

3. ENVIRONMENTAL MANAGEMENT PLAN

3.1 Introduction

Sri Siddangouda S Patil , has applied for a quarry lease for extraction of Building stone in Sy No. 45/7, Belur(J) Village, Kalaburagi taluk, Kalaburagi district, Karnataka over an extent of 3-13Acres for production capacity of 52242 TPA (aggregate).

Department of Mines and Geology, Kalaburagi has notified the area in the name of Sri Siddangouda S Patil , to an extent of 3-13 acres in Sy No. 45/7, Belur(J) Village, Kalaburagi taluk, Kalaburagi district, Karnataka. The sketch showing the demarcated area to be granted under Quarrying Lease, is enclosed as Plate No.2.

Copy of Notification is herewith attached in the Quarrying Plan.

As per the statutory obligation this project needs Environmental Clearance from DEIAA Kalaburagi for Quarrying. Accordingly submitting 1) Form- IM, 2) Pre-Feasibility Report, 3) Quarry Plan approved by District Mines and Geology, 4) Land documents, 5) Notification, 6) Statutory Clearances, 7) Survey of India Toposheet duly marking the project site. To the District Level Environment Assessment Authority of Kalaburagi a constituted by Mo EFCC, GoI for issuing Environment Clearance as per EIA September 14, 2006 Notification.

The Environmental Management Plan report has been prepared for the documentation of environmental impact from the activity and significant measures to mitigate the impact.

This Environmental Management Plan report has been prepared for submission to District Level Environmental Appraisal Committee/District Level Environmental Impact Assessment Authority constituted by MOEF for obtaining Environmental Clearance.

3.2 Estimation of reserves

The reserves are estimated considering block of 3-13 Acres. The norms of Reserve estimation are of counting squares of sectional areas marked on the cross sections. About 2713338 Tons of 'Geological Reserves' are estimated in block. In order to meet the various statutory requirement some part of the lease area cannot be excavated i.e 7.5mtrs safety zone area along the Mining Lease boundary & after deducting the quantity of Non Mineable area, the Quarry able / Mineable reserves estimated is 2134959 Tons in block. The details of reserve estimation is as shown in quarry plan.

Category Wise Reserves Calculation of						
Belur Building Stone Quarry (3-13 Acres) of						
Sri. SiddangoudaS Patil						
Section	Sectional area (Sq.m.)	Sectional Influence (m)	Volume (Cu.m.)	ROM @2.66t/cmt	Saleable Building stone (98%)	Inter calculated Waste (2%)
Proved reserves						
L L'	9134	97	885998	2356755	2309620	47135
Probable reserves						
L L'	1382	97	134054	356584	349452	7132
TOTAL	10516	97	1020052	2713338	2659072	54267

Mineable Reserves Calculation of						
Belur Building Stone Quarry (3-13 Acres) of						
Sri. SiddangoudaS Patil						
Section	Sectional area (Sq.m.)	Sectional Influence (m)	Volume (Cu.m.)	ROM @2.66t/cmt	Saleable Building stone (98%)	Inter calculated Waste (2%)
Proved reserves						
L L'	8652	82	709464	1887174	1849431	37743
Probable reserves						
L L'	1136	82	93152	247784	242829	4956
TOTAL	9788	82	802616	2134959	2092259	42699

3.3 Project Description

Year wise development for next five years: The Building Stone deposit is a undulated terrain which is sloping gently north and is well exposed in the entire area. The deposit is wide enough for opening along the strike. An open cast Other than fully Mechanised method will be adopted to operate the area. Since, the annual production is 52242 TPA; the Open cast method will be followed during the plan period. The Tonnages of saleable stone and intercalated waste during the plan period is as given below:

Table 3-2 Details of production and waste

Production and Development Calculation of						
Belur Building Stone Quarry (3-13 Acres) of						
Sri. SiddangoudaS Patil						
Section	Sectional area (Sq.m.)	Sectional Influence (m)	Volume (Cu.m.)	ROM @2.66t/cmt	Saleable Building stone (98%)	Inter calculated Waste(2%)
I year						

