# EXECUTIVE SUMMARY OF ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENT MANAGEMENT PLAN

**FOR OBTAINING**

**Environmental Clearance under EIA Notification – 2006**

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

**"B1" CATEGORY-MINOR MINERAL-CLUSTER-NONFOREST LAND-FRESH QUARRY**

**CLUSTER EXTENT = 10.35.5 hectares**

**At**

**Kundiyathandalam Village, Vembakkam Taluk,**

**Tiruvannamalai District, Tamil Nadu State**

TOR File No. 13038 and ToR Identification No. TO25B0108TN5265914N Dated: 22.12.2025

**NAME AND ADDRESS OF THE PROPOSED PROJECT PROPONENT**

| Name and address | Extent & S.F.No. | Production in $m^3$ & Tons |
|---|---|---|
| M/s. S.A.Enterprises<br>No. 2, Kurunji Nagar,<br>1st Main Road,Abdul Kalam Park,<br>Sothupakkam Village,<br>Old Perungalattur,<br>Chennai District – 600063. | 4.96.0 ha &<br>S.F. Nos. 139, 140/1A, 140/1B, 144/1A1, 144/1A2, 145/1A, 145/1B1,145/1B2, 145/1B3, 145/2A, 145/2B1, 145/2B2, 145/3A, 145/4, 145/5A, 145/5B, 145/7A, 145/7B, 145/9A1, 145/9A2, 145/9B, 145/10 & 145/11 | Rough stone<br>635925$m^3$ & 1748794Ts<br>Gravel<br>314313$m^3$ & 628626Ts |

**ENVIRONMENTAL CONSULTANT**


**GEO TECHNICAL MINING SOLUTIONS**

No: 1/213-B, Ground Floor, Natesan Complex
Oddapatti, Collectorate Post office,
Dharmapuri-636705. Tamil Nadu.
E-mail: info.gtmsdpi@gmail.com,
Website: www.gtmsind.com
NABET ACC. NO: NABET/EIA/23-26/RA 0319
Valid till: 31.12.2026


**ENVIRONMENTAL LAB**


INTERSTELLAR TESTING CENTRE Pvt. Ltd
Plot.No.2, Site No.12/2A,
Industrial Estate, Perungudi, Chennai, Tamil Nadu
NABL Certificate Number:TC-6952, Valid Until : 30.07.2026.


**Baseline Study Period – Oct through Dec 2025**

# EXECUTIVE SUMMARY

## 1 INTRODUCTION

As the proposed rough stone mining project (B1) falls within the quarry cluster of 500m radius with the total extent of 10.35.5ha, it requires submission of EIA report for grant of Environmental Clearance (EC) after conducting public hearing. The proposed project falling in S.F. No's. 139, 140/1A, 140/1B, 144/1A1, 144/1A2, 145/1A, 145/1B1,145/1B2, 145/1B3, 145/2A, 145/2B1, 145/2B2, 145/3A, 145/4, 145/5A, 145/5B, 145/7A, 145/7B, 145/9A1, 145/9A2, 145/9B, 145/10 & 145/11, over the extent of 4.96.0ha is situated in the cluster falling in Kundiyathandalam Village, Vembakkam Taluk, Tiruvannamalai District, Tamil Nadu. The quarries involved in the calculation of cluster extent are one proposed quarry and two existing quarries.

## 2 PROJECT DESCRIPTION

The proposed project area is located between Latitudes from 12°44'31.09"N to 12°44'38.96"N Longitudes from 79°43'8.05"E to 79°43'22.41"E in Kundiyathandalam Villages, Vembakkam Taluk, Tiruvannamalai District, Tamil Nadu. According to the approved mining plan, about 635925$m^3$ & 1748794 tons of rough stone and gravel is about 314313$m^3$ & 628626 tons will be mined up to the ultimate depth of 60m BGL in the five years. The quarrying operation is proposed to be carried out by open cast mechanized mining method involving drilling, blasting, and formation of benches of the prescribed dimensions.

## 3 DESCRIPTION OF THE ENVIRONMENT

Field monitoring studies to evaluate the base line status of the project site were carried out with CPCB guidelines. Environmental baseline data were collected by an NABL accredited and MoEF notified **Interstellar Testing Centre Pvt. Ltd** for the environmental attributes including soil, water, air, and noise and by FAEs for ecology and biodiversity, traffic, and socio-economy.

### 3.1 Land Environment

Land use pattern of the area of 5km radius was studied using Sentinel II imagery. LULC types and their extent are given in Table 1.1.

**Table.1.1 LULC Statistics of the Study Area**

| S. No. | LU/LC Type | Extend (ha) | Percentage |
|---|---|---|---|
| 1 | Water Bodies | 893.55 | 10.64 |
| 2 | Vegetation cover | 66.23 | 0.79 |
| 3 | Crop Lands | 5604.48 | 66.71 |
| 4 | Mining area | 197.07 | 2.35 |
| 5 | Built-up Area | 1408.09 | 16.76 |
| 6 | Barren Land | 33.12 | 0.39 |
| 7 | Fallow land | 197.55 | 2.35 |
| **Total** | | **8400.11** | **100.00** |

