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CHAPTER - 5

ENVIRONMENTAL MANAGEMENT PLAN

5.1 *INTRODUCTION* :-

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This section discusses the management plan for mitigation/abatement of adverse environmental impacts and enhancement of beneficial impacts due to mining. The EMP has been designed within the framework of various Indian legislative and regulatory requirements on environmental and socio-economic aspects.

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The adverse environmental impacts can be mitigated by following one or all of the following measures:

i. To restrict minimum land degradation by deploying appropriate scientific mining technologies
ii. To prepare and implement scientific land reclamation methods for the restoration of the degraded land
iii. To improve suitable plantation programme in the target area
iv. To select mining areas which would affect the forest area to the minimum
v. To adopt scientific methods to disturb less the existing water environment and
vi. To develop and adopt suitable methods for improving socio-economic condition of the area.

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Thus, keeping in view the impacts and mitigative measures, the Environmental Management Plan of Ajitaburu Iron & Manganese Ore mine is based on the following consideration:

i. Proposed project activities

ii. Study on EIA
iii. Air and water pollution control
iv. Work zone environment improvement
v. Solid waste management
vi. Biological reclamation and landscaping
vii. Occupational hazards and safety
viii. Environmental monitoring facilities
ix. Environment management costs

The mitigation measures recommended in the Environmental Management Plan are described for those specific impacts of environment which are likely to have adverse impact as predicted earlier for various activities. The following measures shall be the integral part of the project and implemented at desired level for better environmental management.

5.2 *MEASURES FOR CONTROLLING AIR POLLUTION :-*

Mitigative measures suggested for air pollution control are based on the baseline ambient air quality monitoring data. From the point of view of maintenance of an acceptable ambient air quality in the region, it is desirable that air quality should be monitored on a regular basis to check it vis-à-vis the standards prescribed by CPCB and in cases of non-compliance, appropriate mitigative measures shall be adopted.

As per the results of ambient air quality monitoring data, the background concentrations of SPM, RPM are within the stipulated CPCB standards for most of the samples. The proposed mining operations and related activities are expected to add to the levels of air borne particulates. However, the increment of gaseous pollutants due to the proposed mining activities is expected to be relatively low, as predicted in Section - 4.7.

As the mining activity within target area is very small and is mostly manual, there is very little scope of air pollution because of the mining activities. However, for day to day mining operation the following preventive measures are undertaken and will be continued:

5.2.1 *Controlling Dust Level ;*

Dust would be generated during mining operations, and also during handling and transportation of the material. The suggested control measures are:

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Mines

- Dust suppression systems (water spraying) to be adopted at
- Faces/sites while loading;
- Use of sharp teeth for shovels;
- Dust extraction systems to be used in drill machines;
- Use of sharp drill bits for drilling holes and drills with water flushing systems (wet drilling), to reduce dust generation.

Stock-piles

- Mist sprays will be provided at appropriate places for preventing dust pollution during handling and stockpiling of shale.

Haulage

- Regular water spraying on haulage roads during transportation of ore/waste by water sprinklers.
- Transfer points shall be provided with appropriate hoods/chutes to prevent dust emissions.
- Dumping of ore/waste should be done from an optimum height (preferably not too high) so as to reduce the dust blow.

5.2.2 *Controlling NO_x Levels ;*

NOx emissions in the mine mainly occur during blasting operations. The main reasons for NO_x emissions are:

- Poor quality of explosives having large oxygen imbalance. This may be due to:
  - Manufacturing defect;
  - Use of expired explosives in which ingredients have disintegrated
- Incomplete detonation, which may be due to low Primer to column ratio.

However, no significant blasting would be required in the proposed mining operations. The only other source of NO_x would be due to vehicular emissions which are also very less in numbers.

5.2.3 *Occupational Health & Safety Measure to Control Dust Inhalation ;*

All the above precautions would be adopted to prevent dust generation at site and to be dispersed in the outside environment. However, for the safety of workers at

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site, engaged at the strategic locations/dust generation points like drills, loading & unloading points dust masks would be provided. Dust masks would prevent inhalation of RPM thereby reducing the risk of lung diseases and other respiratory disorders. Regular health monitoring of workers and nearby villagers will be carried out by M/s Devkabai Velji.

