CHAPTER I

INTRODUCTION

1.1 INTRODUCTION

Manganese is one of the major mineral deposits occurring in the Indian sub-continent. It has played a great role in development of civilization and industrialization. The discovery of the metal manganese and it's use by man through the ages embossed a milestone in the march of civilization.

Manganese ore is an important material in iron and steel metallurgy. It is an essential constituent of steel and there is no satisfactory substitute for it in the manufacturing of steel. It is the fourth most widely consumed metal after Iron, Aluminum and Copper. It has vital use in the manufacture of Ferro-manganese, dry batteries, manganese base chemicals and paints.

The recent liberalization of the Indian economy has catapulted the Indian industry into new realms of thinking and progress. The policies of Government on economic development have given various subsidies like slashing the import duties and provisions for the Indian industry to grow indigenously.

Maharashtra is one of the largest producers of manganese in the country. Manganese ore deposits of Maharashtra are one of the most remarkable in the world. They are associated with the Pre-Cambrian meta-sediments. Commercially exploitable manganese ore deposits occur in Nagpur, Bhandara and Sindhudurg districts of which those occurring in Nagpur district are the largest and the most important.

M/S. TIRUPATI MINERALS the project proponents is a firm having registered office at Ramtek in Nagpur District. The State Government of Maharashtra has identified

15.71 Ha of the lease to the proponent in **village Bhandarbodi, Tahsil Ramtek, District Nagpur, Maharashtra**. Mining Plan for the said area has been approved from the competent authority. The proponent envisages developing mining activities based on the available reserves of ore in central India. The proponent is committed to operate systematic and scientific mining operations making optimum utilization of the resources. Needless to mention that the mining activities shall be carried out as per the mandatory laws and regulation prevailing.

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M/s Pollution Ecology and Control Services, Nagpur have been retained to undertake a Environmental Impact Assessment [EIA] Study and preparation of Environment Management Plant [EMP] for the proposed Manganese mine. Reconnaissance survey of the region was carried out in the period of January 2009 to March 2009 and various sampling locations to monitor environmental parameters have been identified. Subsequently, monitoring has been commenced for meteorology, ambient air quality, surface water and ground water quality, soil characteristics, noise levels and flora and fauna at the specific locations. The other studies such as socio-economic profile, landuse pattern etc. are based on the secondary data collected from various authentic government agencies and through primary surveys. The air monitoring locations have been selected based on the predominant wind directions recorded through meteorological data generated at IMD, Nagpur. This Rapid Environment Impact Assessment (REIA) covers the primary data collected for one season since January, 2009 to March 2009 which covers winter season.

1.2 SCOPE OF THE STUDY

The study covers an area of 10 km radius with the proposed mine lease area as the center. The scope of the study broadly includes:

- To undertake environmental monitoring so as to establish the baseline environmental status of the study area;

- To identify various existing pollution loads due to various activities in the ambient levels;
- To predict incremental levels of pollutants in the study area due to the proposed mining activity;
- To evaluate the predicted impacts on the various environmental attributes in the study area by using scientifically developed and widely accepted Environmental Impact Assessment Methodologies;
- To prepare an Environmental Management Plan (EMP) outlining the measures for improving the environmental quality and scope for future expansions for environmentally sustainable development; and to identify critical environmental attributes required to be monitored.

The literature review includes identification of relevant articles from various publications, collection of data from various government agencies and other sources. Field studies were conducted for a period of one year to determine seasonal variations which would determine existing conditions of various environmental attributes as outlined in Table 1.1.

TABLE – 1.1

ENVIRONMENTAL ATTRIBUTES & FREQUENCY OF MONITORING

Sr. No	Attribute	Parameters	Frequency of Monitoring
1.	Ambient air quality	SPM, SO_2 and NOx	24 hourly samples twice a week for one month covering one season for four locations.

2.	Meteorology	Surface Wind speed and direction, temperature, relative humidity, rainfall, evaporation rates, cloud cover.	Secondary sources like IMD station
3.	Water quality	Physical, Chemical and Bacteriological parameters	Samples were collected in winter seasons
4.	Ecology	Existing terrestrial and aquatic flora and fauna	Through field visits
5.	Noise levels	Noise levels in dB(A)	Continuous recording at hourly interval for 24 hours per location for one season.
6.	Soil characteristics	Parameters related to agricultural & afforestation potential	Dry Conditions
7.	Land use	Trend of landuse change for different categories	Based on data published in district census handbooks
8.	Socio-economic aspects	Socio-economic characteristics, labour force characteristics, boom town effects etc.	Based on data collected from secondary sources like Census handbooks.
9.	Geology	Geological history	Based on data collected from secondary sources.
10	Hydrology	Drainage area and pattern, nature of streams, aquifer characteristics, recharge and discharge areas	Based on data collected from secondary sources

1.3 ORGANIZATION OF THE STUDY

Sampling locations were identified on the basis of the following criteria:

- Predominant wind direction
- Existing topography;
- Location of water bodies;
- Overburden and solid waste dumps;
- Location of villages/towns/sensitive areas;
- Accessibility, power availability and security of monitoring equipment.
- Pollution pockets in the area; and
- Areas, which represent baseline conditions.

1.4 LOCATION OF THE PROJECT

Bhandarbodi applied area having Khasra no. 94/1, 94/2, 95, 96, 97, 98, 99, 100, 101 is located at a distance from Nagpur up to Ramtek 50 kms on Ramtek - Tumsar road 19 kms. The total distance from Nagpur to the area is about 69 kms. Nearest PWD rest house facility is available at Khindsi, which is situated at distance of 11 km. in the south of the applied area. All basic facilities like education and PHC available at Bhandarbodi. The nearest rail head and Rly siding is situated at a distance of 19 km in west direction. From the applied area it is in east direction the applied area is falling under the Tahsil Ramtek's Jurisdiction. The area applied for mining lease is situated in the survey of India Toposheet No. 55 O/7, having Latitude of 21^0 23' 46" and longitude $79^0$27'59".

1.5 EVALUATION OF INDUSTRIAL DEVELOPMENT IN THE STUDY AREA

In the entire Maharashtra state, Vidarbha region is relatively a backward area with predominantly forest areas and with tribal settlements. There are no industries in the study area of 10 km. As a matter of fact, the entire Vidarbha region has been declared as the backward region by the state government.

1.6 CONTENTS OF THE REPORT

The Rapid EIA Report is based on one season field data generated to represent winter season at site and data collected from secondary sources. The report has been divided into seven chapters and presented as follows:

Chapter 1 - Introduction

Chapter 2 - Mining Method & Sources of Pollution

Chapter 3 - Baseline Environmental Status

Chapter 4 - Impact Assessment

Chapter 5 - Environment Management Plan (EMP)

Chapter 6 - Additronal Studies

Chapter 7 - Project benifits

Chapter 8 - Environmental Cost

Chapter 9 - Environmental Management Plan.

CHAPTER II

PROPOSED MINING & SOURCES OF POLLUTION

2.1 INTRODUCTION

This chapter basically deals with the geology of the mining lease area, exploration details, estimation of ore reserves, proposed method of mining, the proposed machinery, phase wise ore extraction details, various sources of pollution and the proposed measures to control the pollution.

The total mining lease area proposed is **17.51 Ha**. The proposed area is located in the jurisdiction of village Bhandarbodi, Ramtek Thasil, Dist – Nagpur, and include in Survey of India Toposheet No. 55 O/7. The mining operation will be taken up in the Southern part of the area. The area in general is plain and gently sloping towards South. The land under mining lease is agricultural and hence has no growth of large trees. The average MRL is considered is 313. The difference in the level in northern & Southern boundary is about 3 m or so. There are no other prominent features in the area.

2.2 GEOLOGY OF THE MINING LEASE AREA

2.2.1 Regional Geology: The Dharwarian System covers large connector areas within Madhya Pradesh and Baihar, spreading over Balaghat, Nagpur, Bhandara, Chhindwara and over Hazaribagh and Rewah. In this area it possesses a highly characteristic metalliferous facies of deosits.

The Dharwarian rocks of the Nagpur, Chhindwara and Bhandara districts of Maharashtra have been named as Sausar series. These rock types carry important economic deposits of Manganese Ores. The Sausar series have been sub-divided into stages which have a wide geographical extent in Madhya Pradesh and can therefore be correlated in district outcrops of the series.

Named Gondite from the Gonds of Madhya Pradesh by Dr. L. Permo, these are a series of metamorphosed rocks belonging to the archaean and Dharwar System and largely composed of quartz, spessartite, rhodonite and other manganese silicates. These rocks are supposed to be the product of the dynamic metamorphism of manganiferous soil and sands deposits during Dharwar times.

Out crocs of the Gondite series are typically developed in Balaghat, Chhindwara dists of M.P. and Nagpur and Bhandara dists of Maharashtra State & also in Panch Mahals of Gujrat and Banswara area of Rajasthan.

Manganese ore & Gondite Horizon is assigned to Mansar Stage.

Sausar Series:

Bichua		:	Marbles, Calc siticate granulite
Junewani		:	Quartz-biotite Schists with garnter Kyanite, Straurolite
Chorbaoli		:	Quartz-muscovit schist with garnet and kyanite, micaceous, flaggy, Quartzites, Quarts schist.
		:	Manganese Ore & Gondite Horizon.
Mansar		:	Muscovite Schist, Quartz-Muscovite Schists, Quartz-sericite-muscovite Schists.
SAUSAR	Lohagi	:	Schist with Garnet, Phyllite, alaty phyllite.
		:	Manganese ore & Gondite

		Horizon pink Calcitic marbles (impersistent)
Sitasongi	:	Quartzite, Quartz-muscovite Schist and Conglomerate, felspatic grit.
Older Metamorphics	:	Ortho and pagagneisses, granite Bands and lenses of amphibolites epidiorites, quartzite with pegmatites and quartz veins.

2.3 LOCAL GEOLOGY

The idea of the geological formation can be had from old pits in the area. These old Pits and exposures of Manganese Ore are shown in Geological Plan.

All these Pits are considered for studying the formations in the area.

The Geological formations met with in the area are:-

1) Soil/Alluvium Thickness 1 m. (average thickness)

2) Mica Schists, with Pegmatites

3) Manganese Ore with Gondite Thickness 2 m. (average thickness)

a) Soil: It is pale brown to brown in color and is formed due to decomposition of country rocks. The thickness varies from 1 to 2m. For the sake of calculations average thickness is considered to be 1 m. There is Top Soil in the area. The average thickness of the Top Soil is 0.5 m.

b) Mica Schists with Pigmatites: This formation is found to occur on hanging wall as well as foot wall side of the Primary bedded deposit of Manganese Ore. It maintains the strike line of E-W with dips of about 35^0 towards south.

This formation is intruded with pegmatite veins in irregular manner.

c) Manganese Ore with Gondite: In all there are four old pits and exposures of Manganese Ore formation mostly along the entire strike line length (E-W) of the area under question. The formation is having dips varying from 35^0-42^0 towards NE. For the sake of calculations of Reserves the average angle of dip is considered to be 35^0 towards south. Hence the occurrence of Manganese ore in the area is considered all along the area even though part of ore body is covered by soil.

The average thickness is considered to be 2 m on the basis of occurrence of ore body in old pits and adjoining ongoing mining operations.

2.3.1 Details Of Exploration:

Already Carried Out In The Area:

The Old Pits are already done by the earlier by unknown party.

No exploration by pitting or drilling is carried out in the area by the Applicant since the Applicant did not hold Prospecting License over the area.

Old Pits (i) – 19 m L x 8 m W x 3 m D

Old Pits (ii) – 33 m L x 11 m W x 4.5 m D

Old Pits (iii) – 24 m L x 11 m W x 4 m D

Old Pits (iv) – 196 m L x 25.5 m W x 7 m D

Manganese Ore formation is well exposed in these Pits.

