DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

For

Pothuvai & Pazhavalam Black Granite & Quartzo-Feldspathic Gneiss Quarry

Over an extent of 40.13.05 Ha

At

Survey No: 58/1(Pothuvai village) & 135/1(Pazhavalam village)
Villages: Pothuvai&Pazhavalam
Taluk: Gingee
District: Villupuram
State: Tamil Nadu

By

M/s. Tamil Nadu Minerals Limited

(Project termed under Schedule 1(a) Mining of Minerals 'B1' category as per EIA Notification 2006 and its Amendments thereafter and O.M issued vide F.No.L-11011/175/2018-IA-II (M), dated: 14.08.2018)

EIA Consultant

HUBERT ENVIRO CARE SYSTEMS (P) LTD, CHENNAI

April 2023

ACKNOWLEDGEMENT

The following personnel are gratefully acknowledged for their fullest support in collection, compilation of needful data regarding the project and kind cooperation in fulfilling the report on Environmental Impact Assessment (EIA) report of Pothuvai & Pazhavalam Black Granite & Quartzo-Feldspathic Gneiss Quarry, over an extent of 40.13.05 Ha at S.F. 58/1 (Pothuvai) &135/1 (Pazhavalam) at Pothuvai & Pazhavalam village, Gingee taluk, Villupuram District, Tamilnadu State.

M/s Tamil Nadu Minerals Limited,

- Dr. E.Ganesan- Deputy Manager (ML)

M/s Hubert Enviro Care System Private Limited

1) Dr. J R Moses (CEO)
2) Dr. Raj Kumar Samuel (Director- Technical)
3) Mr. Vamsee Krishna Navooru (Head-Consultancy& EIA Coordinator)

Declaration by the Project Proponent

I, Dr. E Ganesan, Deputy Manager (ML) of M/s Tamil Nadu Minerals Limited, declaration/ undertaking that owing the contents (information and data) of the EIA report preparation has been undertaken in the compliance with Terms of Reference (ToR) for the **"Pothuvai & Pazhavalam Black Granite & Quartzo-Feldspathic Gneiss Quarry over the extent of 40.13.05 Hectares at S.F. 58/1 (Pothuvai) &135/1(Pazhavalam) at Pothuvai& Pazhavalam villages, Gingee Taluk, Villupuram District, Tamil Nadu State."** and the information and content provided in the report are factually correct.

for Tamil Nadu Minerals Ltd,

Authorised signatory
Deputy Manager (ML)
TAMIN - Chennai

Declaration by the Head of the Accredited Consultant Organization

I, Dr.J.R. Moses, hereby, confirm that the below mentioned experts prepared the EIA/EMP report for **"Pothuvai & Pazhavalam Black Granite & Quartzo-Feldspathic Gneiss Quarry over the extent of 40.13.05 Hectares at S.F. 58/1 (Pothuvai) &135/1(Pazhavalam) at Pothuvai&Pazhavalam village, Gingee taluk, Villupuram District, Tamil Nadu State"**. I also confirm that I shall be fully accountable for any misleading information mentioned in this statement.

Signature:

Date: 04.05.2023

Name: Dr. J. R. Moses

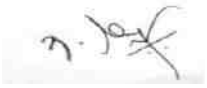
Designation: Chief Executive Officer

Name of the EIA Consultant Organization: M/s. Hubert Enviro Care Systems (P) Ltd, Chennai

NABET Certificate No & Validity: NABET/EIA/2224/SA 0190& valid upto27.07.2024

Declaration of Experts contributing to the EIA

I, hereby, certify that I was involved in the EIA report for the project titled **"Pothuvai & Pazhavalam Black Granite & Quartzo-Feldspathic Gneiss Quarry over the extent of 40.13.05 Hectares at S.F. 58/1 (Pothuvai) &135/1(Pazhavalam) at Pothuvai&Pazhavalam village, Gingee taluk, Villupuram District, Tamil Nadu State"**. I was a part of the EIA team in the following capacity that developed the above EIA with the support of the following functional area experts.

EIA Coordinator
Name: Mr. Vamsee Krishna Navooru
Signature: 
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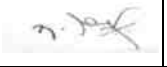
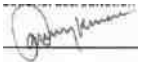
Functional Area Experts (FAEs):

S. No.	Functional Areas		Name of the Expert	Signature	Duration of Involvement
1.	AP	FAE	Mr. Vamsee Krishna Navooru		Jan 2023 to Till Date
2.	WP	FAE	Mr. Vamsee Krishna Navooru		Jan 2023 to Till Date
3.	SHW	FAE	Mr. Vamsee Krishna Navooru		Jan 2023 to Till Date
4.	SE	FAE	Mr. V. Dhivakar		Jan 2023 to Till Date
5.	EB	FAE	Dr. Rajkumar Samuel		Jan 2023 to Till Date
6.	HG	FAE	Mr. Mallikarjuna Rao		Jan 2023 to Till Date
7.	GEO	FAE	B. Mallikarjuna Rao		Jan 2023 to Till Date

S. No.	Functional Areas		Name of the Expert	Signature	Duration of Involvement
8.	NV	FAE	Mr. VivekNavare		Jan 2023 to Till Date
9.	LU	FAE	Mr. Venkateswarlu		Jan 2023 to Till Date
10.	RH	FAE	Dr. J R Moses		Jan 2023 to Till Date
11.	SC	FAE	Dr. B.C. Nagaraja		Jan 2023 to Till Date

LU - Land Use

AP - Air Pollution monitoring, prevention and control

AQ - Meteorology, air quality modeling and prediction

WP - Water pollution monitoring, prevention and control

EB - Ecology and biodiversity

NV - Noise& Vibration

SE - Socio-economics

HG - Hydrology, ground water and water conservation

GEO - Geology

RH - Risk assessment and hazards management

SHW - Solid and hazardous waste management

SC - Soil Conservation

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LIST OF ABBREVIATIONS

AAQ	Ambient Air Quality
AAQM	Ambient Air Quality Monitoring
AGL	Above Ground Level
AMSL	Above Mean Sea Level
BGL	Below Ground Level
CPCB	Central Pollution Control Board
CER	Corporate Environmental Responsibility
DMP	Disaster Management Plan
EIA	Environmental Impact Assessment
EMC	Environmental Management Cell
EMP	Environmental Management Plan
GLC	Ground Level Concentration
GO	Government Order
HECS	Hubert Enviro Care Systems
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Nature
O. B	Over Burden
S. B	Side Burden
KWh	Kilowatt Hour
MSDS	Material Safety Data Sheet
MMR	Metalliferous Mines Regulations
MoEF&CC	Ministry of Environment, Forest and Climate Change
NAAQ	National Ambient Air Quality
NABET	National Accreditation Board for Education and Training
QCI	Quality Council of India
R & D	Research & Development
RA	Risk Assessment
ROM	Run of Mine
STP	Sewage Treatment Plant
SOM	Scheme of Mining
SEIAA	State Environmental Impact Assessment Authority
SEAC	State Expert Appraisal Committee
TAMIN	Tamilnadu Minerals Limited
TWAD	Tamilnadu Water Supply and Drainage Board
TDS	Total Dissolved Solids
TNPCB	Tamil Nadu Pollution Control Board
TNSEAC	Tamil Nadu State Expert Appsaisal Committee
TOR	Terms of Reference
TANGEDCO	Tamil Nadu Generation and Distribution Corporation
kVA	kilovolt-ampere

1 INTRODUCTION

1.1 Purpose of the report

The granite dimensional stone material by virtue of its pleasing colour and texture and its best ability to take polishing and appealing look in polished product has attracted the consumers TAMIN's Client to provide in the building construction and interior decoration industries. The domestic market capabilities have also been explored in recent periods. Bulk quantity of the blocks are produced and exported as raw blocks and some quantity is being processed at TAMIN's Granite polishing units and exported as value added finished products.

The earning source in the targeted area is limited, most of the people in and around the area depend upon the seasonal agriculture and much of the people migrate to nearby towns where good industries and factories are growing up.

Around 30 people directly employed including mining operations, outside workshops, unit supported industries. Local villages residing in the nearby villages shall be employed as semi-skilled workers.

1.2 Project back ground

M/s. Tamil Nadu Minerals Ltd, (An undertaking of Government of Tamil Nadu) was established in the year 1978, to carry out systematic mining and development of different minerals all over the state. Ever since its inception TAMIN has developed expertise in the mining of granite dimensional stones of different varities including Black Granite(Dolerite), Kashmir White(Leptynite), Paradiso(Migmatite Gneiss), Green Onyx(Syenite-porphyry), Red wave (Pink Feldspathic Gneiss) Colombo Juparana(Pegmatitic Granite Gneiss of magmatic origin), Raw silk(Yellow Feldspathic Leptynite) and a number of other coloured granite varieties apart from other industrial minerals viz., Quartz and Feldspar, Graphite, Limestone, Vermiculite etc,.

Government of Tamil Nadu issued to grant lease for 30 years for extent of 40.13.05 Ha [10.44.0 Ha. at S.F. 58/1 (Pothuvai) and 29.69.05 Ha at S.F.No.135/1 (Pazhavalam)] at Pothuvai&Pazhavalam village, Gingee taluk, Villupuram District, Tamil Nadu State.Tamil Nadu vide G.O.(3D) No 66, industries(MME.1) department, dated: 05.12.2011.Meanwhile,an amendment was issued for quarrying Country Rock (Quartzo-Feldspathic Gneiss)for making M-sand in the same lease hold area without changing the lease period G.O.(MS)No.108, Industries (MME.1) Department, dated:04.08.2016. Accordingly, mining plan has been submitted and approved by the Director of Geology and Mining, Chennai vide Letter.No.7388/MM5/2018, dated: 11.05.2019. G.O. is enclosed as **Annexure-I.** Mining plan and approval letter is enclosed as **Annexure-II.**

The area lies in the Eastern Longitude from 79°15'39.40"E to 79°16'08.11"Eand Northern latitude from 12° 08'15.47"N to 12° 08'45.41"N enclosed sectional plates as **Annexure-III.** The area does not falls under forest land of any category. It is Government Poramboke land.

Black Granite

The Geological reserves of Black granite have been computed based on the Geological Plan & Sections up to the economically workable average depth of 30m from the surface level and the top surface of the granite body works out to 4,79,221 m^3. By applying 10% recovery the effective Geological reserves 47,922 $m^{3.}$

Mineable Reserves have been computed as 3,37,609 m^3 after deleting the reserves locked up in safety barrier and benches based on the Conceptual Plan and sections, the effective(Saleable) Mineable Reserves have been worked out as 33,761 m^3 by applying the recovery factor 10%. The annual peak production per year would be 1,811m^3 of ROM of saleable and 33,761m^3 of ROM during the first five year of Mining plan period at the rate of 10% recovery. Open cast Semi mechanized method will be followed for proposed mining as per Mining plan. Sectional plates are enclosed as **Annexure-III.**

Total waste to be generated during the five years of Mining Plan period will be around 87,300m^3. These wastes are proposed to be dumped on the North eastern side of lease area with dimensions of 200m x 50 x 8.75m.

Quartzo-Feldspathic Gneiss

The Geological reserves of Black granite have been computed based on the Geological Plan & Sections up to the economically workable average depth of 40m from the surface level and the top surface of the granite body works out to 1,08,13,395 m^3. By applying100% recovery the effective Geological reserves 1,08,13,395 $m^{3.}$

Mineable Reserves have been computed as 77,39,961 m^3 after deleting the reserves locked up in safety barrier and benches based on the Conceptual Plan and sections, the effective(Saleable) Mineable Reserves have been worked out as 77,39,961 m^3 by applying the recovery factor 100%. The annual peak production per year would be 7,52,124m^3 of ROM of saleable and 77,39,961m^3 of ROM during the first five year of Mining plan period at the rate of 100% recovery. Open cast Semi mechanized method will be followed for proposed mining as per Mining plan. Sectional plates are enclosed as **Annexure-III.**

The total water requirement is 1.5KLD (Drinking & Domestic purpose-0.5 KLD, Wire Saw cutting -0.3 KLD, Dust suppression -0.3 KLD & Greenbelt-0.4KLD). The total water requirement will be met from private tankers. Power requirement 60 kVA will be met through 125 kVA DG Set. Diesel consumption will be 200 liters/day. Man power requirement will be 35 Nos directly. Municipal Solid

waste will be disposed into local municipal bins. Hazardous waste like waste oil will be disposed through TNPCB authorized dealers. Sewage will be disposed through septic tank followed by soak pit. Septic Tank will be cleaned periodically.

The project cost is Rs. 99.97 Lakhs. (Fixed Cost Rs. 2, 25,000/-, Operational Cost Rs. 95,67,000/- and EMP Cost Rs. 2,05,000/-).

1.3 Identification of Project & Project Proponent

1.3.1 Project

The proposed Black Granite&Quartzo Feldspathic Gneiss Mine is over an extent of 40.13.05Ha located at S.F.No.58/1& 135/1, Pothuvai&Pazhavalam villages, Gingee taluk, Villupuram District, Tamil Nadu State.TAMIN is obtaining Environmental Clearance from SEIAA-Tamil Nadu.Since, the project falls under B1 Category, Schedule 1(a) Mining of Minerals as per MoEF&CC Notification and its amendment vide S. O. 3977(E) dated; 14th Aug 2018. The land use classification of the project site is government poramboke land. TAMIN obtained lease vide G.O.(3D)No.66,Industries(MME.1) Department,dated: 05.12.2011. Lease amendment is enclosed as **Annexure-I.**

The Mining Plan has been prepared for quarrying Black Granite (Dolerite) over an extent of 10.44.0 Ha. in S.F. 58/1 (Pothuvai) & over an extent of 29.69.05 Ha in S.F.No.135/1(Pazhavalam) and a total extent of 40.13.05 Ha of Pothuvai&Pazhavalam village, Gingee taluk, Villupuram District,TamilNadu State. Tamil Nadu for 30 years. Mining plan and approval letter is enclosed as **Annexure-II.**
The area applied for quarry lease is exhibits hillock with height of about (~291m AMSL) surrounded by plain lands on North and it is surrounded by hillock on Southeast side. Geologically, the lease applied area is a Dolerite dyke intruded into the Gneissic formation. The area lies in the Eastern Longitude from 79°15'39.40"E to 79°16'08.11"Eand Northern latitude from 12°08'15.47"N to 12°08'45.41"N enclosed sectional plates as **Annexure-III**. The area is marked in the survey of India Topo sheet No. 57P/4&8.

1.3.1 Project Proponent

Tamil Nadu Minerals Limited (TAMIN) (An Undertaking of Government of Tamil Nadu) has been established in the year 1978. It entered the international granite market in the year 1979 and has secured a steady market for dimensional blocks of black and other color materials in countries like Japan, Germany, Italy, Australia, UK, Switzerland, Holland, USA etc. TAMIN had started the Captive Graphite Mine in the year 1986.

TAMIN is only organization recognized by Bureau of Indian Standard for manufacture and supply of I.S. Sand all over the country. TAMIN has also been marketing granite cubes with sides measuring 6cm to 12cm. TAMIN has developed expertise in the mining of granite dimensional stones of

different varieties including black granite (Dolerite), Kashmir white (Leptynite), Paradiso (Migmatite gneiss), Green onyx (Syenite - porphyry) Red wave (Pink Feldspathic gneiss) Colombo Juparana (Pegmatitic granite gneiss of migmatitic origin), Raw silk (Yellow Feldspathic Leptynite) and a number of other color granite varieties apart from other industrial minerals viz. quartz and feldspar, graphite, lime stone, silica sand, vermiculite, etc.

TAMIN has also set up industrial units for polishing processing the granite stones one each at Manali (Chennai), Madhepalli at Krishnagiri District and Melur at Madurai District. A Beneficiation plant for the beneficiation of graphite ore has been established close to Sivaganga Graphite mine. An exfoliation plant for the processing of vermiculite mineral at Sevathur village Tirupathur district has also been established.

1.4 Letter of Intent (LoI) & Mining Plan approval details

i. TAMIN obtained lease vide G.O.(3D)No.66, Industries (MME.1) Department, dated: 05.12.2011. Lease amendment is enclosed as **Annexure-I.**

ii. The Mining Plan has been prepared for quarrying Black Granite (Dolerite) & Quartzo-Feldspathic Gneiss over an extent of 10.44.0 Ha. in S.F. 58/1 (Pothuvai) & over an extent of 29.69.05 Ha in S.F.No.135/1(Pazhavalam) and a total extent of 40.13.05 Ha of Pothuvai&Pazhavalam village, Gingee taluk, Villupuram District, Tamil Nadu State, for 30 years. Mining plan was approved by the Director of Geology and Mining, Chennai vide Lr.No.7388/MM5/2018, dated: 11.05.2019 and letter is enclosed as **Annexure-II.**

1.5 Land Acquisition Status

iii. The entire mine lease area of 40.13.05 Ha is Government land which is leased by TAMIN. TAMIN obtained lease vide G.O.(3D) No.66, Industries (MME.1) Department, dated: 05.12.2011. Lease amendment is enclosed as **Annexure-I.**

Table 1-1 Land Use Description

District and State	Taluk	Village	S.F. No	Area in (Ha)	Land Classification
Villupuram District, Tamil Nadu	Gingee	Pothuvai& Pazhavalam	S.F.No.58/1,Pothuvai & 135/1 Pazhavalam	40.13.05	Government Land

1.6 Purpose and Status of the Report

The Pothuvai & Pazhavalam Black Granite &Quartzo Feldspathic Gneiss Quarry isover extent of 40.13.05 Ha.The project falls under B1 Category, Schedule 1(a) Mining of Minerals as per EIA Notification dated 14th September 2006 and its subsequent amendments.The EC application was submitted to TN SEIAA vide File No.845.The proposal was appraised during 345th SEAC meeting held on 10.01.2023 and 590th SEIAA meeting held on 09.02.2023 and ToR was issued vide Lr No.

SEIAA-TN/F.No.845/SEAC/ToR-1328/2023, dated: 09.02.2023 for the preparation of EIA/EMP report. Draft EIA report was submitted for Public Hearing (PH) to Villupuram PCB. Final EIA will be submitted to TNSEAC for further appraisal of the project and obtaining Environment Clearance.

Final EIA report will be submitted to TN-SEAC for further appraisal of the project and obtaining Environmental Clearance.

1.7 Brief Description of the Project

1.7.1 Nature of the Project

The project falls under B1 Category, Schedule 1(a) Mining of Minerals as per EIA Notification and its amendment. Hence, the project will appraise for Environmental Clearance from State Expert Appraisal Committee, Tamil Nadu. The EC application was submitted to TN SEIAA –TN/ File No.845/EC/1(a)/1970/2014 & Proposal No. SIA/TN/MIN/30164/2018 dated 07.12.2018.

The TAMIN has obtained lease vide G.O.(3D)No.66, Industries (MME.1) Department, dated: 05.12.2011. Lease amendment is enclosed as **Annexure-I.**

The mining plan has been submitted and approved by the Director of Geology and Mining, Chennai vide Letter.No.7388/MM5/2018, dated: 11.05.2019. Mining approval letter is enclosed as **Annexure-II.**

The proposal was appraised during 345th SEAC meeting held on 10.01.2023 and 590thSEIAA meeting held on 09.02.2023 and ToR was issued vide Lr No. SEIAA-TN/F.No.845/SEAC/ToR-1328/2023, dated: 09.02.2023.

1.7.2 Size of the Project

The Proposed Black Granite & Quartzo Feldspathic Gneiss Quarry over an extent of 40.13.05 Ha is located at SF.No.58/1&135/1 (Pothuvai&Pazhavalam), Pothuvai&Pazhavalam village, Gingee Taluk, Villupuram District, Tamil Nadu State.

Black Granite

Black Granite Quarry area is over an extent of 40.13.05 Ha with the Geological reserves of Black granite have been computed based on the Geological Plan & Sections up to the economically workable average depth of 30m from the surface level and the top surface of the granite body works out to 4,79,221 m^3. By applying 10% recoveries the effective Geological reserves works outto 47,922m^3.

Mineable Reserves have been computed as 3,37,609 m^3 after deleting the reserves locked up in safety barrier and benches based on the Conceptual Plan and sections, the effective (Saleable) Mineable Reserves have been worked out as 33,761 m^3 by applying the recovery factor 10%. The average

annual production per year would be 1,811m^3 of ROM of saleable and 33,761m^3 of ROM during the first five year of Mining plan period at the rate of 10% recovery.Open cast Semi mechanized method will be followed for proposed mining as per mining plan. Sectional plates are enclosed as **Annexure-III.**

Total waste (Granite Waste+Side Burden) to be generated during the five years of Mining Plan period will be around 95,909 m^3. These wastes are proposed to be dumped on the North eastern side of lease area with dimensions of 190m x 90m x 5.60m. The method of mining is Open cast semi mechanized.

Quartzo-Feldspathic Gneiss

Quartzo-Feldspathic Gneiss Quarry area is over an extent of 40.13.05 Ha with the Geological reserves of Black granite have been computed based on the Geological Plan & Sections up to the economically workable average depth of 30m from the surface level and the top surface of the granite body works out to 1,08,13,395 m^3. By applying 100% recovery the effective Geological reserves works outto 1,08,13,395m^3.

Mineable Reserves have been computed as 77,39,961 m^3 after deleting the reserves locked up in safety barrier and benches based on the Conceptual Plan and sections, the effective (Saleable) Mineable Reserves have been worked out as 77,39,961 m^3 by applying the recovery factor 100%. The average annual production per year would be 7,52,124m^3 of ROM of saleable and 77,39,961m^3 of ROM during the first five year of Mining plan period at the rate of 100% recovery.Open cast Semi mechanized method will be followed for proposed mining as per mining plan. Sectional plates are enclosed as **Annexure-V.**

Table 1-2 Ultimate Pit Dimensional Details

S. No	Description	Average Ultimate Pit Dimensional(m)		
		Length	Width	Depth
1	Top	342.25	578.20	30
2	Bottom	310.25	549.40	

Table 1-3 Black Granite Geological Reserves

Section	Average Measurements (m)			ROM (m3)	Effective Reserves@ 10%(m3)	Granite waste @90% (m3)
	Length	Width	Depth			
PQR-B1B2	94	60	29	1,63,560		
PQR-C1C2	94	45	29	1,22,670		
PQR-D1D2	94	42	29	1,14,492		
PQR-E1E2	94	36	29	98,136		
Total Geological Reserves				4,98,858		
Depletion of reserves during mining period (2012 to 2017)				(-)11,570		
Depletion of reserves during mining period (2017 to 2022)				(-)8,067		
Total				**4,79,221**	**47,922**	**4,31,299**

Table 1-4 Quartzo-Feldspathic Gneiss Geological Reserves

Section	Average Measurements (m)			ROM (m3)	Effective Reserves@ 100%(m3)
	Length	Width	Depth		
ST-AA1	120.60	305.00	30.00	11,03,490	
ST-B3B4	99.00	542.20	30.00	16,10,334	
ST-C2C3	99.00	593.40	30.00	17,62,398	
ST-D2D3	99.00	625.00	30.00	18,56,250	
ST-EE3	146.80	565.20	30.00	24,89,141	
UV-BB1	88.80	234.20	30.00	6,23,909	
UV-CC1	85.20	279.80	30.00	7,15,169	
UV-DD1	104.00	209.20	30.00	6,52,704	
Total Geological Reserves				1,08,13,395	
Depletion of reserves				Nil	
Total				**1,08,13,395**	**1,08,13,395**

1.7.3 Location of the project

Pothuvai&Pazhavalam Black Granite &Quartzo-Feldspathic Gneiss Quarry area is over an extent of 40.13.05 Ha, the lease area is located at S.F.No.58/1 (Pothuvai-10.44.0Ha)& S.F.No.135/1 (Pazhavalam-29.69.05Ha) of Pothuvai&Pazhavalam village, Gingee taluk, Villupuram District, Tamil Nadu State.The boundary co-ordinates of the mine lease area are tabulated in

Table 1-5**.**

Table 1-5 Boundary Coordinates of the project

S.No	Bourndary mark point	Latitude (N)	Longitude(E)
1	TM1	12° 8' 23.36"	79° 15' 44.41"
2	TM2	12° 8' 22.91"	79° 15' 45.67"
3	TM3	12° 8' 24.44"	79° 15' 46.36"
4	TM4	12° 8' 25.15"	79° 15' 45.69"
5	TM5	12° 8' 26.2"	79° 15' 46.25"
6	TM6	12° 8' 26.17"	79° 15' 46.97"
7	TM7	12° 8' 25.34"	79° 15' 49.29"
8	TM8	12° 8' 25.51"	79° 15' 49.82"
9	TM9	12° 8' 27.15"	79° 15' 47.89"
10	TM10	12° 8' 30.8"	79° 15' 48.99"
11	TM11	12° 8' 34.95"	79° 15' 50.26"
12	TM12	12° 8' 35.36"	79° 15' 49.10"
13	TM13	12° 8' 38.04"	79° 15' 51.13"
14	TM14	12° 8' 40.34"	79° 15' 58.89"
15	TM15	12° 8' 41.28"	79° 15' 59.51"
16	TM16	12° 8' 40.70"	79° 15' 59.81"
17	TM17	12° 8' 39.95"	79° 16' 0.21"
18	TM18	12° 8' 39.21"	79° 16' 0.98"
19	TM19	12° 8' 39.18"	79° 16' 1.47"

20	TM20	12° 8' 38.96"	79° 16' 2.01"
21	TM21	12° 8' 38.60"	79° 16' 2.21"
22	TM22	12° 8' 38.02"	79° 16' 3.7"
23	TM23	12° 8' 37.63"	79° 16' 3.77"
24	TM24	12° 8' 38.00"	79° 16' 5.15"
25	TM25	12° 8' 38.07"	79° 16' 5.45"
26	TM26	12° 8' 37.65"	79° 16' 6.05"
27	TM27	12° 8' 37.62"	79° 16' 6.55"
28	TM28	12° 8' 37.10"	79° 16' 6.52"
29	TM29	12° 8' 35.90"	79° 16' 7.85"
30	TM30	12° 8' 34.53"	79° 16' 7.62"
31	TM31	12° 8' 34.60"	79° 16' 8.15"
32	TM32	12° 8' 33.20"	79° 16' 8.49"
33	TM33	12° 8' 30.57"	79° 16' 8.41"
34	TM34	12° 8' 29.66"	79° 16' 8.15"
35	TM35	12° 8' 29.36"	79° 16' 7.86"
36	TM36	12° 8' 28.61"	79° 16' 7.73"
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40	TM40	12° 8' 25.74"	79° 16' 6.39"
41	TM41	12° 8' 25.31"	79° 16' 5.86"
42	TM42	12° 8' 24.79"	79° 16' 5.11"
43	TM43	12° 8' 23.05"	79° 16' 2.97"
44	TM44	12° 8' 22.82"	79° 16' 2.34"
45	TM45	12° 8' 22.52"	79° 16' 1.42"
46	TM46	12° 8' 21.33"	79° 15' 57.82"
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48	TM48	12° 8' 18.32"	79° 15' 55.49"
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50	TM50	12° 8' 17.27"	79° 15' 54.24"
51	TM51	12° 8' 17.95"	79° 15' 53.91"
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53	TM53	12° 8' 16.86"	79° 15' 52.16"
54	TM54	12° 8' 16.11"	79° 15' 50.51"
55	TM55	12° 8' 16.12"	79° 15' 48.33"
56	TM56	12° 8' 15.99"	79° 15' 48.10"
57	TM57	12° 8' 15.48"	79° 15' 48.89"
58	TM58	12° 8' 15.70"	79° 15' 47.50"
59	TM59	12° 8' 16.21"	79° 15' 46.54"
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76	TM76	12° 8' 22.43"	79° 15' 47.13"
77	TM77	12° 8' 23.95"	79° 15' 46.19"

1.7.4 Connectivity of the Project

The project is situated at a distance of ~0.36km to Pattuvoy Village towards North West direction and ~0.51 km North East of Ramarajapettai Village. The project site has well established connection facilities. The nearest railway station is Andampallam Railway station located at ≃ 11.42 km towards WSW direction. NH 38 (Vellore to Thoothukudi) situated at distance of ≃ 3.56 km (SW).

1.7.5 Need for the project and its importance to the country and or region

The granite dimensional stone material by virtue of its pleasing colour and texture and its best ability to take polishing and appealing look in polished product has attracted the consumers in the building construction and interior decoration industries. The domestic market capabilities have also been explored inrecent periods. Bulk quantity of the blocks is produced and exported as raw blocks and some quantity is being processed at TAMIN's Granite polishing units and exported as value added finished products.

The earning source in the targeted area is limited, most of the people in and around the area depend upon the seasonal agriculture and much of the people migrate to nearby towns where good industries and factories are growing up.

Around 35 people directly employed including mining operations, outside workshops, unit supported industries. Local villagers residing in the nearby villages shall be employed as semi-skilled workers.

1.7.5.1 Demand –Supply Gap

As of now there is good demand for this granite blocks in foreign as well as local market. The quarried granite blocks are either exported as raw blocks or processed at TAMIN's factories as value added products such as slabs, tiles, fancy items, monuments, sawn slabs or local sales as raw block etc.

1.7.5.2 Imports Vs Indigenous

There isno import of this granite material at present in India as we are having huge resources of this granite material particulary in South India.

1.7.5.3 Export possibility

The quarried granite blocks are either exported as raw blocks or processed at TAMIN's factories as value added products such as slabs, tiles, fancy items, monuments, sawn slaps etc. Apart from TAMIN so many private enterprises are exporting the granite material as raw blocks, polished slab and monuments etc.

1.7.5.4 Domestic/export markets

As of now there is good demand for this granite blocks in foreign as well as local market. The granite blocks are either exported as raw blocks or processed at TAMIN's as factories as value added products such as slabs, tiles, fancy items, monuments, sawn slabs etc. Apart from TAMIN so many private enterprises are exporting the granite material as raw blocks, polished slab and monuments etc.

1.8 EIA Study

As a part of compliance to the regulatory requirement i.e., to obtain Environmental Clearance from SEIAA-TN, TAMIN has appointed Environmental Consultant accredited by National Accreditation Board for Education and Training (NABET)-Quality Council of India (QCI), New Delhi. The work of undertaking field studies and preparation of EIA/EMP report under B1category as obtained Terms of Reference from SEIAA-TN was assigned to M/s Hubert Enviro Care Systems (P) Ltd. (HECS) Chennai by the project proponent. HECS is accredited by NABET, vide possession of Certificate No.NABET/EIA/2224/SA0190, valid up to 27.07.2024.

1.9 EIA Cost

EIA study was undertaken by HECS for an amount of Rs.1,54,225/- Lakhs.The base line monitoring was done by M/s. HECS lab, Chennai, an NABL and MoEF& CC Accredited Laboratory.

1.10 Scope of the Study

The scope of the work mentioned includes an assessment study of proposed black Granite Quarryproject and their impact on the region. This study puts forward the most effective ways to protect the environment from increasing pollution caused by the mining activities and recommendations for environmental-friendly development initiatives in the region.

An Environmental Impact Assessment (EIA) is an assessment of the possible impact, whether positive or negativethat, themining activities may have on the environment, together consisting of the natural, social and economic aspects, i.e., aiming at "Sustainable Development" due to the project activities.

This EIA report presents the existing baseline scenario and the assessment and evaluation of the environmental impacts that may arise during mining. This report also highlights the Environmental Monitoring Program during the operation phase of the project and the post mined management

program. The generic structure of the EIA document will be as per the EIA Notification of the MoEF&CC dated 14th September 2006 and subsequent amendments. The basic structure of the report will be as under:

Chapter 1: Introduction

Introductory information is presented in this Chapter. The introduction chapter provides background to the project, project proponent and describes the objective of this document. The purpose and organization of the report is also presented in this chapter.

Chapter 2: Project Description

This chapter includes project description and infrastructure facilities delineating all the quarry operations and environmental aspect of the quarry activities.

Chapter 3: Description of the Environment

This chapter provides baseline environmental status of Environmental Components (Primary data) delineating meteorological details of the project site and surrounding area.

Chapter 4: Anticipated Environmental Impacts & Mitigation Measures

This chapter presents the analysis of impacts on the environmental and social aspects of the project as a result of establishment of plan and thereby suggesting the mitigation measures.

Chapter 5: Analysis of Alternatives (Technology and Sites)

This chapter includes the justification for the selection of the project site from Environmental point of view as well as from economic point of view.

Chapter 6: Environmental Monitoring Program

This chapter will include the technical aspects of monitoring, the effectiveness of mitigation measures which will include the measurement methodologies, frequency, location, data analysis, reporting schedules etc,

Chapter 7: Additional Studies

This chapter will detail about the public consultation sought regarding the project. It will also identify the risks of the project in relation to the general public and the surrounding environment during quarry operation phase and thereby presents Disaster Management Plan, Social impact assessment and R&R action plans.

Chapter 8: Project Benefits

This chapter deals with improvement in physical and social infrastructures, employment potential and other tangible benefits.

Chapter 9: Environmental Cost Benefit analysis

Not recommended during scoping

Chapter 10: Environmental Management Plan

This is the key chapter of the report and presents the mitigation plan, covers the institutional and monitoring requirements to implement environmental mitigation measures and to assess their adequacy during project implementation.

Chapter 11: Summary and Conclusion

This chapter summarizes the information given in Chapters in this EIA/EMP report and the conclusion based on the environmental study, impact identification, mitigation measures and the environmental management plan.

Chapter 12: Disclosure of the Consultant

Names of consultants engaged in the preparation of the EIA/EMP report along with their brief resume and nature of consultancy rendered are included in this chapter.

1.10.1 Objectives of the Study

- To ensure environmental considerations are explicitly addressed and incorporated into the development decision-making process.
- To anticipate and avoid, minimize or offset the adverse significant biophysical, social and other relevant effects of the above project proposal.
- To protect the productivity and capacity of natural systems and the ecological processes which maintain their respective functions
- To promote development that is sustainable and optimizes resource use as well as management opportunities.
- To fully recognize the scope and requirements of the ToR and comply with the same.
- The major objective of this study is to prepare a detailed Environmental Impact Assessment study within the study area i.e 10 km radius from the project.

1.10.2 Methodology adopted for the Study

An Environmental Impact Assessment (EIA) is an assessment of the possible impact, whether positive or negative, that a proposed project may have on the environment, together consisting of the natural, social and economic aspects, i.e., aiming at “Sustainable Development” due to the project activities.

1.10.3 Applicable Regulatory Framework

The EIA process followed for this EIA report is composed of the following stages:

1. Studyof project information.
2. Screening & Scoping.

3. Environmental pre-feasibility study & application for approval of ToR.
4. Collection of detailed project management plan/report.
5. Baseline data collection.
6. Impact identification, Prediction & Evaluation.
7. Mitigation measures & delineation of EMP.
8. Risk assessment and safety & disaster management plan.
9. Review & finalization of EIA Report based on the ToR requirements.
10. Submission of EIA report for implementation of mitigation measures & EMP as well as necessary clearances from relevant Authority.

1.10.4 Legal Complicability

The establishment and functioning of mining industry will be governed by Tamin Client to provide the following environmental acts/regulations besides the local zoning and landuse laws of the States.

1. The Water (Prevention and Control of Pollution) Act, 1974 as amended
2. The Water (Prevention and Control of Pollution) Cess Act, 1977, as amended
3. The Air (Prevention and Control of Pollution) Act, 1981 as amended (Air Act)
4. The Noise Pollution and Regulation Act: 2000as amended
5. The Environment (Protection) Act, 1986 (EPA)as amended
6. The Wildlife (Protection) Act, 1972
7. The Forest (Conservation) Act, 1980
8. The Public Liability Insurance Act, 1991
9. The Mines and Minerals (Regulation and Development) Act, 1957 as amended
10. Circulars issued by the Director-General Mines Safety (DGMS) as amended
11. Contract Labor Regulation and Abolition Act 1970as amended
12. The Motor Vehicles Act – 1989as amended
13. PESO – Explosives and handling of Hazardous Material: 1934

1.10.5 Terms of Refernce Compliance

The Terms of Reference (ToR) issued by SEIAA-Tamil Nadu compliance is given as follows:

1.10.5.1 Standard Terms of Reference

<table>
<tr><th>S. No</th><th>Terms of Reference</th><th>Compliance</th></tr>
<tr><td>1</td><td>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.</td><td>Government has issued G.O to grant of lease for 30 years vide G.O.(3D)No.66,Industries (MME.1), dated: 05.12.2011.

G.O is enclosed as Annexure-2.
Granite Quarry Reserves
<table>
<tr><th>S. No</th><th>Description</th><th>Granite (m^3)</th><th>Recovery 10% (m^3)</th><th>Granite waste 90% (m^3)</th></tr>
<tr><td>1</td><td>Geological Resource</td><td>4,79,221</td><td>47,922</td><td>4,31,299</td></tr>
<tr><td>2</td><td>Mineable Reserves</td><td>3,37,609</td><td>33,761</td><td>3,03,848</td></tr>
</table>
Government has issued G.O to grant of lease for 30 years vide G.O.(Ms)No.108,Industries (MME.1) department, dated: 04.08.2016.

G.O is enclosed as Annexure-3.
Quartzo-Feldspathic Gneiss Quarry Reserves
<table>
<tr><th>S. No</th><th>Description</th><th>Granite (m^3)</th><th>Recovery 100% (m^3)</th></tr>
<tr><td>1</td><td>Geological Resource</td><td>1,08,13,395</td><td>1,08,13,395</td></tr>
<tr><td>2</td><td>Mineable Reserves</td><td>77,39,961</td><td>77,39,961</td></tr>
</table>
Yearwise Production details (Black Granite)
<table>
<tr><th>S. No</th><th>Year</th><th>ROM (m^3)</th><th>Recovery@10% (m^3)</th><th>Granite Waste @ 90 % (m^3)</th><th>Over Burden (m^3)</th></tr>
<tr><td>1</td><td>1st Year</td><td>18,108</td><td>1,811</td><td>17,588</td><td>1,291</td></tr>
</table></td></tr>
</table>

2	2nd Year	18,049	1,805	16,244	--
3	3rd Year	18,029	1,803	17,773	1,547
4	4th Year	18,104	1,810	17,293	999
5	5th Year	18,008	1,801	18,402	2,195
Total		**90,298**	**9,030**	**87,300**	**6,032**

The production details are provided in **Chapter 2 Section 2.7.**

Yearwise Production details (Quartzo Feldspathic Gneiss)

S. No	Year	ROM (m^3)	Recovery@ 100% (m^3)
1	1st Year	6,52,162	6,52,162
2	2nd Year	7,41,536	7,41,536
3	3rd Year	7,25,299	7,25,299
4	4th Year	7,24,900	7,24,900
5	5th Year	7,52,124	7,52,124
Total		**35,96,021**	**35,96,021**

2	A copy of the document in support of the fact that the Proponent is the rightful lessee of the mine should be given.	It is a Government Poromboke Land Tamil Nadu Minerals limited has leased for 30 years. TAMIN obtained lease vide G.O. (3D)No.66, Industries (MME.1) Department, Dated:05.12.2011 is enclosed as **Annexure–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 Plan Approval by Director, Department of Geology and Mining vide Rc.No.7388/MM5/2018, dated: 11.05.2019 attached as **Annexure-II**. Mine Lease Area: 40.13.05 Ha **Yearwise Production details(Black Granite)**

	mining technology etc. and should be in the name of the lessee.	

S. No	Year	ROM (m^3)	Recovery @10% (m^3)	Granite Waste @ 90 % (m^3)	Over Burden (m^3)
1	1st Year	18,108	1,811	17,588	1,291
2	2nd Year	18,049	1,805	16,244	--
3	3rd Year	18,029	1,803	17,773	1,547
4	4th Year	18,104	1,810	17,293	999
5	5th Year	18,008	1,801	18,402	2,195
	Total	**90,298**	**9,030**	**87,300**	**6,032**

Production Details:

Black Granite

Mineable Reserves have been worked out as 33,761 m^3 by applying the recovery factor 10%. The annual peak production per year would be 1,811m^3 of ROM of saleable and 18,108m^3 of ROM during the first five year of mining plan period at the rate of 10% recovery.

Waste Generation and its management: 87,300 m^3. These wastes will be proposed to dump on the Southeren side of the lease area with dimensions of 200m X 50m X 8.75m.

The space available in the lease area for waste dump has been identified in the barren area.

Quartzo-Feldspathic Gneiss

Mineable Reserves have been worked out as 77,39,961 m^3 by applying the recovery factor 100%. The annual peak production per year would be 7,52,124m^3 of ROM of saleable and 77,39,961m^3 of ROM during the entire life of quarry at the rate of 100% recovery.

Mining Technology: Open cast semi mechanized mining.

All the above mentioned documents are obtained in the name of Tamil Nadu Minerals only.

4	All corner co-ordinates of the	

S.No	Bourndary mark point	Latitude (N)	Longitude(E)

	mine lease area, superimposed in a High Resolution Imagery/ topo sheet, topographic sheet, geomorphology and geology of the area should be provided. Such a Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).	1	TM1	12° 8' 23.36"	79° 15' 44.41"	
		2	TM2	12° 8' 22.91"	79° 15' 45.67"	
		3	TM3	12° 8' 24.44"	79° 15' 46.36"	
		4	TM4	12° 8' 25.15"	79° 15' 45.69"	
		5	TM5	12° 8' 26.2"	79° 15' 46.25"	
		6	TM6	12° 8' 26.17"	79° 15' 46.97"	
		7	TM7	12° 8' 25.34"	79° 15' 49.29"	
		8	TM8	12° 8' 25.51"	79° 15' 49.82"	
		9	TM9	12° 8' 27.15"	79° 15' 47.89"	
		10	TM10	12° 8' 30.8"	79° 15' 48.99"	
		11	TM11	12° 8' 34.95"	79° 15' 50.26"	
		12	TM12	12° 8' 35.36"	79° 15' 49.10"	
		13	TM13	12° 8' 38.04"	79° 15' 51.13"	
		14	TM14	12° 8' 40.34"	79° 15' 58.89"	
		15	TM15	12° 8' 41.28"	79° 15' 59.51"	
		16	TM16	12° 8' 40.70"	79° 15' 59.81"	
		17	TM17	12° 8' 39.95"	79° 16' 0.21"	
		18	TM18	12° 8' 39.21"	79° 16' 0.98"	
		19	TM19	12° 8' 39.18"	79° 16' 1.47"	
		20	TM20	12° 8' 38.96"	79° 16' 2.01"	
		21	TM21	12° 8' 38.60"	79° 16' 2.21"	
		22	TM22	12° 8' 38.02"	79° 16' 3.7"	
		23	TM23	12° 8' 37.63"	79° 16' 3.77"	
		24	TM24	12° 8' 38.00"	79° 16' 5.15"	
		25	TM25	12° 8' 38.07"	79° 16' 5.45"	
		26	TM26	12° 8' 37.65"	79° 16' 6.05"	
		27	TM27	12° 8' 37.62"	79° 16' 6.55"	
		28	TM28	12° 8' 37.10"	79° 16' 6.52"	
		29	TM29	12° 8' 35.90"	79° 16' 7.85"	
		30	TM30	12° 8' 34.53"	79° 16' 7.62"	
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		49	TM49	12° 8' 18.42"	79° 15' 56.75"	
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		53	TM53	12° 8' 16.86"	79° 15' 52.16"	
		54	TM54	12° 8' 16.11"	79° 15' 50.51"	
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		60	TM60	12° 8' 16.27"	79° 15' 45.65"	
		61	TM61	12° 8' 15.47"	79° 15' 43.24"	
		62	TM62	12° 8' 16.18"	79° 15' 42.34"	

		63	TM63	12° 8' 18.31"	79° 15' 39.38"
		64	TM64	12° 8' 20.33"	79° 15' 39.77"
		65	TM65	12° 8' 20.99"	79° 15' 40.06"
		66	TM66	12° 8' 20.7"	79° 15' 41.55"
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		73	TM73	12° 8' 23.35"	79° 15' 44.11"
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		75	TM75	12° 8' 21.87"	79° 15' 46.90"
		76	TM76	12° 8' 22.43"	79° 15' 47.13"
		77	TM77	12° 8' 23.95"	79° 15' 46.19"

Topo sheet:57P/4&8

All corners co-ordinates of the mine lease area are given in **Chapter 1** and **Section 1.7.3**, **Table 1-4,** Topo map in **Figure 2-8.**

Geology:

The hills are found in the western part of the district and they are Kalrayan and Ginjee hills falling under Kallakurichi and Ginjee taluks respectively. Plain terrain occurs in the middle part of this district, while the coastal plains lie in the eastern part of the district in and around Marakanam and Vanur taluks.

Source: *http://cgwb.gov.in/District_Profile/TamilNadu/VILUPPURAM.pdf*

*(**Ref:** Government of India, Ministry of Water Resources, Central Ground Water Board, South Eastern Coastal Region Chennai, "District Ground Water Brochure Viluppuram District")*

Geomorphology of the study area consists of Denudational origin - pediment – pedi plain Complex- 75.61%,

<table>
<tr><td></td><td></td><td>Denudational Origin-Moderately Dissected Hills and Valleys – 18.04% , Structural Origin - Low Dissected Hills and Valleys -0.96% and Water bodies- 5.39%. The total Geographical area of the study area is 341.20sq.km. Geomorphology pattern of the study area is given in Figure 3.11.

Geology and Geomorphology of the area is provided in Chapter 3 Section 3.5.6, Figure 3.12.</td></tr>
<tr><td>5</td><td>Information should be provided in Survey of India Topo sheet in 1:50,000 scale indicating geological map of the area, geomorphology of land forms of the area, existing minerals and mining history of the area, important water bodies, streams and rivers and soil characteristics.</td><td>It is a fresh quarry and It is a government poramboke land. Topo map prepared in 1:50000 scale and given as Figure 2-8.
Geomorphology Map of Study Area if given in Figure 3-12 Geomorphology pattern of the study area is shown in Chapter 3, Section 3.5.6, Figure 3-11.
Hydrogeology of district is given in Chapter 3, Section 3.5.6 Figure 3-13.

Drainage map is shown in Chapter 3, Section 3.5.8, Figure 3-14.
<table>
<tr><th>S.No</th><th>Places</th><th>Distance (≈km)</th><th>Direction</th></tr>
<tr><td>1.</td><td>Lake near Pattuvoy</td><td>Adjacent to Site</td><td>N</td></tr>
<tr><td>2.</td><td>Lake near Palavalam</td><td>0.07</td><td>S</td></tr>
<tr><td>3.</td><td>Vettavalam Lake</td><td>1.94</td><td>SSW</td></tr>
<tr><td>4.</td><td>Nandan Kalva</td><td>4.11</td><td>NNW</td></tr>
<tr><td>5.</td><td>Canal Near Nallampillaipetral</td><td>4.12</td><td>NNW</td></tr>
<tr><td>6.</td><td>Nandan Kava</td><td>5.18</td><td>E</td></tr>
<tr><td>7.</td><td>Varaha Nadi</td><td>6.16</td><td>N</td></tr>
<tr><td>8.</td><td>Adukkam Lake</td><td>7.24</td><td>SSE</td></tr>
<tr><td>9.</td><td>Pillaiyarkovil Odai</td><td>8.22</td><td>SSE</td></tr>
<tr><td>10.</td><td>Chunnambu Odai</td><td>8.28</td><td>NE</td></tr>
<tr><td>11.</td><td>Nari Ar</td><td>10.68</td><td>ENE</td></tr>
<tr><td>12.</td><td>Karungalikuppam</td><td>11.37</td><td>NNW</td></tr>
<tr><td>13.</td><td>Panamalai Eri</td><td>11.50</td><td>ESE</td></tr>
<tr><td>14.</td><td>Turinjal Ar</td><td>11.71</td><td>W</td></tr>
<tr><td>15.</td><td>Pambai Ar</td><td>12.34</td><td>SSE</td></tr>
</table></td></tr>
<tr><td>6</td><td>Details about the land proposed for mining activities should be</td><td>It is a fresh quarry. Government has issued precise area communication letterfor 30 years vide G.O. (3D)No.66, Industries (MME.1) Department, Dated:05.12.2011 is enclosed as Annexure–1.</td></tr>
</table>

	given with information as to whether mining confirms to the land use policy of the State; land diversion for mining should have approval from State land use board or the concerned authority.	Director of Geology and Mining has approved the Mining Plan to carryout the mining activities. Mining Plan is enclosed as **Annexure-4 (Annexure page no. 20).** **Black Granite** The Geological reserves of Black granite have been computed based on the Geological Plan &Sections up to the economically workable average depth of 40m from the surface level and the top surface of the granite body works out to 4,79,221 m^3. By applying 10% recovery the effective Geological reserves works out 47,922 m^3. Mineable Reserves have been computed as 3,37,609 m^3 after deleting the reserves locked up in safety barrier and benches based on the Conceptual Plan and sections, the effective(Saleable) Mineable Reserves have been worked out as 33,761 m^3 by applying the recovery factor 100%. The annual peak production per year would be 1,811m^3 of ROM of saleable and 33,761m^3 of ROM during the first five year of Mining plan period at the rate of 10% recovery.

S. No	Year	ROM (m^3)	Recovery@ 10% (m^3)	Granite Waste @ 90 % (m^3)	Over Burden (m^3)
1	1st Year	18,108	1,811	17,588	1,291
2	2nd Year	18,049	1,805	16,244	--
3	3rd Year	18,029	1,803	17,773	1,547
4	4th Year	18,104	1,810	17,293	999
5	5th Year	18,008	1,801	18,402	2,195
	Total	**90,298**	**9,030**	**87,300**	**6,032**

The production details are provided in **Chapter 2 Section 2.7**

Quartzo-Feldspathic Gneiss

<table>
<tr>
<td></td>
<td></td>
<td>The Geological reserves of Quartzo feldspathic Gneiss have been computed based on the Geological Plan &Sections up to the economically workable average depth of 30m from the surface level and the top surface of the granite body works out to 1,08,13,395 m^3. By applying 100% recovery the effective Geological reserves works out 1,08,13,395m^3.

Mineable Reserves have been computed as 77,39,961 m^3 after deleting the reserves locked up in safety barrier and benches based on the Conceptual Plan and sections, the effective(Saleable) Mineable Reserves have been worked out as 77,39,961 m^3 by applying the recovery factor 100%. The annual peak production per year would be 7,52,124m^3 of ROM of saleable and 77,39,961m^3 of ROM during the first five year of Mining plan period at the rate of 100% recovery.

<table>
<tr><th>S. No</th><th>Year</th><th>ROM (m^3)</th><th>Recovery@ 100% (m^3)</th></tr>
<tr><td>1</td><td>1st Year</td><td>6,52,162</td><td>6,52,162</td></tr>
<tr><td>2</td><td>2nd Year</td><td>7,41,536</td><td>7,41,536</td></tr>
<tr><td>3</td><td>3rd Year</td><td>7,25,299</td><td>7,25,299</td></tr>
<tr><td>4</td><td>4th Year</td><td>7,24,900</td><td>7,24,900</td></tr>
<tr><td>5</td><td>5th Year</td><td>7,52,124</td><td>7,52,124</td></tr>
<tr><td colspan="2">Total</td><td>35,96,021</td><td>35,96,021</td></tr>
</table>
The production details are provided in Chapter 2 Section 2.7.</td>
</tr>
<tr>
<td>7</td>
<td>It should be clearly stated whether the proponent Company has a well laid down Environment Policy approved by its Board of Directors? I so, it may be spelt out in the EIA</td>
<td>Environmental Policy of TAMIN is given in Chapter 10 Section 10.15. Also enclosed as Annexure-6.

➢ We develop safe working methods and practices, with as an objective of no injuries and accidents at the work place and provide a safe work place for our employees, contractors and other who perform their duties. We shall provide adequate Health care to our employees, and create processes to reduce the adverse effect of the operations on the health of the employees.</td>
</tr>
</table>

<table>
<tr>
<td></td>
<td>Report with description of the prescribed operating process/procedures to bring into focus any infringement/deviation/vibration of the environmental or forest norms/conditions? The hierarchical systems or administrative order of the Company to deal with the environmental issues and for ensuring compliances 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 stakeholders at large, may also be detailed in the EIA Report.</td>
<td>

We provide safety appliances and continuous training in safety to our employeesand contract workmen to ensure safe production and achieve the target of zero accidents. We are committed for supporting actions aimed at increase in employees' safety outside work hours.
We protect the environment by control and prevention of pollution and promote green environment.
We continuously evaluate and improve our conduct and carryout regular audit, analysis and studies to eliminate potential concerns and continuously improve upon our Safety, Health and Environmental standards.
We communicate our Safety, Health and Environmental Policy to all our employees' contractors and to the public for better understanding and practice.
Management has knowledge of relevant issues regarding Safety, Health and Environment and provides a foundation for setting objectives and targets. Management shall fulfill its responsibility to inform, educate and motivate employees and others to understand and comply with this policy and applicable laws.
M/s. Tamil Nadu Minerals Ltd shall use its resources in order to live up to this policy and thereby promote our business.

</td>
</tr>
<tr>
<td>8</td>
<td>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 be provided.</td>
<td>
Mine Saftey and Mitigation Measures:
<table>
<tr><th>S. No</th><th>Activity</th><th>Mitigation measures</th></tr>
<tr><td>1</td><td>Excavation</td><td>➢ Planned excavation, avoid haphazard mining.</td></tr>
<tr><td>2</td><td>Drilling and blasting</td><td>➢ In addition, the operators and other workers should be provided with masks, helmets, gloves and earplugs.</td></tr>
</table>
</td>
</tr>
</table>

<table>
<tr>
<td></td>
<td></td>
<td>
<table>
<tr><td>3</td><td>Safety zone</td><td>➢ Provisions for a buffer zone between the local habitation and the mine lease in the form of a green belt of suitable width.
➢ Restricted entry, use of sirens and cordoning of the lasting area are some of the good practices to avoid accidents.</td></tr>
<tr><td>4</td><td>Overburden stabilization</td><td>➢ Accidents are known to happen due to overburden collapse.
➢ Therefore, slope stabilization and dump stability are critical issues for safety and environment. Adequate measures will be taken care.</td></tr>
<tr><td>5</td><td>Worker’s health surveillance</td><td>➢ Health survey programmes for workers and local community.
➢ Regular training and awareness of employees to be conducted to meet health and safety objectives.</td></tr>
</table>

No underground mining method is proposed. It is a Black Granite&Quartzo feldspathic Gneiss quarry an open cast Mining methodology will be followed.
Workable depth of mining will be 30m AGL.

Mining methodology is provided in Chapter 2 and Section 2.9 and Section 2.10.

Safeguard measures are provided in Chapter-4, Section 7.2.2.8.
➢ Adequate care has been taken in deciding the size of the bench for the working pit.
➢ The benches are properly sloped at an angle of 60 degree to avoid any spillage of benches.
➢ Adequate drainage system at the top of the pit and also on the benches shall be made to prevent erosion of the benches.
➢ The quarries will be protected by garland drains around the periphery for storm water drainage.
</td>
</tr>
<tr>
<td>9</td>
<td>The study area will comprise of 10km 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.</td>
<td>The study area considered for the EIA study comprises of 10km zone of radial distance from the lease periphery.

The data contained within the EIA including Production capacity, mineable capacity, Waste generation and other such details have been calculated for the lease period of five years as per the approved mining plan.

The study area of 10km zone around the mines lease from lease periphery and furnished in Chapter 3.

The production and waste generation details such as Mineable Reserves have been worked out as 33,761 m^3 by applying the recovery factor 10%. The annual peak production per year would be 1,811m^3 of ROM of saleable</td>
</tr>
</table>

<table>
<tr><td></td><td></td><td>and 33,761m^3 of ROM during the first five year of Mining plan period at the rate of 10% recovery.
The total waste (Granite waste + Over Burden) to be generated during the 5 years of Mining plan period will be around 87,300 m^3. These wastes are proposed to be dumped on the North eastern side of lease area with dimensions of 200m x 50 x 8.75m.
Life time of the mine is 19years.</td></tr>
<tr><td>10</td><td>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.</td><td>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 are given below.
Land use pattern of the Study Area:
<table>
<tr><th>Description</th><th>Area (sq.km)</th><th>Area (Acres)</th><th>Area (Hectares)</th><th>Area (%)</th></tr>
<tr><td>Crop land</td><td>156.32</td><td>38627.45</td><td>15632</td><td>45.81</td></tr>
<tr><td>Fallow</td><td>69.28</td><td>17119.43</td><td>6928</td><td>20.30</td></tr>
<tr><td>Deciduous</td><td>53.22</td><td>13150.93</td><td>5322</td><td>15.60</td></tr>
<tr><td>Water Bodies</td><td>22.6</td><td>5584.57</td><td>2260</td><td>6.62</td></tr>
<tr><td>Scrub Land</td><td>16.75</td><td>4139.01</td><td>1675</td><td>4.91</td></tr>
<tr><td>Evergreen/Semi-Evergreen</td><td>13.45</td><td>3323.56</td><td>1345</td><td>3.94</td></tr>
<tr><td>Rural</td><td>5.24</td><td>1294.83</td><td>524</td><td>1.54</td></tr>
<tr><td>Barren rocky</td><td>3.83</td><td>946.41</td><td>383</td><td>1.12</td></tr>
<tr><td>Mining</td><td>0.39</td><td>96.37</td><td>39</td><td>0.11</td></tr>
<tr><td>Urban</td><td>0.12</td><td>29.65</td><td>12</td><td>0.04</td></tr>
<tr><td>Total</td><td>341.20</td><td>84312.23</td><td>34120</td><td>100.00</td></tr>
</table>
Land use/land coverof Study Areais given in Chapter 3 and Section 3.5.4.1, Table 3-4, Figure 3-7 & Figure 3-8.

The impact on land pattern in the area has been and will be due to the following:
• Land degradation due to disposal of large volume of waste materials.
• Creation of infrastructural facilities like office, rest shelter, first-aid centre and other service facilities.
• Exposure of topsoil to wind and water erosion.</td></tr>
</table>

<table>
<tr><td></td><td></td><td>The details are provided in Chapter 4 Section 4.1.2.
Land use details of the quarry area:
<table>
<tr><th>S. No</th><th>Land Use</th><th>Area to be required during the mining plan (Ha)</th><th>Area at the end of the quarrying period (Ha)</th></tr>
<tr><td>1</td><td>Area under Quarry</td><td>22.53.0</td><td>33.47.5</td></tr>
<tr><td>2</td><td>Waste Dump</td><td>1.00.0</td><td>3.61.0</td></tr>
<tr><td>3</td><td>Infrastructure</td><td>--</td><td>0.01.5</td></tr>
<tr><td>4</td><td>Road</td><td>--</td><td>0.08.5</td></tr>
<tr><td>5</td><td>Mine approach road</td><td>--</td><td>0.20.0</td></tr>
<tr><td>5</td><td>Green Belt</td><td>--</td><td>0.19.0</td></tr>
<tr><td>6</td><td>Un utilized Area</td><td>14.81.55</td><td>2.55.55</td></tr>
<tr><td colspan="2">Total</td><td>38.39.55</td><td>40.13.05</td></tr>
</table>
A Land use detail of the quarry areais provided in Chapter 2, Section 2.6, Table 2.6.</td></tr>
<tr><td>11</td><td>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.</td><td>As it is a new project there is no external dump for over burden, side burdens. Over burden, Side burden and granite rejects will be dump within the lease area/boundary only.

The total waste (Granite waste + Over Burden) to be generated during the 5 years of mining plan period will be around 87,300 m^3. These wastes are proposed to be dumped on the North eastern side of lease area with dimensions of 200m x 50m x 8.75m.</td></tr>
<tr><td>12</td><td>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</td><td>No Forest land involved in this project area.

The proposed lease area is classified as Government poramboke land.

TAMIN obtained lease vide G.O. (3D)No.66, Industries (MME.1) Department, Dated:05.12.2011 is enclosed as Annexure–1, to obtain lease period of mining for 30 years.</td></tr>
</table>

	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.	
13	State 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.	No forest clearance is required. As there is no forest land involved in the lease applied area.
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.	No scheduled tribes and other traditional forest dwellers are observed.

<table>
<tr>
<td>15</td>
<td>The vegetation in the RF/ PF areas in the study area, with necessary details, should be given.</td>
<td>Environmental sensitive areas covering within 15 km from project boundary.

<table>
<tr><th>S.No</th><th>Description</th><th>Distance (~km)</th><th>Direction</th></tr>
<tr><td>1</td><td>Pakkammalai RF</td><td>0.80</td><td>E</td></tr>
<tr><td>2</td><td>Pulanji Malai RF</td><td>2.88</td><td>SSE</td></tr>
<tr><td>3</td><td>Gengavaram RF</td><td>3.22</td><td>SE</td></tr>
<tr><td>4</td><td>Adukkam RF</td><td>4.90</td><td>S</td></tr>
<tr><td>5</td><td>Turinjikadu RF</td><td>5.71</td><td>SSE</td></tr>
<tr><td>6</td><td>Tandavasamudram RF</td><td>8.54</td><td>E</td></tr>
<tr><td>7</td><td>Padippallam RF</td><td>9.20</td><td>ENE</td></tr>
<tr><td>8</td><td>Odaiyanattam RF</td><td>9.47</td><td>SE</td></tr>
<tr><td>9</td><td>Nayanur RF</td><td>11.63</td><td>SSW</td></tr>
<tr><td>10</td><td>Muttakadu RF</td><td>13.16</td><td>NE</td></tr>
<tr><td>11</td><td>Tippakkadu RF</td><td>13.31</td><td>W</td></tr>
<tr><td>12</td><td>Siruvadi RF</td><td>14.46</td><td>NE</td></tr>
<tr><td>13</td><td>Karai RF</td><td>14.61</td><td>ENE</td></tr>
<tr><td>14</td><td>Attippakkam RF</td><td>14.82</td><td>SW</td></tr>
</table>

The details of environmental sensitive areas covering within 15 km from project boundary are given in Chapter 3, Section 3.4, Table 3-1 and Figure 3-3.</td>
</tr>
<tr>
<td>16</td>
<td>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</td>
<td>There are no protected wildlife areas within the 15km radius of the project.

Impact study was carried out as per ToR and detailed mitigation measures are furnished in Chapter 4 Section 4.6.3.</td>
</tr>
</table>

<table>
<tr><td></td><td>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.</td><td></td></tr>
<tr><td>17</td><td>Locations of National parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/ Elephant Reserves/(existing as well proposed), if any, within 10km 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.</td><td>There are no National parks, Sanctuaries, Biosphere Reserves, There is no Wildlife Corridors, Ramsar site Tiger/ Elephant Reserves within the 10km radius.

These are the only reserve forests within 15 Km of the project site.

The details of environmental sensitive areas covering within 15km from project boundary are given in Chapter 3 and section 3.4, Table 3-1 & Figure 3-3.

<table>
<tr><th>S.No</th><th>Description</th><th>Distance (~km)</th><th>Direction</th></tr>
<tr><td>1</td><td>Pakkammalai RF</td><td>0.80</td><td>E</td></tr>
<tr><td>2</td><td>Pulanji Malai RF</td><td>2.88</td><td>SSE</td></tr>
<tr><td>3</td><td>Gengavaram RF</td><td>3.22</td><td>SE</td></tr>
<tr><td>4</td><td>Adukkam RF</td><td>4.90</td><td>S</td></tr>
<tr><td>5</td><td>Turinjikadu RF</td><td>5.71</td><td>SSE</td></tr>
<tr><td>6</td><td>Tandavasamudram RF</td><td>8.54</td><td>E</td></tr>
<tr><td>7</td><td>Padippallam RF</td><td>9.20</td><td>ENE</td></tr>
<tr><td>8</td><td>Odaiyanattam RF</td><td>9.47</td><td>SE</td></tr>
<tr><td>9</td><td>Nayanur RF</td><td>11.63</td><td>SSW</td></tr>
<tr><td>10</td><td>Muttakadu RF</td><td>13.16</td><td>NE</td></tr>
<tr><td>11</td><td>Tippakkadu RF</td><td>13.31</td><td>W</td></tr>
</table></td></tr>
</table>

		12	Siruvadi RF	14.46	NE	
		13	Karai RF	14.61	ENE	
		14	Attippakkam RF	14.82	SW	
18	A detailed biological study of the study area [core zone and buffer zone (10km radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET Species duly authenticated, separately for core and buffer zone should be furnished based on such primary filed survey, clearly indicating the schedule of the fauna present. In case of any Schedule-I fauna found in the study area, the necessary plan along with budgetary provisions for their conservation should be prepared in consultation with State Forest and Wildlife Department and details furnished. Necessary allocation of funds implementing the same should be made as part of the project cost.	Detailed study on Biological Environment of the study area is given in **Chapter 3, Section 3.11.** **Flora:** The ecology and diversity survey were conducted in the core area and buffer area extend 10 km radius in the study area. It is observed that human settlements present in and surround the project site and within the study area of 10 km radius vegetation area is in agricultural, horticultural land and private plantation and some natural vegetation observed near the Kallar river and Ammur reserve forest. Total 112 species under 41 families were found in the study area. The details are provided in **Chapter 3, Section 3.11.3** The lists of floral species are provided in **Chapter 3. Section 3.11.3.1, Table 3.21.** **Fauna:** Both direct (sighting) and indirect (evidences) observations methods were used to survey the faunal species around the study area. ➢ Bird species ➢ Mammals ➢ Reptiles & Amphibians ➢ Butterfly Species ➢ Aquatic Ecology				

		List of Fauna in the Study Area are provided in **Chapter 3, Section 3.11.4, Table 3.22 to Table 3.27.**
19	Proximity to Areas declared as "Critically Polluted" or the Project areas likely to come under the 'Aravali Range', (attracting court restriction 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.	Nil.
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)	There is no Coastal Zone within 15km radius of the project site.
21	R&R Plan/compensation details	The lease area is classified as Government Poramboke land. G.O. (3D) No. 66, Industries (MME.1) Department,

	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 access their requirements and action programmes prepared 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.	dated: 05.12.2011 is enclosed as **Annexure–1.**is obtained from Govt.of Tamil Nadu for 30 years. There will be no Rehabilitation and Resettlement involved.
22	One season (non-monsoon) [i.e March–May (Summer Season); October-December (Post Monsoon Season); December-February (Winter Seasons)]	The primary baseline data monitored covered three (3) months i.e., from **mid of January 2023 – mid of April 2023**, and secondary data was collected from Government and Semi-Government organizations. The primary baseline data results and discussions are furnished in **Chapter 3**. **Ambient Air Quality:** **Monitoring Locations**

primary baseline data on ambient air quality as per CPCB Notification of 2009, water quality, noise level, soil nd flora and fauna shall be collected and the AAQ and other data so compiled presented data-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 500m of the mine lease in the pre-dominant downwind direction.
The mineralogical composition of PM10, particularly for free silica, should be given.

Station Code	Location	Type of Wind	Distance (~km) from Project boundary	Azimuth Directions
A1	Project Site	-	Within the Site	
A2	Palavalam	c/w	0.68	S
A3	Mallirisankuppam	u/w	3.57	SE
A4	Vettavalam	c/w	3.19	SSW
A5	Anukkamalai	c/w	1.64	WSW
A6	Nagalampattu	d/w	3.84	NW
A7	Pattuvoy	d/w	0.59	NW
A8	Nallampillaipetral	c/w	4.82	NNW

The details of Ambient Air Quality Monitoring Locations, Results and Maps are provided in **Chapter 3, Section 3.7, Table 3.8- Table 3.10, Figure 3.18 & Figure 3.19.**

The average baseline levels of PM_{10} (50.37-57.68 µg/m³).

Noise:

Monitoring Locations

Station Code	Location	Distance (~km) from Project boundary	Azimuth Directions
N1	Project Site	Within Site	
N2	Palavalam	0.68	S
N3	Mallirisankuppam	3.57	SE
N4	Vettavalam	3.19	SSW
N5	Anukkamalai	1.64	WSW
N6	Nagalampattu	3.84	NW
N7	Pattuvoy	0.59	NW

		N8	Nallampillaipetral	4.82	NNW

The details of Noise Monitoring Locations, Results and Maps are provided in **Chapter 3, Section 3.8, Table 3.11, Figure 3.20.**

Water:

i. Surface Water:

Location Code	Locations	Distance from Project Boundary (~km)	Direction from project boundary
SW1	Pattuvoy Lake	0.18	NE
SW2	Varaha Nadi	9.51	NNE
SW3	Palavalam Lake	0.20	S
SW4	Adukkam Lake	7.61	SSE
SW5	Vettavalam Lake	2.58	SW
SW6	Avur Lake	6.03	W
SW7	Kolattur Lake	7.60	WNW
SW8	Canal near Nallampillaipetral	4.29	NNW

The details of Surface Water Monitoring Locations, Results and Maps are provided in **Chapter 3, Section 3.9.1, Table 3.12 &Table 3.13, Figure 3.21.**

ii. Ground Water:

Station Code	Location	Distance (km) from Project boundary	Azimuth Directions
GW1	Near Project Site	0.18	S
GW2	Palavalam	0.68	E
GW3	Mallirisankuppam	3.57	SE
GW4	Vettavalam	3.19	SSW
GW5	Anukkamalai		
GW6	Nagalampattu	1.64	WSW
GW7	Pattuvoy	3.84	NW

GW8	Nallampillaipetral	0.59 NW
		4.82 NNW

The details of Ground Water Monitoring Locations, Results and Maps are provided in **Chapter 3, Section 3.9.3, Table 3.17 to Table 3.18, Figure 3.22.**

Soil:

Location Code	Location	Distance in km	Direction
S1	Near Project Site	Within the Site	
S2	Palavalam	0.68	E
S3	Mallirisankuppam	3.57	SE
S4	Vettavalam	3.19	SSW
S5	Anukkamalai	1.64	WSW
S6	Nagalampattu	3.84	NW
S7	Pattuvoy	0.59	NW
S8	Nallampillaipetral	4.82	NNW

The details of soil Monitoring Locations, Results and Maps are provided in **Chapter 3, Section 3.10, Table 3.19 & Table 3.20, Figure 3.23.**

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

Total maximum GLCs from emissions:

Pollutant	Max. Base Line Conc. ($\mu g/m^3$)	Estimated Incremental Conc. ($\mu g/m^3$)	Total Conc. ($\mu g/m^3$)	NAAQ standard	% contribution of concentration above Base line
TSPM	171.35	39.28	210.63	500	22.92
PM_{10}	68.54	7.86	76.4	100	11.47
$PM_{2.5}$	39.27	4.74	44.01	60	12.07
SO_2	17.26	0.07	17.33	80	0.41
NO_X	30.35	1.66	32.01	80	5.47

The maximum ground level concentration observed due to mining activities and traffic movement through Air Modelling for TSPM, PM_{10}, $PM_{2.5}$, SO_2 and NO_x are 173µg/m^3, 69µg/m^3, 39µg/m^{3}17µg/m^3, and

	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.	35µg/m^3respectively. The details are provided in **Chapter 4, Section 4.2.5, Table 4.15.** Predominent wind direction South west. Map showing the Ambient Air Quality monitoring locations are given in **Chapter 3, Secion 3.7.1 Figure 3.18.** Wind rose diagram considered for dispersion modeling is shown in **Chapter 4, Section 4.2.3 Figure 4.1.** **Traffic Volume after Implementation of the Project:**

For the Road	Volume of Traffic	Volume (V)	Road Capacity (C)	V/C Ratio	LOS Category*	Traffic Classification
Existing	252	457.85	1500	0.31	"A"	Free Flow Traffic
After implementation	272	505.8	1500	0.34	"A"	Free Flow Traffic

*LOS (Level Of Service) categories are A-Free Flow, B- Reasonably Free Flow, C-Stable Flow, D-Approaching unstable flow, E- Unstable flow, F- Forced or breakdown flow

Due to propose project there will be slight increment in the vehicle movement but the level of service (LOS) anticipated will be Free Flow.
The details are provided in **Chapter 4, Section 4.2.5, Table 4.16 & Table 4.17.**

<table>
<tr>
<td>24</td>
<td>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.</td>
<td>The water requirement for the project is addressed in Chapter 2 and Section 2.11.2. Table 2.12.
<table>
<tr><th>S. No</th><th>Description</th><th>Water Requirement (KLD)</th></tr>
<tr><td>1</td><td>Drinking &Domestic purpose</td><td>0.5</td></tr>
<tr><td>2</td><td>Wire Saw Cutting</td><td>0.3</td></tr>
<tr><td>3</td><td>Dust suppression</td><td>0.3</td></tr>
<tr><td>4</td><td>Green Belt</td><td>0.4</td></tr>
<tr><td colspan="2">Total</td><td>1.5</td></tr>
</table>
The total water requirement is sourced from Private tank suppliers.
The details are shown in Chapter 4, Section 4.3.</td>
</tr>
<tr>
<td>25</td>
<td>Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the Project should be provided.</td>
<td>No ground water withdrawal to meet the water requirement is proposed.