5.3 *MEASURES FOR CONTROLLING WATER POLLUTION :-*

The proposed mining operation would be carried out above the normal ground water table. Therefore, chances of mine water discharge would be insignificant other then monsoon season. During the monsoon period the estimated daily discharge would be 4m^3/day and the same can be consumed for green belt development or dust suppression activities where per day water requirement would be about 6 - 18m^3/day (refer water balance diagram as shown in Figure 5.1).

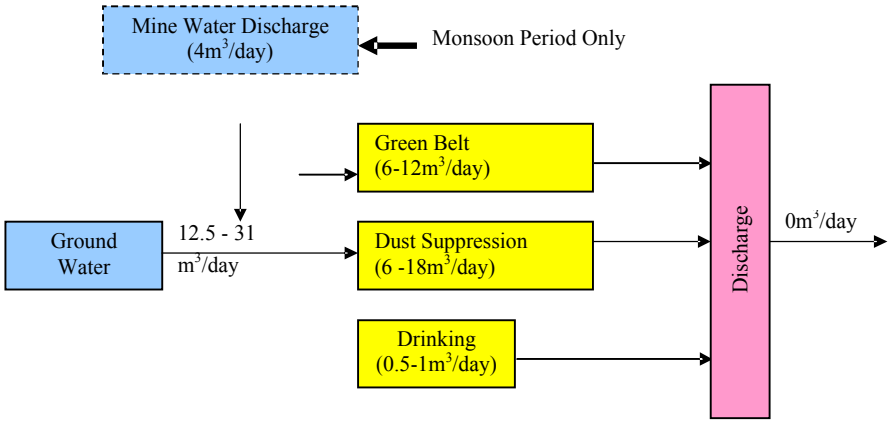

Figure 5.1: Water Balance Diagram

However, an alternate water pollution control measures has been formulated. The objectives of these measures are to regulate the surface water of the mining area in such a manner so as to cause minimum contamination and alteration of drainage system. Present topographical feature of the area is such that water (mostly precipitate) flows away from mining area. Development of dump and quarry will interfere with natural course of the streams flowing down the area which may have impact on the natural drainage system. Therefore, garland drains will be constructed all rounds the dumping and quarry to guide the water down to join the natural water course again (out side the project area) after necessary treatment whenever required.

There are two aspects of collection of surface run-off in respect of overburden dumps. First the water flowing from the over burden is to be collected and directed

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to pass over filter drains which will be provided at the foot of the dump. The filter drain would arrest suspended solids and clear water would pass into storm water drains. Further precipitation' run-off from over burden dump would be directed to nearby storm water drains through controlled discharged outlets and would be regularly monitored for silt load and nitrate level to enable corrective actions before water meets natural water course or otherwise use for some other purpose. The followings measures are to be taken up.

i. Construction of garland drain around quarry, waste dump yard etc.

ii. Check dams will be provided around the overburden dump site to arrest loose sediment, before discharging into the drainage system of the region

iii. Drains will be cleaned up periodically

iv. Small stone/rock barriers of about 1.2 to 1.5 m. height across the drains shall be constructed at intervals to check the water current and to arrest the solid particles

v. Small grasses and bushes shall be planted along the drain to hold back the solid particles from draining away

vi. No overburden or loose sediments will be kept in the workings benches particularly during monsoon months

vii. Some of the drains which will serve for a longer period shall be made permanent

viii. Effluent water from the quarry if any will be pumped and discharged to the adjacent garland drains.

ix. Finally all the water of mines shall be passed through settling tanks and after treatment shall be discharged to the seasonal nallahs which is flowing nearby area. This stream after a long traverse meets Karo River.

5.3.1 Water Table and Ground Water Contamination ;

Ground water will be never affected. The discharge of the water to natural drainage system will help in regaining the water table to some extent. Though ground water samples do not show any contamination, but continuous monitoring of ground water by installing 10 cm diameter piezometer at suitable location is suggested. Piezometers are designed for both water level measurement and water sampling to assess ground water quality. However, leaching effect, if any, will be checked considerably by putting a good green cover and developing a good drainage system over the overburden dump.

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5.3.2 **Drinking Water ;**

As such, no treatment for water is necessary as all the parameters are well within the norms of ground water quality. However, water shall be treated before use for drinking purpose. Before water is supplied for consumption it has to be ensured that the water is free from any pathogens.

