will enhance their income and lead to overall economic growth of the area.

8.5 OTHER TANGIBLE BENEFITS

The proposed mine is likely to have other tangible benefits as given below.

- Indirect employment opportunities to local people in contractual works like construction of infrastructural facilities, transportation, sanitation, for supply of goods and services to the mine and other community services.
- Additional housing demand for rental accommodation will increase
- Cultural, recreation and aesthetic facilities will also improve
- Improvement in communication, transport, education, community development and medical facilities and overall change in employment and income opportunity
- The State Government will also benefit directly from the proposed mine, through increased revenue from royalties, cess, DMF, GST etc.,

CORPORATE SOCIAL RESPONSIBILITY

The Proponent will take responsibility to develop awareness among all levels of their staff about CSR activities and the integration of social processes with business processes. Those involved with the undertaking of CSR activities will be provided with adequate training and re-orientation.

Under this programme, the project proponent will take-up following programmes for social and economic development of villages within 10 km of the project site. For this purpose, separate budget will be provided every year. For finalization of these schemes, proponent will interact with LSG. The schemes will be selected from the following broad areas –

- Health Services
- Social Development
- Infrastructure Development
- Education & Sports
- Self-Employment

CSR Cost Estimation

CSR activities will be taken up in the Melathattapparai 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, being a green field project & Capital Investment is ≤ 100 crores, The Cluster Projects of two proposed and one existing quarry owners shall contribute 2% of Capital Investment towards CER as per directions of EAC/SEAC. Capital cost is **Rs 1,44,18,000/-**and 2% of the same works out to Rs 7,20,900,/-.

TABLE 8.1: CER – ACTION PLAN

Activity	Beneficiaries	CER In Rs
Installation of Solar lamps at Melathattapparai village roads	Melathattapparai villagers	10,00,000/-
Providing funds for improving Sanitation facilities at Melathattapparai village Government School	Melathattapparai villagers	
Providing funds for smart class facilities at Melathattapparai village Government School	Melathattapparai villagers	
Total		**10,00,000/-**

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

9. ENVIRONMENTAL COST BENEFIT ANALYSIS

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

10. ENVIRONMENTAL MANAGEMENT PLAN - P1

10.0 GENERAL

Environment Management Plan (EMP) aims at the preservation of ecological system by considering in-built pollution abatement facilities at the proposed site. Good practices of Environmental Management plan will ensure to keep all the environmental parameters of the project in respect of Ambient Air quality, Water quality, Socio – economic improvement standards.

Mitigation measures at the source level and an overall environment management plan at the study area are elicited so as to improve the supportive capacity of the receiving bodies. The EMP presented in this chapter discusses the administrative aspects of ensuring that mitigative measures are implemented and their effectiveness monitored after approval of the EIA.

10.1 ENVIRONMENTAL POLICY

The proponent is committed to conduct all its operations and activities in an environmentally responsible manner and to continually improve environmental performance.

The Proponent will –

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

Description of the Administration and Technical Setup –

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

The said team will be responsible for:

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

10.2 LAND ENVIRONMENT MANAGEMENT –

Landscape of the area will be changed due to the quarrying operation, restoration of the land by converting the quarry pit (0.48.0Ha) into temporary reservoir and the remaining part of the area (un utilized areas,

infrastructure, haul Roads) will be utilized for greenbelt development. Aesthetic of the Environment will not be affected. There is no major vegetation in the project area during the course of quarrying operation and after completion of the quarrying operation thick plantation will be developed under greenbelt development programme.

TABLE 10.1: PROPOSED CONTROLS FOR LAND ENVIRONMENT

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

Source: Proposed by FAE's & EIA Coordinator

10.3 SOIL MANAGEMENT

Top Soil Management –

- There is no topsoil in this project site.

Overburden / Waste and Side Burden Management –

- The overburden in the form of Gravel formation, the Gravel will be directly loaded into tippers and sold.

TABLE 10.2: PROPOSED CONTROLS FOR SOIL MANAGEMENT

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

Source: Proposed by FAE's & EIA Coordinator

10.4 WATER MANAGEMENT

In the proposed quarrying project no process is involved for the effluent generation, only oil & grease from the machinery wash is anticipated and domestic sewage from mine office. The quarrying operation is proposed upto a depth of 45m maximum below ground level, the water table in the area is 50m – 55m below ground level, hence the proposed projects will not intersect the Ground water table during entire quarry period.

TABLE 10.3: PROPOSED CONTROLS FOR WATER ENVIRONMENT

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

Source: Proposed by FAE's & EIA Coordinator

10.5 AIR QUALITY MANAGEMENT

The proposed quarrying activity would result in the increase of particulate matter concentrations due to fugitive dust. Daily water sprinkling on the haul roads, approach roads in the vicinity would be undertaken and will be continued as there is possibility for dust generation due to truck mobility. It will be ensured that vehicles are properly maintained to comply with exhaust emission requirements.