The total water requirement will be sourced from Vendors and Pothuvai & Pazhavalam village Panchayats.</td>
</tr>
<tr>
<td>26</td>
<td>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.</td>
<td>Water conservation measures:
Ground water occurrence in this area is 14m BGL due to scanty rainfall and subtropical climate. The quarry operation confined to well above the water table for the entire lease period; hence the quarry operation will not be affected by the ground water in any manner.
Rainwater harvesting:
The rainwater will be diverted towards the middle of the mine to prevent water entering the mine working. The rainwater flows will also contain fines both from surface and waste dumps during seasonal flows. As such, it is proposed to have structures in such a way to act as settling pond and also for rainwater harvesting.
➢ Construct barriers at suitable intervals along the path of the drains.
➢ Divert the water to de-silting cum rainwater harvesting pond in the mine area.
Provide necessary overflow arrangement to maintain the natural drainage system.
Rainwater harvesting details are provided in Chapter 4 Section 4.3.4.2</td>
</tr>
</table>

27	Impact of the Project on the water quality, both surface and groundwater, should be assessed and necessary safeguard measures, if any required, should be provided.	The Proposed depth the quarry is 30m AGL of a hill of 100m and the ground water is in 14m. So there will be no impact on the Ground water. There are no major surface water bodies in the surrounding the project area but the following measures will be taken to prevent the runoff water from polluting. **Surface Water Pollution Control Measures:** ➢ Odai is passes through the site. As per the mining plan, a safety distance of 50mts shall be maintained for the odai. ➢ Construction of garland drains of suitable size around mine area and dumps to prevent rain water descent into active mine areas. ➢ During monsoon season, the rain water will be collected by natural slope of area to water fed tank of the mine and it will be utilized for dust suppression and greenbelt development. ➢ The dump tops will be provided with inner slopes to control water flow to prevent erosion washouts. The dumps tops and slopes of in active areas will be covered with grasses, shrubs, mulching, etc, to prevent erosion, till final backfilling of dumps into mined out areas. ➢ Retaining walls of adequate dimensions will be provided at the top of dumps and the unstable OB benches within the mine to prevent wash off from dumps and sliding of material from benches. This will help in preventing silting of water drains/channels. ➢ The water channels/drains carrying the rain water from the mine will be provided with baffles and settling pits to arrest the suspended solids, if any, present in this water. ➢ The worked out slopes will be stabilized by planting appropriate shrub/grass species on the slopes. ➢ The mine water will be regularly tested for presence of any undesirable elements and appropriate measures will be taken in case any element is found exceeding the limits prescribed by CPCB. **Ground Water Pollution Control Measures** ➢ The proposed mining project will not generate any effluent. The domestic sewage from the toilets will be

		routed to septic tanks. ➢ Regular monitoring of water levels and quality in the existing open wells and bore well in the vicinity will be carried out. The details are provided in **Chapter 4, Section 4.3.4.2**.
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 be obtained and copy furnished.	The mining activity proposed in depth of 30m from the top of the hill. (AGL as per mining plan) Ground water table is available at 14mBGL as per Mining plan. Mining activities will not intersect with ground water table as the proposed depth of mining will be above ground level (from the top of the hill). Workable depth will be 30m from the top of the hill of 100m height.

<table>
<tr><td>29</td><td>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.</td><td>Nil</td></tr>
<tr><td>30</td><td>Information on site elevation, working depth, groundwater table etc. Should be provided both in ASML and bgl. A schematic diagram may also be provided for the same.</td><td>Site Elevation: 291m
Groundwater level is 14m depth in the summer. (As per mining plan)
Proposed Depth of Mining is 30m AGL given in the Mining Plan enclosed as Annexure-4.</td></tr>
<tr><td>31</td><td>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</td><td>About 1.00.0 Ha of area is proposed for Green Belt development. It is proposed to plant 30 No’s of trees per year. Detailed Green Belt Development plan is given in Chapter 2 section 2.16.8. Table 2.18

Species of ecological value and good utility value to the local population with emphasis on local and native species are proposed as part of the afforestation.
<table>
<tr><th>Year</th><th>No. of trees proposed to be planted</th><th>Name of the species</th><th>Area (m^3)</th><th>Survival rate expected</th><th>No. of trees expected to be grown</th></tr>
<tr><td>1st Year</td><td>30</td><td>Neem/ Pungam</td><td>200</td><td>50%</td><td>15</td></tr>
<tr><td>2nd Year</td><td>30</td><td>Neem/ Pungam</td><td>200</td><td>50%</td><td>15</td></tr>
<tr><td>3rd Year</td><td>30</td><td>Neem/ Pungam</td><td>200</td><td>50%</td><td>15</td></tr>
<tr><td>4th Year</td><td>30</td><td>Neem/ Pungam</td><td>200</td><td>50%</td><td>15</td></tr>
</table></td></tr>
</table>

	species to be planted. The details of plantation already done should be given. The plant species selected for greenbelt 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.	
32	Impact on local transport infrastructure due to the Project should be indicated. Projected increase in truck traffic as a result of the Project in the present road network (including those outside the Project area) should be worked out, indicating whether it is capable of handling the incremental load. Arrangement for improving the infrastructure, if contemplated (including action to be taken by other agencies such as State Government) should be covered. Project Proponent shall conduct Impact of Transportation study as per Indian Road Congress Guidelines.	

5th Year	30	Neem/ Pungam	200	50%	15

Traffic volume after implementation of the project

For the Road	Volume of Traffic	Volume (V)	Road Capacity (C)	V/C Ratio	LOS Category*	Traffic Classification
Existing	252	457.85	1500	0.31	"A"	Free Flow Traffic
After implementation	272	505.8	1500	0.34	"A"	Free Flow Traffic

*LOS (Level of Service) categories are A-Free Flow, B- Reasonably Free Flow, C-Stable Flow, D-Approaching unstable flow, E- Unstable flow, F- Forced or breakdown flow.

Due to propose project there will be slight increment in the vehicle movement but the level of service (LOS) anticipated will be Free Flow.

Impact and Mitigation on local transport:

The increment in the dust emissions will be mainly due to transportation activity. Therefore, emissions due to mineral handling during mining operation are not much and restricted to the lease area only.Proper mitigation measures are practiced during mining activities to control air pollution load below the prescribed limits are as follows:

<table>
<tr><td></td><td></td><td>

Regular water sprinkling on haul and access roads.
Watering of haul roads and other roads at regular intervals
Provision of green belt by vegetation for trapping dust.
Greenbelt development along the haul roads, dumps and along the boundaries of the lease area.
Utmost care will be taken to prevent spillage of sand and stone from the trucks.

Impacts and mitigation measures on transportation is given in Chapter 4. Section 4.2.5.1.
</td></tr>
<tr><td>33</td><td>Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.</td><td>
Sanitation facilities are provided to mines workers. The details are provided in Mining plan and the same is enclosed as Annexure-4 (Table 2.5).
An area of 0.01.5 Ha, of land is allocated for infrastructure within the lease area.
Land use details of the quarry area:
<table>
<tr><th>S.No</th><th>Land Use</th><th>Area to be required during the mining plan (Ha)</th><th>Area at the end of the quarrying period (Ha)</th></tr>
<tr><td>1</td><td>Area under Quarry</td><td>22.53.0</td><td>33.47.5</td></tr>
<tr><td>2</td><td>Waste Dump</td><td>1.00.0</td><td>3.61.0</td></tr>
<tr><td>3</td><td>Infrastructure</td><td>--</td><td>0.01.5</td></tr>
<tr><td>4</td><td>Road</td><td>--</td><td>0.08.5</td></tr>
<tr><td>5</td><td>Mine approach road</td><td>--</td><td>0.20.0</td></tr>
<tr><td>6</td><td>Green Belt</td><td>--</td><td>0.19.0</td></tr>
<tr><td>7</td><td>Un utilized Area</td><td>14.81.55</td><td>2.55.55</td></tr>
<tr><td colspan="2">Total</td><td>38.39.55</td><td>40.13.05</td></tr>
</table>
Land use details of the quarry area are given in Chapter-2, Section 2.6.
</td></tr>
<tr><td>34</td><td>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.</td><td>
There will be no reclamation and restoration.

It is proposed not to fill back the ultimate pit, in as much as good quantity of reserve is available below the workable depth.
</td></tr>
<tr><td>35</td><td>Occupational Health impacts of</td><td>Impacts on Occupational Health due to project operations:</td></tr>
</table>

	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.	Anticipated occupational illness sequel to mining activities involved in the project. Occupational health problems due to dust&noise and Occupational illness by quarry activities as follows; ➢ Dust related pneumonia ➢ Tuberculosis ➢ Rheumatic arthritis ➢ Segmental vibration **Mitigate Measures for Occupational Health** ➢ Adoption of dust suppression measures like spraying water, use of drill with dust collection system or wet drills etc. ➢ Plantation ➢ Avoid blasting during unfavorable wind & atmospheric conditions. ➢ Use of personal protective equipment. Compliance with DGMS circulars. ➢ Emergency response plan that includes installation of emergencyresponse equipment to combat events such as fire. ➢ All personnel required to handle hazardous materials will be provided with personal protective equipment suitable for the hazardous material being handled. ➢ On-site first aid facilities will be provided and employees will be extended to the local community in emergencies. Occupational Health impacts & preventive measures detail given in **Chapter 4Section 4.7.3** Granite stone does not contain any toxic elements. Further this being a semi-mechanized mine, production is by semi-mechanized means and waste material handling partly by mechanized way, there shall be marginal impact on air and noise qualities. Therefore, the possibilities of any health hazards are minimal. ➢ Awareness and planning are keys to prevention of occupational health hazards. ➢ Conducting air monitoring to measure worker exposures and to ensure that provided controls are adequate for protection of workers. ➢ Adequate respiratory protection will be provided to the workers.

<table>
<tr><td></td><td></td><td>

Periodic medical examinations for all workers.
Provide workers with training that includes information about health effects, work practices, and use of protective equipments.

The EMP details are given separately as Chapter 10 along with EMP Cost details are providing in Section 10.14.
</td></tr>
<tr><td>36</td><td>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.</td><td>
Occupational Health impacts & preventive measures details are given in Chapter 4Section 4.7.1.
Granite stone does not contain any toxic elements. Further this being a semi-mechanized mine, production is by semi-mechanized means and waste material handling partly by mechanized way, there shall be marginal impact on air and noise qualities. Therefore, the possibilities of any health hazards are minimal.

Awareness and planning are keys to prevention of occupational health hazards.
Conducting air monitoring to measure worker exposures and to ensure that provided controls are adequate for protection of workers.
Adequate respiratory protection will be provided to the workers.
Periodic medical examinations for all workers.
Provide workers with training that includes information about health effects, work practices, and use of protective equipments.

The EMP details are given as a separately as Chapter 10 along with EMP Cost details are provide in Section 10.14.
<table>
<tr><th colspan="3">EMP COST</th></tr>
<tr><th>S.No</th><th>Description</th><th>Amount in Rs.</th></tr>
<tr><td>1</td><td>Afforestation</td><td>30,000/-</td></tr>
<tr><td>2</td><td>Water Sprinkling</td><td>50,000/-</td></tr>
<tr><td>3</td><td>Water Quality Test</td><td>25,000/-</td></tr>
<tr><td>4</td><td>Air Quality Test</td><td>25,000/-</td></tr>
<tr><td>5</td><td>Noise / Vibration Test</td><td>25,000/-</td></tr>
<tr><td>6</td><td>CSR Activity</td><td>50,000/-</td></tr>
<tr><td></td><td>Total EMP Cost</td><td>2,05,000/-</td></tr>
</table>
</td></tr>
</table>

<table>
<tr>
<td>37</td>
<td>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.</td>
<td>A socio-economic study was undertaken in assessing aspects which are dealing with social and cultural conditions, and economic status with secondary sources in the study area. The socio - Economic conditions of the village and distance will enhance due to the project, hence the project should be allowed after considering all the parameters.
• It can thus be concluded that the project is environmentally compatible, financially viable and would be in the interest of construction industry thereby indirectly benefiting the masses.
• The quarrying activities in this belt will benefit to the local people both directly 30 persons & indirect persons are 20 Nos.
• The direct beneficiaries will be those who got employed in the mines as skilled and unskilled workers.
• Providing Smart screen facilities for nearby Govt.School& Solar Pannel (2 No’s) for an amount of 1,99,940/- lakhs in Pothuvai village.</td>
</tr>
<tr>
<td>38</td>
<td>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.</td>
<td>The EMP details are given as a separately as Chapter 10 along with EMP Cost details are provided in Section 10.14.
<table>
<tr><th colspan="3">EMP COST</th></tr>
<tr><th>S.No</th><th>Descriptions</th><th>Amount in Rs.</th></tr>
<tr><td>1</td><td>Afforestation</td><td>30,000/-</td></tr>
<tr><td>2</td><td>Water Sprinkling</td><td>50,000/-</td></tr>
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<tr><td>5</td><td>Noise / Vibration Test</td><td>25,000/-</td></tr>
<tr><td>6</td><td>CSR Activity</td><td>50,000/-</td></tr>
<tr><td></td><td>Total EMP Cost</td><td>2,05,000/-</td></tr>
</table>
</td>
</tr>
<tr>
<td>39</td>
<td>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</td>
<td>The public hearing points raised and commitment of the Project Proponent will be discussed after the completion of Public Hearing.</td>
</tr>
</table>

<table>
<tr><td></td><td>provided and also incorporated in the final EIA/EMP Report of the Project.</td><td></td></tr>
<tr><td>40</td><td>Details of litigation pending against the project, if any, with direction/order passed by any Court of Law against the Project should be given.</td><td>No litigation pending against the project as per Project Proponent.</td></tr>
<tr><td>41</td><td>The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.</td><td>
<table>
<tr><th>S. No</th><th>Description of the Cost</th><th>Amount in Rs.</th></tr>
<tr><td colspan="3">A. Fixed Cost</td></tr>
<tr><td>1</td><td>Land Cost</td><td>Nil. Because Govt. land</td></tr>
<tr><td>2</td><td>Labour shed</td><td>50,000/-</td></tr>
<tr><td>3</td><td>Sanitary facilities</td><td>50,000/-</td></tr>
<tr><td>4</td><td>Fencing Cost</td><td>1,25,000/-</td></tr>
<tr><td colspan="2">Total</td><td>2,25,000/-</td></tr>
<tr><td colspan="3">B. Operational Cost</td></tr>
<tr><td>1</td><td>Jack Hammers</td><td>1,98,000/-</td></tr>
<tr><td>2</td><td>Compressor</td><td>19,82,000/-</td></tr>
<tr><td>3</td><td>Diamond wire saw</td><td>4,87,000/-</td></tr>
<tr><td>4</td><td>Diesel General</td><td>4,00,000/-</td></tr>
<tr><td>5</td><td>Excavators</td><td>6,00,000/-</td></tr>
<tr><td>6</td><td>Tippers</td><td>58,00,000/-</td></tr>
<tr><td>7</td><td>Drinking water facilities for the labours</td><td>50,000/-</td></tr>
<tr><td>8</td><td>Safety kits</td><td>50,000/-</td></tr>
<tr><td colspan="2">Total Operational Cost</td><td>95,67,000/-</td></tr>
<tr><td colspan="3">C. EMP Cost</td></tr>
<tr><td>1</td><td>Afforestation</td><td>30,000/-</td></tr>
<tr><td>2</td><td>Water Sprinkling</td><td>50,000/-</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td></td><td>
<table>
<tr><td>3</td><td>Water Quality test</td><td>25,000/-</td></tr>
<tr><td>4</td><td>Air Quality test</td><td>25,000/-</td></tr>
<tr><td>5</td><td>Noise/Vibration test</td><td>25,000/-</td></tr>
<tr><td>6</td><td>CSR activities</td><td>50,000/-</td></tr>
<tr><td colspan="2">Total EMP Cost</td><td>2,05,000/-</td></tr>
<tr><td colspan="2">Total Cost of the Project (A+B+C)</td><td>99,97,000/- (Say 1 Crore)</td></tr>
</table>
The project Cost is Rs.99,97,000/- as addressed in Chapter 2 and Section 2.8
</td></tr>
<tr><td>42</td><td>A Disaster Management Plan shall be prepared and include in the EIA/EMP Report.</td><td>
Disaster Management Plan:

Effect the 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
Identify any dead
Provide for the needs of relatives
Provide authoritative information to the news media
Secure the safe rehabilitation of affected area
Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the emergency
In effect, it is to optimize operational efficiency to rescue rehabilitation and render medical help and to restore normalcy.

Detailed Disaster management plan are provided in Chapter 7 and Section 7.2.3.
</td></tr>
<tr><td>43</td><td>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.</td><td>

The quarrying activities in this belt will benefit to the local people both directly 30 persons & indirect persons are 20 Nos.
The direct beneficiaries will be those who get employed in the mines as skilled and unskilled workers.
Improvement in Per Capita Income.
The socio - Economic conditions of the village and distance will enhance due to the project, hence the project should be allowed after considering all the parameters.
It can thus be concluded that the project is environmentally compatible, financially viable and would be in the interest of construction industry thereby indirectly benefiting the masses.

</td></tr>
</table>

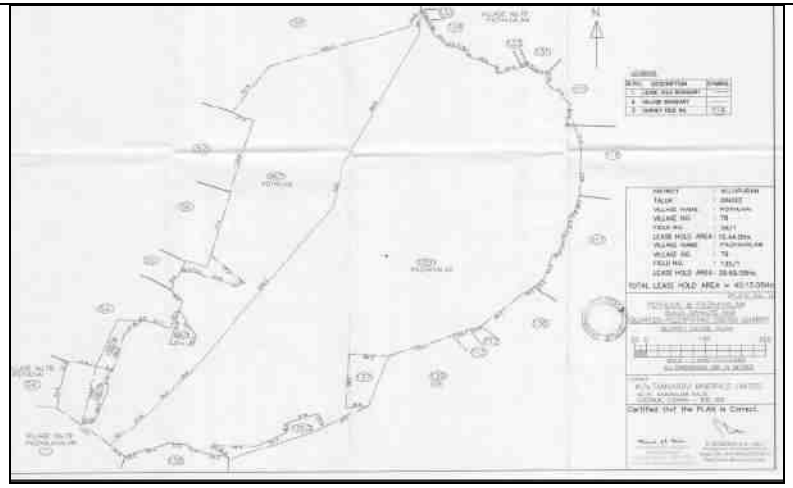
44	Besides the above, the below mentioned general points are also to be followed:	
a)	Executive Summary of the EIA/EMP report.	Executive Summary of EIA Report enclosed separately
b)	All documents to be properly referenced with index and continuous page numbering.	Noted and all documents addressed with properly referenced with index and continuous page numbers.
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.	Noted and sources for all tables are addressed.
d)	Project Proponent shall enclose all the analysis/testing reports of Water, Soil, Air, Noise etc. using the MoEF&CC/NABL accredited laboratories. All the original analysis/testing reports should be available during appraisal of the Project.	All the analysis/testing reports of Water, Soil, Air, and Noise etc. are conducted by MoEF&CC& NABL accredited laboratories. The disclosure of Consultant is given in **Chapter 12.**
e)	Where the documents provided are in a language other than English, an English translation should be provided.	The entire document is prepared in English.
f)	The Questionnaire for environmental appraisal of mining projects as devised earlier by the ministry shall also be filled and submitted.	Questionnaire for environmental appraisal of mining projects is prepared as per prescribed format.
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.	EIA is Prepared as per O.M No. J-11013/41/2006-IA.II (I) dated 4th August, 2009 given by MoEF&CC and the generic structure prescribed in **Appendix–III** of EIA Notification 2006 and covered all ToR Compliances.
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	Noted

	the revised documentation.	
i)	As per the circular no J-11011/618/2010-IA.II(I) dated 30.5.2012, certified report of the status of compliance of the condition 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, as it is a new project
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 adjoin area.	All the Sectional Plates are enclosed as **Annexure-5**

1.10.5.2 In addition to the above the following shall be furnished

The executive summary of the EIA/EMP report in about 8-10 pages should be prepared incorporating the information on following point:

S. No	ToR Point	Compliance
1	Project name and location (village, District, State, Industrial Estate (if applicable)	The same has been complied in the Executive Summary.
2	Process description in brief, specifically indicating the gaseous emission, liquid effluent and solid and hazardous waste.	The gaseous emission, liquid effluent and solid and hazardous wastes are discussed in **Chapter 4**
3	Measures for mitigation the impacts on the environment and mode of discharge or disposal	The Mine waste in the mine includes the over burden, side burden, rock fragments and rubbles generated as mineral rejects during production works and the country rock fragments generated during development works as approach road formation, formation of dumping yard sites etc., During the first five years of Mining Plan period, such waste material are proposed to be dumped along the Southern part of the lease area where it comprises of country rock terrain.

		No wastewater will be generated by quarry operation except domestic sewage. Domestic sewage will be disposed to septic tank followed by soak pit. Septic tank will be cleaned periodically.
4	Capital cost of the project, estimated time of completion.	Cost of the project is **Rs.99,97,000/-**
5	The proponent shall furnish the contour map of the water table detailing the number of wells located around the site and impacts on the wells due to mining activity	Contour map is shown in **Chapter 3, Section 3.5.5, Figure 3.10**
6	A detailed study of the lithology of the mining lease area shall be furnished	Lithology details are provided in Mining plan. Mining Plan is enclosed as **Annexure-4.**
7	Detailed of village map" A'' register and FMB sketch shall be furnished	 Village map is shown in **Chapter 2, Figure 2.9**
8	Detailed mining closure plan for the proposed projects approved by the Geology of Mining department shall be shall be submitted along with EIA report	Mine closure plan is discussed in **Chapter 7, Section 7.2.4**
9	Obtain a letter/certificate from the Assisstant Director of Geology and Mining standing that there is no other Minerals/resources like sand in the quarrying area within	Noted and is followed

<table>
<tr><td></td><td>the approved depth of mining and below depth of mining and the same shall be furnished in the EIA report</td><td></td></tr>
<tr><td>10</td><td>EIA report should strictly follow the Environmental Impact Assessment Guidance Manual for Mining of Minerals published February 2010</td><td>EIA report is prepared as per Environemntal Impact Assessement Guidance Manual.</td></tr>
<tr><td>11</td><td>Details plan on rehabitation and reclamation carried out for the stabilization and restoration of the mined areas.</td><td>There will be no reclamation and restoration.

It is proposed not to fill back the ultimate pit, in as much as good quantity of reserve is available below the workable depth.</td></tr>
<tr><td>12</td><td>The EIA study report shall include the surrounding mining activity, if any.</td><td>There is no mining activity around the Proposed project site.</td></tr>
<tr><td>13</td><td>Modelling study for Air, Water and Noise shal be carried out in this field and incremental increase in the above study shall be substantiated with mitigation measures</td><td>AERMOD Software Version 8.0.5 is used for the modeling study of air and noise. The details are dicussed in Chapter 4</td></tr>
<tr><td>14</td><td>A study on the geological resources available shall be carried out and reported</td><td>
<table>
<tr><th>S. No</th><th>Description</th><th>Quantity (m^3)</th></tr>
<tr><td colspan="3">Geological Reserves:</td></tr>
<tr><td>1</td><td>Geological Reserves (ROM)</td><td>5,38,240</td></tr>
<tr><td>2</td><td>Geological Reserves (at 10% Recovery)</td><td>53,824</td></tr>
<tr><td colspan="3">Mineable Reserves:</td></tr>
<tr><td>1</td><td>Mineable Reserves (ROM)</td><td>2,23,562</td></tr>
<tr><td>2</td><td>Mineable Reserves (at 10 % Recovery)</td><td>22,356</td></tr>
<tr><td>3</td><td>The peak/maximum annual production per year would be</td><td>20,048</td></tr>
</table>
</td></tr>
<tr><td>15</td><td>A specific study on agriculture and livelihood shall be carried out and reported</td><td>The details of agriculture & Livelihood is discussed in Chapter 3, Section 3.12</td></tr>
<tr><td>16</td><td>Impact of soil erosion, soil physical chemical and biological property changes may be assumed</td><td>The quality of soil is discussed in Chapter 3, Section 3.10</td></tr>
<tr><td>17</td><td>Site selected for the project-Nature of land Agricultural (single/double crop), barren, Govt./private land, status of is acquisition, nearby (in 2-3km) water body, population, with in 10km other industries, forest, eco-sensitive zones, accessibility, (note-incase if industrial estate this</td><td>The details are discussed in Chapter 3, Section 3.2, Table 3.1</td></tr>
</table>

	information may not be necessary)	
18	Baseline environmental data-air quality, surface and ground water quality and soil characteristic, flora and fauna, socio economic conditions of the nearby population.	Baseline environmental data-air quality, surface and ground water quality and soil characteristic, flora and fauna, socio economic conditions of the nearby population are discussed in **Chapter 3.**
19	Identification of hazards in handling, processing and storage of hazardous material and safety system provided to mitigate the risk.	3.0 litres/year of waste oil is generated from the mining activity. The waste oil will be collected in leak proof containers and disposed to TNPCB Authorized Agencies for Reprocessing/ Recycling.
20	Likely impact of the project on Air, Water, Land, flora and fauna and nearby population.	The impacts of the project on Air, Water, Land, flora and fauna are discussed in **Chapter 4**
21	Emergency preparedness plan in case of natural or in case of plant emergencies.	The emergency preparedness plan is discussed in **Chapter 7, Section 7.2.3**
22	Issues raised during public hearing (if applicable) and response giving.	The public hearing minutes and compliance will be discussed after the completion of Public Hearing.
23	CER plan with proposed expenditure.	CER Acttivity will be implemented as per MoEF&CC O.M dated20th October, 2020 (F.No. 22-65/2017-IA.III)
24	Occupational Health Measures.	Occupational Health impacts & preventive measures detail given in **Chapter 4, Section 4.7.3 and Table 4.28**
25	Post project monitoring plan.	Post project monitoring plan is discussed in **Chapter 3, Section 6.3**
26	The project proponent shall carry out detailed hydro geogical study through instituitions/NABET Accredited agencies.	The Proposed depth the quarry is 30m AGL of a hill of 100m and the ground water is in 14m. So there will be no impact on the Ground water.Also there are no major surface water bodies in the surrounding the project area.
27	A detailed report on the greenbelt development already	As proposed, 30 plants per year were planted during the mining Period along the eastern

	undertaken is to be furnished and also submit the proposal for greenbelt activities	boundary of lease area and achieved survival rate of 50%. The project proponent will spend Rs.30,000/- for the afforestation.
28	The proponent shall propose the suitable control measure to control the fugitive emissions during the operations of the mines	The control measures to control the fugitive emissions during the operations of the mines is discussed in **Chapter 4, Section 4.2, Table 4.3**
29	A specific study should include impact on flora and fauna, disturbance to migratory pattern of animals	Flora and Fauna study is discussed in **Chapter , Section 3.11**
30	Reserve funds should be earmarked for proper closure plan	Reserve Funds will be earmarked while mining activity.
31	A detailed plan on plastic waste management shall be furnished. Further, the proponent should strictly comply with, Tamil Nadu Government Order (Ms) No.84 Environment and Forests (EC.2) Department dated 25.06.2018 regarding ban on time use and throw away plastics irrespective of thickness with effect from 01.01.2019 under Environement (Protection) Act, 1986. In this connection, the project proponent has to furnish the action plan.	A sustainable plastic waste management plan by installing bins for collection/Segregation of recycleable and non-recyclable plastic waste at the proposed project site will be implemented.

1.10.5.3 Besides the above the below mentioned general points should also be followed:

S. No	ToR Point	Compliance
a.	A note confirming compliance of the ToR with cross referencing of the relevant sections/pages of the EIA report should be provided.	Compliance of the ToR with cross referencing of the relevant sections/pages of the EIA report is provided in **Chapter 1, Section 1.10.5**
b.	All documents mat be properly referenced with index, page number and continuous page numbering.	All documents are properly referenced with index, page number.
c.	Where data are present in the report especially in table, the period in which the data where were collected and the sources should be indicated.	The sources are mentioned in the table. The period and locations of water, air, noise and soil samples collected from the site are discussed in

		Chapter 3.
d.	While preparing the EIA report, the instructions for the proponents and instruction for the consultant issued by the MoEF vide OM no. J-11013/41/2006-IA.II (I) dated 4th August 2009 which are available on the website of the ministry should also be followed.	Noted and is followed
e.	The consultants involved in the preparation of EIA/EMP report after accreditation with quality council of India (QCI)/National Accreditation board of Education and Training (NABET) would need to include a certificate in this regard in the EIA/EMP reports prepared by them and data provided by other organizations/laboratories including the status of the approvals etc. in this regards circular no. F.No.J-11013/77/2004-IA-II(I) dated 2nd December, 2009, 18th March 2010 , 28th may 2010, 28th June 2010, 31st December 2010 and 30th September 2011 posted on the Ministry's website http://www/moef.nic.in/ may be referred.	EIA Report is prepared by NABET accredited Consultant, The Consultancy Laboratory is certified by MoEF&CC and NABL accredited. The disclosure of Consultant is given in **Chapter 12.**

2 PROJECT DESCRIPTION

2.1 Type of Project including interlinked and interdependent projects

Black Granite

The black granite quarrying operation is proposed to carry out by opencast semi mechanized method by formation of benches. Benches are proposed with a height of 6m &6 m width with vertical slopes. The area applied for quarry lease exhibits hilly terrain; the altitude of the area is above (~156 -291) AMSL. Total estimated Geological reserves are 4,79,221 m^3. Total Mineable Reserves is estimated as 3,37,609 m^3. Maximum production will be 18,108 m^3 of ROM of Black Granite and 1,811 m^3 of recoverable production of granite per annum. Summary of quarry reserves are given in **Table 2-1.**

Quartzo Feldspathic Gneiss

The Quartzo Feldspathic Gneiss quarrying operation is proposed to carry out by opencast semi mechanized method by formation of benches. Benches are proposed with a height of 10m &10 m width with vertical slopes. The area applied for quarry lease exhibits hilly terrain; the altitude of the area is above (~156 -291) AMSL. Total estimated Geological reserves are 1,08,13,395 m^3. Total Mineable Reserves is estimated as 77,39,961 m^3. Maximum production will be 7,52,124m^3 of ROM of Black Granite and 7,52,124 m^3 of recoverable production of granite per annum. Summary of quarry reserves are given in **Table 2-1.**

The extent of the Quarry lease area is 40.13.05 Ha. The Quarry is located at Pothuvai&Pazhavalam village, Gingee taluk, Villupuram District, Tamilnadu State. Quarry lease area falls in the survey of India Toposheet no 57 P/4&8 and the area lies in the Eastern Longitude from 79°15'39.40"E to 79°16'08.11"E and Northern latitude from 12°08'15.47"N to 12°08'45.41"N.

Table 2-1 Summary of Project Reserves (Black Granite)

S. No	Description	Quantity (m^3)
Geological Reserves:		
1	Geological Reserves (ROM)	4,79,221
2	Geological Reserves (at 10% Recovery)	47,922
Mineable Reserves:		
1	Mineable Reserves (ROM)	3,37,609
2	Mineable Reserves (at 10 % Recovery)	33,761
3	The peak/maximum annual production per year would be	1,811

Table 2-2 Summary of Project Reserves(Quartzo Feldspathic Gneiss)

S. No	Description	Quantity (m^3)
Geological Reserves:		
1	Geological Reserves (ROM)	1,08,13,395
2	Geological Reserves (at 100% Recovery)	1,08,13,395

Mineable Reserves:		
1	Mineable Reserves (ROM)	77,39,961
2	Mineable Reserves (at 100 % Recovery)	77,39,961
3	The peak/maximum annual production per year would be	7,52,124

2.2 Need of the Project

Black Granite

The granite dimensional stone material by virtue of its pleasing color and texture and its best ability to take polishing and appealing look in polished product has attracted the consumers in the building construction and interior decoration industries. The domestic market capabilities have also been explored in recent periods. Bulk quantity of the blocks is produced and exported as raw blocks and some quantity is being processed at TAMIN's granite processing units and exported as value added finished products.

The earning source in the targeted area is limited, most of the people in and around the area depend upon the seasonal agriculture and much of the people migrate to nearby towns where good industries and factories are growing up.

This project will provide direct employment for about 35 persons. This material is well known in the international supermarket of Granite which will fetch a good fetch a good foreign exchange to the nation.

Quartzo-Feldspathic Gneiss

The country rock (Quartzo-Feldspathic Gneiss) is being excavated as is where is condition and transported to the M-sand unit for making of M-sand. The finished M-sand material can be used for all civil constructions projects as alternate for river sand.

2.3 Location of the project

The quarry is located at SF.No.58/1 (Pothuvai)&135/1(Pazhavalam), Pothuvai&Pazhavalam village, Gingee taluk, Villupuram District, Tamilnadu State.Quarry lease area falls in the survey of India Topo sheet 57 P/4&8 and the area lies in the eastern Longitude from 79°15'39.40"E to 79°16'08.11"Eand Northern latitude from 12°08'15.47"N to 12°08'45.41"N. The topography of the area is hilly. The elevation of the lease area is ≃156 - 291m AMSL.The boundary coordinates of the site are shown in the **Table 2.3.**

Table 2-3 Boundary Coordinates of the Site

S.No	Bourndary mark point	Latitude (N)	Longitude(E)
1	TM1	12° 8' 23.36"	79° 15' 44.41"
2	TM2	12° 8' 22.91"	79° 15' 45.67"
3	TM3	12° 8' 24.44"	79° 15' 46.36"

4	TM4	12° 8' 25.15"	79° 15' 45.69"
5	TM5	12° 8' 26.2"	79° 15' 46.25"
6	TM6	12° 8' 26.17"	79° 15' 46.97"
7	TM7	12° 8' 25.34"	79° 15' 49.29"
8	TM8	12° 8' 25.51"	79° 15' 49.82"
9	TM9	12° 8' 27.15"	79° 15' 47.89"
10	TM10	12° 8' 30.8"	79° 15' 48.99"
11	TM11	12° 8' 34.95"	79° 15' 50.26"
12	TM12	12° 8' 35.36"	79° 15' 49.10"
13	TM13	12° 8' 38.04"	79° 15' 51.13"
14	TM14	12° 8' 40.34"	79° 15' 58.89"
15	TM15	12° 8' 41.28"	79° 15' 59.51"
16	TM16	12° 8' 40.70"	79° 15' 59.81"
17	TM17	12° 8' 39.95"	79° 16' 0.21"
18	TM18	12° 8' 39.21"	79° 16' 0.98"
19	TM19	12° 8' 39.18"	79° 16' 1.47"
20	TM20	12° 8' 38.96"	79° 16' 2.01"
21	TM21	12° 8' 38.60"	79° 16' 2.21"
22	TM22	12° 8' 38.02"	79° 16' 3.7"
23	TM23	12° 8' 37.63"	79° 16' 3.77"
24	TM24	12° 8' 38.00"	79° 16' 5.15"
25	TM25	12° 8' 38.07"	79° 16' 5.45"
26	TM26	12° 8' 37.65"	79° 16' 6.05"
27	TM27	12° 8' 37.62"	79° 16' 6.55"
28	TM28	12° 8' 37.10"	79° 16' 6.52"
29	TM29	12° 8' 35.90"	79° 16' 7.85"
30	TM30	12° 8' 34.53"	79° 16' 7.62"
31	TM31	12° 8' 34.60"	79° 16' 8.15"
32	TM32	12° 8' 33.20"	79° 16' 8.49"
33	TM33	12° 8' 30.57"	79° 16' 8.41"
34	TM34	12° 8' 29.66"	79° 16' 8.15"
35	TM35	12° 8' 29.36"	79° 16' 7.86"
36	TM36	12° 8' 28.61"	79° 16' 7.73"
37	TM37	12° 8' 28.19"	79° 16' 7.43"
38	TM38	12° 8' 27.40"	79° 16' 7.31"
39	TM39	12° 8' 27.11"	79° 16' 6.88"
40	TM40	12° 8' 25.74"	79° 16' 6.39"
41	TM41	12° 8' 25.31"	79° 16' 5.86"
42	TM42	12° 8' 24.79"	79° 16' 5.11"
43	TM43	12° 8' 23.05"	79° 16' 2.97"
44	TM44	12° 8' 22.82"	79° 16' 2.34"
45	TM45	12° 8' 22.52"	79° 16' 1.42"
46	TM46	12° 8' 21.33"	79° 15' 57.82"
47	TM47	12° 8' 21.44"	79° 15' 55.64"
48	TM48	12° 8' 18.32"	79° 15' 55.49"
49	TM49	12° 8' 18.42"	79° 15' 56.75"
50	TM50	12° 8' 17.27"	79° 15' 54.24"
51	TM51	12° 8' 17.95"	79° 15' 53.91"
52	TM52	12° 8' 17.48"	79° 15' 52.29"
53	TM53	12° 8' 16.86"	79° 15' 52.16"
54	TM54	12° 8' 16.11"	79° 15' 50.51"
55	TM55	12° 8' 16.12"	79° 15' 48.33"
56	TM56	12° 8' 15.99"	79° 15' 48.10"

57	TM57	12° 8' 15.48"	79° 15' 48.89"
58	TM58	12° 8' 15.70"	79° 15' 47.50"
59	TM59	12° 8' 16.21"	79° 15' 46.54"
60	TM60	12° 8' 16.27"	79° 15' 45.65"
61	TM61	12° 8' 15.47"	79° 15' 43.24"
62	TM62	12° 8' 16.18"	79° 15' 42.34"
63	TM63	12° 8' 18.31"	79° 15' 39.38"
64	TM64	12° 8' 20.33"	79° 15' 39.77"
65	TM65	12° 8' 20.99"	79° 15' 40.06"
66	TM66	12° 8' 20.7"	79° 15' 41.55"
67	TM67	12° 8' 17.38"	79° 15' 40.78"
68	TM68	12° 8' 17.48"	79° 15' 41.47"
69	TM69	12° 8' 19.24"	79° 15' 42.16"
70	TM70	12° 8' 20.48"	79° 15' 42.25"
71	TM71	12° 8' 20.38"	79° 15' 42.45"
72	TM72	12° 8' 22.53"	79° 15' 43.16"
73	TM73	12° 8' 23.35"	79° 15' 44.11"
74	TM74	12° 8' 22.00"	79° 15' 45.68"
75	TM75	12° 8' 21.87"	79° 15' 46.90"
76	TM76	12° 8' 22.43"	79° 15' 47.13"
77	TM77	12° 8' 23.95"	79° 15' 46.19"

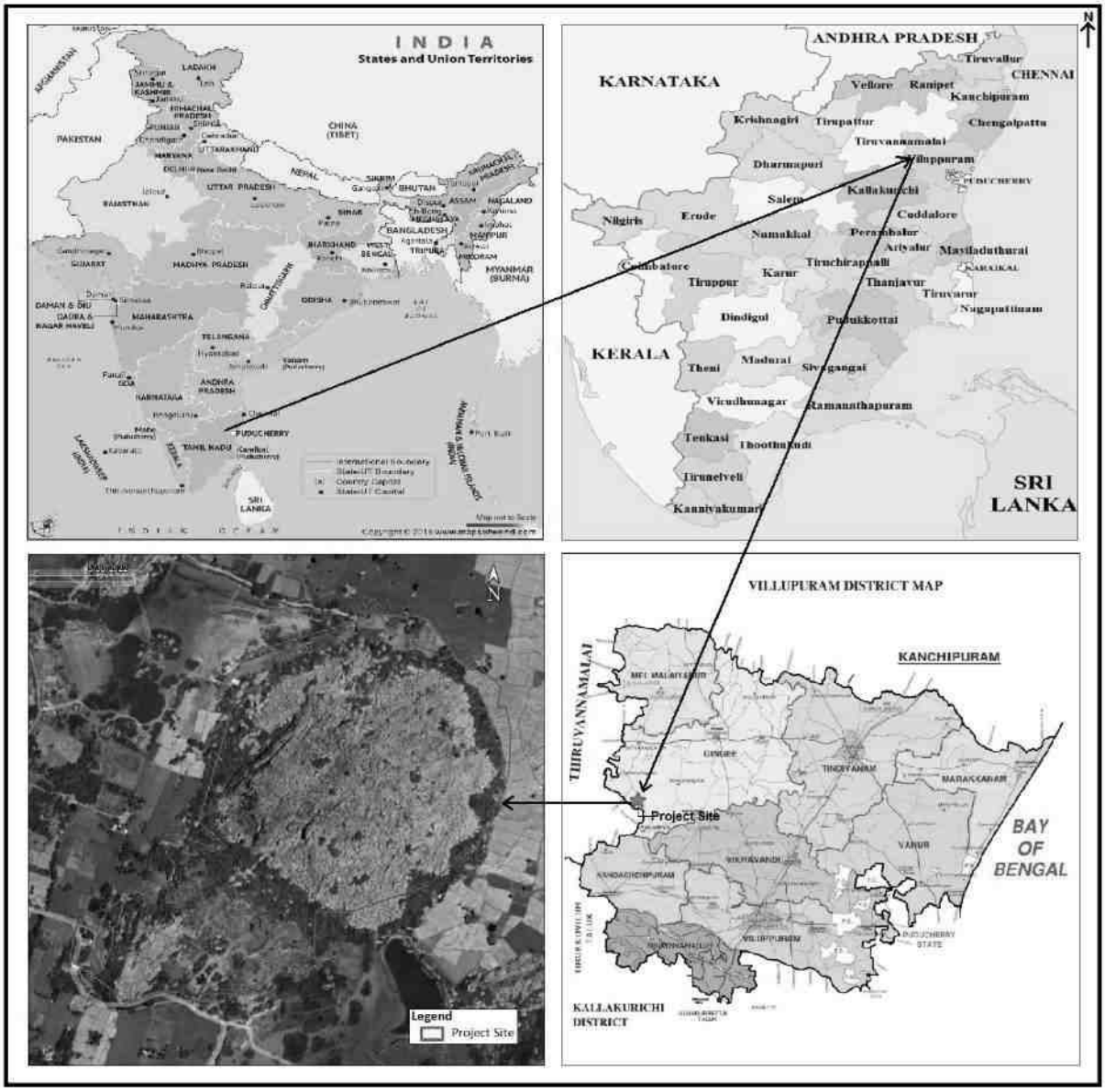


Figure 2-1 Project Location map

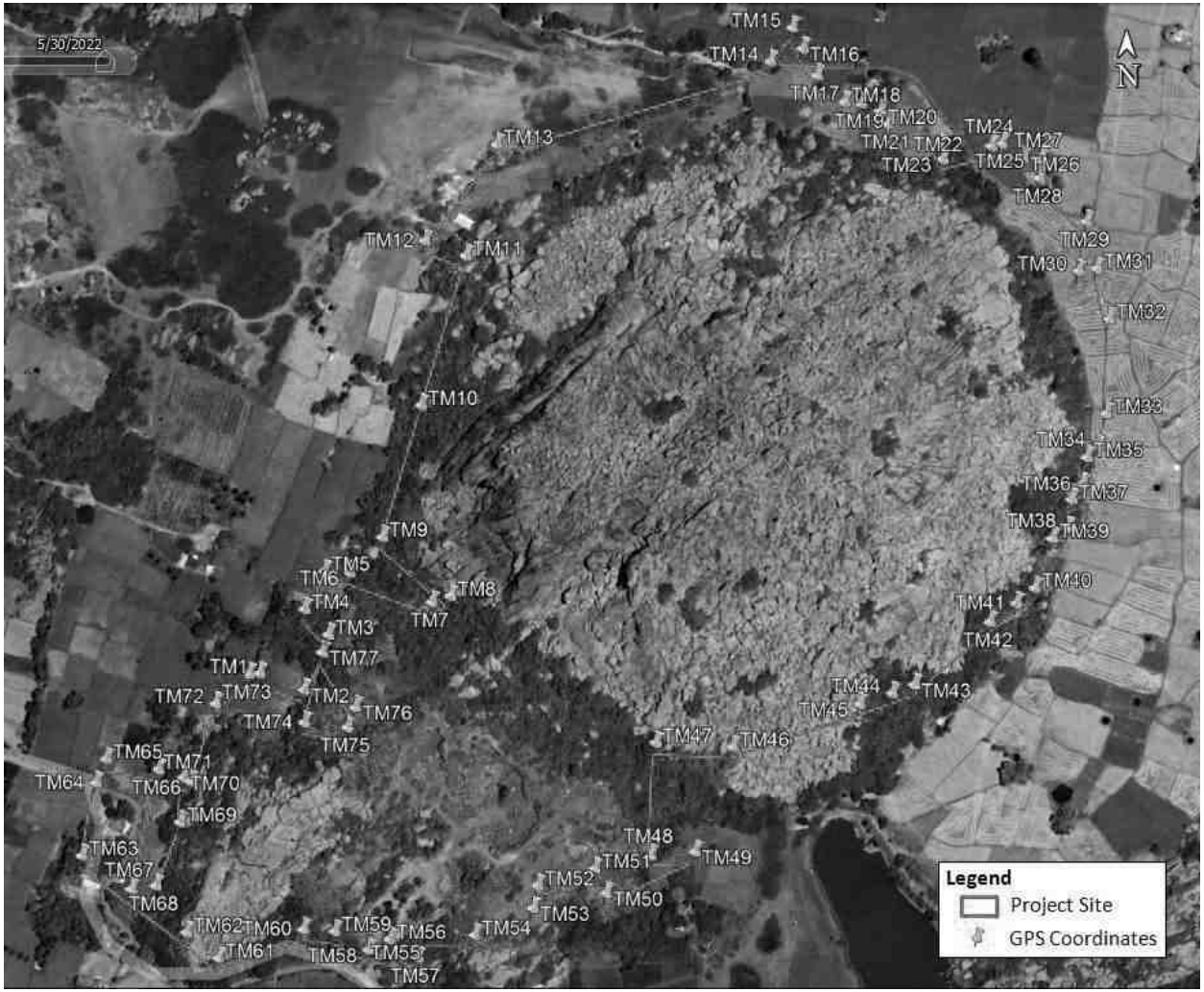


Figure 2-2 Google image of the lease area

Figure 2-3 500m radius Google imagery of the lease area

Figure 2-4 Google Imagery of 1 km radius of the lease area

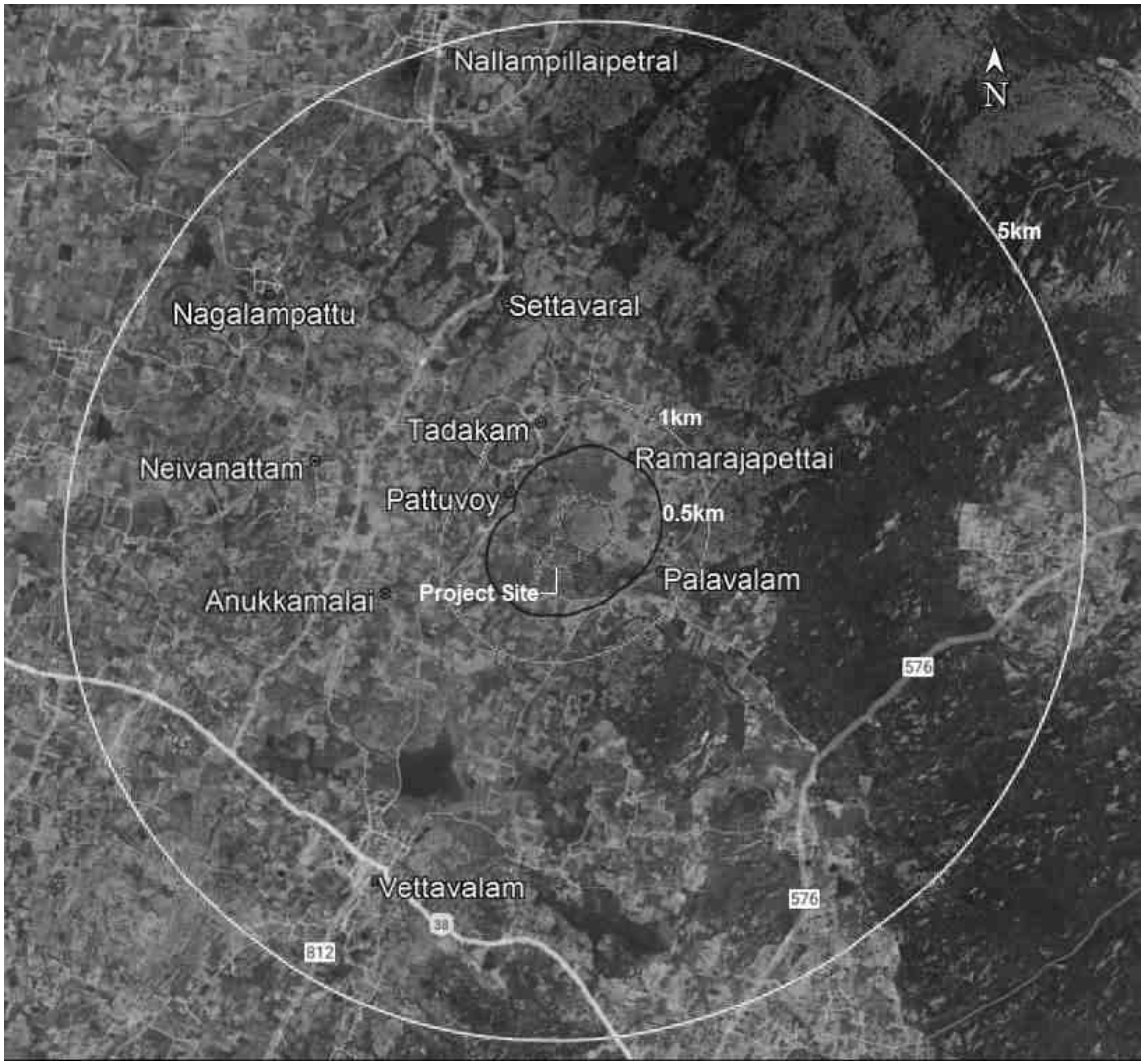


Figure 2-5 5km Google Imagery of the project site

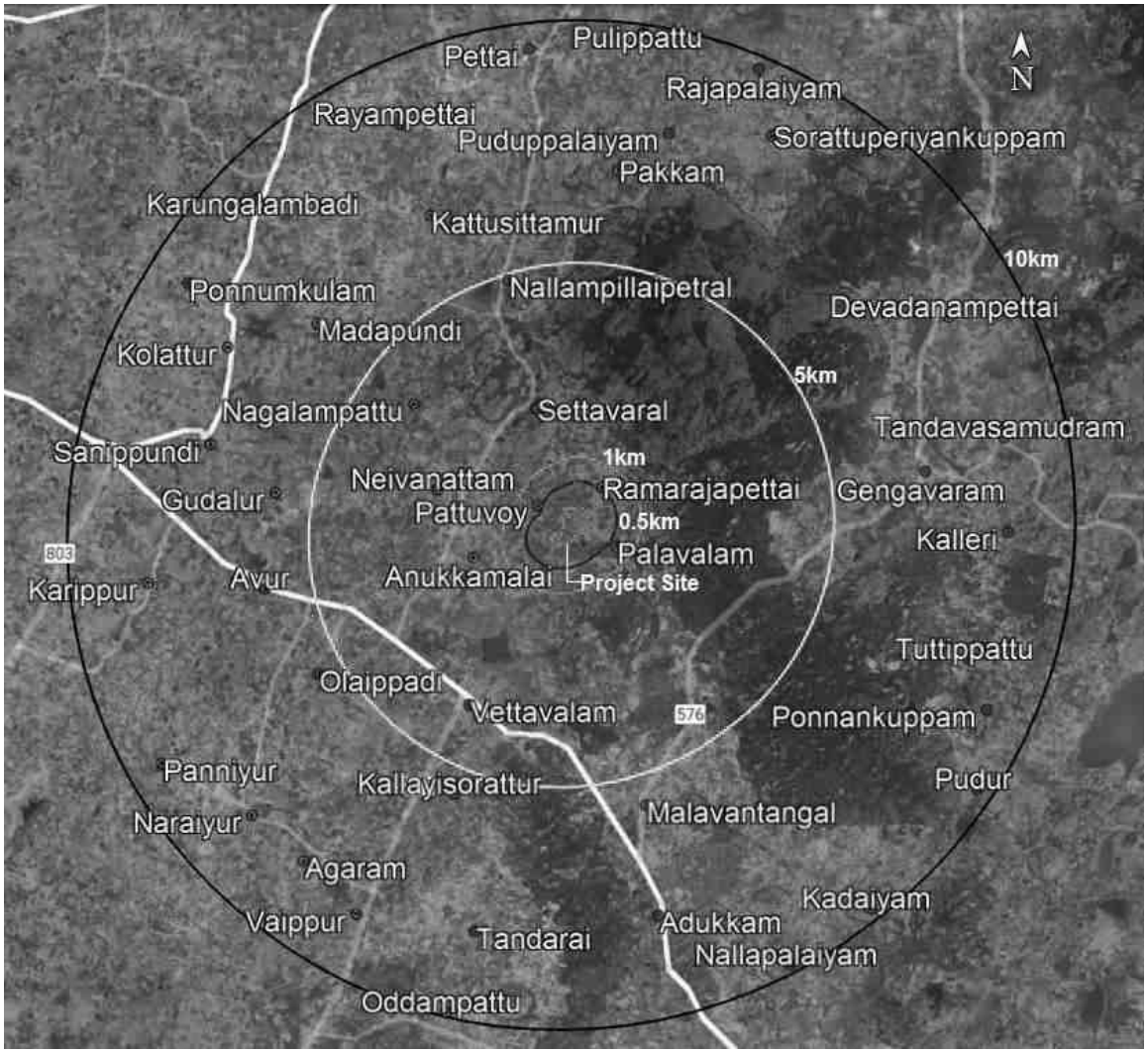


Figure 2-6 10km Google Imagery of the project site

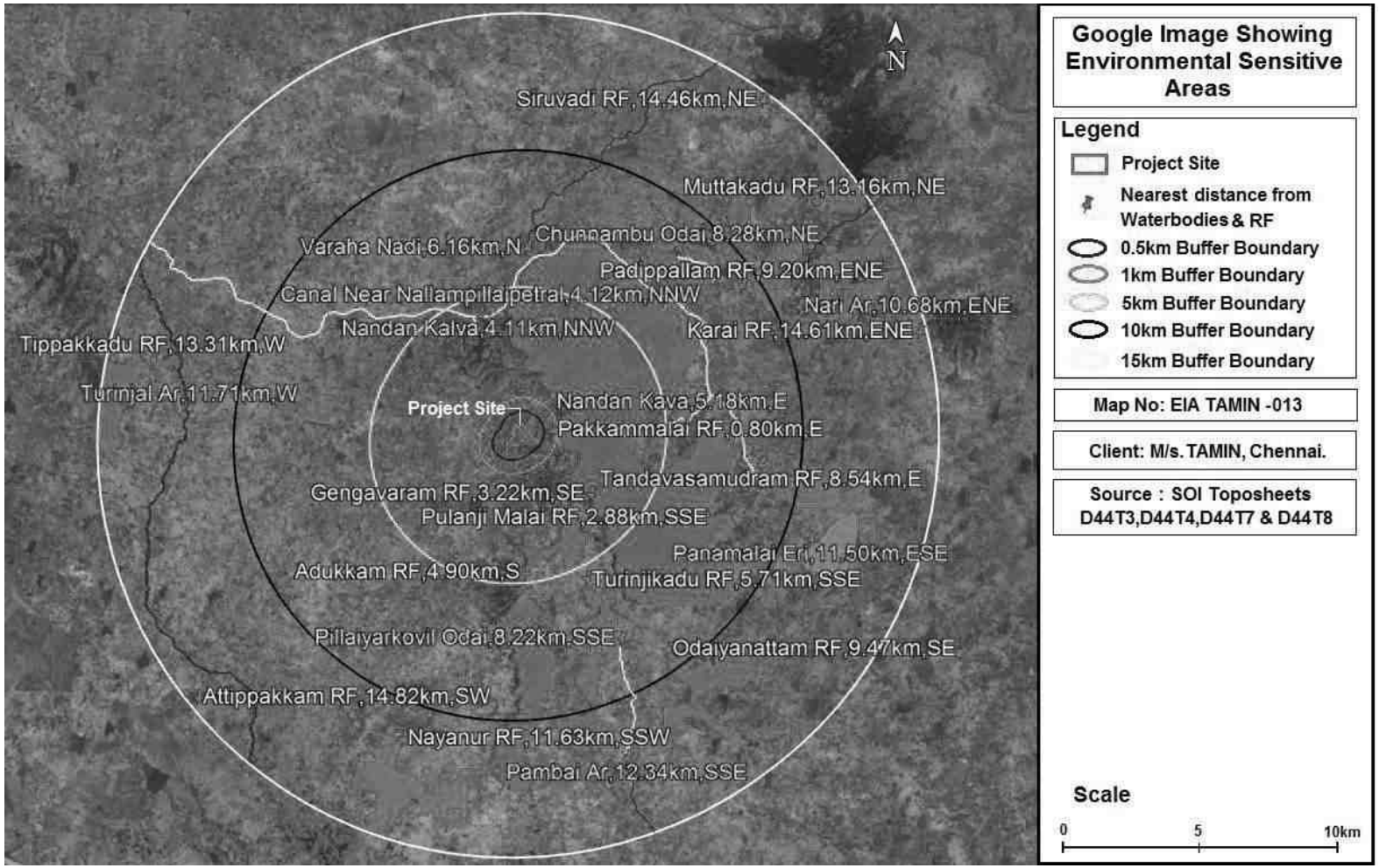


Figure 2-7 Environmental Sensitive areas within 15km radius of the lease area demarcated on Google image

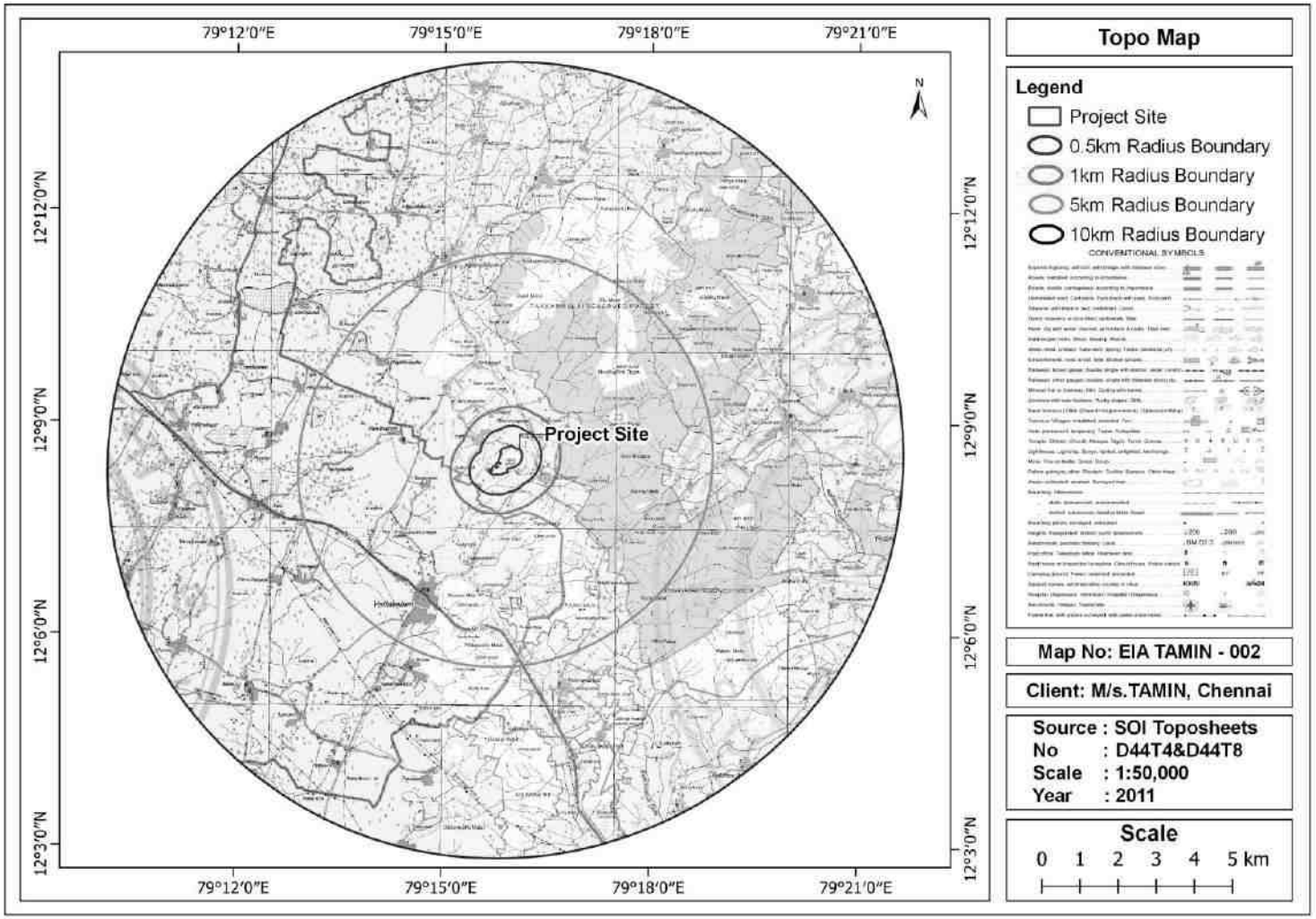


Figure 2-8 Topo map of the study area

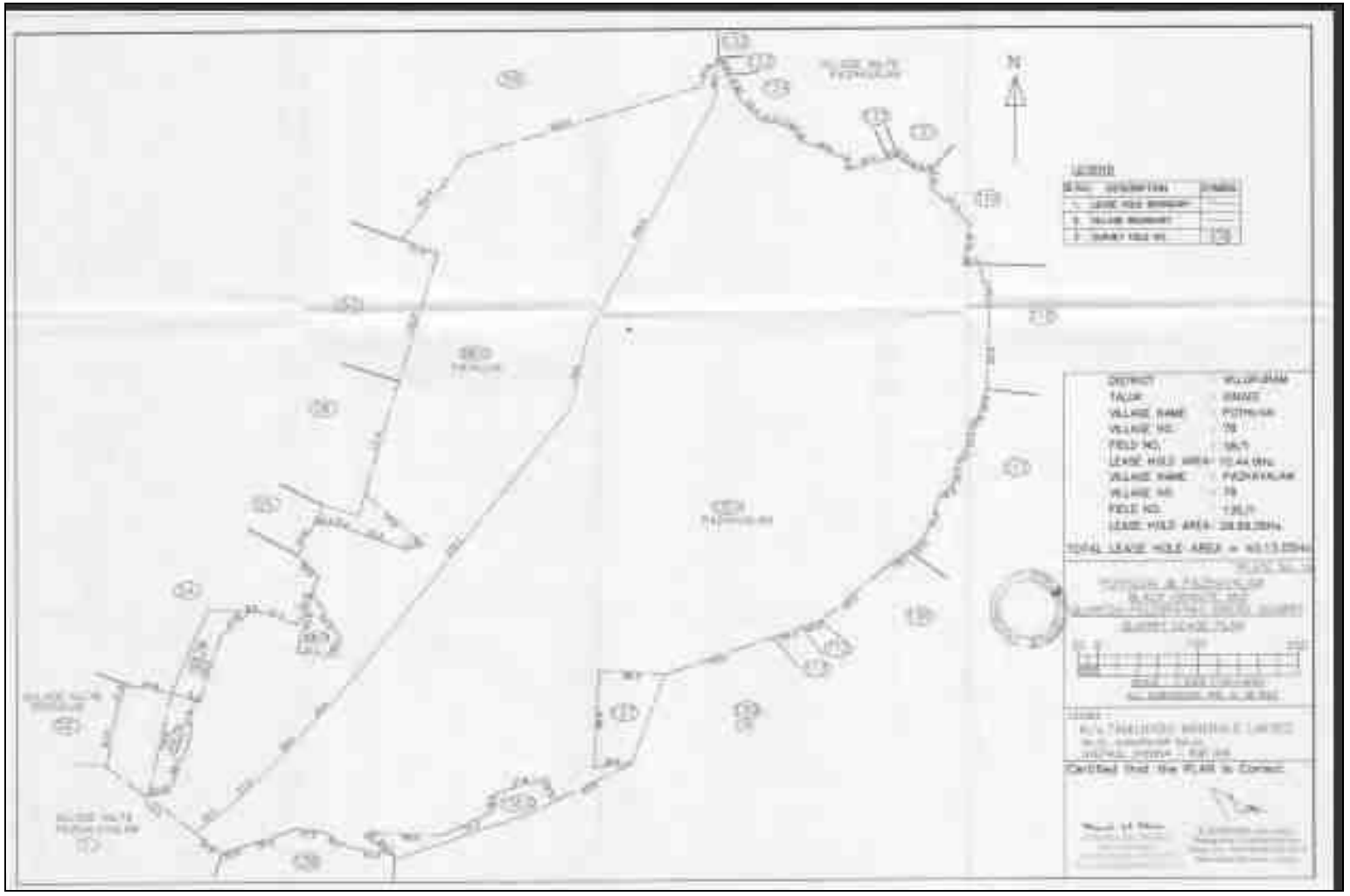


Figure 2-9 Lease plan of the area

Table 2-4 Salient Features and Environmental sensitivity details within 15km radius of the project site

<table>
<tr><th>S.No</th><th>Particulars</th><th>Details</th></tr>
<tr><td>1</td><td>Latitude</td><td>79°15'39.40"E to 79°16'08.11"E</td></tr>
<tr><td>2</td><td>Longitude</td><td>12°08'15.47"N to 12°08’45'2.41"N</td></tr>
<tr><td>3</td><td>The lease area height</td><td>291m</td></tr>
<tr><td>4</td><td>Topo sheet no.</td><td>57 P/4&8</td></tr>
<tr><td>5</td><td>Topography</td><td>Hilly terrain</td></tr>
<tr><td>6</td><td>Land Type</td><td>Government Poramboke land</td></tr>
<tr><td>7</td><td>Extent of lease area(hectares)</td><td>40.13.05</td></tr>
<tr><td>8</td><td>Nearest National highway</td><td>NH 3(Vellore to Thoothukudi) ≃ 3.56km- SW</td></tr>
<tr><td>9</td><td>Nearest State highway</td><td>SH 4A(Chepet-Thavalakulam) ≃7.30km-WNW</td></tr>
<tr><td>10</td><td>Nearest railway station</td><td>Andampallam Railway station ≃ 11.43km– SE</td></tr>
<tr><td>11</td><td>Nearest airport</td><td>Chennai International Airport≃132.87km- NE</td></tr>
<tr><td>12</td><td>Nearest town / city</td><td>Gingee ~19km-NE</td></tr>
<tr><td>13</td><td>Hills / valleys</td><td>Nil in 15 km radius</td></tr>
<tr><td>14</td><td>Archaeologically important Places</td><td>
<table>
<tr><th>S. No</th><th>Monuments</th><th>Distance (≈km)</th><th>Direction</th></tr>
<tr><td>1.</td><td>Talagiriswara Temple and a Cave containing an image of Durga and Pallava inscriptions together with adjacent land</td><td>12.64</td><td>ESE</td></tr>
</table>
</td></tr>
<tr><td>15</td><td>National parks / Wildlife Sanctuaries</td><td>Nil in 15 km radius from the project boundary</td></tr>
<tr><td>16</td><td>Seismicity</td><td>Seismic zone-II (moderate risk)</td></tr>
<tr><td>17</td><td>Defense Installations</td><td>Nil in 15 km radius</td></tr>
<tr><td>18</td><td>State Boundary</td><td>NIL</td></tr>
<tr><td>19</td><td>Water bodies</td><td><u>Water bodies:</u>
<table>
<tr><th>S. No</th><th>Name</th><th>Distance (~km)</th><th>Direction</th></tr>
<tr><td>1.</td><td>Pattuvoy Lake</td><td>Adjacent to Site</td><td>N</td></tr>
<tr><td>2.</td><td>Palavalam Lake</td><td>0.06</td><td>E</td></tr>
<tr><td>3.</td><td>Vettavalam Lake</td><td>1.94</td><td>SSW</td></tr>
<tr><td>4.</td><td>Nandan Kalva</td><td>4.11</td><td>NNW</td></tr>
<tr><td>5.</td><td>Canal Near Nallampillaipetral</td><td>4.12</td><td>NNW</td></tr>
<tr><td>6.</td><td>Nandan Kava</td><td>5.18</td><td>E</td></tr>
<tr><td>7.</td><td>Varaha Nadi</td><td>6.16</td><td>N</td></tr>
<tr><td>8.</td><td>Adukkam Lake</td><td>7.24</td><td>SSE</td></tr>
<tr><td>9.</td><td>Pillaiyarkovil Odai</td><td>8.22</td><td>SSE</td></tr>
<tr><td>10.</td><td>Chunnambu Odai</td><td>8.28</td><td>NE</td></tr>
<tr><td>11.</td><td>Nari Ar</td><td>10.68</td><td>ENE</td></tr>
<tr><td>12.</td><td>Karungalikuppam</td><td>11.37</td><td>NNW</td></tr>
<tr><td>13.</td><td>Panamalai Eri</td><td>11.50</td><td>ESE</td></tr>
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<tr><td>14.</td><td>Turinjal Ar</td><td>11.71</td><td>W</td></tr>
<tr><td>15.</td><td>Pambai Ar</td><td>12.34</td><td>SSE</td></tr>
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</td></tr>
<tr><td>20</td><td>Reserve Forests/ Protected Forests</td><td>
<u>Reserve Forests:</u>
<table>
<tr><th>S. No</th><th>Name</th><th>Distance (~km)</th><th>Direction</th></tr>
<tr><td>1.</td><td>Pakkammalai RF</td><td>0.80</td><td>E</td></tr>
<tr><td>2.</td><td>Pulanji Malai RF</td><td>2.88</td><td>SSE</td></tr>
<tr><td>3.</td><td>Gengavaram RF</td><td>3.22</td><td>SE</td></tr>
<tr><td>4.</td><td>Adukkam RF</td><td>4.90</td><td>S</td></tr>
<tr><td>5.</td><td>Turinjikadu RF</td><td>5.71</td><td>SSE</td></tr>
<tr><td>6.</td><td>Tandavasamudram RF</td><td>8.54</td><td>E</td></tr>
<tr><td>7.</td><td>Padippallam RF</td><td>9.20</td><td>ENE</td></tr>
<tr><td>8.</td><td>Odaiyanattam RF</td><td>9.47</td><td>SE</td></tr>
<tr><td>9.</td><td>Nayanur RF</td><td>11.63</td><td>SSW</td></tr>
<tr><td>10.</td><td>Muttakadu RF</td><td>13.16</td><td>NE</td></tr>
<tr><td>11.</td><td>Tippakkadu RF</td><td>13.31</td><td>W</td></tr>
<tr><td>12.</td><td>Siruvadi RF</td><td>14.46</td><td>NE</td></tr>
<tr><td>13.</td><td>Karai RF</td><td>14.61</td><td>ENE</td></tr>
<tr><td>14.</td><td>Attippakkam RF</td><td>14.82</td><td>SW</td></tr>
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</td></tr>
<tr><td>22</td><td>Nearest Villages</td><td>
<table>
<tr><th>S. No</th><th>Village Name</th><th>Distance (~km)</th><th>Direction</th><th>Population Census 2011</th></tr>
<tr><td>1.</td><td>Pattuvoy</td><td>Within the Village</td><td>NW</td><td>1,626</td></tr>
<tr><td>2.</td><td>Ramarajapettai</td><td>0.55</td><td>NNE</td><td>400</td></tr>
<tr><td>3.</td><td>Palavalam</td><td>0.57</td><td>E</td><td>1,870</td></tr>
<tr><td>4.</td><td>Tadakam</td><td>0.65</td><td>NNW</td><td>1,524</td></tr>
<tr><td>5.</td><td>Anukkamalai</td><td>1.48</td><td>W</td><td>706</td></tr>
</table>
</td></tr>
</table>

Table 2-5 Project summary

S. No	Particulars	Details
1.	Project Location	S.F.No.58/1 Pothuvai&135/1 Pazhavalam, Pothuvai&Pazhavalam village, Gingee taluk, Villupuram District, TamilNadu State.
2.	Land classification	Government Land
3.	Extent of lease area (Ha.)	40.13.05
4.	Amendment G.O.	Lease was granted vide G.O.(3D).No.66, Industries (MME.1) Department, dated:05.12.2011.
5.	Lease Period	30 years
6.	Estimated Geological Reserves (ROM) m3	Black Granite-4,79,221m3 & Quartzo feldspathic Gneiss-1,08,13,395m3
7.	Estimated Mineable Reserves (ROM) m3	Black Granite-3,37,609m3 & Quartzo feldspathic Gneiss-77,39,961m3
8.	Black Granite production per annum m3	Black Granite-1811m3& Quartzo feldspathic Gneiss-7,52,124m3

9.	Depth of Mining	30m from the surface level and the top surface of the granite body
10.	Method of Mining	Open cast semi mechanized method
11.	Water Requirement (KLD)	1.5
12.	Source of Water	Vendors&Pothuvai&Pazhavalam village Panchayats
13.	Power requirement (kVA)	60
14.	Power Backup (DG set)Kva	1* 125
15.	Fuel requirements (Lts/Day)	200
16.	Direct Manpower (Nos)	35
17.	Municipal Solid Waste Generation (kg/day)	15.75
18.	Waste Oil generation (Lts/Year)	3.0
19.	Project Cost in Lakhs	99.97
20.	EMP Cost in Lakhs	2.05

2.4 Nearest Human Settlement

The detail of nearest human settlement from the project site is provided below in**Table 2.6.**

Table 2-6 Nearest Human Settlement

S. No	Places	Distance (~km)	Direction	Population
1.	Pattuvoy	Within the Village		1,626
2.	Ramarajapettai	0.55	NNE	390
3.	Palavalam	0.57	E	1,870
4.	Tadakam	0.65	NNW	1,524
5.	Anukkamalai	1.48	W	706

2.5 Details of alternate sites considered

The mineral deposits are site specific in nature; hence question of seeking alternate site does not arise. No R&R, no Sensitive area etc., making the site suitable for the mining of Black Granite&Quartzo feldspathic Gneiss. The site meets the requirement of all critical factors that are important for success of mining in the state and could be a pre-eminent location. Thus, there is no alternative site examined.

