Morayoor Granites Pvt. Ltd

Mr.Ummer Kutty K

Director of Morayoor granites Pvt Ltd

Mucheth House, Elambra Nellikuzhy Ernakulam-686691

From

Mr.Ummer Kutty K

Director

Morayoor granites Pvt Ltd

Mucheth House, Elambra

Nellikuzhy

Ernakulam-686691

To

The Director- IA. II (M),

(Non-Coal Mining Sector)

Ministry OF Environment, Forest & Climate Change

Indira Paryavaran Bhawan,

Jorbagh, New Delhi- 110003

Respected Sir,

Sub: ADS submission of environmental clearance application for Granite Building Stone Quarry of M/s Morayoor Granites Private Limited, for an extent of 4.9797 Ha under B2 category.

Ref 1: Proposal No.IA/KL/MIN/232178/2021

Ref 2: As per minutes of 16th EAC (Non-Coal Mining) meeting held on 20th June, 2023

Ref 3: MoEF&CC file no: IA-J-11015/82/2021-IA-II(NCM)

I, Ummerkutty, the Director of proposed Granite Building Stone Quarry of Morayoor Granites Pvt Ltd which is situated at Re Survey No.152/1-1, 152/1, 159/1-1, 159/1-2, 159/1-3, 160/1-1, 160/1-2, 160/1-3, 160/1-4, Re Survey Block No. 56 of Morayur Village, Kondotty Taluk, Malappuram District, Kerala for an area of 4.9797 hectares under B2 category.

We have submitted an application for Environmental Clearance for our project at EAC through Parivesh online portal. The application was considered in 16th EAC meeting. In the 16th EAC minutes states that, proponent has to submit the detailed Subsidence study under the guidance of qualified RQP, and to submit a letter from Forest Department, that mine site is not a forest land.

As a response on this meeting I hereby attaching letter from Forest department and the subsidence study report as annexures 1 and 2

In the view of submission of above document, we request you to consider our application for the further proceeding to grant the environmental clearance, at your earlier convenience

Yours faithfully,

Place: Malappuram
Date: 21-12-2023

Mr. Ummerkutty K
Authorized Signatory

ANNEXURE 1

RAVEENDRANATHAN.M.P
Divisional Forest Officer
Nilambur North Division
(Full additional charge)

Office of the Divisional Forest Officer,
Nilambur North Division,
Nilambur - 679 329.
☎ Office: 04931 220232
Email: dfo.nilamburnorth@gmail.com
dfo-nlbrn.for@kerala.gov.in

L-7379/2023

Date: 13.12.2023

The District Geologist,
Malappuram.

Sir,

Sub:- Mines and minerals - Quarrying lease application of Morayur granites Pvt. Ltd - reg.

Ref:- 1. That office letter no. D.O.M/M-4211/2018 dated 21.07.2023.
2. This office Letter no. L-7379/2023 dated 07.11.2023.
3. That office Letter no. D.O.M/M-4211/2022 dated 05.12.2023.

Attention is invited to the references cited. In continuation of reference (2) letter, you are hereby informed that the proposed land for quarrying operation leased out by Morayur Granite Private Limited, which comprises in survey No. 152/1-1, 152/1, 159/1-1, 159/1-2, 159/1-3, 160/1-1, 160/1-2, 160/1-3, 160/1-4 of block 56 in Morayur village of Kondotty Taluk in Malappuram District is non-forest land. The above land is situated at an aerial distance of 2.1 kilometers away from the nearest forest land.

Divisional Forest Office * Nilambur North Division * Nilambur P.O. Pin - 679329

Yours faithfully

Divisional Forest Officer,
Nilambur North Division.

ANNEXURE 2

"STONE QUARRY MINING PROJECT OF MORAYUR GRANITE PVT LTD"

SUBSIDENCE STUDY REPORT

For

Ummer Kutty K

Director

Morayoor granites Pvt Ltd

Reg. Office Mucheth House,

Elambra, Nellikkuzhy,

Ernakulam District, Kerala

Pin:686691

PREPARED BY

Mahesh. S **RQP/BNG/338/2014/A** **TC31/580, Navadeepam,S N Nager** **Pettah (p.o), Trivandrum – 695024** **Kerala.**	**Dr. Jayachandra Panikar** **DMG/KERALA/RQP/12/2017** **Navajyothi Nagar 39A, Kadappakada** **P.O., Kollam District-691008**

Certificate

As per the instruction from the EAC committee meeting for the Stone Quarry project of Morayoor Granites in favour of Ummer Kutty. K over an extent of 4.9797 Ha at Re-Survey No. 152/1-1, 152/1, 159/1-1, 159/1-2, 159/1-3, 160/1-1, 160/1-2, 160/1-3, 160/1-4, block no. 56 of Morayur Village, Kondotty Taluk, Malappuram District, Kerala, the Subsidence study where carried out. We had assessed the topographical features of the terrain, mining plan proposed, Sub profiling, Possibilities of Subsidence and recommended the measures to be followed during the operational phase of the project.

Sl. No.	RQP Name	RQP Reg. No.	Validity	Signature
1	**Mahesh. S** **M-Tech in Geotechnical Engineering** .	**RQP/BNG/338/2014/A** **IBM - Banglore**	**01/07/2024**	
2.	**Dr.Jayachandra Panikar** **PhD in Geology (Retd.** **Deputy Director of Department of Mining & Geology, Kerala)**	**DMG/KERALA/RQP/12/2017**	**01-12-2027**	

Place: Malappuram

Date: 21.12.2023

Undertaking

I Ummer Kutty K, Director of Morayoor Granites Pvt Ltd, hereby authorise MAHESH. S, RQP /BNG/338/2014/A and Dr.JAYACHANDRA PANIKAR, DMG/KERALA/RQP/12/2017 to prepare the Subsidence Study Report in respect of Granite Stone Quarry, over an area of 4.9797 hectares in Morayur Village, Kondotty Taluk , Malappuram District, Kerala.

I entrust them for preparing Subsidence Study Report because they are well expert in this field and Mahesh.S. is having more than 20years of experience and Dr. Jayachandra Panicker is having more than 30 years of experience.

Name of RQP:

Mahesh. S **RQP/BNG/338/2014/A** **TC31/580, Navadeepam,S N Nager** **Pettah (p.o), Trivandrum – 695024** **Validity : 01/07/2024**	**Dr. Jayachandra Panikar** **DMG/KERALA/RQP/12/2017** **Navajyothi Nagar 39A, Kadappakada** **P.O., Kollam District-691008** **Validity: 01-12-2027**

Place: Malappuram **Ummer Kutty K**

Date: 21.12.2023 Authorised Signatory

Sl.No	ANNEXURES
1	RQP Certificate of Mahesh. S
2	RQP Certificate of Dr. Jayachandra Panikar

1. INTRODUCTION

<table>
<tr><th>S. No</th><th>ITEM</th><th></th><th>DETAILS</th></tr>
<tr><td>1.</td><td>Application details</td><td></td><td>File No.: IA/KL/MIN/232178/2021</td></tr>
<tr><td>2.</td><td>Name of the Project</td><td>:</td><td>Granite Building Stone Quarry of Morayoor Granites</td></tr>
<tr><td>3.</td><td>Proposed capacity/ area/ length/tonnage to be handled /command area/ lease area /number of wells to be drilled</td><td>:</td><td>Production Capacity: 157669.4 MTA
Area : 4.9797Ha
Mineable reserves : 1576694 MT
Life of Mine About :10 years</td></tr>
<tr><td>4.</td><td>New/ Expansion / Modernization</td><td>:</td><td>New Quarry Project</td></tr>
<tr><td>5.</td><td>Category of project i.e. 'A' or 'B'</td><td>:</td><td>B2</td></tr>
<tr><td>6.</td><td>Location</td><td></td><td>The building stone quarry project is situated at Re Survey No.152/1-1, 152/1, 159/1-1, 159/1-2, 159/1-3, 160/1-1, 160/1-2, 160/1-3, 160/1-4, Block No. 56 of Morayur Village, Kondotty Taluk, Malappuram District, Kerala for an area of 4.9797 hectares. The geographical location of the mine with respect to the pillar boundary of the lease area is given below: -
<table>
<tr><td>Latitude</td><td>11°06'25.44"N to 11°06'40.96"N</td></tr>
<tr><td>Longitude</td><td>76°0'36.26"E to 76°0'43.90"E</td></tr>
</table></td></tr>
<tr><td>7.</td><td>Name of Applicant</td><td></td><td>Mr. Ummer Kutty K</td></tr>
<tr><td>8.</td><td>Address of the applicant</td><td></td><td>Ummer Kutty K
Director
Morayoor granites Pvt Ltd
Reg. Office Mucheth House,
Elambra, Nellikkuzhy,
Ernakulam District, Kerala</td></tr>
</table>