TABLE 10.4: PROPOSED CONTROLS FOR AIR ENVIRONMENT

CONTROL	RESPONSIBILITY
Generation of dust during excavation is minimized by daily (twice) water sprinkling on working face and daily (twice) water sprinkling on haul road	Mines Manager
Wet drilling procedure /drills with dust extractor system to control dust generation during drilling at source itself is implemented	Mines Manager
Maintenance as per operator manual of the equipment and machinery in the mines to minimizing air pollution	Mines Manager
Ambient Air Quality Monitoring carried out in the project area and in surrounding villages to access the impact due to the mining activities and the efficacy of the adopted air pollution control measures	Mines Manager
Provision of Dust Mask to all workers	Mines Manager
Greenbelt development all along the periphery of the project area	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

10.5.1 NOISE POLLUTION CONTROL

There will be intermittent noise levels due to vehicular movement, trucks loading, drilling and blasting and cutting activities. No mining activities are planned during night time.

TABLE 10.5: PROPOSED CONTROLS FOR NOISE ENVIRONMENT

CONTROL	RESPONSIBILITY
Development of thick greenbelt all along the Buffer Zone (7.5 Meters) of the project area to attenuate the noise and the same will be maintained	Mines Manager
Preventive maintenance of mining machinery and replacement of worn out accessories to control noise generation	Mines Foreman
Deployment of mining equipment with an inbuilt mechanism to reduce noise	Mines Manager
Provision of earmuff / ear plugs to workers working in noise prone zones in the mines	Mining Mate
Provision of effective silencers for mining machinery and transport vehicles	Mines Manager
Provision of sound proof AC operator cabins to HEMM	Mines Manager
Sharp drill bits are used to minimize noise from drilling	Mines Foreman
Controlled blasting technologies are adopted by using delay detonators to minimize noise from blasting	Mines Manager
Annual ambient noise level monitoring are 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

10.5.2 GROUND VIBRATION AND FLY ROCK CONTROL

The Rough stone and Gravel quarry operation creates vibration due to the blasting and movement of Heavy Earth moving machineries, fly rocks due to the blasting.

TABLE 10.6: PROPOSED CONTROLS FOR GROUND VIBRATIONS & FLY ROCK

CONTROL	RESPONSIBILITY
Controlled blasting using delay detonators will be carried out to maintain the PPV value (below 8Hz) well within the prescribed standards of DGMS	Mines Manager
Drilling and blasting will be carried under the supervision of qualified persons	Mines Manager
Proper stemming of holes should be carried out with statutory competent qualified blaster under the supervision of statutory mines manager to avoid any anomalies during blasting	Mines Manager
Suitable spacing and burden will be maintained to avoid misfire / fly rocks	Manager Mines

Number of blast holes will be restricted to control ground vibrations	Manager Mines
Blasting will be carried out only during noon time	Mining Mate
Undertake noise or vibration monitoring	Mines Manager
ensure blast holes are adequately stemmed for the depth of the hole and stemmed with suitable angular material	Mines Foreman

Source: Proposed by FAE's & EIA Coordinator

10.8 BIOLOGICAL ENVIRONMENT MANAGEMENT

The proponent will take all necessary steps to avoid the impact on the ecology of the area by adopting suitable management measures in the planning and implementation stage. During mining, thick plantation will be carried out around the project periphery, on safety barrier zone, on top benches of quarried out area etc.,

Following control measures are proposed for its management and will be the responsibility of the Mines Manager.

- Greenbelt development all along the safety barrier of the project area
- It is also proposed to implement the greenbelt development programme and post plantation status will be regularly checked for every season.
- The main attributes that retards the survival of sapling is fugitive dust, this fugitive dust can be controlled by water sprinkling on the haul roads and installing a sprinkler unit near the newly planted area.
- Year wise greenbelt development will be recorded and monitored
    - Based on the area of plantation.
    - Period of plantation
    - Type of plantation
    - Spacing between the plants
    - Type of manuring and fertilizers and its periods
    - Lopping period, interval of watering
    - Survival rate
    - Density of plantation
- The ultimate reclamation planned leaves a congenial environment for development of flora & immigration of small fauna through green belt and water reservoir. The green belt and water reservoir developed within the Project at the end of mine life will attract the birds and animals towards the project area in the post mining period.

10.8.1 Green Belt Development Plan

About 2300 nos. of saplings is proposed to be planted for the Mining plan period in safety barrier of all the proposed projects with survival rate 80% and about 100 nos of fruit bearing and avenue plants are proposed to be developed around the mines office. The greenbelt development plan has been prepared keeping in view the land use changes that will occur due to mining operation in the area.

TABLE 10.7 PROPOSED GREENBELT ACTIVITIES FOR 5 YEAR PLAN PERIOD

Year	No. of tress proposed to be planted	Area to be covered in m2	Name of the species	Survival rate expected in %	No. of trees expected to be grown
I	2300	Safety zone, approach and village roads	Neem, Pongamia pinnata, etc.,	80	1930