L L'	235	82	19270	51258	50233	1025
Sub-Total	235	82	19270	51258	50233	1025
II year						
L L'	240	82	19680	52349	51302	1047
Sub-Total	240	82	19680	52349	51302	1047
III year						
L L'	244	82	20008	53221	52157	1064
Sub-Total	244	82	20008	53221	52157	1064
IV year						
L L'	249	82	20418	54312	53226	1086
Sub-Total	249	82	20418	54312	53226	1086
V year						
L L'	254	82	20828	55402	54294	1108
Sub-Total	254	82	20828	55402	54294	1108
TOTAL	1222	82	100204	266543	261212	5331

Proposed method of quarrying: Quarrying will be carried out by open cast semi mechanization method by using compressor operated jack-hammer drills, truck dumpers etc. As the rock is exposed the open cast quarrying will be sufficient.

Extent of mechanization: The Method of mining shall continue to be Other than fully mechanized method. There will be no changes in the proposed method of mining and deployment of machinery.

The following machines are proposed to be hired and used in the mines.

Table 3-3 List of Machineries

Sl.No	Machinery	Numbers
1	J.C.B	1
2	Air Compressor	1
3	Jack hammer	1
4	Tippers	2
5	Water Tank (Tractor)	1

Drilling: Depending upon the requirement of the size of lumps, to dislodge the same, drilling will be done in a single row by jack hammer. Drilled holes will be filled by the Cracking agent, where next day the lumps gets dislodge by the main rock mass.

Loading: Loading will be done with the help of excavators and loaders.

Hauling and Transport: Transportation will be done by using trucks and tractors etc., the waste and the other over burden will be transported to the waste dumping yard by using trucks/ tractors. The lumps are kept at the stack yard earmarked. The materials will be transported to the destination by hired trucks.

Disposal of Rejects and Waste: About 5% of mineral is being treated as waste in this area for first five year. The waste material is stacked in the waste dump yard and if required will be sent to road construction works. This material can be utilized till the quarrying operations are over. When the dump reaches optimum height, suitable greenery will be grown on this dump to stabilize them.

Table 3-4 Employment Potential

Sl. no	Category	Number of persons
1	Foreman	01
2	Mine Mate	01
3	Mine Supervisor	01
4	Office Clerk	01
5	Office Assistant	01
6	Helpers	01
7	Labors for Production of work	03
8	Labors for Production work	01
9	Labor for Quarrying-About	02
	Total	12

3.4 Baseline Environment

3.4.1 Land environment

The terrain consists of hilly ridge and gentle slope towards North Western & North Eastern side. The elevation difference of this mound is 525-527 above MSL.

Land is a Patta Land.

Proponent will take necessary steps to keep the area under disturbance to the minimum at any stage of quarrying operations. This shall be achieved by ensuring reclamation of the excavated area concurrently with the quarrying activities by reducing the gap between the first damage (due to quarrying and other activities) and the first repair (reclamation) to the minimum. The first step will be a successful reclamation programme, which is to decide the post-reclamation land use. In the case of the present quarrying area, it would be appropriate to convert the quarrying out area into a water-body with shady-surroundings due to the following reasons:

- As the quarry has a long life due to the vast size of the Building Stone deposit, rejects generated during the quarrying need to be systematically dumped and stabilized. Therefore, back filling and restoration of quarried-out area to pre-quarrying land use before abandoning is not feasible.
- With the above scenario, the post reclamation land use of water body, peripheral tree belt and patches of grass shall blend into the surrounding plantation set-up. The reclamation plan shall include working of following areas:
 - Inside quarry,
 - External Dumps,

- Roads, structures etc.
- The disturbed land will be fully reclaimed before abandoning the quarry. To depict the total land use within the quarry area due to the proposed activities, stage plans have been prepared at five yearly intervals. The land uses at different stages of the quarry are shown in the Plates of quarrying plan, up to 5 years of quarrying operations.
- The green belt around the quarrying area in the form of strengthening the plantation growth shall be carried out systematically and continued. The Building Stone nature is such that quarry bench reclamation may not be started before exhausting the Building Stone deposit.
- The total green belt area shall be divided all-round the lease boundary. The reclamation process shall take about one year for grading, soil spreading, stabilization and another three years for landscaping and plantation stabilization. The area will be reclaimed in stages and be fully reclaimed after five years of completion of quarrying excavation.