*Source: Sentinel II Satellite Imagery*

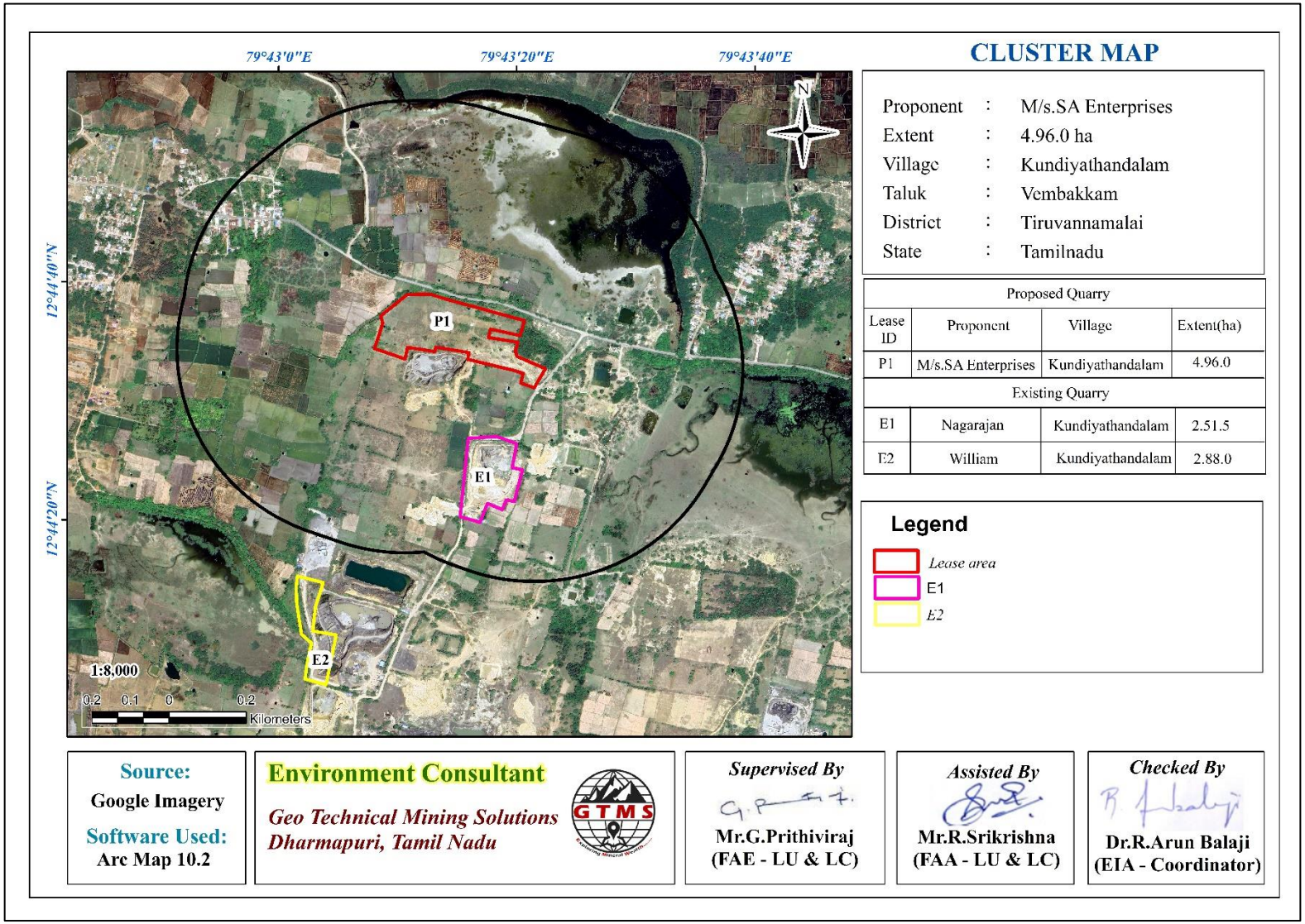



**Figure 1 Location of Proposed and Existing Quarries in the Cluster of 500m Radius**

### 3.2 Soil Environment

The interpretation of the analytical results for the five soil samples (S1–S5) is as follows

| Parameter | Result Range | Interpretation |
|---|---|---|
| Organic Matter | 0.25 – 0.36% | Critically Low. It requires heavy composting. |
| Nitrogen (N) | 0.056 – 0.068% | Deficient and requires fertilization. |
| CEC | 19.30 – 22.50 | Moderate/High shows good nutrient retention potential. |
| pH | 7.35 – 8.53 | Neutral to Alkaline except S4. S4 may need sulfur to lower pH. |
| Texture | Sandy Loam | Well-aerated but dries out quickly. |

These are hungry soils. They have a solid physical foundation and a good capacity to store nutrients (CEC) but they currently contain almost no organic fuel or essential nutrients (N-P-K). Significant application of organic manure and balanced N-P-K fertilizers is essential for any agricultural use.

The Total Organic Matter (TOM) and Total Organic Carbon (TOC) in soil samples indicates a critically depleted state that significantly limits agricultural productivity.

| Sample | TOC (%) | TOM (%) | Rating |
|---|---|---|---|
| S1 | 0.16 | 0.276 | Very Low |
| S2 | 0.17 | 0.293 | Very Low |
| S3 | 0.19 | 0.327 | Very Low |
| S4 | 0.15 | 0.258 | Very Low |
| S5 | 0.21 | 0.362 | Very Low |

Productive agricultural topsoil typically contains 1–6% organic matter. Even the maximum observed value in Sample S5 (0.362%) remains significantly below the minimum threshold required for healthy soil biological activity, nutrient cycling, and structural stability.

The organic matter values follow the **Van Bemmelen conversion factor**, where:

**TOM ≈ TOC × 1.724**

This calculation assumes that soil organic matter consists of approximately 58% organic carbon, which is a widely accepted standard in soil science.

**Agricultural Suitability Evaluation**

Due to the dominant sandy loam texture, low organic matter content, and favorable drainage characteristics, the soil is more suitable for horticultural crops than for conventional wet-paddy cultivation.

| Feature | Paddy Suitability | Horticulture Suitability |
|---|---|---|
| Texture (Sandy Loam) | Low (Poor water retention) | High (Good drainage and aeration) |
| pH (7.35 – 8.53) | Moderate (Paddy prefers acidic 5.5–6.5) | High (Suitable for citrus, pomegranate, guava) |
| Organic Matter | Critically Low (Requires heavy organic input) | Low (Manageable with regular compost application) |
| Nutrients (NPK) | Deficient (Requires heavy fertilization) | Deficient (Requires balanced nutrient management) |

**Stress Relaxation Behaviour of Soil**

Based on the sandy loam texture, very low organic matter content (<0.36%), and moderate cation exchange capacity (19.3–22.5 meq/100 g), the soil is expected to exhibit rapid initial stress relaxation followed by a relatively high residual stress.