			Pin:686691

Mr Ummer Kutty K has applied for environmental clearance for the operation of Granite Building Stone quarry over an extent of 4.9797 Ha at Re Survey No.152/1-1, 152/1, 159/1-1, 159/1-2, 159/1-3, 160/1-1, 160/1-2, 160/1-3, 160/1-4, Block No. 56 of Morayur Village, Kondotty Taluk, Malappuram District, Kerala. As per the 16th meeting of EAC the committee decided to direct the proponent to submit a Subsidence Study Report for the proposed area.

LOCATION

The geographical location of the mine with respect to the pillar boundary of the lease area is given below: -

Boundary Pillar	Latitude	Longitude
BP 1	11°06'40.96"N	76°0'40.59"E
BP 2	11°06'38.08"N	76°0'43.68"E
BP 3	11°06'36.72"N	76°0'42.02"E
BP 4	11°06'34.96"N	76°0'43.90"E
BP 5	11°06'34.43"N	76°0'42.91"E
BP 6	11°06'32.91"N	76°0'42.82"E
BP 7	11°06'25.96"N	76°0'43.75"E
BP8	11°06'25.44"N	76°0'40.63"E
BP9	11°06'31.07"N	76°0'39.87"E
BP10	11°06'33.28"N	76°0'38.30"E
BP11	11°06'34.63"N	76°0'36.26"E
BP12	11°06'35.75"N	76°0'37.59"E

Table 1: Geo-coordinates of project-site

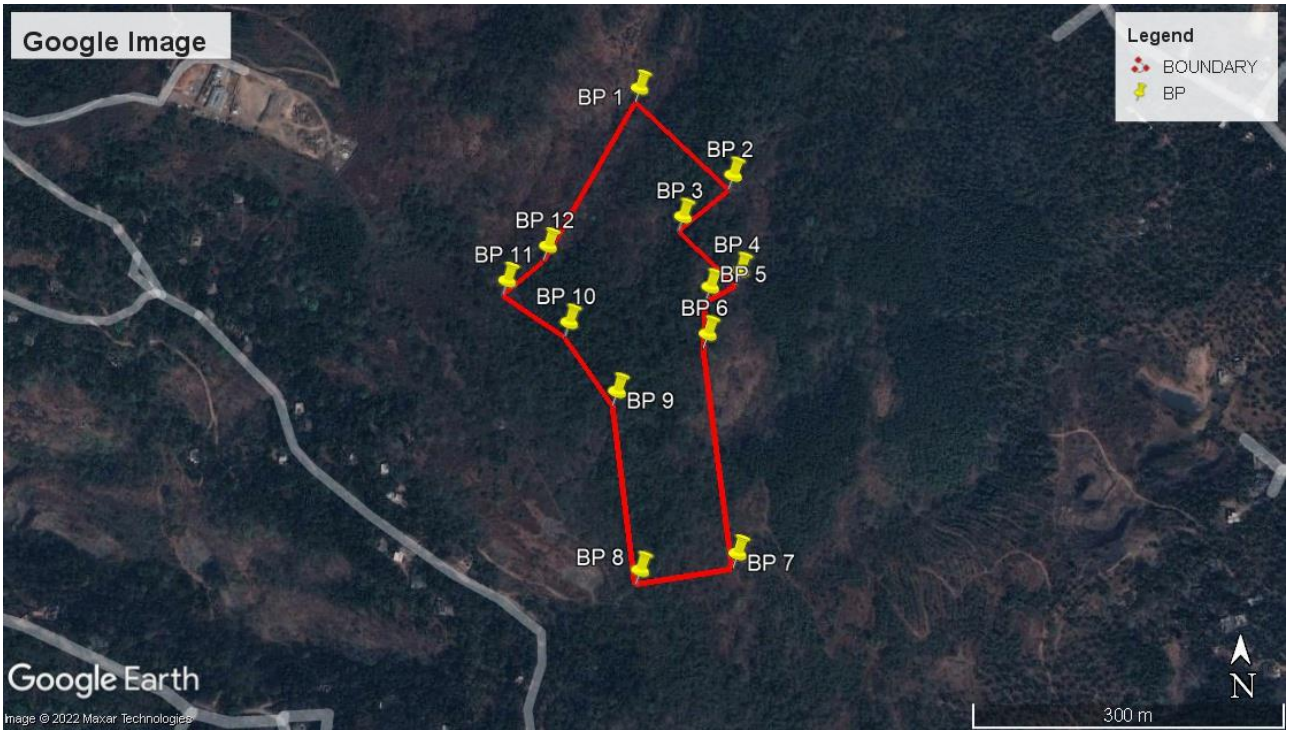


Fig.01 The Google Map showing Location of the lease Area

OBJECTIVE OF STUDY

- This study is conducting to analyse the possibilities of Subsidence during the mining activity of the site and recommend for the measures to be followed during the mining activity.

Site specific observations of Potential factors affecting Subsidence

Topography

The Quarry lease area is an undulated rocky terrain with thin layers of soil (0.9 to 1.8 m) as substratum and shrubby growth of weeds. Area found that of charnockite rock. In the proposed site, is in between 301 AMSL and 195 AMSL. The site is a rocky area with an outcrop (about 25% of area) without extensive vegetation. The weeds and shrubby growth of plant will be cleaned manually. The loose soil layer will be removed and stored in the non-mining area, which will be used for plantation purpose. The boulder and the underneath rock bed consist of rock mass, which is a massive rock.
500 m surrounding of the proposed site has been found that same features as outcropped rocky area with thin layer of soil. also elevation found in gentle manner at higher elevations above this site.
The respective area located in small isolated hilly terrain, the slope of hill is projected towards NE - E -SE direction.