The details of the utilization proposed area for the next five years as follows:

Table 3-5 Land use details

Particulars	Existing	Total
Area for Mining	0-24	2-28
Roads	0-02	0-02
Mineral Stack yard	--	0-00
Infrastructure	--	0-00
Safety zone	0-23	0-23
Un-utilized area	2-04	--
	3-13	3-13

3.4.2 Geomorphology and Soils

The northern part of the district represents a plateau, typical of Deccan Trap terrain and is deeply indented with ravines. The southern part represents undulating terrain with sparsely distributed knolls & tors. The prominent hill ranges in the district at Shorapur and Shahpur have an altitude of 567 & 604 m amsl respectively. The ground elevation varies significantly from 340 m amsl in southeast to 620 m amsl in the north. The regional slope is towards south and southeast.

The soil types in the district are deep black, medium black soil, shallow soil and lateritic soil. The deep & medium black soil covers practically the entire district's area, except a small portion towards the northern part of the district. Black soil has been derived from basaltic rocks and varies in color from medium to deep black. Its thickness varies from 0.5 to 3.6 m. Infiltration rate of shallow, medium and deep black soil is moderate to poor. Infiltration rate of medium black soil recorded in the district is 2.5 cm/hr. Lateritic soil occurs in small extent towards the northern part of the district and its thickness varies from 1.0 to 5.0 m. It has moderate to good infiltration characteristics.

3.4.3 Hydrogeology & Water quality

The southern part of the district comprises the Peninsular Gneiss and granites. Central, northeastern and southwestern part comprises of sedimentary formations viz. sandstone, quartzite, shale, slate, limestone and dolomite (Figure 3). Deccan Trap basalts cover

northern and northwestern parts. A small portion in the north is covered by alluvium and in the northeastern part by laterite.

3.4.4 Ground water quality

Major ground water bearing formations are granite, gneiss, limestone and vesicular basalt. Ground water occurs in weathered, fractured & jointed zones of these formations. In weathered zones ground water occurs in phreatic condition, whereas in the fractured & jointed formation it occurs in semiconfined to confined condition. The main source of recharge to ground water is precipitation, followed by seepage from canals and return flow from irrigation. Deccan Trap basalts, which comprise different flows, fractures & interstitial pore spaces of vesicular zone, are good repositories of ground water. In limestone, solution cavities are considered to be more potential than weathered and fractured zones. Laterite have primary porosity and are considered to be moderately good aquifer.

3.4.5 Noise and vibrations

Noise and vibration there are some noise from neighboring quarrying activities. Steps will be taken to minimize the noise to prevent noise pollution. Vibrations and noises are minor while quarrying as open cast mining is carried out for the proposed project. However, Necessary steps will be taken to minimize the vibrations and to check noise.

3.4.6 Air Quality

The air is clear and healthy as there are no industries and natural clear air is available to the quarry workers.

3.4.7 Climatic conditions

The southwest monsoon sets in the middle of June and extends till the end of September. Bulk of the annual rainfall occurs during this season, which constitutes over 75% of the annual rainfall. Significant rainfall occurs during the winter monsoon owing to northeastern monsoon, which constitutes 15% of the annual rainfall. Normal Rainfall of the district is 777 mm (1901 - 70) and actual rainfall is 881.10 mm (2005). Normal rainy days (as per 1901 - 70) are 46. Although, consistent normal rainfall is prevalent, Sedam, Kalaburagi & Chitapur taluks experience mild drought conditions. Gulbarga district lies in the northern plains of Karnataka and has semi – arid type of climate. Dry climate prevails for most part of the year. December is the coldest month with mean daily maximum and minimum temperatures being 29.5oC & 15o to 10oC respectively. During peak summer, temperature shoots up to 45oC. Relative humidity varies from 26% in summer to 62% in winter.

3.4.8 Socio-Economic environment

The people of this area are farmers and agricultural laborers. They are engaged in cultivation. This quarry will provide employment to some extent to the local people, thus improving socioeconomic conditions.

3.5 Environmental Management Plan

3.5.1 Introduction

Mineral deposits are exploited for the sustained development of the country. But this economic activity is likely to cause some adverse impact on the environment and

ecosystem of the area. Therefore, it is obligatory on the part of the lessee to implement suitable control measures to mitigate the adverse impact of the various quarrying operations. After analyzing and study of the quarry, it is found that the quarry activity certainly will have little effects on the different environmental parameters as is evidenced in the earlier chapter. It is possible to control the deterioration of environment due to quarry activity by adopting and monitoring few fixed practices as described in detail in this chapter.