Broadly indicate the year wise future program of exploration, taking into consideration the future production program planned in next 5 years as in table below :-

Year	No. of Bore Holes	Total Meterage	No. of pits and Dimensions	No. of Trenches & Diameters
First	4 (PBH 1 to PBH 4)	About 42 m	3 (PTP 1 to PTP 3) About 5 mL x 5mW x 5mD 'B' South Part	
Second	--	--	--	3 (PTP 1 to PTP 3) 10 mL x 5mW x 4mD
Third	--	--	--	--
Fourth	--	--	--	--
Fifth	--	--	1 (PTP-4) from the floor of the working Pit about 5 mL x 5mW x 5mD	

The Proposed Bore Holes are projected on nearest Cross Sections.

The above results conform to the specification of Manganese as that of ferro alloy & Cement Industries.

2.4 ESTIMATION OF RESERVES:

2.4.1 Geological Reserves and Grade: In the manganese ore bed, the recovery of marketable Mn-ore is around 90% and the remaining being Gondite rock (mangoniferous cherty jaspery quartzite). The thickness of manganese ore band/bed is 2 m. The average dip of the Mn-bed is 15 degrees towards North-East.

Summary		
Category	Tonnage	UNFC classification
Proved Category	39024 T.	111
Probable Category	11160 T.	222

Possible Category	11160 T.	333
Total		61344 T

The reserves as above are as on 1 August 2007.

2.4.2 Grades of Manganese Ore as follows: Six test samples collected from exposures and old pits were analyzed for determination of chemical composition. Manganese Ore available in the area is suitable for industrial use.

Expected grades of Manganese Ore, on the basis of enclosed analysis results are as under:

Grade		Percentage
46% Mn and above	.....	Nil
40 to 45% Mn	.....	Nil
27 to 39% Mn	.....	about 60%
24 to 27% Mn	.....	about 30%
Mineral & other rejects	.....	about 10%

With present demand of Manganese Ore in the market, the cut off grade is below 20% Mn contents.

The range of impurities is variable and decides the marketability of ore.

2.5 PROPOSED METHOD OF MINING

2.5.1 The rated capacity of the mine is proposed to be 3530 tonnes / annum of R.O.M. Opencast manual method of mining with occasional drilling & blasting has proposed to be done. This is an old mine activity has been done in the near past. The same method of mining was adopted in the past also.

There are old Pits in the area done in earlier period. The mining operations will be taken up in the Southern part of the area.

The method of mining, by open cast method, proposed in this Mining Plan, consists of the following operation:

1) Removal of overburden & soil & waste rocks to dump sites.

2) Mining of Manganese Ore bed by drilling and blasting.

3) Removal of mined ROM to surface yard for proper grading, sizing, sorting, stacking & jigging etc.

4) Preparing grade wise stacks of ore for delivery by breaking, sorting, sizing, screening & separation of Manganese Ore in different grades.

5) De-watering of the working pits whenever required.

Open Cast Working: Each Cycle of operation shall consist of removal of overburden followed by extraction of the exposed Manganese Ore subject to the following conditions being strictly complied with:-

Quarrying operations shall be conducted from top downwards.

The provisions of sub-regulations (4) & (5) of regulation 106 shall be complied with.

Adequate steps shall be taken to ensure that the benches are kept dressed at all times. Special care shall be taken when any slip or other planes of weakness of other geological disturbances exists, so as to prevent danger to the work persons.

No person shall be engaged on work or allowed to travel close to high sides/benches, from which he will be likely to fall more then 1.8m. vertically down, unless he is provided with and use a safety belt or rope.

The proposed generation of waste consisting of Soil, Top Soil an Mica Schists and production of Manganese Ore during the Mining Plan period, is estimated as under:

Year	Pit No.(s)	Overbuden Cu.M.	Top Soil+Soil	ROM Ore	Saleable Ore T. 85%	Sub-grade Ore T.	Mineral Rejects T. 15%

					recovery		
First	--	750	900	1765	1500		265
Second	--	1290	1239	2353	2000		353
Third	--	3705	1788	2353	2000		353
Fourth	--	7866	2559	3529	3000		529
Fifth	--	13328	1764	3529	3000		529
Total	**--**	**26939**	**8250**	**13529**	**11500**		**2029**

This figure includes year wise quantity of Top Soil + Soil.

Out of total production of Manganese ore 85% will be readily marketable & about 15% will be mineralized rejects which may be intermittently mixed & used. Balance production i.e. consists Gondite siliceous impurities, waste intercalations, mining loss & fines.

Proposed rate of production when mine is fully developed is about 4000 T. per year. The anticipated life of mine is 12 years on the basis of present estimation of production of Manganese Ore.

Drilling

(a) Drilling Machine : Drilling will be done by compressed air operated jack hammer. The parameters of drilling by jack hammers are as under: -

Depth of hole - 600 mm

Diameter of hole - 34 mm

Burden - 600 mm

Spacing of holes - upto 600

Every month, number of holes required to be drilled depends upon the production of Manganese Ore, in that particular year. However each hole with the parameters as above should yield about 0.6 m x 0.6 m x 0.6 m = 0.216 or say 0.22 cu.m. of Manganese Ore. When the mine is fully developed the total number of holes

required to be drilled per annum is about 5346 numbers with 3 m height of the benches, drilling will be done in stages of 0.75 in 1.5 m holes, for development of the benches.

The drillers will be given protective appliances to be used during drilling operations.

(b) Loading Equipment: Tractors and Hydraulic trolleys are use for loading of manganese ores.

(c) Haullage And Transport Equipment : The produced Manganese Ore will be transported by tractor trolleys/trucks to the storage yard from where after gradation it will be loaded to the destination of buyers.

The Manganese ore is being transported by trucks to the destination of buyers. This work is done on contract basis.

Miscellaneous Operations: After the ore is brought to the storage yard, Proper stacks for sampling (if required) are prepared and subsequently delivered. All these operations are manual (Stacking by departmental workers and loading on contract basis). Manganese Ore with -5 mm fines will be treated as rejects. This separation is done by means of manual screening at mine head.

2.5.2 Mine Drainage: The depth of the water table is 10m. Depth of working at the end of next 5 years is 10m. Depth of working at the end of lease period is 20m. Seepage of ground water is expected when the mine will reach the depth of only 10m. Accumulation of rain water is expected in the mine during rains. The mine water will be evacuated with the help of a water pump having 20m head and discharge capacity of 30 liters of water per second. The water accumulated during season shall be collected in the sedimentation tank constructed at the pit bottom. The settled water shall be utilized for dust suppression and plantation.

2.5.3 Surface Transport and Site Services: All the required site services are available at the mine. These include rooms for officer, store and first-aid help and rest shelter.

Latrine and urinals will be constructed for male and female workers separately. Provision of crèche is also proposed for the children and female workers.

The site services are equipped with first-aid outfits and adequate supply of cool and wholesome drinking water to workers. A person has been appointed for this purpose.

2.5.4 Disposal of the Waste: As there is going to be no impact on the surface and ground water regimes of the area due to mining there is no need for the treatment of water. The water accumulated into the pit during the rains will be pumped out towards the South into the field, this will aid on diesel pump of 5 HP capacities. However before the final disposal, the water will be passed though siltation tank.

2.6 SOURCES OF POLLUTION: Virtually all surface mining methods for any ore/mineral produce some irreversible impacts. These produce dramatic changes in the landscape due to large scale excavation. The environmental pollution due to opencast mining, in general, could be broadly classified into the following categories:

- Air pollution;
- Despoliation of land;
- Water pollution; and
- Noise pollution

2.6.1 Air Pollution: Mining operations contribute towards air pollution in two ways addition of gaseous pollutants to the atmosphere and emission dust particles. The gaseous pollutants include NOx, SO_2 and hydrocarbons etc. The sources of gaseous pollutants from the proposed mining include: -

- Operation of heavy earth moving equipment which are mostly run on diesel.
- Loading operations;
- Transportation of ore/overburden in dumpers;
- Drilling, Blasting and Crushing operations.

Similarly, the SPM and dust particles emanate during drilling, blasting, excavation, crushing, loading and unloading of the ore and overburden, transportation, from tips, stock piles. Size of the particles emitted in atmosphere plays a major role in deciding the distance to which they may be transported away. Particles of larger size fall fairly rapidly around their source, because of gravitational settling. But the aerosols because of their small size may be held in suspension for years in the atmosphere and may be transported on a global scale. Eventually, these smaller particles are collected in rain drops and fall on earth.

2.6.2 The composition of these particles largely depends on the composition of the ore being processed. The proposed mine with it's capacity of 1500 TPA, is likely to generate negligible quantities of dust, NOx and SO_2. There will not be any ore beneficiation activity proposed. So there is less likelihood of pollution from particulates and tailings.

2.6.3 Water Pollution: The proposed maximum depth of the excavations will be about 10 m height. The proposed excavations are not going to touch the ground water table. Thus there will not be any contamination of the underground water because of the proposed mining.

2.6.4 Noise Pollution: As the mining operations will be manual there will be no impact due to mining operations. It has been established that noise interferes with speech communication, causes annoyance and distraction.

CHAPTER III

BASELINE ENVIRONMENTAL STATUS

3.1 INTRODUCTION

This chapter incorporates the description of the existing environmental setting the area encompassed by a circle of 10 km radius around the proposed Manganese Ore Mine.

The proposed area is located in the jurisdiction of village Bhandarbodi, Tahsil – Ramtek, Dist-Nagpur, the study area is almost like virgin area. There are no industrial activities in the study area. Most of the inhabitants in the nearby scattered villages are tribal.

One season monitoring was conducted during winter season. In addition, certain aspects like landuse, socio-economic status have been analyzed based on the secondary information like district census reports and remote sensing satellite imageries.

3.2 LANDUSE PATTERN

The entire study area is covered under one tahsil Ramtek of district in Maharashtra state. Totally 8 villages are covered under the study area with the proposed mine site as the center. In this study, the geographical area of all the 8 settlements covered under 10 km radius circle is taken into consideration though a couple of villages are covered partially in the study area.

The proposed area is having flat topography surrounded by agricultural and barren land. The area is mostly covered with alluvial soil and murrum, There is no other activity in the area excepting agricultural operation and the area is mostly barren. The deposit is in located on the pleau having flat topography and the surrounding area is agricultural land of single crop pattern depending on proper and sufficient rainfall. In the surrounding area it is mostly private lands occupied by individual. In the proposed lease area as well as in

surrounding areas there is sufficient cover of alluvial soil so that agricultural activities are being carried out. The average thickness of the soil and murrum is varying from 0.2m to 0.5m

The proposed area is located in a small and backward village of Nagpur district and information for five years is not readily available.

Seepage of ground water is expected when the mine reaches the depth of about 10m. The mine water will get polluted by suspected solids.

There is no river in the nearby vicinity. The water table is available within 10m to 20m from the surface level and the make up is scanty except in rainy season. In rainy season water table comes within 5m from the surface level.

3.3 SOIL CHARACTERISTICS

The proposed area is Govt. of Maharashtra Private revenue land with plain topography and without vegetation. The proposed area is predominantly covered with alluvial soil and murrum having thickness 0.2m to 0.5m there will be change in the land use pattern after the mining activity carried out in the area. There will be working pit developed due to excavation in the area. Following will be the land use pattern after 5 years and 20 years as envisaged presently.

Soil characteristics are tabulated in and compared with standard classification given in **Table-3.2**.

1) Salaimeta Village S1

2) Mahadula Village S2

Soil characteristics are tabulated in **Table-3.1** and compared with standard classification given in **Table-3.2**.