5.3.3 **Solid Waste Management ;**

5.3.3.1 *Nature of Waste --*

Types of waste material expected to be produced at the mining site will be as follows:

i. Top soil
As the top soil layer is very thin separation of topsoil is very difficult. Therefore, the generation of topsoil would be insignificant and its storage would be difficult.

ii. Overburden
They are Laterite, Cherty quartzite, shale and morrum. The thickness is up to 1 m. at places. Iron content in overburden is less than 50%. Roads are made using the OB instead of cutting virgin areas. The top soil, which comes as wash off along with rain water gets arrested in three check dams. This is cleared at regular intervals and the same is utilized for massive afforestation programme in and around mine.

iii. Waste Associated with Ore
In Ajitaburu iron and manganese mines ore is lumpy and bouldery iron ore, flote manganese ore and blue dust. These ores are found in association with weathered laterite, lateritic soil, cherty quartzite etc. After separation of ore this weathered laterite and laterittic soil etc. will be dislodged as waste material.

iv. Sub-grade Ore
The ore which will be dislodged from the quarry face will be sorted out carefully, and then saleable iron ore will be separated from sub-grade iron ore having Fe content 55% to 60% ands saleable manganese ore will be separated from sub-grade manganese ore having Mn content of 10% to 20% and recovery about 1.2 to 2%. As per the market demand, whatever iron and Mn sub-grade will be generated, that will be judiciously blended with high grade ore to make it saleable. As such there will not be any stock of sub-grade ore from fresh generation.

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5.3.3.2 *Selection of Dumping Sites*

The dumping site Dump 4 is old and is selected after considering various alternatives based on the following observations:

- Non-mineralized area proved by DTH hole and surface geological study also.
- Area with comparatively gentle slope, so that maximum quantities can be accommodated in small space.
- Easily approachable.

5.3.3.3 *Maximum Height and Spread of the Dump*

In Ajitaburu mine, all the dumping will be done in old dumping area over 2.33 Ha. A detail of the proposed OB dump is given below. The in-situ volume of waste and overburden material as well as loose volume with 30% swelling factor has been considered.

Table 5.1: Details of Solid Waste Dumping during 1st Five Years

Year	In-situ volume of waste (m^3)	Volume of waste/OB considering 30% swelling factor (m^3)
1st year	82520	24756
2nd year	135934	40780
3rd year	76164	22849
4th year	84912	25474
5th year	76800	23040

During the proposed mining operation waste–overburden, which will be generated, will be shifted to the proposed dumping site by dumpers and there after, the material will be leveled to form a plan surface. Spaces usually 8 – 10m from the edge of dump are kept clear from dumping for benching/terracing purpose. The toe of the dump is proposed to be surrounded by retaining wall and garland drain to check rolling down of debris and dump wash-off.

5.4 ***LAND USE PLANNING :-***

As compared to present scenario, a much better land use will come into view when the forestry will be developed on the overburden dumps and other selected sites. Mining is only interim land use and substantial greenery will be noted within 4-5 years.

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In coming 5 years it is proposed to develop a 10m wide green belt all along the boundary line of the leasehold area which covers 0.55 Ha as per the advise of Forest Department to have a greenbelt.

5.4.1 **Afforestation and Landscape Development ;**

The green belt programme shall help in:

i. Protection and stability of dumps
ii. Prevention and degradation of land and soil
iii. Prevent ion of dust
iv. Maintaining ecological balance
v. Increase in aesthetic value.

The forest cover when fully developed will have a tree density of about 1000 tree per hectare. This is much higher as compared with the natural forest already existing in the vicinity. Terraced formation shall give much better landscaping. Plantation along periphery, selected spots and road sides will help to develop a much better and improved landscape.

5.4.2 ***Scheme and Selection of Species ;***

Mining lease over an area of 46.62 hectares within compartment no. 31 of Ghatkuri Reserve Forest in Serenda Forest Division was granted to M/s Devkabai Velji who is working from 4th Aug.'1953. In course of 44 years of mining 15.57 Hectares of forestland had been degraded for mining and allied works. Here the lessee had opened 16 quarries since beginning, there are some degradation due to these quarries and opening up of road for transport from these quarries. No further degradation in coming 5 (five) years is anticipated, as work will be restricted within broken land.

In coming 5 (five) years it is proposed to develop a 10 meters wide green belt all along the boundary line of the leasehold area which covers 0.55 hectares as per advice of Forest Department to have a green belt. Mixed plantation all along the boundary line will be done. Here 1000 saplings per hectare of species like Acacia Auriculiformis, Casia Seamea, Melia Indica, Dalbergia Sisoo, Tectonagrandis, Gmelina Arborea etc. will be planted.