2.6 Size or Magnitude of operation

Black Granite

The black granite quarrying operations is carryout by opencast semi mechanized method by formation of benches. Benches are proposed with a height of 6m &6m.

The Geological reserves of Black granite have been computed based on the Geological Plan &Sections up to the economically workable average depth of 30m from the surface level and the top surface of the granite body works out to 4,79,221 m^3. By applying 10% recovery the effective geological reserveswork out 4,79,221 m^3.

Mineable Reserves have been computed as 3,37,609 m^3 after deleting the reserves locked up in safety barrier and benches based on the Conceptual Plan and sections, the effective (Saleable) Mineable Reserves have been worked out as 33,761 m^3 by applying the recovery factor 10%. The annual peak production per year would be 1811 m^3 of ROM of saleable and 33,761m^3 of ROM during the first five year of Mining plan period at the rate of 10% recovery.

Total waste (Granite waste + Side Burden) to be generated during the five years of Mining Plan period will be around 87,300 m^3. These wastes are proposed to be dumped on the Southeren side of lease area with dimensions of 200m x 50 x 8.75m. The Land Use break up summarized as **Table 2.7.**

Quartzo-Feldspathic Gneiss

The Quartzo-Feldspathic Gneiss quarrying operations is carryout by opencast semi mechanized method by formation of benches. Benches are proposed with a height of 10m &10m.

The Geological Reserves of Quartzo-Feldspathic Gneiss have been computed based on the Geological Plan & Sections up to the economically workable average depth of 30m from the surface level and the top surface of the granite body works out to 1,08,13,395 m^3. By applying 100% recovery the effective geological reserveswork out 1,08,13,395 m^3.

Mineable Reserves have been computed as 77,39,961 m^3 after deleting the reserves locked up in safety barrier and benches based on the Conceptual Plan and sections, the effective (Saleable) Mineable Reserves have been worked out as 77,39,961 m^3 by applying the recovery factor 100%. The annual peak production per year would be 7,52,124 m^3 of ROM of saleable and 77,39,961m^3 of ROM during the first five year of Mining plan period at the rate of 100% recovery.

Table 2-7 Land use details of the quarry area

S.No	Land Use	Area to be required during the mining plan(Ha)	Area at the end of the quarrying period (Ha)
1	Area under Quarry	22.53.0	33.47.5
2	Waste Dump	1.00.0(including Afforesation 0.10.0)	3.61.0(including Afforesation 0.40.0)
3	Infrastructure	--	0.01.5
4	Road	--	0.08.5
5	Mine roads	--	0.20.0
6	Green Belt	--	0.19.0
7	Un utilized Area	14.81.55	2.55.55
	Total	**38.39.55**	**40.13.05**

2.7 Granite Reserves

The Geological reserves of Black granite have been computed based on the Geological Plan &Sections up to the economically workable average depth of 40m from the surface level and the top surface of the granite body works out to 4,79,221 m^3. By applying 10% recovery the effective Geological reserves works out 47,922 m^3.

Mineable Reserves have been computed as 3,37,609m^3 after deleting the reserves locked up in safety barrier and benches based on the Conceptual Plan and sections, the effective(Saleable) Mineable Reserves have been worked out as 33,760 m^3 by applying the recovery factor 10%. The annual peak production per year would be 1,811m^3 of ROM of sateable and 33,760m^3 of ROM during the first five year of Mining plan period at the rate of 10% recovery.Sectional plates are enclosed as **Annexure-III.**

During extraction of blocks, each bench will be of 6m height with vertical slope for dimensional cutting. The quantum of excavation is estimated to be 3,43,641m^3(ROM 3,37,609 m^3 + Over Burden 6,032m^3) up to an average depth of 55m during the entire lease period. The generation of total waste estimated about 87,600 m^3(Granite Rejects 81,268m^3 and Over Burden 6,032 m^3) and marketable granite blocks as 33,761m^3 during the entire life of Quarry.

The total waste (Granite waste + Side Burden) to be generated during the 5 years of Mining plan period will be around 87,600 m^3. These wastes are proposed to be dumped on the North eastern side of lease area with dimensions of 200m x 50m x 8.75m.Granite Quarry Reserves is given in **Table 2-8.** The yearwise production details are given in the**Table 2.9**. Surface Plan of the Quarry is given in **Figure 2.10.** Geological plan and cross section of the quarry is shown in **Figure 2.11.** Geological section of the quarry area is shown as **Figure 2.12.** Year wise production plan is shown as **Figure 2.13.** Land use and afforestation of the quarry is shown as **Figure 2.14.**

Table 2-8 Granite Quarry Reserves

S. No	Description	Granite (m^3)	Recovery 10% (m^3)	Granite waste 90% (m^3)
1	Geological Resource	4,79,221	47,922	4,31,299
2	Mineable Reserves	3,37,609	33,760	3,03,849

Table 2-9 Yearwise Production details

S. No	Year	ROM (m^3)	Recovery@10% (m^3)	Granite Waste @ 90 % (m^3)	Over Burden (m^3)
1	1st Year	18,108	1,811	16,297	1,291
2	2nd Year	18,049	1,805	16,244	--

3	3rdYear	18,029	1,803	16,226	1,547
4	4thYear	18,104	1,810	16,294	999
5	5thYear	18,008	1,801	16,207	2,195
Total		**90,298**	**9,030**	**81,268**	**6,032**

Estimated Life of the Quarry:

- Mineable ROM: 3,37,609 m^3
- Mineable Recoverable Reserved @10%: 33,761 m^3
- Average Prodution per Year@10%: 33,761/19 Years= 1,811 m^3
- Estimated Life of the Quarry: 33,761/1,811 m^3=19 years

2.8 Quartzo-Feldspathic Gneiss Reserves

The Geological reserves of Quartzo-Feldspathic Gneiss have been computed based on the Geological Plan &Sections up to the economically workable average depth of 40m from the surface level and the top surface of the granite body works out to 1,08,13,395 m^3. By applying 100% recovery the effective Geological reserves works out 1,08,13,395 m^3.

Mineable Reserves have been computed as 77,39,961m^3 after deleting the reserves locked up in safety barrier and benches based on the Conceptual Plan and sections, the effective(Saleable) Mineable Reserves have been worked out as 77,39,961 m^3 by applying the recovery factor 100%. The annual peak production per year would be 7,52,124m^3 of ROM of sateable and 77,39,961m^3 of ROM during the first five year of Mining plan period at the rate of 100% recovery.Sectional plates are enclosed as **Annexure-III.**

Table 2-10 Quartzo-Feldspathic Quarry Reserves

S. No	Description	Granite (m^3)	Recovery 100% (m^3)
1	Geological Resource	1,08,13,395	1,08,13,395
2	Mineable Reserves	77,39,961	77,39,961

Table 2-11 Yearwise Production details

S. No	Year	ROM (m^3)	Recovery@100% (m^3)
1	1stYear	6,52,162	6,52,162
2	2ndYear	7,41,536	7,41,536
3	3rdYear	7,25,299	7,25,299

4	4th Year	7,24,900	7,24,900
5	5th Year	7,52,124	7,52,124
	Total	**35,96,021**	**35,96,021**

Estimated Life of the Quarry:

- Mineable ROM: 77,39,961 m^3
- Mineable Recoverable Reserved @100%: 77,39,961 m^3
- Average Prodution per Year@100%: 77,39,961/10 Years= 7,52,124 m^3
- Estimated Life of the Quarry: 77,39,961/7,52,124 m^3=10 years

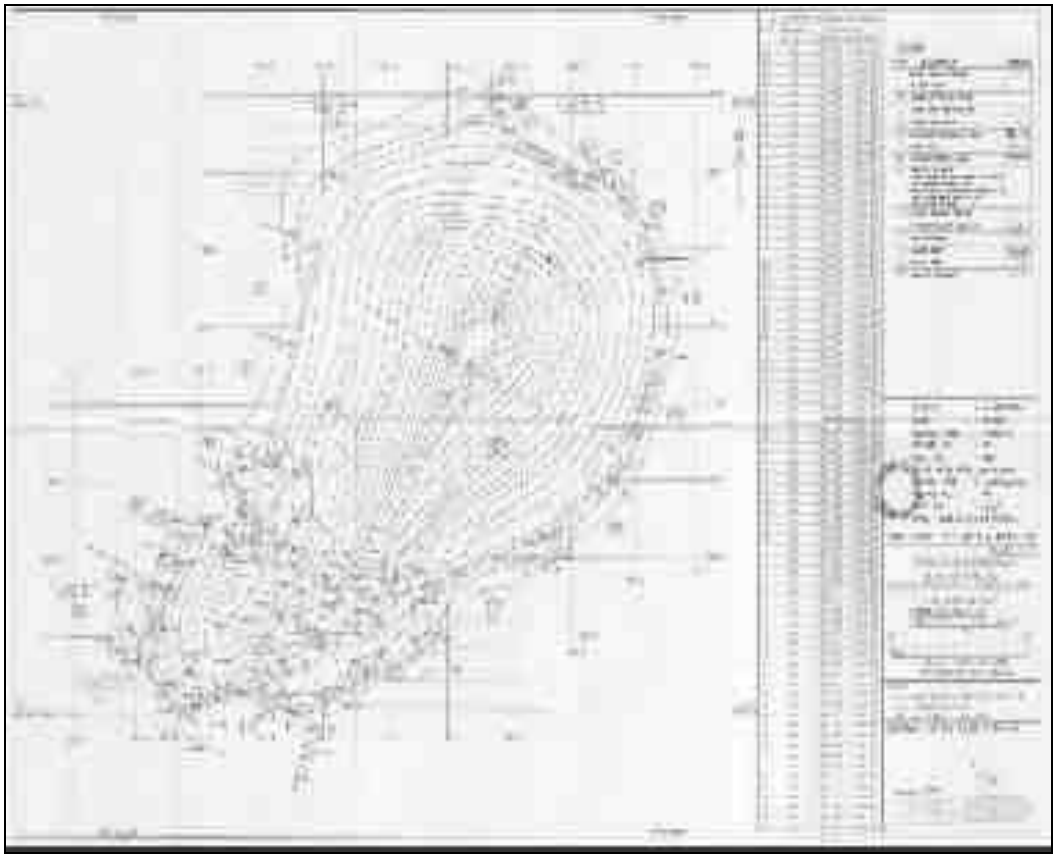


Figure 2-10 Surface Plan of the Quarry

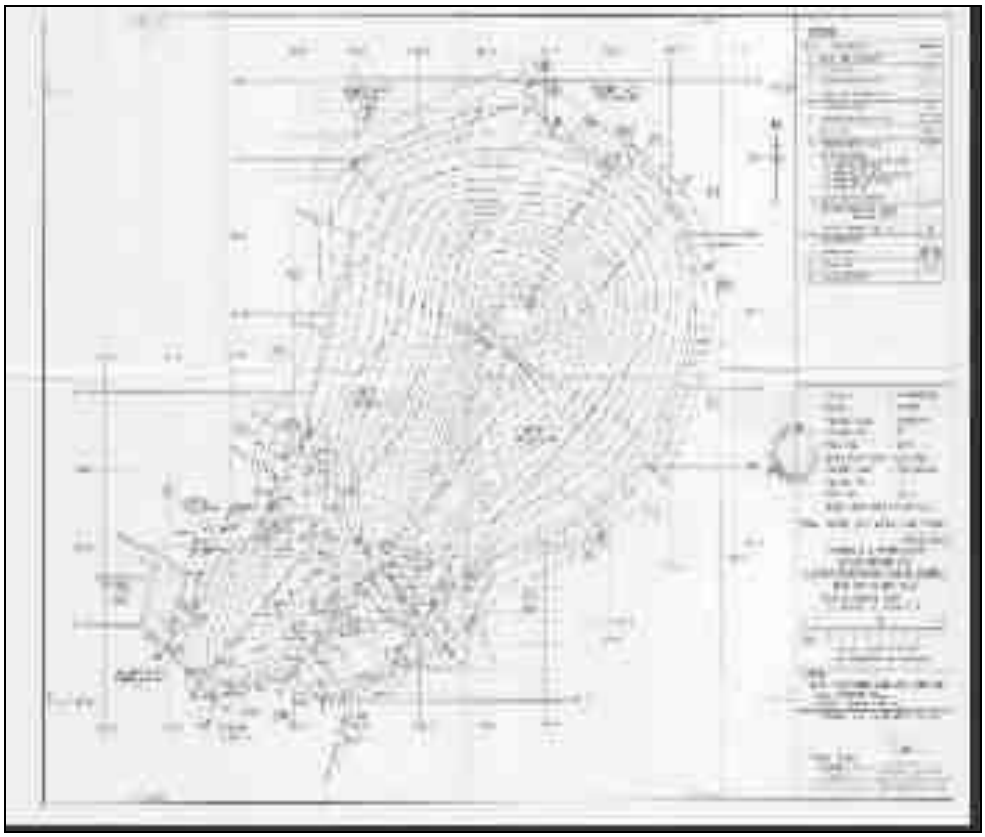


Figure 2-11 Geological plan of the quarry

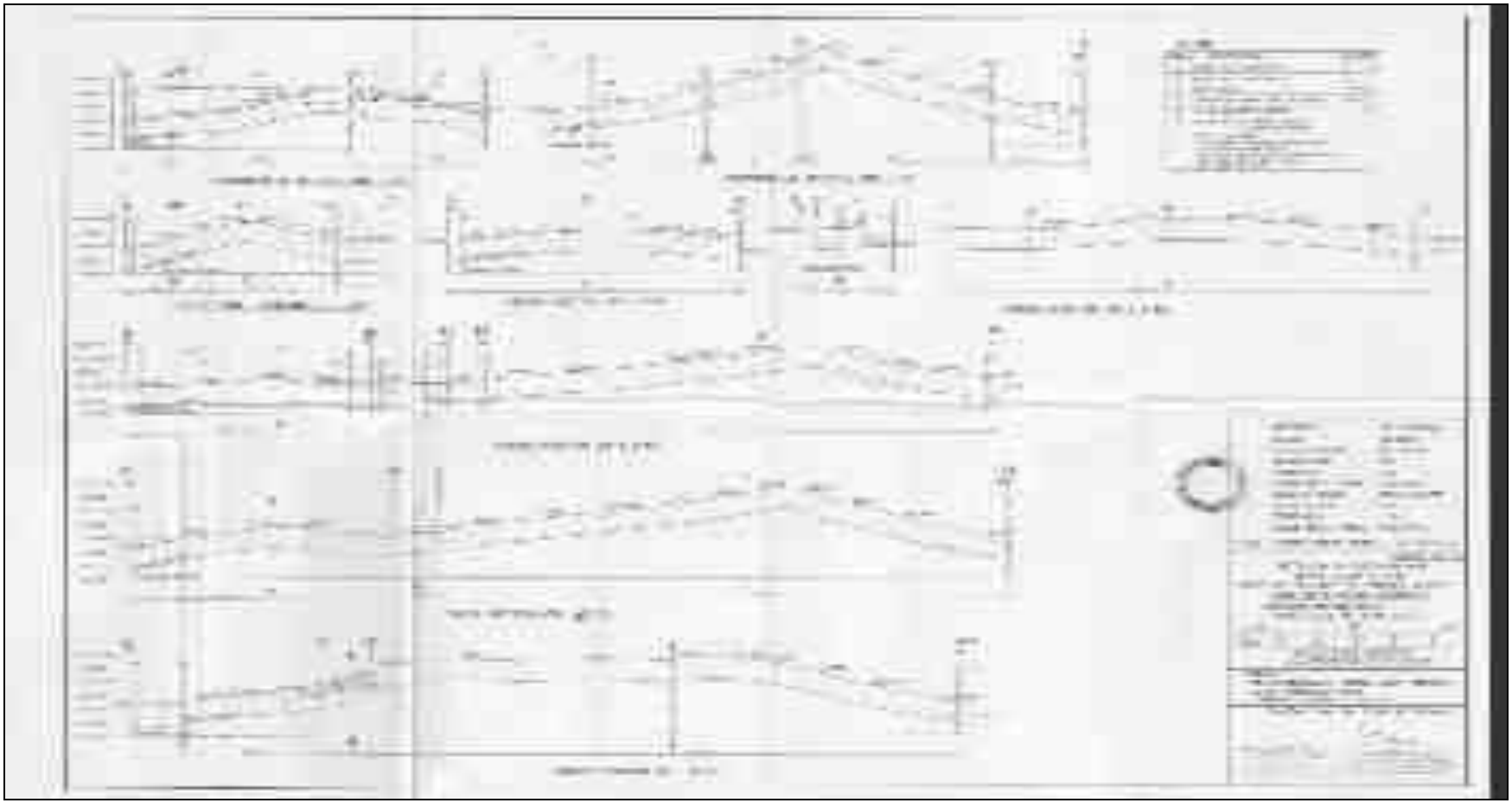


Figure 2-12 Mines Geological Sections of the lease area

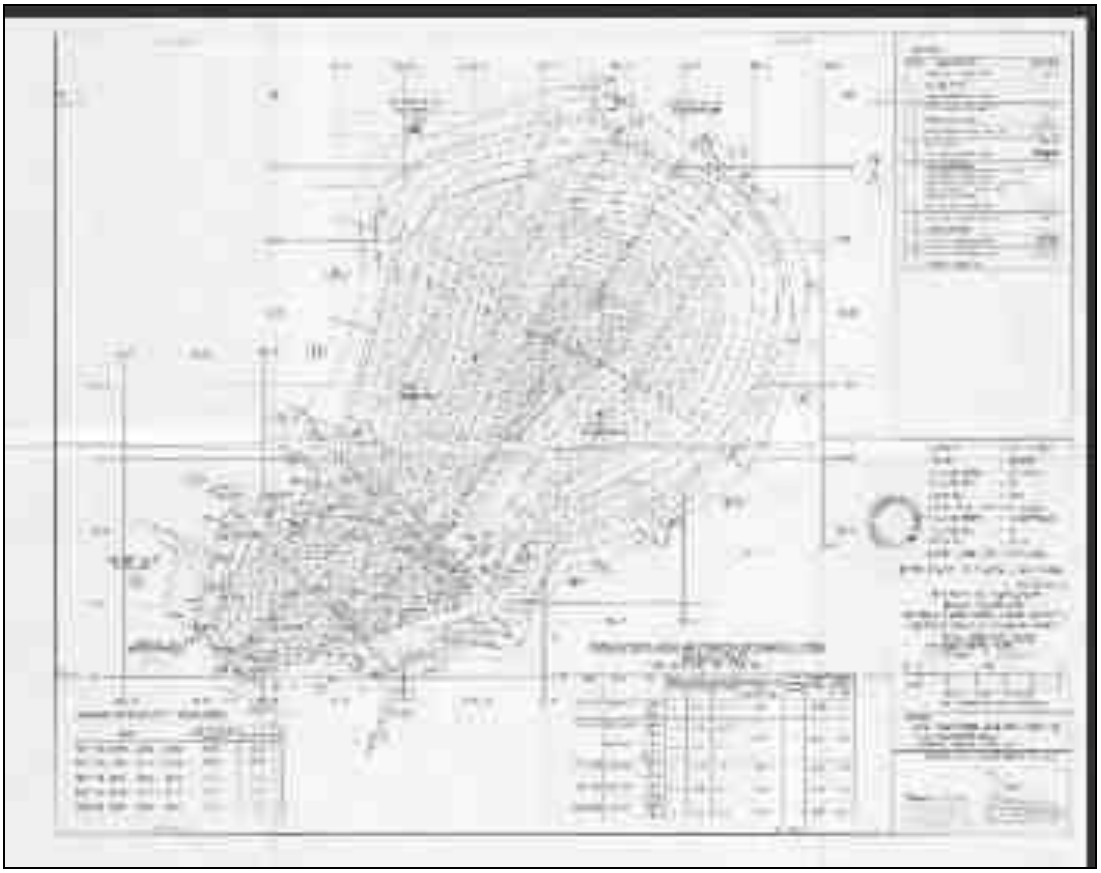


Figure 2-13 Year wise Production/Development Plan for 5 years

Figure 2-14 Land Use and Afforestation Plan

2.7.1Proposed schedule for approval and implementation

The time schedule for the completion of the proposed mining project is given in the below as,

Particulars	Time Schedule
Preparation of PFR, FORM – I and obtaining ToR	December 2022
ToR obtained	09.02.2023
Submission of DRAFT EIA/EMP	April 2023
Conduciting Public Hearing and submitting final EIA/EMP and PoD	May 2023
Presentation before SEAC and Obtaining EC	June 2023

The project will be implemented after Obtaining EC from SEIAA and CTO from PCB.

2.9 Project Cost

The project cost is summarized in **Table 2.12**.

Table 2-12 Project cost

S. No	Description of the Cost	Amount in Rs.
A.	**Fixed Cost**	
1	Land Cost	Nil. Because Govt. land
2	Labour shed	50,000/-
3	Sanitary facilities	50,000/-
4	Fencing Cost	1,25,000/-
	Total	**2,25,000/-**
B.	**Operational Cost**	
1	Jack Hammers	1,98,000/-
2	Compressor	19,82,000/-
3	Diamond wire saw	4,87,000/-
4	Diesel General	4,00,000/-
5	Excavators	6,00,000/-
6	Tippers	58,00,000/-
7	Drinking water facilities for the labours	50,000/-
8	Safety kits	50,000/-
	Total Operational Cost	**95,67,000/-**
C.	**EMP Cost**	
1	Afforestation	30,000/-
2	Water Sprinkling	50,000/-
3	Water Quality test	25,000/-
4	Air Quality test	25,000/-
5	Noise/Vibration test	25,000/-
6	CSR activities	50,000/-
	Total EMP Cost	**2,05,000/-**
	Total Cost of the Project (A+B+C)	**99,97,000/- (Say 1 Crore)**

2.10 Technology & Process Description

2.10.1 Technology

Primary step of mining of minerals is the removal of the deposits from the ground. Once the minerals / ore are removed, additional preparation process is required to isolate the valuable minerals from their waste gangue minerals. There are two basic method of mining of minerals opencast and underground mining. The choice of method depends on the geologic, hydrological, geo-technical, geographic, economic, technological, environmental, safety, Socio - political and financial considerations. Schematic Diagram of Mining Process is given in **Figure 2.16.**

Figure 2-15 Schematic Diagram of Mining Process

2.10.2 Method of mining-Open Cast Working

In accordance with the Regulation 106 (2)(a) of the Metalliferous Mines Regulations 1961, in all open cast workings where the ore body forms hard rock, the working faces and sides should be adequately benched and sloped. A bench height not exceeding 6m and a bench width not less than the height has to be maintained. The slope angle of such benches and sides should not exceed 60° from the horizontal. However, observance of these statutory provisions into in granite dimensional stone mining is seldom possible due to the field difficulties and technical reasons as below:

- Recovery of the granite mineral is to be as undamaged rectangular dimensional blocks. In the attempt to the benches and sides with the above statutory parameters haphazard blasting may be involved.
- In which case the commercial granite body may get spoiled due to generation of blasting cracks. In the exercise of forming the benches with 60° slope within the granite deposit, the portion confined within the 60° as we as its complimentary part in the extricated block will become as mineral waste while shaping into rectangular blocks.
- The granite industry needs blocks as huge as few cubic meters volume with measurements up to 3m x 2m x 2m. Production of such huge blocks with a moving bench of 6m height is not possible. Production of such huge blocks in turn increases the recovery and reduces the mineral waste during dressing. Blocks of smaller size of certain varieties of granite are not marketable now-a-days.
- Formation of too many benches with more height and the width equal to the height may lease to mineral lock up. Hence, in order to avoid granite waste and to facilitate economical and convenient

mining operations, it is proposed to obtain relaxation to the provisions of Regulation 106 (2) (a) up to a bench parameter of 6m height and 3m width with vertical faces. Such a provision for relaxation of the Regulation has been provided within the regulation 106 (2) (a). Further, it is to be noteworthy that opencast granite mining operations with the above proposed bench parameters may not be detrimental to Mines Safety, since the entire terrain is made up of hard rock, compact sheet and possess high stability on slope even at higher vertical angles.

It is proposed not to backfill the pit in as much as good quantities of reserves are underlying the pits. The stock yard for the granite blocks produced and the dressing yard where the manual dressing and shaping of the blocks are carried out are located near the working pit in order to minimize the lead from the pit to the dressing yard and stock yard. A mine office, store room, first-aid room and workers rest shelter are provided within the lease hold area.

2.11 Process Description

2.11.1 Mining

The production of Black Granite dimensional stone in this mine involves the following methods typical for granite mining in contrast to any other major mineral mining.

Splitting of rock mass of considerable volume from the parent sheet rock carefully avoiding any kind of damage in the form of cracks in the deposit by adopting the following methods.

a. Separation of two vertical ends along the width side by diamond wire cutting.
b. Separation of the horizontal(bottom) and the vertical(length side) planes by serial blasting simultaneously along the above two plans by using 32mm dia blast holes charged with mild explosives like gunpowder or detonatincord.
c. Diamond wire cutting along the horizontal as well as two sides parallel to strict and dip direction and the vertical face will be a free face is liberated by conventional serial blasting.

All the above process continued together aiming at the liberation of huge volume of the granite body from the parent sheet rock is called ‘primary cutting’.

The secondary splitting in to required size involves long hole drilling up to the bottom of the separated block and mild blasting along the required plans. The blocks split as above are separated and removed from the pit to the dressing yard by using hydraulic excavators.

Now-a-days the secondary splitting is carried out by way of splitting and overturning cushion operational procedure. The procedure is by utilizing the compressed air available at the quarry at 7 to 8 bar pressure, initially (widening) splitting up to 15 to 18cms. Next by using super imposed cushion widening up to 80cms and overturning of the blocks.

Removing the defective portions and dressing into the dimensional blocks are done manually using feather and wedges and chiseling respectively by the laborers who are skilled in this work.

The defect free rectangular shaped dimensional stones as acceptable to consumers are produced by the method described as above which is constantly supervised by experienced mining geologist.

The waste material generated during mining activity include the rock fragments of different angularity formed during the works, during the removal of naturally defective and uneconomical portions of the deposits and the working waste formed during dressing of the extricated blocks. Such waste materials are proposed to be dumped along the northern side of the lease boundary / barren area where the commercial granite occurrences are not seen / the area covered with poor quality granite deposit identified to be uneconomical due to sheared and contacted nature or the presence of closely space natural joints, etc.

2.11.2 Blasting

Black Granite

The blasting parameters in the mining of granite dimensional stones are entirely different from that of industrial minerals, since the basic purpose for the use of explosives in both the cases are entirely different. In the industrial minerals, maximum fragmentation and crushing of the ore is essential, whereas in the granite mining, the granite stones are to be extricated intact, without any damage on both the extricated part and the parent rock body.

The portion to be extricated from the parent rock body is free in all planes by adopting different methods. Only mild explosives such as detonating cord, ordinary detonators etc will be used for the production of granite blocks. The blast holes of 32mm diameter are drilled up to the bottom of the horizontal plane all along the required planes without deviations.

Conventional 32 mm dia blast holes are drilled perfectly parallel to each other at 20 to 25cm intervals without any hole deviations, all along the required plane of splitting. The holes are drilled up to a depth of few cms above the required horizontal plane. Sub grade drilling is not necessary, since the splitting will be affected up to a further distance of few cms from the drill hole on blasting. Sub grade drilling may affect the underlying granite deposit.

Explosives such as gelatin, delay detonators etc. may also be used occasionally at places further away from the granite deposit for certain development works such as forming approach roads to the working faces below ground level for forming flat surfaces to be used as dumping yard etc. The explosives required for this mine is obtained from the authorized, licensed dealer for which necessary permission will be obtained from the authority concerned. The blasting will be under the direct supervision of the statutory persons of TAMIN.

Blasting is carried out at appointed hours only with prior precaution to the local public. Now-a-days the splitting within the sheet rock is affected by diamond wire sawing, which largely reduces the use of explosives in granite mining. Many adverse effects of blasting are avoided and hence the recovery will be

substantially increased by diamond wire cutting. Hence it is proposed to deploy one wire saw machine in this mine.

Now-a-days expansion mortar [Ca (OH_2)] is used for splitting granite blocks from parent rocks and wire saw cutting is also used for that. Thus, kind of technique will minimize the blasting activities in granite mining.

Quartzo-Feldspathic Gneiss

Air and dust expected to be generated from drilling process, hauling roads, places of excavation etc, will be suppressed by periodical wetting of land by water spraying.Wet drilling and dust extractor arrangements will be provided to drilling units so as to control raise of dust from the site of drilling.

Quarrying of Quartzo-Feldspathic Gneiss will be carried out by drilling and blasting by using low explosives, and hence, noise will be very less.No where the noise level should exceed the permissible limit during the quarry working hours.

The Modified Mining plan proposed is for a small production of Quartzo-Feldspathic Gneiss without involving deep hole drilling and heavy blasting.

2.11.3 Loading & Transportation

The mode of transport of the granite blocks produced and marketed is by road of various consumer destinations and granite processing units located at different parts of the country. The blocks approved for export market are shipped through Chennai / TuticorinHarbours to various countries.

2.11.4 Exploration

A number of valuable data for economical mining of the granite stone in this area have been known.

1. Occurrence of the Black granite stone is economically viable quality and quantity has been established by geological mapping and visual examination by mining geologist experiences in granite mining which have been proved by actual mining practice.
2. The depth persistence of the granite stone is proved beyond the workable limits of depth of 40m from the surface level and the top surface of the granite body works.
3. The recovery of the saleable granite stones has been established as 5% from the visual exploration and from the data available by actual mining practices during the past mining in this area. As the sale of granite dimensional stone is in terms of volumes (cubic meter) only and not in terms of tonnage as in the case of the mining of Industrial minerals, the geological reserves, mineable reserves and quantum of waste generation etc., are given in terms of cubic meter (volume) only.

2.11.5 Storage of Explosives

The applicant will engage an authorized explosive agency to carry out the small amount of blasting as such no storage of explosives is envisaged for this proposal. The blasting will be supervised by DGMS authorized. Mines Foreman /Mines Manager certificate of competency.

2.11.6 Mine Drainage

The lease applied area is hillock 100m height with slope towards south sides. Through the area receives scanty rainfall, the ground water level is at 14m depth. The Production faces are operated at shallow depths. During the rainy seasons the surface run of water and the gorund water are collected at one point called as sump and dewatered nearby agricultural field with the help of 10HP oil engines.

Odai is passes through the site. As per the mining plan, a safety distance of 50mts shall be maintained for the odai.

2.11.7 Disposal of Waste

The Mine waste in the mine includes the over burden, side burden, rock fragments and rubbles generated as mineral rejects during production works and the country rock fragments generated during development works as approach road formation, formation of dumping yard sites etc., During the first five years of Mining Plan period, such waste material are proposed to be dumped along the Southern part of the lease area where it comprises of country rock terrain.

2.11.8 Top Soil Management

Topsoil will be properly stacked at earmarked dump site with adequate measures. It will be used for growing plants along the fringes of the site roads and reclamation of external dump and backfilled area. The topsoil stockpiles will be low height and will be grassed to retain fertility. Besides these topsoil stacks there will be temporary stacks near the excavation area and area to be reclaimed which will be made use of concurrent lying without bringing the topsoil to the soil stack near the OB dump.

2.11.9 Stabilization of Dump

As the waste generation in the mine includes hard rock fragments of considerable size and irregular shape with varying angularity, the waste dump will be stable on its own even at higher slopes of the sides. However, suitable variety of soil will be identified and brought from outside and used for increasing the stability of the sides of the waste dumps and also for planting trees over the dumps in a phased manner.

2.12 Requirements

2.12.1 Land Requirement and Land Use Planning

Quarry Land details are shown in **Table 2-13** and Land use pattern is provided in **Table 2-14.**

Table 2-13 Quarry Land details

District & State	Taluk	Village	S.F. No	Area (Ha)	Land Classification
Villupuram, Tamil Nadu	Gingee	Pothuvai & Pazhavalam	58/1&135/1	40.13.05	Government land

Table 2-14 Land Use Pattern of the lease area

S.No	Land Use	Area to be required during the mining plan(Ha)	Area at the end of the quarrying period (Ha)
1	Area under Quarry	22.53.0	33.47.5
2	Waste Dump	1.00.0	3.61.0
3	Infrastructure	--	0.01.5
4	Road	--	0.08.5
5	Mine approach road	--	0.20.0
6	Green Belt	--	0.19.0
7	Un utilized Area	14.81.55	2.55.55
Total		**38.39.55**	**40.13.05**

2.12.2 Water Requirement

The total water requirement is 1.5 KLD. The total water requirement will be met throughprivate tankers. The granite quarry will not produce toxic effluent in the form of solid, liquid or gas. No wastewater will be generated by quarry operation except domestic sewage. Domestic sewage will be disposed to septic tank followed by soak pit. Septic tank will be cleaned periodically.

Table 2-15 Water requirement breakup

S. No	Description	Water Requirement(KLD)
1	Drinking &Domestic purpose	0.5
2	Wire Saw Cutting	0.3
3	Dust suppression	0.3
4	Green Belt	0.4
	Total	**1.5**

2.12.3 Power & Fuel Requirement

The Power and Fuel requirement details are given in **Table 2-16.**

Table 2-16 Power Requirements

S. No	Description	Power Required
1	Power requirement (kVA)	60
2	Power Backup (DG set)	1*125kVA
3	Fuel requirements (Lts/Day)	200

2.12.4 List of Equipments

1 No. of Excavator having 300LC capacity Tata Hitachi will be used for excavation and 1 nos of 25 tones capacity Ashok Leyland Dumpers will be used during loading. The list of Equipments is given in **Table 2-17.**

Table 2-17 Lists of Machineries

S. No	Machinery type	Numbers	Capacity	Motive power
1	Jack Hammar (32mm dia.)	6	1.2 to 6m	Compressed air

2	Compressor	2	400 psi	Diesel Drive
3	Tractor Mounted air Compressor	1	-	Diesel Drive
4	Diamond wire saw	1	30m^3 /day	Diesel
5	Diesel Generator	1	125 kVA	Diesel
6	Rock Breaker	1	4"(330LC)	Diesel

2.12.5 Man power Requirement

Manpower details are given in **Table 2-18.**

Table 2-18 Manpower Details

S.No	Details	Numbers
A	**Technical/Mining Personnel**	
1	Geologist/Agent (M.sc Qualified)	1
2	Mine Manager (Holder of Manager Certificate of Competency under MMR, 1961	1
3	Mining Mate cum Blaster	1
4	Machinery operator	6
5	Diesel Mechanic	1
B	**Workers**	
1	Skilled	1
2	Semi- Skilled	9
3	Un-skilled	10
	Total	**30**
	Indirect Manpower	**20**

2.12.6 Solid Waste Management

The municipal solid waste generation and management details are given in **Table 2-19.**

Table 2-19 Municipal Solid Waste generation & Management

S. No	Type	Quantity Kg/day	Disposal method
1	Organic	8.1	Municipal bin including food waste
2	Inorganic	5.4	TNPCB authorized recyclers
	Total	**13.5**	

As per CPHEEO guidelines: MSW per capita/day =0.45

2.12.7 Hazardous waste Management

The type of hazardous waste and the quantity generated are detailed in **Table 2-20.**

Table 2-20 Hazardous Waste Management

Waste Category No	Description	Quantity (L/Year)	Mode of Disposal

5.1	Waste Oil	3.0	Will be Collected in leak proof containers and disposed to TNPCB Authorized Agencies for Reprocessing/Recycling

2.13 Infrastructure facilities

Sanitation facility, office room and rest room facilities will be provided.

2.14 Resource optimization/recycling and reuse envisaged in the project

No optimization/recycling and reuse envisaged in the black granite quarry.

2.15 Availability of water its source, Energy/power requirement and source

This quarry project does not require huge water and No electricity requirement is proposed for the project. The operations will be carried out in day time only.

2.16 Schematic Representations of the Feasibility Drawing which Give Information Important for EIA Purpose

A schematic representation of the overall feasibility and environmental assessment process is shown in **Figure 2-16**.The EIA process is composed of the following stages:

- Study of project information
- Screening & Scoping
- Environmental Pre-Feasibility study & application for approval of TOR
- Collection of detailed project management plan/report
- Baseline ata collection
- Impact identification, Prediction & Evaluation
- Mitigation measures & delineation of EMP
- Risk Assessment and Safety & Disaster Management plan
- Review & finalization of EIA report based on the TOR requirements.
- Submission of EIA report for implementation of mitigation measures & EMP as well as necessary clearances from relevant Authority.

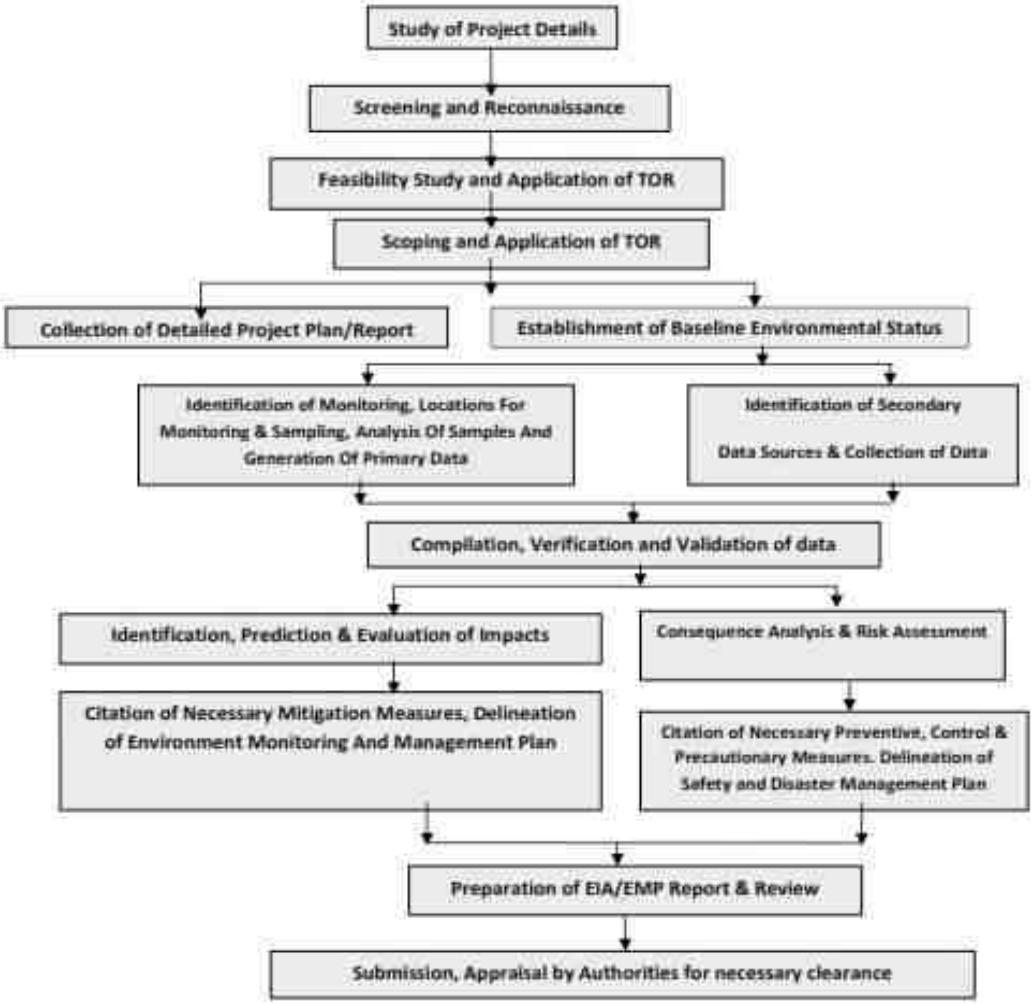


Figure 2-16 Feasibility & Environmental Assessment Process

2.17 Description of mitigation measures incorporated into the project to meet the environmental standards

From an environmental perspective, this phase is of paramount significance due to its potential to invoke long-term impacts. The adverse effects that are likely to occur during operational phase of the project are: Air Pollution (gaseous emissions), Effluent/Sewage generation, Noise generation, Solid waste generation etc.

2.17.1 Land Environment

The land use of the existing area is already for mining purpose. Hence there will be no change in land use pattern.

i. Discharges on Land-Impact

Domestic:

Domestic sewage will be disposed in to septic tank followed by soak pit.

Mitigation Measures

- The mine waste in the mine includes the topsoil/rock fragments and rubbles generated as mineral rejects during production works and the country rock fragments generated during development works as approach road formation or dumping yard/sites etc.
- The dumps may also be source of airpollution due to wind erosion incase they are not properly rehabilitated. Topsoil and overburden will be generated from the mining project which will be stacked separately at the designated areas.

ii. Impacts- Soil Contamination

Potential impacts on land environment are envisaged due to hazardous and non-hazardous wastes generated due to various operations in the project site like municipal waste from domestic use and waste diesel oil from quarry machineries. Poor management of such materials/wastes from the operations is a potential risk of soil contamination.

Soil – Mitigation Measures

Good housekeeping and best practices of waste handling shall be adopted to eliminate/minimize the risks of soil contamination. The wastes generated will be stored in temporary storage facility and transferred to nearby municipal disposal bins. Waste oil generated from quarry machineries and the same is disposed through TNPCB Authorized dealers.

2.17.2 AirEnvironment

Mining operations contribute towards air pollution in two ways: addition of gaseous pollutants to the atmosphere and the dust particles. The gaseous pollutants include NO_x, SO_2 and Hydrocarbons. The sources of pollutants from the mining activity include:

- Operation of Heavy Earth Moving Machinery (HEMM) which mostly run on diesel
- Loading /unloading operations
- Transportation of mineral/overburden in dumpers
- Drilling and Blasting operations.

2.17.3 Sources of Air Pollution

2.17.3.1 Point Source/Single Source

These are stationary sources, which emit air pollutants into the atmosphere from a certain fixed point. In the proposed quarry, the following sources or activities from the point sources, which emit Suspended Particulate Matter (SPM), SO_2 & NO_x.

2.17.3.2 Drilling

Drilling is an important activity of mining process. The secondary splitting in to required size involves drilling up to the bottom of the separated block. Air pollution in the form of SPM is envisaged from this activity.

2.17.3.3 Loading

In the proposed project, the loading of side burden and granite rejects is proposed by Hydraulic excavators. This activity is likely to contribute air pollution in the form of SPM (dust) during discharge of material from bucket and gaseous pollutants like SO_2, NO_x and Hydrocarbons due to combustion of fuel (diesel) in the loading machinery.

2.17.3.4 Unloading

The generated rejects and granite at mine face will be transported by dumpers and unloaded at the designated locations. During unloading operation of both the material, air pollution in the form of SPM (dust) is envisaged due to discharge of material from the dumper and gaseous pollutants like SO_2, NO_x and Hydrocarbons due to consumption of fuel (diesel) by dumper while unloading the material.

2.17.3.5 Line sources

These are normally mobile sources, which emit atmospheric pollutants in the area through which they pass.

2.17.3.6 Transportation

The generated rejects and granite from site will be transported by haul road. Transportation also includes movement of service vehicles also in the mine lease area. The traffic on the haul roads is likely to contribute towards increase in dust and gaseous pollutants concentration in the area. However, this is more of a localized phenomenon within the mining areas that have limited human exposure.

2.17.3.7 Area sources/multiple sources

These constitute pollution from various sources and activities situated in the mine lease area. The total mine area with all its mining activities constitutes the area source. These include all the mining activities, operations of equipment/machinery (HEMM), wind erosion from active mine pit, and waste dump locations and haul road which contribute to the atmospheric pollution from the various units/activities.

2.17.3.8 Instantaneous Sources

The instantaneous sources consist of air pollution due to sudden/instantaneous activities like blasting in the mine area. Blasting process involves dislodgement of big blocks of hard strata/mineral from the mines. This operation generates maximum dust, which results in the increase of SPM concentration. It also contributes to emissions of certain gases (Oxides of Nitrogen and Ammonia) due to the use of explosives.

The size of the dust particles emitted into the atmosphere plays a major role in deciding the distance to which they may be transported. Particles of larger size fall fairly rapidly and closer to their source, because of

gravitational settling. However, the aerosols because of their small size may be held in suspension for years in the atmosphere and may be transported on a global scale. Eventually, these smaller particles are collected in raindrops and fall on earth. The composition of these particles largely depends on the composition of the mineral being processed.

Mitigation Measures

- The increment in the fugitive emissions will be mainly due to transportation activity. Therefore emissions due to mineral handling during mining operation are not much and restricted to the lease area only.
- Proper mitigation measures are practiced during mining activities to control air pollution load below the prescribed limits are as follows:
- Watering of haul roads and other roads at regular intervals
- Spraying of water on permanent transport roads at required frequencies.
- Provision of dust filter / mask to workers working at highly dust prone and affected areas.
- Provision of green belt by vegetation for trapping dust.
- Greenbelt development along the haul roads, dumps and along the boundaries of the lease area.
- Utmost care will be taken to prevent spillage of sand and stone from the trucks.
- Covered tarpaulin for transport of materials.

2.17.4 Noise & Vibration environment

The sound pressure level is generated by noise sources decrease with increase in distance from the source due to wave divergence. The main sources of noise in the mine are as follows:

- Transportation vehicles
- Loading & unloading of minerals.
- Drilling and Blasting

2.17.4.1 Noise Levels

Heavy Earth Moving Machineries (HEMM) is deployed in mining operations. The noise levels of the major equipment are in the range of 88 to 90 dB (A). The noise levels are localized within the mining areas and have human exposure. Occupational hazard is envisaged if proper personal protective equipment is not provided to operator.

2.17.4.2 Vibration

The vibration due to blasting can cause damage to the nearby structures if appropriate technology and control measures are not adopted in the blasting operation. Fly rock is another possible damage causing outcome of blasting. There are many factors which influence fly rock during blasting. Most important of these factors are long explosive column with little stemming column, improper burden, loose material or pebbles near the holes and long water column in the hole.

By adopting controlled blasting, the problems will be greatly minimized and the impacts will also be minimized by choosing proper detonating system, optimizing total charge and charge/delay.

Ground vibration, fly rock, air blast, noise, dust and fumes are the deleterious effects of blasting on environment. The explosive energy sets up a seismic wave in the ground, which can cause significant damage to structures and disturbance to human occupants. The impact will be minimized by choosing proper detonating system and optimizing total charge and charge/delay and by regular monitoring of magnitude of ground vibrations and air blast.

Impact

A noise generation source during operation phase is classified into two categories:

- Stationary sources due to operation of heavy duty machineries at the project site like Compressors, DG sets, Quarry vehicles and drilling machineries etc.

Mitigation Measures

- The major noise generating equipments like Compressors, DG sets, Exacavator, &Tippers etc, will be enclosed in an acoustic enclosure designed for an insertion loss of 25 dB (A) and silencers to other equipment etc.
- Drilling will be carried out with the help of sharp drill bits which will help in reducing noise.
- Secondary blasting will be totally avoided.
- Controlled blasting with proper spacing, burden, stemming and optimum charge/delay will be maintained.
- The blasting will be carried out during favorable atmospheric condition and less human activity timings i.e. during lunch interval.
- Proper maintenance, oiling and greasing of machines at regular intervals will be done to reduce generation of noise.
- Greenbelt and plantation will be developed around the mining activity area and long haul roads. The plantation minimizes propagation of noise.
- Periodical monitoring of noise will be done.
- The occupational noise exposure to the workers in the form of eight hourly times weighted average will be maintained well within the prescribed Occupational Safety and Health Administration (OSHA) standard limits.
- Adequate PPE will be provided to the staff exposing to noise risks.
- Acoustic silencers will be provided in equipment wherever necessary.
- Use of personal protective equipments/devices such as ear-muffs, ear plugs etc. will be strictly enforced for the workers engaged in high noise areas.

- Periodic maintenance of the equipment to be used in the developmental works will be carried out. Worn out parts will be replaced and rotating parts will be lubricated to minimize noise emissions.
- Implementation of greenbelt for noise attenuation will be undertaken.
- Ambient noise levels will be monitored at regular intervals during operational phase of the project.
- Low vibration generating machines/equipment will be selected to meet international standards and foundations will be so designed to minimize vibrations and secured properly.
- Vibration generating sources and their platforms should be maintained properly to minimize vibrations and related impacts.
- Vibration dampers will be provided around the source of generation.
- Transportation Management Plan will be prepared and the transportation of materials will be planned in line with the same.

2.17.5 Water Environment

Impact on Existing Water Resources

The total water requirement for quarry is 1.5 KLD. The total water requirement is met from Vendors&Pothuvai and Pazhavalam village Panchayats; Domestic sewage will be disposed into Septic tank & no toxic/other effluent generation. Hence the impact due to the project is very minimal.

2.17.5.1 Impacts on Surface Water Bodies

The surface water and groundwater are the life line of the villages. All the ponds in the area are working as recharge sites for the under lying groundwater and hence the surface water and ground water systems are acting like a single unit and therefore cannot be seen in Isolation.

Any contamination in surface drainage due to operation of project could collapse the system and will have serious impacts to the water resources especially the availability of potable water in the PIA area. The impacts will be high in the core area especially the 10 km radius area. Therefore, apparent to that there will is negligible impact of mining on the surface water regime.

2.17.5.2 Impact on Ground Water

There will not be any ground water withdrawal, as the total water requirement will be met by Vendors & Pothuvai and Pazhavalam village Panchayats. As, the mine lease area is a Hilly area, elevated at 156 - 291m AMSL height from the ground level. Hence, there will not be any groundwater level intersect as the planned depth of mining is 30m.

Mitigation Measures

The following measures are proposed as a part of development to improve the ground water scenario and also to ensure that ground water is not contaminated. Strategic plans such as implementing the following structures for rainwater harvesting and groundwater recharging purposes in project site will be adhered.

- Rainwater storage ponds/tanks
- Storage cum recharge ponds
- Monitoring of water quality and groundwater level variations in the project site.

2.17.6 Biological Environment

Impact on migratory paths for wildlife and forest blocks

There are no identified migratory paths for major and minor wildlife in the project site and the study area. The identified fauna which are observed at the project site and in the study, area are local migrants only. Therefore, the proposed project operations are not likely to have any adverse impact on the paths for avid-fauna.

Mitigation Measures

- Discharge of wastes into the water bodies during the quarry operation phase would not be allowed.
- Awareness will be given to workers about the importance and conservation of terrestrial ecology and biodiversity.

2.17.7 Solid Waste Management

2.17.7.1 Impact due to Solid Waste Generation

During quarry operations, Municipal solid waste and waste oil are likely to be generated which can be broadly categorized as Hazardous Waste and Non-hazardous Waste. Further, the generated solid waste generation may include Biodegradable, Recyclable and Inert compounds. The details of solid waste generation and its management proposed are discussed in **Chapter 2, Section 2.11.6 & 2.11.7.** If the solid waste generated is not properly managed and disposed in unauthorized manner, it will impact on soil quality, groundwater and air quality.

2.17.7.2 Solid Waste Management

Strict guidelines will be put in place in order to manage the solid waste generation during the operational phase of the development. The main goals of the guidelines will be to ensure adopting recycling techniques and encouraging sorting of solid waste at source into organic and inorganic wastes. Waste management is given in **Figure 2-17.**

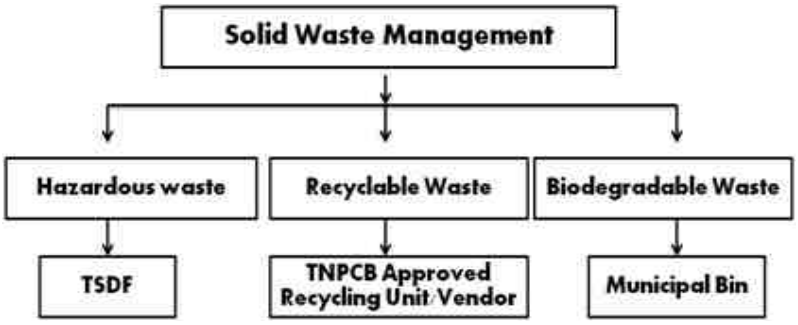


Figure 2-17 Waste Management Concepts

2.17.8 Afforestation

The main aim of the plantation of the mined out areas is to stabilize the area to protect it from rain, wind erosion, improve the aesthetics and support the re-creation of bio-diversity as well as to prevent air pollution & noise pollution. Afforestation will be taken up along the lease area.

During Mining plan period 30 plants per year is proposed to be planted for complying Afforestation program with the arrived survival rate of 50% within the safety distance along the 1000m^2 portion of the lease area in a phase manner. Native species will be planted in phased manner as given in table below**Table 2-21**.

Table 2-21Afforestation Plan details

Year	No. of trees proposed to be planted	Name of the species	Area(M3)	Survival rate expected	No. of trees expected to be grown
1st Year	30	Neem/Pungam	200	50%	15
2nd Year	30	Neem/Pungam	200	50%	15
3rd Year	30	Neem/Pungam	200	50%	15
4th Year	30	Neem/Pungam	200	50%	15
5th Year	30	Neem/Pungam	200	50%	15

2.17.9 Assessment of New and untested technology for the risk of technological failure

The project is a fresh granite quarry. The technology used for mining is made by TAMIN in house there would not be any changes in the Mining. The mining technology is tried & tested method, and therefore there is no risk of technological failure. In addition to this the TAMIN is being processed to take care of any technological failures.

3 DESCRIPTION OF ENVIRONMENT

This chapter depicts the establishment of baseline for valued environmental components, as identified in and around the proposed project of Black Granite and Granitic Gneiss quarry over an extent of 40.13.05Ha in S.F.58/1 (Pothuvai) and 135/1 (Pazhavalam) at Pothuvai & Pazhavalam Village, GingeeTaluk, Villupuram District, Tamil Nadu. The primary baseline data monitored covered three (3) months i.e., from **mid of January 2023 to mid of April 2023,** and secondary data was collected from government and semi-government organizations published data. The primary baseline data has been generated by M/s. Hubert Enviro Care Systems (P) ltd, Chennai, NABL accredited MoEF&CC approved environmental testing laboratory for the following terrestrial environmental

3.1 Study area and Period

A 10 km radial distance with the proposed project site as the epicentre has been identified as the General study area for assessing the baseline environmental status. The core study area is the project area and its immediate surroundings to the tune of 1.0 Km radius from the boundary. Further the Project Impact/Influence Area (PIA) is 10Km from the boundary of the project site which covers parts of Thiruvottiyur Taluk, Tiruvallur district of Tamil Nadu State.The primary baseline data monitored covered three (3) months i.e., from **mid of January 2023 to mid of April 2023**

3.2 Description of the Study Area, components & Methodologies

As described in Chapter 1, the proposed project is Black Granite and Granitic Gneiss quarry over an extent of 40.13.05Ha in S.F.58/1 (Pothuvai) and 135/1 (Pazhavalam) at Pothuvai & Pazhavalam Village, GingeeTaluk, Villupuram District, Tamil Nadu. Andampallam Railway Station is located approximately at a distance of 11.42 km towards South West and Andampallam to Tandarai Railway Line is located approximately at a distance of 11.33 km towards WSW from the project boundary. Vellore to Thoothukudi Highway is located towards SW at a distance of ~3.56 km and SH4A (Chetpet - Sanipundi) is located towards North at a distance of 7.30 km from the project boundary. An overall idea of the study area with reference to the physical conditions are presented for better understanding in the following sections before proceeding into the section on the prevailing environmental conditions of the study area. The map showing the satellite image of the study area is given in **Figure 3-1** and Topo Map of the study area is given in **Figure 3-2**.