Figure 02: Site photographs of massive rocks

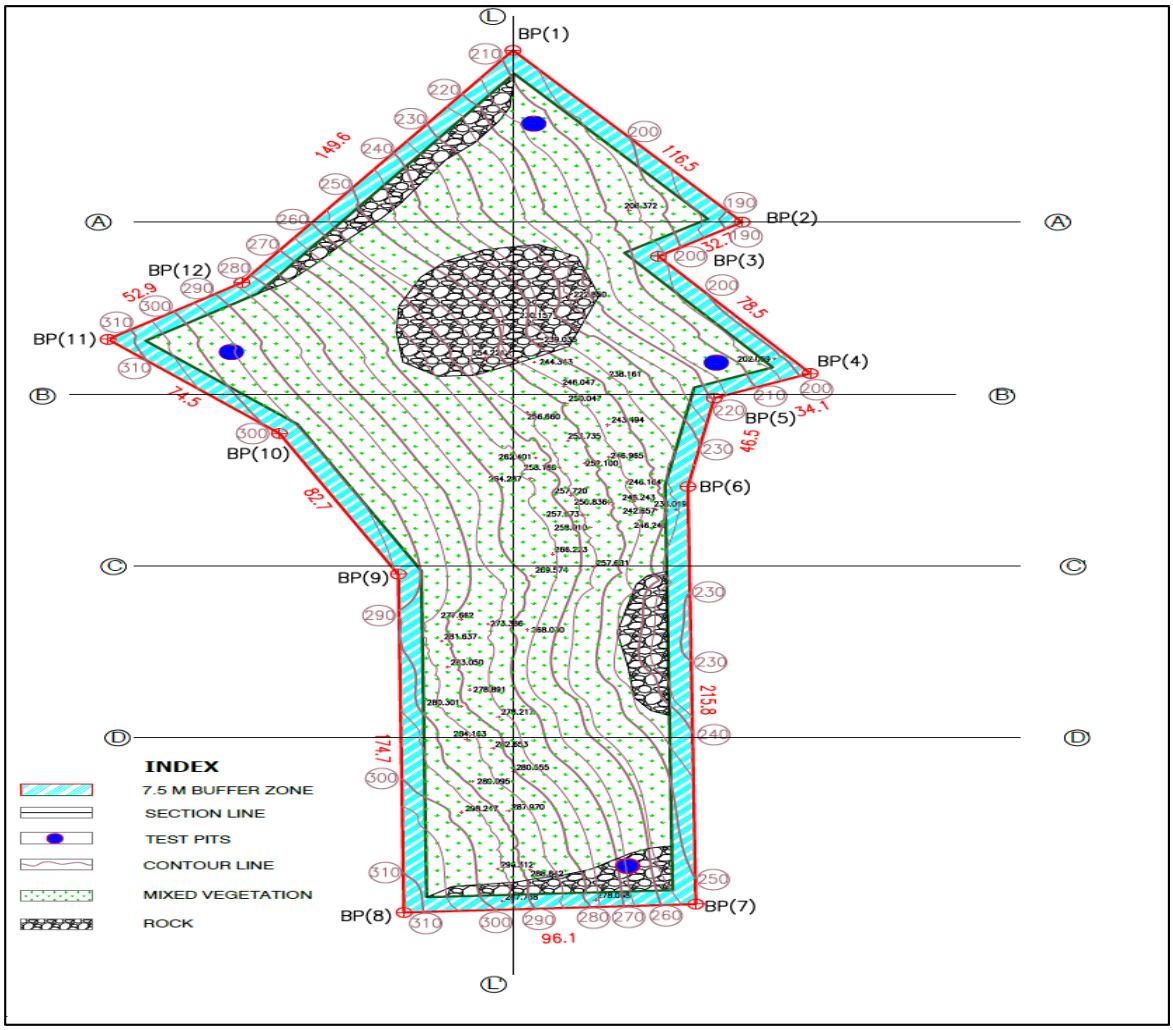


Figure 03: Geological Plan

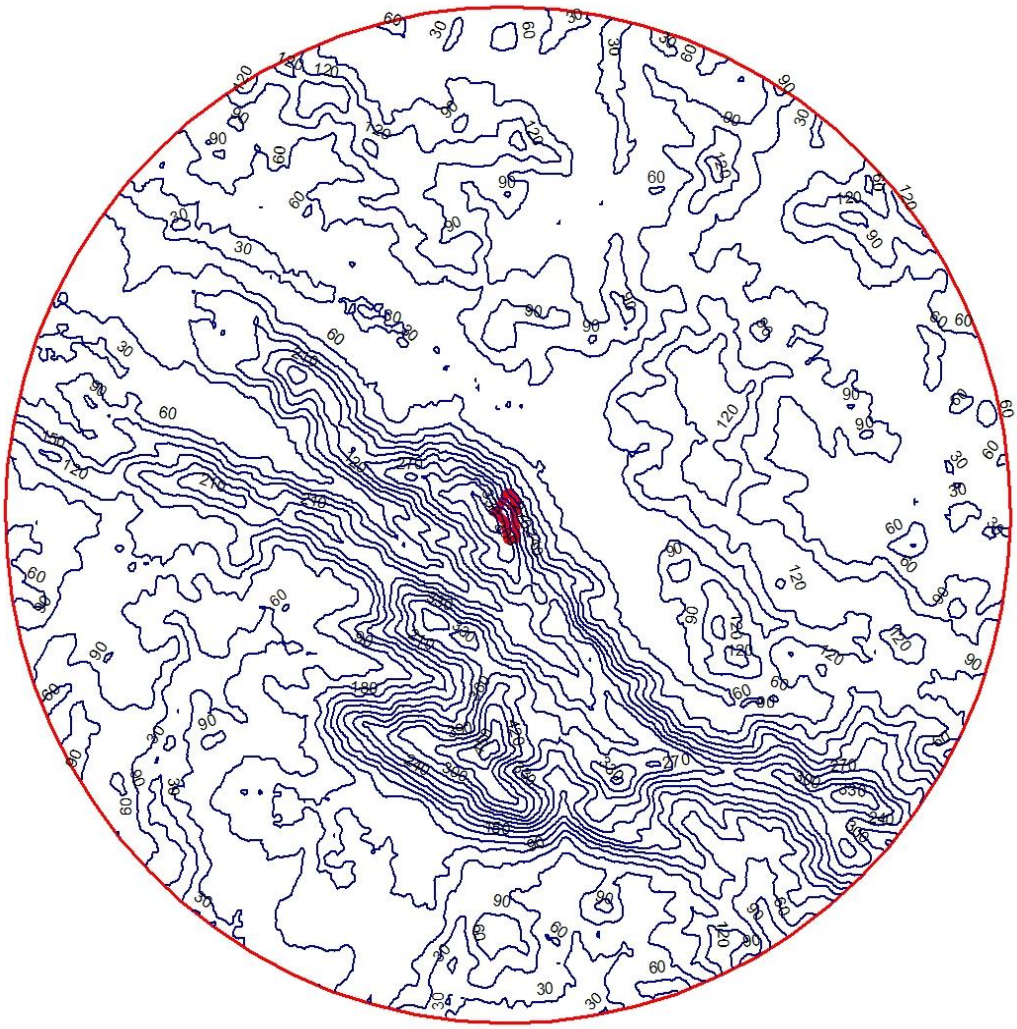


Figure 04: Contour within the 500m radius area

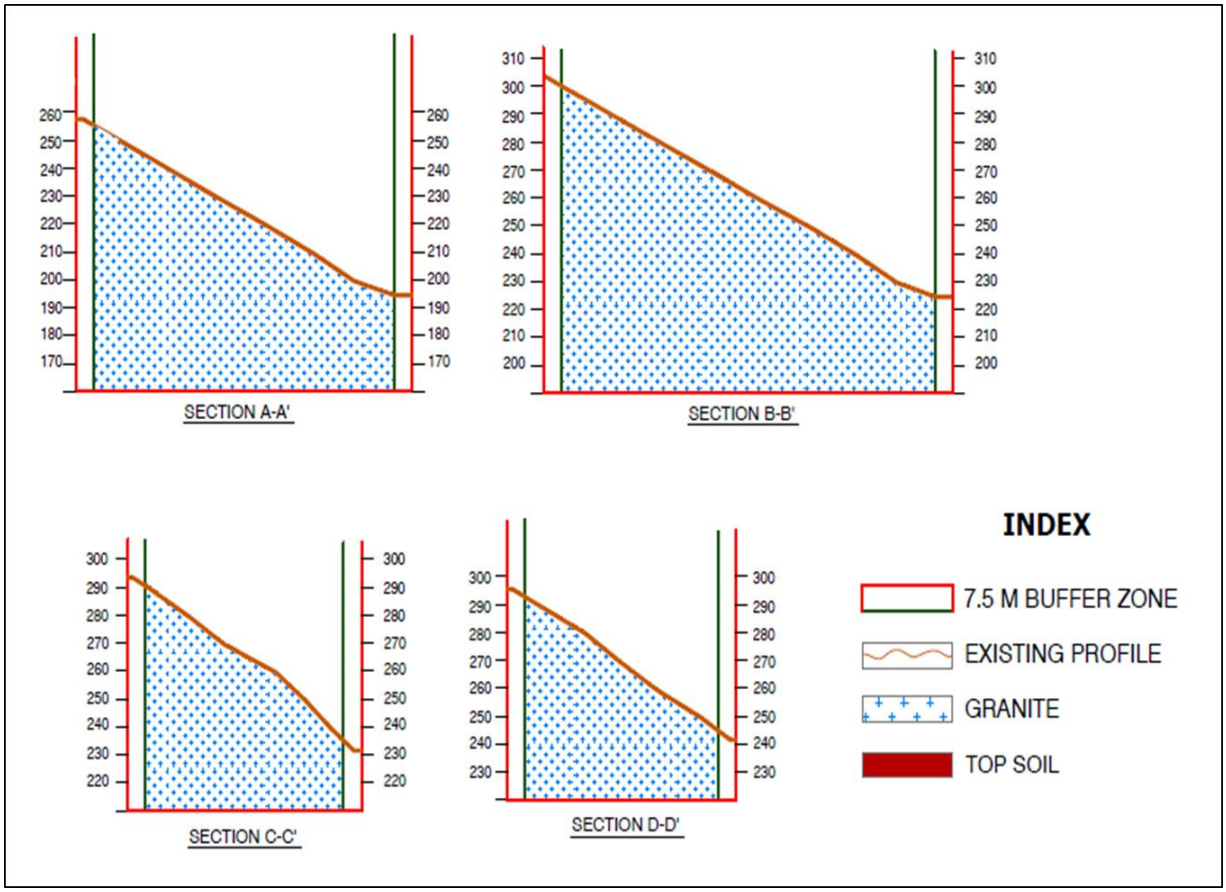


Fig.05 Geological Section

Slope analysis of each sections

In the proposed site, the production will start at the bench 250 MSL and end at 190 MSL, with an average production of 3,58,309MT from section A-A'. From section B-B' the production will start from 295 MSL bench and ends in 205 MSL with an average production of 5,84,819MT. Section of C-C' which start from 285 MSL- 220 MSL with an average production of 2,98,324MT. D-D' section will have average production of 335242MT

The total mineable reserve is about 1576694MT and annual production was about 157669.4MTA with a life of mine is about 10years

Slope stability

Slope stability refers to the condition of inclined soil or rock slopes to withstand or undergo movement. The stability condition of slopes is connected with soil mechanics, geology and geotechnical engineering. Slope stability analysis include static and dynamic, analytical or empirical methods to evaluate the stability of earth and rock-fill excavated slopes, and natural slopes in soil and rock. The analysis is generally aimed at understanding the causes of an occurred slope failure, or the factors that can potentially trigger a slope movement, resulting in a landslide. We here analyze the geological structures at representative locations and conduct a rock mass quality (Q) study for the same.

Geological Structure: The main geological structure which affect the stability of the slopes in the open pit mines are:

- Amount and direction of dip
- Intra-formational shear zones
- Joints and discontinuities
- Faults

Instability of rock slope may occur by failure along pre-existing structural discontinuity, by failure through intact material or by failure along a surface formed partly along discontinuity and partly through intact material. Instability may occur if the strata dip into the excavations. Localized steepening of strata is critical for the stability of the slopes. Stability is hampered if a clay band comes in between the two rock bands. Bedding planes and Joints also provide surfaces of weakness.

Rock Mass Quality (Q) – Existing Terrain

$$Q = \frac{RQD}{J_n} x \frac{J_r}{J_a} x \frac{J_w}{SRF}$$

RQD= 90 (2 joints per m^3)

Based on no of joints, J_n= 1 (2 Joints)

Based on discontinuity roughness, J_r = 2 (Smooth undulating)

Based on discontinuity alteration, J_a = 3 (Silt and sandy clay coating)

Based on presence of water, J_w= 1 (minor inflow)

Stress Reduction Factor, SRF= 5 (No or few weak zone)

Equivalent Supported Ratio, **ESR**= 5 (Open cast mine)

Maximum height of face observed= 8

$$Q = \frac{RQD}{J_n} x \frac{J_r}{J_a} x \frac{J_w}{SRF}$$

$$Q = \frac{90}{1} x \frac{2}{3} x \frac{1}{5}$$

Q=12

$$\boldsymbol{Equivalent\ Dimensions} = \frac{\text{maximum height of face observed}}{ESR} = \frac{8}{5} = \mathbf{1.6}$$