The selection of plant species for the afforestation will be monitored by looking the characteristics of plants to pollution control Herbs and shrubs along with tree species which are not grazed by cattle have been recommended for plantation on the overburden dump and other vacant areas.

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The scheme and selection of plant species are mainly based on the local soil conditions. The plant species will be nitrogen fixers, pollution abater, fruit bearing etc. (green belts have been proposed to be provided and may broadly be classified into three categories.

i. Avenue Plantation
ii. Strip Plantation
iii. Block Plantation.

5.4.3 ***Pre Plantation Programme ;***

For success of afforestation programme, availability of the required species of seedlings is the basic requirement. So, a nursery shall be developed in the area in at suitable place. The seeds of required species shall be obtained and germinated in the nursery beds from where the seedlings are transplanted into polythene bags filled with mixture of topsoil and cow dung manure. The seedlings shall be allowed to grow about 0.30m height in the polythene bags for about 30days before plantation.

5.4.4 ***Post Plantation Care ;***

Immediately after planting the seedlings, watering has to be done. Further watering shall be done depending on the monsoon. After the plants are established little urea, (5 to 10 grams) and cattle manure shall be applied and profusely watered. The afforested area shall be protected from the cattle grazing, soil erosion, plant diseases etc. To regulate the water, earth bounds masonry chutes, protected drain etc. are to be formed wherever necessary. Mine drainage water is proposed to be utilized for irrigation.

5.4.5 ***Recommended Plant Species ;***

Relevant forest authority would be consulted for successful reclamation/ afforestation programme. The plant species which are indigenous, fast growing, spreading roots, broad leaf base etc would be selected for plantation/afforestation with focus on the mine problems discussed so far. Monoculture would be avoided as it is not only expensive to maintain but is also vulnerable to diseases, pests and climatic changes. Mixed plantation all along the boundary line will be done. About 1000 saplings per hectare of species like *Acacia auriculiformis, Casia seamea, Melia indica, Dalbergia sisoo, Tectonagrandis, Gmelina Arborea* etc. will be planted.

The plantation programme proposed for Ajitaburu Iron and Manganese Mine is as follows:

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Table 5.2: Plantation Programme

Year	Area of Plantation, Ha	No. of Sapling to be planted
1st year	0.11	250
2nd year	0.11	250
3rd year	0.11	300
4th year	0.11	300
5th year	0.11	300

Species selected are Acacia, Karanj, Chakunda, Asan, Sisoo, Agava, Casia Pongamiapinnata etc.

5.5 *STABILIZATION AND VEGETATION DUMPS ;*

The Ajitaburu Iron & Manganese Mines 46.320 hectares are being worked in Ghatkuri Reserve Forest since 1953 and are producing iron and manganese ore. The dumping of waste had been done nearer to quarries for which 6 (six) numbers of waste dumps are there and are to be continued. Dumping of waste will have to continue in old Dump 4, as fresh area can't be used without forest clearance for waste dumping. For the purpose of stabilization of dump soil terracing will be resorted to keeping 35^0 to 45^0 slope angles for each individual bench of the terrace and the height of each terrace will be restricted to 4 to 5 meters. In addition to above measures each bench slope will be stabilized with thick grass cover and the base reinforced by fast growing systematic plantation of Dalbergia Sisoo, Terminalia Tomentosa etc. By plantation the dump will be stabilized. Agava plantation on toe of dump will be done to protect from wash off. A boulder wall about 1.2 to 1.5 meters height and beyond it a garland drain will be provided outside the dump, by which any wash off during heavy rain if happen will be checked.

5.6 *NOISE POLLUTION CONTROL :-*

The ambient noise level monitoring carried out in and around the proposed mine shows that the ambient noise levels are well within the stipulated limits of CPCB. Within an operational mine, major noise sources are operation of mine machineries and equipment. Noise generation may be for an instant, intermittent or continuous periods, with low to high decibels. To keep noise generation in control, latest sophisticated technology and equipment have been considered. Drills, loaders, dumpers etc with larger capacities possibly will be acquired to reduce the number of operational units at a time, thereby reducing the noise generating sources.