- **Meteorology:** Temperature, Relative Humidity, Rainfall, Wind Speed & Direction- **Refer Section-3.5**
- **Ambient Air Quality:** Particulate matter <10-micron size (PM_{10}), Particulate matter <2.5-micron size ($PM_{2.5}$), Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Carbon Monoxide (CO), Lead (Pb), Ozone (O_3), Benzene (C_6H_6), Benzo (a) pyrene ($C_{20}H_{12}$), Arsenic (As), Nickel (Ni), Ammonia (NH_3),TVOC,Methane Hydrocarbon, Non-Methane Hydrocarbon and Vanadium **Refer Section- 3.6.**

- **Ambient Noise Levels:** Day equivalent noise levels, Night equivalent noise levels - **Refer Section- 3.7**
- **Water Quality:** Ground Water Quality, Surface Water Quality- **Refer Section- 3.9**
- **Soil Quality- Refer Section- 3.10**
- **Biological Environment - Refer Section- 3.11**
- **Socio Economic Status- Refer Section- 3.12**

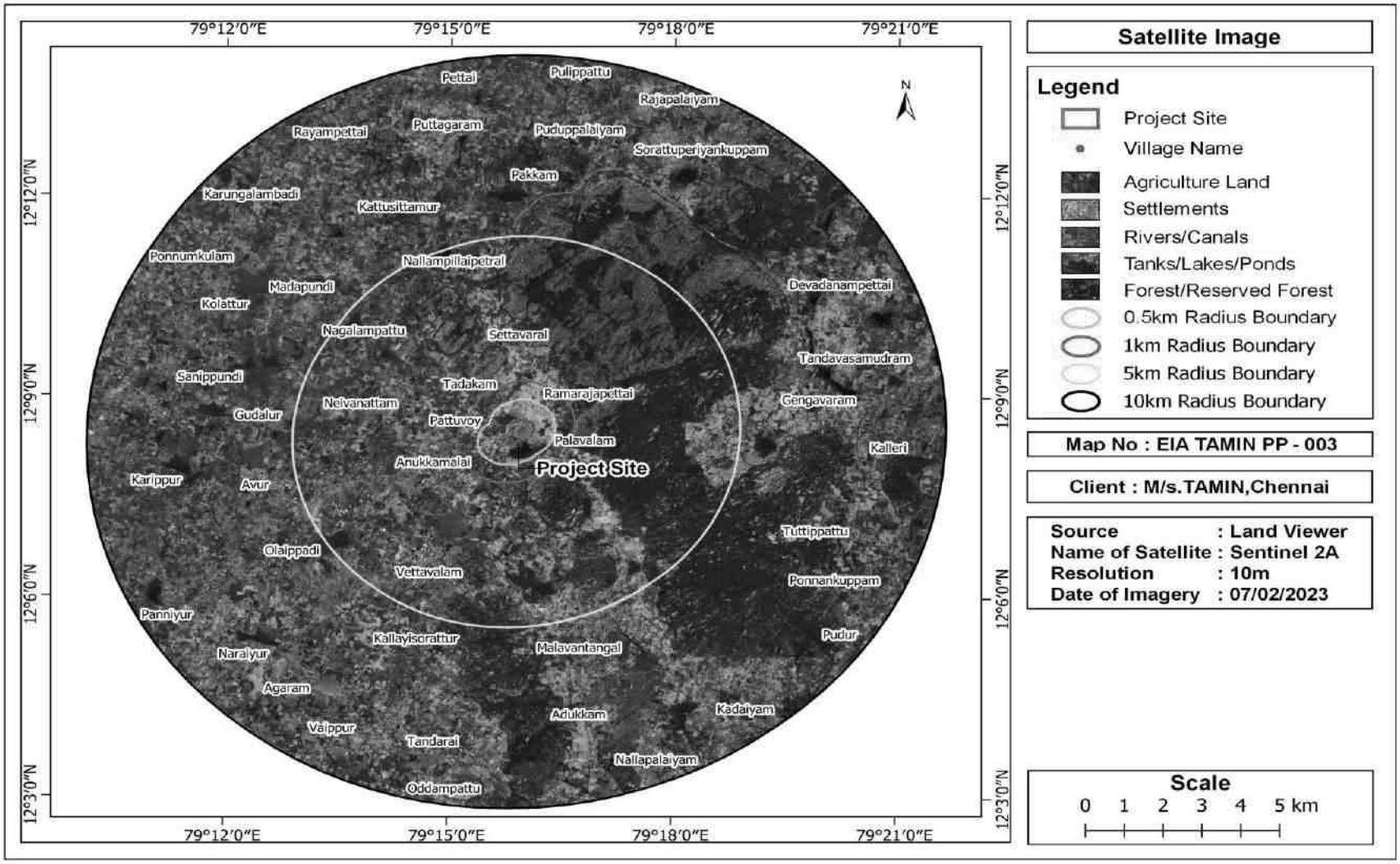


Figure 3-1 Map showing the Satellite Image of the study area of Project

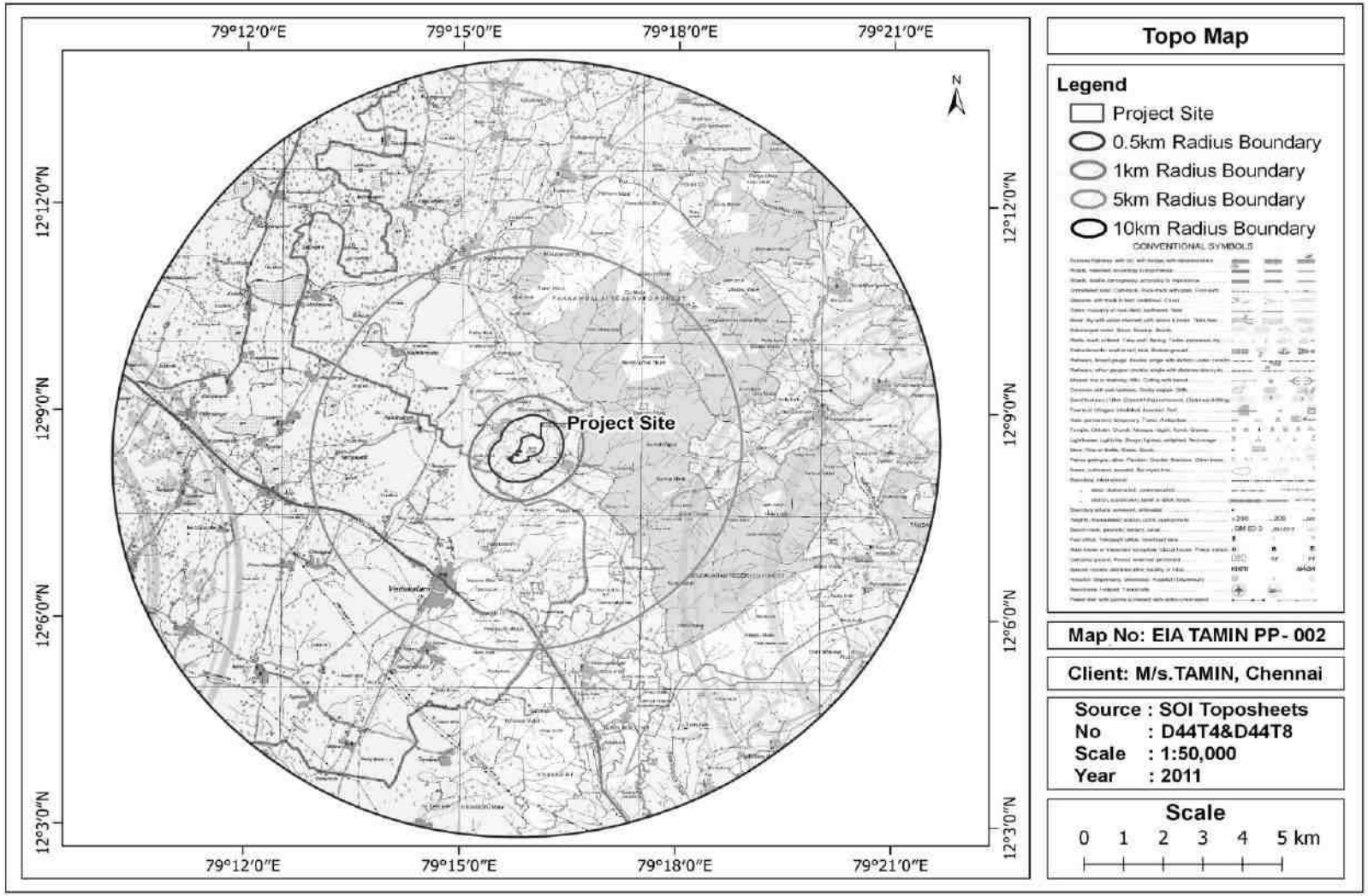


Figure 3-2 Topo Map of Study area

3.3 Environmentally/Ecologically Sensitive areas

This section details with the environmentally sensitive areas present within the project site and surrounding environs. It included national parks, state forest, essential habitats etc. The environmental sensitive areas covering an aerial distance of 15 km from the project boundary is given in **Table 3-1**and **Figure 3-3.**

Table 3-1 Environmentally Sensitive Areas within 15km from Project Boundary

S.No	Areas	Distance & Direction from project boundary			
1	List of Monuments	**S.No**	**Monuments**	**Distance (~km)**	**Direction**
		1.	Talagiriswara Temple and Cave containing an image of Durga and Pallava inscriptions togrther with adjacent land	12.65	ESE
2	List of Waterbodies &Reserve Forest	**S.No**	**Water bodies**	**Distance (~km)**	**Direction**
		1.	Pattuvoy Lake	Adjacent to Site	N
		2.	Palavalam Lake	0.06	E
		3.	Vettavalam Lake	1.94	SSW
		4.	Nandan Kalva	4.11	NNW
		5.	Canal Near Nallampillaipetral	4.12	NNW
		6.	Nandan Kava	5.18	E
		7.	Varaha Nadi	6.16	N
		8.	Adukkam Lake	7.24	SSE
		9.	Pillaiyarkovil Odai	8.22	SSE
		10.	Chunnambu Odai	8.28	NE
		11.	Nari Ar	10.68	ENE
		12.	Karungalikuppam	11.37	NNW
		13.	Panamalai Eri	11.50	ESE
		14.	Turinjal Ar	11.71	W
		15.	Pambai Ar	12.34	SSE
		Reserved Forest			
		1.	Pakkammalai RF	0.80	E
		2.	Pulanji Malai RF	2.88	SSE
		3.	Gengavaram RF	3.22	SE
		4.	Adukkam RF	4.90	S
		5.	Turinjikadu RF	5.71	SSE
		6.	Tandavasamudram RF	8.54	E
		7.	Padippallam RF	9.20	ENE
		8.	Odaiyanattam RF	9.47	SE
		9.	Nayanur RF	11.63	SSW
		10.	Muttakadu RF	13.16	NE
		11.	Tippakkadu RF	13.31	W
		12.	Siruvadi RF	14.46	NE
		13.	Karai RF	14.61	ENE
		14.	Attippakkam RF	14.82	SW
4	State, National boundaries	Nil			

5	Nearest Highway	

S. No	Description	Distance (~km)	Direction
1	Pothuvoy-Palavalam Road	(Road passing through site)	
2	NH-38 (Vellore - Thoothukudi)	3.56	SW
3	SH-4A (Chepet - Sanipundi)	7.30	WNW

6	Nearest City	

S. No	Description	Distance (~km)	Direction	Population
1	Tiruvannamalai	21	WNW	~1,45,278
2	Gingee	19	NE	~27,045

7	Nearest Villages	

S.No	Villages	Distance (~km)	Direction
1.	Pattuvoy	0.36	NW
2.	Ramarajapettai	0.51	NNE
3.	Palavalam	0.52	E
4.	Tadakam	0.55	NNW
5.	Anukkamalai	1.48	W

8	Nearest Port and Airport	

S.No	Villages	Distance (~km)	Direction
1.	Puducherry Airport	61.33	ESE
2.	Chennai International Airport	132.87	NE
3.	Cuddalore Port	72.78	SE

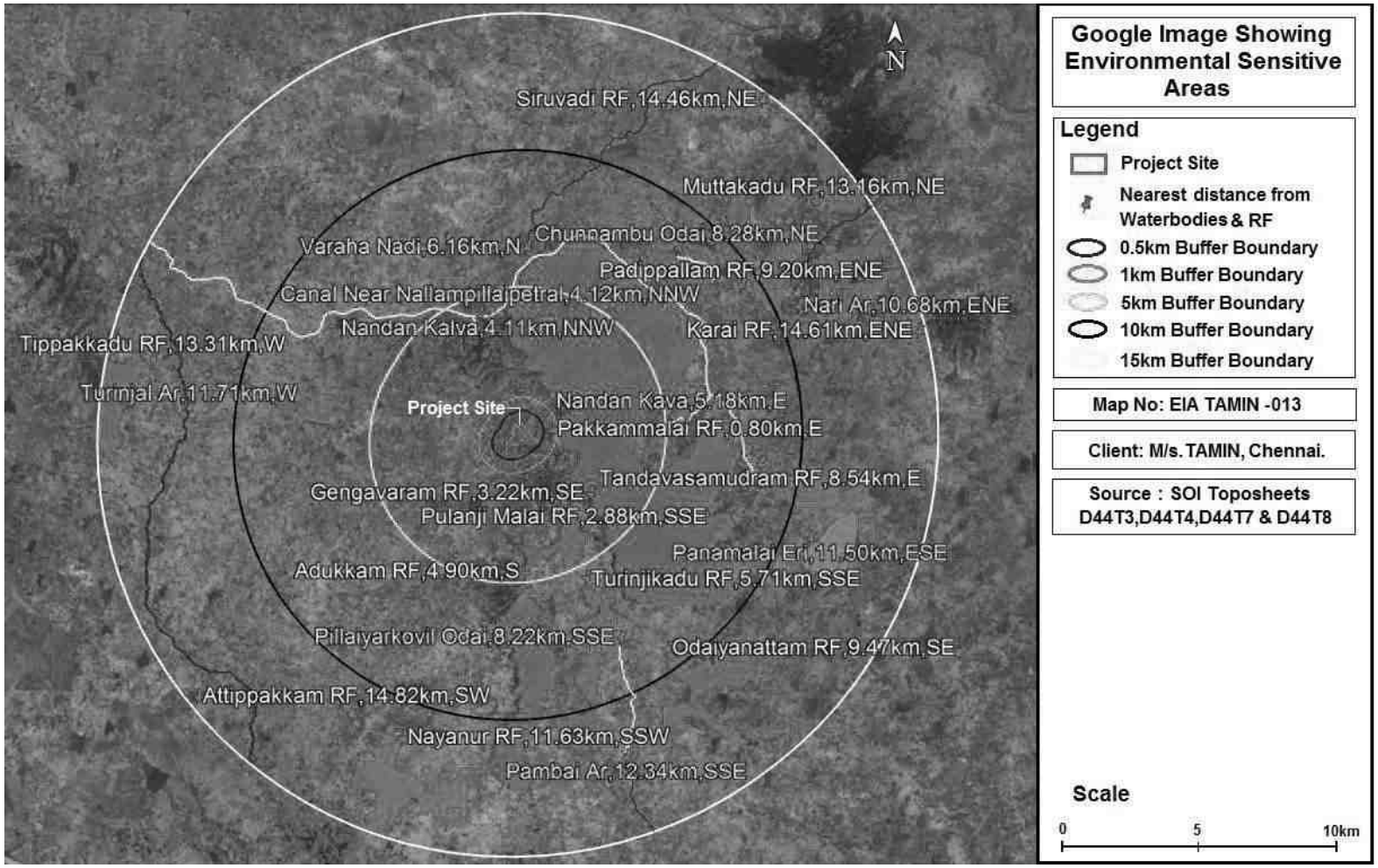


Figure 3-3 Environmental sensitive areas covering within 15 km from project boundary

3.4 Physical Conditions of PIA district

In this section, the physical conditions of PIA district are discussed in general and wherever possible references to the conditions prevailing in the study area in particular are also provided. The physical conditions are discussed as under:

- District profile
- Drainage, land use, geology, Physiographic
- Natural resources

Climatic conditions, seismic zone characteristics and natural hazard

3.4.1 PIA District Profile

Viluppuram district is located between 11^0 and 35^0 Northern Latitude and 78^0 38' and 80^0 Eastern Longitude. It is bordered on the north by Kancheepuram district and Tiruvannamalai district, on the south by Cuddalore district and east by Union Territory of Puducherry. According to district authorities, the total geographical area of the district is 7194 sq kms.

***Source**:https://censusindia.gov.in/nada/index.php/catalog/1105/download/3434/DH_2011_3306_PART_B_DCHB_VILUPPURAM.pdf*

(**Ref**: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Viluppuram District", Series-34 Part XII-A)

3.4.2 Climatic Conditions

The climate of Viluppuram district is fairly dry and on the whole healthy. The temperature is moderate. The maximum and minimum temperature in the district is 36^0C and 21^0C respectively. The rainfall is more in the coastal area compared to interior areas. An average, about 93.82% of the rainfall is received during Nort h East and Sout h West monsoons. Normally the district does not get heavy rainfall with the exception of Marakkanam and Vanur blocks. The rainfall is moderate in Kandamangalam and Koliyanur blocks, it is scanty in Kallakkurichi and Sankarapuram blocks.

***Source**:https://censusindia.gov.in/nada/index.php/catalog/1105/download/3434/DH_2011_3306_PART_B_DCHB_VILUPPURAM.pdf*

(**Ref**: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Viluppuram District", Series-34 Part XII-A)

3.4.3 Natural Resources of PIA District

3.4.3.1 Flora & Fauna

The coastal regions - containing the casuarinas plantations, sand dunes, the mangroves and scrub jungle. This includes the whole of Pitchavaram, Pitchavaram extension and Killai Reserved Forests. **The lateritic region** - containing the extensive cashew plant at ion and dry evergreen forest covering Kangiruppum Bit I and II, Velangulam, Ammeri, Narimanam, Semakottai and Extension, Kallamedu and Kuttady Reserved Forests.

The inland plains region - containing the eucalyptus and miscellaneous fuel plantations and the thorny scrub jungles at Alwarmalai, Varanjaram, Porasakurichi, Magarur, Katt umailur, Nangur, Krishnapuram, Thottapadi, Kottalamalai, Melpalangur, Mallapuram and Poosapadi Reserved Forests.

***Source**:https://censusindia.gov.in/nada/index.php/catalog/1105/download/3434/DH_2011_3306_PART_B_DCHB_VILUPPURAM.pdf*

(**Ref**: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Viluppuram District", Series-34 Part XII-A)

3.4.3.2 Forest Resources

Gingee and Kalrayan hills are the two major hills in the district. Forest areas in the district constitutes about 14% of the total area of the district which spread in t he areas bordering Salem, Dharmapuri and Tiruvannamalai districts with divisions of reserve forest, interface forest and social forest.Teak, rose and sandal trees are found in the hills. In Kalrayan hills and Gingee areas some medicinal plants are grown. In the social forest areas, trees raised are mainly for firewood and paper making. Babul, Eucalyptus and Casuarina are found to be grown in the district. The main activities of forest department are protection and preservation of the existing natural forests and wild animals such as Spotted Deer, Antelope, Sloth Bear etc., and also development of the degraded forests.

***Source**:https://censusindia.gov.in/nada/index.php/catalog/1105/download/3434/DH_2011_3306_PART_B_DCHB_VILUPPURAM.pdf*

(**Ref**: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Viluppuram District", Series-34 Part XII-A)

3.4.3.3 Irrigation

Intensive and extensive cultivation of land depends mainly on the availability of water. The rivers in Viluppuram district are not perennial. So, the major sources of irrigation are tube wells and open dug wells. Lower anaicut, Tirukkoyilur anaicut, Ellis Chuoltry anaicut and reservoir are the important irrigation projects in the district.

***Source**:https://censusindia.gov.in/nada/index.php/catalog/1105/download/3434/DH_2011_3306_PART_B_DCHB_VILUPPURAM.pdf*

(**Ref**: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Viluppuram District", Series-34 Part XII-A)

3.4.3.4 Agricultural Resources

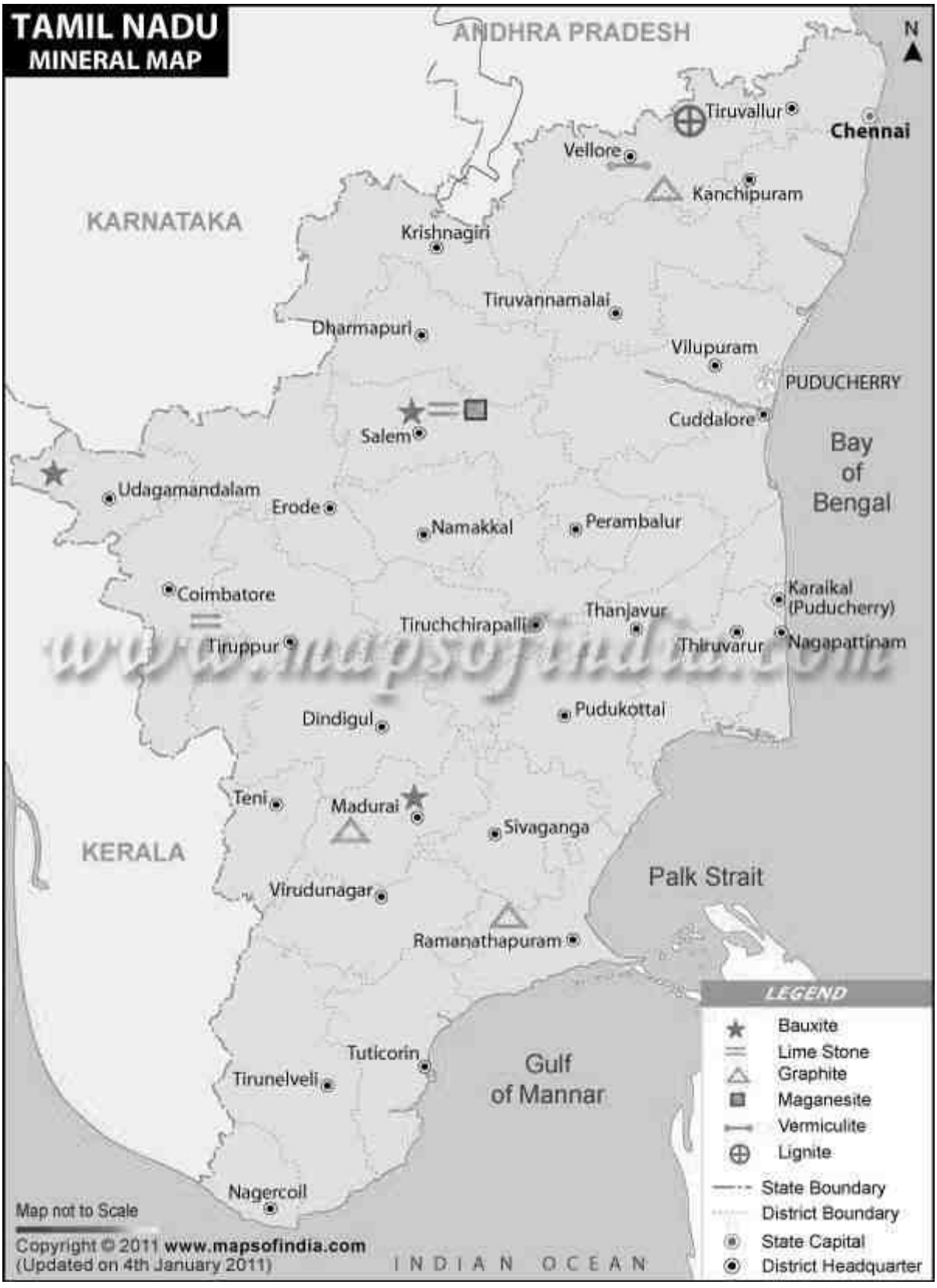
Agriculture is the mainstay of the people in the district. Except Gingee and Kalrayan hills, the entire district is characterized by plains. Major portion of the plains is utilized for agricultural purpose. The major crops in the district are paddy, groundnut, cotton, sugarcane, tapioca and cumbu. Paddy is the important food crop cultivated over an extent of 148454 hectares in the district during 2009-10. Among pulses, black grams and red grams are the most important varieties grown over an extent of 17276 and 519 hectares respectively. During 2009-10, nearly 19763 hectares were used for the production of pulses in the district.

***Source**:https://censusindia.gov.in/nada/index.php/catalog/1105/download/3434/DH_2011_3306_PART_B_DCHB_VILUPPURAM.pdf*

(**Ref**: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Viluppuram District", Series-34 Part XII-A)

3.4.3.5 Mineral Resources

The major portion of Viluppuram district is covered by mineral deposits like silica sand, lime stone, black granite and blue metal. Silica sand is found in Agaram reserve forest in Tindivanam taluk. Fine clay deposits are found in large numbers in Tindivanam t aluk. Inferior grade sedimentary limestone deposit is found in Vanur taluk. Gingee, Kallakkurichi, Tindivanam, Tirukkoyilur, Ulundurpettai, Vanur and Viluppuram taluks has rich sources of export quantity of black granite. Multicoloured granites are found in Gingee, Kallakkurichi and Viluppuram taluks. The mineral map of Tamilnadu is shown in the **Figure 3-4**



Source: *Maps of India*

Figure 3-4 Mineral Map of Tamil Nadu

3.4.4 Land Use & Land Cover

Total geographic area of Viluppuram district is **7254.5 Sq.Km**. Urban Built-up area is **44.12 Sq.Km** and Rural Built-up area is **246.08 Sq.Km**. Details of land use/land cover statistics for Viluppuram district were given in **Table 3-2** and Land cover pattern of Viluppuram district is given in **Figure 3-5.** Land Use map of Viluppuram is given in **Figure 3-6.**

Table 3-2 District land use/land cover statistics (2015-16) for Viluppuram District

S. No	Division of Land Use/Land Cover	Area in Sq.Km	Area in Acres	Area in Ha	Total Area %
1	Built-up, Urban	44.12	10902.27	4412	0.61
2	Built-up ,Rural	246.08	60807.60	24608	3.39
3	Built-up, Mining	33.96	8391.69	3396	0.47
4	Agriculture, Crop land	3609.55	891937.85	360955	49.76
5	Agriculture, Plantation	252.31	62347.06	25231	3.48
6	Agriculture, Fallow	1435.24	354654.98	143524	19.78
7	Forest, Evergreen/ Semi evergreen	56.79	14033.09	5679	0.78
8	Forest, Deciduous	561.07	138643.20	56107	7.73
9	Forest, Forest Plantation	132.83	32822.96	13283	1.83
10	Grass/Grazing	3.81	941.47	381	0.05
11	Barren/ unculturable/ Wastelands, Salt Affected land	32.95	8142.11	3295	0.45
12	Barren/ unculturable/ Wastelands, Gullied/Ravinous Land	5.54	1368.96	554	0.08
13	Barren/ unculturable/ Wastelands, Scrub land	83.27	20576.43	8327	1.15
14	Barren/unculturable/ Wastelands, Sandy Area	9.59	2369.74	959	0.13
15	Barren/unculturable/ Wastelands, Barren rocky	13.97	3452.06	1397	0.19
16	Wetlands/Water Bodies, CoastalWetland	4.06	1003.25	406	0.06
17	Wetlands/Water Bodies, River/Stream/canals	110.19	27228.50	11019	1.52
18	Wetlands/Water Bodies, Resorvoir/Lakes/Ponds	619.17	153000.00	61917	8.53
Total		**7254.5**	**1792623.22**	**725450**	**100.00**

Source:*https://bhuvan-app1.nrsc.gov.in/thematic/thematic/index.php*

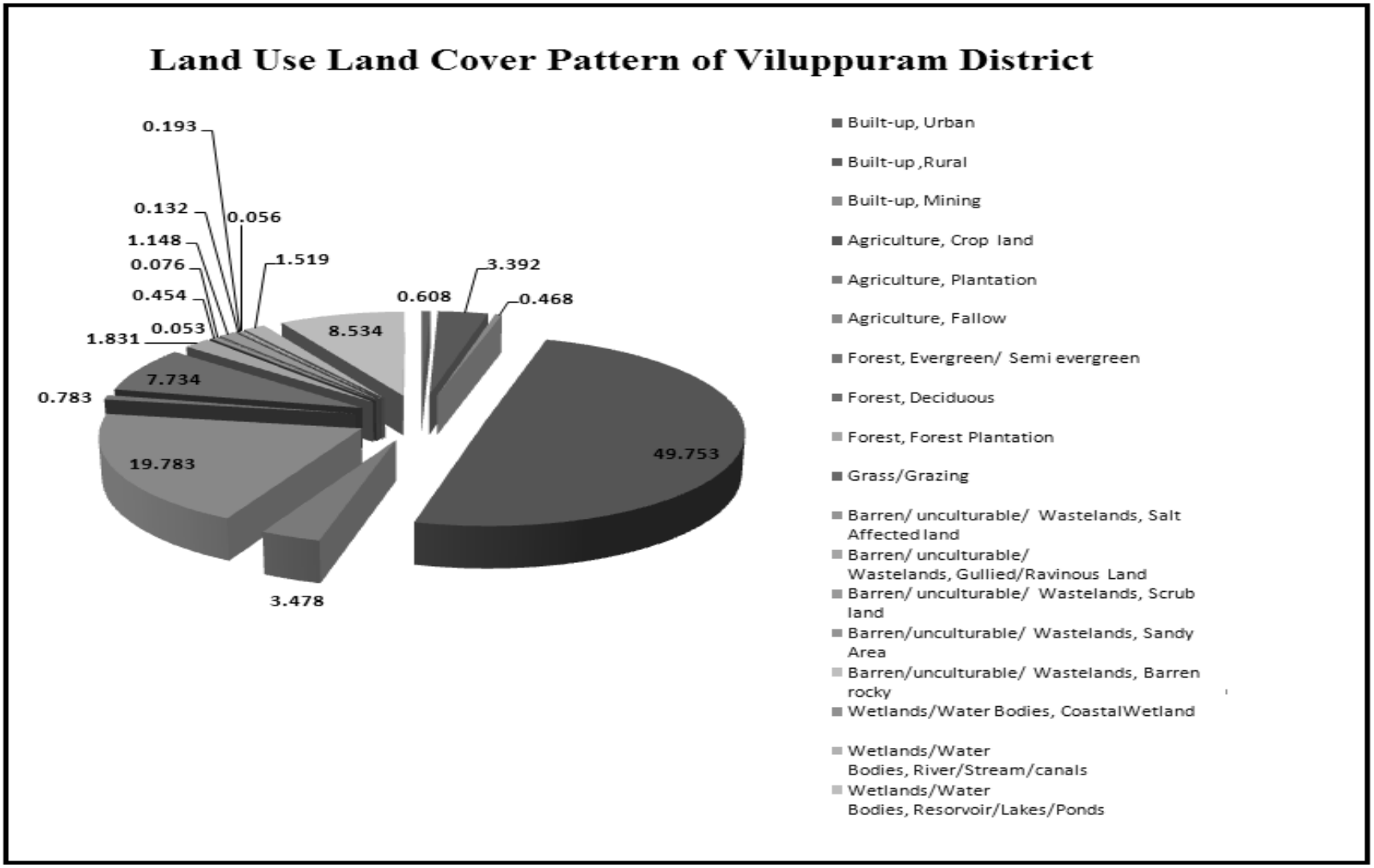


Figure 3-5 Land use/Land cover pattern for Viluppuram district

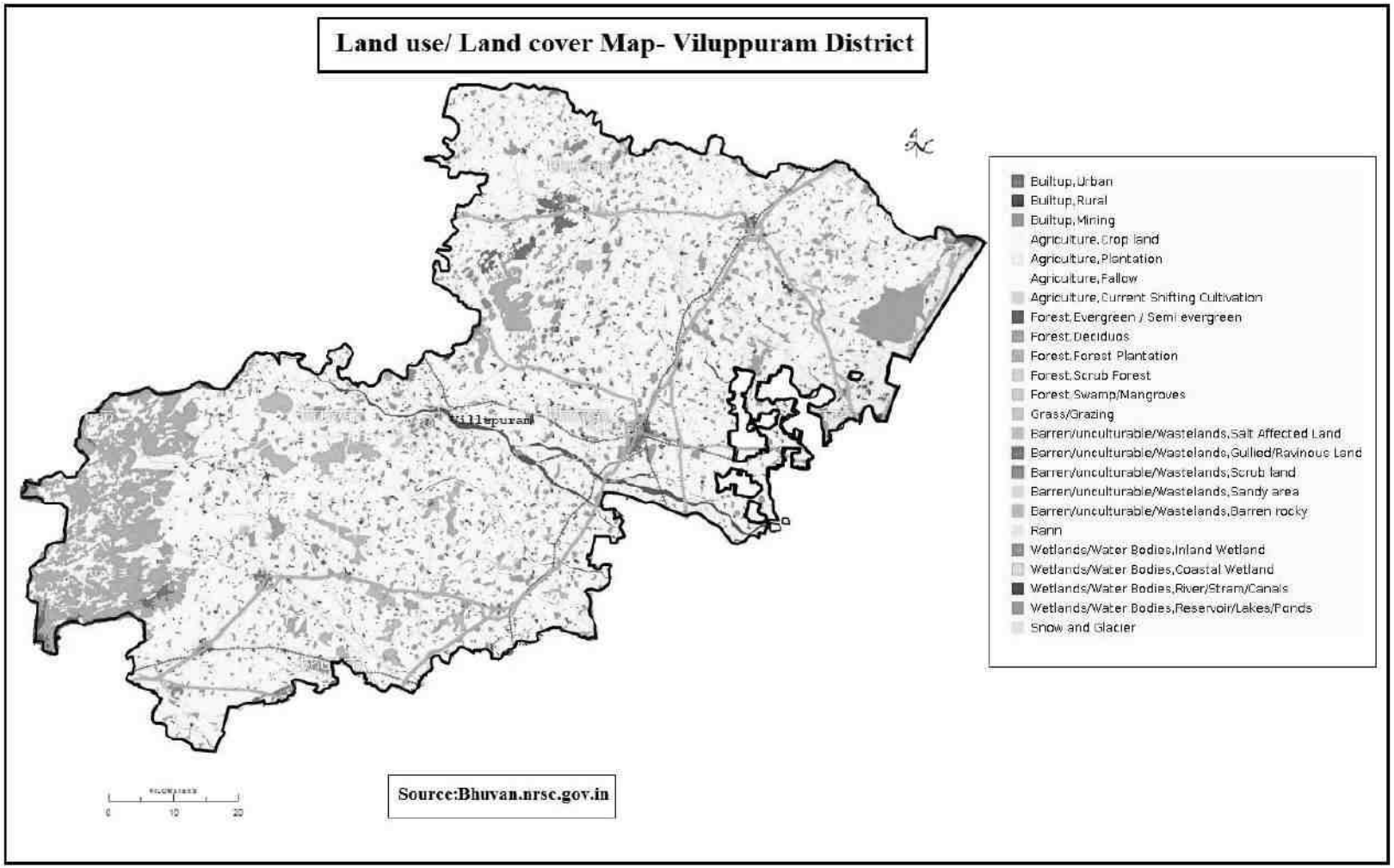


Figure 3-6 Land use/Land cover Map of Viluppuram district

3.4.4.1 Land use land cover for the study area

The land use pattern of the study area is **341.20sq.km** given in **Table 3-3** Land use pattern and land use map of the study area is given in **Figure 3-7** and **Figure 3-8** respectively.

Table 3-3 Land use/ Land Cover pattern of the Study Area

S.No.	Description	Area (Sq.Km)	Area (Acres)	Area (Hectares)	Percentage (%)
1	Crop land	156.32	38627.45	15632	45.81
2	Fallow	69.28	17119.43	6928	20.30
3	Deciduous	53.22	13150.93	5322	15.60
4	Waterbodies	22.6	5584.57	2260	6.62
5	Scrub land	16.75	4139.01	1675	4.91
6	Evergreen / Semi Evergreen	13.45	3323.56	1345	3.94
7	Rural	5.24	1294.83	524	1.54
8	Barren rocky	3.83	946.41	383	1.12
9	Mining	0.39	96.37	39	0.11
10	Urban	0.12	29.65	12	0.04
	Total	**341.20**	**84312.23**	**34120**	**100.00**

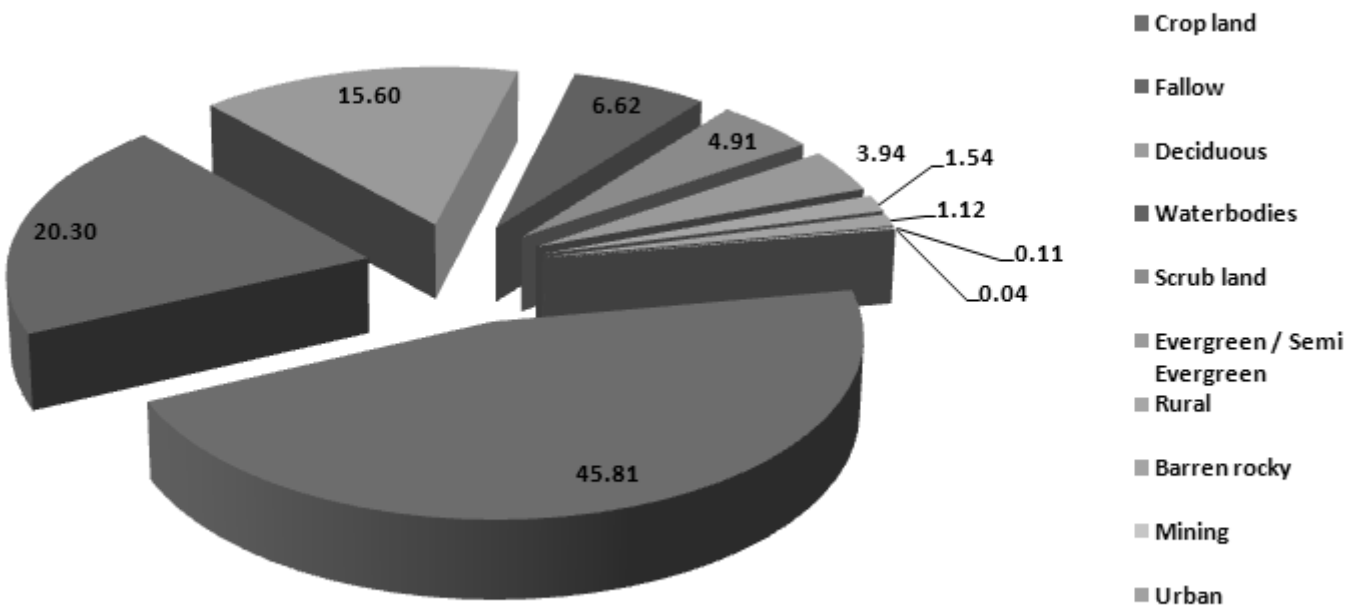


Figure 3-7 Land Use/ Land Cover pattern of the Study Area

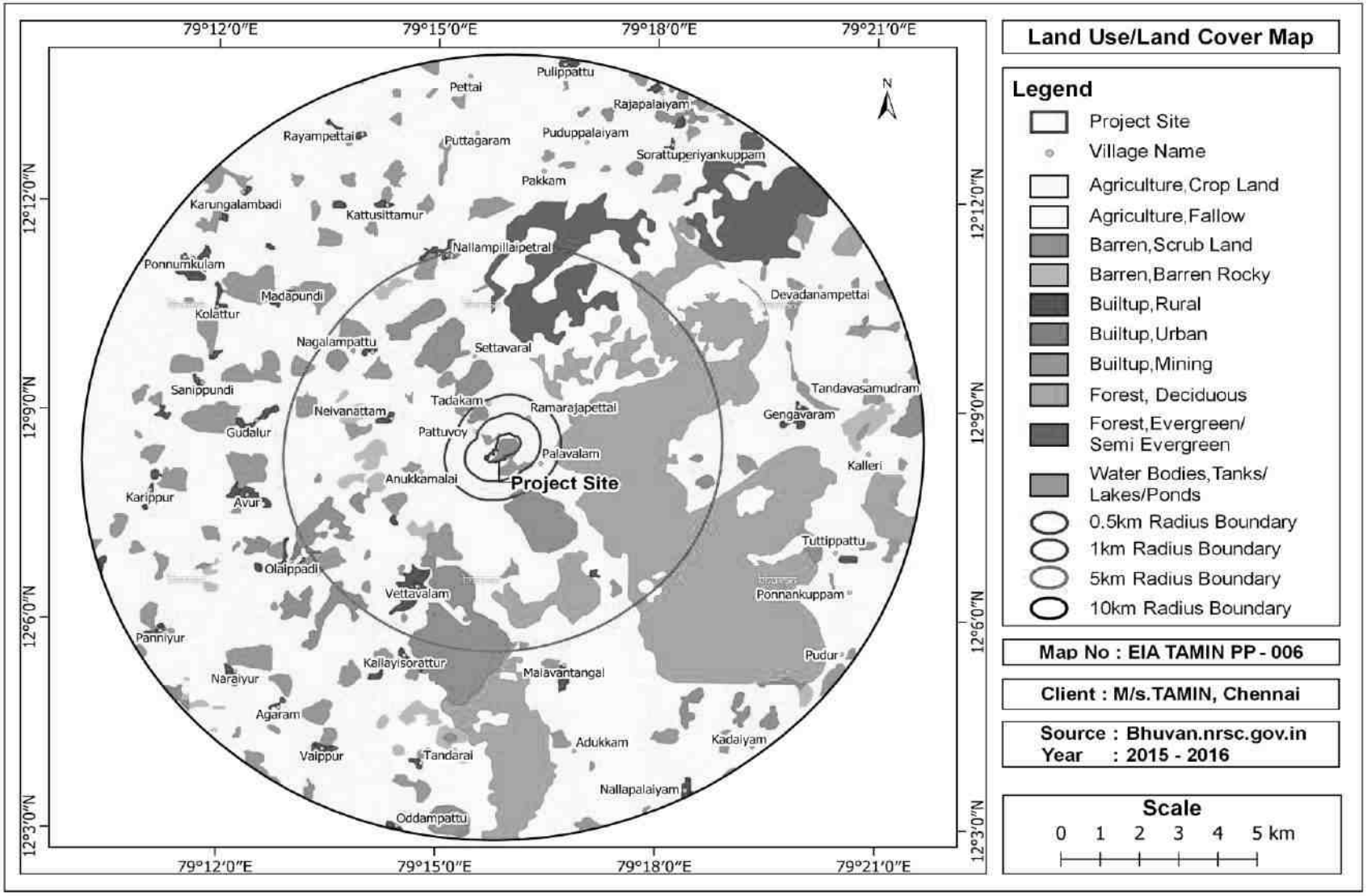


Figure 3-8 Land Use/ Land Cover map of the Study Area

3.4.5 Topography

The greater part of the district is covered by the metamorphic rocks belonging to Gneissic formations. The district has also three types of sedimentary rocks belonging to different geological periods. The Kalrayan hills on the north represent a continuous range of hills covered with some thorny forests and vegetation. The most beautiful hill of the district is Gingee hills. The residual and denudational hills are common in Thirukoilur, Kallakurichi and Gingee taluks. Structural hills are noticed on the western part of the district. The shallow pediments and buried pediments are quite common in the central part of the district.The Physical map of Tamilnadu is given as **Figure 3-9** and Topo map of study area is given as **Figure 3-2** and contour map of the study area is given as **Figure 3-10.**

Source: *https://spc.tn.gov.in/DHDR/Vlupuram_dt.pdf*

(**Ref**: State planning Comission –Tamil Nadu, "District Human Development Report-2017, Viluppuram District")

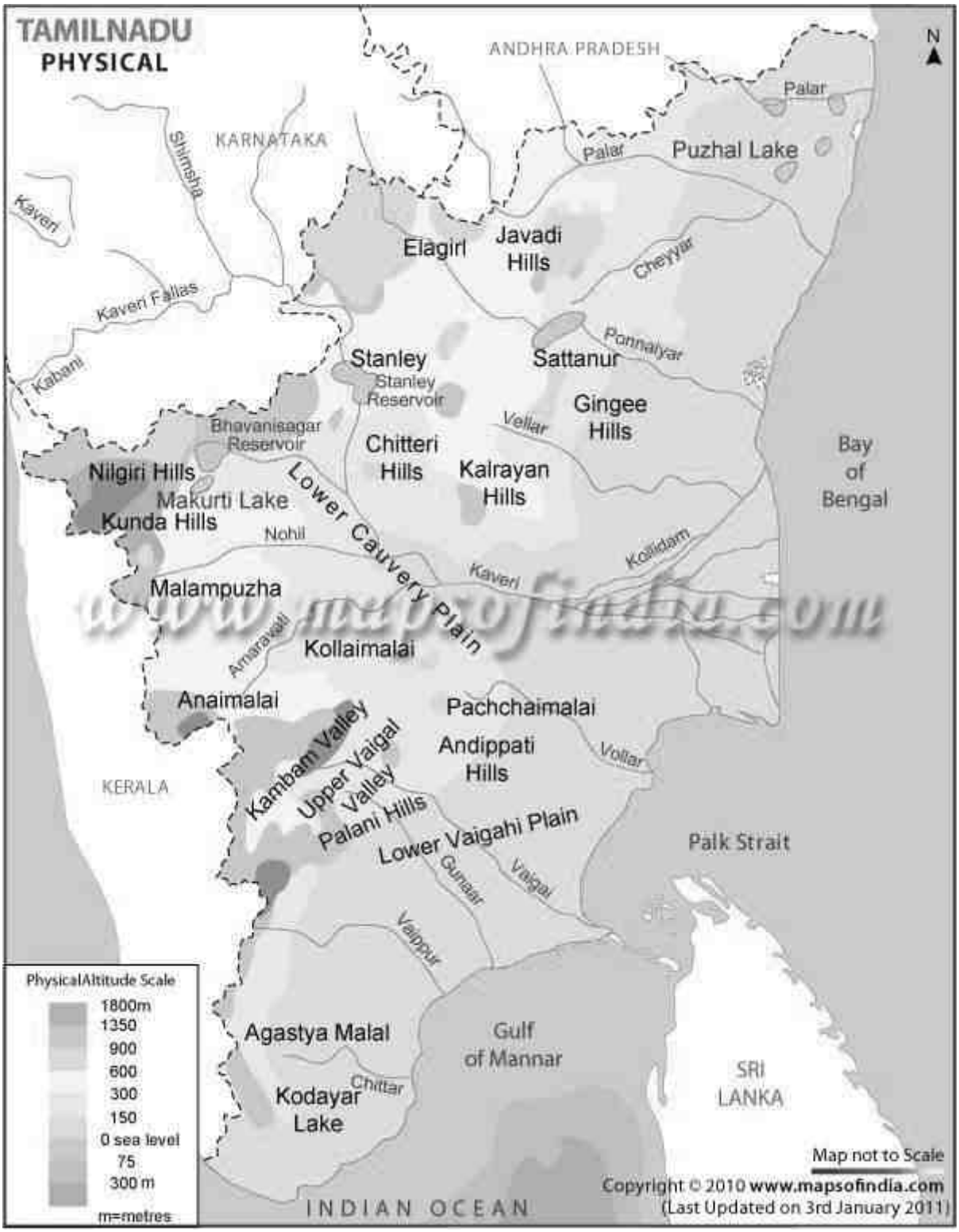


Figure 3-9 Physical Map of Tamilnadu

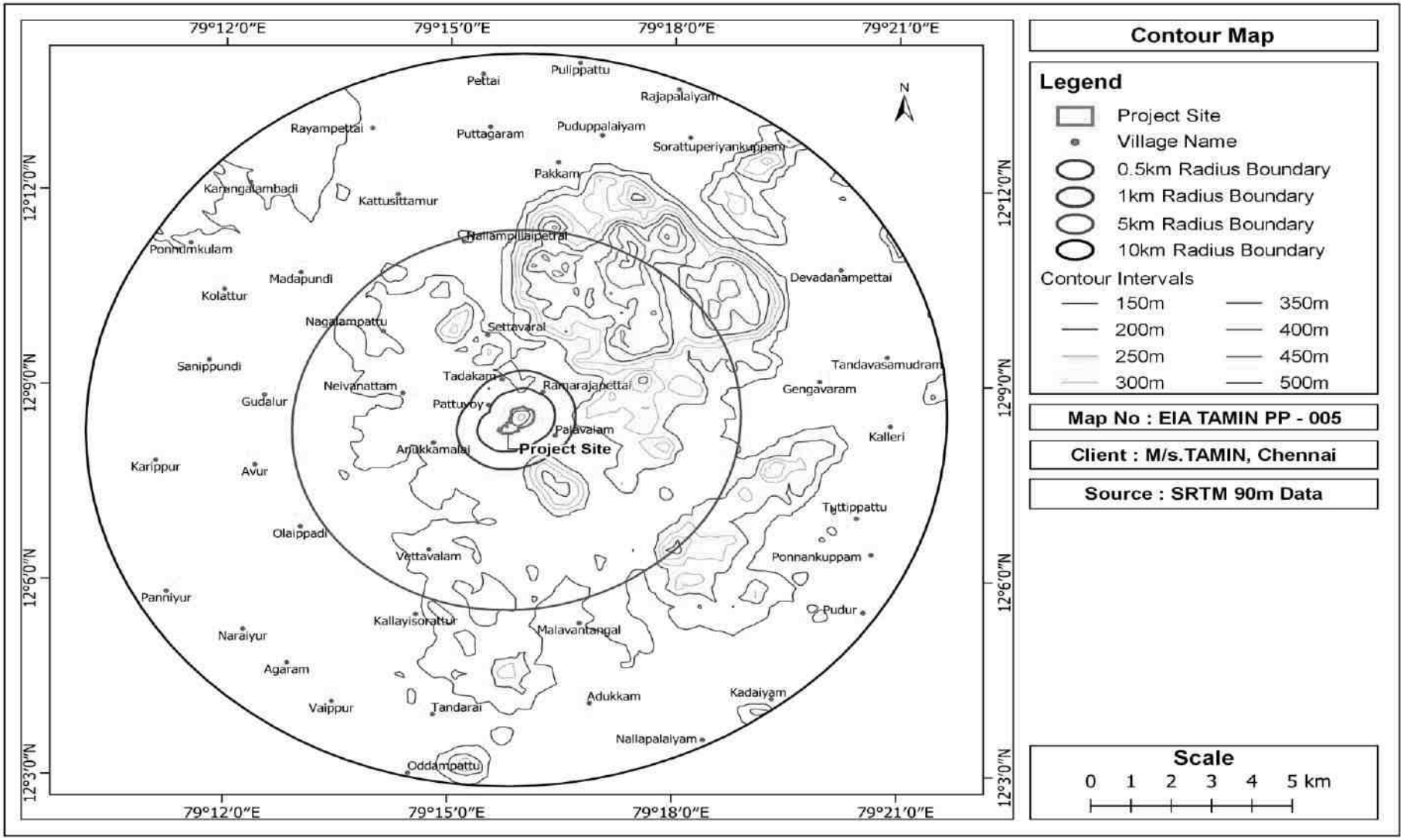


Figure 3-10 Contour map of the Study Area

3.4.6 Geomorphology of PIA District

The residual hills and denudational hills are common in Tirukoilur, Kallakurichi and Gingee taluks. Structural hills are noticed in the western part of the district. The shallow pediments and buried pediments are common in the central part of the district. Coastal areas are having older and younger flood plains and also beach landforms at places. The ground slope is gentle towards coast. The valley fill near Villupuram is thick, which forms main ground water discharge zone. Lineaments are restricted to parts of Kallakurichi and Sankarapuram areas and productive fractures are noticed in select pockets. The crystalline sedimentary contact fault is having sympathetic fractures in hard rocks but mostly they are dry fractures. The Geomorphology Map of the Viluppuram District is shown as **Figure 3-12.**

Source: *http://cgwb.gov.in/District_Profile/TamilNadu/VILUPPURAM.pdf*

*(**Ref:** Government of India, Ministry of Water Resources, Central Ground Water Board, South Eastern Coastal Region Chennai, "District Ground Water Brochure Viluppuram District")*

3.4.6.1 Geomorphology of the study area

Total geographical area of the study area is 332.14 Sq.Km. The Geomorphology pattern of the study area is given in **Table 3-4** and Geomorphology pattern of the study area is given in **Figure 3-11.** Geomorphology map of the study area is given in **Figure 3-12.** The Geomorphology map of the study area is shown in the **Figure 3-13.**

Table 3-4 Geomorphology pattern of the study area

S.No.	Description	Area (Sq.Km)	Area (Acres)	Area (Hectares)	Percentage (%)
1	Denudational Origin Pediment - Pediplain Complex	257.98	63749.17	25798	75.61
2	Denudational Origin - Moderately Dissected Hills and Valleys	61.56	15210.57	6156	18.04
3	Structural Origin - Low Dissected Hills and Valleys	3.28	811.35	328	0.96
4	Waterbodies	18.38	4541.13	1838	5.39
Total		**341.20**	**84312.23**	**34120**	**100.00**

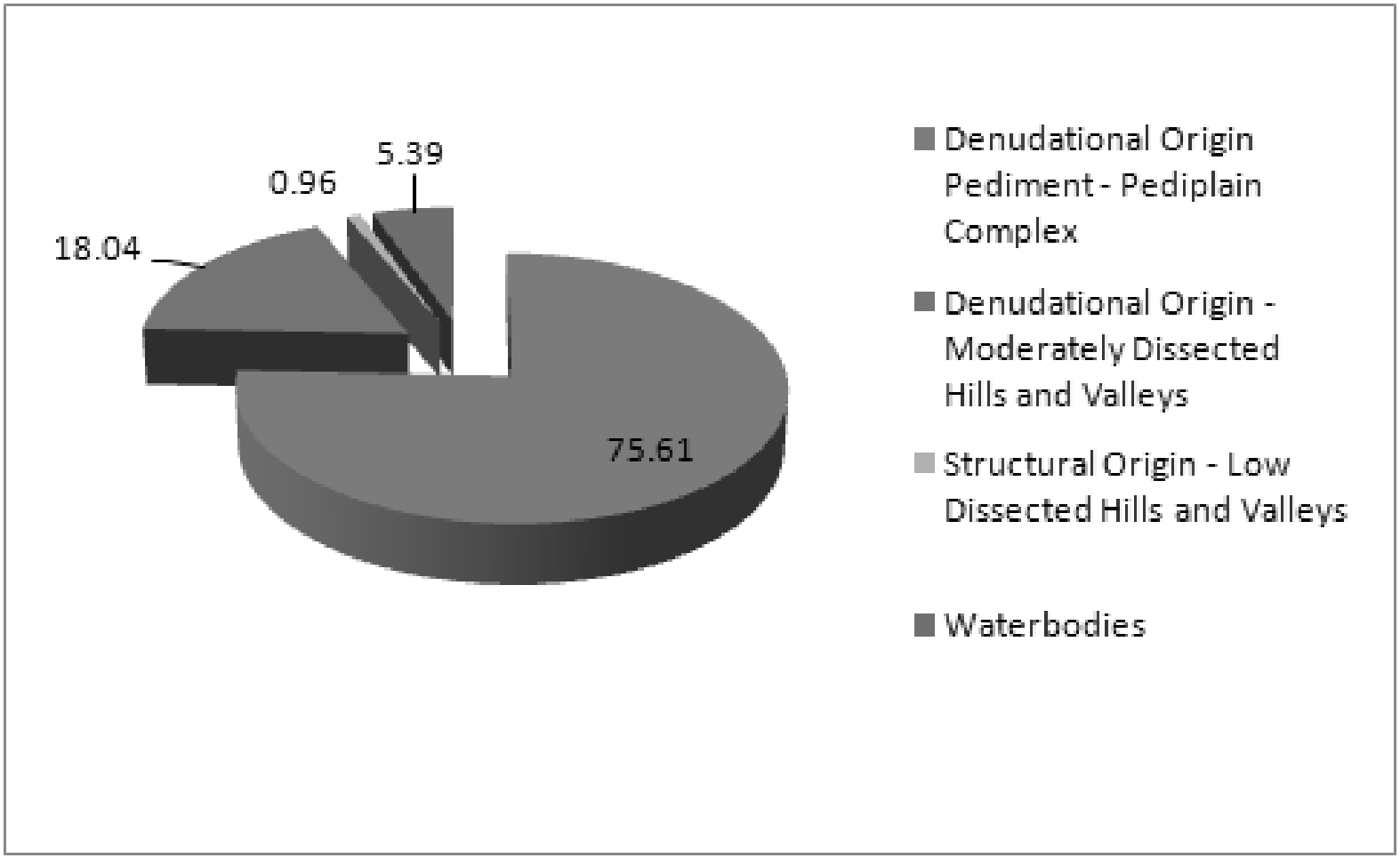


Figure 3-11 Geomorphology pattern of the study area

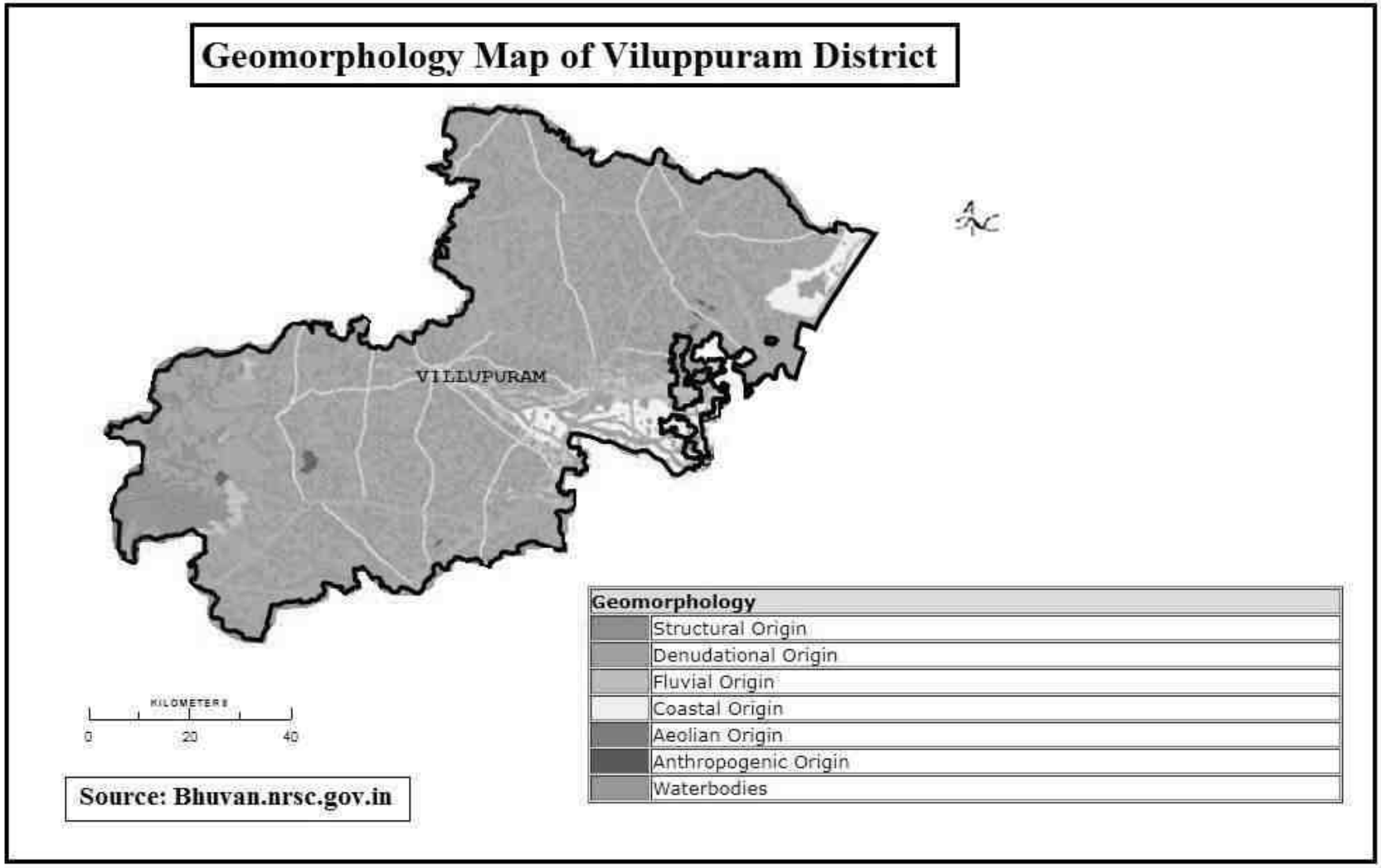


Figure 3-12 Geomorphology Map of the study area

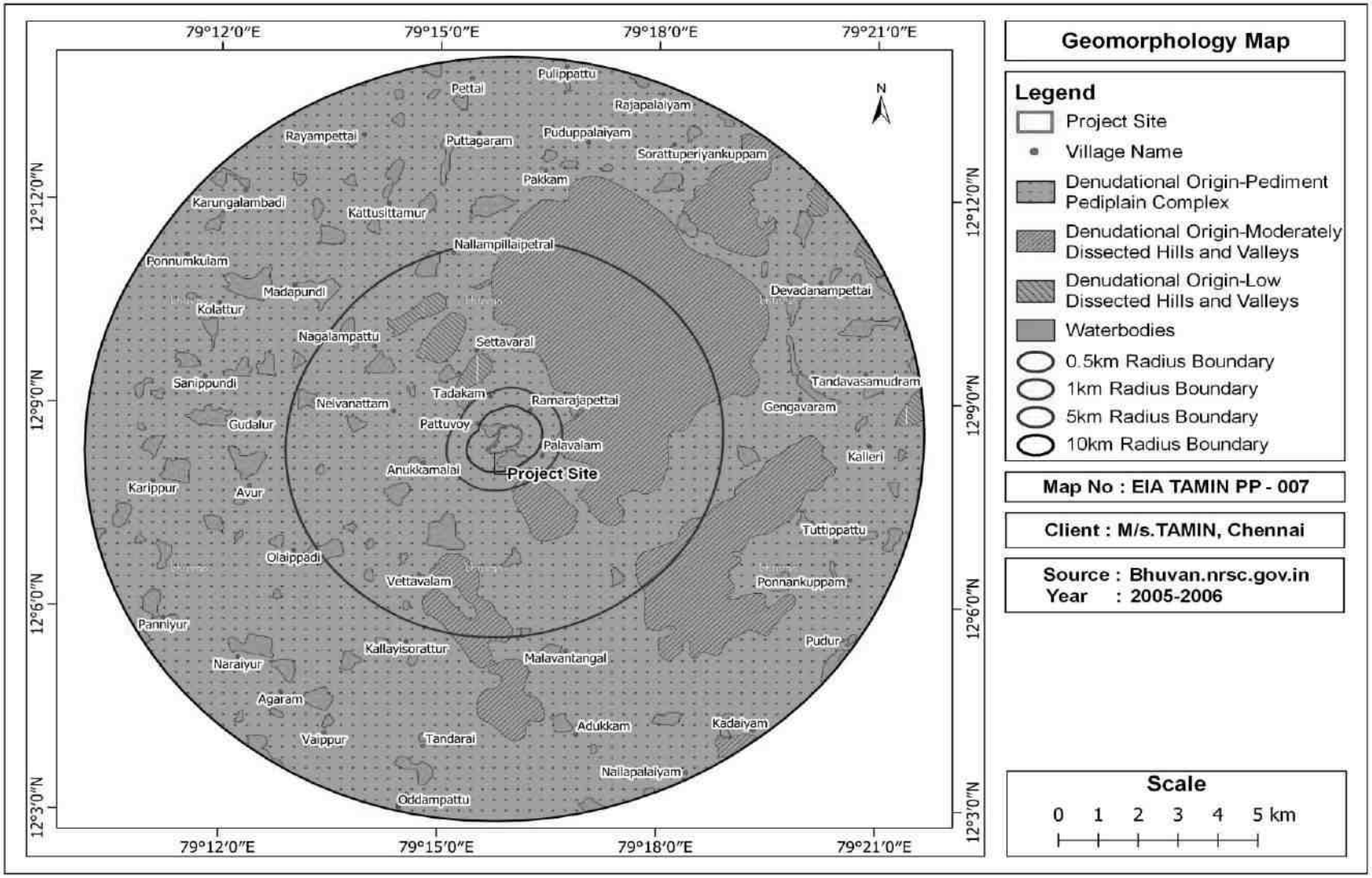


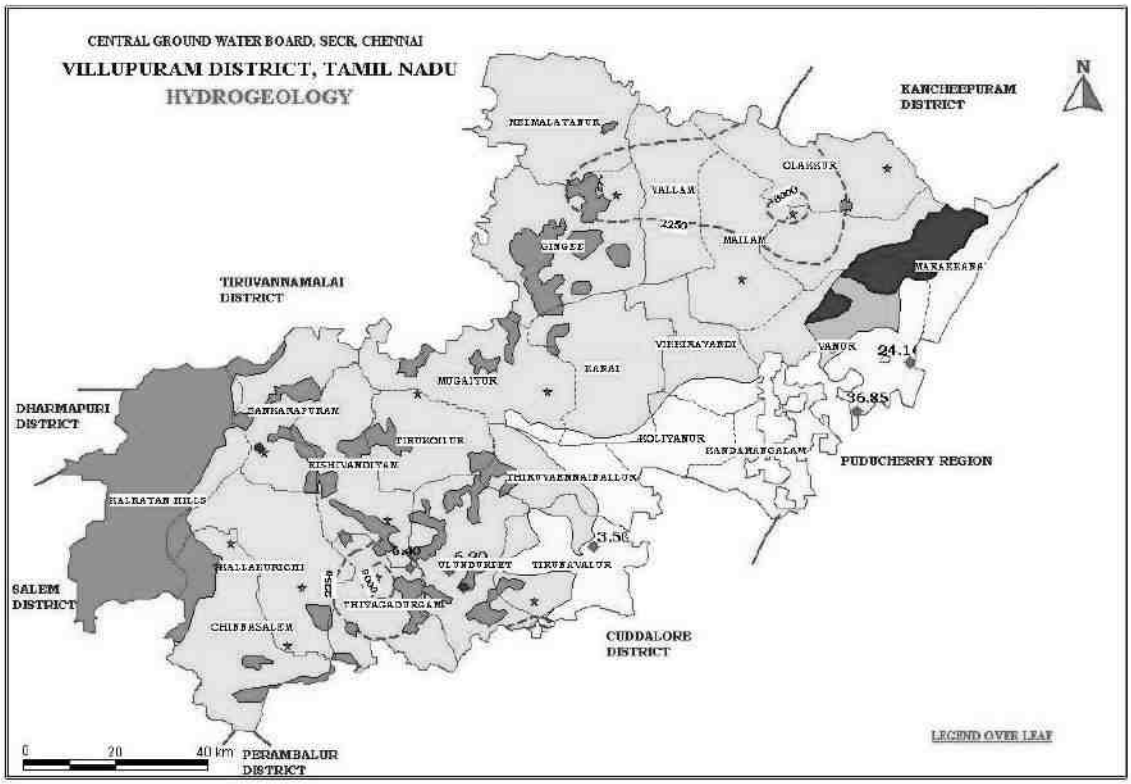
Figure 3-13 Geomorphology Map of Study Area

3.4.7 Hydrogeology of PIA District Profile

Villupuram district is underlain by crystalline metamorphic complex in the western part of the district and sedimentary tract in eastern side (Plate-II). The thickness of sediments exceeds 600m near southern part of the district. Groundwater occurs under phreatic and semi–confined conditions in consolidated formations, which comprises weathered and fractured granites, gneisses and charnockites whereas in unconsolidated sedimentary rocks the groundwater occurs in phreatic, semi-confined conditions in Vanur sandstone, Kadapperi kuppam formation and Turuvai limestone. The district is having rocky outcrops in major part of Kallakurichi, Sankarapuram and Tirukoilur taluks. The weathering is highly erratic and the depth of abstraction structures is controlled by the intensity of weathering and fracturing. The depth of wells varies from 6.64 to 17m bgl and water levels in observation wells tapping shallow aquifers varied from 0.74 to 9.7 m bgl during pre monsoon (May 2006) and it varies from 0.7 to 4.45 mbgl during post monsoon (January 2007). During pre monsoon, the depth to water levels in the range of >2 to 5 m bgl in major part of the district, in the range of >5 -10 m bgl in western and southeastern parts of the district and range of 0-2 m bgl were recorded in two isolated pockets (Plate –III). During post monsoon the depth to water levels range of >2 to 5 m bgl exists in major part of the district, range of 0 - 2 m bgl prevails in central and northeastern parts of the district and range of >5 - 10 m bgl were recorded in two isolated pockets in the southwester and north western parts of the district (Plate –IV). The depth to piezometric surface ranged from 2.8 to 11.25 m bgl during Pre monsoon and 0.5 to 6.35 m bgl during post monsoon. The ground water is being developed my means of dug wells, bore wells and tube wells. The diameter of the well is in the range of 7 to 10 m and depth of dug wells range from 15 to 18 m bgl depending on the weathered thickness and joints. The dug wells yield up to 1lps in summer months and few wells remains dry. The yield is adequate for irrigation for one or two crops in monsoon period. The yield of bore wells in favorable locations vary from <1 to 6lps. The valley fills, intersection of lineaments, particularly, in the western part along the foot hills of Kalrayan hills are reported to have potential pockets suitable for dug wells and bore wells. The area of contact between crystalline and sedimentary formations has variable yield prospects. The cretaceous formations are very compact and yield prospects are low. The dug wells of 6 m diameter and 10 m bgl depth in sandy tracts give about 3.5lps. The yield of tube wells in the sedimentary formation ranges from 2.4 to 37lps.The hydrogeology map of Viluppuram District is given in **Figure 3-14**

Source: *http://cgwb.gov.in/District_Profile/TamilNadu/VILUPPURAM.pdf*

(Ref: Government of India, Ministry of Water Resources, Central Ground Water Board, South Eastern Coastal Region Chennai, "District Ground Water Brochure Viluppuram District")



LEGEND PLATE -VI

DISTRICT – VILLUPURAM

	Wells Feasible	Rigs Suitable	Depth of Well (m.bgl)	Discharge (LPM)	Suitable Artificial Recharge Structures
Soft Rock Aquifer	Dug Cum Bore Well Tube Well	Manual Direct Rotary	10 - 50 75 – 100	150 - 450	Recharge Tube Wells / Recharge Shaft
Soft Rock Aquifer	Dug Well Filter Point-Well Tube Well	Manual Hand Bore Direct Rotary	8 – 12 10 – 15 100 – 150	500 – 750	Rain Water Harvesting / Check Dams / Percolation Ponds / Gabion Structures / Recharge Tube Wells
Hard Rock Aquifer	Dug Well Bore Well	Manual DTH	10 – 18 100 – 300	10 - 60	Check Dams /Percolation Ponds
Hard Rock Aquifer	Dug Cum Bore Well Bore Well	Manual + DTH DTH	15 + 100 60 – 300	60 – 180	Percolation Ponds
Hard Rock Aquifer	Bore Well	DTH	190 – 300	180 - 300	Percolation Ponds
	District Boundary			Block Boundary	
	Block Headquarter			Block Headquarter	
5	Water Level-Pre-Monsoon (Decadal Mean 1993-2002) mbgl			EC (Microsiemens / cm at 25° C)	
	River			Lineament	
	Nitrate Greater Than Maximum Permissible Limit (45 mgl)			Hilly Area	

Source: *http://cgwb.gov.in/District_Profile/TamilNadu/VILUPPURAM.pdf*

Figure 3-14 Hydrogeology Map of Viluppuram District

3.4.8 Drainage Pattern in PIA District

Ponnaiyar, Malattar and Gadilam are the major rivers draining the district. Ponnaiyar River flows from northwest to east in the district. Manimukta nadi originates in Kalrayan hills and drains the southern part of the district. Pambaiyar and Varaganadhi originate in the uplands of the district and join Bay of Bengal. Varaganadhi is also known as Gingee River and drains the parts of Gingee and Vanur taluks of this district. Malattar and Gadilam rivers also originate in the uplands within the district and flow eastwards to Cuddalore district. All the rivers are ephemeral in nature and carry only floodwater during monsoon period. The drainage pattern is mostly parallel to sub parallel and drainage density is very low. There are small reservoirs across rivers namely Gomukhi, Vedur and Mahanathur.The drainage map of the Study Area is given as **Figure 3-15**.