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

The objectives of the greenbelt development plan are –

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

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

10.8.2 Species Recommended for Plantation

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

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

TABLE 10.8: RECOMMENDED SPECIES TO PLANT IN THE GREENBELT

S.No	Botanical Name	Local Name	Importance
1.	Azadirachta indica	Neem, Vembu	Neem oil & neem products
2.	Millettia pinnata	Pungan	landscaping purposes as a windbreak or for shade
3.	Tamarindusindica	Tamarind	Edible & Medicinal and other Uses
4.	Achras sapota	Sapota	Edible fruits
5.	Ficus benghalensis	Alai	Shade and a source of food for birds
6.	Ficus religiosa	araca-maram	Shade and a source of food for birds
7.	Mangifera indica	Mango/ Ma	Edible fruit
8.	Terminalia catappa	nattuvadumai	Edible nuts
9.	Polyalthia longifolia	Nettilinkam	Tall and evergreen tree

Source: Proposed by FAE's & EIA Coordinator

10.9 OCCUPATIONAL SAFETY & HEALTH MANAGEMENT

Occupational safety and health is very closely related to productivity and good employer-employee relationship. The main factors of occupational health impact in quarries are fugitive dust and noise. Safety of employees during quarrying operation and maintenance of mining equipment will be taken care as per Mines Act 1952 and Rule 29 of Mines Rules 1955. To avoid any adverse effect on the health of workers due to dust, noise and vibration sufficient measures have been provided.

10.9.1 Medical Surveillance and Examinations –

- Identifying workers with conditions that may be aggravated by exposure to dust & noise and establishing baseline measures for determining changes in health.
- Evaluating the effect of noise on workers
- Enabling corrective actions to be taken when necessary
- Providing health education

The health status of workers in the mine shall be regularly monitored under an occupational surveillance program. Under this program, all the employees are subjected to a details medical examination at the time of employment. The medical examination covers the following tests under mines act 1952.

- General Physical Examination and Blood Pressure
- X-ray Chest and ECG
- Sputum test
- Detailed Routine Blood and Urine examination

The medical histories of all employees will be maintained in a standard format annually. Thereafter, the employees will be subject to medical examination annually. The below tests keep upgrading the database of medical history of the employees.

TABLE 10.9: MEDICAL EXAMINATION SCHEDULE

Sl.No	Activities	1st Year	2nd Year	3rd Year	4th Year	5th Year
1	Initial Medical Examination (Mine Workers)					
A	Physical Check-up					
B	Psychological Test					
C	Audiometric Test					
D	Respiratory Test					
2	Periodical Medical Examination (Mine Workers)					
A	Physical Check – up					
B	Audiometric Test					
C	Eye Check – up					
D	Respiratory Test					
3	Medical Camp (Mine Workers & Nearby Villagers)					
4	Training (Mine Workers)					

Medical Follow ups:- Work force will be divided into three targeted groups age wise as follows:-		
Age Group	**PME as per Mines Rules 1955**	**Special Examination**
Less than 25 years	Once in a Three Years	In case of emergencies
Between 25 to 40 Years	Once in a Three Years	In case of emergencies
Above 40 Years	Once in a Three Years	In case of emergencies
Medical help on top priority immediately after diagnosis/ accident is the essence of preventive aspects.		

10.9.2 Proposed Occupational Health and Safety Measures –

- The mine site will have adequate drinking water supply so that workers do not get dehydrated.
- Lightweight and loose fitting clothes having light colors will be preferred to wear.
- Noise exposure measurements will be taken to determine the need for noise control strategies.
- The personal protective equipment will be provided for mine workers.
- Supervisor will be instructed for reporting any problems with hearing protectors or noise control equipment.
- At noisy working activity, exposure time will be minimized.
- Dust generating sources will be identified and proper control measure will be adopted.
- Periodic medical examinations will be provided for all workers.
- Strict observance of the provisions of DGMS Acts, Rules and Regulations in respect of safety both by management and the workers.
- The width of road will be maintained more than thrice the width of the vehicle. A code of traffic rules will be implemented.

- In respect of contract work, safety code for contractors and workers will be implemented. They will be allowed to work under strict supervision of statutory person/officials only after they will impart training at vocational training centres. All personal protective equipment's will be provided to them.
- A safety committee meeting every month will be organized to discuss the safety of the mines and the persons employed.
- Celebration of annual mines safety week and environmental week in order to develop safety awareness and harmony amongst employees and co quarry owners.

FIGURE 10.1: PERSONAL PROTECTIVE EQUIPMENT TO THE MINE WORKERS

10.9.3 Health and Safety Training Programme

The Proponent 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 an Environmental Consultants to provide periodical training to all the employees to carry out the mining operation in and eco-friendly manner.

TABLE 10.10: LIST OF PERIODICAL TRAININGS PROPOSED FOR EMPLOYEES

Course	Personnel	Frequency	Duration	Instruction
New-Employee Training	All new employees exposed to mine hazards	Once	One week	Employee rights Supervisor responsibilities Self-rescue Respiratory devices Transportation controls Communication systems Escape and emergency evacuation Ground control hazards Occupational health hazards

				Electrical hazards First aid Explosives
Task Training Like Drilling, Blasting, Stemming, safety, Slope stability, Dewatering, Haul road maintenance,	Employees assigned to new work tasks	Before new Assignments	Variable	Task-specific health & safety procedures and SOP for various mining activity. Supervised practice in assigned work tasks.
Refresher Training	All employees who received new-hire training	Yearly	One week	Required health and safety standards Transportation controls Communication systems Escape ways, emergency evacuations Fire warning Ground control hazards First aid Electrical hazards Accident prevention Explosives Respirator devices
Hazard Training	All employees exposed to mine hazards	Once	Variable	Hazard recognition and avoidance Emergency evacuation procedures Health standards Safety rules Respiratory devices

Source: Proposed by FAE's & EIA Coordinator as per DGMS Norms

10.9.4 Budgetary Provision for Environmental Management –

Adequate budgetary provision has been made by the Company for execution of Environmental Management Plan. The Table 10.11 gives overall investment on the environmental safeguards and recurring expenditure for successful monitoring and implementation of control measures.

