

Goa were abolished and converted into leases. Work was suspended during the period 1987 to 1993 (during which dead rent was paid). Work is going on in the mines from 1993 onwards without any problem. Mine is being worked now by mechanized means. Exploration in the form of core drilling (total No. of holes S1) was carried out in the past at various stages. The details have been shown in Mining Plans/ Schemes submitted earlier. NOC from State Govt. and EC from MOEF are obtained. Application for forest clearance is made. Clearance is expected at any time in near future (as file has gone to Bangalore office).

2) Details of the area-

District and state	South Goa, Goa
Taluka	Sanguem
Village	Collem
Khasara No.	37,39/3,38/3,38/4,39/1
Lease Area (Hectares)	33.3500 ha

Whether the area is recorded in forest -

Area is partly falling in forest and partly in private (non-forest) area. Nearest wild life sanctuary is Mahavir Wild Life sanctuary. The shortest distance of sanctuary is 1.5kms.

- a. Nearest Village is Collem and is 3 kms away.
- b. Nearest Railway station is Collem. It is 3 kms away.
- c. Nearest Seaport is at Marmagoa. It is 73 Kms.
- d. Nearest Powergrid is in Shigao village. It is 3 kms away.

5. Impact Analysis

With respect of collected base line data followings impacts are observed.

a) Flora And Fauna

As discussed before forest is found in vicinity of study area. Major portion of Gotukwadecho Tembo (Collem mine) mine is under active mining operation. Mining process and Drainage pattern influences the vegetation and ecological status of crop along with various Flora and faunas discussed below.

Injuries to which the crop is liable

1) Man

Natural tree growth is frequently cut by the surrounding villagers for meeting domestic requirement of fuel wood, green manure fencing material and fodder.

2) Animals

Domestic cattle regularly graze in the buffer and damage young regeneration besides trampling the ground.

3) Wild animals

Damage by Wild Animals is not conspicuous. Wild Boars move around during cashew harvesting season, besides porcupines also are common but damage to vegetation is insignificant.

4) Fauna

Major portion of Gotukwadecho Tembo (Collem mine) mine is under active mining operation besides the core area is devoid of natural trees barring few shrubs, climbers and bamboos. The core area has been rehabilitated with Coconut, Mango, Jack fruit, Cashew, Bheras, Cumayo, Acacia, Madatti, Banana and other miscellaneous trees on over burden and worked portion

of the lease. Major herbivorous like Deer, Sambar, Gaur and Carnivores like Leopard are not seen in the Core area.

b) Temperature & Humidity

No major increase in temperature & humidity is found in vicinity towns due to proposed project.

c) Air Quality

Ambient air quality was studied during the last season, Monsoon. Since it was monsoon and no work was going on in the mines the values are very less and area not the representative one.

d) Noise Level

The main sources of noise in the area are movement of heavy machinery's, loading and transportation of iron ore by trucks. The noise level was measured at a distance of about 5 to 10m from the source for different locations in the mine site and in the buffer zone. The noise level measurement was carried out during the peak working hours of daytime. But it can be concluded that the average noise level are less than the prescribed maximum permissible limit of 90 Db (A) for the shift of 8 hrs working in an industry.

e) Water Quality

To assess the quality of water in the core zone and buffer zone of 5 km radius, water samples were collected during monsoon. Samples were collected in a season on three consecutive days. In all, five samples collected. The physico-chemical characteristics of surface and ground water revealed that Ph of water is slightly acidic to neutral. The water quality belongs to low electrical conductivity category (E.C. <500 micromhos/cm). The average electrical conductivity of pit water (KNWI) was 64.41 micromhos/cm with lowest being 37.40 micromhos/cm and highest of 84.40 micromhos/cm. Hardness of water discharged from the mines was 30.96 mg/l which indicates that water quality belongs to soft category.

f) Soil Quality

The color of the soil samples varies between reddish brown to brown having salty loam texture with good drainage. The soils are acidic in nature with traces of total soluble salts. The soils are low to medium in available nitrogen and medium to high in available phosphorous and low in potash. Heavy metals are within the limit of toxicity. Total iron content is very high (14.4 to 31.30%).

g) Climatic Conditions

The rainfall data for the year 3003 has been collected from the local meteorological department. The meteorological data such as temperature, relative humidity, wind direction and wind speed were obtained by setting up own meteorological equipment.

h) Socio – Economic Impact

1) Social and demographic profile:

Lease area is in the remote and backward part of the state. Work in the mines and allied activities will generate employment to the local people, this will improve their life standards. Infra structural facilities will be developed in the area due to group of mining activities being carried out at the site.

2) Occupational health and safety:

Workers exposed to noise level and dusts are periodically taken for routine medical checkup. Safety precautions are observed as per the mine safety act. The mines safety committee holds regular meetings to educate and inform the workers about the safety precaution while working. Safety posters are displayed at various strategic points. Safety equipment's such as goggles, helmets, earplugs etc. are provided to the workers.

3) Human settlements:

There are two houses in the area. They need not be shifted in coming five-year period. Settlements outside the lease area will not be affected by mining activities.

i) Positive Impact

Along with negative impacts project has positive impacts also such as:-

- 1) Employments opportunity-There are approximately 30 local people employed as workers.
- 2) Project authority contributed to development of nearby villages through donation.