***Source**:https://censusindia.gov.in/nada/index.php/catalog/1105/download/3434/DH_2011_3306_PART_B_DCHB_VILUPPURAM.pdf*

(**Ref**: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Viluppuram District", Series-34 Part XII-A)

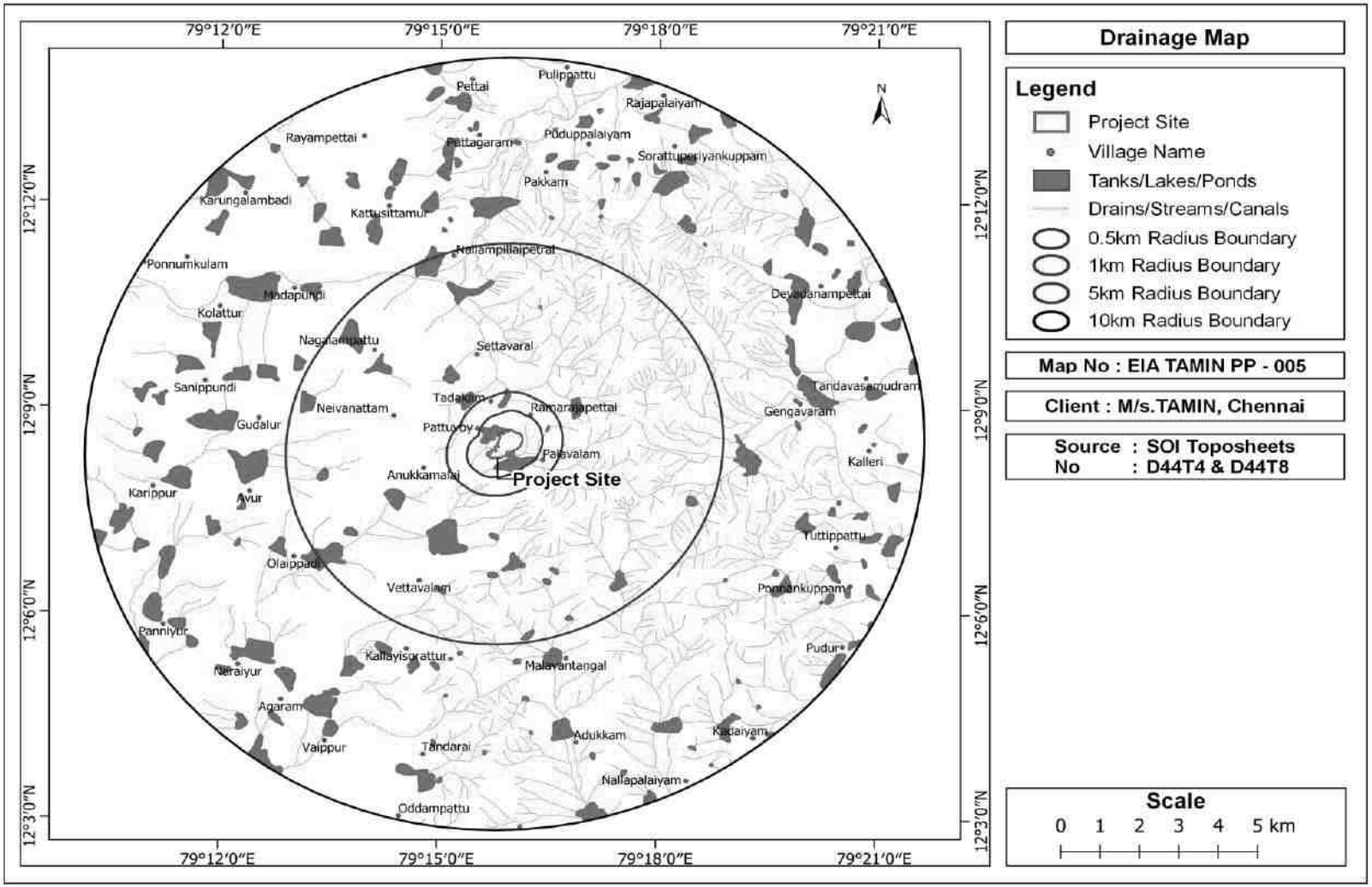


Figure 3-15 Drainage map of the study area

3.4.9 Geology

The hills are found in the western part of the district and they are Kalrayan and Ginjee hills falling under Kallakurichi and Ginjee taluks respectively. Plain terrain occurs in the middle part of this district, while the coastal plains lie in the eastern part of the district in and around Marakanam and Vanur taluks.The Geological map of Tamilnadu is given as **Figure 3-16.**

Source: *http://cgwb.gov.in/District_Profile/TamilNadu/VILUPPURAM.pdf*

*(**Ref:** Government of India, Ministry of Water Resources, Central Ground Water Board, South Eastern Coastal Region Chennai, "District Ground Water Brochure Viluppuram District")*

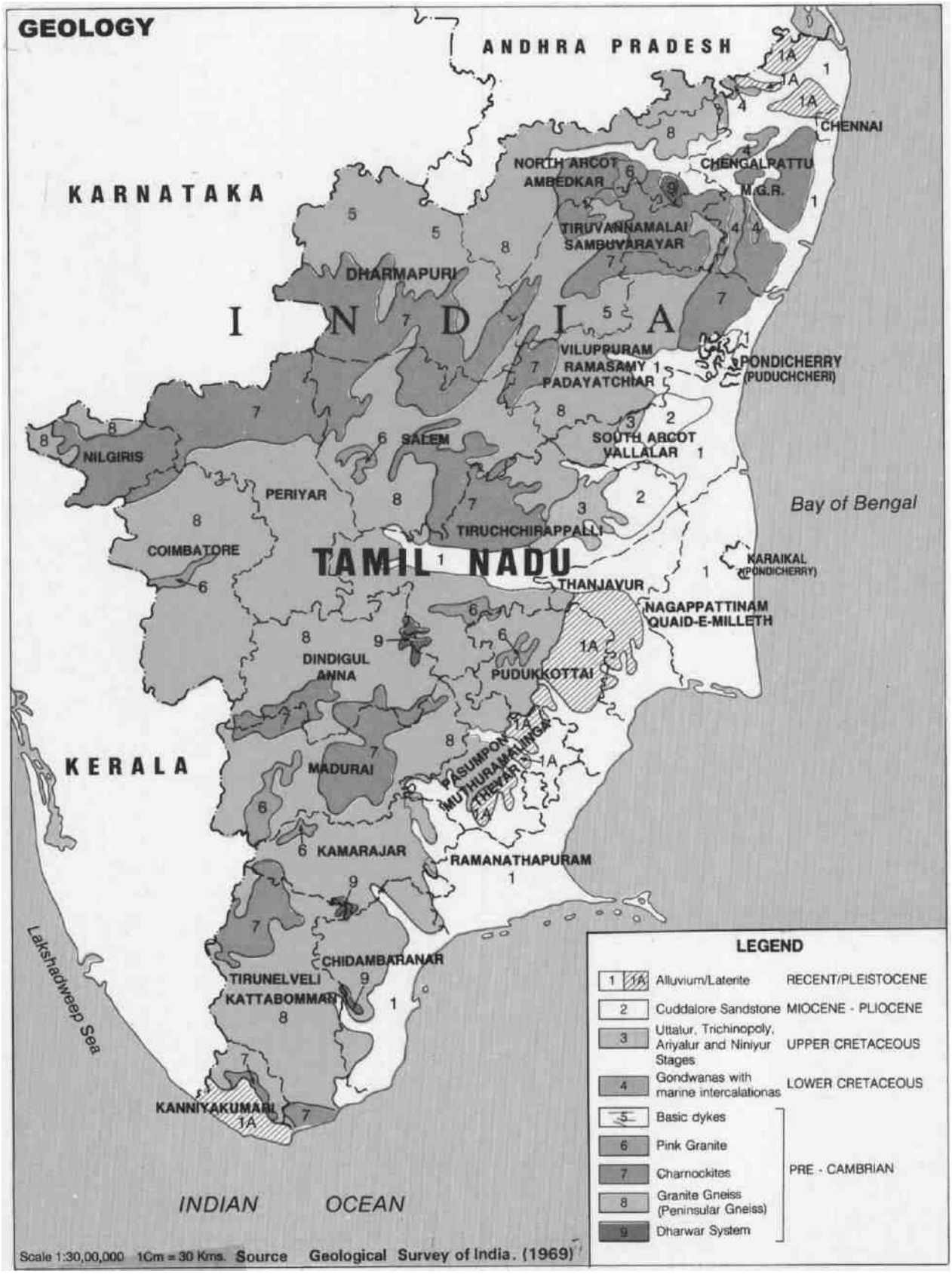
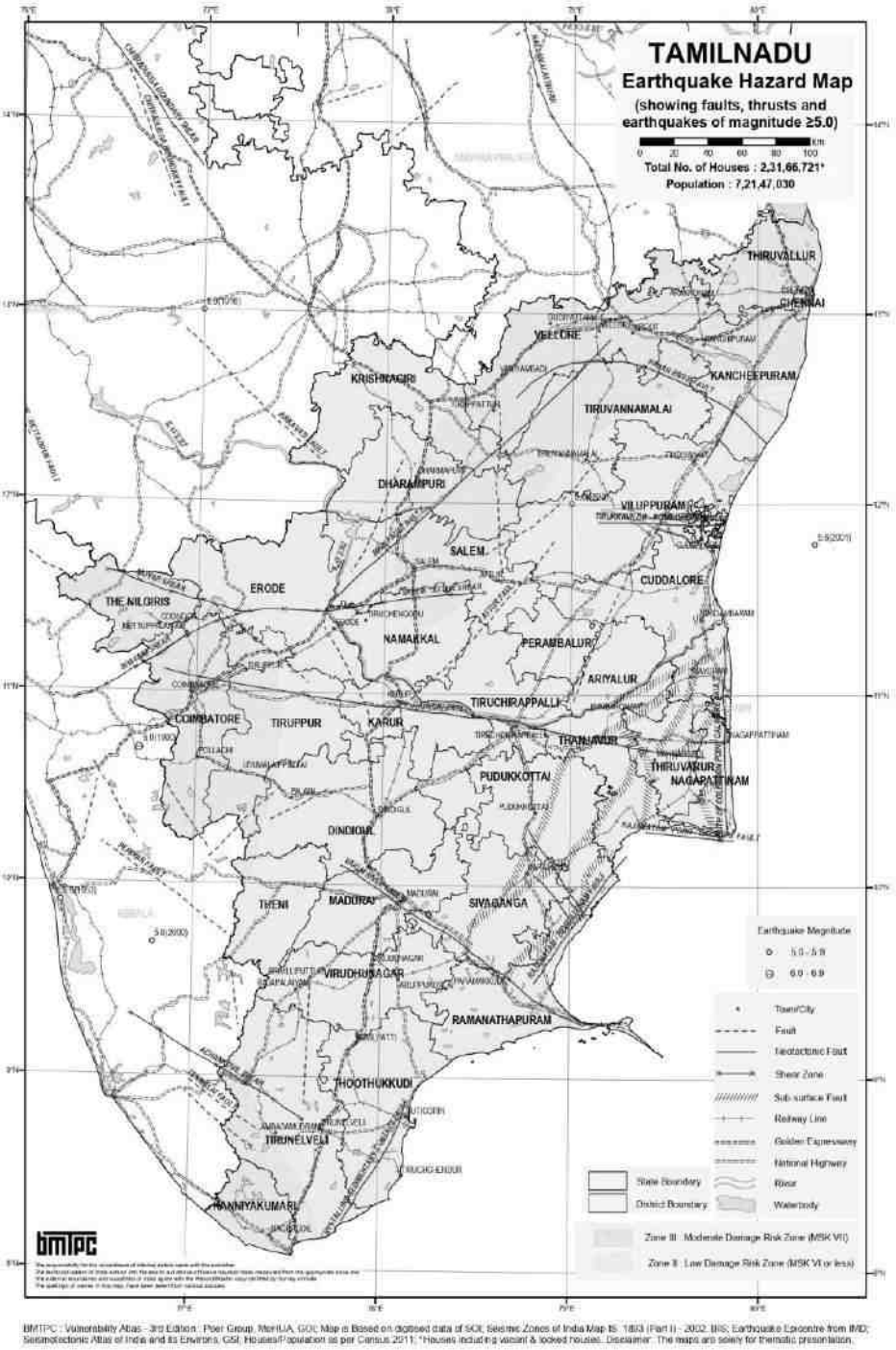


Figure 3-16 Geology Map of Tamilnadu

3.4.10 Seismicity

As per Earthquake hazard map of Tamil Nadu, The project location/study area falls in Zone II, which is categorized as a Low Damage Risk Zone. The Earthquake hazard map of Tamil Nadu is shown in **Figure 3-17**



BMTPC : Vulnerability Atlas - 3rd Edition ; Peer Group, MoHUA, GOI; Map is Based on digitised data of SOI; Seismic Zones of India Map IS: 1893 (Part I) - 2002, BIS; Earthquake Epicentre from IMD; Seismotectonic Atlas of India and its Environs, GSI; Houses/Population as per Census 2011; *Houses including vacant & locked houses. Disclaimer: The maps are solely for thematic presentation.

Figure 3-17 Seismicity Map of Tamil Nadu

3.4.11 Soils in PIA District

The soils in the district are mainly red soil, sandy loam and black cotton soil. Alluvial soils are found in eastern side bordering coastal areas. Black soils are confined to low ground in select pockets in Vanur taluk. The Soil map of India is given in **Figure 3-18.**

Source:*https://censusindia.gov.in/nada/index.php/catalog/1105/download/3434/DH_2011_3306_PART_B_DCHB_VILUPPURAM.pdf*

(**Ref**: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Viluppuram District", Series-34 Part XII-A)

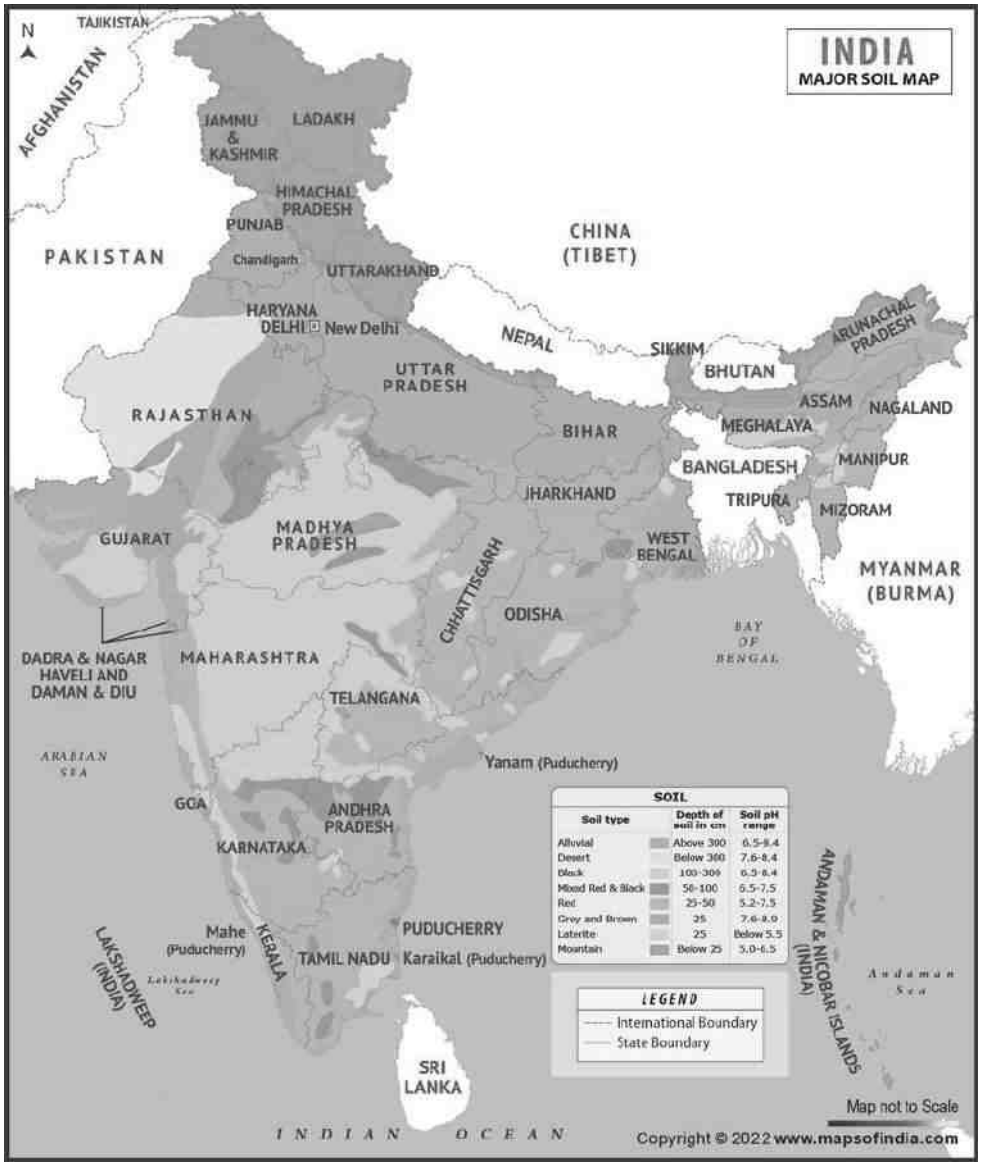
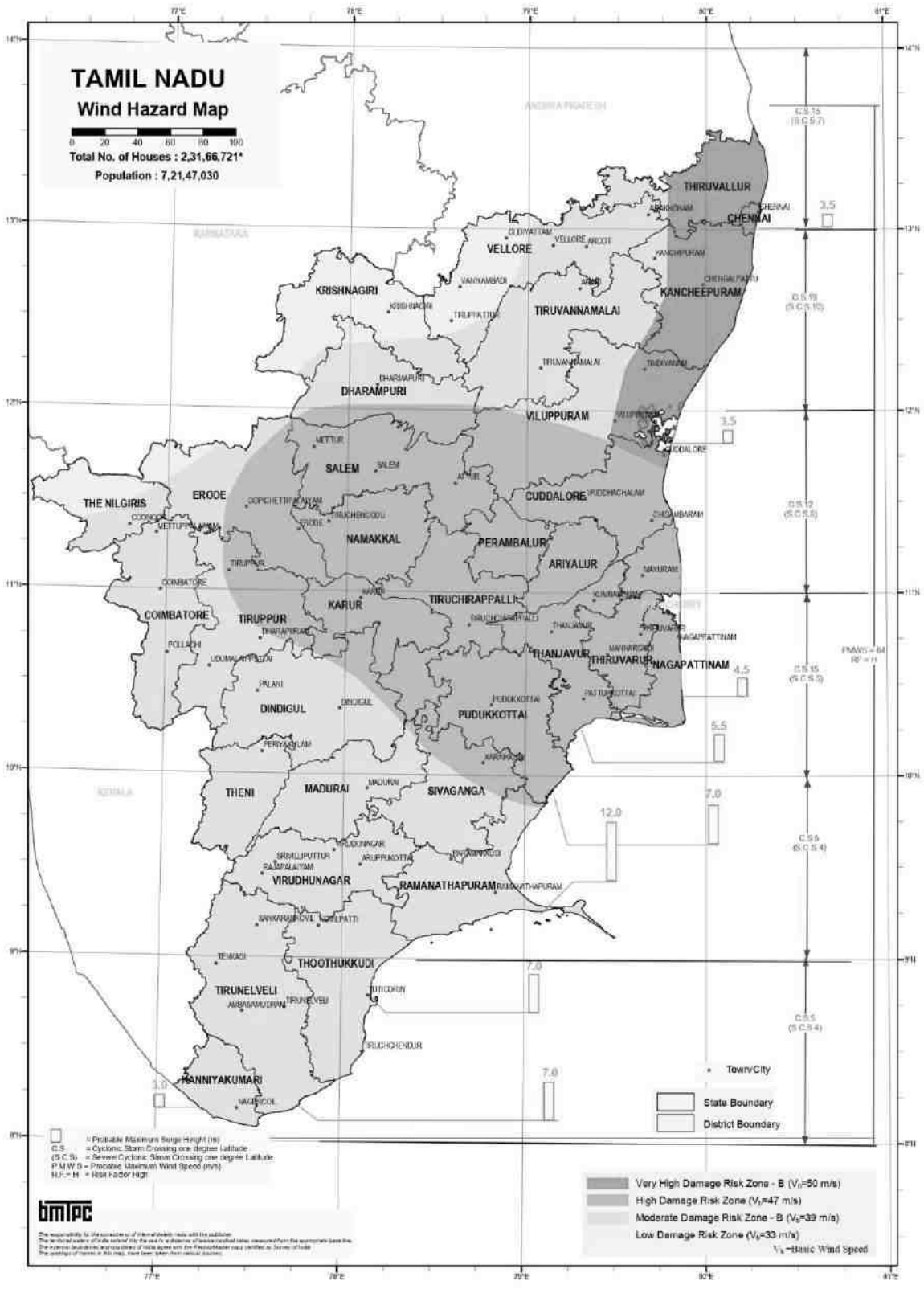


Figure 3-18 Soil map of India

3.4.12 Natural Hazards in PIA District

As any other coastal environment, coast of Villupuram district also gets affected with regular erosion and accretion. Sea level rise and elevation in sea surface temperature are also seen here as the consequences of global climate change. It has been ascertained from the available information that only 8 taluks and 22 blocks were affected by flood in the years 1992-94 and affected by cyclone in the years 1993-94. Banana cultivation faces the cyclone havoc most frequently. The Wind Hazard Map of Tamil Nadu is given in **Figure 3-19.**

Source: *http://tnenvis.nic.in/files/VILLUPURAM%20.pdf*



BMTPC Vulnerability Atlas - 3rd Edition; Peer Group, MoHUA; Map is Based on digitised data of SOI, GOI; Basic Wind Speed Map National Building Code 2016; Cyclone Data, 1891-2015, IMD, GOI. Houses/Population as per Census 2011. *Houses including vacant & locked houses.Disclaimer: The maps are solely for thematic presentation.

Figure 3-19 Wind hazard Map of Tamil Nadu

3.5 Establishment of Baseline for valued environmental components

3.5.1 Air Environment

Baseline ambient air quality assessment gives the status in the vicinity of site and is an indispensable part of environmental impact assessment studies. Significant changes, in predominant winds and weather conditions are observed in winter, summer and post-monsoon seasons apart from the local topographic influences. The baseline status of air environment in the study area is assessed through a systematic air quality surveillance programme

3.5.2 Meteorological Conditions

The regional air quality is influenced by the meteorology of that region. The principal weather parameters that influence the concentration of the air pollutants in the surroundings are wind speed, wind direction and temperature. The meteorological data is useful for proper interpretation of the baseline data.

3.5.3 Meteorological Data Collection

Available secondary data pertaining to the meteorological parameters was obtained from the IMD Climatological tables. In addition, baseline meteorological data was generated during the study period **mid of January 2023 to mid of April 2023**.The methodology adopted for monitoring surface observations is as per the standard norms laid down by Bureau of Indian Standards (BIS) i.e. IS:8829 and Indian Meteorological Department (IMD).

3.5.4 General Meteorological Scenario based on IMD Data

The nearest Indian Meteorological Department (IMD) station located to project site is Cuddalore. The Climatological data of Cuddalore (11° 46' N and 79° 46' E), published by the IMD, based on daily observations at 08:30 and 17:30 hour IST for a 30 year period (1991-2020), is presented in the following sections on the meteorological conditions of the region. The monthly variations of the relevant meteorological parameters are reproduced in **Table 3-5.**

Table 3-5 Climatological Summary– Cuddalore (1991-2020)

Month	Temp (°C)		Rainfall		Relative Humidity (%)		Vapour Pressure hPa		Mean Wind Speed (Kmph)	Predominant Wind Directions (From)*	
	Daily Max.	Daily Min.	Total (mm)	No. of days	08:30	17:30	08:30	17:30		08:30	17:30
Jan	29.7	20.8	26.2	1.3	86	71	24.8	24.9	5.5	NW	NE
Feb	31.0	21.5	13.6	0.8	84	70	26.0	26.3	5.0	NW	E
Mar	32.7	23.3	15.1	0.4	81	71	29.2	29.2	5.3	NW	SE
Apr	34.5	25.9	19.8	1.0	75	73	32.3	33.0	5.9	SW	SE

Month	Temp (°C)		Rainfall		Relative Humidity (%)		Vapour Pressure hPa		Mean Wind Speed (Kmph)	Predominant Wind Directions (From)*	
	Daily Max.	Daily Min.	Total (mm)	No. of days	08:30	17:30	08:30	17:30		08:30	17:30
May	36.9	26.9	49.8	2.1	70	73	31.4	34.6	6.9	SW	SE
Jun	37.0	26.5	53.9	2.9	68	66	29.4	31.6	7.4	SW	SE
Jul	35.9	25.8	62.6	4.0	71	64	28.7	30.5	6.5	SW	SE
Aug	35.1	25.4	118.2	5.7	75	68	29.1	31.2	6.2	SW	SE
Sep	34.2	25.2	112.7	5.8	77	74	29.7	32.0	5.6	SW	SE
Oct	32.2	24.5	272.3	9.9	84	78	30.5	31.1	4.3	SW	SE
Nov	30.0	23.1	389.5	12.2	88	80	29.0	29.1	4.8	N	NE
Dec	29.1	21.7	236.1	6.4	87	76	26.2	26.3	5.8	N	NE
Max.	**37.0**	**26.9**	**389.5**	**12.2**	**88**	**80**	**32.3**	**34.6**	**7.4**	**Annual Predominant wind direction is South East**	
Min.	**29.1**	**20.8**	**13.6**	**0.4**	**68**	**64**	**24.8**	**24.9**	**4.3**		
Annual Avg/Total.	**33.2**	**24.2**	**1369.6**	**52.4**	**79**	**72**	**28.9**	**30**	**5.8**		

As per the above IMD climatological Data given in **Table 3-5,** the observations drawn are as follows

- Highest Daily maximum temperature is 37.0^{o}C and the Lowest daily minimum temperature is 20.8^{o}C were recorded in the months of June and January respectively
- Maximum and minimum relative humidity of 88% and 64% were recorded in the months of November, and July respectively.
- Maximum and minimum rainfall of 389.5 mm and 13.6 mm was recorded in the months of November and February respectively.
- Maximum and minimum Mean wind speed is 7.4 Km/hr and 4.3 Km/hr was recorded in the months of June and October respectively. Annual Predominant wind direction is South East.

3.5.5 Meteorological data during Study Period

The meteorological scenario in and around the project site is an essential requirement during study period for proper interpretation of baseline air quality status. Meteorological data was collected during the study period **mid of January 2023 to mid of April 2023** and is presented in **Table 3-6.** The wind rose for the study period is given as **Figure 3-20.**

Table 3-6 Meteorology Data for the Study Period (January 2022 to March 2022)

S. No	Parameter	Observation
1	Temperature	Max. Temperature: 38°C Min. Temperature: 21°C Avg. Temperature: 28.32°C
2	Average Relative Humidity	74.44%

3	Average Wind Speed	3.01m/s
4	Predominant Wind Direction	E

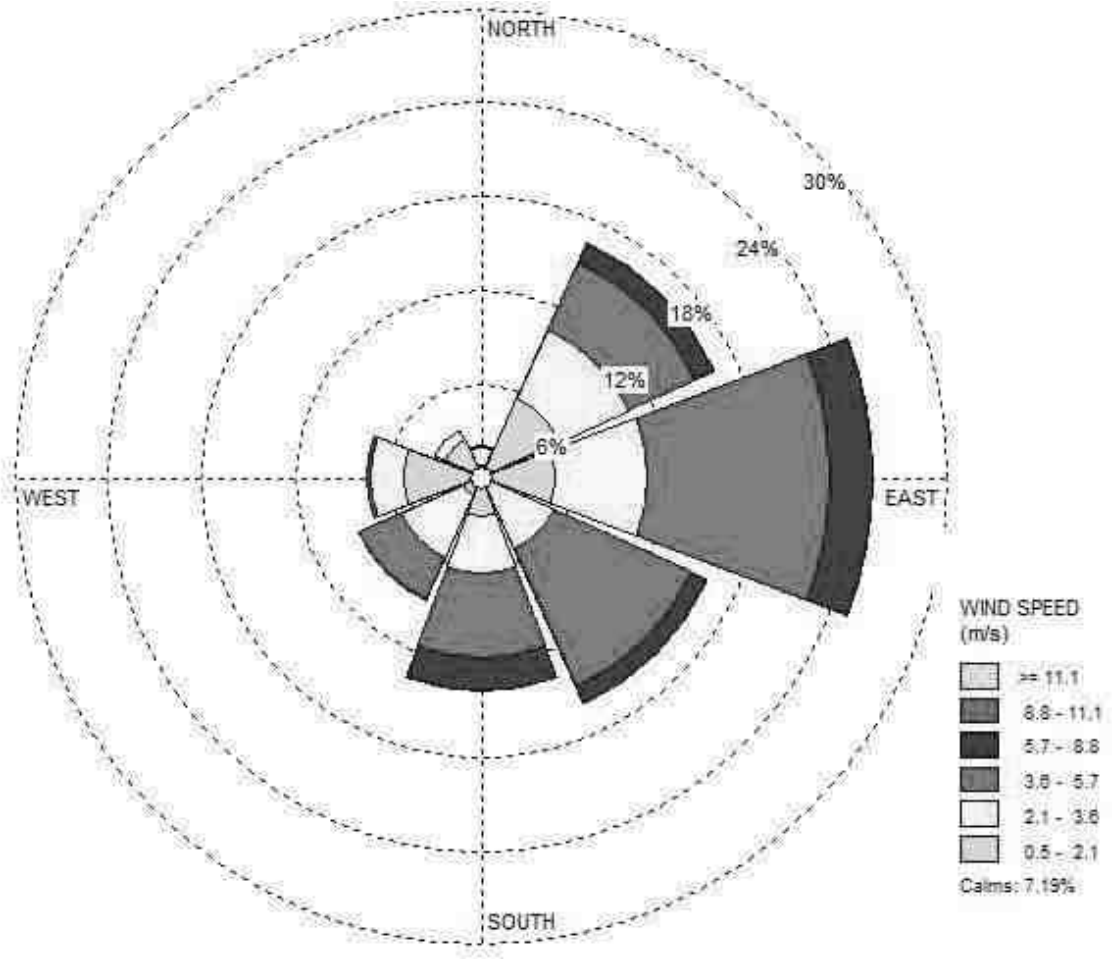


Figure 3-20 Wind Rose diagram during (Jan mid.2023 to April mid.2023)

Atmospheric Inversion

Atmospheric inversion level at the project site was monitored; the results observed at the site during the study period are as follows

- Average atmospheric temperature: 28.32°C
- Average Relative humidity:74.44%
- Average Wind speed: 3.01m/s

The daily inversion level calculated based on the average temperature and average wind speed at the project site and the maximum inversion height is derived by the graph plotted based on the average temperature and

average wind speed. The daily inversion level at the project site varies from 50 to 3097 m during 6 AM to 4 PM, the maximum recorded at 3097 m during April 2023. This is shown in the following **Figure 3-21.**

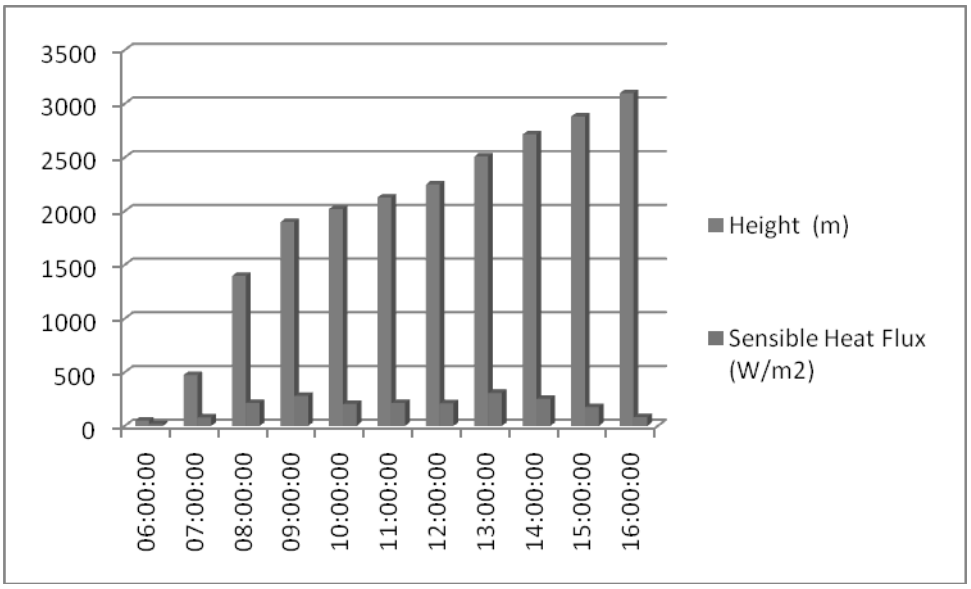


Figure 3-21 Atmospheric inversion level at the project site

3.6 Ambient Air Quality

The selection criteria for monitoring locations are based on the following:

- Topography/Terrain
- Meteorological conditions
- Residential and sensitive areas within the study area
- Representatives of regional background air quality/pollution levels and
- Representation of likely impacted areas

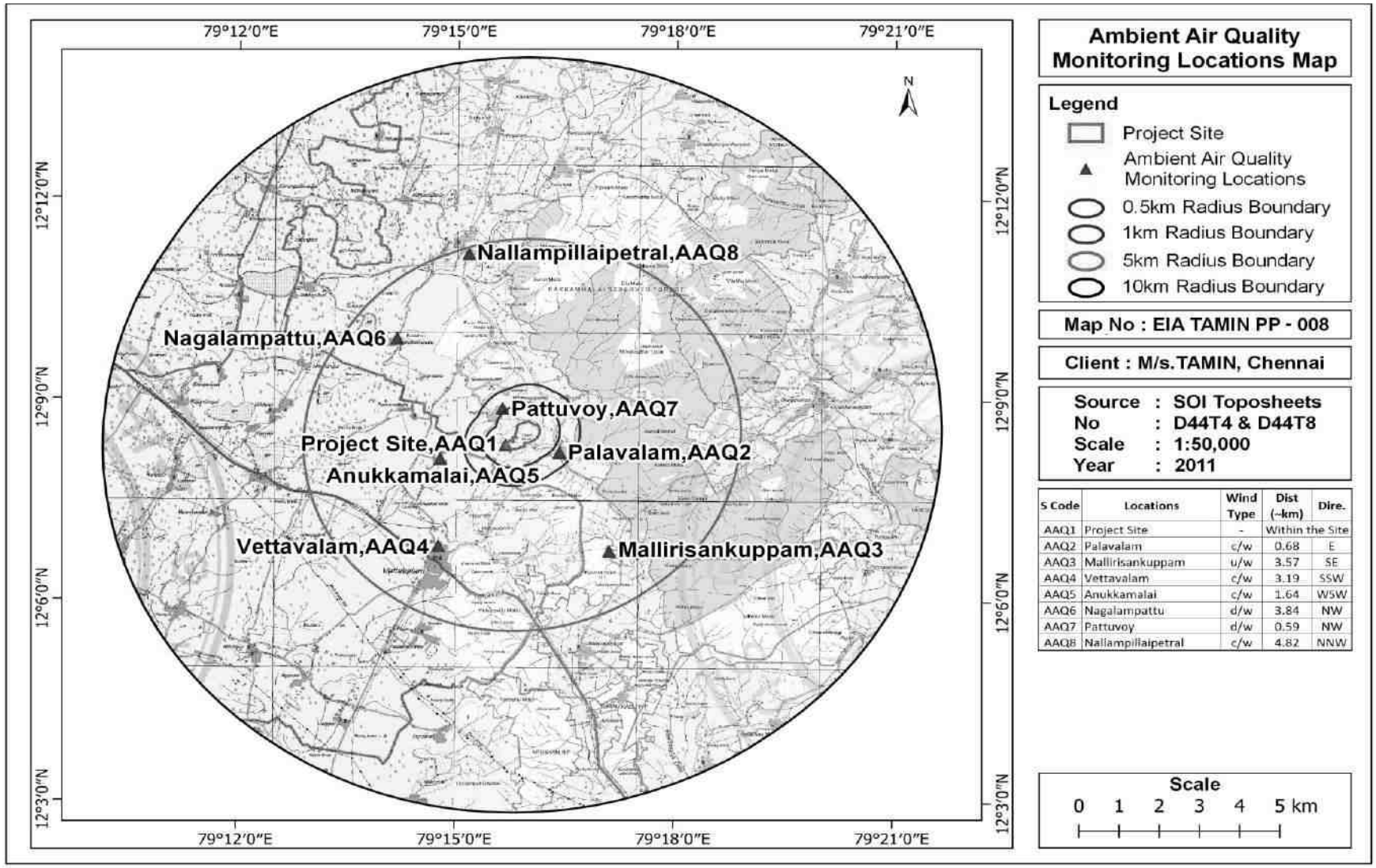
3.6.1 Ambient Air Quality Monitoring Stations

To evaluate the baseline air quality of the study area, Eight (08) monitoring locations have been identified as per annual wind predominance of Cuddalore from IMD data (1991-2020). The wind predominance during study period (mid of January 2023 to mid of April 2023) is from **South East**. AAQ monitoring locations are selected based on Annual wind predominance, map showing the AAQ monitoring locations is given in **Figure 3-22** and the details of the locations are given in **Table 3-7.**

Table 3-7 Details of Ambient Air Quality Monitoring Locations

Station Code	Location	Type of Wind	Distance (~km) from Project boundary	Azimuth Directions
A1	Project Site	-	Within the Site	
A2	Palavalam	c/w	0.68	S

Station Code	Location	Type of Wind	Distance (~km) from Project boundary	Azimuth Directions
A3	Mallirisankuppam	u/w	3.57	SE
A4	Vettavalam	c/w	3.19	SSW
A5	Anukkamalai	c/w	1.64	WSW
A6	Nagalampattu	d/w	3.84	NW
A7	Pattuvoy	d/w	0.59	NW
A8	Nallampillaipetral	c/w	4.82	NNW



S Code	Locations	Wind Type	Dist (~km)	Dire.
AAQ1	Project Site	-	Within the Site	
AAQ2	Palavalam	c/w	0.68	E
AAQ3	Mallirisankuppam	u/w	3.57	SE
AAQ4	Vettavalam	c/w	3.19	SSW
AAQ5	Anukkamalai	c/w	1.64	WSW
AAQ6	Nagalampattu	d/w	3.84	NW
AAQ7	Pattuvoy	d/w	0.59	NW
AAQ8	Nallampillaipetral	c/w	4.82	NNW

Figure 3-22 Map showing the Ambient Air Quality monitoring locations

3.6.2 Ambient Air Quality Monitoring Techniques and Frequency

Ambient air quality was monitored twice in a week for One (01) season (shall cover 12 weeks), i.e. during (mid of January 2023 to mid of April2023). PM10, PM2.5, SO2, NOx, CO, Pb, O3, NH3, C6H6, C20H12, As, Ni, TVOC, Methane Hydrocarbon andNon-Methane Hydrocarbon was monitored. Sampling was carried out as per Central Pollution Control Board (CPCB) monitoring guidelines at each location. Analytical methods used for analysis of parameters are given in **Table 3-8.**

Table 3-8 Analytical Methods for Analysis of Ambient Air Quality Parameters (NAAQ)

S.No	Parameters	Analytical method	NAAQ standards: 2009		Sampling Time
1.	Sulphur Dioxide (SO_2), µg/m^3	IS:5182(Part-2):2001	50 (Annual)	80(24 Hours)	24 Hours
2.	Nitrogen Dioxide (NO_2), µg/m^3	IS: 5182 (Part - 6): 2006	40 (Annual)	80 (24 Hours)	24 Hours
3.	Particulate Matter ($PM_{2.5}$), µg/m^3	IS: 5182 (Part - 23): 2006	40 (Annual)	60 (24 hours)	24 Hours
4.	Particulate Matter (PM_{10}), µg/m^3	IS:5182 (Part– 23): 2006	60 (Annual)	100 (24 hours)	24 Hours
5.	CO mg/m^3	IS:5182(Part–10):1999	2 (8 hours)	4 (1hour)	8 Hours
6.	Pbµg/m^3	IS:5182(Part–22):2004	0.5(Annual)	1(24 hours)	24 Hours
7.	O_3, µg/m^3	IS: 5182 (Part – 9): 1974	100(8hours)	180 (1hour)	8 Hours
8.	NH_3, µg/m^3	IS 5182 Part 25: 2018	100(Annual)	400(24 hours)	8 Hours
9.	Benzene, µg/m^3	IS 5182 Part 11: 2006	5 (Annual)	5 (Annual)	24 Hours
10.	Benzo (a) pyrene, ng/m^3	IS 5182 Part 12 : 2004	1 (Annual)	1 (Annual)	24 Hours
11.	Arsenic, ng/ m^3	HECS/AA/SOP/019,Issue No:01,Issue Date :16.12.:2016: 2016	6 (Annual)	6 (Annual)	24 Hours
12.	Nickel ng/ m^3	HECS/AA/SOP/009,issue No.01,Issue Date :16.12:2016: 2016	20(Annual)	20(Annual)	24 Hours
13.	Free Silica	NIOSH Manual- Method 7601	--	--	8 hours

3.6.2.1 Results and Discussions

The variations of the pollutants Particulate matter <10 micron size (PM_{10}),Particulate matter <2.5 micron size ($PM_{2.5}$), Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2),Carbon Monoxide (CO), Lead (Pb),Ozone (O_3),Benzene (C_6H_6), Benzo (a) pyrene ($C_{20}H_{12}$), Arsenic (As), Nickel (Ni),Ammonia (NH_3) are compared with National Ambient Air Quality Standards (NAAQS), MoEF&CC Notification, November 2009. Ambient Air Quality Monitoring Data (**mid of January 2023 to mid of April 2023)** for the study area is given in **Table 3-9** and trends of measured ambient concentration in the study area were graphically represented in **Figure 3-23.**

Table 3-9 Summary of the average baseline concentrations of pollutants

Parameters	Conc.	NAAQ Standards	Locations							
			Project Site	Palavalam	Mallirisankuppam	Vettavalam	Anukkamalai	Nagalampattu	Pattuvoy	Nallampillaipetral
			A1	A2	A3	A4	A5	A6	A7	A8
PM_{10} Conc. ($\mu g/m^3$)	Min.	100 (24 Hours)	28.33	30.57	47.41	46.03	48.05	49.27	50.95	48.97
	Max.		92.06	108.66	67.57	65.59	68.47	70.22	72.61	69.79
	Avg.		**62.03**	**59.31**	**56.86**	**55.19**	**57.62**	**59.09**	**61.10**	**58.73**
	98th 'tile		91.92	102.29	67.18	65.21	68.08	69.81	72.19	69.39
$PM_{2.5}$ Conc. ($\mu g/m^3$)	Min.	60 (24 Hours)	24.13	26.64	27.30	24.80	25.38	24.97	27.97	25.63
	Max.		34.39	37.96	38.91	35.34	36.18	35.58	39.87	36.53
	Avg.		**28.94**	**31.95**	**32.75**	**29.74**	**30.44**	**29.94**	**33.55**	**30.74**
	98th 'tile		34.19	37.74	38.69	35.14	35.97	35.37	39.63	36.32
SO_2 Conc. ($\mu g/m^3$)	Min.	80 (24 Hours)	9.44	10.52	11.52	12.11	11.11	9.94	11.77	11.19
	Max.		13.45	14.99	16.42	17.26	15.83	14.16	16.78	15.95
	Avg.		**11.32**	**12.62**	**13.82**	**14.52**	**13.32**	**11.92**	**14.12**	**13.42**
	98th 'tile		13.37	14.91	16.33	17.15	15.74	14.08	16.68	15.85
NO_2 Conc. ($\mu g/m^3$)	Min.	80 (24 Hours)	25.2	18.1	19.5	20.5	16.8	21.8	19.2	16.9
	Max.		35.9	25.8	27.8	29.3	24.0	31.1	27.4	24.1
	Avg.,		**30.2**	**21.7**	**23.4**	**24.6**	**20.2**	**26.2**	**23.0**	**20.3**
	98th 'tile		35.7	25.6	27.6	29.1	23.8	30.9	27.2	24.0
Lead (Pb) ($\mu g/m^3$)	Avg.	1 (24 hour)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)
Carbon monoxide (CO) (mg/m^3)	Avg.	4 (1hour)	0.19	0.21	0.26	0.24	0.31	0.28	0.22	0.33
Ozone O_3 ($\mu g/m^3$)	Avg.	180 (1hour)	10.98	12.6	13.4	12.48	14.21	13.11	14.22	13.9
Benzene (C_6H_6) ($\mu g/m^3$)	Avg.	5(Annual)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)

Parameters	Conc.	NAAQ Standards	Locations							
			Project Site	Palavalam	Mallirisankuppam	Vettavalam	Anukkamalai	Nagalampattu	Pattuvoy	Nallampillaipetral
			A1	A2	A3	A4	A5	A6	A7	A8
Benzo (a) Pyrene ($C_{20}H_{12}$ (a)) , (ng/m^3)	**Avg.**	**1 (Annual)**	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)
Arsenic (As) (ng/m^3)	**Avg.**	**6 (Annual)**	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)
Nickel as Ni (ng/m^3)	**Avg.**	**20 (Annual)**	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)
Ammonia (NH_3) ($\mu g/m^3$)	**Avg.**	**400 (24 hour)**	7.14	8.09	7.99	7.63	8.26	8.33	7.56	7.73
Free Silica	**Avg.**	**--**	BLQ (LOQ 0.04)	BLQ (LOQ 0.04)	BLQ (LOQ 0.04)	BLQ (LOQ 0.04)	BLQ (LOQ 0.04)	BLQ (LOQ 0.04)	BLQ (LOQ 0.04)	BLQ (LOQ 0.04)

Note: *BDL (Below detection limit), DL (Detection limit), BLQ (Below Limit Of Quantification), LOQ (Limit of Quantification)*

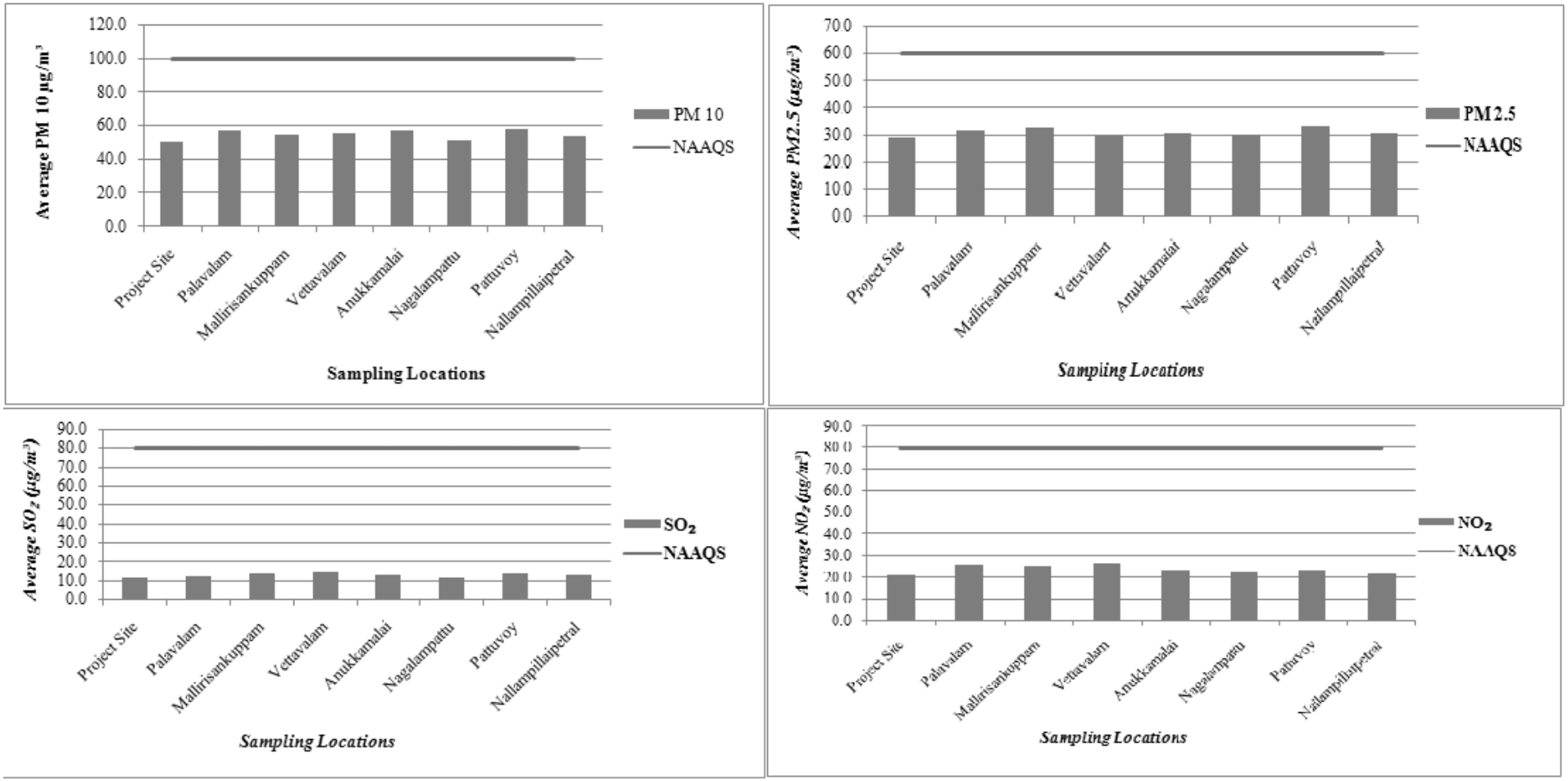


Figure 3-23 Trends of Measured Ambient Concentrations in the Study Area

3.6.2.2 Observations

The ambient air quality has been monitored at 8 locations as per NAAQS, 2009 within the study area. The results obtained are summarised as below:

- The average baseline levels of PM_{10} vary from 50.37 to 57.68 µg/m³.
- The average baseline levels of $PM_{2.5}$ vary from 28.94 µg/m³ to 33.55 µg/m³.
- The average baseline levels of SO_2 vary from 11.32 µg/m³ to 14.52 µg/m³.
- The average baseline levels of NO_2vary from 21.03 µg/m³ to 26.64 µg/m³

3.7 Noise Environment

The prevailing ambient noise level at a particular location is nothing but the resultant (total) of all kinds of noise sources existing at various distances around that location. The ambient noise level at a location varies continuously depending on the type of surrounding activities.

Ambient noise levels have been established by monitoring noise levels at Eight (08) locations in and around 10Km distance from project area during the study period using precision noise level meter. The noise monitoring locations in the study area were selected after giving due consideration to the various land use categories. The land use categories include commercial, residential, rural and sensitive areas. Noise levels were recorded on an hourly basis for one complete day at each location using pre- calibrated noise levels. Map showing noise monitoring locations is **Figure 3-24.**

3.7.1 Results and Discussions

Based on the recorded hourly noise levels at each monitoring location, the day equivalent (Ld) and night equivalent (Ln) were calculated;
Ld: Average noise levels between 6:00 hours to 22.00 hours

The day and night equivalent noise levels given in **Table 3-10**

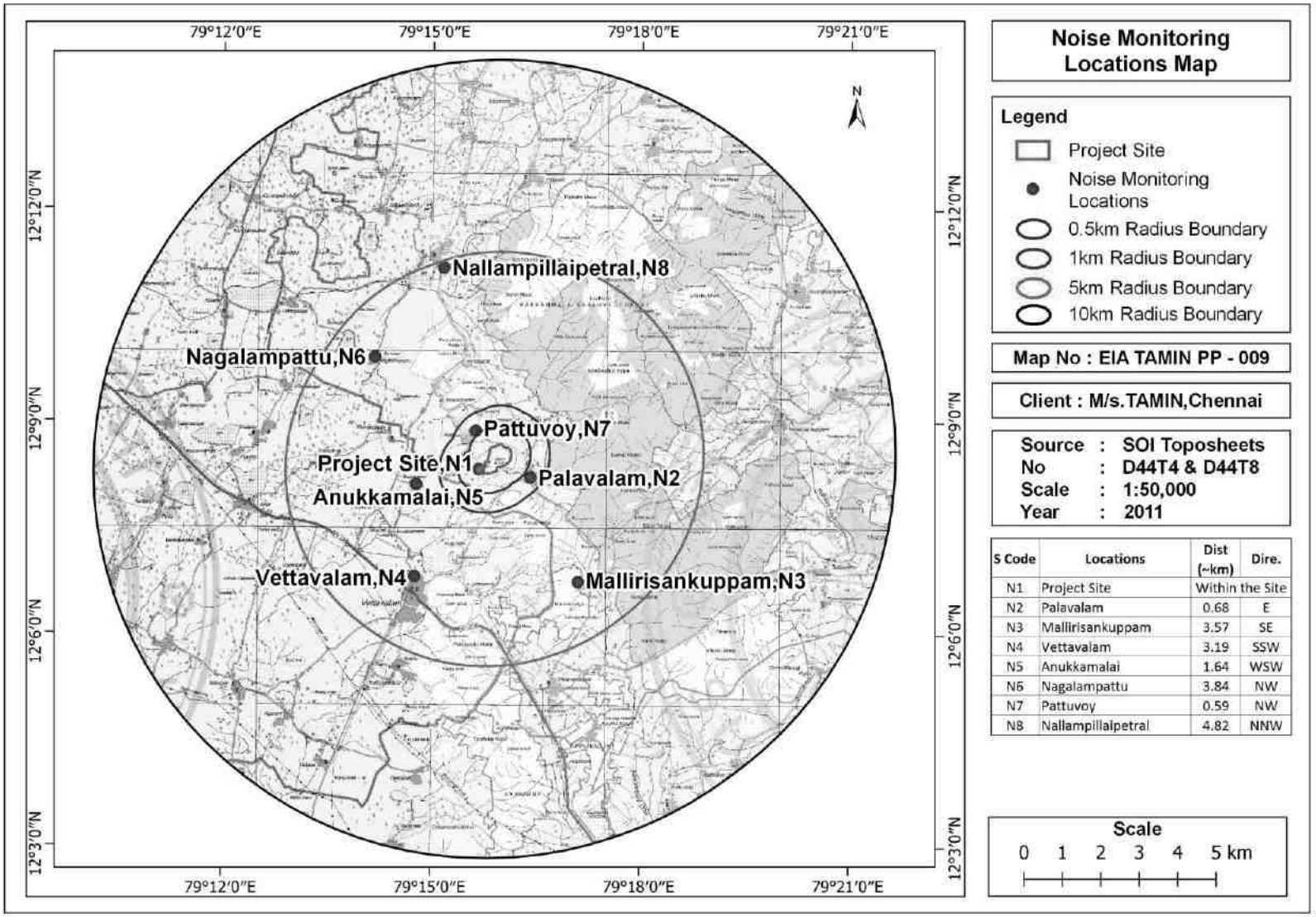
Table 3-10 Day and Night Equivalent Noise Levels

Location Code	Location	Distance (~km) from Project boundary	Azimuth Direction	Noise level in dB(A) Leq		CPCB Standard		Environmental Setting
				Day	Night	Lday (Ld)	LNight (Ln)	
N1	Project Site	Within Site		50.1	47.6	75	70	Industrial
N2	Palavalam	0.68	S	52.1	40.3	55	45	Residential
N3	Mallirisankuppam	3.57	SE	53.1	39.8	55	45	Residential
N4	Vettavalam	3.19	SSW	52.8	41.6	55	45	Residential
N5	Anukkamalai	1.64	WSW	51.9	41.1	55	45	Residential
N6	Nagalampattu	3.84	NW	51.6	43.2	55	45	Residential
N7	Pattuvoy	0.59	NW	52.7	42.8	55	45	Residential
N8	Nallampillaipetral	4.82	NNW	53.3	40.1	55	45	Residential

3.7.1.1 Observations

It is observed that the day equivalent and night equivalent noise levels at all locations are within prescribed CPCB standards

- In Industrial area (Project site), day time noise level was about 50.1 dB (A) and 47.6 dB(A) during night time, which is within prescribed limit by CPCB for Industrial area (75 dB(A) Day time & 70 dB(A)Night time).
- In Residential area day time noise levels varied from 51.6 dB (A) to 53.1 dB (A) and night time noise levels varied from 39.8 dB(A) to 43.2 dB(A) across the sampling stations. The field observations during the study period indicate that the ambient noise levels in Residential area are within the limit prescribed by CPCB for Residential area (55 dB (A) Day time & 45 dB(A) Night time).



S Code	Locations	Dist (~km)	Dire.
N1	Project Site	Within the Site	
N2	Palavalam	0.68	E
N3	Mallirisankuppam	3.57	SE
N4	Vettavalam	3.19	SSW
N5	Anukkamalai	1.64	WSW
N6	Nagalampattu	3.84	NW
N7	Pattuvoy	0.59	NW
N8	Nallampillaipetral	4.82	NNW

Figure 3-24 Map showing the noise monitoring locations

3.8 Water Environment

3.8.1 Surface Water Resources

The Ponnaiyar, the Malattar and the Gadilam are the major rivers draining the district. The Ponnaiyar River flows from northwest to east in the district. The Manimukta nadi originates in Kalrayan hills and drains the southern part of the district. The Pambaiyar and the Varaganadhi originate in the uplands of the district and join Bay of Bengal. The Varaganadhi is also known as the Gingee River and drains the parts of Gingee and Vanur taluks of this district. The Malattar and Gadilam rivers also originate in the uplands within the district and flow eastwards to Cuddalore district. All the rivers are ephemeral in nature and carry only floodwater during monsoon period. The drainage pattern is mostly parallel to sub parallel and drainage density is very low. There are small reservoirs across rivers namely Gomukha, Vedur and Mahanathur.

Source: *http://cgwb.gov.in/District_Profile/TamilNadu/VILUPPURAM.pdf*

*(**Ref:** Government of India, Ministry of Water Resources, Central Ground Water Board, South Eastern Coastal Region Chennai, "District Ground Water Brochure Viluppuram District")*

3.8.2 Surface Water Quality Assessment

Water quality monitoring and assessment can be used to determine ambient water quality, the extent and causes of a water quality problem, or to measure the effectiveness of best management practices being implemented in water system. Monitoring helps to determine the trends in the quality of the aquatic environment and the impact due to the release of contaminants, other anthropogenic activities, and/or by waste treatment operations (impact monitoring).To establish the baseline status of water environment, the representative sampling locations for surface water within a radial distance of 10Km from project site have been selected as per CPCB guidelines of Water Quality Monitoring through an adequate survey of the project area. Test methods used for the analysis of water quality parameters is given in **Table 3-11** Water sampling and map of sampling location are given in **Table 3-12** and **Figure 3-25**. Physicochemical Parameters of Surface water samples from the study area given in **Table 3-13**.

Table 3-11 Test methods used for the analysis of water quality parameters

Sl. No	Parameter Measured	Test Method
1	Turbidity	IS 3025(Part - 10):1984
2	pH	IS:3025 (Part - 11): 1983
3	Electrical Conductivity	IS:3025 (Part - 14): 1983
4	Total Dissolve Solids	IS: 3025:1(Part - 16) 1984
5	Total Suspended Solids	IS 3025 (Part - 17) 1984
6	Total Alkalinity as CaCO3	IS:3025,1 (Part - 23) 1986
7	Total Hardness as CaCo3	IS:3025 (Part - 21) 1983

Sl. No	Parameter Measured	Test Method
8	Sodium as Na	IS:3025,5(Part - 45) 1993
9	Potassium as K	IS:3025,5(Part - 45) 1993
10	Calcium as Ca	IS 3025 (Part - 40):1991
11	Magnesium as Mg	IS 3025 (Part - 46) 1994
12	Chloride as cl	IS 3025 (Part - 32):1988
13	Sulphate as SO4	IS 3025(Part - 24):1986
14	Nitrate as NO3	ASTM (Part - 31)1978
15	Phosphate as PO4	IS 3025 (Pt 45) 1993
16	Fluorides as F	IS 3025 (Part - 60):2008
17	Cyanide as Cd	IS 3025 (Part-27):1986
18	Arsenic as As	IS 3025:(Part-37):1988
19	Cadmium as Cd	IS 3025 (Part - 41)1991
20	Chromium, Total	IS:3025 (Part - 52) 2003
21	Lead as Pb	IS:3025 (Part - 47) 1994
22	Manganese as Mn	IS 3025:(Part - 59):2006
23	Mercury as Hg	IS 3025 (Part48):1994 RA 1999
24	Nickel as Ni	IS 3025:(Part-54):2003
25	Selenium as Se	IS 3025 Part (56)2003
26	Zinc as Zn	IS:3025 (Part - 49) 1994
27	Dissolved Oxygen (DO)	IS:3025 (Part - 38)1989
28	BOD, 3 days @ 27°C as O_2	5210B APHA22nd Edn 2012
29	Chemical Oxygen Demand as O_2	IS:3025 (Part-58)-2006

Table 3-12 Details of Surface water sampling locations

Location Code	Location	Distance in km	Direction
SW1	Pattuvoy Lake	0.18	NE
SW2	Varaha Nadi	9.51	NNE
SW3	Palavalam Lake	0.20	S
SW4	Adukkam Lake	7.61	SSE
SW5	Vettavalam Lake	2.58	SW
SW6	Avur Lake	6.03	W
SW7	Kolattur Lake	7.60	WNW
SW8	Canal near Nallampillaipetral	4.29	NNW

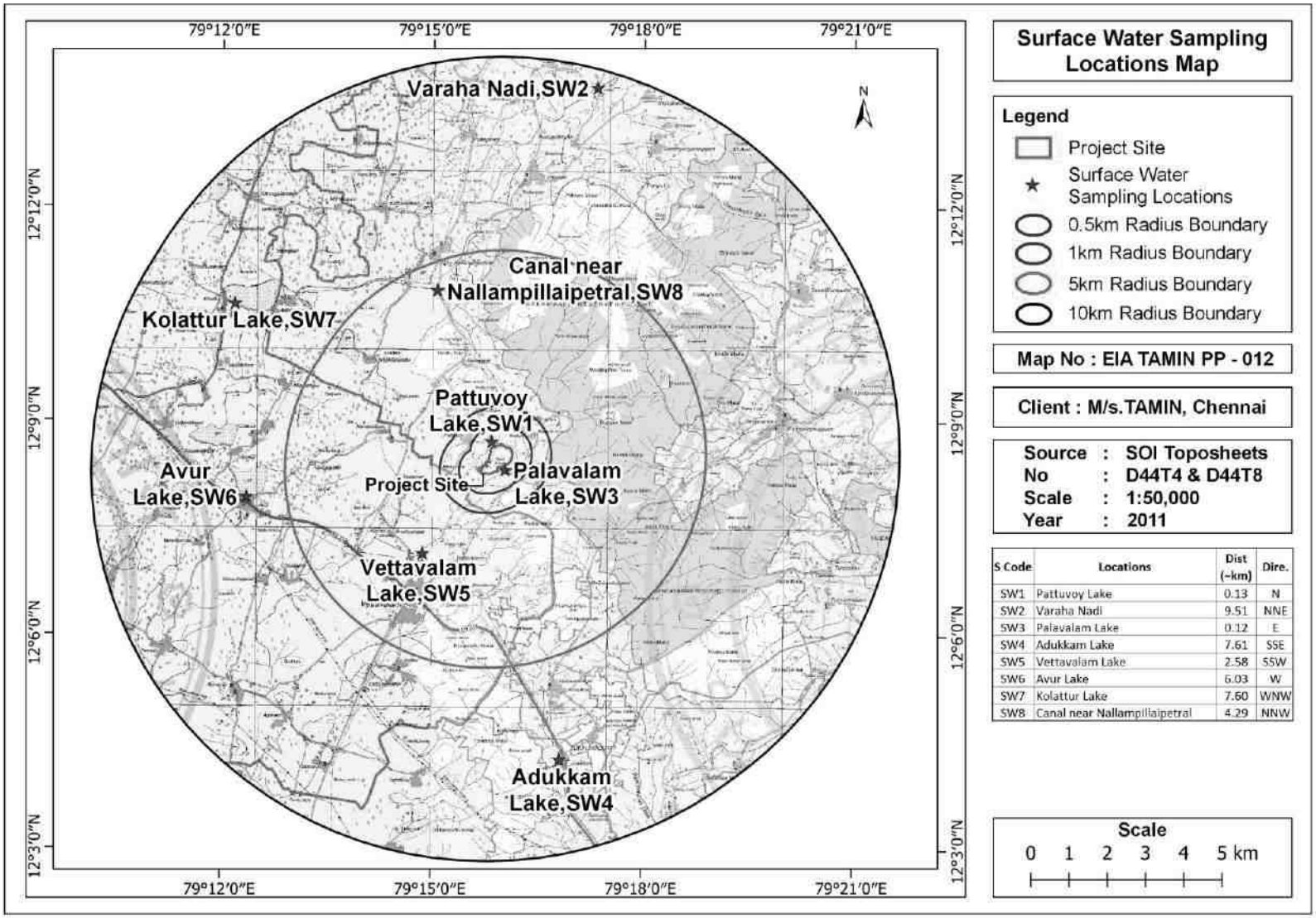


Figure 3-25 Map showing the surface water monitoring locations

Table 3-13 Physicochemical Parameters of Surface water samples from the study area

Sl.No	Parameter	Unit	Pattuvoy Lake	Varaha Nadi	Palavalam Lake	Adukkam Lake	Vettavalam Lake	Avur Lake	Kolatur Lake	Canal near Nallampillaipetral
			SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8
1.	pH (at 25°C)	--	7.49	6.98	7.12	7.33	7.51	7.08	7.22	7.63
2.	Electrical Conductivity	µS/cm	714	657	483	549	623	498	506	612
3.	Total Dissolved Solids	mg/l	441	418	318	376	398	317	321	412
4.	Total Suspended Solids	mg/l	41	38	53	47	26	34	47	59
5.	Total Alkalinity as $CaCO_3$	mg/l	93	107	80	81	72	77	99	95
6.	Total Hardness as $CaCO_3$	mg/l	86	105	110	109	94	132	119	125
7.	Sodium as Na	mg/l	32.5	19.3	25.2	32.6	29.1	13.2	22.3	20.9
8.	Potassium as K	mg/l	3.2	4.3	2.6	3.7	1.7	1.3	2.5	3.4
9.	Calcium as Ca	mg/l	23.1	27.4	28.7	31.6	24.2	37.3	29.1	37.5
10.	Magnesium as Mg	mg/l	6.75	8.8	9.4	7.3	8.1	9.4	11.3	7.6
11.	Chloride as Cl	mg/l	32.3	27.1	29.1	44.1	35.3	29.4	31.3	28.8
12.	Sulphate as SO_4	mg/l	9.6	8.8	11.1	19.3	13.7	12.3	12.9	10.9
13.	Nitrate as NO_3	mg/l	6.3	5.9	7.2	3.4	1.7	5.8	7.4	5.6
14.	Phosphate as PO_4	mg/l	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)
15.	Fluorides as F	mg/l	0.33	0.22	0.37	0.49	0.21	0.11	0.32	0.34
16.	Cyanide	mg/l	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
17.	Arsenic	mg/l	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)
18.	Cadmiu86m as Cd	mg/l	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)
19.	Chromium, Total	mg/l	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
20.	Lead as Pb	mg/l	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
21.	Manganese as Mn	mg/l	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)
22.	Mercury	mg/l	BLQ(LOQ	BLQ(LOQ	BLQ(LOQ	BLQ(LOQ	BLQ(LOQ	BLQ(LOQ	BLQ(LOQ	BLQ(LOQ

Sl.No	Parameter	Unit	Pattuvoy Lake	Varaha Nadi	Palavalam Lake	Adukkam Lake	Vettavalam Lake	Avur Lake	Kolatur Lake	Canal near Nallampillaipetral
			SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8
			0.0005)	0.0005)	0.0005)	0.0005)	0.0005)	0.0005)	0.0005)	0.0005)
23.	Nickel as Ni	mg/l	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
24.	Selenium as Se	mg/l	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
25.	Zinc	mg/l	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
26.	Dissolved Oxygen	mg/l	5.9	5.3	5.8	6.18	5.8	5.9	6	5.6
27.	Chemical Oxygen Demand as O_2	mg/l	57	63	49	33	38	41	29	24
28.	BOD, 3 days @ 27°C as O_2	mg/l	5.6	2.8	4.1	6.3	8.1	4.6	7.7	9.4

Note: BLQ – Below Limit of Quantification; LOQ – Limit Of Quantification

3.8.2.1 Results and Discussions

Surface water sample results are discussed below:

- Water sampling results are compared with Surface water standards IS 2296:1992.
- pH in the collected surface water samples varies between 6.98 to 7.63 which is within the limit of IS 2296:1992.
- The Total Dissolved Solids (TDS) value of collected surface water sample ranges from 317 mg/l to 441 mg/l.
- The Total hardness value of the collected surface water sample ranges between 86 mg/l to 132 mg/l.
- BOD value of surface water varies from 2.8 mg/l to 9.4mg/L
- COD value of surface water varies from 24 to 63 mg/l**.**

Surface water standards (IS 2296:1992) given in **Table 3-14**

Table 3-14 Surface water Standards (IS 2296:1992)

S.No	Parameters	Unit	A	B	C	D	E
1	Turbidity	NTU	---	---	---	---	---
2	pH	--	8.5	8.5	8.5	8.5	8.5
3	Conductivity	µS/cm	---	---	---	1000	2250
4	Total Dissolved Solids	mg/l	500	---	1500	---	2100
5	Alkalinity as $CaCO_3$	mg/l	---	---	---	---	---
6	Total Hardness as $CaCo_3$	mg/l	300	---	---	---	---
7	Calcium as Ca	mg/l	80.10	---	---	---	---
8	Magnesium as Mg.	mg/l	24.28	---	---	---	---
9	Sodium Na	mg/l	---	---	---	---	---
10	Potassium	mg/l	---	---	---	---	---
11	Chloride as Cl	mg/l	250	---	600	---	600
12	Sulphate as SO4	mg/l	400	---	400	---	1000
13	Phosphate	mg/l	---	---	---	---	---
14	Nitrate as NO_3	mg/l	20	---	50	---	---
15	Fluorides as F	mg/l	1.5	1.5	1.5	---	---
16	Cyanide	mg/l	0.05	0.05	0.05	---	---
17	Arsenic	mg/l	0.05	0.2	0.2	---	---
18	Cadmium	mg/l	0.01	---	0.01	---	---
19	Chromium, Total	mg/l	0.05	0.05	0.05	---	---
20	Copper	mg/l	1.5	---	1.5	---	---
21	Iron	mg/l	0.3	---	50	---	---
22	Lead	mg/l	0.1	---	0.1	---	---
23	Zinc	mg/l	15	---	15	---	---
24	Manganese	mg/l	0.5	---	---	---	---

S.No	Parameters	Unit	A	B	C	D	E
25	Selenium	mg/l	0.01	---	0.05	---	---
26	Mercury	mg/l	0.001	---	---	---	---
27	Dissolved Oxygen	mg/l	6	5	4	4	---
28	COD	mg/l	---	---	---	---	---
29	BOD	mg/l	2	3	3	---	---

Class A – Drinking water without conventional treatment but after disinfection.

Class B –Water for outdoor bathing.

Class C – Drinking water with conventional treatment followed by disinfection.

Class D – Water for fish culture and wild life propagation.