TABLE 10.11: EMP BUDGET FOR PROPOSED PROJECT – P1

	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	36800	36800
	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 - 8 Unit	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 - 5 Unit	25000	1250
	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	73600
	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	1708936
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	36800	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	736000	10000
	3. Progressive Closure Activity Green belt development - 500 trees per one hectare - Proposal for 2300 Tress (560 Tress inside the lease area and 1740 Trees outside the 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)	112000	16800
		Avenue Plantation @ 300 per plant (capital) for plantation outside the lease area and @ 30 per plant maintenance (recurring)	522000	52200
	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	84000	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	3877970	0
Implementation of EC, Mining Plan & DGMS	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

Condition-Public hearing commitment	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) -37 Employees	148000	37000
	Health check up for workers will be provisioned	IME & PME Health check up @ Rs. 1000/- per employee	0	37000
	First aid facility will be provided	Provision of 2 Kits per Hectare @ Rs. 2000/-	0	7360
	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	184000	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
	Construction of Greenmesh along with wire fencing around the lease area	Per Hectare greenmesh cost @ Rs. 50,000/- with Maintenance of Rs 20,000/- per annum	1,50,000	20,000
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			**3610600**	**2992945.8**

Year	Total Cost
1st Year	66,03,546
2nd Year	31,42,593
3rd Year	32,99,723

4th Year	34,64,709
5th Year	36,37,944

Cost inflation 5% per annum

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

In order to implement the environmental protection measures, an amount of Rs. 36,10,600 as capital cost and recurring cost as Rs. 29,92,945 as recurring cost is proposed considering present market price considering present market scenario.

10.10 CONCLUSION –

Various aspects of mining activities were considered and related impacts were evaluated. Considering all the possible ways to mitigate the environmental concerns Environmental Management Plan was prepared and fund has been allocated for the same. The EMP is dynamic, flexible and subjected to periodic review. For project where the major environmental impacts are associated, EMP will be under regular review. Senior Management responsible for the project will conduct a review of EMP and its implementation to ensure that the EMP remains effective and appropriate. Thus, the proper steps will be taken to accomplish all the goals mentioned in the EMP and the project will bring the positive impact in the study area.

10. ENVIRONMENTAL MANAGEMENT PLAN – "P2"

10.0 GENERAL

Environment Management Plan (EMP) aims at the preservation of ecological system by considering in-built pollution abatement facilities at the proposed site. Good practices of Environmental Management plan will ensure to keep all the environmental parameters of the project in respect of Ambient Air quality, Water quality, Socio – economic improvement standards.

Mitigation measures at the source level and an overall environment management plan at the study area are elicited so as to improve the supportive capacity of the receiving bodies. The EMP presented in this chapter discusses the administrative aspects of ensuring that mitigative measures are implemented and their effectiveness monitored after approval of the EIA.

10.1 ENVIRONMENTAL POLICY

The proponent is committed to conduct all its operations and activities in an environmentally responsible manner and to continually improve environmental performance.

The Proponent will –

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

Description of the Administration and Technical Setup –

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

The said team will be responsible for:

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

10.2 LAND ENVIRONMENT MANAGEMENT –

Landscape of the area will be changed due to the quarrying operation, restoration of the land by converting the quarry pit (4.67.0 ha) into temporary reservoir and the remaining part of the area (un utilized areas, infrastructure, haul Roads) will be utilized for greenbelt development. Aesthetic of the Environment will not be

affected. There is no major vegetation in the project area during the course of quarrying operation and after completion of the quarrying operation thick plantation will be developed under greenbelt development programme.

TABLE 10.1: PROPOSED CONTROLS FOR LAND ENVIRONMENT

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

Source: Proposed by FAE's & EIA Coordinator

10.3 SOIL MANAGEMENT

Top Soil Management –

- There is no topsoil in this project site.

Overburden / Waste and Side Burden Management –

- The overburden in the form of Gravel formation, the Gravel will be directly loaded into tippers and sold.

TABLE 10.2: PROPOSED CONTROLS FOR SOIL MANAGEMENT

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

Source: Proposed by FAE's & EIA Coordinator

10.4 WATER MANAGEMENT

In the proposed quarrying project no process is involved for the effluent generation, only oil & grease from the machinery wash is anticipated and domestic sewage from mine office. The quarrying operation is proposed upto a depth of 37m maximum below ground level, the water table in the area is 50m – 55m below ground level, hence the proposed projects will not intersect the Ground water table during entire quarry period.