Unlike organic-rich soils, which continue to relax over extended periods due to elastic organic matrices, the present soils show limited long-term stress dissipation capacity.

**Impact of Vehicular Movement on Soil Sample S1**

The cumulative stress generated by repeated vehicle movement over soil sample S1 (Sandy Loam) significantly degrades soil quality by increasing the silt fraction and reducing particulate organic matter, which directly affects plant growth and soil functionality.

**Increase in Silt and Particulate Matter**

Vehicle-induced stress physically alters soil texture through particle crushing and aggregate fragmentation:

- High dynamic stress from vehicle tires, concentrated within the top 0–20 cm soil layer, acts as a mechanical milling force.
- Larger sand grains (≈64.5% in S1) and coarse particles collide and fracture under repeated pressure.
- This process shifts the grain-size distribution toward finer silt-sized particles.
- Surface-accumulated silt is easily resuspended by moving vehicles, increasing $PM_{10}$ emissions and reducing available topsoil nutrients.

**Impact on Plant Growth**

The gradual transformation toward a denser and silt-rich soil structure creates unfavorable growth conditions:

- Increasing silt content fills remaining macropores, rapidly increasing bulk density (≈1.0–1.08 g/cc).
- Higher soil strength restricts root elongation, leading to root impedance and shallow root systems.
- Fine pore dominance reduces aeration and drainage, causing oxygen deficiency (hypoxia) in the root zone.
- In soil sample S1, reduced aeration can decrease root respiration and potentially cause a 12–41% reduction in crop yield, depending on crop sensitivity.

**Preventive Measures for Soil Protection**

To minimize siltation and compaction effects:

- **Surface contact pressure should be maintained below 150 kPa**
- Vehicle movement should be avoided when soil moisture is high (**7–12%**), as wet soil conditions act as a lubricant
- Moist soils accelerate particle breakdown and promote deep-seated compaction

**Summary of Vehicular Stress Effects on Soil Sample S1**

| Soil Component | Change Due to Stress | Effect on Plant Growth |
|---|---|---|
| Silt Content | Increases due to grain crushing | Restricts root penetration |
| Bulk Density | Increases rapidly | Reduces air and water movement |
| Organic Matter | Fragmentation and accelerated decomposition | Loss of nutrient-holding capacity |
| Pore Structure | Loss of macropores | Causes root hypoxia |

**3.3Water Environment**

**Ground and Surface Water Quality – Resources & Results**

The water quality assessment was carried out based on the analytical results presented in Table 3.6 and evaluated with reference to **IS 10500:2012 (Drinking Water Standards)** and **IS 11624:2019 (Indian Standard for Irrigation Water)**. The samples include surface water (SW1 – Palar River, SW2 – Poonaithangal Tank), open well water (OW1), bore well water (BW1) and wastewater (WW).

Overall, **groundwater samples (OW1 and BW1)** exhibit comparatively better and more stable quality than the **surface water samples (SW1 and SW2)**, while the wastewater sample (WW) shows slightly higher turbidity and dissolved solids but remains within permissible limits for irrigation use.

**General Water Quality Interpretation**

• **Safety Rating:** All samples comply with the **permissible limits of IS 10500:2012** for drinking water, except for marginal exceedances in turbidity, total hardness and iron in surface water samples.

• **pH:** The pH values range from **6.53 to 7.37**, indicating **neutral to slightly alkaline nature**, well within the acceptable range (6.5–8.5). This pH is suitable for drinking, domestic use and irrigation.

•**TDS & Taste:** TDS values range from **486 to 718 mg/L**. Surface water (SW2) and wastewater (WW) slightly exceed the acceptable limit of 500 mg/L but remain well below the permissible limit of 2000 mg/L. Such levels may impart a mildly mineralized taste but do not pose health risks.

•Hardness: Total hardness varies from 171 to 241 mg/L, classifying the water as moderately hard to hard. SW2 and OW1 marginally exceed the acceptable limit of 200 mg/L but remain far below the permissible limit of 600 mg/L.

•Health Perspective:Calcium and magnesium concentrations are within safe limits and contribute essential minerals without causing excessive scaling or health issues.

**Interpretation of Water Quality Results (Based on IS 10500:2012)**

| Parameter | Observed Range (All Samples) | Acceptable Limit | Permissible Limit* | Status & Interpretation |
|---|---|---|---|---|
| pH @ 25°C | 6.53 – 7.37 | 6.5 – 8.5 | No relaxation | Safe – All samples within ideal range |
| Turbidity (NTU) | 0.7 – 2.1 | 1.0 | 5.0 | Exceeds acceptable in SW2 & WW; may indicate suspended matter |
| Colour (Hazen) | 5 – 10 | 5 | 15 | Marginal exceedance in OW1 & WW; aesthetic concern only |
| TDS (mg/L) | 486 – 718 | 500 | 2000 | Exceeds acceptable in SW2, OW1 & WW; safe under permissible limit |
| Calcium (as Ca) (mg/L) | 58.8 – 85.0 | 75 | 200 | Slight exceedance in SW2 & OW1; contributes to hardness |
| Total Hardness (mg/L) | 171 – 241 | 200 | 600 | Exceeds acceptable in SW2 & OW1; classified as hard water |

| | | | | |
|---|---|---|---|---|
| Chloride (mg/L) | 136 – 215 | 250 | 1000 | Safe in all samples |
| Fluoride (mg/L) | 0.16 – 0.51 | 1.0 | 1.5 | Safe – Ideal range |
| Nitrate (mg/L) | 6.7 – 12.3 | 45 | No relaxation | Safe – No health risk |
| Iron (mg/L) | 0.11 – 0.36 | 0.3 | No relaxation | Slight exceedance in SW2; may cause staining |
| Total Coliform / E.coli | Absent | Absent | Absent | Satisfactory – No fecal contamination |

*Permissible limit applies in the absence of an alternate source.