Based on the Q value and Equivalent dimension (Q-system, after Barton & Grimstad, 1994), the Face falls in an unsupported category i.e., the faces are stable and do not require any support.

As well here analyze the production benches stability throughout the life of the project.
As well as at preventing the initiation of such movement, slowing it down or arresting it through mitigation countermeasures.
Stability of slopes can be improved by:

- Flattening of slope results in reduction in weight which makes the slope more stable
- Soil stabilization
- Providing lateral supports by piles or retaining walls
- Grouting or cement injections into special places
- Consolidation by surcharging or electro osmosis increases the stability of slope.

Slope Geometry: Slope geometry is the important factor which affects the slope stability. The basic geometrical slope design parameters are bench height, overall slope angle and area of failure surface. Stability of slope decreases with increases in height and slope angle. As well it should be considered

so that the ground deformation at the mine peripheral area also affects the stability. Generally overall slope angle of 45° is considered to be safe by Directorate General of Mines Safety (DGMS). Section A-A' is having an average slope of 27º, section B-B' is having an average slope of 26º, section C-C' is having average slope of 25º, section D-D' is having an average slope of 27º, and total average of slope is 26º.

Here final slope of the area become less than 45° The curvature of the slope has profound effect on the instability and therefore convex section slopes should be avoided in the slope design. The proposed bench designs found the stable geometry.

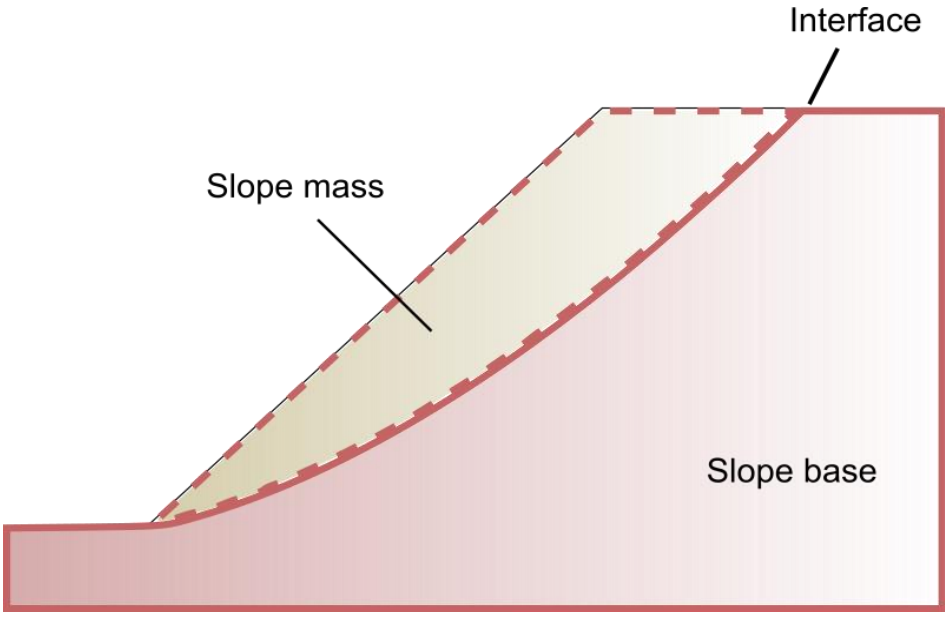


Fig 06. Diagram Showing Two Dimensional Analysis of Slope

***Lithology and Ground Water*:** The rock materials forming a large pit slope determines the rock mass strength modified by discontinuities, folding, faulting, old workings and weathering. Low rock mass strength is characterized by ravelling, circular; and rock fall instability like the formation of slope in Massive sandstone restricts stability. Pit slopes having soil alluvium or weathered rocks at the surface have low shearing strength and the strength gets further reduced if water seepage takes place through them. These types of slopes must be flatter.

Ground water causes increased up thrust and driving water forces and has adverse effect on the stability of the slopes. Chemical and Physical effect of pure water pressure in joints filling material can thus alter the cohesion and friction of the discontinuity surface. Physical effects of providing uplift on the joint surface, reduces the frictional resistances. This will reduce the shearing resistance

along the potential failure plane by reducing the effective normal stress acting on it. Physical and the chemical effect of the water pressure in the pores of the rock cause a decrease in the compressive strength particularly where confining stress has been reduced.