TABLE 10.3: PROPOSED CONTROLS FOR WATER ENVIRONMENT

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

Source: Proposed by FAE's & EIA Coordinator

10.5 AIR QUALITY MANAGEMENT

The proposed quarrying activity would result in the increase of particulate matter concentrations due to fugitive dust. Daily water sprinkling on the haul roads, approach roads in the vicinity would be undertaken and will be continued as there is possibility for dust generation due to truck mobility. It will be ensured that vehicles are properly maintained to comply with exhaust emission requirements.

TABLE 10.4: PROPOSED CONTROLS FOR AIR ENVIRONMENT

CONTROL	RESPONSIBILITY
Generation of dust during excavation is minimized by daily (twice) water sprinkling on working face and daily (twice) water sprinkling on haul road	Mines Manager
Wet drilling procedure /drills with dust extractor system to control dust generation during drilling at source itself is implemented	Mines Manager
Maintenance as per operator manual of the equipment and machinery in the mines to minimizing air pollution	Mines Manager
Ambient Air Quality Monitoring carried out in the project area and in surrounding villages to access the impact due to the mining activities and the efficacy of the adopted air pollution control measures	Mines Manager
Provision of Dust Mask to all workers	Mines Manager
Greenbelt development all along the periphery of the project area	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

10.5.1 NOISE POLLUTION CONTROL

There will be intermittent noise levels due to vehicular movement, trucks loading, drilling and blasting and cutting activities. No mining activities are planned during night time.

TABLE 10.5: PROPOSED CONTROLS FOR NOISE ENVIRONMENT

CONTROL	RESPONSIBILITY
Development of thick greenbelt all along the Buffer Zone (7.5 Meters) of the project area to attenuate the noise and the same will be maintained	Mines Manager
Preventive maintenance of mining machinery and replacement of worn out accessories to control noise generation	Mines Foreman
Deployment of mining equipment with an inbuilt mechanism to reduce noise	Mines Manager
Provision of earmuff / ear plugs to workers working in noise prone zones in the mines	Mining Mate
Provision of effective silencers for mining machinery and transport vehicles	Mines Manager
Provision of sound proof AC operator cabins to HEMM	Mines Manager
Sharp drill bits are used to minimize noise from drilling	Mines Foreman
Controlled blasting technologies are adopted by using delay detonators to minimize noise from blasting	Mines Manager
Annual ambient noise level monitoring are 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

10.5.2 GROUND VIBRATION AND FLY ROCK CONTROL

The Rough stone and Gravel quarry operation creates vibration due to the blasting and movement of Heavy Earth moving machineries, fly rocks due to the blasting.

TABLE 10.6: PROPOSED CONTROLS FOR GROUND VIBRATIONS & FLY ROCK

CONTROL	RESPONSIBILITY
Controlled blasting using delay detonators will be carried out to maintain the PPV value (below 8Hz) well within the prescribed standards of DGMS	Mines Manager
Drilling and blasting will be carried under the supervision of qualified persons	Mines Manager
Proper stemming of holes should be carried out with statutory competent qualified blaster under the supervision of statutory mines manager to avoid any anomalies during blasting	Mines Manager
Suitable spacing and burden will be maintained to avoid misfire / fly rocks	Manager Mines
Number of blast holes will be restricted to control ground vibrations	Manager Mines

Blasting will be carried out only during noon time	Mining Mate
Undertake noise or vibration monitoring	Mines Manager
ensure blast holes are adequately stemmed for the depth of the hole and stemmed with suitable angular material	Mines Foreman

Source: Proposed by FAE's & EIA Coordinator

10.8 BIOLOGICAL ENVIRONMENT MANAGEMENT

The proponent will take all necessary steps to avoid the impact on the ecology of the area by adopting suitable management measures in the planning and implementation stage. During mining, thick plantation will be carried out around the project periphery, on safety barrier zone, on top benches of quarried out area etc.,

Following control measures are proposed for its management and will be the responsibility of the Mines Manager.

- Greenbelt development all along the safety barrier of the project area
- It is also proposed to implement the greenbelt development programme and post plantation status will be regularly checked for every season.
- The main attributes that retard the survival of sapling is fugitive dust, this fugitive dust can be controlled by water sprinkling on the haul roads and installing a sprinkler unit near the newly planted area.
- Year wise greenbelt development will be recorded and monitored
  - Based on the area of plantation.
  - Period of plantation
  - Type of plantation
  - Spacing between the plants
  - Type of manuring and fertilizers and its periods
  - Lopping period, interval of watering
  - Survival rate
  - Density of plantation
- The ultimate reclamation planned leaves a congenial environment for development of flora & immigration of small fauna through green belt and water reservoir. The green belt and water reservoir developed within the Project at the end of mine life will attract the birds and animals towards the project area in the post mining period.

10.8.1 Green Belt Development Plan

About 980 nos of saplings is proposed to be planted for the Mining plan period in safety barrier of all the proposed projects with survival rate 80% and about 810 nos of fruit bearing and avenue plants are proposed to be developed around the mines office. The greenbelt development plan has been prepared keeping in view the land use changes that will occur due to mining operation in the area.