**Irrigation Water Suitability (IS 11624:2019)**

• **Electrical Conductivity (EC):** EC values range from **850 to 1213 µmhos/cm**, placing the water in **medium salinity class**. This category is suitable for most crops with normal soil management practices.

• **Specific Ions:** Chloride, sulphate and nitrate concentrations are low and pose **no risk of leaf burn**, even under sprinkler irrigation.

• **Organic Pollution:** BOD values are below detection limits in all samples, indicating **no organic contamination**.

**Paddy & Crop Suitability Assessment**

| **Parameter** | **SW / GW Range** | **Recommended Limit (Paddy)** | **Suitability** |
|---|---|---|---|
| EC (µmhos/cm) | 850 – 1213 | <1500 | Excellent |
| TDS (mg/L) | 486 – 718 | <600 (Ideal) | Good to Ideal |
| pH | 6.53 – 7.37 | 6.5 – 8.4 | Normal |
| Iron (mg/L) | ≤0.36 | <5.0 | Highly Safe |
| Fluoride (mg/L) | ≤0.51 | <1.0 | Safe |
| Calcium & Magnesium | Moderate | Balanced | Healthy |

**3.4 Air Environment**

The study generated baseline data for four key parameters:

- Particulate Matter (PM2.5 and PM10): Fine and coarse inhalable particles.
- Gaseous Pollutants: Sulphur Dioxide ($SO_2$) and Nitrogen Dioxide ($NOx$)

Table 3.15 summarizes the average concentrations of the four pollutants (($PM2.5$, $PM10$, $SO_2$ and $NOx$) recorded across the five stations during the three-month period.

Figure 3.15 shows the map identifying the five specific sampling locations and Figures 3.16–3.20a give the graphical representations showing pollutant trends or comparisons for each monitoring station.

**Summary of AAQ Result**

**Particulate Matter (µg/m³)**

| Station ID | PM2.5 (Mean) | PM2.5 (98th %) | PM10 (Mean) | PM10 (98th %) |
|---|---|---|---|---|
| AAQ1 | 24.40 | 26.32 | 63.78 | 68.43 |
| AAQ2 | 17.22 | 19.05 | 44.37 | 48.79 |
| AAQ3 | 17.42 | 18.03 | 44.88 | 49.58 |
| AAQ4 | 17.09 | 18.97 | 44.03 | 48.31 |
| AAQ5 | 16.62 | 17.92 | 42.82 | 46.17 |
| AAQ6 | 17.38 | 19.50 | 44.79 | 49.71 |
| AAQ7 | 17.1 | 18.6 | 43.98 | 48.36 |

**Gaseous Pollutants (µg/m³)**

| Station ID | SO2 (Mean) | SO2 (98th %) | NOx (Mean) | NOx (98th %) |
|---|---|---|---|---|
| AAQ1 | 7.50 | 7.87 | 15.25 | 16.38 |
| AAQ2 | 5.27 | 5.84 | 10.54 | 11.68 |
| AAQ3 | 5.38 | 5.90 | 10.77 | 11.80 |
| AAQ4 | 5.25 | 5.66 | 10.56 | 11.63 |
| AAQ5 | 5.20 | 5.39 | 10.47 | 11.01 |
| AAQ6 | 5.39 | 5.82 | 10.78 | 11.95 |
| AAQ7 | 5.31 | 5.59 | 10.58 | 10.80 |

The station AAQ1 has the highest mean and 98th percentile for all four pollutants suggesting it may be located near a higher-intensity emission source like a major traffic intersection or industrial area. The **98th percentile** values represent the levels that 98% of the data falls below. Since these values (e.g., PM2.5 max of 26.32 µg/m³ at AAQ1) are close to the mean it suggests a stable environment without extreme daily pollution spikes.

**Pollutant correlation:**

- The PM10 levels (42.82– 68.43 µg/m³) are roughly 2.5 times higher than PM2.5 levels, which is typical in areas where coarse dust (construction, road dust) contributes more than fine combustion particles.

- $SO_2$ and NOx levels are closely linked likely originating from common vehicular or industrial sources.

**3.5 Noise Environment**

Noise level in core zone was 58.8dB (A) Leq during day time and 45.1dB(A) Leq during night time. Noise levels recorded in buffer zone during day time varied from 39.9 to 43.6dB (A) Leq and during night time from 38.9 to 43.2dB (A) Leq. Thus, the noise level for industrial and residential area meets the requirements of CPCB.

**3.6 Biological Environment**

The study found that there is no endemic, endangered migratory fauna found in the area. This area is not also a migratory path of any faunal species. Hence, this small mining operation over short period of time will not have any significant impact on the surrounding flora and fauna.

***Flora in core zone***

There are no trees in inside of the mining lease area, but there are 60 *Borassus flabellifer* trees, *Morinda citrifolia* 5 and *Azadirachta indica* 4 within a 7.5-meter safety zone.

***Flora in 300 m radius zone***

Taxonomically, a total of 33 species belonging to 19 families have been recorded from the 300m radius from the mining lease area. The species in the 300m radius include herbs (18), trees (08), shrubs (05), the 19 families, Fabaceae and Lamiaceae are the main dominating species in the study area, Species Richness (margalef Index) in the study area it mentioned in Table 3.19-3.21 Moreover, no species are found as threatened category. There is government land around 300 meters. *Vachelia leucophylla* is the dominant tree followed by *Phoenix sylvestris* tree, *Carissa carandas*, *Cascapella thevetia* and *Lantana camara* tree.

***Fauna in Core Zone***

A total of 22 species belonging to 15 families were observed in the core zone (Table 3.24). Among them are 9 species of Insects, 3 species of Reptiles, 1 species of Mammals, and 9 species of Avian. None of these species are threatened or endemic in the study area and surroundings. There are no Schedule I species and 8 species are under schedule IV according to Indian wild life Act, 1972. There are no critically endangered, endangered, vulnerable and endemic species in the core zone.