6. Mitigation Measures

a) Strategy For Conservation Of Endangered Flora And Fauna

Rapid industrialization, rise in population and increasing developmental works have virtually driven the Wild Life inside remote forests for safety and security. Yet for food and shelter frequently wild animals stray into adjoining areas and wherever dense tree cover and undisturbed environment exist they prefer to stay. A safe habitat could be created, in the mined area by planting large number of fruit bearing, fodder and flowering trees to attract herbivorous, birds, insects and butterflies. Careful selection of tree species is necessary to maintain the ecological balance of adjoining forest area. Variety of species is planted in the core zone.

b) Efforts Towards Restoration of the Lease Area

Till now tree plantation has been raised over an area within the lease and plantation outside the mining area in order to restore the ecology of the area. The project aims at prevention of metal leaching from mine dumps/stacks and enhancement of vegetation productivity through the use of organic manure. Under the project an area of five hectares of over burden has been planted with 31 tree species. The saplings were pre-treated with Rhizobium and Azotobacter besides inoculation of Micorrhizae. Growth of plants and habitat studies were monitored for three years. For improving the bio-diversity of the lease area heterogeneous composition of species was aimed at and species like Neem, Shivan, Cassia siamea, Khair, Jambol, Sissoo, Bamboo, Mango, Lagerstroemia parviflora (Nano), Terminalia chebula (Harda), T. paniculata (kindal), T. tomentosa (Marat), Ficus glometata (Rumbad), F. bengalensis (Vad), F. religiosa (Pipal), Pongamia pinnata (Karanji), Mimusops elengi (Onvol), etc.

c) Creation of Green Belt

The Ministry of Environment and Forests while conveying the environmental clearance for expansion of Gotukwadecho

Tembo Iron Ore (Collem mine) Mine stipulated a special condition at a (xii) for raising a plantation in an area of 11.9338 ha. Including a green belt of adequate width around ML area, OB dump sites, roads etc. by planting native species in. Mine is bounded by other active mines on northern side and western side. As such for creation of green belt an area of 1.0000 ha has been identified towards western side of the mining leases. Further all along the internal mining roads avenue plantation of suitable tree species will be raised. Around office buildings green belt will be created with sufficient width for minimizing air, dust and noise pollution.

d) Avenue Plantation

Internal mining roads are used for transportation of iron ore as well as over burden from various mine pits to dumping/stacking ground. On either side of mining roads avenue plantation of board-leaved tree species is proposed to be raised for dust suppression. Suitable plantation as per the area available would be carried out along the mine roads. Pits for planting will be of 60cm X 60cm X 60cm size filled with topsoil, Farm Yard Manure and vermin-compost Two-year-old tall plants or root trainer nursery seedlings of few selected species will be planted with the onset of monsoon. Tall seedlings will be provided with a stake support for guarding against wind velocity.

e) Dump/Stack Area Plantation

The existing dump/ stack is already settled. There will not be any waste generation as lateritic stratum also contains reasonable proportion of FeO and can be used for blending. There will be temporary stacks of such material between the two pits. (This material will be handled as and when opportunity comes). These stacks will have limited height. If height increases sets will be made in it. A stone wall is already built at the foot of the dump. It will be repaired every monsoon. An additional will ahead of the present one, will be built, if required. Drains will be made around the stacks and along the road going to the stacks.

7. Environmental Management Plan

a) Proposal for reclamation

Proposed workings are in the pit area only. There won't be generation of any quantity of top soil. Backfilling will be started from fourth year of the plan period. Waste generated from the mine workings will be directly backfilled. Details of the backfilling are given below.

Year	Waste	Volume	Length m	Width m	Height m	Co-ordinates
2013-2013	30,156	30,104	100	50	4.0	N-730-N-800/W-330-W-300

b) Program of Afforestation

An area along the road will be preferred for plantation purpose. It has less density of vegetation and will serve as a barrier. A strip of 35m parallel to the road will be afforested. This strip is between N 630 and N 340. Dump located on the south side will also be taken up for plantation. It is old one and part of it (southern slopes) will be taken up for plantation. This area falls between N 100/140 – W 40/E 60. Fast growing saplings will be planted, as this will happen at the earliest. Saplings will be obtained from the local forest department. One competent person will be given charge of plantation and post – plantation care.

c) Stabilization and Vegetation of dumps

The existing dump is already settled. There will be very less generation of material. This will be put on the top of the dump (and not along the slope). Thus major foundation of the dump will remain as it is. A step dumping will be followed. A stone wall is already built at the foot of the dump. It will be repaired every monsoon. An additional will ahead of the present one, will be built, if required. Drains will be made around the dump and along the road going to the dump. Plantation will be carried out on the slopes of the dead portion of the dump. All these features will stabilize the dump and avoid flow of silt.

d) Treatment and disposal of water from the mine

Water, which gets stored in the pit, is because of the rains. No work was carried out during monsoon and pumping is not done during the period. Most of the water seeps into the strata. Only some quantity of water is required to be pumped out. This is clean water. It is taken to the plantation/vegetation on the western side of the lease. Seepage rate is very low. One hour pumping in a day is sufficient to work. It is also taken to vegetation. A sump and stone wall will be made near the outlet before it is let to the vegetation. Size of sump will be 3m x 3m x 1m. Stone wall will be 3m x 1m x 0.8m in size. Considering less quantity of water these dimensions are reasonable.

8. Conclusion

The data collection in the process the EIA is the crucial factor to be included in the project management plan. It will save the time, any complications with the government authorities and the local crowd, helps in right investment at right time, makes mining environment salubrious and most important helps to conserve the environmental factors nearby. Database management software systems can help collect and arrange the data as well as for the computation purposes to get most efficiency out of the management plan. Not only are the factors mentioned in this paper included in EIA, but also other important factors like economic state of the mining company and the strategies implemented by them. EIA is a vast concept and data factors are of iterating behavior.

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