TABLE 10.7 PROPOSED GREENBELT ACTIVITIES FOR 5 YEAR PLAN PERIOD

Year	No. of tress proposed to be planted	Area to be covered	Name of the species	Survival rate expected in %	No. of trees expected to be grown
I	980	Safety distance, village road nad panchayat road	Neem, Pongamia pinnata, etc.,	80	810

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

The objectives of the greenbelt development plan are –

- Provide a green belt around the periphery of the quarry area to combat the dispersal of dust in the adjoining areas,

- Protect the erosion of the soil, Conserve moisture for increasing ground water recharging,
- Restore the ecology of the area, Restore aesthetic beauty of the locality and meet the requirement of fodder, fuel and timber of the local community.

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

10.8.2 Species Recommended for Plantation

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

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

TABLE 10.8: RECOMMENDED SPECIES TO PLANT IN THE GREENBELT

S.No	Botanical Name	Local Name	Importance
10.	Azadirachta indica	Neem, Vembu	Neem oil & neem products
11.	Millettia pinnata	Pungan	landscaping purposes as a windbreak or for shade
12.	Tamarindusindica	Tamarind	Edible & Medicinal and other Uses
13.	Achras sapota	Sapota	Edible fruits
14.	Ficus benghalensis	Alai	Shade and a source of food for birds
15.	Ficus religiosa	araca-maram	Shade and a source of food for birds
16.	Mangifera indica	Mango/ Ma	Edible fruit
17.	Terminalia catappa	nattuvadumai	Edible nuts
18.	Polyalthia longifolia	Nettilinkam	Tall and evergreen tree

Source: Proposed by FAE's & EIA Coordinator

10.9 OCCUPATIONAL SAFETY & HEALTH MANAGEMENT

Occupational safety and health are very closely related to productivity and good employer-employee relationship. The main factors of occupational health impact in quarries are fugitive dust and noise. Safety of employees during quarrying operation and maintenance of mining equipment will be taken care as per Mines Act 1952 and Rule 29 of Mines Rules 1955. To avoid any adverse effect on the health of workers due to dust, noise and vibration sufficient measures have been provided.

10.9.1 Medical Surveillance and Examinations –

- Identifying workers with conditions that may be aggravated by exposure to dust & noise and establishing baseline measures for determining changes in health.
- Evaluating the effect of noise on workers
- Enabling corrective actions to be taken when necessary
- Providing health education

The health status of workers in the mine shall be regularly monitored under an occupational surveillance program. Under this program, all the employees are subjected to a details medical examination at the time of employment. The medical examination covers the following tests under mines act 1952.

- General Physical Examination and Blood Pressure
- X-ray Chest and ECG
- Sputum test

- Detailed Routine Blood and Urine examination

The medical histories of all employees will be maintained in a standard format annually. Thereafter, the employees will be subject to medical examination annually. The below tests keep upgrading the database of medical history of the employees.

TABLE 10.9: MEDICAL EXAMINATION SCHEDULE

Sl.No	Activities	1st Year	2nd Year	3rd Year	4th Year	5th Year
1	Initial Medical Examination (Mine Workers)					
A	Physical Check-up					
B	Psychological Test					
C	Audiometric Test					
D	Respiratory Test					
2	Periodical Medical Examination (Mine Workers)					
A	Physical Check – up					
B	Audiometric Test					
C	Eye Check – up					
D	Respiratory Test					
3	Medical Camp (Mine Workers & Nearby Villagers)					
4	Training (Mine Workers)					

Medical Follow ups:- Work force will be divided into three targeted groups age wise as follows:-		
Age Group	**PME as per Mines Rules 1955**	**Special Examination**
Less than 25 years	Once in a Three Years	In case of emergencies
Between 25 to 40 Years	Once in a Three Years	In case of emergencies
Above 40 Years	Once in a Three Years	In case of emergencies
Medical help on top priority immediately after diagnosis/ accident is the essence of preventive aspects.		

10.9.2 Proposed Occupational Health and Safety Measures –

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

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

FIGURE 10.1: PERSONAL PROTECTIVE EQUIPMENT TO THE MINE WORKERS

10.9.3 Health and Safety Training Programme

The Proponent 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 an Environmental Consultants to provide periodical training to all the employees to carry out the mining operation in and eco-friendly manner.

TABLE 10.10: LIST OF PERIODICAL TRAININGS PROPOSED FOR EMPLOYEES

Course	Personnel	Frequency	Duration	Instruction
New-Employee Training	All new employees exposed to mine hazards	Once	One week	Employee rights Supervisor responsibilities Self-rescue Respiratory devices Transportation controls Communication systems Escape and emergency

				evacuation Ground control hazards Occupational health hazards Electrical hazards First aid Explosives
Task Training Like Drilling, Blasting, Stemming, safety, Slope stability, Dewatering, Haul road maintenance,	Employees assigned to new work tasks	Before new Assignments	Variable	Task-specific health & safety procedures and SOP for various mining activity. Supervised practice in assigned work tasks.
Refresher Training	All employees who received new-hire training	Yearly	One week	Required health and safety standards Transportation controls Communication systems Escape ways, emergency evacuations, Fire warning Ground control hazards First aid Electrical hazards Accident prevention Explosives Respirator devices
Hazard Training	All employees exposed to mine hazards	Once	Variable	Hazard recognition and avoidance Emergency evacuation procedures Health standards Safety rules Respiratory devices

Source: Proposed by FAE's & EIA Coordinator as per DGMS Norms

10.9.4 Budgetary Provision for Environmental Management –

Adequate budgetary provision has been made by the Company for execution of Environmental Management Plan. The Table 10.12 gives overall investment on the environmental safeguards and recurring expenditure for successful monitoring and implementation of control measures.