There is no accumulation or impoundment at this hill, as area found virgin area. Also, Hill have a natural course of drain. By the activities proposed there is no disturbances shall be occurred for this natural flow of the hill. To manage surface runoff in the site there should be a garland canal and desiltation tanks and check dams should be constructed and that help to control the runoff water discharge from the site. Detailed drainage management plan has attached with the mining plan and in latter sections.

Mining activities triggered Subsidence

In the proposed site, the production will start at the bench 301 MSL and end at 195 MSL. The total mineable reserve is about 1576694MT and annual production was about 157669.4MTA with a life of mine is about 10years. The said area proposed to work with conventional open cast method with bench system and mode of operation will be semi-mechanized. Based on the mode and method so adopted and taking geological parameters of the ore body into consideration, the quarry is designed in such a way that conceptually the height of the bench is kept about 5m max and maintaining a maximum slope of 45^0 from the horizontal plane. Mining will be done with the help of machineries like rock drills, jack hammer, compressors, hydraulic excavators, breakers etc.

MINEABLE RESERVE (MT)	GEOLOGICAL RESERVE (MT)
1576694	**4681408.8**

Table2: Geological and Mineable Reserve

Year	Bench	Minerals(MT)
I	300-270	157669.4
II	270-260	157669.4
III	255-250	157669.4
IV	250-245	157669.4
V	245-240	157669.4
VI	235-230	157669.4
VII	230-225	157669.4

VIII	225-215	157669.4
IX	215-205	157669.4
X	200-190	157669.4
TOTAL		**1576694**

Table3: Year wise Production

Site Preparation and Bench Height Formation

1. Remove the soil cover and expose the rock

2. Remove the loose boulders with the help of excavator and prepare free face for drilling

3. To develop haul road from the proposed quarry using natural gradient of the hill for movement of tippers

4. Drill holes of 32mm diameter and 2.6m in depth will be made using Jack Hammer. The spacing and burden will be kept at 1m

5. To reduce the noise levels will be blasted by using nitrate mixture and millisecond delay detonators

6 About 48 holes will be blasted in one blast

7. Number of blast per day will be 2 nos' and totally blast of 96 holes per day

8. To maintain the bench height of 5m, sub-bench of 2.5m will be formed first, later on two benches of 2.5m will be merged and one bench of 5m will be formed and maintained.

Drilling and Blasting Details

Drilling: The production of Granite Building Stone in Compact zone is obtained by Drilling and Blasting. Drilling will be done by Jack Hammer with the help of air compressor. About 3 No's of Jack hammers will be used in the respective site. It is capable of drilling 32mm diameter holes upto a depth of 2.6m. About 50no's of holes can be drilled using one jack hammer of above mentioned capacity. So, totally 150no's of holes can be drilled using 3 No's of Jack hammers.

Blasting: The controlled blasting is proposed by adopting all the safety measures as per "MMR 1961" and with the permission of DGMS. In this area for fragmentation of granite the blasting will be conducted. Multiple blast holes of 2.6m depth will be drilled with 32mm drill rod, Jack Hammer and Air Compressors of 100cfm Capacity.

Requirement of Explosives: It is estimated about 375g of explosives per hole is required. About 48 holes per blast are proposed. Therefore, about 96no's of holes required for 1-day blast. So, 36kg of explosives required for 96holes per day.

Average Annual Production	157669.4TPA
Diameter of the hole	32mm
Spacing	1m
Burden	1m
Depth	1.8m
No. of Working days	250
Charge/Hole	0.125kg/stick 3stick/hole=0.375kg
Pattern of Hole	Zig-Zag
Inclination of hole	70^0 from the horizontal
No. of holes per day	2x48=96 holes
No. of holes blast per round	Max.15
Quantity of the explosives per blast round	6 Kg

The bench production ends at the boundary line BP6-BP7 and the last bench will be at the same level as the ground level along the boundary line. Benches has designed as the Reduced levels are at a stable position as maintained the height of 05m and width of 05 m and design has been followed to maintain the same depth manner will be complied with the existing terrain as well.

The Blasing designs mentioned above is found effective to meet with the targeted production and this neither propagates the vibration (Peak Particle Velocity shall be less than 01 mm/s) more than 100 m from the blasting locations (As per the empirical modelling). Also PPV shall be less than 05 mm/s beyond 50m from the blasting location. This induces negligible impacts on subsidence factors associated with geotechnical aspects of the terrain.