TABLE-3.1

SOIL ANALYSIS RESULTS

Sr. No.	Parameters	Unit	(S1)	(S2)
1	Color	--	Dark Brown	Slightly Black
2	Soil Texture	--	Silty Sand	Sandy Loam
3	Grain Size Distribution	D_{10}	0.85-0.86	0.70-0.72
		D_{30}	1.40-1.47	1.34-1.40
		D_{60}	2.09-2.20	1.80-1.95
4	Porosity	%	21-33.40	28.5-30.05
5	Bulk Density	gm/cc	1.32-1.40	1.88-1.93
6	Wilting Co-efficient	--	9.00-9.63	13.88-14.00
7	Cation Exchange Capacity (CEC)	Meq/100 gm	7.40-7.65	10.70-11.00
8	Sodium Adsorption Ratio (SAR)	--	1.90-2.05	2.69-2.95
9	Water Retention Capacity	%	24.80-25.10	31.20-32.00
10	Available Organic Matter	%	0.80-0.84	0.98-1.15
11	pH (1:5)	--	8.55-8.70	8.2
12	Electrical Conductivity	Umho/cm	450-462	780-792
13	Sodium as Na	mg/100 gm	6.10-6.44	21.1-21.6
14	Potassium as K	kg/ha	140-147	456-470
15	Nitrogen as N	kg/ha	29.6-30.0	690.0-692
16	Phosphorous as PO_4	kg/ha	15.1-15.4	38.8-40.0
17	Infiltration Rate	cm/hr	182-190	2.38-2.60
18	Calcium as Ca	mg/100 gm	313-320.0	258-265
19	Magnesium as Mg	mg/100 gm	16.6-17.0	40.6-41.1
20	Sulphate as SO_4	mg/100 gm	4.05-4.20	7.60-7.90
21	Lead as Pb	ppb	4.8-4.9	3.4-3.45
22	Nickel as Ni	ppb	6.4-6.5	4.3-4.4
23	Zinc as Zn	ppb	7.0-7.15	9.2-9.6
24	Copper as Cu	ppb	4.2-4.4	3.8-4.0
25	Iron as Fe	ppb	24.50-26.7	2.85-3.50
26	Manganese as Mn	ppb	2.8-3.05	1.05-1.20
27	Boron as B	ppb	1.45-1.60	0.65-0.70
28	Molybdenum as Mo	ppb	0.70	0.3

TABLE-3.2
STANDARD SOIL CLASSIFICATION

Sr No	Soil Tests	Classification	
1.	pH	< 4.50 extremely acidic 4.50-5.00 very strongly acidic 5.00-5.50 strongly acidic 5.50-6.00 moderately acidic 6.00-6.50 slightly acidic	6.50-7.30 neutral 7.30-7.80 slightly alkaline 7.60-8.50 moderately alkaline 8.50-9.00 strongly akaline 9.00 very strongly alkaline
2.	Salinity Electrical Conductivity (mmhos/cm) (1mmho/cm = 640 ppm)	Upto 1.00 average 1.01-2.00 harmful to germination 2.01-3.00 harmful to crops sensitive to salts	
3.	Organic Carbon	Upto 0.3 : very less 0.21-0.4 : less 0.41-0.5 : medium	0.61-0.8 : On an average sufficient 0.81-1.0 : Sufficient >1.0 : more than sufficient
4.	Nitrogen (kg/ha)	Upto 50 very less 51-100 less 101-150 good	151-300 better Above 300 sufficient
5.	Phosphorous (kg/ha)	Upto 15 very less 16-30 less 31-50 medium	51-65 on an average sufficient 65-80 sufficient Above 80 more than sufficient
6.	Potash (kg/ha)	0 very less 120-180 less 181-240 medium	241-300 average 301-360 better Above 360 more than sufficient

3.4 GEOLOGY

The area in general is plain and gently sloping towards East. The land under M.L. is non-agricultural and has no growth of large trees. The average MRL is considered is 313. The difference in the level in Northern & Southern boundary is about 3 m or so. There are no other prominent features in the area.

Soil is pale brown to brown in color and is formed due to decomposition of country rocks.

The exposures of Manganese ore formation mostly along the entire strike line length (E-W) of the area under question. The formation is having dips varying from 35^0-42^0 towards NE. For the sake of calculations of Reserves the average angle of dip is considered to be 35^0 towards South. Hence the occurrence of Manganese ore in the area is considered all along the area even though part of ore body is covered by soil. The average thickness is considered to be 2 m on the basis of occurrence of ore body in old Pits and adjoining ongoing mining operations.

3.5 METEOROLOGY

Micro-Meteorological data within the study area during the air quality survey period is an indispensable part of air pollution studies. The meteorological data recorded during the monitoring period is very useful for proper interpretation of the baseline information as well as for input, to the predictive models for air quality dispersion. Historical data on meteorological parameters will also play an important role in identifying the general meteorological status of the region. Site specific data can be compared with the historical data in order to identify changes over a period of time due to the various developments in the study area.

The micro-meteorological parameters regulate the transport and diffusion of pollutants released into the atmosphere. The principal variables which affect the micrometeorology are horizontal connective transport (average

wind speed and directions), vertical connective transport (atmospheric stability and inversion conditions) and topography of the area.

The climate of the study area and the surrounding area is generally dry except in the south-west monsoon season. The year may broadly be divided into four seasons.

- Winter Season : December to February
- Pre Monsoon Season : March to May
- Monsoon Season : June to September
- Post Monsoon Season : January and March

The area experiences hot summer and this is due to the presence of granitic and basaltic rocks.

Rainfall: The lease area is located in small and backward village of Nagpur and information for five years is not readily available. About 1800-2100mm average annual rainfall has been recorded in the area which is spread over from June to September.

Climate: Sub –tropical climatic condition prevail in the area. Maximum temperature recorded during summer is 48^0C and the minimum temperature recorded during winter is 10^0 C.

TABLE-3.3
SUMMARY OF METEOROLOGICAL DATA

Month	Temperature ºC			RH (%) 0830 hrs			RH (%) 1730 hrs			Atmospheric Pressure (mb) 0830 hrs			Atmospheric Pressure (mb) 1730 hrs		
	Max	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.
Jan	33.9	8.2	23.7	99	51	80	98	22	45	1008.2	996.6	1002.6	1003.8	991.6	998.3
Feb	38.7	10.7	26.0	98	38	73	91	11	38	1006.8	993.0	1000.5	1002.8	988.9	995.8
Mar	41.8	11.7	29.6	95	14	58	86	9	27	1004.3	994.1	998.5	999.6	988.2	993.3
Apr	45.0	14.2	34.0	94	20	54	73	7	24	1000.8	974.2	995.2	995.2	984.0	989.6
May	47.1	14.6	35.2	93	15	54	96	7	25	999.3	983.6	992.4	994.6	966.4	986.8
Jun	46.5	17.8	32.5	99	21	68	99	12	49	1001.5	981.3	988.7	991.3	978.8	984.6
Jul	40.5	15.1	28.5	99	43	84	99	25	70	995.8	983.7	989.8	992.2	981.4	986.8
Aug	35.7	17.2	27.4	99	43	86	99	42	76	997.2	971.6	990.0	995.2	979.3	987.0
Sep	37.3	19.4	28.3	99	62	84	99	37	70	1001.1	984.9	993.3	996.3	985.5	989.7
Oct	36.8	15.3	27.6	98	56	78	98	38	57	1003.8	985.6	997.5	999.4	982.0	993.8
Nov	36.9	11.4	25.3	95	39	74	97	19	51	1006.5	992.6	1000.4	1008.5	990.1	997.1
Dec	32.5	10.9	23.0	98	30	76	85	24	46	1013.8	996.2	1002.7	1008.0	993.5	998.7

3.6 AIR QUALITY

3.6.1 The dust generated during drilling and blasting and due to operation of crusher will pollute the air which may cause respiratory diseases to the workers.

Due to this there will not be much generation of dust in the area which can pollute the environment. Besides, the applicant does not have any proposal for putting up any crushing plant or other processing unit in the area which can pollution the air quality of the area. Monitoring period January 2009 – March 2009.

1) Salaimeta (A1)
2) Mahadula (A2)
3) Bhandarbodi (A3)
4) Seoni (A4)

TABLE 3.4

METHOD OF ANALYSIS

Sr. No.	Parameters	Techniques	Technical Protocol	Min Detectable limit (μg/m3)
1	**Suspended Particulate Matter (SPM)**	Respirable Dust Sampler, APM 460 (Gravimetric Method)	IS-5182 (Part-IV)	Nil
2	**Respirable Particulate Matter (RSPM)**	Respirable Dust Sampler, APM 460 (Gravimetric Method)	IS-5182 (Part-IV)	Nil
3.	**Sulphur Dioxide**	West and Gaeke	IS-5182 (Part-II)	Nil
4.	**Oxides of Nitrogen**	Jacob & Hochheiser	IS-5182 (Part-IV)	Nil

The detailed monitoring results of SPM, RPM, SO_2 and NO_x are presented through **Tables 3.5(A) to Table 3.5(D)** corresponding to air quality stations A1 to A4. The Minimum, Maximum, Average (Avg) and 98 Percentile values (p98) of 24-hourly average values measured during the period are shown in **Table 3.6.** The National Ambient Air Quality Standards as notified on 11.4.1994 by the CPCB are presented in **Table-3. 7** Monitoring period 2007 – December 2007.

Table –3.5(A)

Ambient Air Quality Monitoring Results At Station AQ1 *all values unit is µ/m^3*

Sl. No.	Week	SPM	RPM	SO_2	NOx
1	Week 1	146	43	8	7
2		129	38	10	12
3	Week 2	188	49	8	9
4		123	41	10	12
5	Week 3	149	45	12	13
6		93	38	9	10
7	Week 4	210	59	10	13
8		122	50	8	10
9	Week 5	152	57	10	12
10		109	36	9	12
11	Week 6	151	59	8	13
12		156	62	11	13
13	Week 7	136	55	10	12
14		150	46	10	12
15	Week 8	170	55	10	12
16		125	49	9	12
17	Week 9	103	40	8	11
18		123	43	9	11
19	Week 10	164	54	9	12
20		156	49	9	9
21	Week 11	140	50	11	10
22		146	55	8	10
23	Week 12	133	46	10	12
24		115	42	10	9
25	Week 13	97	37	9	11
26		121	47	10	12
27	Week 14	130.95	29	9	10
28		134.83	45	7	9

Table –3.5 (B)

Ambient Air Quality Monitoring Results At Station AQ2

Sl. No.	Week	SPM μ/m^3	RPM μ/m^3	SO_2 μ/m^3	NOx μ/m^3
1	Week 1	147	61	11	11
2		141	71	9	9
3	Week 2	185	34	11	9
4		129	43	12	12
5	Week 3	201	58	12	12
6		159	42	9	10
7	Week 4	211	70	13	13
8		211	70	8	11
9	Week 5	178	59	12	11
10		181	52	10	13
11	Week 6	170	60	8	10
12		134	50	12	11
13	Week 7	122	42	11	14
14		177	66	12	14
15	Week 8	110	50	9	13
16		121	49	11	14
17	Week 9	141	53	11	13
18		129	48	10	11
19	Week 10	150	59	10	13
20		156	64	11	14
21	Week 11	114	40	9	11
22		140	45	11	10
23	Week 12	120	50	10	13
24		117	41	9	11
25	Week 13	154	58	11	13
26		176	71	10	10
27	Week 14	160.05	45	9	10
28		110.58	39	8	10

Table -3.5 (C)

Ambient Air Quality Monitoring Results At Station AQ3

Sl. No.	Week	SPM μ/m^3	RPM μ/m^3	SO_2 μ/m^3	NOx μ/m^3
1	Week 1	108	38	8	11
2		98	37	8	11
3	Week 2	109	32	8	12
4		105	30	8	11
5	Week 3	137	40	9	12
6		127	48	9	11
7	Week 4	149	46	10	14
8		104	34	9	10
9	Week 5	113	42	10	13
10		157	39	11	13
11	Week 6	140	42	10	12
12		95	33	9	11
13	Week 7	103	45	10	12
14		122	48	10	13
15	Week 8	114	43	8	11
16		137	46	10	13
17	Week 9	86	35	10	12
18		85	33	9	12
19	Week 10	103	41	10	13
20		121	49	11	13
21	Week 11	126	50	11	11
22		123	49	11	13
23	Week 12	115	44	10	12
24		86	39	8	10
25	Week 13	95	40	9	12
26		107	46	10	12
27	Week 14	111.55	36	6	8
28		110.58	32	7	9

Table –3.5 (D)