TABLE 10.11: EMP BUDGET FOR PROPOSED PROJECT

	Mitigation Measure	Provision for Implementation	Capital	Recurring
Air Environment	Compaction, gradation and drainage on both sides for Haulage Road	Rental Dozer & drainage construction on haul road @ Rs. 10,000/- per hectare; and yearly maintenance @ Rs. 10,000/- per hectare	16200	16200
	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 - 4 Unit	100000	10000
	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 -2 Unit	10000	500
	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	32400
	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	403312
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	16200	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	324000	10000
	3. Progressive Closure Activity Green belt development - 500 trees per one hectare - Proposal for 980 Tress (280Tress inside the lease area and 700 Trees outside the lease area)	Site clearance, preparation of land, digging of pits / trenches, soil amendments, transplantation of saplings @ 200 per plant (capital) for plantation inside the lease area and @ 30 per plant maintenance (recurring)	56000	8400
		Avenue Plantation @ 300 per plant (capital) for plantation outside the lease area and @ 30 per plant maintenance (recurring)	210000	21000
	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	53250	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	915208	0

		implemented in the Project Site		
Implementation of EC, Mining Plan & DGMS Condition- Public hearing commitment	Size 6' X 5' with blue background and white letters as mentioned in MoM Appendix II by the SEAC TN	Fixed Display Board at the Quarry Entrance as permanent structure mentioning Environmental Conditions	10000	1000
	Air, Water, Noise and Soil Quality Sampling every 6 Months for Compliance Report of EC Conditions	Submission of 2 Half Yearly Compliance - Lab Monitoring Report as per CPCB norms	0	50000
	Workers will be provided with Personal Protective Equipment's	Provision of PPE @ Rs. 4000/- per employee with recurring based on wear and tear (say, @ Rs. 1000/- per employee) - 19 Employees	76000	19000
	Health check up for workers will be provisioned	IME & PME Health check up @ Rs. 1000/- per employee	0	19000
	First aid facility will be provided	Provision of 2 Kits per Hectare @ Rs. 2000/-	0	3240
	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	81000	10000
	Installation of CCTV cameras in the mines and mine entrance	Camera 4 Nos, DVR, Monitor with internet facility	30000	5000
	Implementation as per Mining Plan and ensure safe quarry working	Mines Manager (1^{st} Class / 2^{nd} Class / Mine Foreman) under regulation 34 / 34 (6) of MMR, 1961 and Mining Mate under regulation 116 of MMR,1961 @ 40,000/- for Manager & @ 25,000/- for Foreman / Mate	0	780000
	Construction of Greenmesh along with wire fencing around the lease area	Per Hectare greenmesh cost @ Rs. 50,000/- with Maintenance of Rs 20,000/- per annum	1,50,000	20,000
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	**2499400**	**1535052**

Year	Total Cost
1st	40,34,452
2nd	16,11,805
3rd	16,92,395
4th	17,77,015
5th	18,65,865

Cost inflation 5% per annum

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

In order to implement the environmental protection measures, an amount of Rs. 25.0 lakhs as capital cost and recurring cost as Rs. 15.50 lakhs as recurring cost is proposed considering present market price considering present market scenario.

10.10 CONCLUSION –

Various aspects of mining activities were considered and related impacts were evaluated. Considering all the possible ways to mitigate the environmental concerns Environmental Management Plan was prepared and fund has been allocated for the same. The EMP is dynamic, flexible and subjected to periodic review. For project where the major environmental impacts are associated, EMP will be under regular review. Senior Management responsible for the project will conduct a review of EMP and its implementation to ensure that the EMP remains effective and appropriate. Thus, the proper steps will be taken to accomplish all the goals mentioned in the EMP and the project will bring the positive impact in the study area.

11. SUMMARY AND CONCLUSION

Melathattapparai Rough Stone and Gravel Quarries (Extent: 7.03.5 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 Oct to Dec 2022 for various environmental components so as to assess the anticipated impacts of the cluster quarry projects on the environment and suitable mitigation measures for likely adverse impacts due to the proposed project is suggested individually for the respective proposed project under Chapter 10.

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

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

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

Sustainable and modern mining leads us to see positive impact of mining operation and providing consistent employment for nearly 56 people directly in the cluster.

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 Melathattapparai Rough Stone and Gravel Quarries (Extent: 7.03.5 ha).

12. DISCLOSURE OF CONSULTANTS

The project Proponents Thiru. P. Ananthakumar&Tmt. P. Ananthammal, have engaged M/s Geo Exploration and Mining Solutions, an Accredited Organization under Quality Council of India – National Accreditation Board for Education & Training, New Delhi, for carrying out the EIA Study as per the ToR Issued.