***Fauna in Buffer Zone***

A total of 44 species belonging to 34 families were recorded from the buffer area. Among them were 20 species of Birds, 13 species of Insects, 3 species of Reptiles,1 species of Mammals, and 9 species of Amphibians, as mentioned in Table.3.25. There are four species under Schedule

II and twenty-six species under schedule IV according to Indian wild life Act 1972. And there are no critically endangered, vulnerable and endemic species in the buffer area. There is no schedule I Species in study area and there are no critically endangered, endangered, vulnerable and endemic species.

### 3.7 Socio Economic Environment

The proposed project will provide direct and indirect employment and improve the infrastructural facilities in that area, thus leading to the improvement of people's standard of living.

## 4 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

### 4.1 Land Environment

**Anticipated Impacts**

- Converting barren land of 4.96.0hectares to rough stone and gravel mining creates a significant and usually irreversible change in land use and land cover involving the physical alteration of the land's surface, potential deforestation, loss of biodiversity, altered topography from pits and spoil dumps.
- Heavy vehicle movement causes significant problems to nearby agriculture and human habitation. These pollutants can degrade soil quality and introduce heavy metals into the environment.
- During transportation the tippers damage the bituminous roads. The primary damage is caused by the fourth power law (*The law posits that if you double an axle's load, the damage caused to the pavement increases by a factor of 2x4 or 16 times*) where pavement damage increases with the fourth power of the axle load. The immense weight of heavy payloads on an axle exerts a concentrated and repetitive stress on the road surface leading to permanent strain, premature failure and a cumulative damage.
- Rain drops hitting stone crushing waste can break apart the particles and flowing water detaches them from the surface transports and redeposits these particles especially from sloped surfaces. This a form of splash erosion followed by sheet erosion which can lead to environmental issues.

**Mitigation measures**

- After mining there is a huge void of 3.37.35hectares upto a depth of 60m is useful for rain water storage structure has an advantage for local farmers. The artificial pond boundary shall be fences to avoid any mishaps.

- Union ministry of road transport and highways on July 16th 2018 increased the maximum cap of axle load limit by 20 to 25 percent cross various categories to keep the limit "at par with international standards". MoRTH knows that previously built Indian roads are made keeping standard axle loads. The new national and state highways along with expressways can be built by using new norms but for the existing roads the life will be reduced on average by one year.
- 6-wheel tipper generally has a maximum legal speed limit which can be up to 60 km/h and speeds should be reduced for loaded conditions. The mine management should take care of the speed of vehicles i.e up to 40km/h in village roads constructed under Pradhan Mantri Gram Sadak Yojana and other district roads developed by Highways and Minor Ports Department, Government of Tamil Nadu as each time a truck passes the concentrated stress causes a small amount of permanent strain on the pavement. Over time these small strains accumulate and lead to significant fatigue and eventual failure.
- 6-wheel tippers of not more than 9tons payload capacity covered with tarpaulin to stop the spillage and dust should use.
- Protective measures such as establish plants like grasses, cover crops and trees to form a dense layer over the dump absorbing raindrop energy and holding particles in place.

**4.2 Soil Environment**

**Anticipated Impact**

- The fertility status of the soil near by the lease area may affect due to extra dust deposition on the soil. Dust deposition from a lease area can harm soil fertility by physically blocking soil pores, reducing aeration and water infiltration, and potentially altering the soil's chemical properties. This damage to the topsoil negatively impacts plant growth by interfering with photosynthesis and nutrient uptake ultimately decreasing crop production.
- Topsoil will be scraped from the area of 4.96.0 hectares in the project site will store in safety area left for 7.5m and 10m in the western side as shown in mining plan.

**Mitigation Measures**

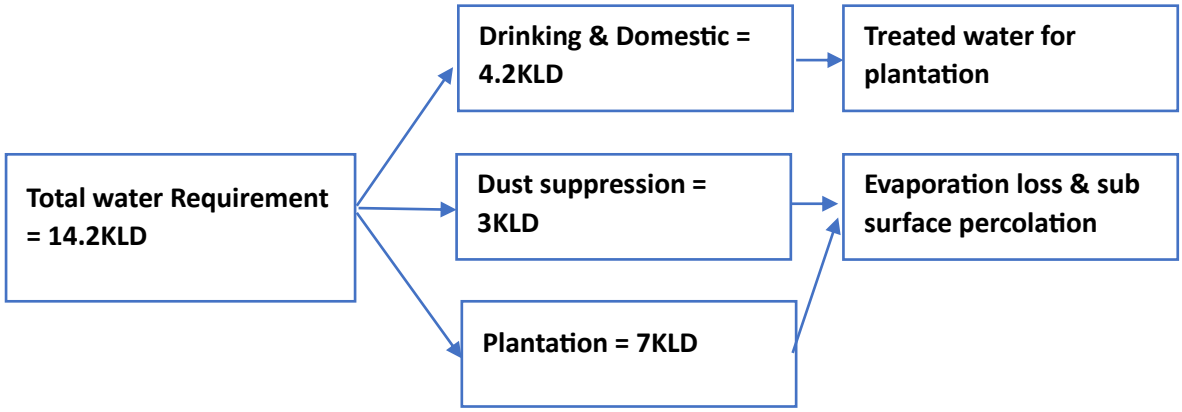
- When stock piling of top soil is done the mound should not be higher than 1.2m and 3.0m.
- To minimize surface runoff and erosion the topography of a graded surface should be designed to create terraces or benches that follow land contours which intercept sheet flow. Additionally, a bulldozer's tracks can be used to create a fine-scale roughened surface perpendicular to the slope and stockpiles should be constructed with a rough surface to improve drainage, reduce erosion and encourage revegetation.

- Efforts will be made to minimize the storage time to prevent nutrient loss.
- To protect the quality of stockpiled topsoil immediate re-vegetation is crucial. Temporary seeding should be done within 30 days of stockpile formation to control erosion, prevent weed growth and maintain healthy soil microbes.
- If the stockpile will not be reused within 12 months it must be stabilized with permanent vegetation to ensure long-term erosion and weed control.
- The stored topsoil will be utilized for plantations in later phases during the progressive and final closure of the mine.