Ambient Air Quality Monitoring Results At Station AQ4

Sl. No.	Week	SPM μ/m^3	RPM μ/m^3	SO_2 μ/m^3	NOx μ/m^3
1	Week 1	132	52	9	12
2		101	56	9	11
3	Week 2	123	66	10	12
4		132	64	10	12
5	Week 3	106	63	9	12
6		170	59	9	11
7	Week 4	136	62	9	10
8		155	64	9	11
9	Week 5	162	56	8	10
10		170	61	9	11
11	Week 6	142	59	10	12
12		137	58	9	12
13	Week 7	108	66	10	11
14		140	55	8	12
15	Week 8	127	52	8	11
16		140	59	9	12
17	Week 9	147	63	9	11
18		118	62	8	11
19	Week 10	135	64	10	12
20		110	56	9	12
21	Week 11	142	57	10	11
22		136	59	10	10
23	Week 12	109	40	10	11
24		113	63	10	12
25	Week 13	147	58	9	11
26		137	55	10	12
27	Week 14	105.536	46.4	6.4	8
28		110.192	36	6.4	8

TABLE- 3.6
STATISTICAL ANALYSIS OF AMBIENT AIR QUALITY RESULTS

Location	Unit	Pol	SPM	RPM	SO_2	NOx
AQ1	$\mu g/m^3$	**Min**	93	29	7	7
		Max	210	62	12	13
		Avg	138	47	9.34	11.11
		p98	198	60	11.49	13.19
AQ2	$\mu g/m^3$	**Min**	110	34	8	9
		Max	211	71	13	14
		Avg	152	53	10.29	11.65
		p98	211	71	12.722	14.092
AQ3	$\mu g/m^3$	**Min**	85	30	6	8
		Max	157	50	11	14
		Avg	114	41	9.22	11.64
		p98	153	50	11.25	13.54
AQ4	$\mu g/m^3$	**Min**	101	36	6	8
		Max	170	66	10	12
		Avg	132	58	8.98	11.10
		p98	170	66	10.16	12.32

Note: Pol : Pollutant
AAQMS : Ambient Air Quality Monitoring Station
Avg : Average
P98 : 98 Percentile Value

TABLE-3.7

NATIONAL AMBIENT AIR QUALITY STANDARDS

[As Notified on 11th April, 1994 by the Central Pollution Control Board in exercise of its powers conferred under section 16(2)(h) of the Air (Prevention and Control of Pollution) Act, 1981 (14 of 1981)]

Pollutant	Time-Weighted Average	Concentration (□g/m^3) in Ambient Air		
		Industrial	Residential Rural	Sensitive
Sulphur Dioxide (SO_2)	Annual*	80	60	15
	24-Hours**	120	80	30
Oxides of Nitrogen (NO_x)	Annual*	80	60	15
	24-Hours**	120	80	30
Suspended Particulate Matter (SPM)	Annual*	360	140	70
	24-Hours**	500	200	100
Respirable Particulate Matter (RPM)	Annual*	120	60	50
(size less than 10 um)	24-Hours**	150	100	75
Lead (Pb)	Annual*	1.00	0.75	0.50
	24-Hours**	1.50	1.00	0.75
Carbon Monoxide (CO)	8-Hours**	5000	2000	1000
	1-Hour	10000	4000	2000

Annual Arithmetic Mean of minimum 104 measurements in a year taken twice a week 24-hourly at uniform interval.

24-hourly/8-hourly values should be met 98% of the time in a year. However, 2% of thetime, it may exceed but not on two consecutive days.

3.7 WATER QUALITY

Selected water quality parameters for surface and ground water resources within 10 km of the study area have been considered for assessing the water environment and evaluate the impact due to the proposed mining project. Understanding the water quality is important in preparation of Environment Impact Assessment (EIA) and to identify critical issues with a view to identify appropriate mitigation measures for implementation. The purpose of this study is to.

- To understand the baseline characteristics;
- Identify water polluting sources;
- Identify critical parameters of water characteristics and their origin;
- Evaluate the extent of leaching to ground water from solid waste dumps located in the vicinity; and
- Predict impact on water quality viz. the existing and the future expansion of mining and other relevant activities.

Methodology:

Reconnaissance survey was undertaken and monitoring locations were finalized based on:

- Topo maps to identify major water bodies;
- Location of industrial/residential areas, their water intake and effluent disposal locations; and
- Likely areas which can represent baseline conditions.

Samples have been collected as per IS-2488 (Part I-V). Sampling and analysis of water samples for physical, chemical & heavy metals have been undertaken on seasonal basis. Two locations for surface water and four locations for ground water were selected.

During the first years the mining operation will not reach the level of ground water. Thus no adverse effect on the ground water is expected.

The ground water available in the well, Bore well etc. is of potable nature and no adverse effect has been noticed in the past due to human consumption and in future also there will not be any change in quality due to future mining activity.

Station Code	Location	Source
SW_1	Salaimeta	Hand pump
GW_2	Mahadula	Hand pump
GW_3	Bhandarbodi	Dug well
GW_4	Seoni	Handpump

PHYSICAL CHARACTERISTICS:

Ground Water: It is already mentioned that ground water is available within 10m of the surface level and available in nearby well, Bore well etc.

Surface Water At present is no water sources which are passing through the lease area and nearby surrounding. There may be accumulation of surface water during rainy season which will be pumped out through pump. Apart from this there will not be any other sources for surface water in the area.

Sampling Procedure for Primary Data Generation: Ground and surface water sources covering 10 km radial distance were examined for physico-chemical, heavy metals and bacteriological parameters in order to assess the effect of industrial and other activities on surface and ground water. The samples were collected and analyzed as per the procedures specified in 'Standards Methods for the Examination of Water and Waste Water' published by American Public Health Association (APHA).

Samples for chemical analysis were collected in polyethylene carboys. Samples collected for metal content were acidified (1 ml HNO_3). Samples for bacteriological analysis were collected in sterilized glass bottles. Parameters analyzed at the site are pH, temperature, odor, turbidity and dissolved oxygen using portable water analysis kits.

Selected physico-chemical and bacteriological parameters have been analyzed for protecting the existing water quality status in the core area.

TABLE-3.8
ANALYSIS RESULTS OF WATER

S N	Characteristics	SW1	GW1	GW2	GW3
1	Colour, Hazen units	< 1	< 1	< 1	< 1
2	Odour	Unobjec-tionabl	Unobjec-	Unobjec-	Unobjec-
3	Taste	Agreeable	Agreeable	Agreeable	Agreeable
4	Turbidity, NTU	< 1	< 1	< 1	< 1
5	PH	7.21	7.2	7.07	7.57
6	Temperature	23	22	26	27
7	BOD	2.3	1.7	0.9	0.7
8	TSS	1.2	1.2	6.1	5.6
9	Conductivity	1562	1653	1682	1077
10	Oil & Grease	Nil	Nil	Nil	Nil
11	O.A.	284	278	277	270
12	Redox Potential	546.6	540	531.2	554.2
13	Hardness as CaCO3 (mg/l	292.8	243.4	280	259.9
14	Iron (Fe) (mg/l.)	0.21	0.3	0.26	0.24
15	Sulphate (mg/l.)	118.3	100	145.1	63.4
16	Chloride (mg/l.)	186.5	211.6	188.7	124.8
17	Residual Chlorine (mg/l.)	0.1	0.1	0.1	0.1
18	Fluoride (mg/l.)	0.7	0.9	0.8	0.7
19	Total Dissolved Solids	490.2	959.2	983.5	624.7
20	Calcium as Ca (mg/l.)	74.7	69.5	73.9	74.7
21	Ca as CaCO3 (mg/l.)	186.7	173.9	184.8	186.7
22	Magnesium as Mg (mg/l.)	25.8	16.9	23.1	17.8
23	Copper as Cu (mg/l.)	0.01	0.02	0.01	0.01
24	Manganese (mg/l.)	0.03	0.02	0.02	0.01
25	Nitrate (NO3) (mg/l.)	39.8	44.8	44.8	43.1
26	Nitrite (NO2) (mg/l.)	0.14	0.1	0.08	0
27	EC (Mhos)	3.49	2.29	3.26	0.959
28	Alkalinity, HCO3 (mg/l.)	51.8	62.2	56.2	35.5
29	Sodium mg/l	65.2	97.1	88.3	15.6
30	Potassium mg/l	8.6	12.4	9.8	1.2
31	COD (mg/l.)	7.3	5.3	3.6	3.2
32	Mineral Oil (mg/l.)	< 0.01	< 0.01	< 0.01	< 0.01
33	Chromium	Absent	Absent	Absent	Absent
34	Lead	Absent	<0.01	Absent	Absent
35	Selemium	BDL	BDL	BDL	BDL
36	Arsenic	BDL	<0.05	Absent	Absent
37	Cadmium	<0.001	<0.001	Absent	Absent

3.8 NOISE LEVEL SURVEY

The physical description of sound concerns its loudness as a function of frequency. Noise in general is sound which is composed of many frequency components of various loudness distributed over the audible frequency range. Various noise scales have been introduced to describe, in a single number, the response of an average humans to a complex sound made up of various frequencies at different loudness levels. The most common and universally accepted scale is the 'A'. Weighted scale which is measured as dB (A). This is more suitable for audible range of 20 to 20,000 Hz. The scale has been designed to weigh various components of noise according to the response of a human ear. The impact of noise sources on surrounding community depends on:

- Characteristics of noise sources (instantaneous, intermittent or continuous in nature). It can be observed that steady noise is not as annoying as one which is continuously varying in loudness;
- The time of day at which noise occurs, for example high noise levels at night in residential areas are not acceptable because of sleep disturbance; and
- The location of the noise source, with respect to noise sensitive land use, which determines the loudness and period of exposure.

The environmental impact of noise can have several effects varying from Noise Induced Hearing Loss (NIHL) to annoyance depending on loudness of noise levels. The environmental impact assessment of noise from the industrial activity, vehicular traffic can be undertaken by taking into consideration various factors like potential damage to hearing, physiological responses, annoyance and general community responses.

The main objective of noise pollution impact assessment in the study area is to assess the impact of the total noise generated by the existing domestic activities and vehicular traffic on the human settlements within 10 km radius. The main objective of the studies conducted is:

a) Assessment of background noise levels;

b) Identification and monitoring the major noise sources of the existing activity; and

c) To assess the impact of noise on the workers as well as on general population.

Identification of Sampling Locations: A preliminary reconnaissance survey has been undertaken to identify the major noise generating sources in the area. Noise generating sources have been identified with respect to the activities viz, industrial noise, ambient noise due to industries & traffic noise impact on sensitive areas.

The operation of compressor and jack hammer and operation of crusher will increase the noise level to some extent.

The use of small quantity of explosive will not increase the vibration level. The ambient noises are primarily due to wind and during the time of blasting of jack hammer drilled holes. The noise level is within acceptable limit.

TABLE – 3.9

AMBIENT BASELINE NOISE LEVELS

Location code	Location	Area Category	Noise Level (L_{eq})in dB(A)	
			Day Time	Night Time
N1	Salaimeta	Residential	45	38
N2	Mahadula	Residential	55	42
N3	Bhandarbodi	Residential	51	45
N4	Seoni	Residential	52	43

Types of Sound Fields:

- **Free Field:** Free progressive sound waves have been described as sound waves that propagate without obstruction from source to the receiver. In the

case of spherical waves, the inverse square law holds well so that the sound pressure level decreases by 6 dB as the distance is doubled. Such a field is known as free field.

- **Near Field:** The near field is defined as that region close to the source where the inverse square law does not apply. Usually this region is located within a few wavelengths of the source and it is also controlled by the dimensions of the source.
- **Far Field:** The far field consists of two parts, the free part and the reverberation part. In the free part of the far field, the sound pressure level obeys the inverse square law. The reverberant part of the field exists for enclosed situation where the reflected sound waves are superimposed on the incident sound waves. If there are many reflected waves from all possible direction, a diffuse sound field exists.