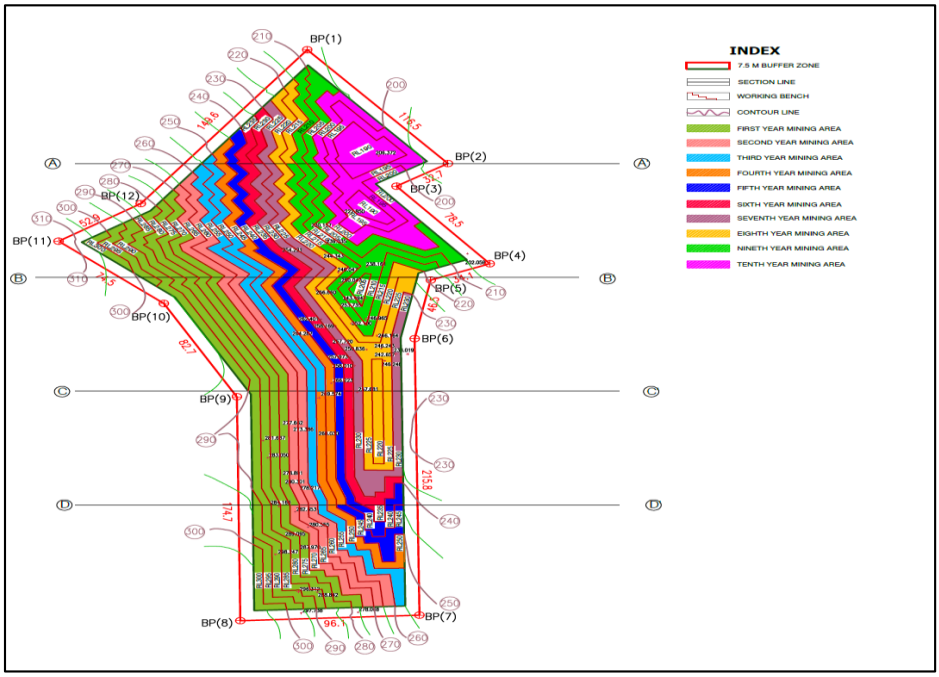


Fig.07 Production Plan

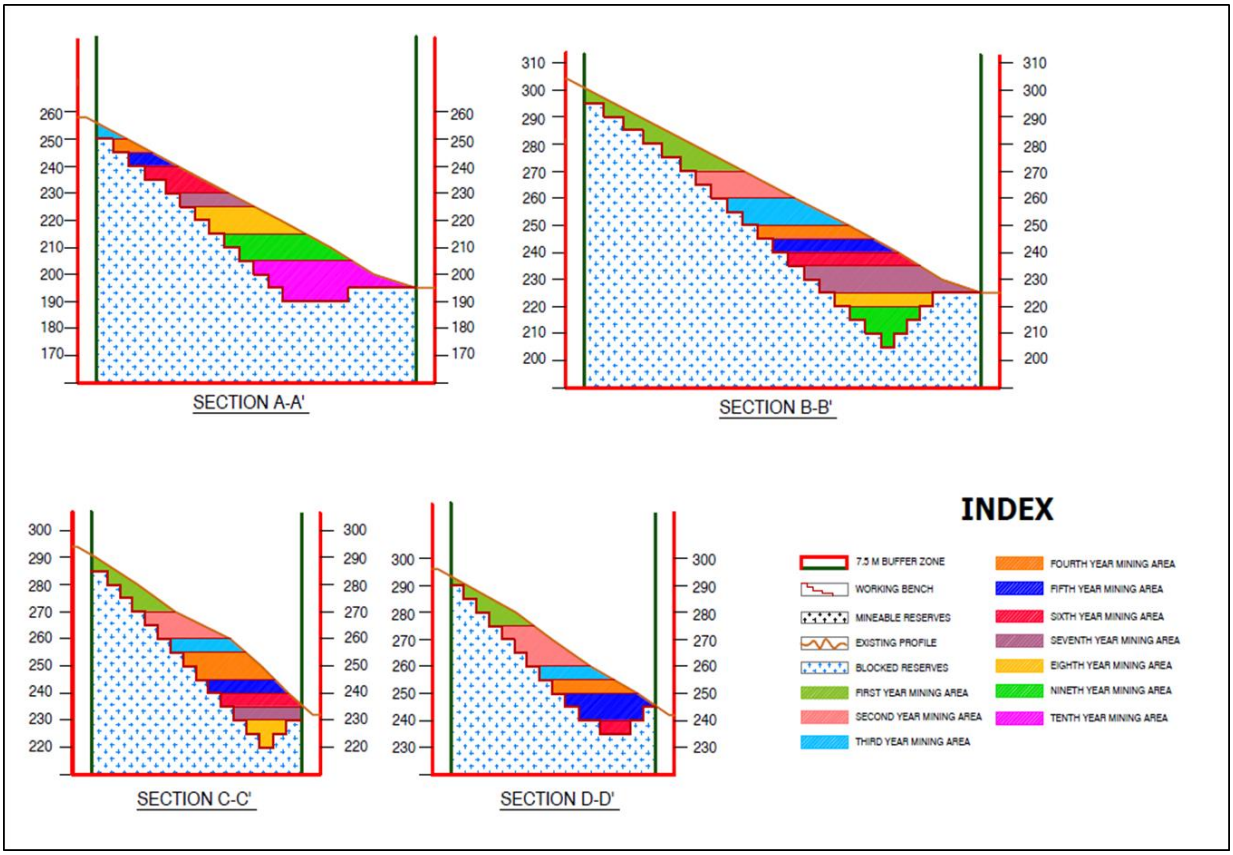


Fig 07.1: Section wise Production details

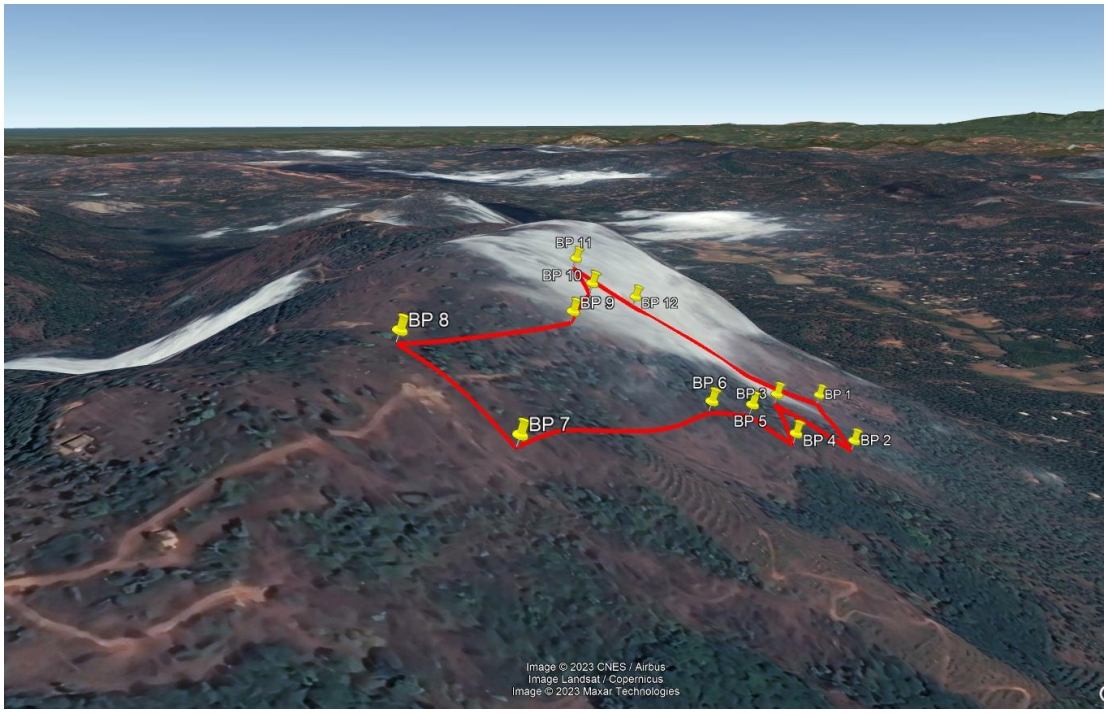


Figure 08: Typical terrain view of project site

Measures to be followed

1.Drainage

The Project Proponent submitted that proper drainage management plan has been designed to prevent the contamination of public drainage and water bodies. Slope of the project area is towards SE direction. Garland Drains will be constructed in the lower slope of Project area about having dimensions of 1m width around the working benches. The surface runoff water from the quarry area carries by Garland Drains and flows through silt traps at each slope breaks. Collected run-off from the lease area passess through Desiltation tanks. Two Desiltation tanks will be proposed in the quarry area.

A garland drainage shall be constructed at the start of mining operation. In the initial phase, garland drainage with silt traps will be constructed along the boundary pillars BP8-BP10-BP11-BP12. While mine progressing stage, garland drain will be constructed along the boundary pillars BP8-BP7-BP6-BP4 within 1year. In the 2ndyear, garland drainage with silt traps are constructed in the northern

stretch of the lease area i.e., along the boundary pillars BP2-BP1. Garland Drains will be constructed in the lower slope of mine lease area having enough width around the working benches. PP also submitted that the surface runoff water from the quarry area carries by Garland Drains and flows through silt traps at each slope breaks. Collected run-off from the lease area passes through Desiltation tanks. Two Desiltation tanks will be proposed in the quarry area. One Desiltation tank will be proposing nearer to the boundary pillars BP6 having dimensions of 3mx1.5mx2.5m and another one proposing nearer to boundary pillar BP2 of lease area having dimensions of 3mx1.5mx2.5m. Within 1 year it is proposed to construct the Desiltation tanks. Clarified and controlled water flow passes through check dam. From the check dam, the controlled flow only connects to the existing natural drainage.