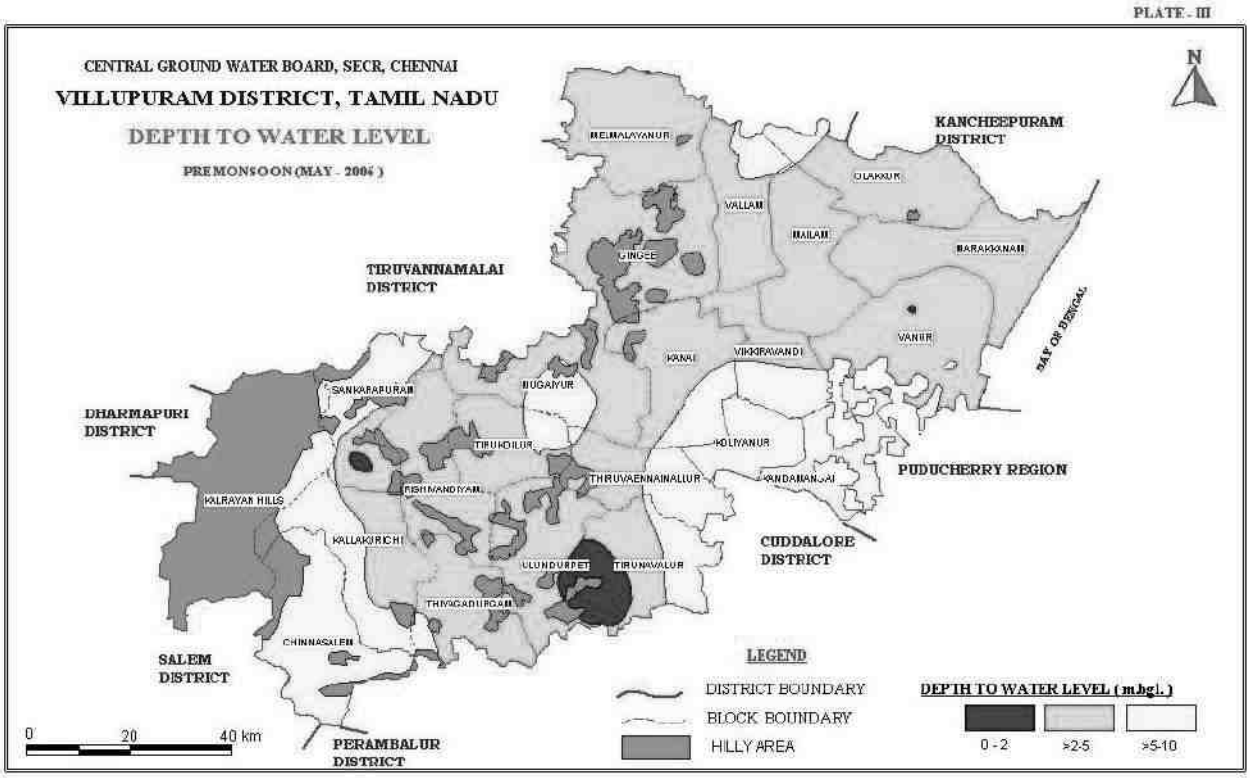
Class E – Water for irrigation, industrial cooling and controlled waste disposal

3.8.3 Groundwater Resources

Ground water development is very high in the district. There are number of dug wells and dug cum bore wells in the hard rock areas while tube wells are common in the sedimentary areas. The average draft of dug wells in hard rock areas is of the order of 1.2 ha.m./year. The extraction of ground water by shallow tube wells in the eastern part of the district is of the order of 2.5 ha.m./year. The average command area for dug well and bore well in the district is 2 ha and 3 ha respectively. The hard rock areas in select pockets with valley fills and lineaments are having appreciable ground water potential. At many pockets, the command areas are the main potential ground water zones, The yield prospects are good in select pockets of Villupuram, Sankarapuram and Kallakurichi areas where as it is very poor in Tirukoilur, Ulundurpet, Gingee and Tindivanam taluks. The massive granites in Gingee and Tindivanam taluks do not favour even bore wells. The augmentation of well yield by horizontal and extension bores is successful in part of Kallakurichi and Tirukoilur areas. The crystalline sedimentary contact zones have thick limestone capping followed by productive granular zones, which are tapped, by number of cavity wells of 40 to 60 m bgl depth giving 7 to 10 lps discharge. The tube wells can yield about 70 to 200 m3/hr and can sustain pumping for 10 hrs a day. The Depth to water level during Pre Monsoon & Post Monsoon for Viluppuram District, Tamil Nadu, is given in **Figure 3-26**

Source: *http://cgwb.gov.in/District_Profile/TamilNadu/VILUPPURAM.pdf*

*(**Ref:** Government of India, Ministry of Water Resources, Central Ground Water Board, South Eastern Coastal Region Chennai, "District Ground Water Brochure Viluppuram District")*



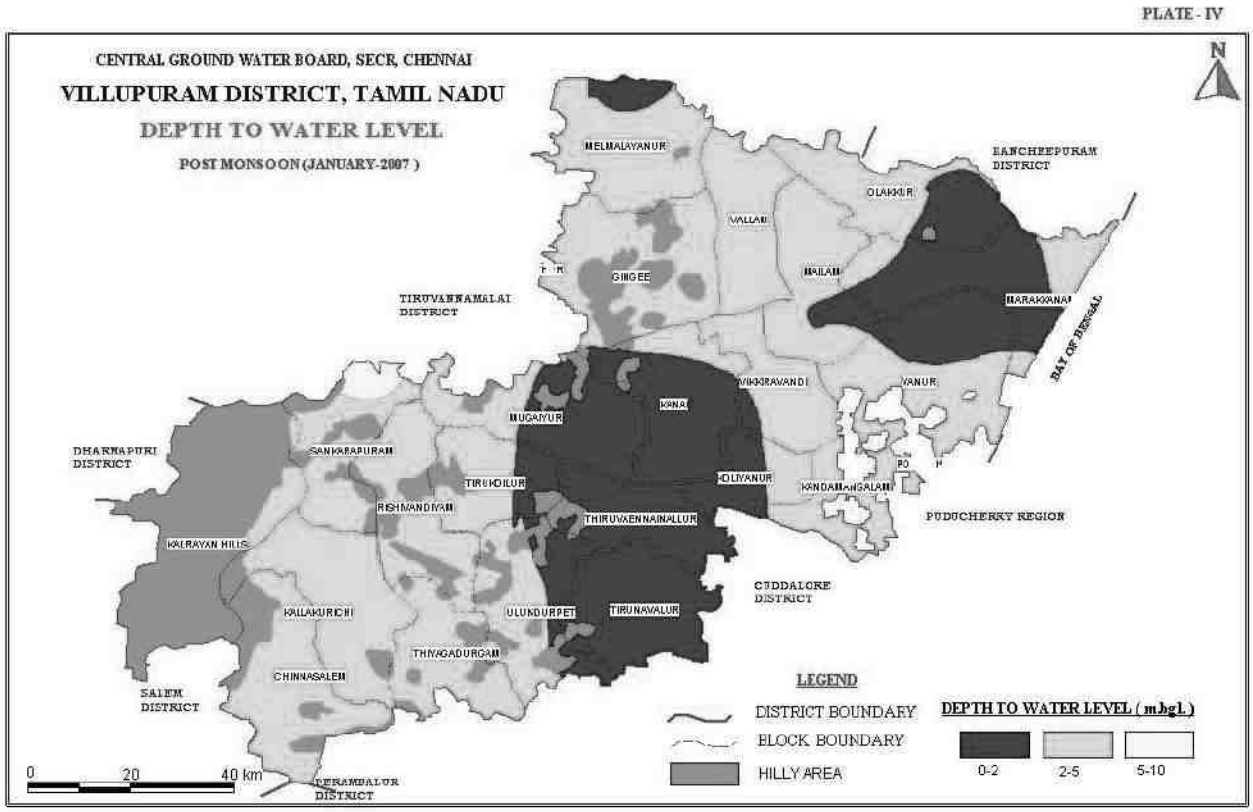


Figure 3-26 Depth to water level during Pre-Monsoon & Post Monsoon in Villupuram District

3.8.3.1 Groundwater Quality

Groundwater is the principal source for domestic and drinking purposes in almost all villages near the study area. The quality of the groundwater received is influenced by pollution of soil and air, industrial and domestic waste disposal, organic components, pathogenic microorganisms, application of fertilizers and pesticides in agriculture, etc. Total Eight (08) ground water monitoring locations were identified for assessment in different villages around the project site based on the usage of sub surface water by the settlements/ villages in the study area. The groundwater results are compared with the desirable and permissible water quality standards as per IS 10500 (2012) for drinking water. Groundwater quality monitoring locations and results are given in **Table 3-15** and **Table 3-16.** Map showing the groundwater monitoring locations are given in **Figure 3-27.**

Table 3-15 Details of Groundwater Quality Monitoring Locations

Location Code	Location	Distance in Km	Direction
GW1	Near Project Site	0.18	S
GW2	Palavalam	0.68	E
GW3	Mallirisankuppam	3.57	SE
GW4	Vettavalam	3.19	SSW
GW5	Anukkamalai	1.64	WSW
GW6	Nagalampattu	3.84	NW
GW7	Pattuvoy	0.59	NW
GW8	Nallampillaipetral	4.82	NNW

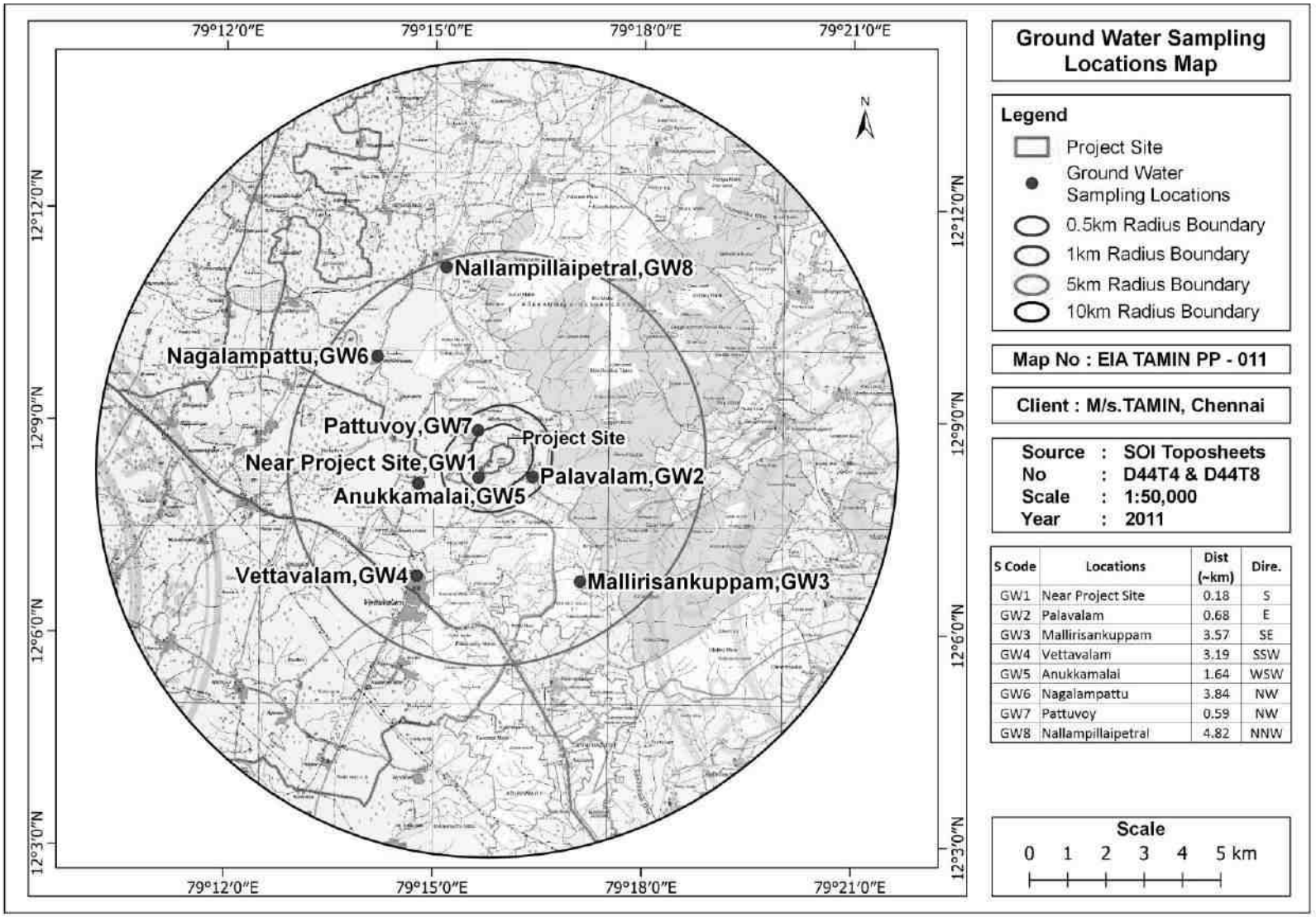


Figure 3-27 Map showing the groundwater monitoring locations

Table 3-16 Physico chemical analysis of Ground water samples from study area

S.No	Parameters	Unit	Drinking water Standard (IS 10500: 2012)		Project Site	Palavalam	Mallirisankuppam	Vettavalam	Anukkamalai	Nagalamattu	Pattuvoy	Nallampillaipetral
			Permissible Limit	Acceptable Limit	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
1	Colour	Hazen	**15**	**5**	BLQ (LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)
2	Turbidity	NTU	**5**	**1**	BLQ (LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
3	pH	-	**NR**	**6.5-8.5**	7.16	7.22	7.54	6.98	7.18	7.64	7.85	8.12
4	Electrical Conductivity	µS/cm	**-**	**-**	690	710	546	627	898	690	520	741
5	Total Dissolved Solids	mg/l	**2000**	**500**	459	489	359	437	561	416	319	464
6	Total Suspended Solids		**-**	**-**	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)
7	Total Alkalinity as $CaCO_3$	mg/l	**600**	**200**	40	43	50	84	80	69	70	60
8	Total Hardness as $CaCO_3$	mg/l	**600**	**200**	345	357	510	726	609	550	414	469
9	Sodium as Na	mg/l	**-**	**-**	119	210	244	223	212	201	110	175
10	Potassium as K	mg/l	**-**	**-**	5.2	6.7	7.1	6.9	5.8	6.3	6.7	5.1
11	Calcium as Ca	mg/l	**200**	**75**	69	72	112	106	145	118	70	117
12	Magnesium as Mg	mg/l	**100**	**30**	42	43	56	112	60	62	58	43
13	Chloride	mg/l	**1000**	**250**	372	486	453	512	493	380	378	501
14	Sulphate SO_4	mg/l	**400**	**200**	111	215	220	236	223	212	123	118
15	Nitrate as NO_3	mg/l	**NR**	**45**	35	32	22	26	31	20	18	24
16	Phosphate as PO_4	mg/l	**-**	**-**	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)
17	Fluorides as F	mg/l	**1.5**	**1**	0.1	0.2	0.4	0.3	0.2	0.4	0.1	0.2
18	Cyanide	mg/l	**NR**	**0.05**	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
19	Arsenic as As	mg/l	**0.05**	**0.01**	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
20	Boron as B	mg/l	**1.0**	**0.5**	BQL(LOQ	BQL(LOQ	BQL(LOQ	BQL(LOQ	BQL(LOQ	BQL(LOQ	BQL(LOQ	BQL(LOQ

S.No	Parameters	Unit	Drinking water Standard (IS 10500: 2012)		Project Site	Palavalam	Mallirisankuppam	Vettavalam	Anukkamalai	Nagalamattu	Pattuvoy	Nallampillaipetral
			Permissible Limit	Acceptable Limit	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
					0.1)	0.1)	0.1)	0.1)	0.1)	0.1)	0.1)	0.1)
21	Cadmium as Cd	mg/l	**NR**	**0.003**	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)
22	Chromium as Cr	mg/l	**NR**	**0.05**	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)
23	Copper as Cu	mg/l	**1.5**	**0.05**	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
24	Lead as Pb	mg/l	**NR**	**0.01**	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
25	Manganese as Mn	mg/l	**0.3**	**0.1**	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)
26	Mercury	mg/l	**NR**	**0.001**	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)
27	Nickel as Ni	mg/l	**NR**	**0.02**	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
28	Selenium as Se	mg/l	**NR**	**0.01**	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)

Note: BLQ – Below Limit of Quantification; LOQ – Limit Of Quantification; NR – No Relaxation

3.8.3.2 Results and Discussions

A summary of analytical results are presented below:

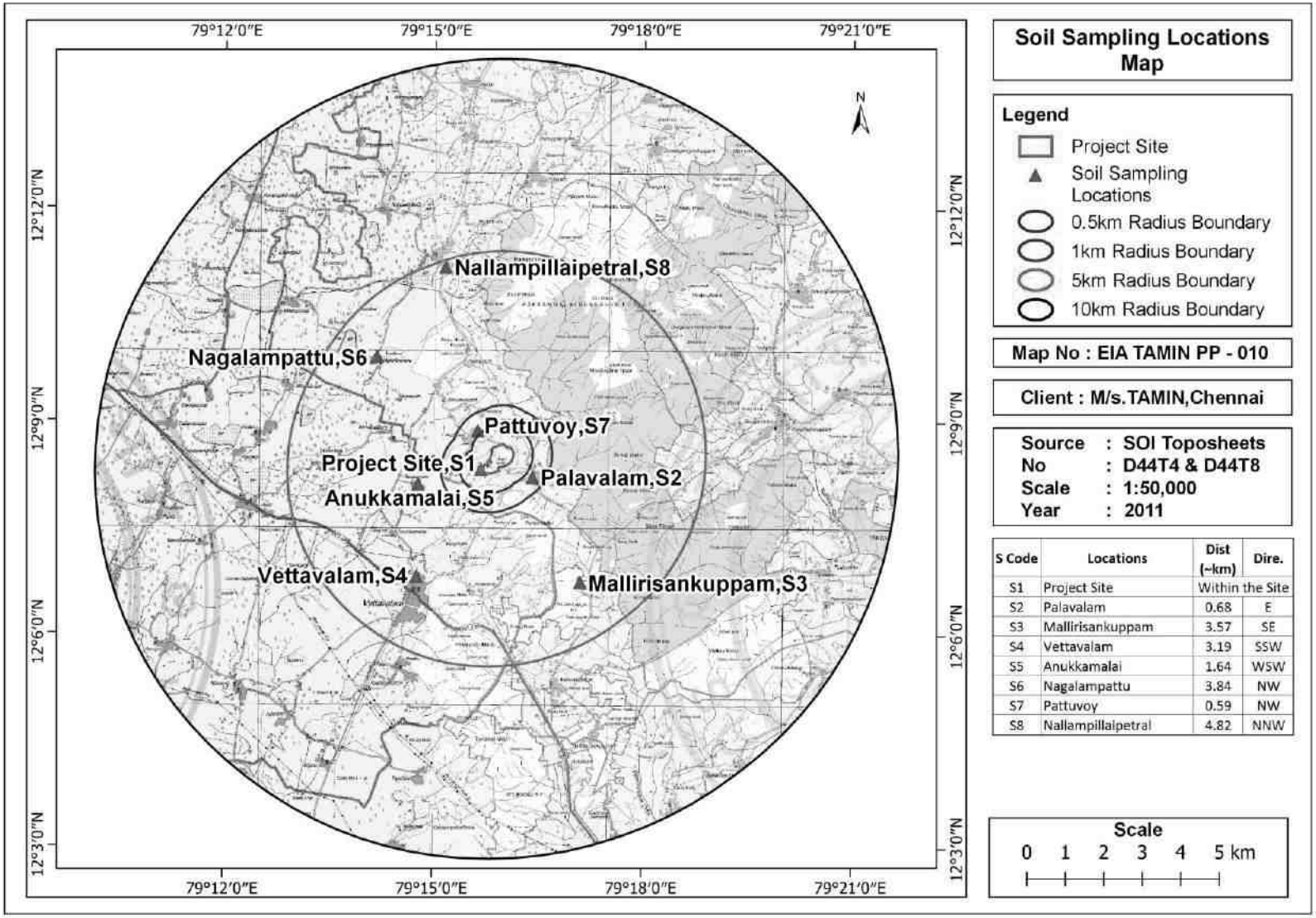
- The pH of the collected ground water sample ranges from 6.98 to 8.12.
- The concentrations of Chloride in the collected ground water sample ranges from 372 to 512 mg/l.
- Total Dissolved Solids (TDS) value of the collected ground water sample varies from 821 mg/l to 1353 mg/l.
- Total hardness of the collected ground water sample ranges from 345 mg/l to 726 mg/l.
- The concentrations of Sulphate in the collected ground water sample ranges from 111 to 236 mg/l.

3.9 Soil Quality

Soil quality monitoring locations & results are given in **Table 3-17** & **Table 3-18.** Map showing the soil monitoring locations are given in **Figure 3-28.**

Table 3-17 Soil & Sediment Quality Monitoring Locations

Location Code	Location	Distance in km	Direction
S1	Near Project Site	Within the Site	
S2	Palavalam	0.68	E
S3	Mallirisankuppam	3.57	SE
S4	Vettavalam	3.19	SSW
S5	Anukkamalai	1.64	WSW
S6	Nagalampattu	3.84	NW
S7	Pattuvoy	0.59	NW
S8	Nallampillaipetral	4.82	NNW



S Code	Locations	Dist (~km)	Dire.
S1	Project Site	Within the Site	
S2	Palavalam	0.68	E
S3	Mallirisankuppam	3.57	SE
S4	Vettavalam	3.19	SSW
S5	Anukkamalai	1.64	WSW
S6	Nagalampattu	3.84	NW
S7	Pattuvoy	0.59	NW
S8	Nallampillaipetral	4.82	NNW

Figure 3-28 Map showing the soil monitoring location

Table 3-18 Physico Chemical parameters of soil samples from the study area

Sl. No	Parameters	Units	Project Site	Palavalam	Mallirisankuppam	Vettavalam	Anukkamalai	Nagalamapattu	Pattuvoy	Nallampillaipetral
			S1	S2	S3	S4	S5	S6	S7	S8
1	Soil Texture	-	Clay loam	Clay Loam	Sandy Loam	Sandy Loam	Sandy loam	Clay loam	Sandy clay loam	Sandy clay loam
2	Sand	%	35.9	32.10	62.3	57.4	53.2	43.5	59.4	51.3
3	Silt	%	30.6	27.0	28.7	32.5	35.4	24.1	8.2	21.1
4	Clay	%	33.5	40.90	9.0	10.1	11.4	32.4	32.4	27.6
5	pH	-	7.23	6.9	7.11	7.09	6.69	7.54	7.34	6.87
6	Electrical conductivity	µmho/cm	315	254	305	278	322	354	298	276
7	Nitrogen as N	mg/kg	219	491	324	298	267	315	237	338
8	Phosphorus	mg/kg	12.5	19.4	24.4	34.6	21.6	26.9	19.8	18.9
9	Potassium	mg/kg	98	87.1	46.7	49.8	80.6	56.0	66.4	59.1
10	Boron	mg/kg	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
11	Cadmium	mg/kg	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
12	Porosity	-	0.31	0.35	0.54	0.49	0.37	0.29	0.33	0.40
13	Water Holding Capacity	Inches of water per foot of soil	2.1	1.92	1.36	1.46	1.64	1.93	1.82	2.2

Note: *BLQ – Below Limit of Quantification; LOQ – Limit Of Quantification*

3.9.1 Results and Discussions

Summary of analytical results

- The pH of the soil samples ranged from 6.69 to 7.54.
- Conductivity of the soil samples ranged from 254 to 354 µmho/cm
- Nitrogen content ranged from 219 kg/ha to 491 kg/ha.
- Phosphorous ranged from 12.5 kg/ha to 34.6 kg/ha.
- Potassium content ranges from 46.7 kg/ha to 98 kg/ha.

3.10 Biological Environment

An ecological study of the ecosystem is essential to understand the impact of industrialization and urbanization on existing flora and fauna of the study area. Studies on various aspects of ecosystem play an important role in identifying sensitive issues for under taking appropriate action to mitigate the impact, if any. The biological study was under taken as a part of the EIA study report to understand the present status of ecosystem prevailing in the study area, to compare it with past condition with the help of available data, to predict changes in the biological environment as a result of present activities and to suggest measures for maintaining its health. Secondary information was collected to study the flora & fauna in 10 km radius. Some of the information was gathered from the local habitants. All the collected data were classified to interpret the impact of pollution on the flora and fauna of that region. All the available information was recorded about the wild plants and cultivated crop plants.

During secondary information, following aspects were considered for ecological studies:

- Assessment of present status of flora and fauna;
- Identification of rare and endangered species of plants and animals (if any);
- Identification of ecologically sensitive areas within the study area;
- Assessment of migratory route of wildlife (if any); and
- Assessment of Aquatic Ecology with specific reference to aquatic birds and plankton resources.

Methodology

Terrestrial investigations for flora and fauna records were collected by secondary information like research article, periodicals, floras and forest checklist.

Floral Study

- Plants species were identified based on their specific diagnostics characters of family, genus and species using available floral, other related literature.
- Besides the identification of plant species, information was collected on the vernacular names and uses of plants made by local inhabitants.

Faunal Study

- Secondary information collected from published government data etc.
- List of the endangered and endemic species as per the schedule of The Wildlife Protection Act, 1972.
- Emphasis is given to identify avifauna and mammals to determine the presence and absence of Schedule-1 species, listed in The Wildlife Protection Act 1972, as well as in Red List of IUCN.

Floristic composition within the study area

Based on secondary information a total 112 species under 41 families found in the study area. The detailed list of plant species found in each quadrat provided in **Table 3.19.**

Table 3-19 Checklist of floral diversity in and around the area

S.No	Species	Family	Common Name	Habit	IUCN
1	Abrus precatorius	Fabaceae	Kundumani	Shrub	NA
2	Abutilon indicum	Malvaceae	Perun thuthi	Shrub	NA
3	Acacia nilotica	Mimosaceae	Karuvelam	Tree	LC
4	Acacia planifrons	Mimosaceae	Kodaivelam	Tree	NA
5	Acalypha indica	Euphorbiaceae	Kuppaimeni	Herb	NA
6	Acanthospermum hispidum	Compositae	--	Herb	NA
7	Achyranthes aspera	Amaranthaceae	Nayurivi	Herb	NA
8	Aegle marmelos	Rutaceae	Vilvam	Tree	NA
9	Aerva lanata	Amaranthaceae	Peelai, Sirupeelai	Shrub	NA
10	Aerva persica	Amaranthaceae	Perumpeelai	Shrub	NA
11	Aeschynomene americana	Fabaceae	--	Herb	NA
12	Aeschynomene aspera	Fabaceae	Thakkai	Shrub	NA
13	Ageratum conyzoides	Compositae	Poom pillu	Herb	NA
14	Alloteropsis cimicina	Poaceae	--	Grass	NA
15	Alternanthera sessilis	Amaranthaceae	Ponnanganni	Herb	NA
16	Anisomeles indica	Labiatae	--	Herb	NA
17	Annona squamosa	Annonaceae	Seetha	Tree	NA
18	Arachis hypogaea	Fabaceae	Verkadalai	Herb	NA
19	Argemone mexicana	Papaveraceae	Braman Thandu	Herb	NA

20	Aristida adscensionis	Poaceae	--	Grass	NA
21	Aristida hystrix	Poaceae	--	Grass	NA
22	Aristolochia bracteolata	Aristolochiaceae	Aduthinnappalai	Herb	NA
23	Barleria acuminata	Acanthaceae	--	Shrub	NA
24	Barleria longiflora	Acanthaceae	--	Shrub	NA
25	Barleria noctiflora	Acanthaceae	--	Shrub	NA
26	Boerhavia diffusa	Nyctaginaceae	Mookarattai	Herb	NA
27	Boerhavia erecta	Nyctaginaceae	Seemai mookarattai	Herb	NA
28	Carica papaya	Caricaceae	Pappali	Tree	NA
29	Carissa carandas	Apocynaceae	Kalaa, Perun kala	Shrub	NA
30	Cassia fistula	Caesalpiniaceae	Kondrai	Tree	NA
31	Celosia argentea	Amaranthaceae	Pannai keerai	Herb	NA
32	Cissus quadrangularis	Vitaceae	Pirandai	Shrub	NA
33	Citrullus colocynthis	Cucurbitaceae	Peikkumatti	Herb	NA
34	Citrus aurantifolia	Rutaceae	Elumichai	Tree	NA
35	Cleome viscosa	Capparidaceae	Nai kadugu	Herb	NA
36	Coccinia grandis	Cucurbitaceae	Kovai	Climber	NA
37	Croton bonplandianum	Euphorbiaceae	Rail poondu	Herb	NA
38	Cucumis sativus	Cucurbitaceae	Vellarikkaai	Climber	NA
39	Cyperus bulbosus	Cyperaceae	–	Sedge	NA
40	Eclipta prostrata	Compositae	Karisaalai	Herb	NA
41	Eleocharis acutangula	Cyperaceae		Sedge	NA
42	Eragrostis tenella	Poaceae		Grass	NA
43	Euphorbia antiquorum	Euphorbiaceae	Sadura-kalli	Tree	NA
44	Euphorbia hirta	Euphorbiaceae	Ammanpacharisi	Herb	NA
45	Euphorbia indica	Euphorbiaceae	Ammanpacharisi	Herb	NA
46	Evolvulus alsinoides	Convolvulaceae	Vishnukarandi	Herb	NA
47	Ficus benghalensis	Moraceae	Aala maram	Tree	NA
48	Ficus religiosa	Moraceae	Arasu	Tree	NA
49	Fimbristylis ovata	Cyperaceae		Sedge	NA
50	Glinus lotoides	Molluginaceae	Siruseruppadai	Herb	NA
51	Gynandropsis gynandra	Capparidaceae	Nal vaelai, Vaelai	Herb	NA
52	Hedyotis aspera	Rubiaceae		Herb	NA
53	Heliotropium indicum	Boraginaceae	Thael kodukku	Herb	NA
54	Hibiscus surattensis	Malvaceae		Undershrub	NA
55	Hybanthus enneaspermus	Violaceae	Orilai thamarai	Herb	NA
56	Hygrophila schulli	Acanthaceae	Neermulli	Herb	NA
57	Hyptis suaveolens	Labiatae		Shrub	NA
58	Indigofera aspalathoides	Fabaceae	Sivanaar vaembu	Herb	NA
59	Indigofera linnaei	Fabaceae		Herb	NA
60	Indigofera tinctoria	Fabaceae	Avuri, Neeli	Herb	NA
61	Ipomoea pes-caprae	Convolvulaceae	Attukkal, Kudhirai Kulambu	Creeper	NA
62	Jasminum sambac	Oleaceae	Malli, Peru malli, Pichigai	Climbing Shrub	NA

63	Jatropha curcas	Euphorbiaceae	Kaatu-amanakku	Shrub	NA
64	Jatropha gossypifolia	Euphorbiaceae	Kaatu-amanakku	Shrub	NA
65	Justicia adhatoda	Acanthaceae	Adathodai	Shrub	NA
66	Justicia simplex	Acanthaceae		Herb	NA
67	Kylinga bulbosa	Cyperaceae		Sedge	NA
68	Lagenaria siceraria	Cucurbitaceae	Surakkaai	Climber	NA
69	Lantana camara	Verbenaceae	Unnichedi	Shrub	NA
70	Leucaena leucocephala	Mimosaceae	Soundil	Tree	NA
71	Leucas aspera	Labiatae	Thumbai	Herb	NA
72	Ludwigia perennis	Onagraceae		Herb	NA
73	Martynia annua	Martyniaceae	Thael Kodukku	Herb	NA
74	Melia azedarach	Meliaceae	Malai vaembu	Tree	NA
75	Merremia hederacea	Convolvulaceae		Herb	NA
76	Nyctanthes arbor-tristis	Nyctanthaceae	Parijaatham	Tree	NA
77	Ocimum americanum	Labiatae	Ganjaankorai	Herb	NA
78	Pavonia odorata	Malvaceae	Peramutti	Herb	NA
79	Pedalium murex	Pedaliaceae	Perunerunji	Herb	NA
80	Phyllanthus acidus	Euphorbiaceae	Aranelli	Tree	NA
81	Phyllanthus amarus	Euphorbiaceae	Kizha-nelli	Herb	NA
82	Phyllanthus emblica	Euphorbiaceae	Nelli, Muzhu nelli	Tree	NA
83	Phyllanthus reticulatus	Euphorbiaceae	Inki pazham	Shrub	NA
84	Pithecellobium dulce	Mimosaceae	Kodukkaai puli	Tree	NA
85	Plumbago zeylanica	Plumbaginaceae	Chitthiragam	Herb	NA
86	Polygala javana	Polygalaceae		Shrub	NA
87	Pongamia pinnata	Fabaceae	Punga maram	Tree	NA
88	Portulaca oleracea	Portulacaceae	Kari keerai	Herb	NA
89	Prosopis juliflora	Mimosaceae	Velikkaathaan	Tree	NA
90	Psidium guajava	Myrtaceae	Koyya	Tree	NA
91	Punica granatum	Punicaceae	Madhulai	Shrub	NA
92	Rhynchosia viscosa	Fabaceae		Climber	NA
93	Ricinus communis	Euphorbiaceae	Amanakku	Shrub	NA
94	Rivea hypocrateriformis	Convolvulaceae	Boodhikeerai	Climber	NA
95	Ruellia tuberosa	Acanthaceae		Herb	NA
96	Sansevieria roxburghiana	Dracaenaceae	Marun, Mottamamji	Herb	NA
97	Senna auriculata	Caesalpiniaceae	Avaram	Shrub	NA
98	Senna occidentalis	Caesalpiniaceae	Peiyavarai	Tree	NA
99	Sesamum indicum	Pedaliaceae	Ellu	Herb	NA
100	Sida acuta	Malvaceae	Malai thangi	Herb	NA
101	Sida cordata	Malvaceae	Pazhampaasi	Herb	NA
102	Sida cordifolia	Malvaceae	Nilatutthi	Herb	NA
103	Solanum americanum	Solanaceae	Manatakkali	Herb	NA
104	Solanum melongena	Solanaceae	Kathiri	Herb	NA
105	Solanum torvum	Solanaceae	Chundai	Shrub	NA
106	Solanum trilobatum	Solanaceae	Thoodhuvalai	Climber	NA

107	Solanum virginianum	Solanaceae	Kandankathiri	Herb	NA
108	Spermacoce hispida	Rubiaceae	Nathaichoori	Herb	NA
109	Spermacoce ocymoides	Rubiaceae		Herb	NA
110	Tamarindus indica	Caesalpiniaceae	Puliya maram	Tree	NA
111	Tectona grandis	Verbenaceae	Thekku	Tree	NA
112	Tephrosia purpurea	Fabaceae	Kozhinji	Undershrub	NA

Source:

a) Gamble, J.S. and C.E.C. Fischer. 1915-1935. Flora of Presidency of Madras, Adlard and Son, London. pp. 1-3.

b) Mathew, K. M. 1981. The Material for the Flora of the Tamilnadu Carnatic, Madras, India.

c) Matthew, K. M. 1982. Illustrations on the Flora of the Tamilnadu Carnatic. Vol. II. The Diocesan press, Madras, India.

d) Matthew, K. M. 1983. The Flora of Tamilnadu Carnatic. Vol. III. The Diocesan press, Madras, India.

e) Matthew, K. M. 1988. Further Illustrations on the Flora of the Tamilnadu Carnatic. Vol. IV. The Diocesan press, Madras, India.

f) Nair, N.C. and A.N. Henry. 1983. Flora of Tamil Nadu, India.Series 1, Vol. 1, Botanical Survey of India, Southern Circle, Coimbatore. 1-184.

g) Henry, A.N., Chithra, V.N. and Balakrishnan, P. (1989) Flora of Tamil Nadu India. Series 1: Analysis. Vol. III. Botanical Survey of India, Coimbatore.

Terrestrial Fauna of the Study Area

The core area is not a habitat for any Rare or endangered or threatened (RET) wildlife. Common rodents, reptiles and birds were seen. There was nothing unusual or special about the wild fauna of the core area. Within 5 Km from the core area, Elephant and Bison corridor is there. Among the large birds, Peacocks were found both in the forest and non-forest areas. A list of vertebrates other than Aves that were either spotted or reported from the study area is given in **Table 3-20**. A list of terrestrail birds that were spotted and those that were recorded from the study area is given in **Table 3-21.**

Table 3-20 List of Terrestrial Vertebrates other than Birds Reported

Scientific name	Common name	Family	IUCN / WPA
MAMMALS			
Bandicota bengalensis	Lesser Bandicoot Rat	Hystricidae	LC/ IV
Bandicota indica	Greater Bandicoot Rat	Hystricidae	LC/ IV
Cynopterus sphinx	Greater Short-nosed Fruit Bat	Pteropodidae	LC /IV
Felis chaus	Jungle Cat	Felidae	LC /III
Funambulus palmarum	Three-striped Palm Squirrel	Sciuridae	LC/ IV
Macaca mulatta	Rhesus Macaque	Cercopithecidae	LC/ II
Mus booduga	Little Indian Field Mouse	Hystricidae	LC/ IV
Rattus rattus	House Rat	Hystricidae	LC/ IV
Semnopithecus entellus	Common Langur	Cercopithecidae	LC/ II
REPTILES			
Calotes rouxii	Roux's Forest Calotes	Agamidae	LC /IV
Calotes versicolor	Indian Garden Lizard	Agamidae	LC /IV
Eutropis carinata	Keeled / Common GrassSkink	Scincidae	LC /IV
Eutropis macularia	Bornze Grass Skink	Scincidae	LC /IV
Hemidactylus brooki	Brooke's House Gecko	Geckonidae	LC /IV
Hemidactylus flaviviridis	House Gecko	Geckonidae	LC /IV
Hemidactylus frenatus	Asian House Gecko	Geckonidae	LC /IV
Hemidactylus leschnaulti	Bark Gecko	Geckonidae	LC /IV
Naja naja	Spectacled Cobra	Colubridae	VU /II
Ophiophagus hannah	King Cobra	Elapidae	VU /II
Ptyas mucosa	Indian Rat Snake	Colubridae	LC /II
Xenochrophis piscator	Checkered Keelback Water Snake	Colubridae	LC /II
AMPHIBIANS			
Bufo scaber	Furguson's Toad	Bufonidae	LC / IV
Clinotarsus curtipes	Bi-colored Frog	Dicroglossidae	LC / IV
Duttaphrynus melanostictus	Common Indian Toad	Bufonidae	LC / IV
Euphlyctis cyanophylyctis	Skittering Frog	Dicroglossidae	LC / IV
Euphlyctis hexadactylus	Indian green Frog	Dicroglossidae	LC / IV
Hoplobatrachus crassus	Jerdon's Bull Frog	Dicroglossidae	LC / IV
Hoplobatrachus tigerinu	Indian bull Frog	Dicroglossidae	LC / IV
Indirana brachytarsus	Short-legged Leaping frog	Ranixalidae	LC / IV
Limnonectes limnocharis	Paddyfield / Cricket Frog	Dicroglossidae	LC / IV
Microhyla ornata	Ornate Narrow-mouthedFrog	Microhylidae	LC / IV
Sphaerotheca breviceps	Indian Burrowing Frog	Dicroglossidae	LC / IV
Sphaerotheca rolandea	Southern Burrowing Frog	Dicroglossidae	LC / IV

Table 3-21 List of Birds

Scientific name	Common name	Family	IUCN / WPA
Acridotheres fuscus	Jungle Myna	Sturnidae	LC / IV
Acridotheres tristis	Common Myna	Sturnidae	LC / IV
Acritillas indica	Yellowbrowed Bulbul	Pycnonotidae	LC / IV
Anthus trivialis	Tree Pipit	Motacillidae	LC / IV
Apus affinis	Little Swift	Apodidae	LC / IV
Athene brama	Spotted owlet	Strigidae	LC / IV
Butastur teesa	White-eyed Buzzard	Accipitridae	LC /IV
Cacomantis passerinus	Greybellied Cuckoo	Cuculidae	LC / IV
Chloropsis jerdoni	Jerdon's Leafbird	Chloropseida	LC / IV
Chrysocolaptes lucidus	Greater Flameback	Picidae	LC / IV
Chrysomma sinense	Yelloweyed Babbler	Timaliidae	LC / IV
Cinnyris asiaticus	Purple Sunbird	Nectariniidae	LC / IV
Coracias benghalensis	Indian Roller	Coraciidae	LC / IV
Coracina macei	Large Cuckoo shrike	Campephagidae	LC / IV
Coracina melanoptera	Blackheaded Cuckooshrike	Campephagidae	LC / IV
Corvus culminatus	Indian Jungle Crow	Corvidae	LC / IV
Corvus splendens	House Crow	Corvidae	LC /V
Cuculus micropterus	Indian Cuckoo	Cuculidae	LC / IV
Cyornis tickelliae	Tickell's Blue Flycatcher	Muscicapidae	LC / IV
Cypsiurus balasiensis	Asian Palm Swift	Apodidae	LC / IV
Dendrocitta vagabunda	Rufous Treepie	Corvidae	LC / IV
Dendrocopos mahrattensis	YellowcrownedWoodpecker	Picidae	LC / IV
Dendrocopos nanus	Browncapped Pygmy Woodpecker	Picidae	LC / IV
Dicrurus macrocercus	Black Drongo	Cuculidae	LC / IV
Elanus caeruleus	Blackwinged Kite	Accipitridae	LC /IV
Eudynamys scolopaceus	Asian Koel	Cuculidae	LC / IV
Glaucidium radiatum	*Jungle Owlet*	*Strigidae*	*LC / IV*
Haliastur indus	*Brahminy Kite*	*Accipitridae*	*LC /IV*
Harpactes fasciatus	*Malabar Trogon*	*Trogonidae*	*LC / IV*
Iduna aedon	Thickbilled Warbler	Sylviidae	LC / IV
Irena puella	Asian Fairybluebird	Irenidae	LC / IV
Lanius cristatus	Brown Shrike	Laniidae	LC / IV
Lonchura malacca	Tricoloured Munia	Estrildidae	LC / IV
Lonchura punctulata	Scaly breasted Munia	Estrildidae	LC / IV
Lonchura striata	Whiterumped Munia	Estrildidae	LC / IV
Loriculus vernalis	Vernal Hanging Parrot	Psittacidae	LC / IV
Luscinia svecica	Blue throat	Muscicapidae	LC / IV
Megalaima haemacephala	Coppersmith Barbet	Megalaimidae	LC / IV
Megalaima malabarica	Malabar Barbet	Megalaimidae	LC / IV
Megalaima viridis	Whitecheeked Barbet	Megalaimidae	LC / IV
Megalaima zeylanica	Brownheaded Barbet	Megalaimidae	LC / IV
Merops orientalis	Green Bee-eater	Meropidae	LC / IV
Merops philippinus	Bluetailed Bee-eater	Meropidae	LC / IV
Milvus migrans	Black Kite	Accipitridae	LC /IV
Motacilla cinerea	Grey Wagtail	Muscicapidae	LC / IV

Muscicapa dauurica	Asian Brown Flycatcher	Muscicapidae	LC / IV
Myophonus horsfieldii	Malabar Whistling Thrush	Turdidae	LC / IV
Nisaetus cirrhatus	Crested Hawk Eagle	Accipitridae	LC /IV
Nyctyornis athertoni	Bluebearded Bee-eater	Meropidae	LC / IV
Orthotomus sutorius	Common Tailorbird	Sylviidae	LC / IV
Parus aplonotus	Indian Yellow Tit	Paridae	LC / IV
Passer domesticus	House Sparrow	Passeridae	LC / IV
Pavo cristatus	Indian Peafowl	Phasianidae	LC / I
Pellorneum ruficeps	Puffthroated Babbler	Timaliidae	LC / IV
Phylloscopus trochiloides	Greenish Warbler	Sylviidae	LC / IV
Picumnus innominatus	Speckled Piculet	Picidae	LC / IV
Pitta brachyura	Indian Pitta	Pittidae	LC / IV
Ploceus manyar	Streaked Weaver	Ploceidae	LC / IV
Ploceus philippinus	Baya Weaver	Ploceidae	LC / IV
Pomatorhinus horsfieldii	Indian ScimitarBabbler	Timaliidae	LC / IV
Prinia hodgsonii	Greybreasted Prinia	Cisticolidae	LC / IV
Prinia inornata	Plain Prinia	Cisticolidae	LC / IV
Prinia socialis	Ashy Prinia	Cisticolidae	LC / IV
Psittacula columboides	Bluewinged Parakeet	Psittacidae	LC / IV
Psittacula cyanocephala	Plumheaded Parakeet	Psittacidae	LC / IV
Psittacula krameri	Roseringed Parakeet	Psittacidae	LC / IV
Ptyonoprogne concolor	Dusky CragMartin	Hirundinidae	LC / IV
Pycnonotus cafer	Redvented Bulbul	Pycnonotidae	LC / IV
Pycnonotus gularis	Flame-throated Bulbul	Pycnonotidae	LC / IV
Pycnonotus jocosus	Redwhiskered Bulbul	Pycnonotidae	LC / IV
Pycnonotus luteolus	Whitebrowed Bulbul	Pycnonotidae	LC / IV
Rhipidura albogularis	Whitespotted Fantail	Rhipiduridae	LC / IV
Rhopocichla atriceps	Darkfronted Babbler	Timaliidae	LC / IV
Saxicola caprata	Pied Bushchat	Muscicapidae	LC / IV
Saxicoloides fulicatus	Indian Robin	Muscicapidae	LC / IV
Sitta frontalis	Velvet fronted Nuthatch	Sittidae	LC / IV
Spilopelia chinensis	Spotted Dove	Columbidae	LC / IV
Streptopelia decaocto	Eurasian CollaredDove	Columbidae	LC / IV
Streptopelia orientalis	Oriental Turtle Dove	Columbidae	LC / IV
Tephrodornis gularis	Large Woodshrike	Tephrodornithidae	LC / IV
Tephrodornis pondicerianus	Common Woodshrike	Tephrodornithidae	LC / IV
Tephrodornis sylvicola	Malabar Woodshrike	Tephrodornithidae	LC / IV
Terpsiphone paradisi	Asian ParadiseFlycatcher	Monarchidae	LC / IV
Treron bicinctus	Orange breasted Green pigeon	Columbidae	LC / IV
Turdoides striata	Jungle Babbler	Timaliidae	LC / IV
Turdus simillimus	Indian Blackbird	Turdidae	LC / IV
Turnix suscitator	Barred Buttonquail	Turnicidae	LC / IV
Turnix tanki	Yellowlegged Buttonquail	Turnicidae	LC / IV
Upupa epops	Hoopoe	Upupidae	LC / IV
Zoothera citrina	Orange headed Thrush	Turdidae	LC / IV

Butterfly Species

Butterfly can also serve as useful indicators of habitat biodiversity. They are responsible for a large part of the complex interconnections that characterize natural ecosystems. The butterfly communities that are present in forests help to maintain crucial ecological processes and preserve biodiversity as a whole. They participate in most of the ecological processes that sustain ecosystems. A totally 26 species belonging to five families of butterflies recorded. The Nymphalidae were more dominant family followed by Lycaenidae, Pieridae, Papilionidae and Hesperiidae.

Table 3-22 Occurrence of butterfly species

S.No	Family	Species name	Common name	Status
1	Nymphalidae	Danaus chrysippus	Plain Tiger	LC
2	Nymphalidae	Danaus genutia	Striped Tiger	NA
3	Nymphalidae	Ariadne merione	Common Caster	NA
4	Nymphalidae	Neptis hylas	Common Sailor	NA
5	Nymphalidae	Phalanta phalantha	Common Leopard	NA
6	Nymphalidae	Melanitis leda	Common Evening Brown	NA
7	Nymphalidae	Mycalesis perseus	Common Bush Brown	NA
8	Nymphalidae	Ypthima asterope	Common Three Ring	LC
9	Nymphalidae	Euthala nais	Baronet	NA
10	Nymphalidae	Argynnis hyperbius	Indian Fritillary	NA
11	Nymphalidae	Byblia ilithya	Joker	NA
12	Pieridae	Colotis danae	Crimson Tip	LC
13	Pieridae	Colotis etrida	Small Orange Tip	NA
14	Pieridae	Eurema hecabe	Common Grass Yellow	NA
15	Pieridae	Catopsillia pomona	Common Emigrant	NA
16	Pieridae	Cepora nerissa	Common Gull	NA
17	Pieridae	Leptosia nina	Psyche	NA
18	Lycaenidae	Castalius rosimon	Common Pierrot	NA
19	Lycaenidae	Arhopala centaurus	Large Obakblue	NA
20	Lycaenidae	Euchrysops cnejus	Gram Blue	NA
21	Lycaenidae	Jamides celeno	Common Cerulin	NA
22	Lycaenidae	Freyeria trochylus	Grass Jewel	LC
23	Papilionidae	Papilio polytes	Common Mormon	NA
24	Papilionidae	Papilio demoleus	Lime Butterflies	NA
25	Papilionidae	Atrophaneura aristolochiae	Common Rose	LC
26	Hesperiidae	Borbo cinnara	Rice Swift	NA

LC- Least Concern, NT- Near Threatened, EN- Endangered, NE-Not Evaluated, DD -Data Deficient, VU- Vulnerable, IUCN- International Union for Conservation of Nature.

Conservation Plan for Indian Peafowl (Peacock)

An Indian Peafowl or Peacock *(Pavo cristatus)* is a large pheasant justifiably declared as the National Bird of India in 1963 due to its flagship value founded on its glorious position in mythology and its widespread distribution and grandeur. In India, it is given the utmost protection by inclusion in Schedule 1 of Indian Wildlife Act, 1972 (2002). Being a wide spread species, apart from the various urban habitats, it is also found in agriculture field, along stream with good vegetation and close to human habitation in semi – feral conditions. In the present study area this species have been confirmed from various habitats located near the village periphery.

Appearance

Male peacock has a spectacular glossy green long tail feathers that may be more than 60% of the total body length. These feathers have blue, golden green and copper colored eyes. The long tail feathers are used for mating rituals like courtship displays. The feathers are arched into a magnificent fan shaped from across the back of the bird and almost touching the found on both sides. Female do not have these graceful tail feathers. They have to fan like crest with whites face and throat, chestnut brown crown and hind neck, metallic green upper breast and mantle, white belly and brown back rump and tail. Their primaries are dark brown.

Study Approach

Since the buffer zone of the proposed Project site unit reported with Schedule 1 Species named as *Pavo cristatus* commonly known as peacock, a systematic study was conducted to assess their status in terms of movement and habitat use of the species. At first, a detailed biological survey of the core & buffer zone was carried out to understand the status distribution of the species in the study area. Also, questionnaire survey was carried out to understand the recent status of peacock sighting and their movements. The conclusion of the survey discussed the potential sighting & habitat use, and movement and food habitats of peacock in the study area.

Sighting and Habitat Use

From the core zone no any peacock was sighted. However, direct sighting of the peacock were located near the human dominated and associated surround habitats like agriculture fields and near water bodies. This species is well adapted to natural village environment setting. According to the villagers (interview), during day time that temporally move towards the surrounding areas like agricultural fields or water bodies for feeding while during night time roosts on the trees present in vicinity of the human settlement and also road side trees. Some villages emphasized that, sometime peacock roosts on the roof of the houses.

Food and Feeding Habitats

Peafowls are omnivores, eating plant parts, flower petals, seed heads, insects, and other arthropods, reptiles and amphibians. In the study area dense tree canopy cover supports good insect diversity which is very common food for peafowls.

Habitat Improvement Action Plan

Habitat improvement program will include plantation of various plant species like *Borassus flabiliber*, *Mangifera Indica, Tamarindus indica* and other grass species reported from the study area should be taken into priority. In order to improve vegetation cover, it is suggested to carry out extensive afforestation program in different phases. These species will help to provide habitat for faunal diversity, and also increases the species diversity and maintain the naturalness of the surrounding area.

Seed Distribution among the Villagers

During this habitat improvement programme the seed of *Borassus flabiliber*, *Mangifera indica, Tamarindus indica* and other grass seeds will be distributed in the various villages of the study area. Compost packets will be also provided at the intervals of the every one year by the proponent (in consultation of forest department).

Water Filing in the existing Water Bodies during summer

Water will be filled in the existing water bodies by water tankers (five numbers in each water body).

Inference – Buffer Zone as Peacock Habitat

Presented survey of the peacock in the buffer zone of the project site shows that, peafowl is well adapted to the existing rural setting of the study area. However, the following points can give an insight on the overall status of peafowl in the study area and thereby plan for better management strategies related to proposed activities.

- Local resident of the study area well aware of the movement pattern of peafowl in their surrounding habitats.
- Peafowl uses agriculture and various rural habitats as a feeding ground during day time while during night time they take shelter on the trees as well as on the roof of the houses. It clearly indicates peafowl normally uses ecosystem or habitats adjacent to village.

From the above said facts, it can be inferred that, some villages of the buffer zone provide roosting and feeding ground for peafowl, while core zone do not have potential habitat for roosting or feeding ground for peafowl. Therefore, it has been visualized that, the proposed project will not have any significant impact on peacock in terms of their normal movements and other activities. However, it is necessity to take some management option like habitat improvement in the villages

located in the immediate vicinity of the project site. So, habitat improvement programme (Plantation of recommended and local plant species) will be under taken in (in consultation of forest department) different villages located in the close vicinity of the project area. Under this programme sampling will be distributed in the nearby villages with the consultation of the local forest department.

In consultation of the forest department, following conservation measures will be adapted for peacock conservation:

- Habitat improvement programme in the different villages will be undertaken in the buffer zone area for shelter and roosting of peacocks. This will be achieved by plantation of local varieties of the tree species near villages in buffer area. Plantation will also be carried in some forest patches identified by local forest department.
- School level awareness programme will be conducted for conservation of peacock by organizing competition during "Wildlife Week" and "Van Mahotsav" celebration.

Conservation Measures

- Community inhibiting in study area should make well aware about the importance of the insects in their daily life especially butterflies and bees which acts a very vital role in pollination which results in high and successful fruiting of crops. This can be achieved by arrangements of village wise awareness campaigns.
- Community awareness for selection of wild ornamental plants in empty spaces, home gardens, and open scrub areas which provide breeding and feeding ground for Common Pierrot and such other butterflies and insects.
- Plant saplings of flowering and fruiting plants can be distributed to local people to promote the plantation of butterfly and bee friendly species which gives breeding and feeding platform to the species.

Table 3-23 Conservation plan for Peacock and Butterflies for five years

Sr. No	Work or Activity	1 to 5 years	Location
1	Plantation	350 trees per year plant of local plant species for five years in villages.	Boundary
2	Water filling	5 number in water hole filing during summer.	Ponds covered in 10 km study area
3	Awareness	In school of nearby villages for peacock conservation as Drawing Competition. (Peacock Picture) & Essay Writing on Peacock.	Villages covered in 5 km study area
*****All above activity will be carried out with the consultation of Ecologist***			
Plant Species will be suggested by the Ecologist and plant saplings will be distributed in project villages as per the above mentioned schedule (year wise).			

The proponent has proposed a sum of Rs. 5,35,000/-for the "Schedule – I species" conservation plan under the following heads:

S.No	Work or Activity	Approximate Cost. Rs.				
		Year 1	Year 2	Year 3	Year 4	Year 5
1	Plantation-350 tree plants (@ 150/-per plant)	52,500/-	52,500/-	52,500/-	52,500/-	52,500/-
2	Small water tank –20 in number @ 5000/- per tank	1,00,000/-				
3	One awareness programme	20,000/-	20,000/-	20,000/-	20,000/-	20,000/-
	Total	202500/-	72,500/-	72,500/-	72,500/-	72,500/-

(Not including water supply, grass seed collection and plantation)

Following Plants will be planted on the periphery of Project area & along the Approachable Road			
S.No	Botanical name	Common Name	Key future of Tree
1	*Albizia lebbeck*	Vagai	A middle-sized deciduous tree with a spreading crown.
2	*Azadicrta Indica*	Vembu	It is adapted to various climate zones.
3	*Dalbergia latifolia*	Eeitti	It is common on deep loams or clays containing lime.
4	*Ficus benghalensis*	Allamaram	Nesting and food purpose for wildlife
5	*Ficus relegiosa*	Arasamaram	It is tolerant to various climate zones.
6	*Madhuca longifolia*	Illupai	A large deciduous shapely, long lived tree
7	*Pongamia pinnata*	Pungaimaram	Dust reduce
8	*Pterocarpus marsupium*	Vengai	--
9	*Syzygiumcumini*	Naval	It is tolerant to temprature resistant.
10	*Termanilia arjuna*	Maruthu	It is reducing soil erosion

3.11 Socio Economic profile

In 2011, the total population of Viluppuram district was 3458873; rural with 2939785 and urban with 519088. In 2001, the total population was 2960373, rural and urban population returned as 2533456 and 426917 respectively.

***Source**:https://censusindia.gov.in/nada/index.php/catalog/1105/download/3434/DH_2011_3306_PART_B_DCHB_VILUPPURAM.pdf*

(**Ref**: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Viluppuram District", Series-34 Part XII-A)

3.11.1 Socio Economic Aspects

A socio-economic study was undertaken in assessing aspects which are dealing with social and cultural conditions, and economic status in the study area. The study provides information such as demographic structure, population dynamics, infrastructure resources, and the status of human health and economic attributes like employment, per-capita income, agriculture, trade, and industrial development in the study area. The study of these characteristic helps in identification, prediction and evaluation of impacts on socio-economic and parameters of human interest due to proposed project developments. The parameters are:

- Demographic structure
- Infrastructure Facility
- Economic Status
- Health status

- Cultural attributes
- Awareness and opinion of people about the project and Industries in the area.

The following **Table 3-24** provides the certain important social indicators of Viluppuram district in Tamil Nadu.

Table 3-24 Social Indicators

S.No	Social Indicators	Viluppuram District
1	Decadal growth rate %	16.8
2	Urban population %	15
3	Sex ratio	987
4	0-6 age group %	12
5	Population density (Persons per square Km)	481
6	Scheduled caste population %	29.4
7	Scheduled tribe population %	2.2
8	Literacy rate %	71.9
9	Work Participation rate %	49.2
10	Main Workers %	36.45
11	Marginal Workers %	12.79
12	Cultivators %	21.70
13	Agricultural labourers %	48.86
14	Workers in household industries %	2.24
15	Other workers %	27.19

***Source**:https://censusindia.gov.in/nada/index.php/catalog/1105/download/3434/DH_2011_3306_PART_B_DCHB_VILUPPURAM.pdf*

(**Ref**: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Viluppuram District", Series-34 Part XII-A)

3.11.1.1 Population and Household Size

In 2011, the total population of Viluppuram district was 3458873; rural with 2939785 and urban with 519088. In 2001, the total population was 2960373, rural and urban population returned as 2533456 and 426917 respectively. The number of statutory towns and non - statutory towns by size and class of population. The district constituted with 18 statutory towns (3 Municipalities and 15 Town Panchayats) and one Census Town.

***Source**:https://censusindia.gov.in/nada/index.php/catalog/1105/download/3434/DH_2011_3306_PART_B_DCHB_VILUPPURAM.pdf*

(**Ref**: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Viluppuram District", Series-34 Part XII-A)

3.11.1.2 Sex Ratio and Population Density

The sex ratio of the population is calculated for number of females for every 1000 males, irrespective of age. The child sex ratio is calculated in the same manner for the children aged upto 6 years. The sex ratio of the district was 987 and the State was 996.

The population density is an indicator for the assessment of the development of the area and the people. The population density of the district in 2011 was 481 per sq.km, lower than State density of 555. In 2001, density of the district was 412.

Source:*https://censusindia.gov.in/nada/index.php/catalog/1105/download/3434/DH_2011_3306_PART_B_DCHB_VILUPPURAM.pdf*

(**Ref**: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Viluppuram District", Series-34 Part XII-A)

3.11.1.3 Scheduled Caste (SC) and Scheduled Tribe population (ST)

The Scheduled Caste population in Tamil Nadu is 20% and Scheduled Tribe is 1.1% to the total population. The Scheduled Caste population in the district is higher (29.4%) than the State and the rural and urban percent ages are 31.5% and 17.5% respectively. The Scheduled Tribe population percentage in the district was 2.2% both in 2001 and 2011.

Source:*https://censusindia.gov.in/nada/index.php/catalog/1105/download/3434/DH_2011_3306_PART_B_DCHB_VILUPPURAM.pdf*

(**Ref**: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Viluppuram District", Series-34 Part XII-A)

3.11.1.4 Education & Literacy

The literacy rate of the district was 71.9%, lower than the literacy level of the State 80.1%. The literacy rate for males was higher than females. The male literacy was 80.5% and female literacy was 63.2%. The rural and urban literacy in the district has recorded significant disparity. The rural literacy was 61% in 2001 which has marginally increased to 69.6% in 2011. The urban literacy in the district was 80.3% in 2001 and 84.7% in 2011. The urban literacy in the district has seen significant increase in 2011 census compared to 2001 census. The accessibility of Primary and Upper Primary education has increased the literacy rate as well as reducing the dropout rate **Table 3-25** Show the details of education infrastructures in Viluppuram District.

Table 3-25 Education Infrastructures in Viluppuram district

Type of school	Total schools		Rural Schools	
	Government	Private	Government	Private
Primary	1357	475	1281	394
Primary + Upper Primary	421	66	399	46
P + UP+ Secondary + Higher Secondary	5	61	3	35
UP only	15	12	15	9
UP + Secondary + Higher Secondary	178	38	150	25
P + UP + Secondary	9	60	5	49

Type of school	Total schools		Rural Schools	
	Government	Private	Government	Private
UP + Secondary	190	35	183	25

Source:*http://udise.in/Downloads/Publications/Documents/District_Report_Cards-2016-17-Vol-II.pdf))*

3.11.1.5 Economic Activity & Livelihood Pattern

The main workers among the workers constituted 74% and the marginal workers of both categories were with 26%. The non-workers to the total population was 58.4%, who were 51. 2% in 2001 census. The male participation is higher than the female participation within main workers and marginal workers, whereas the female dominates in the non-workers category with 74.2%.

Source*:https://censusindia.gov.in/nada/index.php/catalog/1105/download/3434/DH_2011_3306_PART_B_DCHB_VILUPPURAM.pdf*

(**Ref**: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Viluppuram District", Series-34 Part XII-A).

3.11.2 Social Economic Profile of the study area

The villages and towns covering 10 km radius from the boundary of the project site is taken for the study. **Table 3-26** shows the list of locations which comes under the study area.

Table 3-26 Population profile within the study area

Sl. No	Name	Households	Total Population	Male	Female	Children below 6	Scheduled Caste	Scheduled Tribe
0-5 km								
Gingee Taluk- Viluppuram District								
1.	Kanjur	48	199	105	94	19	0	193
2.	Nagalampattu	177	823	410	413	81	0	0
3.	Nallampillaipetral	727	3123	1557	1566	318	1325	260
4.	Uliyampattu	47	240	118	122	42	224	16
5.	Settavarai	277	1303	630	673	145	294	5
6.	Tadagam	368	1524	766	758	146	39	0
7.	Pothuvoy	356	1626	780	846	204	173	5
8.	Palavalam	437	1870	907	963	192	319	63
9.	Malarasankuppam	485	2086	1034	1052	190	0	49
10.	Malavantangal	1307	6141	3055	3086	757	1120	8
11.	Gangavaram	773	3122	1555	1567	327	4	81
Tiruvannamalai Taluk- Tiruvannamalai District								
12.	Gudalore (Z)	635	2718	1369	1349	210	0	105
13.	Neivanatham	438	1772	880	892	195	316	334
14.	Avur	1112	5213	2654	2559	614	374	49
15.	Olaipaddi	472	2141	1110	1031	220	849	62
16.	Anukkumalai	175	706	337	369	85	9	0
17.	Ponnimedu	250	1086	539	547	141	0	634
18.	Sorathur	246	1045	514	531	124	454	0
19.	Vettavalam (TP) WARD NO.-0001	299	1380	675	705	173	0	486
20.	Vettavalam (TP) WARD NO.-0002	209	865	430	435	87	0	0
21.	Vettavalam (TP) WARD NO.-0003	255	1176	588	588	132	8	0
22.	Vettavalam (TP) WARD NO.-0004	399	1554	782	772	165	28	0
23.	Vettavalam (TP) WARD NO.-0005	152	649	326	323	83	0	0

Sl. No	Name	Households	Total Population	Male	Female	Children below 6	Scheduled Caste	Scheduled Tribe
24.	Vettavalam (TP) WARD NO.-0006	174	888	441	447	107	266	0
25.	Vettavalam (TP) WARD NO.-0007	260	1390	700	690	140	1108	0
26.	Vettavalam (TP) WARD NO.-0008	237	1171	582	589	138	1060	0
27.	Vettavalam (TP) WARD NO.-0009	293	1465	729	736	157	9	0
28.	Vettavalam (TP) WARD NO.-0010	179	799	400	399	78	41	0
29.	Vettavalam (TP) WARD NO.-0011	256	1056	528	528	119	0	0
30.	Vettavalam (TP) WARD NO.-0012	163	728	345	383	58	9	0
31.	Vettavalam (TP) WARD NO.-0013	172	712	341	371	78	11	11
32.	Vettavalam (TP) WARD NO.-0014	199	948	466	482	112	4	11
33.	Vettavalam (TP) WARD NO.-0015	167	725	348	377	82	0	5
5-10 Km								
Gingee Taluk- Viluppuram District								
34.	Viramanallur	242	1036	509	527	94	741	0
35.	Nayampadi	617	2472	1207	1265	241	240	135
36.	Manalapadi	437	2138	1111	1027	213	731	194
37.	Periyamur	134	559	295	264	53	235	0
38.	Devadanampettai	972	3871	1952	1919	372	930	84
39.	Sorattupperiyankuppam	685	2930	1488	1442	294	943	108
40.	Pullipattu	375	1650	855	795	172	99	0
41.	Pudupalayam	256	1092	554	538	119	81	9
42.	Pakkam	512	2507	1242	1265	324	2150	131
43.	Pettai (Gingee)	434	2004	1040	964	233	1075	13
44.	Puttagaram	327	1383	691	692	124	81	0
45.	Kamagaram	239	974	488	486	85	133	0

Sl. No	Name	Households	Total Population	Male	Female	Children below 6	Scheduled Caste	Scheduled Tribe
46.	Tadanguppam	113	467	233	234	60	0	0
47.	Kattuchittamur	535	2466	1232	1234	276	1305	4
48.	Madappundi	406	1832	965	867	185	810	0
49.	Kanakkankuppam	957	4239	2111	2128	454	14	48
50.	Tandavasamudram	409	1756	865	891	173	0	85
51.	Padippallam	607	2639	1371	1268	260	577	46
52.	Mullur	98	427	223	204	54	168	9
53.	Tuttipattu	503	2005	1031	974	189	753	64
54.	Ponnankuppam	581	2596	1322	1274	307	4	124
55.	Ananthapuram (TP) WARD NO.-0001	62	252	124	128	24	19	0
56.	Ananthapuram (TP) WARD NO.-0002	101	488	240	248	63	360	0
57.	Ananthapuram (TP) WARD NO.-0003	156	757	379	378	79	148	0
58.	Ananthapuram (TP) WARD NO.-0004	73	326	166	160	29	0	0
59.	Ananthapuram (TP) WARD NO.-0005	110	465	230	235	63	0	0
60.	Ananthapuram (TP) WARD NO.-0006	96	407	209	198	35	0	0
61.	Ananthapuram (TP) WARD NO.-0007	93	417	195	222	44	13	0
62.	Ananthapuram (TP) WARD NO.-0008	142	625	339	286	59	84	0
63.	Ananthapuram (TP) WARD NO.-0009	82	340	166	174	37	11	0
64.	Ananthapuram (TP) WARD NO.-0010	71	296	152	144	32	0	0
65.	Ananthapuram (TP) WARD NO.-0011	133	640	324	316	60	0	0
66.	Ananthapuram (TP) WARD NO.-0012	77	376	185	191	46	376	0
67.	Ananthapuram (TP) WARD	112	534	260	274	82	534	0

Sl. No	Name	Households	Total Population	Male	Female	Children below 6	Scheduled Caste	Scheduled Tribe
	NO.-0013							
68.	Ananthapuram (TP) WARD NO.-0014	129	631	313	318	73	82	3
69.	Ananthapuram (TP) WARD NO.-0015	63	338	185	153	48	27	0
Viluppuram Taluk- Viluppuram District								
70.	Nallapalayam	1075	4595	2344	2251	543	948	208
71.	Kadayam	812	3457	1754	1703	430	391	118
72.	Karuvakshi	1119	5111	2573	2538	671	675	182
Tirukkoyilur Taluk- Viluppuram District								
73.	Veerapandi	1588	7690	3789	3901	1059	1655	2
74.	Pulikkal	346	1644	793	851	189	822	0
75.	Kallandal	216	1082	554	528	115	656	0
76.	Arunapuram	649	3365	1659	1706	509	971	0
77.	Oddampattu	1056	4903	2413	2490	724	1200	108
78.	Thandarai	226	993	508	485	106	26	112
79.	Adukkam	385	1602	795	807	198	249	0
Tiruvannamalai Taluk- Tiruvannamalai District								
80.	Rayampettai	268	1034	513	521	98	5	1
81.	Andalur	156	616	321	295	60	12	24
82.	Manavaram	104	418	215	203	39	0	24
83.	Karikilambadi	467	2163	1123	1040	233	494	183
84.	Kaniyampoondi	210	884	448	436	94	99	8
85.	Kolathur	530	2160	1070	1090	237	743	3
86.	Sanipoondi	380	1769	892	877	172	352	3
87.	Erpakkam	237	861	447	414	99	38	10
88.	Vayalur	228	1029	533	496	89	238	126
89.	Rajanthangal	289	1207	618	589	133	0	0
90.	Iluppanthangal	128	548	283	265	65	258	0
91.	Isukalikatteri	646	3406	1747	1659	383	2270	0
92.	Kilkaripoor	285	1371	726	645	177	482	21
93.	Kallanai	293	1417	720	697	177	235	0

Sl. No	Name	Households	Total Population	Male	Female	Children below 6	Scheduled Caste	Scheduled Tribe
94.	Vanniandal	115	543	286	257	72	120	12
95.	Kallayyee	357	1488	748	740	140	0	0
96.	Vaippur	431	1771	885	886	215	359	25
97.	Agaram	331	1376	693	683	141	410	0
98.	Naraiyur	736	3497	1787	1710	442	984	0
99.	Panniyur	332	1764	911	853	225	1415	0
100.	Angunam	198	980	498	482	110	334	47
	Total	**36876**	**164923**	**82899**	**82024**	**18720**	**37209**	**4651**

(Source: Census 2011)

3.11.2.1Employment and Livelihood within study area

Majority of population in the study area comes under other working categories. As agriculture cannot be a main sustenance for most of farmers, they have dual professions. Farming is mostly seasonal, they involve in other livelihood activities like business, non-agriculture labour, agriculture labour and other service sectors. Fragmentation of landholding leads to adopt to have additional occupation.Summaries of employment and livelihood within the study are given in **Table 3-27.**

Table 3-27 Summaries of Employment and Livelihood within the study area

Sl. No	Name	Total Workers	Main Workers	Marginal Workers	Agriculture Workers				Household Industry Workers		Other Workers	
					Cultivators		Agri. Labourers					
					Main	Marginal	Main	Marginal	Main	Marginal	Main	Marginal
0-5 Km												
Gingee Taluk- Viluppuram District												
1)	Kanjur	118	116	2	88	1	26	0	0	0	2	1
2)	Nagalampattu	519	341	178	187	55	117	119	3	1	34	3
3)	Nallampillaipetral	1437	510	927	79	91	177	738	6	13	248	85
4)	Uliyampattu	98	0	98	0	13	0	85	0	0	0	0
5)	Settavarai	923	472	451	340	20	42	414	13	4	77	13
6)	Tadagam	846	706	140	463	7	108	129	2	0	133	4
7)	Pothuvoy	862	466	396	313	60	24	261	56	40	73	35
8)	Palavalam	905	607	298	337	32	196	218	4	8	70	40
9)	Malarasankuppam	937	809	128	402	56	195	23	10	8	202	41
10)	Malavantangal	3222	2230	992	934	54	828	838	18	20	450	80
11)	Gangavaram	1768	949	819	475	28	241	722	21	16	212	53
Tiruvannamalai Taluk- Tiruvannamalai District												
12)	Gudalore (Z)	1163	997	166	249	6	422	125	13	7	313	28
13)	Neivanatham	823	652	171	310	19	57	104	15	7	270	41
14)	Avur	2091	1749	342	290	22	276	44	269	39	914	237
15)	Olaipaddi	1256	1243	13	672	0	386	13	40	0	145	0
16)	Anukkumalai	458	391	67	210	3	145	64	1	0	35	0
17)	Ponnimedu	651	482	169	85	6	293	141	1	1	103	21
18)	Sorathur	523	485	38	167	2	222	13	1	0	95	23
19)	Vettavalam (TP) WARD NO.-0001	561	255	306	54	25	64	224	4	4	133	53
20)	Vettavalam (TP) WARD NO.-0002	429	315	114	48	1	13	100	25	2	229	11
21)	Vettavalam (TP)	453	172	281	28	3	10	12	8	2	126	264

Sl. No	Name	Total Workers	Main Workers	Marginal Workers	Agriculture Workers				Household Industry Workers		Other Workers	
					Cultivators		Agri. Labourers					
					Main	Marginal	Main	Marginal	Main	Marginal	Main	Marginal
	WARD NO.-0003											
22)	Vettavalam (TP) WARD NO.-0004	537	510	27	35	0	61	3	25	2	389	22
23)	Vettavalam (TP) WARD NO.-0005	267	85	182	1	27	1	16	1	32	82	107
24)	Vettavalam (TP) WARD NO.-0006	264	122	142	3	7	28	120	1	1	90	14
25)	Vettavalam (TP) WARD NO.-0007	679	222	457	3	1	5	421	0	4	214	31
26)	Vettavalam (TP) WARD NO.-0008	500	398	102	46	0	96	76	0	2	256	24
27)	Vettavalam (TP) WARD NO.-0009	458	368	90	24	2	48	7	3	9	293	72
28)	Vettavalam (TP) WARD NO.-0010	359	354	5	0	0	220	0	1	1	133	4
29)	Vettavalam (TP) WARD NO.-0011	519	302	217	32	0	37	84	38	39	195	94
30)	Vettavalam (TP) WARD NO.-0012	298	285	13	13	0	112	4	37	0	123	9
31)	Vettavalam (TP) WARD NO.-0013	272	218	54	17	0	15	9	7	4	179	41
32)	Vettavalam (TP) WARD NO.-0014	381	260	121	27	2	42	8	3	2	188	109
33)	Vettavalam (TP) WARD NO.-0015	243	243	0	21	0	47	0	0	0	175	0
5-10 Km												
Gingee Taluk- Viluppuram District												
34)	Viramanallur	607	584	23	71	2	282	8	13	2	218	11
35)	Nayampadi	1401	1111	290	651	17	201	174	15	6	244	93

Sl. No	Name	Total Workers	Main Workers	Marginal Workers	Agriculture Workers				Household Industry Workers		Other Workers	
					Cultivators		Agri. Labourers					
					Main	Marginal	Main	Marginal	Main	Marginal	Main	Marginal
36)	Manalapadi	1391	155	1236	39	186	35	684	6	94	75	272
37)	Periyamur	203	27	176	0	48	0	96	1	3	26	29
38)	Devadanampettai	2413	1874	539	720	27	1022	490	10	1	122	21
39)	Sorattupperiyankuppam	2034	1148	886	387	33	647	810	15	14	99	29
40)	Pullipattu	852	36	816	1	713	0	92	1	8	34	3
41)	Pudupalayam	685	29	656	8	467	2	182	1	2	18	5
42)	Pakkam	1464	783	681	502	33	18	603	1	2	262	43
43)	Pettai (Gingee)	1003	910	93	74	16	721	19	13	2	102	56
44)	Puttagaram	799	456	343	387	44	15	263	4	5	50	31
45)	Kamagaram	505	139	366	69	148	5	120	3	7	62	91
46)	Tadanguppam	305	303	2	287	0	2	0	0	0	14	2
47)	Kattuchittamur	1229	1052	177	483	40	352	77	13	4	204	56
48)	Madappundi	1082	931	151	360	60	484	26	7	3	80	62
49)	Kanakkankuppam	2029	1391	638	215	40	730	264	25	52	421	282
50)	Tandavasamudram	1099	992	107	299	7	367	18	100	2	226	80
51)	Padippallam	1617	1435	182	594	55	744	72	22	22	75	33
52)	Mullur	251	6	245	1	0	1	238	1	2	3	5
53)	Tuttipattu	1185	505	680	365	8	71	610	1	10	68	52
54)	Ponnankuppam	1604	1253	351	739	22	90	305	19	3	405	21
55)	Ananthapuram (TP) WARD NO.-0001	88	77	11	5	0	0	0	0	0	72	11
56)	Ananthapuram (TP) WARD NO.-0002	221	210	11	21	0	177	9	0	0	12	2
57)	Ananthapuram (TP) WARD NO.-0003	346	338	8	51	0	265	0	1	0	21	8
58)	Ananthapuram (TP) WARD NO.-0004	146	142	4	23	0	1	0	0	0	118	4

Sl. No	Name	Total Workers	Main Workers	Marginal Workers	Agriculture Workers				Household Industry Workers		Other Workers	
					Cultivators		Agri. Labourers					
					Main	Marginal	Main	Marginal	Main	Marginal	Main	Marginal
59)	Ananthapuram (TP) WARD NO.-0005	154	146	8	5	0	30	0	0	0	111	8
60)	Ananthapuram (TP) WARD NO.-0006	128	125	3	2	0	8	0	3	0	112	3
61)	Ananthapuram (TP) WARD NO.-0007	138	136	2	2	0	2	0	3	0	129	2
62)	Ananthapuram (TP) WARD NO.-0008	198	188	10	0	0	0	1	0	0	188	9
63)	Ananthapuram (TP) WARD NO.-0009	112	97	15	0	0	0	0	2	0	95	15
64)	Ananthapuram (TP) WARD NO.-0010	95	84	11	0	1	2	3	8	0	74	7
65)	Ananthapuram (TP) WARD NO.-0011	213	209	4	0	0	10	0	25	0	174	4
66)	Ananthapuram (TP) WARD NO.-0012	130	129	1	0	1	61	0	0	0	68	0
67)	Ananthapuram (TP) WARD NO.-0013	281	64	217	0	0	40	214	0	0	24	3
68)	Ananthapuram (TP) WARD NO.-0014	319	7	312	1	2	1	293	1	7	4	10
69)	Ananthapuram (TP) WARD NO.-0015	175	9	166	3	1	1	158	0	5	5	2
Viluppuram Taluk- Viluppuram District												
70)	Nallapalayam	2152	210	1942	54	159	11	1723	8	6	137	54
71)	Kadayam	1846	1777	69	508	15	910	46	14	1	345	7
72)	Karuvakshi	2473	2334	139	610	1	1351	100	10	3	363	35
Tirukkoyilur Taluk- Viluppuram District												
73)	Veerapandi	3507	3274	233	1277	14	1340	180	28	2	629	37
74)	Pulikkal	876	499	377	49	10	150	143	25	25	275	199

Sl. No	Name	Total Workers	Main Workers	Marginal Workers	Agriculture Workers				Household Industry Workers		Other Workers	
					Cultivators		Agri. Labourers					
					Main	Marginal	Main	Marginal	Main	Marginal	Main	Marginal
75)	Kallandal	553	220	333	83	3	18	299	1	3	118	28
76)	Arunapuram	1712	1608	104	601	12	855	78	16	2	136	12
77)	Oddampattu	2387	2186	201	1120	6	600	142	60	2	406	51
78)	Thandarai	536	415	121	129	14	67	5	10	4	209	98
79)	Adukkam	726	309	417	136	1	87	348	6	8	80	60
Tiruvannamalai Taluk- Tiruvannamalai District												
80)	Rayampettai	461	431	30	15	1	209	11	139	10	68	8
81)	Andalur	387	53	334	6	0	8	329	0	0	39	5
82)	Manavaram	194	182	12	71	0	66	0	2	0	43	12
83)	Karikilambadi	1062	1011	51	511	8	249	18	7	1	244	24
84)	Kaniyampoondi	357	304	53	94	0	114	35	0	0	96	18
85)	Kolathur	1230	1121	109	480	5	466	38	8	19	167	47
86)	Sanipoondi	872	803	69	226	1	437	61	5	0	135	7
87)	Erpakkam	519	517	2	317	0	149	1	4	0	47	1
88)	Vayalur	519	490	29	67	2	293	8	12	4	118	15
89)	Rajanthangal	636	557	79	309	3	125	37	9	4	114	35
90)	Iluppanthangal	256	47	209	8	0	13	192	3	0	23	17
91)	Isukalikatteri	1757	1192	565	416	15	646	462	6	13	124	75
92)	Kilkaripoor	480	454	26	256	2	169	13	1	1	28	10
93)	Kallanai	769	766	3	186	0	385	1	0	0	195	2
94)	Vanniandal	232	216	16	66	0	100	1	0	0	50	15
95)	Kallayyee	652	639	13	207	1	351	11	3	0	78	1
96)	Vaippur	873	560	313	160	2	250	239	2	2	148	70
97)	Agaram	552	485	67	68	4	296	52	2	1	119	10
98)	Naraiyur	1714	1583	131	553	8	849	91	23	3	158	29
99)	Panniyur	934	911	23	62	0	669	9	15	1	165	13
100)	Angunam	621	620	1	39	0	512	0	6	0	63	1

Sl. No	Name	Total Workers	Main Workers	Marginal Workers	Agriculture Workers				Household Industry Workers		Other Workers	
					Cultivators		Agri. Labourers					
					Main	Marginal	Main	Marginal	Main	Marginal	Main	Marginal
	Total	**83167**	**60169**	**22998**	**21002**	**2801**	**22686**	**15637**	**1365**	**639**	**15116**	**3921**

*(**Source:** Census 2011)*

3.11.2.2Educational Infrastructure within study area

The district has good primary and secondary education infrastructure in urban and rural areas. The people around the study area have well connected to educational infrastructures.