**4.3 Water Environment**

- 14.2KLD (14,200 litters per day) water requirement for drinking, domestic, dust suppression and plantation.

**Water Balance Chart of the Mine**




- The domestic effluents being generated during mine operation.
- Major impact of opencast mining on groundwater regime is quality deterioration. The proposed mining activities shall be carried out upto a depth of 60m from average ground level. The specific water table depth in the core and buffer zone is between 10.8m and 13.5 meters below ground level.
- The volume of rain water entering to the mine and accumulating in the quarry has been estimated on the basis of direct catchment area, maximum daily precipitation and the run-off coefficient. $(\boldsymbol{Q = A\ x\ Hx}\ đ\ )\boldsymbol{cubic\ meters/day}$.

  Where A- catchment area in $m^2$

  H- Max daily precipitation in mm

  đ- Run-off Co-efficient.

  The run off co-efficient for mined out area is $0.60m^3$. The all-time record for maximum daily precipitation in The run off co-efficient for mined out area is $0.60m^3$. The all-time

record for maximum daily precipitation in Tiruvannamalai district was 468mm on September 30, 2018 as reported by CEIC Data. More recent rainfall records are 110mm on October 17, 2025. The maximum broken area is 1.95.50hectares in the sixth year and estimation for make of water done on the quarry parameters for sixth year onwards.

Q = 4.96.0hecatres x 10000 x 0.175 x 0.60 $m^3$.

Q = 2079$m^3$.

Total accumulated water in the pit is 5280$m^3$.

Additionally, 20% of water from seepage is 1041.6$m^3$.

Total water estimated for pumping requirement = **6249.6$m^3$.**

If we take the all-time record then the total water estimated for pumping = **6249.6$m^3$.**

To manage rain water runoff into quarry a 5 HP diesel operated pump will be placed at the site during the monsoon.

**Mitigation Measures**

- The hard rock itself has very few interconnected pore spaces, limiting the amount of water it can store or transmit. Groundwater flow and storage occur primarily in secondary openings such as joints, cracks and fissures. The thickness of the weathered layer, where more significant porosity can develop, is typically limited to 1-3 meters, particularly in low-lying topographic areas. The groundwater in these shallow zones is under unconfined (or water table) conditions, meaning it is directly connected to the surface and not confined by impermeable layers.
- The storm water discharge coming out of quarries and dump through a network of garland drains is expected to contain solid particles. These solid particles shall be removed by settling in the settling pond before being used for dust suppression and plantation. Hence, there shall be no change in drainage system due to this mining project in buffer zone.
- Domestic sewage from site office will be discharged in MAK Anaerobic bacteria digestion bio-septic tank. The treated water will be utilized for watering and maintaining the green belt.
- Groundwater development efforts would need to focus on the weathered and fractured zones near the surface in the buffer zone.
- Periodic (every 6 month once) analysis of ground water level and quality from the open well DW8 and bore well BW3 as shown in Figure 3.8 & 3.10 to find the change due to quarrying.

- The average annual rainfall of the project area is 1521mm and the runoff coefficient factors have been taken as per guidelines of Manual on Norms and Standards for Environmental Clearances by MoEF & CC, Govt. of India.

The total annual runoff can be calculated as:

**Runoff = Rainfall × Catchment Area × Runoff Coefficient**

Annual Rainfall = 1521mm

Total Project Area = 49600sq.m

Coefficient of Run off for Rooftop (Inclined) = 0.90

Coefficient of Run off for Rooftop (Flat) = 0.80

Coefficient of Run off for Road/Paved Area = 0.70

Coefficient of Run off for Open Area = 0.25

Coefficient of Run off for Greenbelt Area = 0.15 Rain water can effectively be collected from Maximum size of void in 6th year of mining = 37735sq. m.

Top soil dump area = 4950q.m

Road & Infrastructure = 800sq.m

Runoff from Void pit area = 37735sq.m x 0.805 m x 0.25 = 7594.16$m^3$

Runoff from Top soil dump area = 0.80m x 4950sq. m x 0.25 = 990$m^3$

Runoff from Road & Infrastructure = 0.805m x 800sq. m x 0.70 = 450.8$m^3$

Total Runoff from Project Area = 9034.96$m^3$

The annual runoff generated in the project site is 9034.96$m^3$. By considering the loss of 20% due to evaporation, spillage and wastage the effective runoff that can be harvested inside the project area is **722.96$m^3$.**

Daily water requirement (except drinking purpose) is 8$m^3$. So, with 300 working days the water requirement will be = 8$m^3$ X 300 = **2400$m^3$**

The surface runoff being generated from the project area will be channelized to rain water harvesting pond of 2m x 2m x 2m through network of drainage system 1m x 1m. The bottom of the ponds is naked and natural seepage from the bottom will recharge the ground water regime. Hence the storage pond will act as recharging structure. Even though rain water will be sufficient to fulfil the daily requirement of water but in the initial years of mining when the mining pit is smaller in size or in the year with deficit rainfall surface water will be collected with due permission.

### 4.4 Air Environment

**Leopold Matrix: Air Quality Impact**

The Leopold Matrix is used to cross-reference project activities against environmental factors. Based on the $PM2.5$ data the project activities impact the environmental factor air quality. Scale: 1 (Lowest) to 10 (Highest). Magnitude is negative (-) for adverse impacts. Example for AAQ1 (Total $32.6\mu g/m^3$): If magnitude is -6 and importance is 6 the resulting **-**36 indicates a moderate negative impact that requires specific mitigation measures.

| Environmental Factor | Project Activity: Construction | Project Activity: Operation |
|---|---|---|
| Physical: Air Quality | -4/5 | −6/7 |
| Biological: Health | −3/4 | −5/8 |
| Social: Aesthetics | −2/2 | -3/4 |

*Mitigation Measures: Air Quality Mitigation & Management Plan (2026).*

In accordance with 2026 **National Clean Air Programme (NCAP)** targets which aim for a 40% reduction in particulate matter by the end of 2026. These measures focus on reducing $PM2.5$ at the source.