Parameters Measured During Monitoring: A noise rating developed by E P A for specification of community noise from all the sources is the Day-Night Sound Level (L_{dn}). It is similar to a 24 hr equivalent sound level except that during the night time period, which extends from 9 p.m. to 6 a.m., a 10 dB (A) weighing penalty is added to the instantaneous sound level before computing 24 hr average. This night time penalty is added to account for the fact that noise during night when people usually sleep is judged more annoying than the same noise during the day time. For Noise levels measured over a given period of time interval, it is possible to describe important features of noise using statistical quantities. This is calculated using the percent of the time certain noise levels exceeding during the time interval. The notation for the statistical quantities of noise levels are described below:

- L_{10} is the noise level exceeded 10 percent of other time.
- L_{50} is the noise level exceeded 50 percent of the time and
- L_{90} is the noise level exceeded 90 percent of the time and
- L_{day} is defined as the equivalent noise level measured over a period of time during day (6 am to 9 pm)

- L_{night} is defined as the equivalent noise level measured over a period of time during night (9 pm to 6 am).

Equivalent Sound Pressure Level (L_{eq}): This L_{eq} is the equivalent continuous sound level which is equivalent to other same sound energy as the actual fluctuating sound measured in the same period. This is necessary because sound from noise source often fluctuates widely during a given period of time.

This is calculated from the following equation:

$$L_{eq} = \frac{L_{50} + (L_{10} - L_{90})^2}{60}$$

L_{dn}: The noise rating developed for community noise from all sources is the Day-Night Sound Level (L_{dn}). It is similar to a 24 hr equivalent sound level except that during night time period (9 pm to 6 am) a 10 dB (A) weighing penalty is added to the instantaneous sound level before computing the 24 hr average. The L_{dn} for a given location in a community may be calculated from the hourly L_{eq}'s, by the following equation.

$$L_{dn} = 10 \log (1/24 [15(10^{Ld/10}) + 9 (10^{(Ln + 10)})]\}$$

Where L_d is the equivalent sound level during the day time (6 am to 9 pm) and L_n is the equivalent sound level during the night time (9 pm to 6 am).

3.9 FLORA AND FAUNA

Flora: There is no flora and fauna of national importance. It has already been mentioned that this area is generally considered arid and devoid of high moisture in the atmosphere. There is hardly local varities of tree like shal, babul and thorny bushes shrubs are main vegetation in the area. There is plantation in the mining lease area which has been planted by the lessee during the pendency of the lease period. Apart from the above agricultural lands are there were one time crop is being cultivated. Except the abovementioned trees vast tracts of area does not have any flora of great importance.

Fauna: Natural fauna in the area is field mice, rabbit, foxes. No animal seen in the area. Domesticated cattle are oxes, buffalows, cows and goats are available in plenty numbers.

Rural Vegetation: The lease area is barren land and devoid of any agricultural activities in the area. In case, agricultural activities has to be carried out in the area good amount of nutrients has to be poured in the ground to enrich it. At present there are no agricultural activities in the lease area so there will not be any impact on this due to future mining activity.

The lease area at present devoid of any vegetation and the land is barren. But due to future mining activities there will be generation of alluvial soil which will be dumped in the lease boundary and through plantation the dumps will be established. It will give greenery pastures to the environment and will also have retention effect on the soil dump.

3.10 SOCIAL AND DEMOGRAPHIC PROFILE:

Socio-Economical Environment: The small scale mining operations will not have any major effect on the socio-economics of the area. It will provide employment to the local people and will help in uplifting their living standards.

Social & demographic profile at present there is not much activity excepting mining activity in the area. But due to mining activity in the area there will be generation of employment to the local people as well as there earning will also be increased. Due to this reason there will be more improvement in the living condition of the people, there will be more employment in the area.

Human Settlement: In this region there will be mining activities in area. Though there is local populace available but due to increase in demand or increase in mining activity and there is possibility of migration of labour from surrounding area. For this reason there will be increase in the human settlement of the area. Due to increased revenue earning in the area there will be development of infrastructural facilities such as transport, road, housing, schooling as well as hospitals.

Historical Places: The study area has no major historical places important from the archaeological point of view.

TABLE 3.12

DEMOGRAPHIC INFORMATION - 2001 CENSUS

S.N.	NAME OF THE VILLAGE	NO OF HOUSE HOLDS	POPULATION			SCHEDULE CASTE POPULATION	SCHEDULED TRIBE POPULATION	LITERATE	
			TOTAL	MALE	FEMALE			MALE	FEMALE
1	Mahadula	298	1348	702	646	148	511	492	352
2	Bhandarbodi	344	1538	757	781	136	476	539	401
3	Seoni	76	346	180	166	126	50	115	88
4	Seoni-Bhondki	346	1601	804	797	84	312	578	442
5	Hasapur	55	246	125	121	10	164	95	72
6	Salaimeta	131	628	316	312	0	253	238	182
7	Goguldoh	194	939	466	476	12	732	311	216
8	Sirpur	188	795	392	403	203	220	215	139

(According to Censes of India 2001)

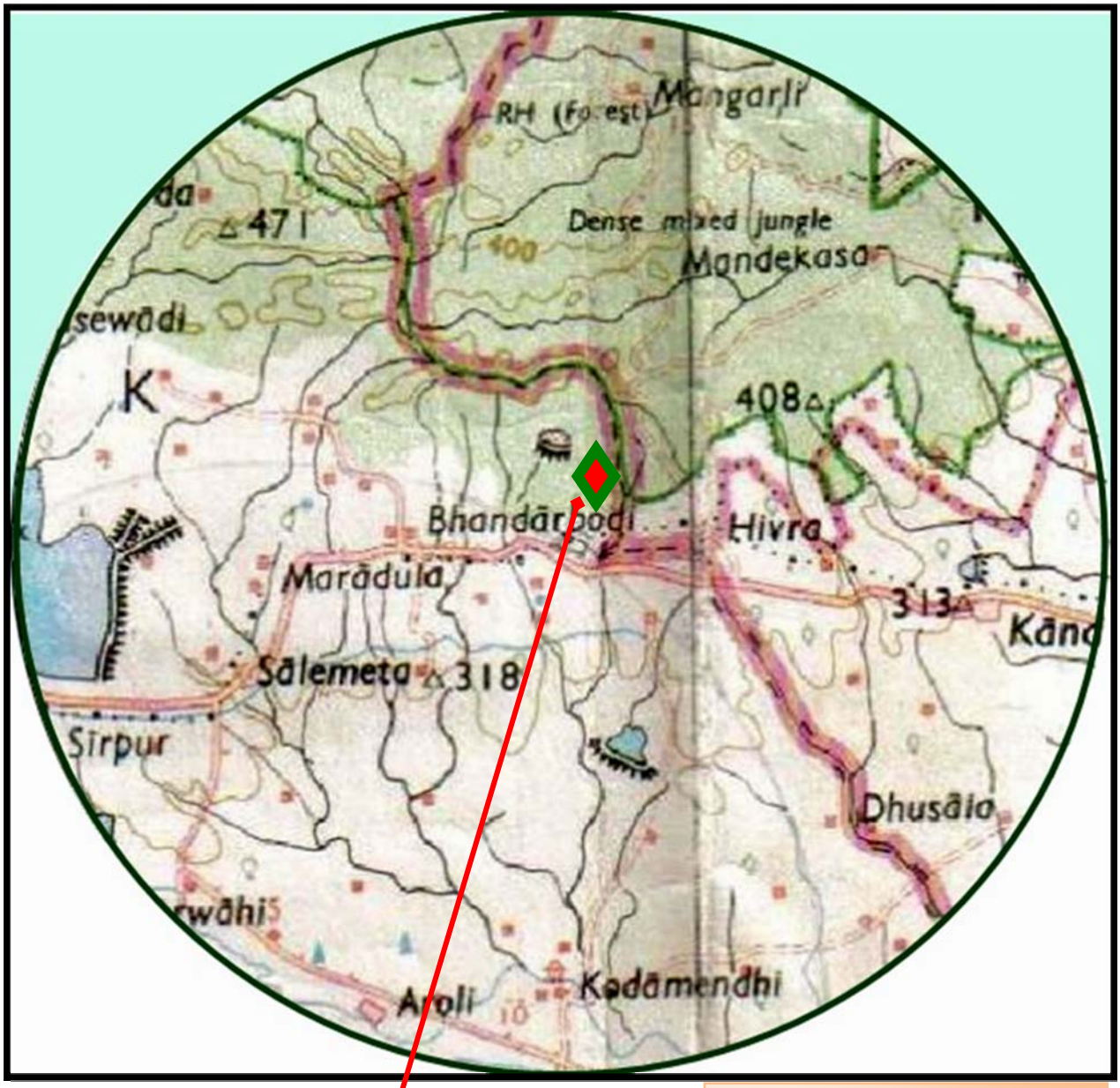
TABLE 3.13

VOCATIONAL INFORMATION - 2001 CENSUS

S.N.	NAME OF THE VILLAGE	TOTAL MAIN WORKERS		CULTIVA-TORS		AGRIL LAB		HH INDUSTRY		OTHER WORKERS		MARGINAL WORKER		NON WORKERRS	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F
1	Mahadula	394	325	161	97	180	220	0	0	53	8	93	120	308	321
2	Bhandarbodi	431	411	170	172	176	218	18	2	67	19	20	58	326	370
3	Seoni	102	83	48	27	47	56	0	0	7	0	15	27	78	83
4	Seoni-Bhondki	419	380	106	85	253	278	17	11	43	6	226	257	385	417
5	Hansapur	68	58	29	18	30	32	1	5	8	3	6	8	57	63
6	Salaimeta	316	312	88	57	81	90	10	0	0	1	37	56	137	164
7	Guguldoh	252	94	88	17	139	70	9	2	16	5	42	66	214	379
8	Sirpur	392	403	25	139	65	74	0	0	138	120	1	1	164	183

(According to Censes of India 2001)

Village Bhandarbodi, Tahsil Ramtek, District Nagpur (M.S.)



TOPOSHEET NO. 55 O / 7

BHANDARBODI MANGANESE MINE

CHAPTER IV

ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURE

4.1 INTRODUCTION

The air pollution impacts of proposed Manganese Ore mine depend on the intensity of ore extraction operations, mode of transport and mode of screening of ore. The intensity of operation is directly related to the rate of production of ore from mining. Production details are reported in Chapter-2. Similarly drills, excavator, loaders, trucks of different capacities are engaged mainly for extracting and transporting the ore from mining area. The details of the equipment are also given in Chapter-2.

Majority of the heavy machinery is operated on diesel. The mining activity is likely to contribute additional Suspended Particulate Matter (SPM), Dust from area sources and Oxides of Nitrogen (NO_X) and hydrocarbons from automobile exhaust. The existing baseline concentrations of pollutants are within the limits prescribed by CPCB.

Air pollution sources at the mining area can be classified into three categories, viz., area sources, line sources and instantaneous point sources. Extraction of manganese by various activities in mining area is considered as an area source. Transportation of ore from mining area to the loading bay is considered as line source. Blasting is the main source of instantaneous point sources. Blasting is usually done by deep holes.

The total explosive consumption will be about 763.71 Kg / annual during the next five years of operation. The manganese will be drilled, blasted and transported by trucks/ dumpers. SPM and NO_X emissions are envisaged during these blasting and transportation operations. But these are kept under control by monitoring regularly the emissions from exhaust and by

sprinkling of water on haul roads etc. The sources of pollutants from mining activities are given in **Table-4.1. Table-4.1.**

Source	Type of
Mining activity (drilling, blasting, loading)	SPM, NO_X
Transport of Over Burden (OB) waste for dumping/ backfill and ore to sorting/sizing	SPM,
Dumping of waste	SPM
Sorting of ore and loading	SPM
Transportation of sorted ore	SPM, NO_X

Sources of Pollutants

Impacts from Area Sources.

a) Mine Pit: As discussed in Chapter-2, the area sources include mine pit and its activities covering drilling, blasting, hauling and loading/unloading and stockpiles.