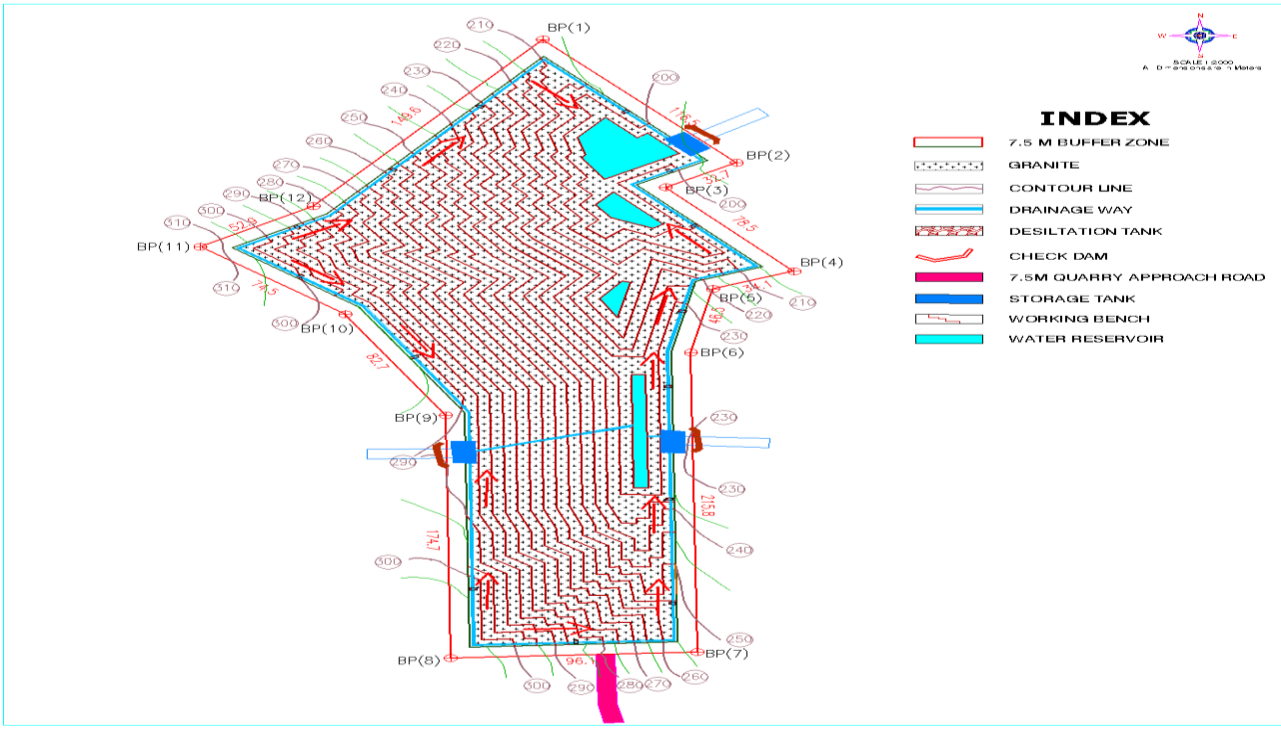


Figure 9: Surface drainage runoff plan Initial stage

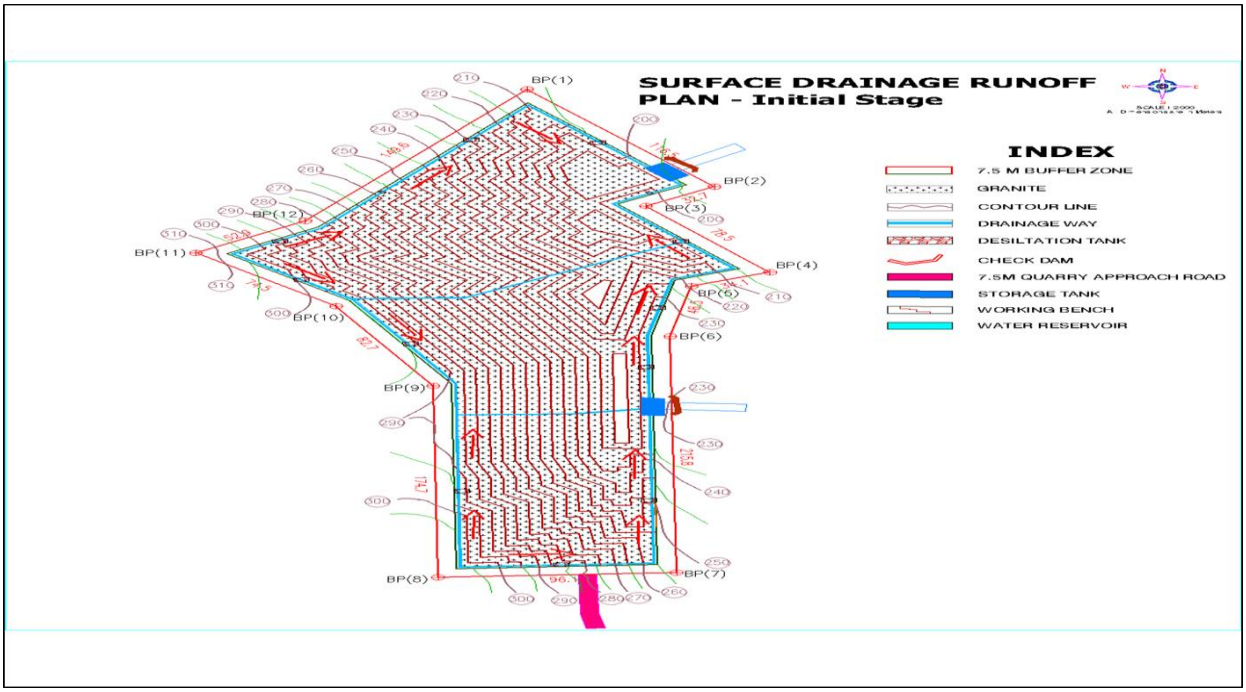


Figure 9.1: Drainage plan in mine closure stage

Before onset of monsoon, drains are cut along toe of the quarry faces to divert the surface run off. Garland drain is provided at the quarry top to regulate monsoon water and direct the same to the settling ponds / quarry pit to contain the quarry wash off and to avoid the same joining to the adjoining surface water bodies / water courses. It also helps to avert eventual collapses and damages to the quarry faces if any. The quarry is currently designed to avoid surface water courses and drainage channels.

2. Geotextiles

While Mining activities advances if any sections around the benches having more than two-meter thickness of soil, we suggest apply geotextile to stabilize that stretch. This would help to accelerate vegetation development in that area. Geotextile are fibrous materials, which made of elements such as individual fibres, filaments, yarns, tapes, etc. that are long, small in cross section and strong in tension. One of important characteristics of geotextile is flexibility. Flexibility is useful both for good contact conditions and for avoiding stress concentration in the fibres. Besides, hydraulic functions of geotextile due to its fibrous nature allows geotextile to have a high void ratio (high permeability) and at a same time, a small filtration diameter. By stabilising the slope and improving water management

the mats provided favourable conditions for seeds germination and accelerated further plants growth. In unfavourable terrain conditions, the geotextiles enabled quick greening of that soil section slopes and formation of vegetation with great ecological value.

Fig.10 Model for proposed geotextile method

Advantages of Geosynthetics can include;

- Relatively low cost for many applications
- Ease and convenience for many applications
- Quick and effective protection against erosion problems
- Many varieties of geosynthetic products are available to meet specific needs
- May be removed and reused if economically feasible

Storage of OB and Top Soil

About 20701 cu.m of topsoil and 24841.2 cu.m of Over burden was generated from the site. The area selected for dump is near to the buffer area. A total area of 0.06Ha will be allotted for dumping top soil and OB waste. This will dump separately in NE side of the site, where the area is stable and plain. Precautions were taken to limit the height of the topsoil dump to 5 to 6 meters inorder to preserve its fertility and shelf life.

Retaining walls with weep holes and with a garland drain will be provided around the dump. Hence, contamination of surface drainage/ water body due to seepage of topsoil/OB is insignificant.

Plantation in Buffer Zone

The native trees within the buffer zone will maintain undisturbed and for more soil stability more deep routed trees, shrubs will plant to protect the soil slope. Where ever find the soil sections shall plant the species *Bambusoideae* (Bamboo) is also proposed to avoid soil erosion. The potential of bamboo in erosion control and slope stabilization has been proven worldwide. The soil and water bioengineering approach are combined with bamboo traits and mechanical properties. Also proposed more deep rooted and native species to plant along the buffer zone which enrich the green belt of the project as follows.

Sl.No.	Scientific Name	Common/ Vernacular Name	Family
1.	*Anogeissus latifolia*	Mazhukanjiram	Combretaceae
2.	*Terminalia arjuna*	Neermaruthu	Combretaceae
3.	*Dalbergia latifolia*	Eeti	Fabaceae
4.	*Sterculia villosa*	Para Vakka	Malvaceae
5.	*Butea monosperma*	Chamatha	Fabaceae
6.	*Bombax ceiba*	Elavu	Malvaceae
7.	*Dillenia pentagyna*	Pattipunna	Dilleniaceae
8.	*Grewia tiliifolia*	Unnam, Chadachi	Malvaceae
9.	*Alstonia scholaris*	Eazhilam pala	Apocynaceae
10.	*Holarrhena antidysenterica*	Kudakapala	Apocynaceae
11.	*Wrightia tinctoria*	Danthapala	Apocynaceae

12.	*Tabernaemontana heyneana*	Koonanpala	Apocynaceae
13.	*Mimusops elengi*	Elanji	Sapotaceae
14.	*Schleichera oleosa*	Poovam	Sapindaceae
15.	*Chionanthus mala-elengi*	Mala Elanji	Oleaceae
16.	*Tamarindus indica*	Puli	Fabaceae
17.	*Ficus benghalensis*	Aal	Moraceae
18.	*Ficus mysorensis*	Aal	Moraceae
19.	*Bambusa vulgaris*	Bamboo	Poaceae
20.	*Ficus callosa*	Aal	Moraceae
21.	*Polyanthia longifolia*	Arana maram	Annonaceae

Table 4: List of trees planning to plant in buffer zone

Figure 11: Site photograph

Rolled Down management

The roll down possibility of rock boulders is very low at this site since the entire lease area is massive rock formation and with few boulders. As the proposed lease area is a hilly area, propose here additional measures to manage the roll down of boulders during the site preparation phase of the mine while, top soil removal, construction of road and removal of OB. So, necessary measures have taken to control the rolling down of boulders at pre & operation phases.