3.5.2 Environmental Impact Statement & Control measures

3.5.2.1 Climate

The proposed quarry activities are not likely to contribute to any variation in the climate parameters of the region. The variations observed are on a regional scale and the control factors lie much beyond the small area considered for Quarrying. Hence no management measures are needed and proposed.

3.5.2.2 Air Environment

The sources of air pollution in the region will be due to quarrying and the related transportation activities. The meteorology of the area becomes an important parameter in environmental issues in the mining settlements. Suitable measures to protect the inhabitants and environment against the dust and fumes emanating from vehicular movements are required to be taken. The dust generated is from the mine haul roads and drilling/cutting/loading sites. It is proposed to take up mitigative measures in the form of sprinkling water in the sensitive areas and also create green belt along lease boundary to act as a dust barrier. The gaseous pollutants namely SO₂ & NO_x are below detection level. As stated earlier the gaseous pollutants in and around the quarry are well within the permissible limits There is no likelihood of the concentrations exceeding the standards as there is no dust emanating from the drilling & wire saw cutting units. There is no other factory or beneficiation unit in the lease area. However, gaseous pollutants will be monitored as per the requirement.

The future quarrying operations are not expected to raise the concentration of the pollutants beyond prescribed limits, as the production capacity and equipment shall remain the same as at present. However, the following measures would be adopted to mitigate the SPM levels in ambient air.

Dust particles, which are normally generated during quarrying operations, on becoming air borne lead to increase in SPM levels in the ambient air. Another source of dust generation is the transport of the material by trucks. Adequate control measures shall be taken up during quarrying operations as well as transportation. The control measures are:

- Dust suppression by water injection while drilling.
- Using sharp teeth for excavators would reduce dust generation.
- Dust suppression by water spraying with tankers and sprinkling system would be adopted on roads used for transportation.
- Afforestation around the quarry to filter out the dust and preventing it from reaching the residential areas would be undertaken.

For dust suppression on the haul roads, sprinkling system along the permanent portions of the haul road will be adopted. In addition to the control measures adopted during quarrying and transport operations, reclamation of dumps and quarried out areas would be done with minimum gap between dumping/excavation and reclamation to fix the loose material and prevent dust getting airborne.

3.5.2.2.1 Dust Control

The dust generated from loading and transport operations will be controlled by water spraying. For these purposes water tanker fitted with sprayer will be used at haul road, etc. Sprinkling water on the roads by tanker will be practiced. The water tankers to be deployed for dust suppression. The water availability is adequate & the applicant will provide structures for ground water recharging in their field to replenish the aquifer. The number of trips of tankers supplied to the mine measures the quantity of water supplied. The number of trips is recorded in a logbook every day, which will be duly certified by the in-charge so as to have control on the trips of water utilization. Further the green belt proposed all-round the Quarry lease boundary will act as a dust filter and arrest the spread of air borne dust on to the nearby agricultural lands and villages. The office complex is also suggested to be surrounded by green belt, to arrest the spread of dust to the other locations.

3.5.2.3 Noise Environment

The haulage vehicles shall be maintained with proper lubrication, fitting of effective silencers and maintenance to reduce the noise. The proposed green belt around the lease area will help in reducing the noise level.

The deployment of the machines for excavation, transport, dumping and other auxiliary operations has adverse impact on the noise levels within the lease area. However, in the proposed area, the noise level will remain the same as of the pre-quarrying stage. Additionally, due to the large distances of the quarrying area to habitation areas, there is negligible impact of the noise levels. However, the following measures are being taken to reduce the impact to the minimum.

- Green belt around the periphery of the quarry to attenuate noise.
- Tree would be planted on the side of the approach road to the quarry area.
- Proper maintenance of noise generating machinery including the transport vehicles.
- Provision of silencers to reduce noise generated by machines.