The dust emissions from the above areas will be fugitive in nature and maximum during summer season (when the wind velocities are likely to be high) and almost nil during the monsoon season. The dust emissions are likely to be confined to the mine premises only. The quantification of these fugitive emissions from the area sources is difficult as it depends on lot of factors such as dust particle size, specific gravity of dust particles, wind velocity, exposed area, moisture content of the material, surface compactness of the exposed area and ambient temperatures etc. Also, there is a high level of variability in these factors. Hence, these are not amenable for mathematical dispersion modeling.

The gaseous emissions like Oxides of Nitrogen from the blasting activity will be instantaneous and will prevail for shorter duration. Hence, the impact due to blasting will be instantaneous and there will not be any long-term adverse impacts.

Similarly, the excavation/mining operations, loading and unloading operations will cause dust generation. The dust generated will be confined to the area of operation of the excavator and will not have any adverse impact on the community. The gaseous emissions from these operations will also be negligible and limited to the mine pit only.

A temporary soil overburden dump will be created, which is another source of dust generation.

b) Pollution at the Overburden Dumps: The dumping and grading operations at the dumpsites are the other sources of dust generation. There will be generation of dust while heaping the overburden and movement of tippers. The overburden can be dumped by giving less aerial lift and fragmentation can be done by gradual dozing. This will help in reduction of dust generation

c) Line Sources and their Impact: Transportation of ore / waste from the mine pit to the stockpile / dump site will be covered under line source. There will be a number of tippers operating for transportation.

The likely contribution from the dumpers plying on the haul roads has been computed by using CALINE3 model. The modeling has been carried out for Oxides of Nitrogen and Carbon Monoxide. The emission factors specified by Indian Institute of Petroleum (IIP), Dehradun have been used for the modeling. The modeling for dust has not been carried out, as there are no specified emission factors for particulate matter by IIP.

The maximum concentration (1-hourly) due to the vehicle movement will occur within 20-m on either side during stability Class-A conditions.

It can be observed that the contribution from the tipper movement on the haul road will be confined to the mine area only and will not have any adverse impact on the community. The tipper movement will cause emission of particulate matter. However, this will be fugitive in nature and

will be restricted to the proximity of the haul road only.

d) Impact due to Instantaneous Emission Sources and their Impact: Blasting is the major source of instantaneous emission sources. Blasting in the mining will be conducted through deep blast holes and will be carried out during day time only between 12 pm to 4 pm only.

SPM and NO_X emissions are envisaged during these blasting operations. Even though blasting generates NO_X, it will be instantaneous and intermittent. There will not be any secondary blasting as rock breaker will be used for fragmenting lump ore.

e) Fugitive Emissions: The fugitive emissions are mainly generated while loading the manganese ore at mine face, transportation of ore from mine face and while unloading of ore.

Another source of fugitive emissions would be stacked soil dumps in the ML area. Fugitive emissions are likely to be generated from these dumps due to the wind. With the proposed control measures, the fugitive emissions will be insignificant in terms of their impact on environment.

f) Overall Impact due to the Mine: As discussed above under each activity, there will be increase in terms of dust load and gaseous emissions. However, it can be stated that these incremental contributions will be confined to the mine lease area only and will not have any adverse impact on the outside community.

Mitigation Measures

- It is recommended that drilling shall be done with the wet drilling thus the likelihood of dust emission from drilling activities is reduced.
- The blasting shall be carried out only during 12 noon to 4 pm during the daytime when normally low wind conditions prevail and temperature inversions are not likely to occur.

- Regular sprinkling of water will be taken-up which will minimize the dust generation.
- Gradual compaction and subsequent plantation on the inactive dumps will reduce the dust emissions.
- The truck wheels are likely to cause pollution in terms of dust. Thus the truck washing system is suggested which will minimize the fugitive dust emission.
- SPM and NO_X emissions are envisaged during blasting operation which will be kept under control by sprinkling of water on haul roads and monitoring regularly the emissions from exhaust etc. The large quantity of dust will be wind borne due to blasting but due to the proposed greenbelt around the mine, the spread of dust will be arrested.
- Water will be sprinkled to control the dust arising from the handling and operations. The dust on haul roads is suppressed through regular water sprinkling.
- The fugitive emission generated during drilling is suggested to be controlled by using dust collectors with vacuum suction to the drilling machines.
- And will also be controlled by means of sprinklers and development of greenbelt, which will also serve to arrest the soil erosion.
- The emissions from vehicles will be managed through an appropriate maintenance schedule for all vehicles, correct engine tuning, and a reduction in the numbers of diesel driven equipment and use of good fuels.
- The approach roads and vehicles will be kept in good condition to minimise automobile exhaust.
- Tarpaulin covers shall be used over the beds of trucks, which will be used for transportation of overburden and manganese ore , which are prone to fugitive dust emission.

- Idling of delivery trucks / equipments should not be permitted.
- Extensive tree plantations Program along the boundaries of the proposed mine and transportation roads will reduce the effect of fugitive dust from various activities.
- Provision of dust masks and periodic health check up for workers.

4.2 IMPACT ON WATER QUALITY:

a) Impact on Water Resources

Surface Water Resources: Major portion of the water requirement for the mining operations will be sourced from mine pit water and a small quantity of water will be sourced from the groundwater within the mine lease area.

There is no water source passing through the proposed Manganese mine. There may be accumulation of surface water during rainy season when the pit will be developed due to future mining activity. The same will be removed by pumping.

b) Groundwater Resources: The groundwater in the study area occurs in shallow aquifers at a depth of about 3 m to 10 m. It is anticipated that the ground water table will be intercepted by the mining operations, once 315 MRL bench and other deeper levels are opened-up. The maximum envisaged depth of mining will be about 5 m. Accumulation of water in the pit will help in recharging and improving the water table.

c) Impact on Surface Water Quality: The wastewater generation in the mining process is not envisaged. No treatment is required for domestic effluent also. The extra mine water may be discharged to stream if it is required.

d) Impact on Ground Water Quality: Groundwater pollution can take place only if the mining rejects contain chemical substances. The chemicals get leached by the precipitation water and percolate to the groundwater

table thus polluting it. Any nearby wells or other sources of water can be rendered unfit for drinking and even for industrial use.

This is not the case with this deposit as the mineral or topsoil does not contain any harmful ingredients. Moreover, Manganese constitutes of fairly inert and chemically non-reactive ingredients.

The water is portable in the dug well and bore well. There is no beneficiation plant located nearby and hence the contamination of water due to chemical is not envisaged.

e) Waste water Generation, Treatment and Disposal: The waste consists of soil, Mica-Schists as overburden etc.

There is a thin layer of topsoil in the area.

Mineral rejects consists of Gondite formation, fragments of Quartz & Pegmatite, intercalations & other gangue minerals etc.

Year wise likely generation of soil and waste and mineralized rejects, during the Mining Plan.

Land chosen for disposal of waste proposed justification is proposed to dump the overburden on the site shown in Five year development & production plan & Conceptual Plan as Proposed dump. This land is on the foot wall side and hence, it is non-mineralised.

There will be no production of sub-grade material but as and when the sub-grade will be produced it will be stored in separate space.The production of Manganese ore will be stored in the area provided in storage yard. The produce ore after gradation will be transported out of the area in about 3 to 4 week time.

The stacks of Manganese ore may be 10mL x 10 mB x about 1 mH.

f) Quantity of Water Likely to be encountered in Mine Pits: The groundwater table may be intercepted by proposed mining operations, however it will happen in rare situation, as the mining will be carried out at shallow depth of 5 m and the ground water table is 3 to 8 m. The mine water from the sump is used for activities such as:

- Spraying on haul roads for dust suppression;
- Equipment washing in the service centre.
- Dust suppression in the mine pit.
- Watering in greenbelt and afforestation areas.

The excess mine water will be discharged to nearby stream hence; no impact of mine water is envisaged.

g) Hydrological Conditions: The mining activities especially excavation and blasting are likely to develop cracks and joints in the underlying formations. However, these cracks and joints will develop secondary porosity thereby increasing the infiltration index, which subsequently enhances the recharge to groundwater in the region. No major hydrological changes are envisaged due to the mining activities.

There is no drain or stream in the mining lease area hence no impact is envisaged on the drainage pattern.

- **Mitigation Measures**
  i. The storm water will be diverted from the mining areas through a series of diversion banks intercept drains to either the natural drainage channels or to water storage reservoirs.
  ii. The storm water runoff from the mining areas will be diverted to the sedimentation dams to reduce the suspended solids to meet the regulatory requirements, through garland drains formed around the mine, dump yards, stockpiles, workshops, etc.

iii. All drain channels will provide with small stone/rock barriers across drains to check water current and to arrest solid particles. These will also be cleaned periodically.

iv. A network of drains, sedimentation control dams and sumps will be provided in the in-pit drainage so that maximum quantity of water will be reused to store in the water reservoirs.

v. For complying the statutory provisions of MOEF and Pollution Control Board, water quality will be monitored and evaluated. The corrective measures will be taken on the basis of monitoring results.

4.3 IMPACT ON NOISE LEVELS AND GROUND VIBRATIONS

4.3.1 Noise Impact Analysis on Working Environment: With the mining operations, due to the deployment of machinery, drilling and blasting for mine development, excavation and transportation of ore and men, it is imperative that noise levels would increase. However, as the mine is located about 1.5 Km away from the nearest settlement, the expected noise levels will not have significant effect on the community.

4.3.2 Noise Generated Due to Blasting: Noise generated from blasting is neither continuous nor for a shorter duration but instantaneous. It takes less than 5 seconds to occur. Noise of blast is site specific and depends on type, quantity of explosives, dimensions of drill holes, degree of compaction of explosive in the hole and rock. Typical noise levels generated by blasting from the mine lease are presented in Table-4.2.

Table-4.2

Typical Noise Generating Source

Total Explosive Charge	Distance (m) from Blasting Site	Noise Level (dB)

145	300	125-130
240	300	120-125
500	300	115-120

The noise levels during blasting operations are likely to be in the range of 110-130 dB (A) at 300 m distance from the blast site. The noise levels tend to decrease with distance. Blasting in the existing mine is carried out maximum four times per week between 12 pm to 4 pm. As the blasting is likely to last for 5 to 7 minutes depending on the charge, the noise levels over this time would be instantaneous and short in duration. As the nearest village is located at about 1.0-km from the mine center, impact due noise levels from blasting is not envisaged.

4.3.3 Noise Generated due to Drilling: The drilling operations in the existing mine as well as in the mines are carried out using wet drilling and Jack Hammer. The typical Noise levels due to drilling at 1-m distance will be about 85 to 95 dB (A).

It is noted that the noise levels due to drilling are above 90 dB (A). Noise generated due to drilling may affect workers if equivalent 8-hr exposure is more than the safety limit of 90 dB (A).

4.3.4 Noise Generated due to Excavation and Transportation: Typical noise levels generated during excavation, loading and transportation activities of the mining activities are presented in Table-4.3.

Table-4.3

Typical Noise Generation Due to Excavation/ Loading/ Transportation

S	Name of the Equipment	Noise at Source
1	Jack hammer drills(at full race)	85-90

2	Excavator /loader	90-95
3	Tippers	80-85

The total noise from all of the above equipments occurs only when all the equipments operate together and simultaneously, which is a remote possibility.

4.3.5 Noise Dispersion from the Mine: The noise generation from the mine will be from various sources, which will be originating from various locations within the quarry pit. For the purpose of noise dispersion, it is assumed that all the noise generating sources from the quarry as one source. Hence, total noise from drilling, excavation, transportation and loading will be equivalent to 107.5 dB (A). The dispersion of this noise is computed by using the model.

4.3.6 Noise Impact Analysis on Community: The noise levels in the working environment are compared with the standards prescribed by Occupational Safety and Health Administration (OSHA) which in-turn are being enforced by Government of India through Model rules framed under the Factories Act. These standards were established with the emphasis on reducing the hearing loss. It should be noted that each shift being of 8 hr duration, equivalent noise level exposure during the shift is 90 dB (A).

The isopleths and the noise levels obtained by modeling are presented in Figure-4.3. From the isopleths, it is observed that higher noise levels will be conformed to work zone areas only. It can be seen that noise levels get diffused rapidly with distance.