According to the size of boulders, the blasting of boulders can be categorised into two:

(i) Secondary breaking methods

(ii) Blasting with expansive chemicals

Figure 12: Typical figure showing filling of chemicals for breaking of boulders

Construction of Trenches or ditches at the bottom

As an additional measure we propose here a trench at the lower altitude. A trench is an excavation in which the depth exceeds the width. Trenches will be provided with 1.5 metres height for preventing roll down possibilities. The trench will act like a container which holds on the dropdown boulders and prevents further rolling.

Fencing with Retaining Wall will be provided after trench

Different types of walls or fences are also considered here to avoid the further rolling of fall down boulders as a vertical barrier in the form of a wire mesh or anything with equivalent strength. The height of the barrier will be maintained at 1.5m and depth will be 2m, so that the boulders tending to further rolling will be bounce back to the trench by hitting the wire mesh wall.

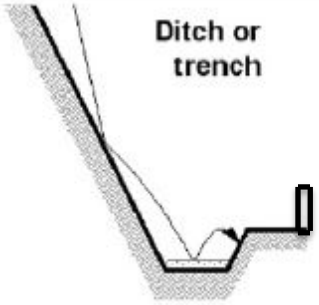


Figure 13: Schematic representation of the trench/ditch & Fencing-wire mesh

It can be concluded that the boulders present in the proposed lease area can be handle scientifically without causing any impact. For breaking boulders having size less than 1.5m, secondary breaking methods will be used. Whereas, for breaking boulders having size greater than 1.5m non-explosive chemical agents will be used. Trenches will be provided at the bottom to collect the roll down rock fragments and prevents further rolling of rocks. Fencing of about 2m height will be provided which act as a barrier.

Conclusion

As the scrutiny instruction from EAC committee meeting, the Subsidence Study for the project has been conducted. Since the proposed terrain is Rocky massive formation there is negligible possibility of the subsidence. As well we recommend few measures and practices to have a safe environment of mining activities.

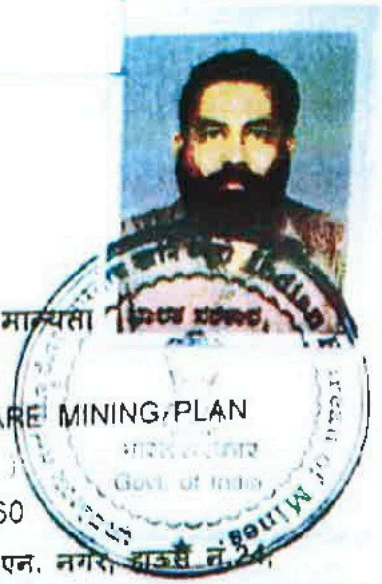
Mahesh. S **Jayachandra Paniker**

RQP/BNG/338/2014/A **DMG/KERALA/RQP/12/2017**

Place: Malappuram

Date: 21.12.2023

Annexure 1



खननयोजना तैयार करने के लिए अहर्ता प्राप्त व्यक्ति के रूप मे मान्यता

प्रमाण पत्र

CERTIFICATE OF RECOGNITION AS QUALIFIED PERSON TOPREPARE MINING PLAN

(खनिज रियायत नियमावली 1960 के नियम 22सी के अंतर्गत)

(Under Rule 22C of Mineral Concession Rules,1960

श्री महेश एस. पुत्र श्री पी. सुरेन्द्रन पिल्लई, निवासी - टी.सी. - 31/580, नवदीपम, एस.एन. नगर, हाउस नं.24, पेट्टा पोस्ट ऑफिस, त्रिवेन्द्रम, तालुक - त्रिवेन्द्रम, जिला - त्रिवेन्द्रम 695024, राज्य केरला, जिनका फोटो एवं हस्ताक्षर दिया गया है उनकी योग्यता तथा अनुभवो के संतोषजनक प्रमाण पत्र देने के एवज में एतद द्वारा खनिज रियायत नियमावली 1960 के नियम 22 सी के अंतर्गत खनन योजना / खनन अभियोजना /उतरोत्तर-खान बंद/ अंतिम खान बंद करने की योजना तैयार करने के लिये अहर्ता प्राप्त व्यक्ति के रूप में मान्यता दी जाती है.

Shri Mahesh S. son of Shri P.Surendran Pillai, resident of :-T.C 31/580,Navadeepam S.N Nagar, House No.-24, Pettah Post Office, Trivandrum, Taluk- Trivandrum, District- Trivandrum-695024, State- Kerala whose Photograph and Signature is appended herewith having given satisfactory evidence of his qualifications & experience is hereby granted RECOGNITION under Rule 22C of the Mineral Concession Rules,1960 as a Qualified Person to prepare Mining Plan / Scheme of Mining / Progressive Mine Closure Plan / Final Mine closure plan.

उनका पंजीकरण क्रमांक/ His Registration Number is

आर.क्यू.पी./बेंग/338/2014/ए	/	RQP/BNG/338/2014/A

यह मान्यता दस वर्ष की अवधि के लिए वैध है जो दिनांक **01.07.2024** को समाप्त होंगी।

The recognition is valid for a period of Ten Years, ending on **01.07.2024.**

खनन योजना / खनन अभियोजना /उतरोत्तर खान बंद/ अंतिम खान बंद करने की योजना में यदि कोई गलत/झूठ सूचनाएँ दी गई हो तो उनका यह प्रमाण पत्र वापस ले लिया जाएगा।

Furnishing any wrong/false information in the Mining Plan/Scheme of Mining / PMCP / FMCP may lead to withdrawal of this certificate.

आर.क्यू. पी. के हस्ताक्षर / Signature of RQP

02.7.14

स्थान/Place: बैंग्लोर/Bangalore

दिनांक/Date: 02.07.2014

क्षेत्रीय खान नियंत्रक/

Regional Controller Of Mines

B. RAM MOHAN

क्षेत्रीय खान नियंत्रक

Regional Controller of Mines

भारतीय खान ब्यूरो

Indian Bureau of Mines

दक्षिणी / बेंगलूर / BANGALORE

Annexure 2

GOVERNMENT OF KERALA

DEPARTMENT OF MINING AND GEOLOGY

Directorate of Mining and Geology, Pattom Palace PO,
Kesavadasapuram, Thiruvananthapuram-695004, Kerala
www.dmg.kerala.gov.in

FORM Q

CERTIFICATE OF RECOGNITION AS QUALIFIED PERSON TO PREPARE MINING PLANS FOR QUARRYING MINOR MINERALS IN KERALA

(Issued under Rule 54 of the Kerala Minor Mineral Concession Rules, 2015)

Shri. Jayachandra Panicker. P. S, S/o Sukumara Panicker. K. P, Souparnika, Navajyothi Nagar 39A, Kadappakada. P. O, Kollam District – 691 008, Kerala, having given satisfactory evidence of his qualification and experience is hereby granted **RECOGNITION** under Rule 54 of the Kerala Minor Mineral Concession Rules, 2015 as qualified person to prepare Mining Plans for quarrying minor minerals in Kerala.

The registration number is DMG/KERALA/RQP/12/2017

This recognition is valid for a period of 10 years ending 01/12/2027

Photograph of RQP

Signature of RQP

DIRECTOR OF MINING & GEOLOGY GOVT. OF KERALA

20/12/17

C. K. BAIJU
DIRECTOR OF MINING AND GEOLOGY [I/C]

C.K. BAIJU
M.Sc, MPhil, Dip.Crl, MMGI
Director of Mining & Geology (i/c)
Kesavadasapuram, Pattom Palace P.O
Thiruvananthapuram-695 004

Place: Thiruvananthapuram
Date: 20-12-2017