Table 3-6 Permissible Noise Exposure for different period of time

Duration per day (Hours)	Sound level dBA.
16	80
8	85
4	90
2	95
1	100

1/2	105
1/4	110
1/8	115

3.5.2.4 Water Environment

It is proposed to use water for sprinkling over the roads for suppression of dust during summer. The major source of water pollution in open cast quarrying is the surface run-off carrying the fine silt. The problem is prevalent mostly in rainy season. For this control measures by way of providing check-dams along the boundary of the project site outside the lease area will be initiated and will be strengthened further and the lessee will also take up erection of retention walls along the dump toes, slopes & take up afforestation on the side of these retention walls to minimize the flow of silt. Drains should be constructed to channelize the water in loose soil areas to prevent erosion.

3.5.2.5 Storm Water Management

Check dams will be constructed to contain the surface run-off of the silt and sediments from the lease area during heavy rainy season. Garland drain around the quarry will be made to divert the water from working areas.

The major cause of surface water pollution during the opencast quarrying activities of this quarry is the wash-off from the excavated areas and dumps. The program to prevent water pollution shall focus on controlling wash-off from these areas. Control measures have been proposed to check not only the wash off from the excavated areas and soil erosion but also uncontrolled flow of quarry water into the natural drainage.

These measures are briefly discussed in the following paragraphs:

- A water gradient of about 1 in 21 shall be kept at every bench towards the inside of the bench to prevent formation of gully in the bench slopes and the soil being carried away by storm water.
- Bunds will be erected on the outer edges of the dumps to prevent formation of erosion gullies along the dump slopes. Chutes shall be constructed by being local stone or masonry to guide the water from the dumps and prevent uncontrolled descent of water along dump slopes thus causing soil erosion.
- The worked out quarry benches and dump slopes would be stabilized by planting appropriate shrub/grass species.
- Loose material final slopes will be planted by making contour trenches at 2-m interval to check soil erosion due to rain.
- Garland drains will be provided around the excavations, dumps and along roads to divert storm water from broken areas into the quarry sump where the water percolates into the ground due to porosity of building stone material.
- During monsoon, the probability of water flowing into the working benches increases. Garland drains will be provided around the excavations to prevent storm water from catchments area coming in contact with freshly excavated areas. Making garland drain and diverting the water into the natural drainage channels shall prevent the inflow of rainwater into

quarrying benches. Water from the garland drains shall be taken to settling pits to settle suspended solids before release into surface drainage.

- All water channels/drains carrying rainwater from the quarry will be provided with check dams and settling pits to arrest the suspended solids, if required. With no major water body in the vicinity and the afore proposed management measures, there will be very marginal effect due to the operation of this quarry, if any, on the surface water quality as well as quantity in the catchments.
- There are no wells or springs in the quarrying area. Since there is no scope of ground water sources drying up or any chance of harmful chemicals leaching from the quarry or dump, there is no chance of pollution or depletion of ground water. Hence, no control measures are necessary. Moreover, as explained in previous chapter quarrying could lead to enhanced recharge a positive impact.

3.5.2.6 Land Restoration/Reclamation

Land restoration or reclamation of the area is very essential in any mining industry. Proper measures adopted during restoration will control most of the adverse environmental impacts of Quarry and also improve the aesthetic beauty of the area. Due to the Quarry activities in this area the profile of the ground will change due to formation of pits. At the end of the Quarry operations, the top soil/mineral rejects will be utilized for back filling wherever suitable and rehabilitated.

3.5.2.6.1 Reclamation Schedule

Green belt formation has been started all along the boundary and roads. All these areas that do not fall within quarrying related activity have been covered under green belt. The green belt is strengthened every year by additional plantation in the intermediate open patches. Starting from the northern portion, the green belt shall be extended towards southern directions along the east and west QL boundaries. The average width of the green belt shall be about 7.5 m in the north and about 7.5 m on the eastern and western flanks. The well-developed belt shall add to aesthetic value. The annual green belt coverage shall be about 0.02 acres with more emphasis on strengthening the green belt. The reclamation of dump shall be taken up in the future. The availability of areas for reclamation shall increase continuously, with the advance of quarrying and part of the quarry and dumps reaching their final positions. Any area achieving the final position shall be immediately taken up to reclamation.