The predicted noise levels indicate that the noise contours of 50 dB (A) occurs within the mine lease area only at about 1.0-km from the centre of the source. Thus, there will not be an increment to the ambient noise levels.

The isopleths and the noise levels obtained by modeling are presented in summary, it can be stated that only the noise impact due to mining on working environment is relatively significant (equivalent levels are but likely to be within limits), while the noise impact on community will be insignificant.

- **Mitigation Measures**
  i. Acoustic treatment for rotating equipments.
  ii. Compulsory use of personnel protective equipment (PPE) such as ear plugs for the workers.
  iii. Installation of noise generating machinery, strictly in compliance with the recommendations of the manufacturers. This would ensure an installation free from vibration and exhaust leaks which are also major contributors to increased noise levels.
  iv. Provision of insulating caps and aids at the exit of noise source on the machinery.
  v. Use of damping materials such as thin rubber sheet for wrapping the worn places of compressors, generators etc.
  vi. Shock absorbing techniques to reduce impact.
  vii. Use of physical barriers and green belt development around the mine to restrict the noise from going outside the proposed mine boundary during operation.

4.3.7 Impact due to Ground Vibrations: When an explosive charge is fired in a hole, stress waves propagate radically in all directions and cause the rock particles to oscillate. This oscillation is felt as ground vibration. The mining operations using deep hole drilling and blasting using delay detonators are bound to produce ground vibrations. The total explosive consumption is about 294 to 300 tons per month during the next five years.

Blasting, in addition to easing the hard strata, generates ground vibrations and instantaneous noise. Ground vibrations from mine blasting may be expressed by amplitude, frequency and duration of blast. The variables, which influence ground vibrations, are: controllable and non-controllable. The non-controllable variables include: general surface terrain, type and depth of overburden and wind. Similarly, the controllable variables include: type of explosives, charge per delay, delay interval, direction of blast progression, burden, spacing and specific charge and coupling ratio. The broad blasting parameters to be adopted in the mine are given in Chapter2.

4.4. BLASTING

Blasting is one of he key units of operation in an open cast mine. In opencast mining, the explosive used for blasting predominantly has two important functions to perform mainly:

1. To displace the overburden of the underlying mineral, to facilitate its removal.

2. To fragment the parent rock, so that it can be easily loaded and transported by the equipment provided for further processing/ utilization.

The type of explosives used and the blasting techniques/ parameters employed shall be such that the above two parameters are performed most economically. Considering the aspect and from the past experiences, broad parameters for the development of the overburden, side burden and for the production of the mineral would be as under:

4.4.1 Storage of Explosives: No storage of explosive is proposed.

As and when required explosive will be stored in magazine to be provided in mine. And blasting will be done by contract basis.

4.4.2 Impact due to Ground Vibrations: When an explosive charge is fired in a hole, stress waves propagate radically in all directions and cause the rock

particles to oscillate. This oscillation is felt as ground vibration. The mining operations using deep hole drilling and blasting using delay detonators are bound to produce ground vibrations.

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The ground vibrations due to the nearby existing mining activities are measured by MCW as the Peak Particle Velocity (PPV), and are compared vis-à-vis the circular no. 7, issued by Director General of Mines Safety for safe level criteria. The study concludes that the ground vibrations generated by blasting during the mining operations are well within the standards prescribed by DGMS.

In order to assess vibration measurements at Mines, a study of similar capacity of mine was considered. As per the studies, the details of charge, the waveform of the event are enclosed as per the DGMS Specifications as per the Technical Circular No. 7071997.

Table-4.4

DGMS Specifications for Blasting for Different Structures

Type of Structures	**Dominant Excitation Frequency**		
	< 8 Hz	**8-25 Hz**	**> 25 Hz**
a) Buildings/ Structures not belonging to the owner			

Domestic Houses/ Structures (Kaccha, Brick & Cement)	5	10	15
Industrial buildings (RCC & Framed Structure)	10	20	25
Objects of Historical Importance and Sensitive Structures	2	5	10
b) Buildings belonging to the owner with limited span of life			
Domestic Houses/ Structures (Kacha, Brick & Cement)	10	15	20
Industrial Buildings (RCC & Framed Structure)	15	25	50

Source: DGMS Specifications as Technical Circular No. 7071997

On carrying out the vibration measurement studies to evaluate the peak particle velocity of the blasted material during the process of blasting is given in the table below.

Table-4.5

Observed Readings for Vibration measurements

Axis	Dominant Frequency	Peak Particle Velocity (mm/sec)
Radial	22.2 Hz	4.191
Vertical	39.3 Hz	6.604
Transverse	36.5 Hz	3.303

4.4.3 Interpretation & Discussions: The study revealed that the vibrations are within the limits. Ground vibration, fly rock, air blast, noise, dust and fumes are the deleterious effects of blasting on environment. The explosive energy

sets up a seismic wave in the ground, which can cause significant damage to structures and disturbance to human occupants. It causes major damages to the pit configuration too.

When an explosive charge is fired in a hole, stress wave propagates radially in all directions and causes the rock particles to oscillate. This oscillation is felt as ground vibrations. The ground vibrations due to the existing mining activities are measured by MCW as the Peak Particle Velocity (PPV), and are compared vis-à-vis the circular no. 7, issued by Director General of Mines Safety for safe level criteria. The study concludes that the ground vibrations generated by blasting during the mining operations are well within the standards prescribed by DGMS. Ground vibrations are not likely to affect the structures in the vicinity of mine lease area.

While the core area has no structures, the structures adjacent to the mine are of concrete structures like workshop, office, store etc. These structures will not be affected by the ground vibrations as they will be away from the nearest face of the mine and being of good construction.

- **Mitigation measures**

By adopting controlled blasting, the above said problems are greatly minimized. Choosing proper detonating system and optimizing total charge and charge/delay also minimize the impact. Regular monitoring of magnitude of ground vibrations and air blast by "Minimate" is carried out.

Hence, the impact of the mine blasting is insignificant on the surrounding area.

4.5 DISPOSAL OF REJECTS

4.5.1 Type of Rejects and their Generation: The overburden from the mining activity is basically soil / Mica - Schist. The overburden (sub soil) to be

handled during the next five-year period will be about 9000 Sq. m. These details are given in the chapter 2 and mining plan.

4.5.2 Disposal of Waste material: The overburden generated will be temporarily dumped in earmarked overburden dumps. The dimensions and ultimate capacity of the dumps are given in chapter-2.

Waste rock will not be generated. The thickness of alluvial soil/overburden is around 0.2m in the area. Apart from these 10% of the excavation in Manganese Ore zone is intercalated material which is aluminous & siliceous in nature..

Mitigation measure

- The overburden is proposed to be dumped earmarked area, Dumping area of alluvial soil/overburden will in located in the southern part of the lease boundary in first five years of mining operation.
- Dumps will be around the boundaries and the slope, spread and height of the dumps will not be more than 45^{0}, 7.5 and 5.0m respectively.
- Afforestation will be carried out on dumps once complete dumping height has been reached. The slopes will be covered with grass to protect against erosion.
- Along the mining lease boundary, afforestation will be carried out once the nearby area has been mined.
- The plantation, which is not surviving, will be replanted periodically prior to rainy season.

4.6 IMPACT ON ECOLOGY

4.6.1 Impact on Flora and Fauna: The baseline flora and fauna has been depicted in Chapter-3. Accordingly, there is no wild life sanctuary in 10-km radius around the mine lease boundary. The impacts on flora are briefly described in the following sections:

4.6.2 Impact on Terrestrial Ecology:

a) Flora: The local varieties of tree like Palas, Neem, Tinsa, Mango, and thorny bushes, shrubs are main vegetation in the area. There is no tree in the proposed area. Apart from the above agricultural lands are there where one time crop is being cultivated. Except the above-mentioned tree vast tracts of the area does not have any flora of great importance.

The impact on terrestrial ecology will be due to emission of gaseous pollutant like NOX. The pollutant at a very low dose acts as an atmospheric fertilizer for the vegetation. However, at higher doses, they are injurious to both vegetation as well as animals.

In the mining operations, NOX emissions are mainly due to burning of diesel in mining vehicles. As described in Chapter-3 on air quality, the low concentrations of NO_X due to operation of the mining operations will have insignificant impact on ambient air quality and NO_X concentration will remain within the NAAQ standards. Therefore, the impact of these emissions on the surrounding agro-ecosystem will be insignificant.

It is proposed to include *Azadirachta indica, Ficus religosa, Pongamia glabra* and *Ficus racimosa* in the plantation program as they serve as sinks for gaseous emissions.

b) Fauna: The adverse impacts on fauna would be mainly due to:

- Human activity;
- Noise; and
- Land Degradation.

The impact on the fauna of the buffer zone due to the mining activity will be marginal. The proposed progressive plantation with over a period of time will create conditions favorable for fauna.

4.6.3 Impact on Aquatic Ecology: No wastewater generation is envisaged from the mining operations. The rainwater and seepage water collected in the

sumps will be re-used for dust suppression and for greenbelt. The excess mine water will be discharged to natural stream. Hence, no impact is envisaged from the mining operations on aquatic bodies.

4.6.4 Mitigation measure: Extensive plantation comprising of pollutant resistant trees is proposed around the mine site, which will serve not only as pollution sink but also as a noise barrier. It is expected that with the adoption of these mitigative measures, the impact due to operation of the mine will be minimal on the terrestrial ecosystem.

i. Proper land management to restore the ecological conditions in the region
ii. Proper handling of Manganese and Overburden and transportation in closed tankers will significantly reduce fugitive emissions and hence minimal impact is expected on surrounding flora and fauna due to deposition of Manganese and Overburden.
iii. A Comprehensive green belt development Programme is suggested

4.6.5 Impact on Socio - Economic Aspects: It is obvious to assume that the activities of the mining operations will improve the socio-economic levels in the study area. The anticipated impact of this project on various aspects is described in the following sections:

4.6.6 Impact on Human Settlement: There is no human settlement in the ML area. No rehabilitation and resettlement is necessary for the mining operations. The mining operations will thus not disturb/relocate any village or settlement. No adverse impact is anticipated on any settlement.

4.6.7 Impact on Population Growth: All of the mine operating personnel will be accommodated in the nearby villages. Hence, there will not be any impact of the population growth on nearby surroundings.

4.6.8 Impact on Literacy and Educational Facilities: The literacy rate of the study area is poor. This is not likely to change as the mining activity does not envisage any inflow of educated manpower to the mine site. However, the socio economic benefits arise from the mining activities may increase the literacy and educational facilities in the buffer zone.

4.6.9 Impact on Civic Amenities: The civic amenities have already been developed due to mining operations in the area. However, there will not be a significant shift in terms of civic amenities due to the mining operations at mines.

4.6.10 Impact on Health Care Facilities: Mining activities involve accidents during operation phase. Thus, it is imperative to have proper health care facilities near the mining area.

4.6.11 Impact on Economic Aspects: The proposed mining activities in the area will provide employment to persons of different skills and trades. The local population is the largest plausibility among these employees. The employment potential will ameliorate economic conditions of these families directly and provide employment to many other families indirectly who are involved in business and service oriented activities. This in-turn will improve the socio-economic conditions of the area.

4.6.12 Impact on Sensitive Locations: There are no buildings of public interest and monuments notified by archaeological department in and around the mine lease area. Thus, there will not be any adverse impact on the tourist/religious or historical important places due to mining project.