The equipment systems will include cabins to ensure that the operators and other work persons, in and around the operating equipment, have comfortable

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work stations. To keep the ambient noise levels within the permissible limits of 75 dB(A), the following measures should be adopted :

- Innovative approaches of using improvised plant and machinery designs, with in-built mechanism to reduce sound emissions like improved silencers, mufflers and closed noise generating parts.
- Procurement of drill, loaders and dumpers and other equipment with noise proof system in operator's cabin.
- Confining the equipment with heavy noise emissions in soundproof cabins, so that noise is not transmitted to other areas.
- Regular and proper maintenance of noise generating machinery including the transport vehicles, to maintain the noise levels.
- Provision would be made for noise absorbing pads at foundations of vibrating equipment to reduce noise emissions.

5.6.1 ***Occupational health and Safety Measures to Control Exposure to Noise ;***

To protect the workers from exposure to high levels of noise, following measures would be adopted:

- Provision of protective devices like ear muffs/ear plugs to workers who cannot be isolated from the source of high intensity noise, e.g. blasting.
- Confining the noise by isolating the source of noise as discussed above.
- Reducing the exposure time of workers to the higher noise levels by shift management.

5.7 *CONTROL OF GROUND VIBRATIONS :-*

Ground vibrations due to blasting and its impact on various mine structures, should be studied in details when the mine becomes operational, especially the charge per delay factor. Drilling and charging pattern should accordingly be modified based on this study. Thereafter, a proper management plan should be designed and administered. General measures to reduce ground vibration resulting from blasting are given below:

- Peak particle velocity or ground vibrations for safety of nearby structures and residential buildings should be well within 12.5 mm/sec, however, the

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predicted maximum peak particle movement is just 63 and 100 mm/sec at a distance of 50m therefore, the nearby residential building which are more than 500m away may not be affected;

- to contain fly rocks, stemming column should not be less than the burden of the hole, and the blasting area should be muffled;
- short delay detonators should preferably be used in blasting rounds rather than detonating fuse as trunk line;
- detonating fuse, if used, should be covered at least with 150 mm thick cover of sand or drill cuttings.;
- blasting should be carried out in the daytime, as during the night time the sound intensity becomes higher;
- blasting should not be carried out when strong winds are blowing towards the inhabited areas;
- each blast should be carefully planned, checked, and executed under the supervision of a responsible officer. Blasting data/observations should be recorded; and

As per the mining plan, in order to ensure slope stabilization, controlled production blasting shall be adopted to avoid tension cracks and back breaks. Such cracks may get filled with water, which reduces the stability of excavated slopes and the angle of slopes.

5.8 *OCCUPATIONAL SAFETY AND HEALTH* :-

Occupational safety and health is very closely related to productivity and employee employer relationship. The main factors of occupational health in open cast mines are dust and noise. Safety of employees during blasting operation and maintenance of mining equipment and handling of explosive materials are to be taken care as per mines rules and regulations. To avoid any adverse effect on the health of workers due to dust, noise and vibration etc., sufficient measures have already been addressed in this chapter. Other measures mainly relating to health and safety include Safety measures.

i. Provision of rest shelters for mine workers with amenities like drinking water, fans etc.

ii. All safety measures like use of safety appliances, safety training, safety awards, posters, slogans related to safety etc.

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iii. Training of employees for use of safety compliances and first aid

iv. Extensive publicity and awareness about safety

v. Mining operations as per approved mining plan and environmental rules

vi. Regular maintenance and testing of all equipment as per manufacture's guidelines.

vii. Periodical medical examination of all workers by medical specialists shall be conducted.

5.9 *SOCIOECONOMIC MEASURES :-*

Apart from introducing eco-friendly mining, special attention in uplifting of socioeconomic conditions of the nearby villages namely Bokna, Gua, Barajamda and Boraiburu etc. the following facilities have been proposed.

i. Health

ii. Education

iii. Roads development

iv. Drinking water facilities

v. Cultural and recreational activities

vi. Afforestation

vii. Providing vocational training to local people.

viii. Providing employment to local people

ix. Constructing residential colonies in a planned manner for workers and provision of sanitation system.

The project will no doubt improve the socioeconomic status of the region being represented mostly by the people of scheduled castes and scheduled tribes. The continuation of mining activity shall play a vital role in improving the Socio-economics status and life style of the local people of backward communities.

The mine shall offer employment to the persons mostly belonging to schedule caste, schedule tribe and other backward classes from nearby villages. As described earlier the project will generate direct and indirect employment for several persons in mines itself and different associated activities like local trading, house construction, transportation or ore, loading of materials, supply of

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different materials to mines etc. Hence, commencement of mining activity in this area shall help in providing employment for several persons both through direct and indirect means.