The steps of reclamation of dump shall include:

1. The steep areas of the final dumps shall be graded. It is proposed to keep the final slope to the natural angle of repose of the dumped material.
2. The retaining wall built all along the dump toe shall be strengthened.
3. After grading of the final terraces, soil shall be spread uniformly over the area forming a thickness of 0.25 to 0.50 m.
4. The soil while spreading, shall be mixed with fertilizer, watered and planted with grass and shrubs for stabilization and binding the soil.

5. Along with sowing of grass for stabilization of the soil, pits shall be dug and trees planted.

The complete procedure from preparing an area for reclamation, plantation and stabilization is expected to take about four years. The annual reclamation shall be at an average rate of 0.05 acre per year until ultimate pit of the quarry is achieved.

3.5.2.6.2 Back-filling/Dumping of Overburden

For reclamation of benches, the overburden/rejects from quarrying shall be backfilled on the benches. A layer of about 0.5 m of the overburden shall be laid on each bench. This loose material will help in easy penetration by the roots in the initial years of plant growth.

3.5.2.6.3 Preparation of Quarry Benches for Afforestation

The quarry benches available for afforestation will be provided with a parapet (of local stone) of about 30-cm height at the edge of each bench. A 10 cm layer of topsoil shall be spread over the benches with a base layer of rejects thickness of about 0.2 m thick. The areas will be roughly leveled manually and divided into plots of different sizes and shapes depending upon the location.

3.5.2.7 Maintenance of Roads

The roads constructed during quarrying shall be kept in good condition during the reclamation/afforestation period until the quarry is fully reclaimed and abandoned. The material required for planting trees such as saplings, manure, water etc. can be transported to the site by trucks/tractor-trailers/pipeline.

3.5.2.8 Topsoil Management

The top soil in the quarrying lease area will be used for afforestation. The overburden is the mixture of stone fragments with soil. This is conducive for agriculture.

3.5.2.9 Plantation

Plantation shall be done to prevent emission of dust from the quarry area. The aim of plantation of dumps and quarried out areas is to stabilize the land to protect it from rain and wind erosion, as the working areas contain broken material and fine particles. The plantation scheme shall broadly cover the following areas:

- Green belt formation around the quarry
- Plantation along roads
- Reclamation of dumps
- Reclamation of quarried out areas

Apart from the green belt plantations for controlling fugitive emissions and noise, the plantation shall create an aesthetically pleasing site.

3.5.2.9.1 Plantation Species

The plantation species have been considered keeping in view the following:

Adaptation to the Geo-climatic conditions of the area. A mix of round, spreading, oblong and conical canopies, different heights ranging from 4 m to 20 m and preferably evergreen trees is selected. The species that have history of good survival and growth under similar site conditions shall be planted. The species proposed to be planted are given in table.

Table 3-7 Species proposed to be planted

Sl.No.	Tree Species	Common Name
1	Azadirachta Indicia	Neem
2	Alhizzia sp	Siris
3	Dalhergia Sissoo	Sisham
4	Cassia sp	Amaltas
5	Pongamia pinnata	Karnj

The above species have been recommended by the Central Pollution Control Board in its guidelines for green belt formation and are adaptable to the geo-climatic conditions of the area.

Plantation by direct seeding synchronous with the onset of rains for the green belt shall be started. This will involve preparation of local site with regard to water harvesting, soil and water conservation measures and weeding. It will give the initial advantage of time, saving by eliminating nursery, sapling transport and planting. It has the advantage of improving the form of the tree and its rooting pattern. The plantation is generally done using saplings procured from forest department nurseries.

3.5.2.9.2 Nursery

Success of afforestation measures at site will depend on investigation of soil selection of suitable species and a good planting stock. For this reason, the saplings for plantation are brought from the nearby forest nurseries. The sapling requirement is met from the forest department. The saplings brought from the forest nurseries are directly transported to planting sites.

Afforestation will be carried out in accordance with a timetable drawn up for sowing and plantation depending upon the afforestation requirements and species to be planted with regular guidance of authorities.