Name and address of the consultancy:

GEO EXPLORATION AND MINING SOLUTIONS
No 17, Advaitha Ashram Road,
Alagapuram, Salem – 636 004
Tamil Nadu, India
Email: infogeoexploration@gmail.com
Web: **www.gemssalem.com**
Phone: 0427 2431989.

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

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

Abbreviations	
EC	EIA Coordinator
AEC	Associate EIA Coordinator
FAE	Functional Area Expert

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

DECLARATION BY EXPERTS CONTRIBUTING TO THE EIA/EMP

Declaration by experts contributing to the EIA/EMP for Rough Stone & Gravel Cluster Quarries over an Extent of 7.03.5ha in Melathattapparai Village of Thoothukudi Taluk, Thoothukudi District of Tamil Nadu. It is also certified that information furnished in the above EIA study are true and correct to the best of our knowledge.

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

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

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

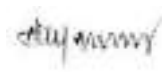
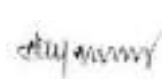
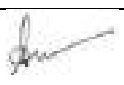
Date & Signature: 

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

Associated Team Member with EIA Coordinator:

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

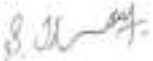
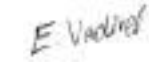
FUNCTIONAL AREA EXPERTS ENGAGED IN THE PROJECT

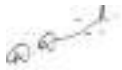
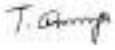
Sl. No.	Functional Area	Involvement	Name of the Expert/s	Signature
1	AP	▪ Identification of different sources of air pollution due to the proposed mine activity ▪ Prediction of air pollution and propose mitigation measures / control measures	Mr. A. Jagannathan	
2	WP	▪ Suggesting water treatment systems, 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.	Mrs. K. Anitha	

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

LIST OF TEAM MEMBERS ENGAGED IN THIS PROJECT

Sl.No.	Name	Functional Area	Involvement	Signature
1	Mr. S. Nagamani	AP; GEO;	▪ Site Visit with FAE	

		AQ	▪ Provide inputs & Assisting FAE with sources of Air Pollution, its impact and suggest control measures ▪ Provide inputs on Geological Aspects ▪ Analyse & provide inputs and assist FAE with meteorological data, emission estimation, AERMOD modelling and suggesting control measures	
2	Mr. Viswathanan	AP; WP; LU	▪ Site Visit with FAE ▪ Provide inputs & Assisting FAE with sources of Air Pollution, its impact and suggest control measures ▪ Assassisting FAE on sources of water pollution, its impacts and suggest control measures ▪ Assisting FAE in preparation of land use maps	
3	Mr. Santhoshkumar	GEO; SC	▪ Site Visit with FAE ▪ Provide inputs on Geological Aspects ▪ Assist in Resources & Reserve Calculation and preparation of Production Plan & Conceptual Plan ▪ Provide inputs & Assisting FAE with soil conservation methods and identifying impacts	
4	Mr. Umamahesvaran	GEO	▪ Site Visit with FAE ▪ Provide inputs on Geological Aspects ▪ Assist in Resources & Reserve Calculation and preparation of Production Plan & Conceptual Plan	
5	Mr. A. Allimuthu	SE	▪ Site Visit with FAE ▪ Assist FAE with collection of data's ▪ Provide inputs by analysing primary and secondary data	
6	Mr. S. Ilavarasan	LU; SC	▪ Site Visit with FAE ▪ Assisting FAE in preparation of land use maps ▪ Provide inputs & Assisting FAE with soil conservation methods and identifying impacts	
7	Mr. E. Vadivel	HG	▪ Site Visit with FAE ▪ Assist FAE & provide inputs on aquifer	

			characteristics, ground water level/table ▪ Assist with methods of ground water recharge and conduct pump test, flow rate	
8	Mr. D. Dinesh	NV	▪ Site Visit with FAE ▪ Assist FAE and provide inputs on impacts due to proposed mine activity and suggest mitigation measures ▪ Assist FAE with prediction modelling	
9	Mr. Panneer Selvam	EB	▪ Site Visit with FAE ▪ Assist FAE with collection of baseline data ▪ Provide inputs and assist with labelling of Flora and Fauna	
10	Mrs. Nathiya	EB	▪ Site Visit with FAE ▪ Assist FAE with collection of baseline data ▪ Provide inputs and assist with labelling of Flora and Fauna	

DECLARATION BY THE HEAD OF THE ACCREDITED CONSULTANT ORGANIZATION

I, Dr. M. Ifthikhar Ahmed, Managing Partner, Geo Exploration and Mining Solutions, hereby, confirm that the above-mentioned Functional Area Experts and Team Members prepared the EIA/EMP for Rough Stone & Gravel Cluster Quarries over an Extent of 7.03.5 ha in Melathattapparai Village of Thoothukudi Taluk, Thoothukudi District of Tamil Nadu. It is also certified that information furnished in the EIA study are true and correct to the best of our knowledge.

Signature & Date: 

Name: **Dr. M. Ifhikhar Ahmed**

Designation: **Managing Partner**

Name of the EIA Consultant Organization: **M/s. Geo Exploration and Mining Solutions**

NABET Certificate No & Issue Date: **NABET/EIA/2225/RA0276 Dated: 20-2-2023**

Valid Date **Aug 06, 2025**