Apart from introducing eco-friendly mining methods & generating employments **M/s Devkabai Velji** will also take care to pay special attention for betterment of socioeconomic conditions of the nearby villages by providing facilities like, Education, Health, Recreational as well as entertainment programmes, organizing environmental awareness programmes, extending help during drought/natural calamities etc. to the nearby villages and pursuing with Govt. authorities to take up required community oriented welfare programs under DRDA, PMGSY, Swajal Dhara and other entrepreneurship development schemes. There is a well organized NGO called Krishi Gram Vikas Kendra (KVGK) already working in the project area; therefore, the above socioeconomic developmental work can be undertaken by the NGO in this region effectively.

However, for implementation of the aforesaid plans and programme a budget and annual plan will be prepared by M/s ***M/s Devkabai Velji*** and funds shall be allocated accordingly.

5.10 ***REHABILITATION :-***

As the project is with reserve forest and does not involve any displacement or human habilitation, no rehabilitation package needed for displacement.

5.11 ***ENVIRONMENTAL MONITORING SCHEDULE***

To evaluate the effectiveness of environmental management program, regular monitoring of the important environmental parameters will be taken up. The Schedule, duration and parameters to be monitored are illustrated in the Table - 5.3.

For effective implementation and mid-term corrective measures, if required, monitoring and control of program implementation are essential. For air, water and noise pollution control measures, it has been suggested that samples would be collected and tested all round the year with appropriate frequency at strategic places by suitable agencies. In case, it is found that any of the control parameters exceed the tolerance limit as fixed by the State/Central Pollution Control Board or any other statutory body, preventive measures will be taken and if required expert opinion will be sought for proper remedial measures.

Further, a regular monitoring will be carried out for slope failure on mine faces, dump and barriers. Any abnormal conditions, if observed, will be brought to be

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notice of concerned department. Mine faces will also be monitored by the mine's survey team with precision level, Theodolite and Extensometer. Regular observation for checking land erosion will be made in the mined out areas, dumps and flood protection barrier.

The effectiveness of drainage system depends upon proper cleaning in the mine area. Any blockage due to silting or loose materials will be checked on a regular basis. Plantation work, cleaning of drains and sump etc., will be done departmentally or by engaging contractor. Machinery operators will be taken from mine operation section as and when required by the environmental section for operating the machines required for plantation, reclamation, cleaning of drains and other civil works.

Table 5.3 : Description of Parameters Schedule and Duration of Monitoring

Ambient Air Quality (PM, SO_2, NO_X)		
A.	In the vicinity of the mine	One sample over 24 hours continuous duration, for not less than one month duration in a season (not less than 4 days in a season)
B.	Within the mine	One sample over 24 hours continuous duration, for not less than one month duration in a season (not less than 8 days in a season)
C.	In the surrounding areas covering three locations close to the nearest habitations	One sample over 24 hours continuous duration, for not less than one month duration in a season (not less than 8 days in a season)
Water Quality		
A.	Water stored in the mine area	Twice a week for selected parameters like, pH, TSS, TDS, COD, BOD and Oil and Grease. The detailed analysis should be carried out once in three months.
B.	Surface and ground water quality in the vicinity of the mine area for water portability conforming to Drinking Water Standard IS:10500:1991	Once in three months.
Ambient Noise Level		Quarterly
Inventory of flora		Once in two years in project monitoring area
Soil quality		Once a year on all reclaimed areas and adjoining villages

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5.12 ENVIRONMENTAL BUDGET :-

Soon after the grant of Environmental Clearance, mining operations will be commenced and a separate environment cell will be formed to take care of environment including plantation. The total fiscal estimation for EMP is indicated in Table no. 5.4.

Table 5.4 : Cost of Environmental Protection Measures

Particulars	Annual Recurring Cost, Rs.	
	Existing	Proposed
Pollution Monitoring	20000	50000
Occupational Health	10000	50000
Green Belt	20000	10000
Reclamation/Rehabilitation of mined out area	100000	300000
Total	**150000**	**410000**

5.13 CONCLUSION :-

The entire project area is devoid of any endangered flora and fauna. Thus, the proposed project is not likely to affect the species and the adjacent ecosystem adversely. It is predicted that the socioeconomic impact due to project will be positive and project shall help increasing the employment opportunities and also project infrastructure shall be of use to people of the area. The roads transporting facilities and the rest sheds can be utilized by the community of the area.

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