3.5.2.9.3 Planting Methodology

The plantation site is prepared by digging the required number of pits. 30 cm diameter pits are dug at 3m interval up to a depth of 50 cm wherever possible. The healthy nursery raised saplings put in polythene containers are transported to the plantation sites in baskets. Planting is done soon after the first monsoon showers. After planting the saplings, the pits are refilled with soil mixed with 4 to 5 kg of FYM and 80 to 100gm of phosphate fertilizer. The soil around the plant is pressed with feet. The level of the refilled soil is kept about 5 cm below ground for water harvesting. The filled pit is mulched with dead leaves, vegetation or straw to minimize the evaporation losses. Watering is

continued after plantation during dry spells. Watering is done manually. A water trolley supplies water in the plantation area.

Cleaning and weeding is done twice during first and once during the following seasons. Planted area is inspected regularly and mortality rate assessed for each species. Fresh saplings are planted to replace the dead and decaying plants.

The method adopted for fruit trees is same as given above. Manure, chemical fertilizer and insecticide are used more liberally, that is twice as much as for other trees. The frequency of weeding and cleaning is also increased to three in the first season and two in the subsequent seasons.

Nothing is more discouraging to a tree seedling than being eaten. Thus, protection from grazing animals is essential. For the protection of saplings in open areas, barbed wire or fencing along with deputation of security personnel shall be made.

3.5.2.9.4 Stabilizing Planting:

Construction of check dams is necessary for preventing the downward movement of solids, stabilization of planted vegetation and improving the water regime. The check dams will be constructed liberally and at appropriate places. The width of check dams will be 1.5 times more than the height and the wall of check dam. It shall be raised from the base ground level. The upper side of the check dam shall be vegetated by putting appropriate shrubs/plants.

3.5.2.9.5 Plantation Schedule:

Keeping the master plan at abandoning stage in mind, the stage-wise plantation shall be done. Schedule of plantation of the total area in and around the quarry will be planted to be carried out in the manner given in Table.

Table 3-8 Schedule of Plantation

Year	No. of Plants	Total Green Belt Reclamation
1	150	150
2	150	300
3	Maintainers	Maintainers
4	Maintainers	Maintainers
5	Maintainers	Maintainers

3.5.2.9.6 Provision of Green Belt along the affected area

Development of the Greenbelt around the project site. The major pollutant is generation of dust. This is an effective way to check pollutants and their dispersion into surrounding areas. The degree of pollution attenuation by a green belt depends on its height and width, foliage surface area and density. The main objective of green belt is as follows:

1. Mitigation of impacts due to fugitive emissions caused by vehicles
2. Attenuation of noise levels
3. Ecological restoration
4. Creation of aesthetic environment

3.5.2.10 Control on Soil Erosion

The only source of soil erosion is from soil dumps. Since there is no solid waste/overburden there will not be any effect and hence chances of soil erosion is negligible.

3.5.2.11 Management of Socio Economic status

The mining activity will improve the economic status of the people in the region. Continued Quarrying activities, will benefit the local people due to provision of more infrastructural facilities provided by the mining industry, as mining industry boosts up the local market, which will invite people from different places to install their ancillary units. Thus the population density may have some effect over traditional life style of the local people, and it may create scarcity of the essential commodities thus creating rise in prices. Adequate facility for drinking water, health, education, recreation and employment is provided to the workers and shall be continued.

3.5.2.12 Disaster Management Plan

Disaster Management Plan is envisaged with a goal to prevent hazards and accidents at work places by careful design, operation, maintenance and inspection of the Quarrying machineries & equipment. All the quarry activities will be in accordance with the approved Quarrying plan and directives of Directorate General of Mines Safety. All the eligible employees will be sent to refresher courses from time to time on safety issues. The control measures will be adopted to take care of hazards/disasters that may occur during quarry operation.

- Safety awareness through competitions, posters & organizing safety weeks every year
- Firefighting & first aid provisions will be provided in mines office & quarry lease area.
- All safety appliances to be made available to all the staff.
- Proper maintenance of haulage roads

3.5.2.13 Occupational Safety and Health:

Occupational safety and health is very closely related to productivity and good employer-employee relationship. The main factors of occupational health in quarries are fugitive dust and noise. Safety of employees during blasting operation and maintenance of quarrying equipment and handling of explosive materials will be taken care of as per the Quarrying Act. To avoid any adverse effects on the health of the workers due to dust, heat, noise and vibration, sufficient measures have been provided in the quarry project. These include:

- Provision of wet drilling.
- Provision of rest shelters for quarry workers.
- Provision of personal protection devices to the workers.
- Dust suppression on haul road.
- First aid facilities in the quarry area.