**Table 4.6 Proposed Mitigation Measures for Air pollution**

| Impacted Area | Leopold Score (M/I) | Targeted Mitigation Measure | Implementation Frequency |
|---|---|---|---|
| AAQ1 (High Change) | -7 / 6 | Permanent Water sprinkler | Continuous during high-dust activities |
| Core Area (AAQ2) | -5 / 8 | Install continuous wind-breaking walls (min. 3m height) to shield the core area. | Fixed throughout project phase |
| Transport Routes | -4 / 5 | Strictly enforce a 10 km/h limit for heavy vehicles to reduce dust resuspension. | All vehicle movements |
| Stockpiles | -3 / 4 | Use tarpaulins or plastic sheets to cover all sand, cement and loose debris. | Daily at close of work |
| Site Entry/Exit | -2 / 3 | Tire wash unit to prevent track-out onto public roads. | Every vehicle exit |

Compliance Requirements

- **Real-Time Monitoring:** As of 2026 large construction sites are required to link low-cost air quality sensors directly to state pollution control board (SPCB) dashboards for live compliance tracking.
- **Emission Norms:** Ensure all on-site machinery and diesel generators (DG sets) meet the latest BS-VI or equivalent standards to minimize $PM2.5$ and $NOx$ emissions.
- **Emergency Response:** If $PM2.5$ exceeds the 60 $\mu g/m^3$ limit trigger the Graded Response Action Plan (GRAP) which may require temporary suspension of excavation or demolition.

**4.5 Noise Environment**

| Impact | Mitigation Measures |
|---|---|
| Noise impact due to mining activities.<br>Noise impact due to vehicular movement.<br>Auditory impact (hearing impairment resulting from excessive noise exposure) | ❖ Diesel powered machineries which are major source of noise in open cast environment will be properly maintained as per maintenance schedule to prevent undesirable noise.<br>❖ Attention shall be paid towards rigorous maintenance of silencers of diesel engines.<br>❖ Static diesel engines shall be housed as far as possible (not made of sheet metals or surrounded by baffles). If possible, they will be placed on vibration isolators.<br>❖ Drill machine operators, blasters and dumper drivers will be issued earplugs and earmuffs. Duty hours of operators of noisy machinery will be regulated to keep their noise exposure levels within limits.<br>❖ Provision of sound proof cabins for the workers deployed on machines producing higher level of sound like dumpers, shovels etc.<br>❖ Proper maintenance, oiling and greasing of machines will be done every week to reduce generation of noise<br>❖ Provision of sound insulated chambers for the workers working on machines (HEMM) producing higher levels of noise<br>❖ Silencers / mufflers will be installed in all machineries |

| | |
|---|---|
| | ❖ Greenbelt/Plantation will be developed around the project area and along the haul roads. The plantation minimizes propagation of noise<br>❖ Personal Protective Equipment (PPE) like ear muffs/ear plugs will be provided to the operators of HEMM and persons working near HEMM and their use will be ensured though training and awareness<br>❖ Regular medical check–up and proper training to personnel to create awareness about adverse noise level effects. |

**4.6 Ground Vibrations**

***Anticipated Impact***

- Mining operations generate significant noise and vibration impacting both worker health and nearby communities.
- These impacts can range from annoyance and sleep disturbance to structural damage and hearing loss. Effective management of noise and vibration is crucial to mitigate these adverse effects.

**Sources of Noise and Vibration in Mining:**

- Drilling and Blasting: A primary source of both noise and ground vibrations, with the intensity dependent on the amount of explosives, atmospheric conditions and proximity to the blast.
- Heavy Machinery: Excavators, haul trucks, and other equipment used in mining operations generate substantial noise.
- Loading and Transportation: The movement and handling of materials within the mine site contribute to noise pollution.

**Common Mitigation Measures**

- ❖ The blasting operations in the cluster quarries are carried out without deep hole drilling and blasting using delay detonators which reduce the ground vibrations
- ❖ Proper quantity of explosives, suitable stemming materials and appropriate delay system will be adopted to avoid overcharging and for safe blasting
- ❖ Adequate safe distance from blasting will be maintained as per DGMS guidelines
- ❖ Blasting shelter will be provided as per DGMS guidelines
- ❖ Blasting operations will be carried out only during day time
- ❖ The charge per delay will be minimized and preferably a greater number of delays will be used per blasts

- ❖ During blasting, other activities in the immediate vicinity will be temporarily stopped Drilling parameters like depth, diameter and spacing will be properly designed to give proper blast
- ❖ A fully trained explosives blast man (Mining Mate, Mines Foreman, 2nd Class Mines Manager/ 1st Class Mines Manager) will be appointed
- ❖ A set of shot firing rules will be drawn up and blasting shall commence outlining the detailed operating procedures that will be followed to ensure that shot firing operations on site take place without endangering the workforce or public
- ❖ Sufficient angular stemming material will be used to confine the explosive force and minimise environmental disturbance caused by venting / misfire
- ❖ The detonators will be connected in a predetermined sequence to ensure that only one charge is detonated at any one time and a NONEL or similar type initiation system will be used
- ❖ The detonation delay sequence shall be designed so as to ensure that firing of the holes is in the direction of free faces so as to minimise vibration effects
- ❖ Vibration monitoring will be carried out every 6 months to check the efficacy of blasting practices.

**4.7 Biological Environment**

***Anticipated Impact***

- During loading the truck, dust generation will be likely. This shall be a temporary effect and not anticipated to affect the surrounding vegetation significantly
- The Number of plants in the mining lease area is given in Chapter 3 which vegetation in the lease area may be removed during mining.
- Carbon released from quarrying machineries and tippers during quarrying would be 2776kg per day, 749520kg per year and 3747600kg over five years.