The following **Table 3-28** shows the literates population and the percentage within the study area

Table 3-28 Literates population and the percentage within the study area

S. No	Name	Total Population	Literates Population	Literates Population Male	Literates Population Female	Illiterates Population	Illiterates Population Male	Illiterates Population Female
0-5 Km								
Gingee Taluk- Viluppuram District								
1.	Kanjur	199	10	6	4	189	99	90
2.	Nagalampattu	823	422	242	180	401	168	233
3.	Nallampillaipetral	3123	1929	1065	864	1194	492	702
4.	Uliyampattu	240	129	68	61	111	50	61
5.	Settavarai	1303	876	470	406	427	160	267
6.	Tadagam	1524	1042	584	458	482	182	300
7.	Pothuvoy	1626	1082	584	498	544	196	348
8.	Palavalam	1870	1187	662	525	683	245	438
9.	Malarasankuppam	2086	1285	696	589	801	338	463
10.	Malavantangal	6141	3639	2088	1551	2502	967	1535
11.	Gangavaram	3122	1868	1073	795	1254	482	772
Tiruvannamalai Taluk- Tiruvannamalai District								
12.	Gudalore (Z)	2718	2039	1078	961	679	291	388
13.	Neivanatham	1772	1030	592	438	742	288	454
14.	Avur	5213	3797	2074	1723	1416	580	836
15.	Olaipaddi	2141	1377	757	620	764	353	411
16.	Anukkumalai	706	593	287	306	113	50	63
17.	Ponnimedu	1086	523	299	224	563	240	323

S. No	Name	Total Population	Literates Population	Literates Population Male	Literates Population Female	Illiterates Population	Illiterates Population Male	Illiterates Population Female
18.	Sorathur	1045	660	363	297	385	151	234
19.	Vettavalam (TP) WARD NO.-0001	1380	838	466	372	542	209	333
20.	Vettavalam (TP) WARD NO.-0002	865	668	362	306	197	68	129
21.	Vettavalam (TP) WARD NO.-0003	1176	878	472	406	298	116	182
22.	Vettavalam (TP) WARD NO.-0004	1554	1141	627	514	413	155	258
23.	Vettavalam (TP) WARD NO.-0005	649	414	237	177	235	89	146
24.	Vettavalam (TP) WARD NO.-0006	888	665	358	307	223	83	140
25.	Vettavalam (TP) WARD NO.-0007	1390	1057	587	470	333	113	220
26.	Vettavalam (TP) WARD NO.-0008	1171	815	437	378	356	145	211
27.	Vettavalam (TP) WARD NO.-0009	1465	1183	621	562	282	108	174
28.	Vettavalam (TP) WARD NO.-0010	799	688	351	337	111	49	62
29.	Vettavalam (TP) WARD NO.-0011	1056	761	414	347	295	114	181
30.	Vettavalam (TP) WARD NO.-0012	728	515	276	239	213	69	144
31.	Vettavalam (TP) WARD NO.-0013	712	562	288	274	150	53	97
32.	Vettavalam (TP) WARD NO.-0014	948	682	372	310	266	94	172
33.	Vettavalam (TP) WARD NO.-0015	725	510	268	242	215	80	135
5-10 Km								

S. No	Name	Total Population	Literates Population	Literates Population Male	Literates Population Female	Illiterates Population	Illiterates Population Male	Illiterates Population Female
Gingee Taluk- Viluppuram District								
34.	Viramanallur	1036	701	387	314	335	122	213
35.	Nayampadi	2472	1744	925	819	728	282	446
36.	Manalapadi	2138	1458	832	626	680	279	401
37.	Periyamur	559	361	216	145	198	79	119
38.	Devadanampettai	3871	2328	1341	987	1543	611	932
39.	Sorattupperiyankuppam	2930	1761	1002	759	1169	486	683
40.	Pullipattu	1650	1031	605	426	619	250	369
41.	Pudupalayam	1092	634	362	272	458	192	266
42.	Pakkam	2507	1386	767	619	1121	475	646
43.	Pettai (Gingee)	2004	1177	683	494	827	357	470
44.	Puttagaram	1383	920	527	393	463	164	299
45.	Kamagaram	974	670	392	278	304	96	208
46.	Tadanguppam	467	281	162	119	186	71	115
47.	Kattuchittamur	2466	1468	845	623	998	387	611
48.	Madappundi	1832	1169	674	495	663	291	372
49.	Kanakkankuppam	4239	2567	1427	1140	1672	684	988
50.	Tandavasamudram	1756	1241	658	583	515	207	308
51.	Padippallam	2639	1823	1061	762	816	310	506
52.	Mullur	427	257	146	111	170	77	93
53.	Tuttipattu	2005	1144	661	483	861	370	491
54.	Ponnankuppam	2596	1643	931	712	953	391	562
55.	Ananthapuram (TP) WARD NO.-0001	252	191	104	87	61	20	41
56.	Ananthapuram (TP) WARD NO.-0002	488	298	165	133	190	75	115
57.	Ananthapuram (TP) WARD NO.-0003	757	500	270	230	257	109	148

S. No	Name	Total Population	Literates Population	Literates Population Male	Literates Population Female	Illiterates Population	Illiterates Population Male	Illiterates Population Female
58.	Ananthapuram (TP) WARD NO.-0004	326	239	133	106	87	33	54
59.	Ananthapuram (TP) WARD NO.-0005	465	288	161	127	177	69	108
60.	Ananthapuram (TP) WARD NO.-0006	407	303	165	138	104	44	60
61.	Ananthapuram (TP) WARD NO.-0007	417	336	163	173	81	32	49
62.	Ananthapuram (TP) WARD NO.-0008	625	441	265	176	184	74	110
63.	Ananthapuram (TP) WARD NO.-0009	340	282	144	138	58	22	36
64.	Ananthapuram (TP) WARD NO.-0010	296	229	122	107	67	30	37
65.	Ananthapuram (TP) WARD NO.-0011	640	451	252	199	189	72	117
66.	Ananthapuram (TP) WARD NO.-0012	376	226	122	104	150	63	87
67.	Ananthapuram (TP) WARD NO.-0013	534	308	160	148	226	100	126
68.	Ananthapuram (TP) WARD NO.-0014	631	372	208	164	259	105	154
69.	Ananthapuram (TP) WARD NO.-0015	338	205	123	82	133	62	71
Viluppuram Taluk- Viluppuram District								
70.	Nallapalayam	4595	2649	1571	1078	1946	773	1173
71.	Kadayam	3457	1935	1156	779	1522	598	924
72.	Karuvakshi	5111	2909	1698	1211	2202	875	1327
Tirukkoyilur Taluk- Viluppuram District								
73.	Veerapandi	7690	4116	2377	1739	3574	1412	2162
74.	Pulikkal	1644	917	495	422	727	298	429

S. No	Name	Total Population	Literates Population	Literates Population Male	Literates Population Female	Illiterates Population	Illiterates Population Male	Illiterates Population Female
75.	Kallandal	1082	666	393	273	416	161	255
76.	Arunapuram	3365	1771	1003	768	1594	656	938
77.	Oddampattu	4903	2409	1377	1032	2494	1036	1458
78.	Thandarai	993	569	341	228	424	167	257
79.	Adukkam	1602	872	486	386	730	309	421
Tiruvannamalai Taluk- Tiruvannamalai District								
80.	Rayampettai	1034	782	421	361	252	92	160
81.	Andalur	616	364	218	146	252	103	149
82.	Manavaram	418	276	160	116	142	55	87
83.	Karikilambadi	2163	1381	820	561	782	303	479
84.	Kaniyampoondi	884	605	344	261	279	104	175
85.	Kolathur	2160	1298	722	576	862	348	514
86.	Sanipoondi	1769	1378	736	642	391	156	235
87.	Erpakkam	861	446	276	170	415	171	244
88.	Vayalur	1029	723	406	317	306	127	179
89.	Rajanthangal	1207	814	467	347	393	151	242
90.	Iluppanthangal	548	382	208	174	166	75	91
91.	Isukalikatteri	3406	2063	1175	888	1343	572	771
92.	Kilkaripoor	1371	887	514	373	484	212	272
93.	Kallanai	1417	944	527	417	473	193	280
94.	Vanniandal	543	323	180	143	220	106	114
95.	Kallayyee	1488	897	530	367	591	218	373
96.	Vaippur	1771	1173	671	502	598	214	384
97.	Agaram	1376	845	481	364	531	212	319
98.	Naraiyur	3497	2281	1280	1001	1216	507	709
99.	Panniyur	1764	942	534	408	822	377	445
100.	Angunam	980	552	319	233	428	179	249

S. No	Name	Total Population	Literates Population	Literates Population Male	Literates Population Female	Illiterates Population	Illiterates Population Male	Illiterates Population Female
	Total	**164923**	**103467**	**58171**	**45296**	**61456**	**24728**	**36728**

(Source: Census 2011)

3.11.3 Summary

The Socioeconomic profile of the study area shows that the majority of people in the study area work in non-agricultural sector, however in rural area majority of the people in the rural area depends on agricultural sector. They have good educational infrastructures and the people in the study area are well connected to the educational infrastructures. The average literacy rate of the study area is 79.82%. The people in the study area are well connected to Government primary health centres and Primary health sub-centresshows the socio-economic indicators within the study area given in **Table 3-29.**

Table 3-29 Summaries of Socio-economic indicators within the study area

S.No	Particulars	Study area	Unit
0-5 km			
1	Number of villages in the Study Area	33	Nos.
2	Total Households	11744	Nos.
3	Total Population	52244	Persons
4	Children Population (<6 Years Old)	5719	Persons
5	SC Population	8044	Persons
6	ST Population	2377	Persons
7	Total Working Population	24820	Persons
8	Main Workers	17314	Persons
9	Marginal Workers	7506	Persons
10	Cultivators	6469	Persons
11	Agricultural labours	9689	Persons
12	Household Industries	894	Persons
13	Other Workers	7741	Persons
14	Literates	34865	Persons
15	Illiterates	17379	Persons
5-10 km			
1	Number of villages in the Study Area	67	Nos.
2	Total Households	25132	Nos.
3	Total Population	112679	Persons
4	Children Population (<6 Years Old)	13001	Persons
5	SC Population	29165	Persons
6	ST Population	2274	Persons
7	Total Working Population	58347	Persons
8	Main Workers	42855	Persons
9	Marginal Workers	15492	Persons
10	Cultivators	17307	Persons
11	Agricultural labours	28634	Persons
12	Household Industries	1110	Persons
13	Other Workers	11296	Persons
14	Literates	68602	Persons
15	Illiterates	44077	Persons

4 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The impacts due to mining operation and its mitigation measures adopted are detailed in this chapter. In general, the opencast mining operations cause environmental problems such as degradation of land, deteriorating air, water and soil quality, affecting the biological and socio-economicenvironment of the area, if adequate control measures are not taken to prevent/mitigate the adverse environmental impacts, these operations may cause irreversible damage to the eco-system.

The opencast mining operations involve development of benches, approach roads, haul roads, blasting, excavation and handling & transportation of materials. If adequate control measures are not taken to prevent/mitigate the adverse environmental impacts, these operations may cause environmental degradation and lead to irreversible damage to the ecosystem. Various environmental impacts, which have been identified due to the mining operations proposed project, are discussed in the following sections. The environmental parameters most commonly affected by mining activities are:

- Air quality including Climate
- Noise levels and ground vibrations
- Water resources and quality
- Land use Pattern
- Soil quality
- Flora and Fauna
- Socio-Economic conditions
- Occupational Health.

4.1 Land Environment

The total extent of lease area is 40.13.05 Ha. The Land is classified as a Government land. The lease area exhibits hilly terrain (~156 - 291mAMSL) topography covered by massive granite formation. Quarry lease was granted over an extent of 40.13.05Ha.In S.F.No.58/1 Pothuvai&135/1 Pazhavalam, Pothuvai&Pazhavalam village, Gingee taluk, Villupuram District, Tamil Nadu state. Tamil Nadu was granted lease vide G.O.(3D).No.66, Industries (MME.1) Department,dated: 05.12.2011 for 30 years of mining. G.O is enclosed as **Annexure-1.** The land use pattern is given in **Table 4-1.**

4.1.2 Land Degradation

The impact on land pattern in the area has been and will be due to the following:

- Land degradation due to disposal of large volume of waste materials.

- Creation of infrastructural facilities like office, rest shelter, first-aid centre and other service facilities.
- Exposure of topsoil to wind and water erosion.

Table 4-1 Land Use Pattern of the lease area

S. No	Land Use	Area to be required during the mining plan(Ha)	Area at the end of the quarrying period (Ha)
1	Area under Quarry	22.53.0	33.47.5
2	Waste Dump	1.00.00	3.61.0
3	Infrastructure	--	0.01.5
4	Road	--	0.08.5
5	Mine approach road	--	0.20.0
6	Green Belt	--	0.19.0
7	Un utilized Area	14.81.55	2.55.55
	Total	**38.39.55**	**40.13.05**

4.1.3 Mitigation Measures

- Dust suppression on exposed areas using water tankers.
- Contour overburden dump to minimize erosion
- Plantation around service building, along road, in and around safety zone using native plant sapling.
- Compliance with mine decommissioning plan.
- The following precautions will be taken to reduce the risk of dump failure:
  - OB benches will be made of <10m height in each tier. Angle of repose of OB dump to be around 26^0. Construction of toe wall around the OB dump.
  - Drainage control structures like garland drain to be made around OB dump area to avoid water flow during monsoon below the OB dump.
  - Leveling, grading and drainage arrangement for OB dumps.
  - The deeper working pits, after completion of mining /quarrying left as it is which would serve as water ponds/water reservoirs.
  - The quarried pits after the end of the life of lease will be fenced to prevent inherent entry of public and cattle.
  - Management plan for topsoil utilization and conservation.
  - Progressive year-wise green belt development inside.

4.2 Air Environment

The main source of air pollution is from open cast mining activities is dust generation from excavation of granite, movement of vehicles for transportation of product to consumers, drilling, loading and unloading operation and wind erosion of dumps and also gaseous emission due to

operation of diesel driven mining equipment. The sources of air emission are detailed below in **Table 4-2.**

Table 4-2 Sources of air pollution at quarry

S. No	Source of emission	Pollutant
1.	Excavation of Granite	PM
2.	Operation of diesel driven equipment	Gaseous emission
3.	Transportation of product	PM

The major air pollution sources from the mining operations are DG sets, mining activities like drilling, and transportation. The DG sets are provided with stacks of adequate height to disperse the emanating flue gases containing suspended particulate matter, oxides of Sulphur and nitrogen without affecting the ground level concentrations. The emissions mainly generated from the mining activities are Blasting, Drilling, Excavation, Loading, Unloading, and transportation etc. Machinery like compressors and jack hammers are used for Drilling.

4.2.1 Mitigation measures

- Use of dust aprons on drilling equipment and adopting wet drilling methods.
- Delay blasting under unfavorable wind and atmospheric conditions
- The production of blast fumes containing noxious gases will be reduced by the following methods:
    - Use of adequate booster/primer.
    - Proper stemming of the blast hole.
    - Development of greenbelt.

Table 4-3 Fugitive dust control in mine

S. No	Activities	Best practices
1	Drilling	➢ Drills should be provided with dust extractors (dry or wet system)
2	Blasting	➢ Water spray before blasting ➢ Water spray on blasted material prior to transportation ➢ Use of control blasting technique
3	Transportation of mined material	➢ Covering of the trucks/dumpers to avoid spillage ➢ Compacted haul road ➢ Speed control on vehicles ➢ Development of a green belt of suitable width on both sides of road, which acts as wind break and traps fugitive dust

Table 4-4 Dust control measures in quarry

S. No	Operation or source	Control options
1	Drilling	➢ Liquid injection (water or water plus a wetting agent)

		➢ Capturing and venting emissions to a control device.
2	Blasting	➢ Water spray before blasting ➢ Water spray on blasted material prior to transportation ➢ Use of control blasting technique
3	Loading	➢ Water spray
4	Hauling (emissions from roads)	➢ Water spray, treatment with surface agents, soil stabilization, paving, traffic control.

4.2.2 Meteorological Data

The meteorological data for three months, i.e. from **Jan mid of 2023 to April mid of 2023** was considered for the study. Data included for AERMET were daily wind speed, wind direction, temperature, relative humidity, air pressure, precipitation, and solar radiation recorded during the period. AERMET reformats meteorological data so that it can be used as input for AERMOD model. Meteorology considered for modeling is shown in **Figure 4-1.**

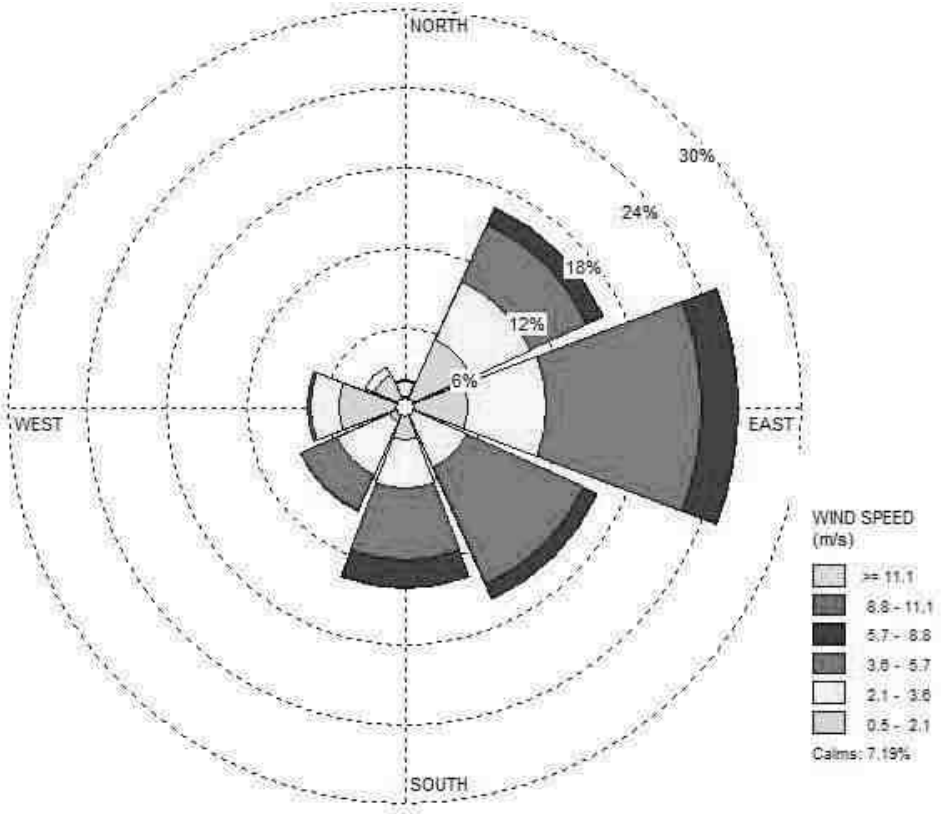


Figure 4-1 Wind rose diagram considered for dispersion modeling

4.2.3.1 AERMET Process

For the 3 phase AERMET processing of the meteorological data, specifications of the land use in the area are required to determine the terrain roughness for modeling. The land use was characterized for

in and around the site. The surface characteristics for the site and surroundings were selected and used to calculate the Albedo, Bowen ratio and surface roughness parameter.

The meteorological data were processed in the AERMET software to generate wind flow pattern & to generate surface meteorological data and profile meteorological data in a prescribed format that can be fed to AERMOD for modeling.

4.2.3.2 AERMOD Process

AERMOD Software Version 8.0.5 was used for air dispersion modeling and is applicable to a wide range of buoyant or neutrally buoyant emissions up to a range of 50 km. In addition to more straight forward cases, AERMOD is also suitable for complex terrain and urban dispersion scenarios.

AERMOD is a steady-state plume model. In the Stable Boundary Layer (SBL), it assumes the concentration distribution to be Gaussian in both the vertical and horizontal. In the Convective Boundary Layer (CBL), the horizontal distribution is also assumed to be Gaussian, but the vertical distribution is described with a bi-Gaussian probability density function (pdf). This behavior of the concentration distributions in the CBL was demonstrated by Willis and Deardorff (1981) and Briggs (1993). Additionally, in the CBL, AERMOD treats "plume lofting," whereby a portion of plume mass, released from a buoyant source, rises to and remains near the top of the boundary layer before becoming mixed into the CBL. AERMOD also tracks any plume mass that penetrates into the elevated stable layer, and then allows it to re-enter the boundary layer when and if appropriate. For sources in both the CBL and the SBL, AERMOD treats the enhancement of lateral dispersion resulting from plume meander. The emissions mainly generated from the mining activities are Blasting, Drilling, Scrapping, Excavation, Loading, Unloading, and transportation etc. Machinery like compressors and jack hammers are used for Drilling are estimated and used as inputs for the air dispersion modeling as shown in**Table 4.5 to Table 4.9.**

Maximum incremental value for SO_2, NO_x and PM are shown in **Figure 4.2 to Figure 4.6** and Top 10 highest Ground Level Concentration (GLC) obtained from modeling are given in **Table 4.10 to Table 4.14** respectively.

4.2.3.3 Emission Calculations

Each mining activity is a source of emission and the estimation of emissions depends on parameters such as meteorological, topographic conditions and material characteristics. It is necessary to calculate the qty of emissions for work or a source on site to the atmosphere. The following emission formulas are used to calculate the emission rate for the different emission source.

4.2.3.4 Mining Operational data

Table 4-5 Overview of the Source Parameters

S. NO	Description	Symbol	Quantity
1	Moisture Content (%)	m	1.64
2	Silt Content (%)	s	6
3	Production / Day (Tonn/Day)		17
4	Waste Dumping Area (Sq.Km)	a	0.01
5	Open Pit Area (Sq.Km)	Aa	0.2253

Source:

a) Emission Estimation Technique Manual for Mining and Processing of Non-Metallic Minerals by NPI, Nov 1999

b) Determination of the emission rate from various opencast mining operations, S. K. CHAULYA∗, M. K. CHAKRABORTY, et. Al. *Water, Air, and Soil Pollution 140: 21–55, 2002.*

c) Chaulya, S., 2006. Emission rate formulae for surface iron mining activities. *Environmental Modeling Assessment,* Issue 11, pp. 361-370.

d) EPA. August, 2004. Section 11.19.2, Crushed Stone Processing and Pulverized Mineral Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.

4.2.3.5 Emission dispersion models

Each mining activity is a source of emission and the estimation of emissions depends on parameters such as meteorological, topographic conditions and material characteristics. The emission factors for $PM_{2.5}$, which is particulate matter of 2.5µm or less in diameter, were not available in literature. Thus, $PM_{2.5}$ emissions have been calculated considering an assumption that 60% of for PM_{10} emissions contribute to $PM_{2.5}$.

Table 4-6 Emission from Mining Equipments

Source	Fuel used	Stack Details					Emissions (g/s)			
		No of Stack	Height (m) AGL	Dia (m)	Temp (°C)	Exit Velocity (m/s)	PM_{10}	$PM_{2.5}$	SO_2	NO_X
125 KVA DG	Diesel	1	3	0.3	180	10	5.81E-03	3.48E-03	5.38E-03	8.16E-02

Table 4-7 Vehicular Source Emission details

Source	Emission (g/s)		
	PM_{10}	$PM_{2.5}$	NO_X

4 Wheeler (1no.)	6.94E-05	4.17E-05	6.94E-04
Heavy Duty Vehicles (2 no.)	1.11E-04	6.67E-05	1.94E-02

Table 4-8 Emissions considered for mining

Activities	TSPM Emission rate	PM_{10} Emission rate	$PM_{2.5}$ Emission rate
Wet Drilling (g/s)	1.74E-06	3.49E-07	2.09E-07
Haulage (g/s)	2.57E-04	5.15E-05	3.09E-05
Waste Dumping (g/s)	1.20E-05	2.40E-06	1.44E-06
Open Pit ($g/s.m^2$)	1.18E-04	2.37E-05	1.42E-05

Table 4-9 Emission input for modelling

Activities	TSPM	PM_{10}	$PM_{2.5}$	SO_2	NO_x
Line Source (Haul Road) (g/s)	2.57E-04	5.15E-05	3.09E-05	-	-
Area Source (Open Pit) ($g/s.m^2$)	1.18E-04	2.37E-05	1.42E-05	-	-
Area Source (Waste Dumping) (g/s)	1.20E-05	2.40E-06	1.44E-06	-	-
Point Source (DG) (g/s)	-	5.81E-03	3.48E-03	5.38E-03	8.16E-02
Point Source (Drilling) (g/s)	1.74E-06	3.49E-07	2.09E-07	-	-
Point Source (Vehicle)(g/s)	-	1.81E-04	1.08E-04	-	2.01E-02

Note:

a. Since emission factors are available for PM_{10} the following assumptions are made for PM_{10} and $PM_{2.5}$ estimation

1. TSPM is considered as 5 times of PM_{10}
2. 60% of PM_{10} is considered as $PM_{2.5}$

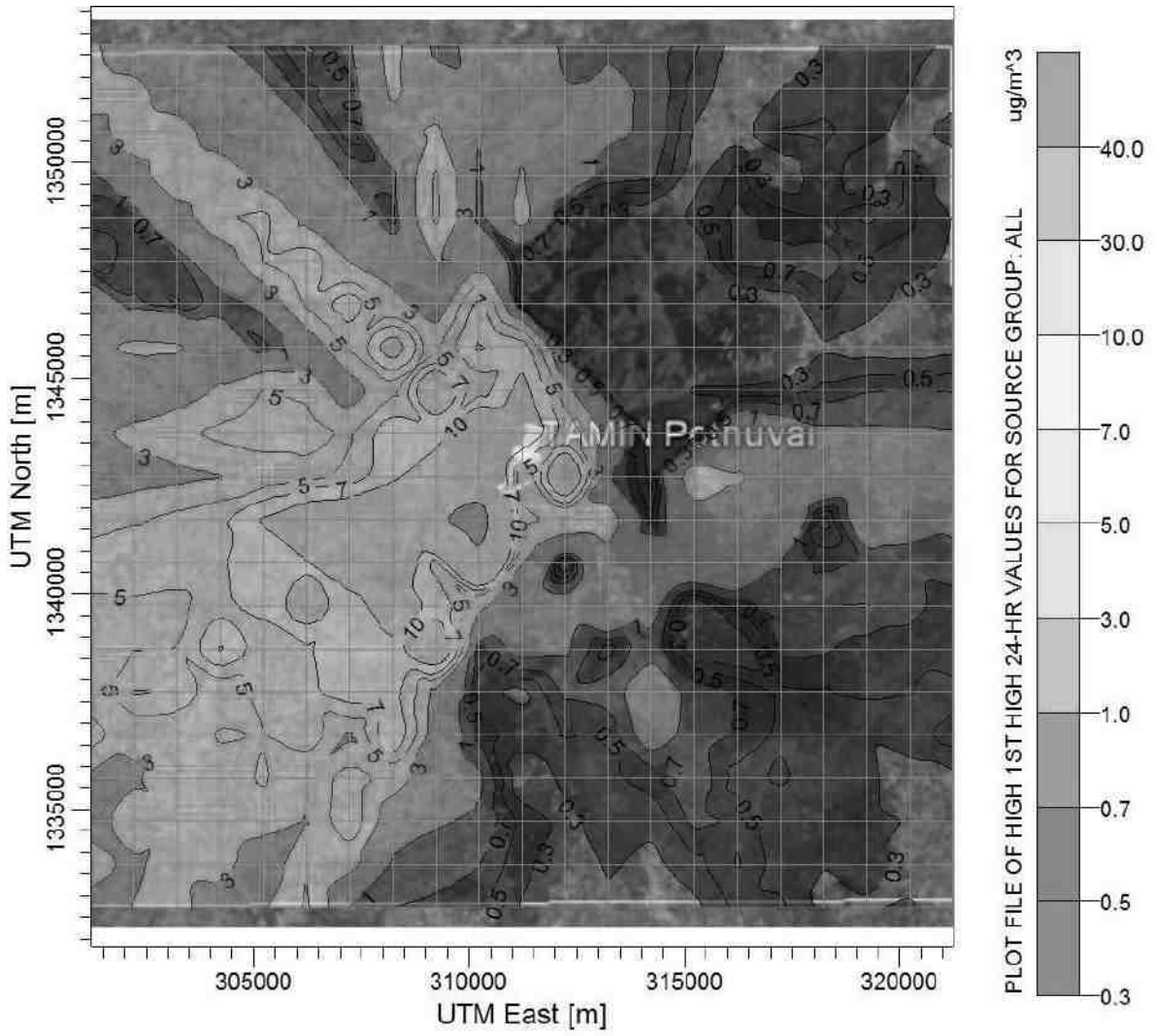


Figure 4-2 Predicted 24-Hrs GLC of Particulate matter TSPM within 10km Radius of the Study Area

Table 4-10 Predicted Top 10 Highest Concentrations TSPM

S.NO	UTM coordinates (m)		Conc. (µg/m^3)	Distance from Centre of the project (km)	Direction from project Centre
	E	N			
1.	310223	1341722	39.28489	1.41	SW
2.	309223	1341722	28.82508	2.24	WSW
3.	310223	1340722	26.87147	2.24	SSW
4.	310223	1342722	22.06989	1	W
5.	310223	1343722	21.8905	1.41	NW
6.	308223	1341722	19.24259	3.16	WSW
7.	312223	1342722	18.4968	1	E
8.	309223	1344722	18.09867	2.82	NW
9.	309223	1338722	17.47623	4.47	SSW
10.	308223	1340722	15.33335	3.60	WSW

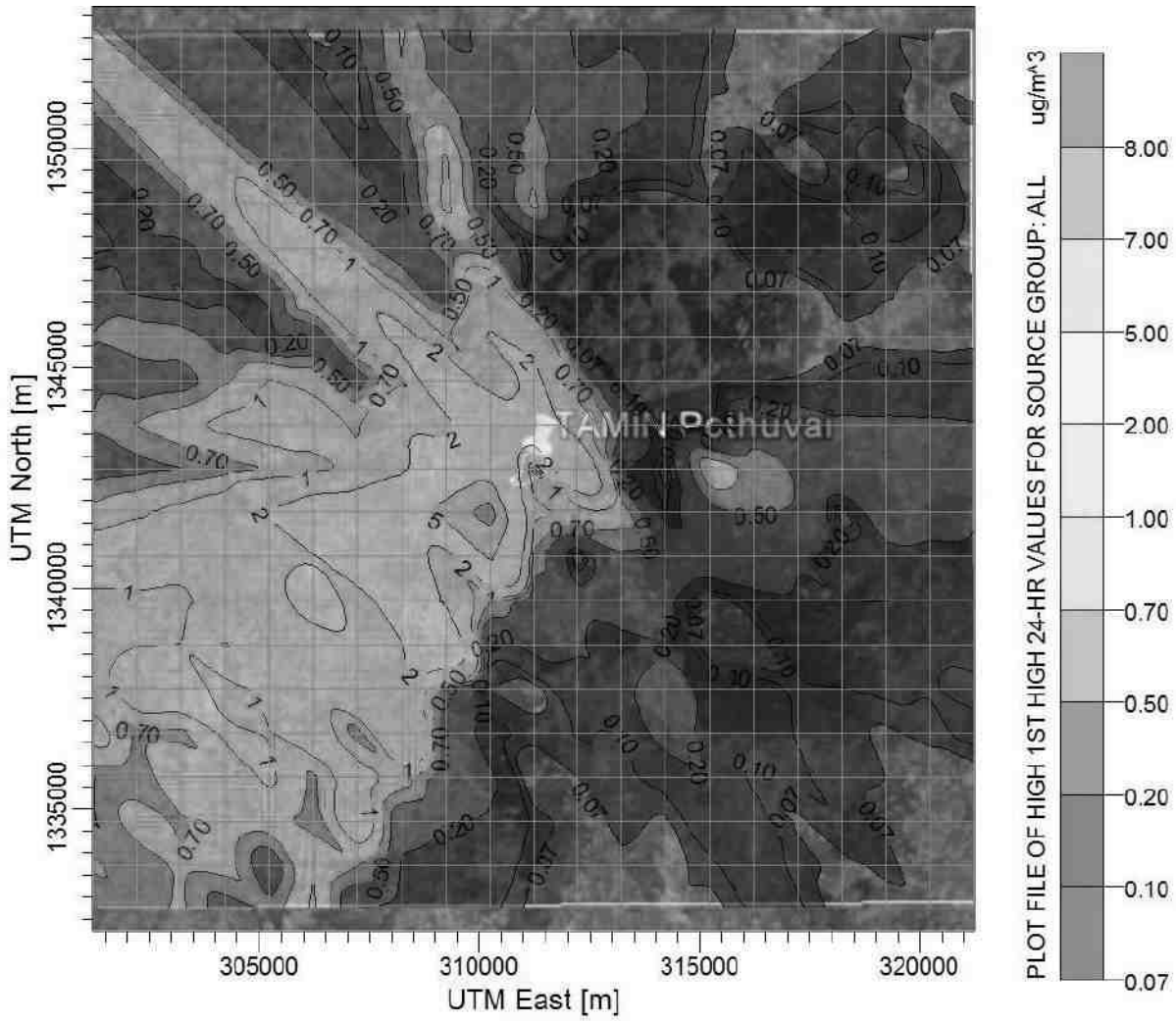


Figure 4-3 Predicted 24 Hrs GLC's of PM_{10} within 10km radius of the study area

Table 4-11 Predicted Top 10 Highest Concentrations Particulate Matter PM_{10}

S.No	UTM coordinates (m)		Conc. ($\mu g/m^3$)	Distance from Centre of the project (km)	Direction from project Centre
	E	N			
1.	310223	1341722	7.86003	1.41	SW
2.	309223	1341722	5.77502	2.24	WSW
3.	310223	1340722	5.37455	2.24	SSW
4.	310223	1342722	4.41687	1	W
5.	310223	1343722	4.37856	1.41	NW
6.	308223	1341722	3.85151	3.16	WSW
7.	312223	1342722	3.70037	1	E
8.	309223	1344722	3.62004	2.82	NW
9.	309223	1338722	3.49588	4.47	SSW
10.	308223	1340722	3.06714	3.60	WSW

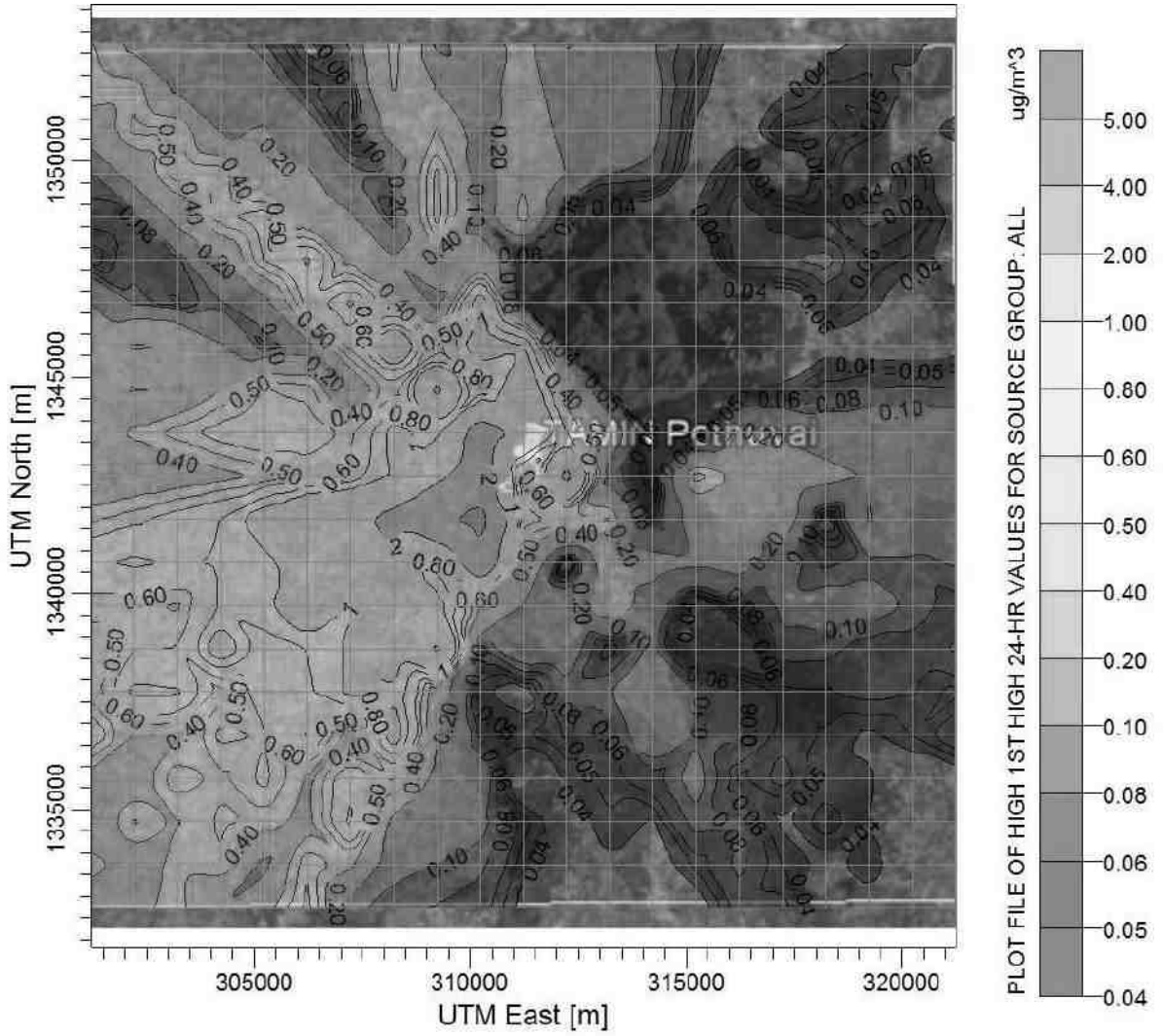


Figure 4-4Predicted 24-Hrs GLC of Particulate matter $PM_{2.5}$ within 10 km radius of the study area

Table 4-12 Predicted Top 10 Highest Concentrations Particulate Matter $PM_{2.5}$

S.No	UTM coordinates (m)		Conc. ($\mu g/m^3$)	Distance from Centre of the project (km)	Direction from project Centre
	E	N			
1.	310223	1341722	4.71933	1.41	SW
2.	309223	1341722	3.46743	2.24	WSW
3.	310223	1340722	3.22699	2.24	SSW
4.	310223	1342722	2.65198	1	W
5.	310223	1343722	2.62898	1.41	NW
6.	308223	1341722	2.31251	3.16	WSW
7.	312223	1342722	2.22178	1	E
8.	309223	1344722	2.17355	2.82	NW
9.	309223	1338722	2.09899	4.47	SSW
10.	308223	1340722	1.84156	3.60	WSW

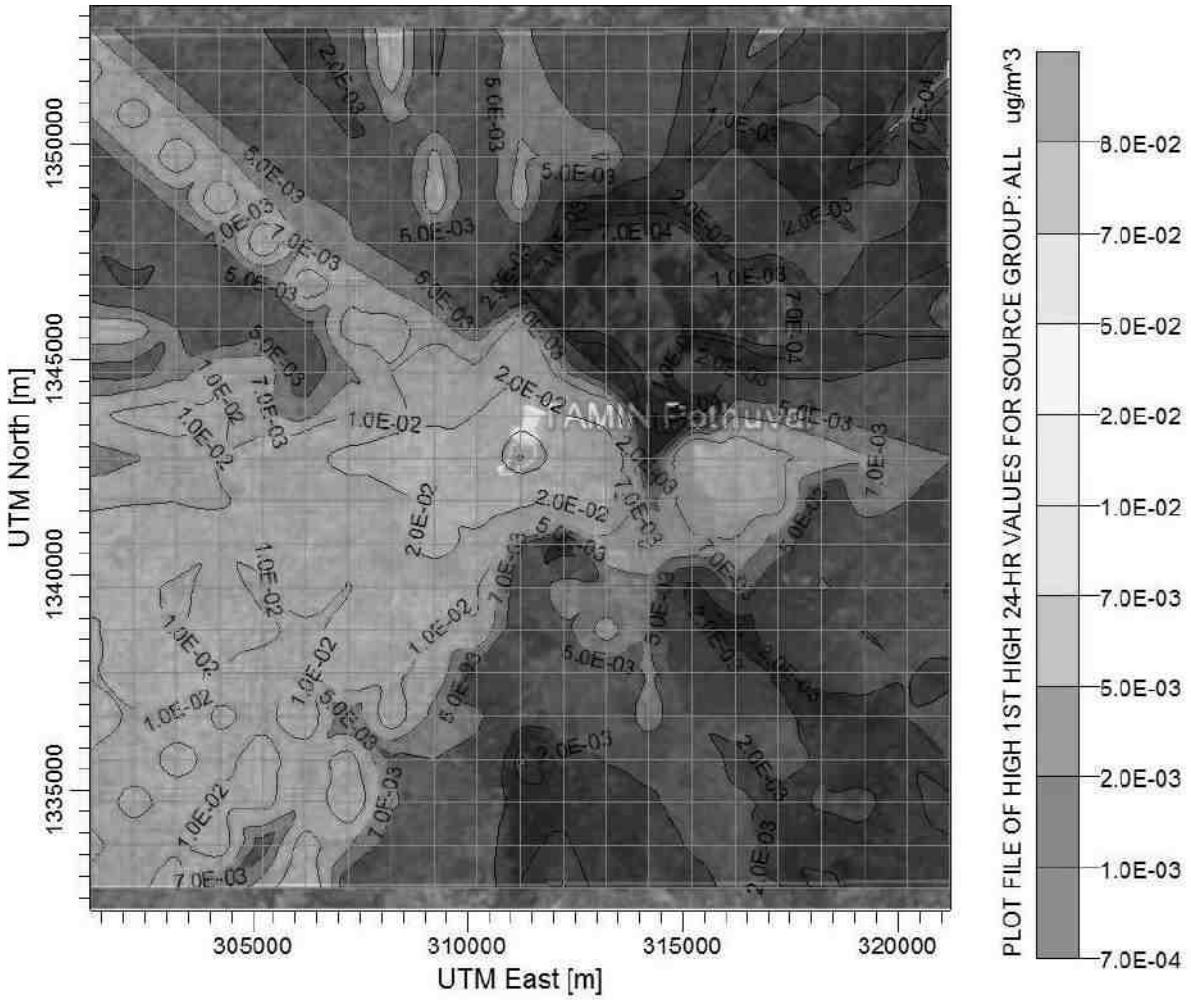


Figure 4-5 Predicted 24-Hrs' GLC's of SO_2within 10 km Radius of the Study Area

Table 4-13 Predicted Top 10 Highest Concentrations of Sulphur Dioxide

S.NO	UTM coordinates (m)		Conc. (µg/m^3)	Distance from Centre of the project (km)	Direction from project Centre
	E	N			
1.	311223	1342722	0.07254	1	E
2.	309223	1342722	0.04898	2	W
3.	311223	1343722	0.04566	1	N
4.	312223	1342722	0.04481	1	E
5.	313223	1342722	0.03569	2	E
6.	308223	1342722	0.03525	3	W
7.	310223	1342722	0.03215	1	W
8.	310223	1341722	0.02847	1.41	SW
9.	309223	1340722	0.02679	2.82	SW
10.	313223	1341722	0.02454	2.24	ESE

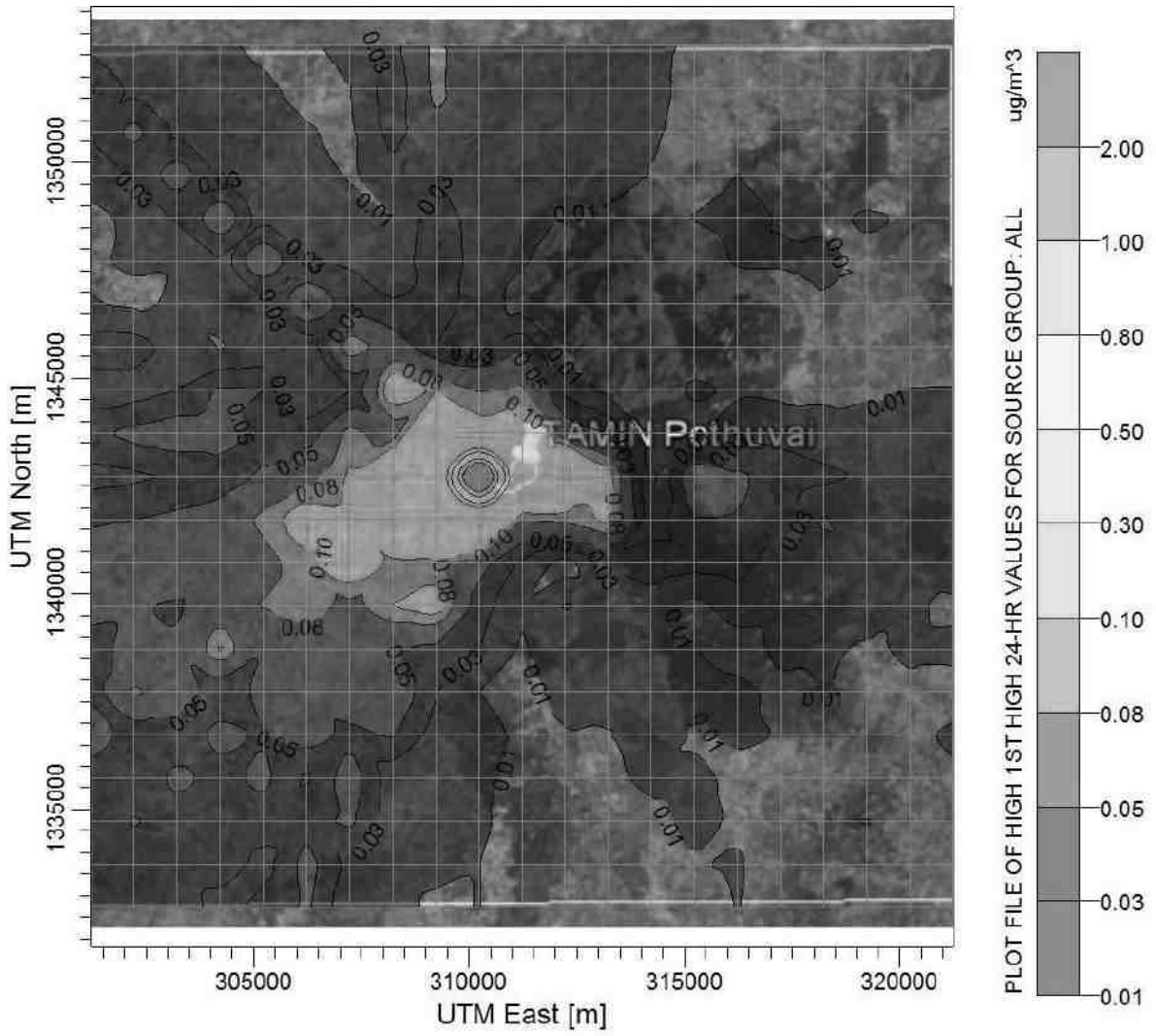


Figure 4-6 Predicted 24-Hrs' GLC's of NO_X within 10 km Radius of the Study Area

Table 4-14 Predicted Top 10 Highest Concentrations Nitrogen Oxide

S.NO	UTM coordinates (m)		Conc. (µg/m^3)	Distance from Centre of the project (km)	Direction from project Centre
	E	N			
1.	310223	1342722	1.66559	1	W
2.	309223	1342722	0.28394	2	W
3.	310223	1341722	0.25016	1.41	SW
4.	309223	1341722	0.24672	2.24	WSW
5.	312223	1342722	0.22218	1	E
6.	311223	1342722	0.21978	Project Site	Project Site
7.	309223	1343722	0.18505	2.24	WNW
8.	308223	1341722	0.17333	3.16	WSW
9.	308223	1342722	0.16375	3	W
10.	311223	1343722	0.16097	1	N

4.2.4 Conclusion

The total increase in concentrations above baseline status to estimate the percentage increase is summarized in the below **Table 4.15.**

Table 4-15 Total maximum GLCs from emissions

Pollutant	Max. Base Line Conc. ($\mu g/m^3$)	Estimated Incremental Conc. ($\mu g/m^3$)	Total Conc. ($\mu g/m^3$)	NAAQ standard	% contribution of concentration above Base line
TSPM	171.35	39.28	210.63	500	22.92
PM10	68.54	7.86	76.4	100	11.47
PM2.5	39.27	4.74	44.01	60	12.07
SO2	17.26	0.07	17.33	80	0.41
NOX	30.35	1.66	32.01	80	5.47

4.2.5 Impacts due to Transportation

The Granite is transported to consumer directly as per buyer's requirement. The granite will be transported through existing road by tippers and approx. no. of trips required is 2 times per week. This minimum trip does not create impact on existing transportation. The vehicular movement for the proposed project is given in **Table 4.16.**

Table 4-16 Existing & proposed vehicular movement per Hour (Peak Hour) SH-61

S. No	Type of Vehicle	Existing vehicles	Existing PCU	Proposed vehicles	Proposed PCU	Total vehicles after project implementation	PCU Factors IRC (SP 41)	Total PCU after project implementation
1	2 wheeler	97	72.75	7	5.25	104	0.75	78
2	3 wheelers	22	26.4	0	0	22	1.2	26.4
3	4 wheelers/ cars	59	59	2	2	61	1	61
4	truck/Lorry	43	159.1	11	40.7	54	3.7	199.8
5	agricultural tractor	27	135	0	0	27	5	135
6	light emission vehicle	4	5.6	0	0	4	1.4	5.6
Total		**252**	**457.850**	**20**	**47.95**	**272**		**505.8**

Table 4-17 Traffic Volume after Implementation of the Project

For the Road	Volume of Traffic	Volume (V)	Road Capacity (C)	V/C Ratio	LOS Category*	Traffic Classification
Existing	252	457.85	1500	0.31	"A"	Free Flow Traffic
After implementation	272	505.8	1500	0.34	"A"	Free Flow Traffic

*LOS (Level of Service) categories are A-Free Flow, B- Reasonably Free Flow, C-Stable Flow, D-Approaching unstable flow, E- Unstable flow, F- Forced or breakdown flow

Due to propose project there will be slight increment in the vehicle movement but the level of service (LOS) anticipated will be Free Flow.

4.2.5.1 Mitigation Measures

The increment in the dust emissions will be mainly due to transportation activity. Therefore, emissions due to mineral handling during mining operation are not much and restricted to the lease area only.Proper mitigation measures are practiced during mining activities to control air pollution load below the prescribed limits are as follows:

- Regular water sprinkling on haul and access roads.
- Watering of haul roads and other roads at regular intervals
- Provision of green belt by vegetation for trapping dust.
- Greenbelt development along the haul roads, dumps and along the boundaries of the lease area.
- Utmost care will be taken to prevent spillage of sand and stone from the trucks.

4.3 Water Environment

The existing water environment quality has been studied and the study results are discussed in **Section 3.9** of **Chapter-III**, which show that generally the water quality in the area is well within statutory standards.

The major sources of water pollution due to this quarry operation will be as below:

- Domestic sewage from the mine.
- Deterioration in surface / ground water quality of receiving body.
- Changes to hydraulic regime.

4.3.3 Wastewater Generation

There is no process effluent generation. The domestic sewage of 1.27 KLD will be disposed through septic tank followed by soakpit.

4.3.4 Mitigation Measures

4.3.4.1 Surface Water Pollution Control Measures

- A safety distance of 50m has been provided in the Southern side of the applied area and running through Patta lands of the Pothuvai&Pazhavalam village.

- Construction of garland drains of suitable size around mine area and dumps to prevent rain water descent into active mine areas.
- During monsoon season, the rain water will be collected by natural slope of area to water fed tank of the mine and it will be utilized for dust suppression and greenbelt development.
- The dump tops will be provided with inner slopes to control water flow to prevent erosion washouts. The dumps tops and slopes of in active areas will be covered with grasses, shrubs, mulching, etc, to prevent erosion, till final backfilling of dumps into mined out areas.
- Retaining walls of adequate dimensions will be provided at the top of dumps and the unstable OB benches within the mine to prevent wash off from dumps and sliding of material from benches. This will help in preventing silting of water drains/channels
- The water channels/drains carrying the rain water from the mine will be provided with baffles and settling pits to arrest the suspended solids, if any, present in this water
- The worked out slopes will be stabilized by planting appropriate shrub/grass species on the slopes.
- The mine water will be regularly tested for presence of any undesirable elements and appropriate measures will be taken in case any element is found exceeding the limits prescribed by CPCB.

4.3.4.2 Ground Water Pollution Control Measures

- The domestic sewage from the toilets will be routed to septic tanks.
- Regular monitoring of water levels and quality in the existing open wells and bore well in the vicinity will be carried out.

4.3.4.3 Rain Water Harvesting

- The rainwater will be diverted towards the middle of the mine to prevent water entering the mine working. The rainwater flows will also contain fines both from surface and waste dumps during seasonal flows. As such, it is proposed to have structures in such a way to act as settling pond and also for rainwater harvesting.
- Construct barriers at suitable intervals along the path of the drains.
- Divert the water to de-silting cum rainwater harvesting pond in the mine area.
- Provide necessary overflow arrangement to maintain the natural drainage system.

4.3.4.4 Drainage pattern and Hydrogeology

- Catchment area inside the mine will be affected.

4.3.4.5 Mitigation measures

- The study has recommended new alignment in line with upstream drainage slope of the area to facilitate smooth entry of water into the diversion channel and ultimate discharge of water into the original stream. No reduction in surface run-off is envisaged.

4.4 Impact of Noise / Vibrations & Mitigation Measures

4.4.3 Impact of Noise on Working Environment

The main sources of noise in the mine are as follows:

- Transportation vehicles
- Loading & unloading of minerals.
- Drilling

4.4.4 Noise due to Drilling, Excavation and Transportation

The noise levels in the working environment will be maintained within the standards prescribed by Occupational Safety and Health Administration (OSHA). These standards were established with the emphasis on reducing the hearing loss. The permissible limits, as laid down by OSHA, are presented in **Table 4.18.**

Table 4-18 Permissible Exposure in Cases of Continuous Noise (OSHA, Govt. of India)

S. No	Sound Level (dB A)	Continuous Duration (Hours)
1	85	8
2	88	4
3	91	2
4	94	1
5	97	0.5
6	100	0.25

4.4.5 Noise Due to Blasting

Blasting activities are involved in this Quarry as green belt will be developed around the mine which restricts the propagation of noise. The main source of noise in quarrying is due to usage of machinery like excavators, mining tippers and compressors and diesel generators.

Following mitigation measures should be taken to control noise pollution:

- Wherever the noise levels exceed 85 dB (A), workers should be provided with earmuffs, ear plugs etc.
- All vehicles and machinery will be properly lubricated and maintained regularly.
- Speed of the Vehicles entering and leaving the quarrying lease will be limited to 25 kmph.
- Unnecessary use of horns by the drivers of the vehicles shall be avoided.

4.4.6 Noise modeling

Software – CUSTIC 3.2 English

4.4.6.1 Mitigate Measures

- Controlled blasting with proper spacing, burden and stemming will be maintained
- No secondary blasting.
- Minimum quantity of detonating fuse will be consumed by using alternatively Excel non-electrical initiation system.
- The blasting will be carried out during favorable atmospheric condition and less human activity timings.
- The prime movers/diesel engines will be properly maintained.
- Provision of sound insulated chambers for the workers deployed on machines.
- Proper designing of plant & machinery by providing inbuilt mechanism like silencers, mufflers and enclosures for noise generating parts and shock absorbing pads at the foundation of vibrating equipment.
- Greenbelts around infrastructure site, service building area and township.
- Trees will be planted on both sides of haul roads.
- Personal Protective Equipment (PPE) like ear muffs/ear plugs will be provided to the operators.

4.4.7 Impact of Vibration

Blasting activities are involved in Granite Quarry operations. The vibration during the moment of machinery will be minimal for a short span that will be well within the prescribed limits. Proposed Peripheral green belt will be developed in 7.5m safety zone around the quarry. This will mitigate the Vibration.

4.4.7.1 Mitigation Measures

- Proper quantity of explosive, suitable stemming materials and appropriate delay system are to be adopted for safe blasting.
- Safe blasting zones are kept around the periphery of the quarry.
- Overcharging will be avoided. The charge per delay will be minimized and preferably more number of delays will be used per blasts.

4.5 Impact on Human Settlement

There are no monuments or places of worships in mine area. Ground vibration and noise pollution is maintained minimal and confined to the mine area. The quality of water both surface and ground water is good and all parameters of drinking water are as per IS standards. Water quality analysis will be carried out at periodical intervals during post project monitoring.

The PM, NOx and SO_2 have been observed to be below the prescribed limit. Noise levels have also been found to be below the permissible limits at all the locations. Further, the noise generated in the lease area will get attenuated due to plantation and green belt all around the lease area. As preventive measures, greenbelt development around the mine lease area will be further strengthening for control of air emission to environment.

- All the employees when inducted will be medically examined. Further, they will also be medically examined at periodical interval.

4.6 Biological Environment

4.6.3 Mining activities and their impact on biodiversity

Table 4-19 Impacts on Biodiversity

S. No	Activity	Examples of aspects	Examples of biodiversity impact
1	Extraction	Land clearing	Loss of habitat, introduction of plant diseases, Siltation of water courses
2	Blasting, Digging and hauling	Dust, noise ,vibration, water pollution	Disruption of water courses ,impacts on aquatic ecosystems due to changes in hydrology and water quality
3	Waste dumping	Clearing, water and soil pollution	Loss of habitat, soil and water contamination, sedimentation.
4	Air emissions	Air pollution	Loss of habitat or species
5	Waste disposal	Oil and water pollution	Encouragement of pests, disease transfer, contamination of groundwater and soil
6	Building power lines	Land clearing	Loss or fragmentation of habitat
7	Provision of accommodation	Land clearing, soil and water pollution, waste generation	Loss of habitat, sewage disposal and disease impacts
8	Access roads	Land clearing	Habitat loss or fragmentation, water logging upslope and drainage shadows down slope
9	Population growth	Land clearing or increased hunting	Loss of habitat or species, stress on local and regional resources, pest introduction, clearing
10	Water supply (potableor industrial)	Water abstraction or mine dewatering	Loss or changes in habitat or species composition

4.6.4 Existing Biological Scenario

- There will not be any adverse impact due to mining operations in this lease since only small production is involved from this lease and there will not be any major polluting source from the

mining operations. Besides, all necessary mitigation measures will be implemented.

- There is no perennial water body near the site and there will be no discharge of effluent from the mine.
- In the Quarry area or its proximate areas there is no wetland and the natural flow of water not available.
- There is no rare or endangered species.
- There are no wild animals in the area. In the post mining stage, proper fencing will be carried in the mined out area to prevent fall of animals in the mine pits.
- There are no any wetlands, fish breeding grounds, marine ecology nearby the quarry area, which will be affected due to this project.
- No such significantly important medicinal value species within both the ML areas and its nearby region.
- There are no any wetlands, fish breeding grounds, marine ecology nearby the quarry area, which will be affected due to this project.

4.6.4.1 Mitigate Measures

To reduce the adverse effects on flora/fauna status that are found in project area due to deposition of dust generating from mining operations, water sprinkling and water spraying systems will be ensured in all dust prone areas to arrest dust generation.

4.6.5 Flora and Fauna

Activities of Mine development and operations & transportation to end users will cause the following impacts on flora and fauna.

4.6.5.1 Impact

- Displacement of existing fauna.
- Loss of vegetation

4.6.5.2 Mitigation measures

- Education and training etc.
- Logistic support in the form of equipment, Vehicles etc as required by the implementing DFO will be extended.

The objectives of the green belt cover will cover the following:

- Noise abatement
- Reuse of wastewater to the extent possible
- Prevention of soil erosion
- Ecological restoration
- Aesthetic, biological and visual improvement of area due to improved vegetative and

plantation covers.

- Green belt around mine, dumps, etc:
  - Tall growing, closely spaced, evergreen trees native to the area
  - Easy, quick early growth and establishment
  - Uniform spreading of crown habit.
  - Timber trees having long gestation period.
  - Trees with high foliage density, leaves with larger leaf area
  - Attractive appearance with both good flowering and fruit bearing.
  - Bird and insect attracting species
  - Suitable green cover with minimal maintenance
- Avenue Trees:
  - Trees with conical canopy and with attractive flowering
  - Trees with medium spreading branches to avoid obstruction to the traffic
  - Trees with branching at 10feet and above.

4.7 Green Belt Development

The green belt plantation programme will be continued till the end of the mining operation in the area. In framing out this programme on a sustainable and scientific base, due consultation and coordination with the forest department will be sought.

An area of 0.06.5-hectare land was earmarked for greenbelt development during first 5 years of mining plan, at the end of life of quarry; the green belt area will be 0.19.0 Ha, TAMIN proposed to plant 30 No's of trees per year and Rs. 30,000/- per year will spend for proposed greenbelt development and maintenance.

Plants are chosen to provide aesthetic, ecological and economical value. Trees will help to arrest propagation of noise and help to lessen dust pollution due to dust arresting action. The existing plantation will be developed around 7.5m safety zone of the quarry. The soil dumps, are planted to prevent erosion and for stabilization of the soil. Plants are chosen to provide aesthetic, ecological and economical value. Trees will help to arrest propagation of noise and help to lessen dust pollution due to dust arresting action.

4.7.1 Impacts on Occupational Health due to project operations

Anticipated occupational illness sequel to mining activities involved in the project. Occupational health problems due todust&noise and Occupational illness by quarry activities are as follows;

- Dust related pneumonia
- Tuberculosis
- Rheumatic arthritis

- Segmental vibration

4.7.2 Mitigate Measures for Occupational Health

- Adoption of dust suppression measures like spraying water, use of drill with dust collection system or wet drills etc.
- Plantation
- Avoid blasting during unfavorable wind & atmospheric conditions.
- Use of personal protective equipment. Compliance with DGMS circulars.
- Emergency response plan that includes installation of emergencyresponse equipment to combat events such as fire.
- All personnel required to handle hazardous materials will be provided with personal protective equipment suitable for the hazardous material being handled.
- On-site first aid facilities will be provided and employees will be extended to the local community in emergencies.