3.6 Environmental Monitoring

The Monitoring of pollutant in quarry will be as follows:

- Air monitoring
- Water quality monitoring
- Noise monitoring
- Soil testing.

Air-Monitoring

Work zone ambient air monitoring in quarry area is conducted once in a month from the operations like Excavation, Loading, Transportation (Haul road), etc.

Water Monitoring

Water samples are collected once in 3 months from the nearby village bore wells and analyzed. Additionally, water levels in these wells shall also be monitored regularly.

Noise

Noise measurement of quarry equipment is done once in six months. Noise measurement will be taken before and after overhaul Noise levels at the lease boundary shall be monitored quarterly.

Soil Sampling:

Soil samples will be tested before plantation, vegetation of the area. These areas shall be monitored every six months thereafter.

3.7 Environmental Management Cell

The proponent has created a cell consisting of officers from various disciplines to co-ordinate the activities concerned with the management and implementation of the environmental control measures. The environmental management cell undertakes monitoring of pollution levels by measuring ambient air quality, water quality, noise levels etc., by appointing external agencies.

The Environmental Management Cell co-ordinates with all the related activities such as collection of statistics for health of workers and population of the region, reclamation, afforestation and green belt development. The activities of environmental management cell are co-ordinate by the management itself.

Budget for Environmental Management Plan

After an in depth study of the Environmental Management Plan, the project proponent may make estimates of expenditure on annual basis for the implementation of different environmental protection programme.

The details of investment for procuring the equipment for successful environmental parameters and implementation of control measures are given approximately in below table.

Table 3-9 budgetary provisions for Environmental Management plan:

Sl. No.	Activity	Proposed Quantity	Unit Price (in Rs.)	Capital Cost (Rs.)	Recurring Cost/Yr.(Rs)
1	Afforestation/Green belt development	150 Saplings/yr	500/sapling *	-	75,000-00
2	Barbed wire fencing	458 m	250/m	1,14,500-00	-
	1. Barbed wire fence				
	2. Poles (for every 2m distance)	229	300/pole	68,700-00	
	3. Concrete and lime for filling pits	229 x 0.1 m ³ = 22.9	9000/m ³	2,06,100-00	
3	Drains	150	200/m	30,000-00	-
4	Water for Drinking, Dust suppression, & Plantation	3.78 KLD	200/kld	-	2,26,800-00
5	Periodic Medical Checkup & PPE supplies	Frequency : Half Yearly	12,000/Half Year	-	24,000-00
6	Environmental Monitoring	Frequency : Half Yearly	12,500/ Half Year	-	25,000-00
7	Fire protection	Annual	50,000/annum	-	50,000-00
8	CSR Activities	Annual	--	--	50,000-00
9	Miscellaneous costs	Annual	50,000/annum	-	50,000-00
Total				4,19,300-00	5,00,800-00

* Including transportation & plantation cost

** Including transportation charges

3.8 Conclusions

This investigation has been taken up to assess the quality and quantity of Building Stone available in the area granted. The quarrying tests so far made reveals that the material is good in quality and has good demand in local and foreign market. This quarry works is far away from the neighboring villages and not have any effect on the local environment.

Suggestions/Recommendations

The Building Stone is very hard, compact and massive in nature. It is fine to medium grained. The material is having good market both local, it is recommended to develop the quarry systematically by using modern methods and machinery. Production will be stepped up gradually. This quarry will improve the status of the local people by providing them a better living.

Even though there is no perceptible impact from the quarry activity on the environment of the region, it is imperative that mitigative measures have got to be implemented on full scale for creating environmental balance and maintain the ecology of the region. The following suggestions/recommendations are to be given merit in this regard.

- As no control over wind can be exercised, the frequency of the dust suppression measures like constant watering of the haul roads shall be practiced.
- Afforestation as envisaged in the Quarrying plan is to be carried out so that it not only enhances the green canopy but also stop the spread of dust particles and air borne pollutants.
- Surface water conservation measures and groundwater recharge be given high priority.

Environmental Monitoring-Financial Implications

After an in depth study of the Environmental Management Plan, the project proponent may make estimates of expenditure on annual basis for the implementation of different environmental protection programme.