***Mitigation Measures***

- During conceptual stage, the top bench will be re-vegetated by planting local /native species and lower benches will be converted into rainwater harvesting structure following completion of mining activities, which will replace habitat resources for fauna species in this locality over a longer time.
- Existing roads will be used; new roads will not be constructed to reduce impact on flora.
- To mitigate carbon emission due to mining activities, we recommend planting trees around the quarry to offset the carbon emission during quarrying. A tree can sequester 2008713kg

of carbon per year. Therefore, we recommend planting large number of trees around the quarry and near school campuses, government wasteland, roadsides etc.

- As per the greenbelt development plan as recommended by SEAC (Table 4.11), about 2480 trees will be planted within three months from the beginning of mining. These trees, when grown up would sequester carbon of about 9741600kg of the total carbon.

**4.8 Socio Economic Environment**

***Anticipated Impact***

- Dust generation from mining activity can have negative impact on the health of the workers and people in the nearby area
- Approach roads can be damaged by the movement of tippers
- Increase in Employment opportunities both direct and indirect thereby increasing economic status of people of the region

***Mitigation Measures***

- Good maintenance practices will be adopted for all machinery and equipment, which will help to avert potential noise problems
- Green belt will be developed in and around the project site as per Central Pollution Control Board (CPCB) guidelines
- Air pollution control measure will be taken to minimize the environmental impact within the core zone
- For the safety of workers, personal protective appliances like hand gloves, helmets, safety shoes, goggles, aprons, nose masks and ear protecting devices will be provided as per mines act and rules
- Benefit to the State and the Central governments through financial revenues by way of royalty, tax, duties, etc.., from this project directly and indirectly.

**4.9 Occupational Health**

- All the persons will undergo pre-employment and periodic medical examination
- Employees will be monitored for occupational diseases by conducting medical tests: General physical tests, Audiometric tests, Full chest, X-ray, Lung function tests, Spiro metric tests, Periodic medical examination – yearly, Lung function test – yearly, those who are exposed to dust and Eye test
- Essential medicines will be provided at the site. The medicines and other test facilities will be provided at free of cost.

- The first aid box will be made available at the mine for immediate treatment. First aid training will be imparted to the selected employees regularly. The lists of first aid trained members shall be displayed at strategic places.

**5 Environment Monitoring Program**

| S. No. | Environment Attributes | Location | Monitoring | | Parameters |
|---|---|---|---|---|---|
| | | | Duration | Frequency | |
| 1 | Air Quality | 2 Locations (1 Core & 1 Buffer) | 24 hours | Once in 6 months | Fugitive Dust, $PM_{2.5}$, $PM_{10}$, $SO_2$ and $NO_x$. |
| 2 | Meteorology | At mine site before start of Air Quality Monitoring & IMD Secondary Data | Hourly / Daily | Continuous online monitoring | Wind speed, Wind direction, Temperature, Relative humidity and Rainfall |
| 3 | Water Quality Monitoring | 2 Locations (1SW & 1 GW) | - | Once in 6 months | Parameters specified under IS:10500, 1993 & CPCB Norms |
| 4 | Hydrology | Water level in open wells in buffer zone around 1 km at specific wells | - | Once in 6 months | Depth in m BGL |
| 5 | Noise | 2 Locations (1 Core & 1 Buffer) | Hourly – 1 Day | Once in 6 months | Leq, Lmax, Lmin, Leq Day & Leq Night |
| 6 | Vibration | At the nearest habitation (in case of reporting) | – | During blasting operation | Peak particle velocity |
| 7 | Soil | 2 Locations (1 Core & 1 Buffer) | – | Once in six months | Physical and chemical characteristics |
| 8 | Greenbelt | Within the project area | Daily | Monthly | Maintenance |

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

**6 ADDITIONAL STUDIES**

**6.1 Risk Assessment**

The DGMS risk assessment process is intended to identify existing and probable hazards in the work environment and all operations and assess the risk levels of those hazards in order to prioritize those that need immediate attention. The whole quarry operation will be carried out under the direction of a Qualified Competent Mine Manager holding certificate of competency to manage a metalliferous mine granted by the DGMS, Dhanbad for proposed project.

**6.2 Disaster Management Plan**

The objective of the disaster management plan is to make use of the combined resources of the mine and the outside services to:

- Rescue and treat casualties;
- Safeguard other people;

- Minimize damage to property and the environment;
- Initially contain and ultimately bring the incident under control;
- Secure the safe rehabilitation of affected area; and
- Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the emergency.

**6.3 Cumulative Impact Study**

The results on the cumulative impact of the four proposed projects on air environment of the cluster do not exceed the permissible limits set by CPCB for air pollutants.

- The cumulative results of noise for the habitation in consideration do not exceed the limit set by CPCB for residential areas for day time
- PPV resulting from four proposed project is well below the permissible limit of Peak Particle Velocity of 5 mm/s
- The cluster projects will allocate Rs. 15,00,000/- towards CER as recommended by SEAC
- The cluster projects will directly provide jobs to 57 local people, in addition to indirect jobs
- The cluster projects will plant 5178 about trees in and around the lease area

**7 Project Benefits**

Various benefits are envisaged due to the three proposed mine and benefits anticipated from the proposed project to the locality, neighbourhood, region and nation as a whole are:

- Direct employment to 25 local people
- Creation of community assets (infrastructure) like school buildings, village roads/ linked roads, dispensary & health Centre, community Centre, market place etc.,
- Strengthening of existing community facilities through the Community Development Program
- Skill development & capacity building like vocational training.
- Rs. 5,00,000 will be allocated for CER

**8 ENVIRONMENT MANAGEMENT PLANS**

In order to implement the environmental protection measures, an amount of **Rs. 1,06,72,478** as capital cost and recurring cost as **Rs. 31,65,880** as recurring cost/annum is proposed considering present market price considering present market scenario for the proposed project. After the adjustment of 5% inflation per year, the overall EMP cost for 5 years will be **Rs. 2,83,34,603.**