Table 4-20 Mitigation for occupational health and safety

S. No	Activity	Mitigation measures
1	Excavation	Planned excavation, avoid haphazard mining
2	Drilling and blasting	➢ In addition, the operators and other workers should be provided with masks, helmets, gloves and earplugs.
3	Safety zone	➢ Provisions for a buffer zone between the local habitation and the mine lease in the form of a green belt of suitable width. ➢ Restricted entry, use of sirens and cordoning of the lasting area are some of the good practices to avoid accidents.
4	Overburden stabilization	➢ Accidents are known to happen due to overburden collapse. ➢ Therefore, slope stabilization and dump stability are critical issues for safety and environment. Proper measures will be taken care.
5	Worker's health surveillance	➢ Health survey programmes for workers and local community. ➢ Regular training and awareness of employees to be conducted to meet health and safety objectives.

4.7.2.1 Mitigate Measures for Safety Aspects

- To reduce pollution emanation from quarry operations, carry out splitting of sheet rock by diamond wire saw which largely reduces the dust and noise generation.
- Water sprinkling on haul roads and dumping yards, etc.
- Green belt creation wherever possible to arrest dust and reduce noise propagation.
- All staff and workers will be provided with PPE to guard against excess noise levels
- Provision of safety Helmets, goggles, safety boots, ear muffs, gas masks, etc.
- To provide appropriate instruction, training, retraining, vocational training, etc.

- Organization of safety contests and safety campaigns regularly to update knowledge of safe operational procedures, etc.
- Observation and compliance of all precautions, control measures and stipulations on above lines will ensure that in this project, health and safety problems will be minimal.

4.8 Impacts on Social Environment

Since the entire lease area of the project has no habitations or hutments in the core zone area, no rehabilitation or resettlement problems are involved. By adopting various mitigation measures as explained earlier, the environmental scenario in respect of ambient air quality, water quality, Noise levels, water aspects, biological aspects etc. during the operation of the project will be maintained within the statutorily prescribed levels. As such, impact due to the projects will be positive on socio-economic aspects. It will be ensured that the buffer zone of the quarry will be properly preserved environmentally in all respects within sustainable limits through necessary monitoring. The project will be operated with care for minimizing environmental impacts with proper EMP measures for pollution control.

Indirectly scores of people will be benefited by gainful indirect employment opportunities through various service related activities connected with the project operations as shown under.

4.8.1 Corporate Environmental Responsibility

TAMIN Pothuvai & Pazhavalam site had no Relocation and Rehabilitation. Most villages have benefitted mutually at Pothuvai & Pazhavalam where the mining industry has provided indirect jobs for labour and villages provide accommodation for the labour and staff. Supportive industries like food supply and essential shops are economic growth in the villages. The site has provided road access to a few nearby village sites. CER Acttivity will be implemented as per MoEF&CC O.M dated20th October, 2020 (F.No. 22-65/2017-IA.III)

Other benefits to Community

- Project related logistical operations.
- Various trading services for consumer goods, spare parts, sundry items, etc.
- Contractual services connected with the project.
- Green belt works in the project.
- Casual labour needs for various activities.

The project will provide ample opportunity to the local people for direct and in-direct employment. The proposed project may create opportunities for indirect employment in the field of vehicle hiring, labours, trading of construction materials, carpenters etc. The major areas which required immediate attention relates to infrastructure support, health & sanitation, Anganwadi services, school education, youth development, income generation activities & veterinary services.

5 ANALYSIS OF ALTERNATIVES

5.1 Alternate Technology

The project is a fresh granite quarry. The technology used for mining is made by TAMIN in house there would not be any changes in the Mining. The mining technology is tried & tested method, and therefore there is no risk of technological failure. In addition to this the TAMIN is being processed to take care of any technological failures.

5.2 Method of mining

5.2.1 Opencast Method

Open cast, semi-mechanized mining with 6m vertical bench with a bench width is 6m with vertical slope. Under the regulation 106(2) (a) of the Metalliferous Mines Regulation 1961 in all open cast working in hard ore body, the benches and sides should be properly benched and sloped. The height of any bench shall not exceed 6m and the width thereof shall not be less than the height. The benches shall be sloped at an angle of more than 45° from the horizontal.

5.3 Alternate Site

The mineral deposits are site specific in nature; hence question of seeking alternate site does not arise. The project site is located at S.F. 58/1(Pothuvai) & 135/1 Pazhavalam, Pothuvai&Pazhavalam Village, Gingee Taluk, Villupuram District, Tamil Nadu state. It is Government Poramboke land the applicant has obtained lease from the Government is enclosed as **Annexure -2.**

5.4 Connectivity

Existing road is available to from quarry ends with SH 4A (Chepet - Thavalakulam) at ≃7.30km towards WNW. The nearest railway station is Andampallam Railway station located at ≃ 11.43Km towards WSW direction. NH 38 (Vellore - Thoothukudi) situated at distance of ≃ 3.56Km (SW).

6. ENVIRONMENTAL MONITORING PROGRAMME

6.1 General

The mitigation measures suggested in **Chapter 4** will be implemented so as to reduce the impact on the environment due to the operations of the project. The monitoring schedules are planned for systematic study of various pollution levels with respect to air and water qualities, noise levels, etc. to ensure that they conform to the standards laid down by Environmental Protection Act and various Central and State Pollution Control Board Limits. The various methodologies and frequency of studies of all environmental quality parameters also conform to norms laid down by MOEF& CC, CPCB and SPCB in this respect.

The Project proponent will be overseeing/reviewing following activities:

- To observe the implementation of environmental control measures.
- To ensure implementation of planned plantation programme with monitoring of survival rate, etc.
- To keep monitoring records properly for submission of periodical returns to statutory authorities and for checking by them.
- To evaluate periodically the performance of existing pollution control equipment and systems for taking prompt action in this respect to rectify the defects.
- Conducting safety audits and programmes to create safety awareness in workers/staff.
- Monitoring of dumps and benches for slope stability, monitoring of OB dumps, laying of check dams, garland drains around the dumps and excavated areas and their regular maintenance for de-silting.
- To study the effects of project activities on the environment.
- To interact and liaise with State and Central Government Departments.
- To take immediate preventive action in case of some unforeseen environmental pollution attributable to the project.
- Imparting training on safety and conduct safety drills to educate employees.
- To ensure that firefighting equipment, etc, are kept in ready-to-use condition.

For each of the environmental attributes, the monitoring plan specifies the parameters to be monitored, location of monitoring sites, frequency and duration of monitoring and it also denotes the applicable standards, implementation and supervising responsibilities.

6.2 Monitoring Schedules for Various Environmental Parameters

The proponent shall adopt the following monitoring schedule for environmental parameters. However, based on the need and priority it may be suitably modified / improved. However, since the

proponents are different, monitoring, fulfilling of all the statutory obligations and maintaining records are to be carried out separately by the proponents.

Ambient Air Quality

The following monitoring schedule is given for ambient air quality.

- **Parameters**

  Sulphur dioxide (SO_2), Oxides of Nitrogen (NO_x), Suspended Particulate Matter (SPM), Respirable Particulate Matter ($PM_{2.5/10}$).

- **Frequency of Monitoring**

  Once in a year in each location.

- **Location**

  2 or 3 locations in buffer zone and 1 location in work zone. The environmental standards for Ambient air quality prescribed by CPCB/MOEF/SPCB.

6.2.1 Water Environment

Water quality monitoring at least before and after monsoon from ground water near the lease area and mine pit water sample shall be monitored. General, Physical and chemical parameters, COD, BOD, TSS etc shall be analyzed.

6.2.2 Noise Measurement

Work Zone noise and Ambient Noise level shall be monitored at least once in a year. Noise monitoring at ambient air monitoring locations will be carried out. Besides, vibration studies in the nearby villages shall be carried out, as per necessity and direction of DGMS, etc. The noise level standards as given by CPCB / MOEF given in **Table 6-1** will be enforced in the mine.

Table 6-1 Environment (Protection) Rules 1986

S. No	Area code	Category of area	Limits in dB(A) Leg	
			Day Time	Night Time
1	A	Industrial area	75	70
2	B	Commercial area	65	55
3	C	Residential area	55	45
4	D	Silence Zone	50	40

Note:

- Day time shall mean from 6 a.m. and 10.0 p.m.
- Night time shall mean from 10.0 p.m. and 6 a.m.
- Silence zone is an area comprising not less than 100 meters around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority.

- Mixed categories of areas may be average as one of the four above mentioned categories by the competent authority.

* dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

A "decibel" is a unit in which noise is measured.

"A", in dB (A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq: It is energy mean of the noise level over a specified period.

6.3 Post Project Environmental Monitoring

It is imperative that the Project Authorities set up regular monitoring stations to assess the quality of the neighboring environment of the project. An environmental monitoring programme is important as it provides useful information and helps to:

- Verify the predictions on environmental impacts presented in this study
- Assist in detecting the development of any unwanted environmental situation, and thus, provides opportunities for adopting appropriate control measures, and
- Identify the effectiveness of mitigate measures suggested in the EMP.

Table 6-2 Post Project Environmental Monitoring Program

S. No	Area of Monitoring	Number of Sampling Stations	Frequency of Sampling	Parameters to be Analyzed
1.	Meteorology	One	Hourly and Daily basis.	Wind speed and direction, Temperature, Relative Humidity, Atmospheric pressure, Rainfall.
2.	Ambient Air Quality	2 Stations (In downwind)	Twice a week:24 hourly period	PM_{10}, $PM_{2.5}$, SO_2, and NO_2
3.	Noise	2 (two within core area and two in buffer area)	Once every season	Ambient Equivalent continuous Sound Pressure Levels (Leq) at day and Night time.
4	Exhaust from DG set	Stack of DG set	Quarterly	PM_{10}, $PM_{2.5}$, SO_2 & CO
5	Vehicular Emissions	Parking area	Periodic monitoring of vehicles	Air emission and noise, PCU
6	Soil	Two Locations within the Project Site	Yearly Once	Physico chemical properties, Nutrients, Heavy metals

7	Terrestrial Ecology	Within 10km, around the project	Once in three years	Symptoms of injuries on plants
8	Surface/ Ground water quality	Two Locations Within Project Site	Yearly Once	As per ISO 10500 Standard parameters

6.3.1 Occupational Health and Safety

- Occupational health survey of staff and permanent workers will be undertaken at least once in 3 years to detect early incidence of diseases and for promptremedialmedicalfollow up in the matter. Audiometric test for the workers will be done at regular interval for workers of the noise prone area. Safety matters also will be reviewed periodically by safety in-charge.
- Occupational health and safety is very closely related to productivity and good employer-employee relationship. The main factors of occupational health in mines are fugitive dust and noise. Safety of employees during blasting operation and maintenance of mining equipment and handling of explosive materials is to be taken care of as per the Mine Regulations, 1961 and Circulars of DGMS. To avoid any adverse effects on the health of workers due to dust, heat, noise and vibration, sufficient measures have been proposedin the EMP. These include
    - Provision of wet drilling /or dust collectors
    - Provision of rest shelters for mine workers with amenities like drinking water, fans, toilets etc.
    - Provision of personnel protection devices for the workers
    - Rotation of workers exposed to high noise areas
    - First-aid facilities

Occupational Health Survey of the employees will be carried out at regular intervals.

6.4 Environmental Monitoring Programme

Table 6-3 Environmental Management Plan

S. No	Salient Items	Position at the end of five years of Mining period
1	Land Reclamation	The pit boundaries shall be safely fenced and used for agricuktural purpose when the pit is filled with underground seepage or rain waters
2	Waste Management	The waste materials can be dumped along the north eastern part of the lease area. By adding suitable variety of soil brought from outside and planting trees over the waste dump
3	Afforestationprogram with precautions for survival and protection of plantation.	As proposed, 20 plants per year were planted during the mining Period along the eastern boundary of lease area and achieved survival rate of 50%.

4	Quality of mine water and any interference with surface waterspruces	Followed the Procedure as proposedinthe Mining plan.
5	Meaures for dust suppression	Water will be sprinkled for the suppression of air borne dust from mine approach roads, waste dumps on regular intervals using water tankers.

7. ADDITIONAL STUDIES

7.1 Introduction

The additional studies involved in this project will consist of following aspects:

1. Public consultation
2. Risk assessment /Disaster Management Plan
3. Mine closure plan as per GCDR 1999
4. Occupational Health and safety studies have been conducted and a safety plan was prepared.

7.2 Public Consultation

The proposed project is categorized as 'B1' category Schedule 1(a) as per EIA Notification 2006 and its amendments there after. The total area of the quarry is 40.13.05 Ha.

However, the proposed project falls under 'B1' category, Schedule 1(a), Public Hearing is Mandatory. So, EIA report has been prepared as per the obtained ToR vide. TN/F.No.845/SEAC/ToR-1328/2023, dated: 09.02.2023. Draft EIA report was submitted for Public Hearing (PH) to Villupuram PCB. After PH, the minutes obtained will be incorporated in the EIA report along with action plan by the proponent. Final EIA will be submitted to TNSEAC for further appraisal of the project and obtaining Environment Clearance.

After PH, the minutes were incorporated in the EIA report along with action plan or commitment by the proponent. Final EIA will be submitted to TNSEAC for further appraisal of the project and obtaining Environment Clearance.

7.3 Risk Identification & Management

7.3.1 Introduction

Mining and allied activities are associated with several potential hazards both to the employees and the public at large. A worker in a mine should be able to work under conditions that are adequately safe and healthy. At the same time the environmental conditions should be such as not to impair his working efficiency. The various safeguards to be taken to ensure the safety of the mine and that of employees are provided in the Mines Act, 1952. Risk involves the occurrence or potential occurrence of some accidents consisting of an event or sequence of events. The risk assessment study covers the following:

- Identification of potential hazard areas.
- Identification of representative failure cases.
- Visualization of the resulting scenarios in terms of fire (thermal radiation) and explosion.
- Assess the overall damage potential of the identified hazardous events and theimpact zones from the accidental scenarios

- Assess the overall suitability of the site from hazard minimization and disaster mitigation point of view
- Furnish specific recommendationson the minimization of the worst accidentpossibilities.
- Preparation of broad DMP, On-site and Off-site Emergency Plan.
- Occupational Health and Safety Plan.

The complete mining will be carried out under the management control and direction of aqualified mine manager holding a first class manager's certificate of competency. Moreover, mining staff will be sent to refresher courses from time to time to keep them alert.However, following natural/industrial hazards may occur during norml operation:

- Accident due to explosives
- Accident due to heavy mining equipment; and
- In order to take care of above hazard/disasters, the following control measures will be adopted.
- All safety precautions and provisions of the Mine Act, 1952, the MMR 1961 and the Mines Rules, 1955 will be strictly followed during all mining operations
- Entry of unauthorized persons will be prohibited
- Firefighting and first-aid provisions in the mines 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
- Training and refresher courses for all the employees working in hazardous premises; Under mines rules all employees of mines will have to undergo the training at a regular interval
- Working of mine, as per approved plans and regularly updating the mine plans;
- Cleaning of mine faces will be regularly done
- Handling of explosives, charging and blasting will be carried out by competent persons only.
- Regular maintenance and testing of all mining equipment as per manufacturer's guidelines.
- Suppression of dust on the haulage roads
- Increasing the awareness of safety and disaster through competitions, posters and other similar drives.
- For any type of above disaster, a rescue team will be formed by training the mining staff with specialized training.

7.3.2 Identification of Hazards in Open Cast Mining

There are various factors, which can cause disaster in the mines. These hazards are as follows:

- Drilling
- Blasting
- Overburden handling

- Heavy Machinery

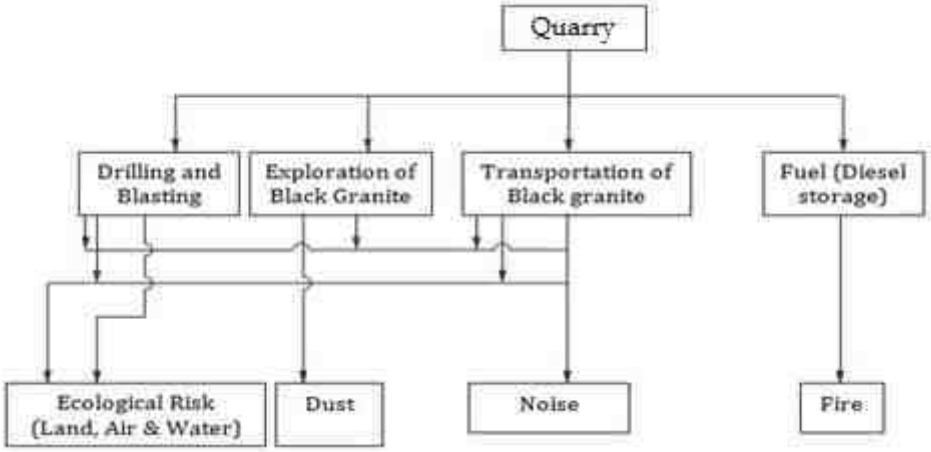


Figure 7-1 Identification of hazards in opencast mine

7.3.2.1 Drilling

Drilling is an important activity in mining. This activity releases particulate matter into the air and noise in the vicinity of the operation. The particulate matter/dust can be arrested by employing dust extractor, wet or dry type. The usage of standard drill bits also reduces the dust formation. The noise is also arrested by the usage of dust extractors. The compressors which feed the compressor air to the drilling jack hammers can be covered in acoustic enclosures which reduce the dust and noise. The hard strata will be excavated after drilling and blasting. Drilling will be done with jack hammers up to 1.2 to1.5m depth having a diameter of 30-32 mm.

7.3.2.2 Blasting

Most of the accidents from blasting occur due to the projectiles, as they may sometimes go even beyond the danger zone, mainly due to overcharging of the shot-holes as a result of certain special features of the local ground. Flying rocks are encountered during initial and final blasting operations. Vibrations also lead to displacement of adjoining areas. Dust and noise are also problems commonly encountered during blasting operations.

- The damaging impacts on environment are evident noise, gas, and flyrock and ground vibration.
- The last factor is most important for safety of constructions, buildings and various natural objects in the vicinity of mining area.
- The ground vibration parameters, crucial for safety of endangered objects have a significant correlation with charge weight and distance of blasting.
- This study tried to associate the main vibration parameter, particle velocity with blasting parameters and properties of vibration medium.

7.3.2.3 Precautionary Measures to Avoid Accidents Due to Blasting

- The provisions laid down in the MMR 1961 related to Blasting shall strictly be followed. However, some of the main provisions are written here
- The Wire saw and crack powder will be utilized extensively to reduce the requirement for blasting.
- The blasting will be done under supervision of blaster/mine mate/mine foreman/mine manager
- Shots shall not be fired except during the hours of daylight.
- The holes charged on any particular day shall be fired on the same day.
- Adequate blasting shelters or other protection shall be provided at mines.
- The shot-firer shall give sufficient warning by effective signals over the entire area falling within a radius of danger zone.
- Multi-shot exploder shall be used. A shot-firer will fire maximum 120 Shots.
- During the approach and progress of electrical storm, adequate precautions shall be taken.

7.3.2.4 Overburden Handling

No overburden will be generated in the proposed project and side burden dump may cause landslides. High side burden dump created at the quarry edge may cause sliding of the side burden dump or may cause failure of the pit slope due to excessive loading, thereby causing loss of life and property.

7.3.2.5 Heavy Machinery

Most of the accidents during transport of dumpers, trucks, proclaim, ripper dozers and other heavy vehicles are often attributable to mechanical failures and human errors.

7.3.2.6 Precautionary Measures to Prevent Accidents due to Trucks and Dumpers

- All transportation within the main working shall be carried out directly under the supervision and control of the management.
- The vehicles must be maintained in good conditions and checked thoroughly at least once a week by the competent person authorized for the purpose by the Management.
- Road signs shall be provided at each and every turning point especially for the guidance of the drivers.
- To avoid danger while reversing of vehicles especially at the embankment and tipping points, all areas for reversing of lorries should as far as possible be made man free. A statutory provision of the fences, constant education, training etc. will go a long way in reducing the incidents of such accidents.
- Generally, oversize rocks shall be dealt with in the pit by secondary blasting.
- A Load consisting of large rocks must not be over the edge. This is unsafe and may damage equipment.

- The movement of the dumpers will be governed under the Code of Traffic rule, this is already formulated & implemented.

7.3.2.7 Storage of Explosives

The explosive requirement of the quarry operation is minimal. The blasting requirement will be carried out using contractors approved by the Controller of Explosives. No Explosive storage is envisaged in this quarry.

7.3.2.8 Safety Measures at the quarry

- Adequate care has been taken in deciding the size of the bench for the working pit.
- The benches are properly sloped at an angle of 60 degree to avoid any spillage of benches.
- Adequate drainage system at the top of the pit and also on the benches shall be made to prevent erosion of the benches.
- The quarries will be protected by garland drains around the periphery for storm water drainage.

7.3.3 Disaster Management Plan

The disaster management plans aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities. For effective implementation of the disaster management plan,it should be widely circulated and personnel training through rehearsals/drills. The objectives of the disaster management plan isto make use of the combined resources of the mining operation and the outside services to achieve the following:

- Effect the 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
- Identify any dead
- Provide for the needs of relatives
- Provide authoritative information to the news media
- Secure the safe rehabilitation of affected area
- Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the emergency
- In effect, it is to optimize operational efficiency to rescue rehabilitation and render medical help and to restore normalcy.

EmergencyOrganization (EO)

It is recommended to setup an emergency organization. A senior executive (Mine Manager) who has control over the affairs of the mine would be heading the emergency organization. He would be designated as site controller. As per the general organization chart, in the mines, the Mines Foreman would be designated as the Incident Controller (IC). The incident controller would be reporting to the site controller. Emergency coordinators would be appointed who would undertake the responsibilities like firefighting, rescue, rehabilitation, transport and provide essential and support services.

Emergency Communication (EC)

Whoever notices an emergency situation such as fire, growth of fire etc. would inform the Mines Foreman. The Mines Foreman would appraise the site controller. Site Controller verifies the situation from the incident controller takes a decision about an impending on site emergency. Simultaneously, the emergency warning system would be activated on the instructions of the site controller.

In order to handle disaster/emergency situations, the following personnel shall deal with the disaster/Emergency

- Mines Manager-site controller
- Mines Forman-incident controller
- Mine mate –Fire controller
- Senior most Driver-Transport coordinator
- Senior most operator- Medical coordinator

7.3.3.1 Emergency Services

This includes the fire-fighting system, first aid center, etc. Alternate sources of power supply for operating fire pumps, communication with local bodies, fire brigade etc. will also be clearly identified. Adequate number of external and internal telephone connections shall be installed.

1. Fire Protection System
2. Off Site Emergency Plan

7.3.3.2 Fire Protection System

The fire protection system for the project maintained will consist of Portable hand appliances of suitable types/capacities for extinguishing small fires in selected mine areas, storages areas such as that of Diesel, Explosives, etc.

7.3.3.3 Off-Site Emergency Plan

The offsite emergency plan defining the various steps to tackle any offsite emergencies, which may affect surrounding areas of the project, has to be prepared after due finalizing discussion in this respect with local Panchayat official, Revenue officials and District Collector. As per this off site plan, in case of any off site emergencies, actions have to be promptly initiated to deal with the situation in consultation with Collector and other revenue officials.

7.3.4 Mine Closure Plan

Land degradation is one of the major adverse impacts of opencast mining in the form of excavated voids and also in the form of waste dumps. As per the petro genetic character, the depth persistence of the black granite body in the area is beyond the workable limits. However, it is very difficult to operate granite dimensional stone mine economically below a depth of 40m by observing the statutory of mine safety rules and regulations. Hence in the proposed mining plan, only 40m depth has been envisaged as 'Workable depth' for safe and economic mining.

However, it is proposed not to back fill the ultimate pit, in as much as quantity of reserves is available below the workable depth of 40m and there is possibility of technology up-gradation in granite mining for greater depths. The site boundaries shall be safely fenced and used as a reservoir after mining activities are over.

There is no proposal for back filling, reclamation and rehabilitation. The quarried pits after the end of the life of lease will be fenced to prevent inherent entry of public and cattle. There is no proposal for back filling, reclamation and re habitation

7.3.4.1 Progressive Mine Closure Plan

The various schedules for mining activities regarding mining of granite block, waste disposal, proposed land use pattern, environmental preservation measures, disaster management plan, etc. have been fully covered in the earlier chapters in this EIA/EMP report.

Concurrent planning for various steps to be adopted for final mine closure, along with regular working schedules and systems of the mine, will facilitate to effect smooth switchover to final mine closure stages ultimately

7.3.4.2 Water Quality Management

The ground water quality in the region indicates neutral range with pH values. Most of the analytical results for ground and surface water showed parameter concentrations well within the permissible limits. Garland drains will be provided all along the periphery of the mining pit and along the toes of the side burden dumps. These drains will be aligned in such a way that all the surface drainage water will be carried away from the mining zone to settling tanks.

The mining pit's catchment water will be coursed to the main sump and used for dust suppression and green belt development & plantation activities.

7.3.4.3 Mines Seepage Water

The experience of mining during past three years suggests a very little, almost negligible seepage of water in the mining pit. It will be collected in a well guarded pond / sump for settling of solids. The treated water will be used for dust suppression on working faces, haul roads and dump surfaces.

7.3.4.4 Air Quality Management

Ambient air quality was monitored twice in a week for One (01) season (shall cover 12 weeks), i.e., during Pre-Monsoon season (**June-August 2018**). PM_{10}, $PM_{2.5}$, SO_2, NOx, Pb, NH_3, C6H6, $C_{20}H_{12}$, As, Ni, were monitored. Sampling was carried out as per Central Pollution Control Board (CPCB) monitoring guidelines at each location.

Thefollowingprecautionshavebeenconsideredforabatementofairpollutionin theblack granitemineare a:

- Water sprinkling shall be carried out at the active working faces, on all haul-roads and the dump surfaces.
- Regular cleaning and removal of spillage black granite from haul roads and weighbridge areas.
- Proper and regular maintenance of mining equipments.
- Development of comprehensive green belt around overburden dumps to reduce fugitive dust emissions in order to create clean and healthy environment.

7.3.4.5 Solid waste Management

As is stated earlier, mining will be carried out by opencast semi-mechanized method using conventional mining equipments i.e., hydraulic excavators / shovels and dumpers combination with ancillary mining equipment like compressor, wire cutting machine, generator etc.

The mine waste in the mine includes the over lain unrecoverable boulders / rock fragments and rubbles generated as granite rejects during the production works and the waste fragments generated during development works will be utilized for forming approach road and dumping yard purposes. Adequate space has been identified within the lease applied area for dumping such waste material on barren land covered with soil. The 7.5 m safety distance as well as the defective portion of the deposit may also be used for waste dumping purpose.

7.3.4.6 Stabilization of Dump

As the waste generation in the mine includes hard rock fragments of considerable size and irregular shape with varying angularity, the waste dump will be stable on its own even at higher slopes of the sides. However, suitable variety of soil will be identified and brought from outside and used for

increasing the stability of the sides of the waste dumps and also for planting trees over the dumps in a phased manner.

7.3.4.7 Mine Drainage

The lease applied area is hillock 100m height with slope towards southern sides. Through the area receives scanty rainfall, the ground water level is at 14m depth. The Production faces are operated at shallow depths. During the rainy seasons the surface run of water and the gorund water are collected at one point called as sump and dewatered nearby agricultural field with the help of 10HP oil engines.

7.3.4.8 Disposal of Waste

The Mine waste in the mine includes the over burden, side burden, rock fragments and rubbles generated as mineral rejects during production works and the country rock fragments generated during development works as approach road formation, formation of dumping yard sites etc., During the first five years of Mining Plan period, such waste material are proposed to be dumped along the Southern part of the lease area where it comprises of country rock terrain.

7.3.4.9 Top Soil Management

Topsoil will be properly stacked at earmarked dump site with adequate measures. It will be used for growing plants along the fringes of the site roads and reclamation of external dump and backfilled area. The topsoil stockpiles will be low height and will be grassed to retain fertility. Besides these topsoil stacks there will be temporary stacks near the excavation area and area to be reclaimed which will be made use of for concurrent lying without bringing the topsoil to the soil stack near the OB dump.

7.3.4.10 Disposal of Mining Machinery

Mining operations are planned to be operated using Company owned machinery. The company has its own Excavators, Mining Tippers, compressors; wire saw machine, jack hammers, and other mining equipment. These machines are complaint to the RTO conditions and CPCB conditions. Further, the company also operates a central workshop at Salem, to cater to major repairs/Rectifications of company Equipment.

These machineries are written off and disposed on completion of their normal life as per the set guidelines of the Government and TAMIN Board. The surplus machinery in working order, will be transferred to Company's other projects.

7.3.4.11 Other Infrastructure

Mine office, store room, first-aid room etc, will be provided on semi-permanent structures within the lease applied area.

7.3.4.12 Safety & Security

The water ponds developed in the reclaimed areas shall be properly fenced for safety. The water from these ponds is likely to be potable and shall be used for human & cattle consumption and for agriculture purposes.

7.3.5 Social Impact Assessment R & R Action plan

There will be no Rehabilitation and Resettlement in this proposed project.

8 PROJECT BENEFITS

8.1 Improvements in the physical infrastructure

Providing Smart screen facilities for nearby Govt.School & Solar Pannel (2 No's) in Pothuvai & Pazhavalam village.

8.2 Improvement in the Social infrastructure

- Improvement in Per Capita Income.
- The socio - Economic conditions of the village and distance will enhance due to the project, hence the project should be allowed after considering all the parameters.
- It can thus be concluded that the project is environmentally compatible, financially viable and would be in the interest of construction industry thereby indirectly benefiting the masses.

8.3 Employment potential –skilled; semi-skilled and unskilled

- The quarrying activities in this belt will benefit to the local people both directly 30 persons & indirect persons are 20 Nos.
- The direct beneficiaries will be those who get employed in the mines as skilled and unskilled workers.

8.4 other tangible benefits

Cultural & economic Development of the nearby villages.

9 ENVIRONMENTAL COST & BENEFIT ANALYSIS

(Not recommended during scoping stage)

10 ENVIRONMENTAL MANAGEMENT PLAN

10.1 Environmental Management Plan

Environmental Management Plan covers the genesis of pollution, the principal sources of pollution, the nature of pollution, the proposed measures required for meeting the prevailing statutory requirements of air emissions, waste water discharge characteristics, noise levels, land use, socio economics etc for environmental management purpose in connection with the mining and quarrying related activities in the study area.

10.2 Emission Source Identification

The Emission sources are activities related to pits and quarries including, overburden operations, drilling, hauling, loading and unloading stockpiles. The emission sources may be subdivided into six broad categories:

- Emissions of PM and road dust due to HEMM & Mining Tippers.
- Emissions from generators.

10.3 Air Quality Management

Quarrying operations are semi mechanized, but there is involvement of labours too. Dust would be generated during the course of over burden removing, drilling, mining, hauling, handling and transportation of the material. Dust is likely to be generated from emissions of diesel vehicles such as SO_2, NO_x etc.

10.3.1 Measures for dust suppression

Water will be sprinkled for suppression of air borne dust on mine haulage roads and waste dumps on regular intervals by water tankers. Drilling of blast holes of 32 mm dia will be always under wet condition to prevent flying of dust. In the unloading point of Tippers, water will be sprinkled and further the drillers are provided with respirators in accordance with mines regulations.

10.3.2 Emissions from Material Handling

PM emissions occur during the handling and transfer operations of material from one process to another within the facility. Open storage piles of raw material and products are generated at various points throughout the operational area. The environmental control measures, which will be taken and proposed to control the fugitive dust released during the stone quarry production are given below:

- The working faces will be regularly wetted before carrying out the drilling and excavation.
- Dust masks will be provided to the workers especially for the drillers and for the workers working in the loading operations.
- Periodic health checkup for the workers shall be done
- Plantation along approach roads and surrounding the Quarry Lease area.

- Water tankers with spraying arrangement will be used for regular water sprinkling on the haul roads to ensure effective dust suppression.

Haulage

- Haul road will be maintained regularly.
- Speed limits will be prescribed for transport vehicles.
- Water will be sprayed daily on the roads by using water tankers.
- Periodic maintenance of the trucks used for transport shall be done to reduce smoke emissions.
- Over loading of trucks is avoided.

10.4 Noise Pollution Control

In an operational mine major noise sources are operation of mine machineries, equipment & plying vehicles. Noise generation may be for an instant, intermittent or continuous period, with low to high decibels. General noise levels generated at mines are documented as below:

Equipment	Noise Level (dB (A))
Rotary Drills	72-100
Compressor (85 m^3/min)	50-55
Excavator	75-90
Diesel Tipper	74-109
Diesel Generator	80-94

The management plan for controlling noise pollution is as given below.

- Reducing the drilling operations as far as possible.
- Provision of earmuffs to workers working in high noise prone areas.
- Proper gradient of haul roads to reduce cumulative noise levels.
- Development of green belt all along the boundary of the mining lease area which will act as effective noise barrier.
- Use of Diamond Wire Saw machine and crack powder to reduce noise.
- Restriction of blast hole drilling to only day time hours and usage of sharp drilling bits and delivery of compressed air at optimal pressure during drilling.
- Noise emanating machine such as compressors, diesel generator is enclosed in acoustic enclosure so as to reduce the noise level.

10.5 Water Pollution Control Measures

10.5.1 Surface Water

There are no major streams and rivers, which can get effected by the mining. Hence there will be no major effect on the surface water environment. Surface water ditches or channels will be made to divert all surface drainage for agricultural purposes.

10.5.2 Mine Drainage Water

Mine water will be used in mechanized cutting of the blocks and for wetting purpose.The runoff from the dumps will be channelized and care will be taken.

- Mine water will be used in wet drilling process, dust suppression & green belt development
- The runoff from the dumps will be channelized and care will be taken.

10.6 Land Environment

Landscape will be slightly changed due to open cast quarry. There will be no land subsidence as area is made up of hard rock. Aesthetic environment will not be effected, as the quarry is located in hilly terrain. Soil cover and the weathered material accounts for the Over Burden. Agriculture is seen mainly in the plains far away from the lease area. A few bushes will be cleared to facilitate mining and other related activities and there are no big trees.

- Top soil shall be used in afforestation work, as early as possible.
- A retaining wall and garland drain will be constructed all around to prevent the wash off. Landscape will be changed due to open cast quarry. There will be no land subsidence as area is made up of hard rock. Aesthetic environment will be effected.
- Soil cover and the weathered material accounts for the Over Burden
- Top soil will be removed & stored on the inner boundary of the mining lease area. To improve its quality, soil stabilizers shall be mixed and leguminous plantation will be done over these stacks.

10.6.1 Top soil management

Top soil will be removed in advance and stacked separately. To improve its quality, soil stabilizers shall be mixed and leguminous plantation will be done over these stacks. Top soil shall be used in afforestation work, as early as possible. A retaining wall and garland drain will be constructed all around to prevent the wash off.

10.7 Solid Waste Management

The solid waste that is likely to be generated during the quarry activity will be stacked along the lease barrier according to their quality and size.The sub Grade material and waste generated will be stored within the lease boundary over areas where there are no granite deposits. All the care will be taken to minimize the waste generation at the source.

- Top Soil recovered will be used in the green belt areas on the Southern side of the lease area.
- Top soil Stored on the inner boundary of the mining lease area. To improve its quality, soil stabilizers shall be mixed and leguminous plantation will be done over these stacks.
- The solid waste that is likely to be generated during the quarry activity will be stacked along the lease barrier according to the mining plan.
- All the care will be taken to minimize the waste generation at the source.

10.8 Stabilization of Dumps

The dumps are mainly constituted of quarry waste. It will be afforested properly to stabilize the dumps and preserve soil character.Garland canal also will be dug around the dump.

As the waste generation in the mine includes hard rock fragments of considerable size and irregular shape with varying angularity, the waste dump will be stable on its own even at higher slopes of the sides. However suitable variety of soil will be identified and brought from outside and used for increasing the stability of the sides of the waste dumps and also for planting trees over the dumps in a phased manner.

10.9 Biological Environment

As in any typical Ligneous rocks deposit, there is no tree growth on the area, but grass shrub and bushes grow sparsely. No wildlife is found in quarry Lease area. In order to minimize the impacts and to improve up on the existing eco system afforestation plan will be envisaged.

- As in any typical intrusive igneous rocks deposit, there is no tree growth on the area, but grass shrub and bushes grow sparsely.
- In order to minimize the impacts and to improve up on the existing eco system afforestation plan will be envisaged.
- No wildlife is found in quarry Lease area.

10.10 Granite Conservation and Development

The mining plan proposed has fully covered the aspects of granite conservation with a future plan to extend the proposed working of the mine to the full depth of the deposit. Extreme care will be taken to ensure proper supervision of quality control of the granite dimensional stone aimed at the recovery of the maximum saleable quantity / quality of granite dimensional stones suitable for full utilization of the consumers

10.11 Afforestation Plan

The main aim of the plantation of the mined out areas is to stabilize the area to protect it from rain, wind erosion, improve the aesthetics and support the re-creation of bio-diversity.

- Afforestation will be taken up along the lease area.

- In the Scheme of Mining 20 plants per year is proposed to be planted for complying Afforestation program with the arrived survival rate of 50% in the North western portion of the lease area in the phased manner.
- Only Shrubs and bushes are seen in the quarry Lease area.

10.12 Occupational Health & Safety Measures

Granite stone does not contain any toxic elements. Further this being a semi-mechanized mine, production is by semi-mechanized means and waste material handling partly by mechanized way, there shall be marginal impact on air and noise qualities. Therefore, the possibilities of any health hazards are minimal.

- Awareness and planning are keys to prevention of occupational health hazards.
- Conducting air monitoring to measure worker exposures and to ensure that provided controls are adequate for protection of workers.
- Adequate respiratory protection will be provided to the workers.
- Periodic medical examinations for all workers.
- Provide workers with training that includes information about health effects, work practices, and use of protective equipments.

10.13 Socio-Economic Benefits

Granite Quarry project is not going to have any negative impact on the social or cultural life of the villagers in the near vicinity. The quarry activity will provide job opportunities, which will help them to develop economically.

Granite quarry will be done with the vision of leaving a positive impact on socio-economics of people living in the nearby villages. A first-aid centre to meet the basic medical needs of employees will be provided.

10.13.1 Employment potential

Around 30 people directly and 20 people indirectly employed including material suppliers, outside workshops, unit supported industries. Local villagers residing in the nearby villages shall be employed as semi-skilled workers.

10.13.2 Care and Maintenance during Temporary Discontinuance

All the provisions as per the Mines Act 1952 and Rule17 of GC & DR 1999 shall be strictly adhered during temporary discontinuation.

10.13.3 Safety and Security

At the end of quarry operations, the total area excavated will be fenced properly with single opening for workers engaged in closure plan work.

10.14 Budget for Environmental Protection

It is necessary to include the environmental cost as a part of the budgetary cost component. Total of Rs.2,05,000/- allocated for environmental protection activities. Environmental Management cost is given in**Table** 10-1**.**

Table 10-1 Environmental Management Plan Cost

S. No	Details	Amount (Rs.)
1	Afforestation	30,000/-
2	Water Sprinkling	50,000/-
3	Water Quality Test	25,000/-
4	Air Quality Test	25,000/-
5	Noise / Vibration Test	25,000/-
6	CSR Activities	50,000/-
	Total	**2,05,000**

10.15 Environment Policy of TAMIN

M/s. Tamil Nadu Minerals Ltd believes that good safety, Health & Pollution control practices contribute to individual well-being and organization morale. Our commitment to Safety, Health and Environment stretch beyond statutory obligations and we are committed to manage and continually improve the overall safety, Health and Environmental performance.

We M/s Tamil Nadu Minerals Ltd are committed to ensure that:

- We develop safe working methods and practices, with as objective of no injuries and accidents at the work place and provide a safe work place for our employees, contractors and other who perform their duties. We shall provide adequate Health care to our employees, and create processes to reduce the adverse effect of the operations on the health of the employees.
- We provide safety appliances and continuous training in safety to our employeesand contract workmen to ensure safe production and achieve the target of zero accidents. We are committed to supporting actions aimed at increase in employees' safety outside work hours.
- We protect the environment by control and prevention of pollution and promote green environment.
- We continuously evaluate and improve our conduct and carryout regular audit, analysis and studies to eliminate potential concerns and continuously improve upon our Safety, Health and Environmental standards.
- We communicate our Safety, Health and Environmental Policy to all our employees' contractors and to the public for better understanding and practice.

- Management has knowledge of relevant issues regarding Safety, Health and Environment and provides a foundation for setting objectives and targets. Management shall fulfill its responsibility to inform, educate and motivate employees and others to understand and comply with this policy and applicable laws.
- M/s. Tamil Nadu Minerals Ltd shall use its resources in order to live up to this policy and thereby promote our business.

Besides, the company has formulated well-planned and integrated Environmental policies as shown below:

M/s Tamil Nadu Minerals Ltd is committed to welfare and development needs of the society around it.

- All rules and conditions prescribed in the Indian Mines Act, Metalliferrous Mines Regulation etc., will be adopted to ensure risks-free and safe mining operations. All personal protective devices supplied to workers and staff should be used while they work in the mines and any violation in this respect will be dealt with inflict of warnings first, followed subsequently by punitive punishments including fines and ultimately dismissal, if repeated continuously.
- Any infringement / violation of any rule or unsafe mining operations should be reported to Mines Manager / Mine Foremen /Mine Mate/ Blaster who will take immediate corrective measures for avoiding major disasters. The report will ultimately reach the Board of Directors through upwardly hierarchical communicative channels from the lowest level to superior levels in quick time bound duration.
- The Agent and the Mines Manager should exercise overall control over entire mining and connected operations and all infringements / violations on any count pertaining to unsafe operations, environmental degradation, etc., should be brought to the notice of the Board of Directors. Remedial measures for such violations and deviations should be taken by the Mines Manager to avoid any hazards or disasters in the mine and nearby areas. The persons responsible for such violations will be punished through appropriate disciplinarily penal actions.
- The EC conditions and stipulations will be strictly followed by all supervisory staff of the mine, and will co-ordinate in various issues like prescribed environmental monitoring schedules, vibration monitoring studies during blasting, green belt development, management of dumps etc.
- Penal actions will be taken by the company in cases of continuous negligence resulting in violations deviations in this respect.

- A time schedule of once in 15 days for review of all operational factors as mentioned above is in force, for proper and quick corrective actions. Hierarchical System of the TAMIN is shown in **Figure 10-1.**

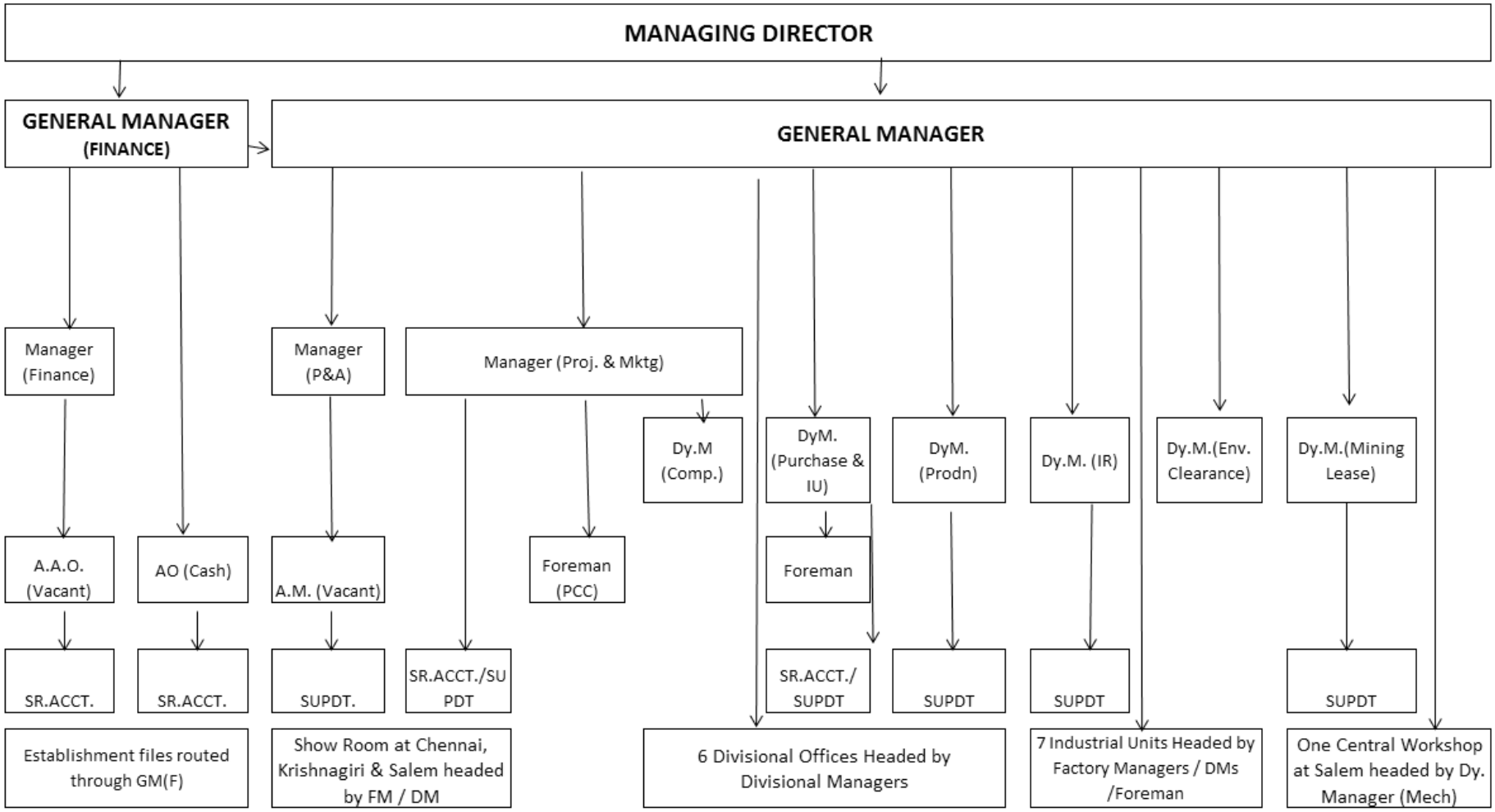


Figure 10-1Hierarchical System of the TAMIN

11 SUMMARY & CONCLUSION

11.1 Background

The extent area of the quarry is 40.13.05 Ha at S.F. 58/1 (Pothuvai) over an extent of 10.44.0 Ha and at S.F.No.135/1 (Pazhavalam) over an extent of 29.69.05 Ha. Lease has been obtained for total extent of **40.13.05 Ha** at Pothuvai&Pazhavalam Village, Gingee Taluk, Villupuram District, Tamil Nadu.TAMIN has been proposed to get a fresh lease for Black Granite (Dolerite)&Quartzo feldspathic Gneiss quarry over an extent of 40.13.05 Ha for 30 years lease vide G.O.(3D).66, Industries (MME.1) department, dated:05.12.2011. Accordingly, the Government of Tamil Nadu issued the precise area communication letter under Rule, 8-C (3b) of Tamil Nadu Mineral Concession Rules, 1959.

The project falls under B1 Category, Schedule 1(a) Mining of Minerals as per EIA Notification dated 14th September 2006 and its subsequent amendments.The EC application was submitted under category B1, schedule 1(a) to TN SEIAA vide File No. 845.

The proposal was appraised during 345th SEAC meeting held on 10.01.2023 and 590th SEIAA meeting held on 09.02.2023 and ToR was issued vide Lr No. SEIAA-TN/F.No.845/SEAC/ToR-1328/2023, dated: 09.02.2023 for the preparation of EIA/EMP report. Draft EIA report was submitted for Public Hearing (PH) to Villupuram PCB.After PH, the minutes obtained was incorporated in the EIA report along with action plan by the proponent. Final EIA will be submitted to TNSEAC for further appraisal of the project and obtaining Environment Clearance.

TAMIN as part of the compliance from MoEF&CC has appointed M/s Hubert Enviro Care systems (P) Ltd, Chennai as Environmental Consultants who are accredited by National Accreditation Board for Education and Training (NABET), Quality Council of India (QCI), New Delhi.
The production capacity of the quarry during the mining plan period was 18,108m^3 (Black Granite)&7,52,124m^3(Quartzo Feldspathic Gneiss) Mine lease area falls in the survey of India Topo sheet 57 P/4&8 and lies between the GPS coordinates of Longitude: 79°15'39.40"E to 79°16'08.11"E Latitude: 12°08'15.47"N to 12°08'45.41"N.

11.2 Management Commitment

The company is assigning prime importance for environmental protection. The company will comply the environmental laws. TAMIN will maintain well developed Greenbelt. Also all the environmental statutory requirements will be implemented and maintained continually.

11.3 Environmental Sensitive Areas

There are no notified ecologically sensitive areas within 15km from project boundary. The Tamilnadu State / Andhra Pradesh State boundary as per google runs in WNW direction at about ~ 7.17km from

the project boundary. Project doesn't attract the special conditions and general conditions as per EIA notifications. The detailed Environmental Sensitivity areas within the 15km radius of the project site are given in **Chapter 3, Section 3.4** and **Table 3-1.**

11.4 Black Granite Quarry Reserves

- The estimated Geological Reserves of Black Granite estimated based on the Geological cross sections was 4,79,221 m^3. By applying the effective Geological recoverable reserves @ 10 % 47,922 m^3& granite waste @90% is 4,31,299 m^3. By applying the effective Geological recoverable reserves @ 10 % 47,922 m^3& granite waste @90% is 4,31,299 m^3.
- The updated Mineable Reserves have been arrived as 2,37,609 $m^3$and by applying 10% recovery, the updated mineable reserves as 33,761 m^3.
- Mineable Reserves have been worked out as 33,761 m^3 by applying the recovery factor 10%. The annual peak production per year would be 1,811m^3 of ROM of saleable and 18,108m^3 of ROM during the first five year of Mining plan period at the rate of 10% recovery.

11.5 Quartzo Feldspathic Gneiss Quarry Reserves

- The estimated Geological Reserves of Black Granite estimated based on the Geological cross sections was 1,08,13,395 m^3. By applying the effective Geological recoverable reserves @ 100% 1,08,13,395 m^3. By applying the effective Geological recoverable reserves @ 100 % 1,08,13,395 m^3
- The updated Mineable Reserves have been arrived as 77,39,961 $m^3$and by applying 100% recovery, the updated mineable reserves as 77,39,961 m^3.
- Mineable Reserves have been worked out as 77,39,961 m^3 by applying the recovery factor 100%. The annual peak production per year would be 7,52,124m^3 of ROM of saleable and 7,52,124m^3 of ROM during the first five year of Mining plan period at the rate of 100% recovery.

11.6 Summary of the Magnitude of Operation

- The black granite quarrying operation is proposed to carry out by opencast semi mechanized method by formation of benches. Benches are proposed with a height of 6m & width bench not less than the height. Major machineries are Compressor, Jack hammer, Diamond wire saw machine and excavator and DG set is used in proposed quarry. Tippers and dumpers will be used for transportation
- Proposed Production Capacity is 18,108 m^3 Black Granite and 7,52,124m^3 of Quartzo Feldspathic Gneiss per annum.
- The geological cross sections up to the economically average depth of 30m from the ground level and top surface of the granite body works out to 4,79,221m^3 of Black Granite and 1,08,13,395m^3 of Quartzo Feldspathic Gneiss.
- The mineable reserves have been computed as 3,37,609 m^3 of Black Granite and 77,39,961 of

Quartzo Feldspathic Gneiss.

11.7 Requirements

11.7.1 Land requirement

- The Black granite &Quartzo Feldspathic Gneiss mine is over an extent of 40.13.05 Ha. The entire area is under possession of TAMIN.
- Lease area located at S. F. No. 58/1(Pothuvai) & 135/1(Pazhavalam) Pothuvai&Pazhavalam village, Gingee Taluk, Villupuram District lies in the latitude of 12°08'15.47"N to 12°08'45.41"Nand longitude of 79°15'39.40"E to 79°16'08.11"E.
- The lease area topography is hilly terrain; site elevation is 182 - 293m (max) AMSL. The area is marked in the survey of India Topo sheet No.57 P/4&8.
- Mining Lease obtained from Tamil Nadu Government for 30 years vide G.O. (3D)No.66,industries (MME.1) department,dated: 05.12.2011.
- Out of 40.13.05 Hectare of lease area 0.67.00 Ha is considered for mining, waste dump is 0.57.5 Ha, & for Greenbelt 0.19.0 is allocated.

11.7.2 Water Requirement

- The total water requirement is 1.5KLD Drinking & Domestic purpose-0.5 KLD, Wire Saw cutting -0.3 KLD, Dust suppression -0.3 KLD & for Greenbelt-0.4KLD. The total water requirement will be met from Vendors and Pothuvai&Pazhavalam village Panchayats.
- Hazardous waste like waste oil will be disposed through TNPCB Authorized dealers.
- Sewage will be disposed through septic tank followed by soak pit. Septic Tank will be cleaned periodically.

11.7.3 Power & Fuel Requirement

- Power requirement will be 60 kVA will me through 125 kVA DG Set. Diesel consumption will be 200 liters/day.
- Diesel will be brought from nearby diesel pumps. No electricity is required for the project.

11.7.4 Manpower

- Direct manpower will be 30 persons directly and indirectly 20 Nos.

11.7.5 Solid Waste Generation & Management

- Municipal solid waste (13.5 kg/day) will be segregated as Organic will dispse through local municipal bins and inorganic waste (5.4kg/day) will be disposed through TNPCB authorized recyclers.
- Waste diesel Oil will be collected in leak proof containers and disposed to TNPCB Authorized Agencies for Reprocessing/Recycling.

11.8 Project Cost

- The total capital investment on the project is Rs. 99, 97,000/- Lakhs including EMP cost is 2, 05,000/-.

11.9 Baseline Study

Project Influence Area (PIA)/Study Area: An area covering 10 km radius from Pothuvai&Pazhavalam Black granite&Quartzo Feldspathic Gneiss quarry boundary has been earmarked as study area for baseline studies.

Study Period:

The baseline environmental surveys were carried out during **(mid January 2023 – mid April 2023)** within the study area.

Summary of Baseline Studies:

- Site has an undulating terrain with level 156 - 291m Above MSL.
- The project site falls under Zone- III (Low Risk Zone) as per IS 1893 (Part- I).
- The predominant wind direction is South East during study period.
- Max Temperature: 38^0CMin Temperature: 21^0C&Avg Temperature: 28.32^0C
- Average Relative Humidity: 74.44 %
- Average Wind Speed : 3.01 m/s

Ambient Air Quality

Maximum concentrations of PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, Pb, O_3, NH_3, C_6H_6, C_{20} H_{12}, As &Ni, are well within the National Ambient Air Quality Standards for Industrial, Commercial and Residential areas at all monitoring locations during the study period. The ambient air quality has been monitored at 8 locations for 12 parameters as per NAAQS, 2009 within the study area. The average baseline levels of PM_{10} (50.37µg/m³-57.68 µg/m³), $PM_{2.5}$(28.94µg/m³ -33.55µg/m³), SO_2 (11.32µg/m³ – 14.52 µg/m³),NO_2(21.03µg/m³ – 26.64µg/m³) all the parameters are well within the National Ambient Air Quality Standards for Industrial, Commercial and Residential areas at all monitoring locations during the study period..

Noise Environment

Ambient noise levels were monitored using precision noise level meter in and around the project site at 10 km radius at 8 locations during study period.

- In industrial area, day time noise level was about 50.1 dB(A) and 47.6 dB(A)during night time, which is within prescribed limit by MoEF&CC (75 dB(A) Day time & 70 dB(A) Night time).
- In Residential area day time noise levels varied from 51.6 dB (A) to 53.1 dB (A) and night time noise levels varied from 39.8 dB(A) to 43.2 dB(A) across the sampling stations. The field observations during the study period indicate that the ambient noise levels in Residential area are within the limit prescribed by CPCB for Residential area (55 dB (A) Day time & 45 dB(A) Night time).

Water Environment

The prevailing status of water quality at 08 locations for surface water and 8 locations for ground water have been assessed during the study period. The standard methods prescribed in IS were followed for sample collection, preservation and analysis in the laboratory for various physiochemical parameters.

Surface water quality

- pH ranges from 6.98 to 7.63.
- Total Dissolved Solids range from 317 mg/l to 441 mg/l.
- Total hardness ranges between 86 mg/l – 132 mg/l.
- The BOD value ranges from 2.8 mg/l to 9.4 mg/l
- COD value 24 mg/l to 63 mg/l.
- The concentration of heavy metals like As, Cd, Cr, Pb, Mn, Hg, Ni and Se at all locations are within the limits of IS 2296:1992(Class-C: Drinking water with conventional treatment followed by disinfection)

Ground Water Quality

- The average pH ranges from 6.98-8.12.
- TDS value varied from varied from 821 mg/l to 1353 mg/l
- The chloride concentration ranged from 372mg/l to 512 mg/l
- Total hardness range from 345to 726 mg/l.
- The sulphate content of the ground water of the study area is varied between 111mg/l – 236mg/l meeting the acceptable limit of the IS 10500: 2012.
- It is observed that all the collected ground water samples meets the drinking water standards (IS 10500:2012) and can be used for drinking.

Land Environment

Assessment of soil characteristics is of paramount importance since the vegetation growth, agricultural practices and production is directly related to the soil fertility and quality. Soil sampling was carried out at eight (08) locations in the study area. It is observed that,

- The pH of the soil samples ranged from 6.69 -7.54.
- Conductivity of the soil samples ranged from 254 – 354 umhos/cm
- Nitrogen content ranged from 219 mg/kg to 491 mg/kg
- Phosphorous ranged from 12.5 mg/kg - 34.6 mg/kg
- Potassium content ranges from 46.7 mg/kg - 98 mg/kg.

Biological Environment

The floral diversity is grouped into trees, shrubs, climbers and herbs. Similarly, the faunal diversity is grouped into mammals, birds, reptiles and amphibians. There is no extinct flora and fauna species found in the study area.

Flora

It was observed that the flora, which includes herbs, shrubs and trees, were sparsely distributed within study area as per IUCN status Least concern, Not yet assessed species are observed within the study area. The detailed List of flora in the study area is given in **Chapter 3, Section 3.11.1**&**Table 3-21.**

Fauna

No rare and endangered faunalspecies are found in the project area as well as study area.List of fauna in the study area is given in**Chapter 3, Section 3.11, Table 3.22**.

Socio Economic Environment

In 2011, the total population of Viluppuram district was 3458873; rural with 2939785 and urban with 519088. In 2001, the total population was 2960373, rural and urban population returned as 2533456 and 426917 respectively. The number of statutory towns and non - statutory towns by size and class of population. The district constituted with 18 statutory towns (3 Municipalities and 15 Town Panchayats) and one Census Town.

Source:*https://censusindia.gov.in/nada/index.php/catalog/1105/download/3434/DH_2011_3306_PART_B_DCHB_VILUPPURAM.pdf*

(**Ref**: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Viluppuram District", Series-34 Part XII-A)

The sex ratio of the population is calculated for number of females for every 1000 males, irrespective of age. The child sex ratio is calculated in the same manner for the children aged upto 6 years. The sex ratio of the district was 987 and the State was 996.

The population density is an indicator for the assessment of the development of the area and the people. The population density of the district in 2011 was 481 per sq.km, lower than State density of 555. In 2001, density of the district was 412.

Source:*https://censusindia.gov.in/nada/index.php/catalog/1105/download/3434/DH_2011_3306_PART_B_DCHB_VILUPPURAM.pdf*

(**Ref**: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Viluppuram District", Series-34 Part XII-A)

11.10 Anticipated Environmental Impacts

Air Environment

The emissions mainly generated from the mining activities are Blasting, Drilling, Scrapping, Excavation, Loading, Unloading, and transportation etc. Machinery like compressors and jack hammers are used for Drilling. Fugitive dust control in mine is shown in **Table 11-1**.

Table 11-1 Fugitive dust control in mine

S. No	Activities	Best practices
1	Drilling	➢ Drills should be provided with dust extractors (dry or wet system)
2	Blasting	➢ Water spray before blasting ➢ Water spray on blasted material prior to transportation ➢ Use of controlled blasting technique
3	Transportation of mined material	➢ Covering of the trucks/dumpers to avoid spillage ➢ Compacted haul road ➢ Speed control on vehicles ➢ Development of a green belt of suitable width on both sides of road, which acts as wind break and traps fugitive dust

Noise Environment

- Baseline study showed that the noise levels in both Industrial area and in Residential area are slightly exceeded the limit prescribed by CPCB. The designed equipment with noise levels not exceeding beyond the requirements of Occupational Health and Safety Administration Standard will be employed.

Land Use

- The quarry is in operations since 1995 and extent of lease area is 40.13.05Ha. Land classifies as a Government land, Mining Lease obtained from Tamil Nadu Government for 30 years vide G.O.(3D)No.66, Industries (MME.1) Department, dated: 05.12.2011.

Wastewater Management

- Sewage (1.27KLD) will be sent to septic tank followed by soak pit. There is no industrial effluent generation during quarry operation.

Biological Environment

- To reduce the adverse effects on flora/fauna status that are found in project area due to deposition of dust generating from mining operations, water sprinkling and water spraying systems will be ensured in all dust prone areas to arrest dust generation.

Solid/ Hazardous Waste Management

- Municipal Solid Wastes including food waste will be disposed to municipal bin.

Environmental Monitoring Program

- A monitoring schedule with respect to Ambient Air Quality, Water & Wastewater Quality, Noise Quality as per Tamil Nadu State Pollution Control Board (TNPCB), shall be maintained.

11.11 Greenbelt Development

- The green belt plantation programme will be continued till the end of the mining operation in the area. In framing out this programme on a sustainable and scientific base, due consultation and coordination with the forest department will be sought. The plantation will be developed inside the mining lease about 0.19.0Ha, out of 40.13.05Ha. Plants are chosen to provide aesthetic, ecological and economical value. Trees will help to arrest propagation of noise and help to lessen dust pollution due to dust arresting action.

11.12 Disaster Management Plan

The salient features of Disaster Management Plan include

- Emergency shutdown procedure
- Fire protection system, Emergency safety equipment & Reporting and response to emergency.Emergency Help from nearby industries and tie up with nearby industries

11.13 Corporate Environmental Responsibility

- TAMIN Pothuvai&Pazhavalam site had no Relocation and Rehabilitation.
- Most villages have benefitted mutually at Pothuvai where the mining industry has provided indirect jobs for labor and villages provide accommodation for the labor and staff. Supportive industries like food supply and essential shops are economic growth in the villages.

11.14 Benefits of the Proposed Project

- The quarrying activities in this belt will benefit to the local people both directly 30 persons& indirect persons are 20 Nos
- Improvement in Per Capita Income.
- The socio - Economic conditions of the village and distance will enhance due to the project, hence the project should be allowed after considering all the parameters.
- It can thus be concluded that the project is environmentally compatible, financially viable and would be in the interest of construction industry thereby indirectly benefiting the masses.

12 DISCLOSURE OF CONSULTANTS

In order to assess the potential environmental impacts due to the proposed project over an extent of 40.13.05 Ha [10.44.0 Ha. at S.F. 58/1 (Pothuvai) and 29.69.05 Ha at S.F.No.135/1 (Pazhavalam)] at Pothuvai & Pazhavalam village, Gingee taluk, Villupuram District, Tamil Nadu State.Tamil Nadu to undertake EIA study. The nature of consultancy service rendered covers terrestrial environmental assessment.

12.1 The names of the Consultants engaged with their brief resume and nature of Consultancy rendered

Brief Profile of Hubert Enviro Care Systems (P) Limited (HECS)

HECS is a total Environmental management company which provides Environmental consultancy services, Analytical testing services, turnkey solutions and Operation-Maintenance services for water and wastewater facilities.

The company provides solutions to several industries like Refineries, Thermal Power Plant, Pharma, R&D Facilities, Electroplating and Manufacturing, IT Parks, Residential Complexes, Mines, Dairies, Food Processing, Textile mills, Breweries, etc.

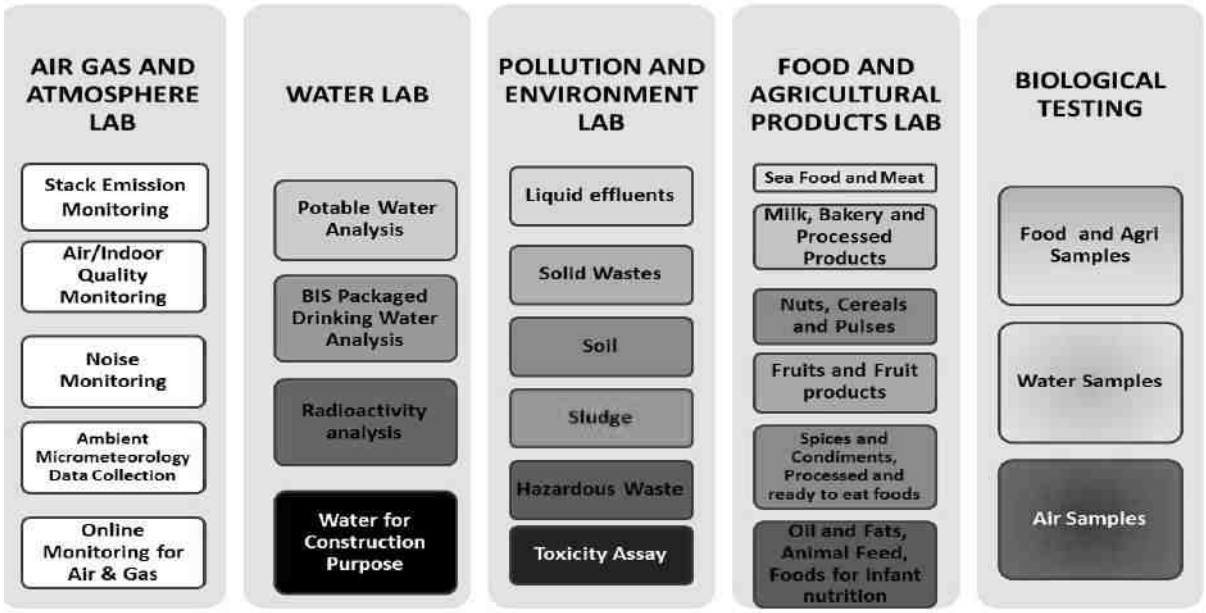
The company is specialized in executing projects right from concept development, supply, erection, commissioning and operation on turnkey basis. HECS has successfully executed more than 300 environmental engineering projects for various industrial sectors both in India and overseas.

Consultancy Profile

- HECS is accredited by QCI-NABET
- An approved consultant for carryout EIA studies across India
- India's leading multidisciplinary Environmental Consultancy organization
- HECS- Consultancy division comprises of technical skilled and competent Team of 40 people. The team consists of Three Doctorates & about thirty postgraduates
- HECS has industry specific prominent expert to provide solutions & recommendations
- Serving client more than 25 years & pan India presence in the following sectors:
    - Environmental Clearance
    - Coastal Regulation Zone
    - Risk Assessment, DMP, HAZOP studies
    - Feasibility/ treatability studies
    - Due diligence studies
    - Ground water Clearance
    - DISH, PESO and other statutory approvals

- Consent to Establish, Consent to Operate
- Hazardous waste, bio medical waste authorization
- Other environmental approvals

➢ Has an in-house laboratory wherein the following activities are being carried out:



12.2 QCI – NABET Accreditation

Consultancy	Hubert Enviro Care Systems Pvt. Ltd., Chennai
NABET Certificate No	NABET/ EIA/ 2224/ SA0190 Valid up to 27/07/2024
MoEF Reg. Lab	F.No. Q-15018/13/2016-CPW

National Accreditation Board for Education & Training (NABET) is a constituent board of the Quality Council of India (QCI). QCI, NABET has accredited HECS for carrying out Category 'A & Category B' EIA studies in the following sectors:

QUALITY COUNCIL® OF INDIA
Creating an Ecosystem for Quality

NABET

National Accreditation Board for Education and Training

NABET

Certificate of Accreditation

Hubert Enviro Care Systems Pvt. Ltd.,

A-21, (Behind Lions Club School) III Phase, Thiru Vi Ka Industrial Estate, Guindy, Chennai - 600 032.

*The organization is accredited as **Category-A** under the QCI-NABET Scheme for Accreditation of EIA Consultant Organization, Version 3: for preparing EIA-EMP reports in the following Sectors –*

S. No	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1	Mining of minerals including open cast/ underground mining	1	1 (a) (i)	A
2	Offshore and onshore oil and gas exploration, development & production	2	1 (b)	A
3	River Valley projects	3	1 (c)	A
4	Thermal power plants	4	1 (d)	A
5	Mineral beneficiation	7	2 (b)	A
6	Metallurgical industries (ferrous & nonferrous)- both primary & secondary	8	3 (a)	B
7	Cement plant	9	3 (b)	A
8	Petroleum refining industry	10	4 (a)	A
9	Pesticides industry and pesticide specific intermediates(excluding formulations)	17	5 (b)	A
10	Petro-chemical complexes (industries based on processing of petroleum fractions & natural gas and/or reforming to aromatics)	18	5 (c)	A
11	Petrochemical based processing (processes other than cracking & reformation and not covered under the complexes	20	5 (e)	A
12	Isolated storage & handling of hazardous chemicals (As per threshold planning quantity indicated in column 3 of Schedule 2 & 3 of MSIHC Rules 1989 amended 2000)	28	-	B
13	Synthetic organic chemicals industry	21	5 (f)	A
14	Industrial estates/ parks/ complexes/ Areas, export processing zones(EPZs), Special economic zones (SEZs), Biotech parks, Leather complexes	31	7 (c)	A
15	Ports, harbours, break waters and dredging	33	7 (e)	A
16	Highways	34	7 (f)	B
17	Common Effluent Treatment Plants (CETPs)	36	7 (h)	B
18	Common municipal solid waste management facility (CMSWMF)	37	7 (i)	B
19	Building and construction projects	38	8 (a)	B
20	Townships and Area development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in SAAC minutes dated Feb 3, 2023 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no. QCI/NABET/ENV/23/2696 *dated March 6, 2023. The accreditation needs to be renewed before the expiry date by Hubert Enviro Care Systems Pvt. Ltd, following due process of assessment*

Sr. Director, NABET Dated: March 6, 2023	Certificate No. NABET/EIA/2224/SA 0190	Valid up to July 27, 2024

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.