CHAPTER V

ENVIRONMENT MANAGEMENT PLAN

5.1 INTRODUCTION

Development projects are usually associated with the risk of lowering environmental quality. The term environment is rather complex as it encompasses not only the biophysical component comprising water, air land and biotic population but also the less tangible component such as land- wise, social system, aesthetics' etc. The Environment Impact studies attempts to asses the overall environmental impact due to the proposed project so that suitable measures may be taken to ensure that the environmental housekeeping costs remains affordable for both the present and future generations, thus ensuring equity. Rapid industrial development and growth of cities through out the world have led to the recognition and increasing understanding of the inter-relationship between pollution, public health and the environment. Essentially the pollution prevention and control measures include; recognition of problem; collection of information definition of sources and causes and selection and implementation of appropriate solutions. If these measures are designed separately for air, water and land pollution or concentrated on removal of waste pollutants from waste receiving water bodies. This often results in transfer of problem from one part of the environment to the other. For example Solid pollutants were removed from water and air but then improperly disposed on land, sewage and industrial sludge were incinerated, adding to the air pollution, solid waster or industrial effluent were exposed to leaching actions or burnt increasing water and air problems. To avoid all such cases we need to recognize the environmental interaction and focus simultaneously on reduction of pollutants and sources so as target our efforts on comprehensive environmental planning. As the environment is a complex system of biotic and abiotic factors and their interaction on each

other so the project impact have wide scope. It is not possible to address all the environmental areas fully in the study area, as it would be impossible to complete all such studies within a limited time frame. Even if completed, the report will be too voluminous for decision makers and involve heavy expenditures on conduction of these studies. So priority setting activity has to be done so as to define limit of the assessment study, before commencing any developmental activity.

The mining development in the study area needs to be intertwined with judicious utilization of non-renewable resources of the study area and within the limits of permissible assimilative capacity. The assimilative capacity of the study area is the maximum amount of pollution load that can be discharged into the environment without affecting the designated use and is governed by dilution, dispersion and removal due to physico-chemical and biological processes. The Environment Management Plan (EMP) is required to ensure sustainable development in the study area (10 km) of the proposed mine site, hence it needs to be an all encompass plan for which the proposed mine authorities, Government, Regulating agencies like Pollution Control Board, Indian Bureau of Mines (IBM) etc. working in the region and more importantly the affected population of the study area need to extend their co-operation and contribution.

It has been evaluated that the study area has not been affected adversely with the proposed mining and likely to get new economic fillip, not only for the study area but for the region as a whole. Mitigation measures at the source level and an overall Management Plan at the study area level are elicited so as to improve supportive capacity of the study area and also to preserve the assimilative capacity of the receiving bodies. The environmental attributes, which will be affected in the region, are landuse, topography, water resources, water quality, soil, air quality, socio-economic status, ecology and public health. The Management attributes, which will be affected in the region, are landuse, topography, water

resources, water quality, soil, air quality, socio-economic status, ecology and public health. It is to be appreciated that Manganesemining is to a certain extent an inevitable destructive process, but the hazards are within measurable limits and can be easily ameliorated to a significant extent.

5.2 AIR POLLUTION MANAGEMENT:

The potential sources of air pollution arising from the proposed project will be drilling, blasting, crushing, overburden waste dumps, haul roads, exhaust fumes of internal combustion machines, combusting of domestic fuel oil and transportation of ore in the vicinity. Air pollution caused by mining and associated activities can be classified into the following categories:

- Gaseous pollutants (Nitrogen Oxides, Sulphur Dioxide and Carbon Monoxide); and
- Suspended Particulate Matter (Silica, Iron, Fluorides and Metallic Mineral Fumes).

Since the proposed Manganese mining is yet to commission, the precise quantities cannot be estimated at this stage. During the air quality monitoring and analysis, it is observed that SPM, RPM SO_2 NO_x and CO are well within the permissible limits. There may be marginal increment of 5 to 6% over the maximum permissible limit in sporadic cases. In addition, the proposed site is presently free of any air pollution and in future there will not be any change in the status as the mining will be of manual nature and it will not affect immediately the vicinity of the proposed site.

5.3 WATER POLLUTION

The mining project will require supply of water for domestic purposes during mining, vegetation etc. There may be small quantity of mine discharge during monsoon season, which contains fine silt. This will be treated in settling tanks followed by desilting tanks and the treated water will be let into the natural nallahs. Another source of pollution will be from

domestic sewage from canteen and toilets which will be treated in septic tanks and soak pits.

There will not be any beneficiation plant located in the areas as such no water will be discharged. The water accumulated in the pit during rainy season will be pumped out and discharged into natural drainage system. But this will not be having any adverse impact on the surrounding.

It is already mentioned that ground water is available within 8 m to 10 m of the surrounding surface level and evident in nearby well, borewell, etc There will be no accumulation of water due to rains as the topography of the area is hilly nature and water will be drained out automatically.

5.4 NOISE POLLUTION

The mining operations are proposed to be manual with minimal machinery. However the mining activity is likely to generate noise which will be mitigated as under:

Mitigation Measures: Mitigation measures for noise and ground vibrations are of following types :

- Prevention at source;
- Attenuation in transmission path; and
- Protective measures in work environment.

The method of mining will be of manual nature, drilling will be carried out by compressed air operated jack hammer. The noise will be generated during drilling and blasting. There will not be deployment of any heavy machines in the area for mining operation as the mining will be in very small scale. There will not be any appreciable impact on noise pollution.

Measures to minimized vibration due to blasting: The method of mining operation will be of manual nature and only drilling will carried out by jack hammer and blasting by gelatine.

5.5 SOLID WASTE GENERATION

Dumping site for side burden will be in the lease boundary and non-minralized zones. The space parameters 600 m^2 along the lease boundary. The proposed are is small and the dumps will be stabilized by plantation as well as retaining wall if necessary to avoid spillage in surroundings areas.

5.6 PLANTATION

It is proposed to plant 25 trees annually of the different local species

5.7 IMPLEMENTATION SCHEDULE

The mitigation measures suggested above should be implemented so as to reduce the impact on environment due to operations of proposed mining activities. In order to facilitate easy implementation, mitigation measures are phased as per the priority implementation. The implementation schedule is given in Table-5.2.

TABLE-5.1

IMPLEMENTATION SCHEDULE

Sr.No	Recommendations	Time requirement (Months)	Implementation Schedule		
			Immediate	Progressive	Depending on thediscretion of the management of the proposed plant
1.	Air pollution control measures	Before commissioning of respective units	•	--	--
2.	Water pollution control measures	Before commissioning of the plant and the colony	•	--	--
3.	Noise control measures	Along with the commissioning of the plant	•	--	--
4.	Ecological preservation and upgradation	Stagewise implementation	•	•	--
5.	Land Reclamation/Solid waste management	Stagewise implementation	•	•	--
6.	Socio-economic measures	As per the policies of Maharashtra Government	--	--	•

Note : [●] indicates implementation of recommendations.

CHAPTER- 6

ADDITIONAL STUDIES

6.1 INTRODUCTION

6.2 RISK ASSESSMENT

Risk assessment is a methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend.

Risk analysis deals with the identification and quantification of risk, the plant equipment and personnel are exposed to, due to accidents resulting from the hazards presents in the plant and process operations.

Risk analysis follows an extensive hazards analysis .It involves the identification and assessment of risk the neighboring populations are exposed to as a results of hazards presents. This requires a through knowledge of failure probability, credible accident scenario, vulnerability of population etc. Much of this information is difficult to get. or generate consequently, the risk analysis is often confined to maximum credible accident studies.

There are various elements of risks in operation of the mine. They include following:

Slope failure of external OB dump –According to five year development plan the height of bench is will be 3 meters. The width of the bench will be 0.5 meters and the final slope on all side of the pit is less than 45 degrees

Slope failure of internal Dump: The slope of the backfilled mass is dynamic i.e. it moves every day. It has to be ensured that slope of backfilled mass is safe otherwise it may pose risk to life & property and interrupt the mining operation.

Stability of High walls: In course of opencast mining slope if created on high wall sides in and OB interburden formations unless property planned they may fail.

Fire: There may be fire in working, store,

Inundation: The open pit will collect water from direct precipitation and surface run-off from surrounding areas. This may lead to inundation of the mine pit.

Seismic activities: The project is located in low risk seismic zone area.

6.3 DISASTER MANAGEMENT

The disaster management plan is essential to guard against and mitigate the consequences of major accidents. The term, "major accident" means an unexpected and sudden occurrence of event from abnormal developments in course of one's industrial activity leading to a serious danger to public or environment, whether immediate or delayed, inside or outside the installation involving one or more hazardous substances.

Keeping in view the three basic principles, i.e., prevention, preparedness (both pro-active and reactive) and mitigation of effect through rescue, recovery, relief and rehabilitation, a comprehensive disaster management plan (DMP) has been made for proposed OC Mine incorporating the following:

Identification and assessment of risks

Recommendation of measures to prevent damage to life and property against such risks.

6.3.1 Blasting : For proper blasting and minimizing its adverse impacts, i.e., noise, ground vibration, air blast, fly rocks, etc., the following precautions would be followed.

The optimal blast design parameters will be used.

All necessary precautions will be taken while blasting so that the workings remain safe.

Blast vibrations will be regularly monitored and whenever necessary corrective measures will be incorporated in blast design.

Before blasting is done, warning signals will be given so that people can move to safer places.

Arrangement will be made to alert the people working in the mine for sudden inrush of water by accidental development of fracture connecting the working place to the water bodies / aquifers.

6.3.2 Explosive Handling: All the safety measures will be taken during storage, transport and handling of explosives. Adherence to relevant statutory safety provisions as stipulated by DGMS, Chief Controller of Explosives and others will be made. Since quantity and characteristics of explosives are not available the hazards associated with explosive are not assessed.

6.3.3 Mine inundation: The mine pit will receive water from surface run-off from the surrounding area and seepage from the strata. During heavy rainstorms, there may be a situation when the mine entry point may get flooded due to ingress of water from the higher ground through local streams. To guard against this eventuality, the following steps will be taken.

- Provision of garland drain around the mine to prevent ingress of precipitations run off.
- Provision of sufficient number of pumps to pump out mine water during the critical rainfall period.
- Precaution against danger from local stream.
- Prevention of flooding of Equipment Deployed at Bottom Horizons:

During the heavy monsoon period, the mining operation in the lower-most bench may have to be stopped. Therefore, it is proposed to drown the lower-

most bench, which would work as a sump. The water will be pumped out and discharged into the nearby nalla .For ensuring safety of the equipment while working out bottom zones with no access to surface profile

Prevention of Electric Shocks: During mining operations, all the statutory provisions of the Indian Electricity Rules 1956, and Indian Standards for installation and maintenance of electrical equipment etc. should be observed.

All metal parts of electrical equipment should be properly earthed to avoid failure of insulation.

All H.T. lines and cables located within the blasting zones should be disconnected during blasting operations.

Dust Suppression: The following measure should be adopted for dust suppression at all quarry-working places, dumps, hauls roads.

- Spraying with water on all working faces & haul roads, by water- sprinkler.
- While drilling holes, it is necessary to use dust extraction devices
- Installation of local dust suppression and air conditioning devices in cabins of excavators and drilling rigs may be considered.
- Leveling of spoil dump surface.

6.3.4 Fires: All precautions and preventive measures shall be taken to avoid occurrence of fire incidences.

In addition to statutory the fire fighting and prevention of fires are as follows:

Storage of lubricants and fuel and cotton waste in enclosed fire proof containers in working places.

Provision of fire extinguishers

6.3.5 Road Accidents: Sufficient arrangements for illumination of roads, including the haul roads have also been made. Road crossings have been properly planned and designed to prevent vehicular accidents.

6.3.6 Safety Rules: Mining operation are required to follow statutory mine safety rules administered by the Directorate General of Mine Safety (DGMS), Chief Controller of Explosives and others. During planning the mine workings sufficient care has been taken to comply with these rules. Planning and design of electrical installations have taken into account the existing provisions in the Indian Electricity Rules 1956.

To create safety awareness and impart education on safe practices, the following steps are being taken.

Holding annual safety weeks

Imparting basic and refresher training to all employees.

(a) Slope failure: The opencast mining has to work with slope angles, as steeper as possible, for economical reasons. But it is also to be kept in mind that the steeper slope angles will cause ground rupture. The mining pit should have optimal slope, which can ensure the stability during operations and modifications of working pits. To avoid damage to life and property it has to be ensured that slope of OB dumps do not fail. .

(b) Training: The personnel directly responsible for handling emergencies will be given training for making them better equipped for discharging their responsibilities.

(c) Medical Preparedness: For guarding against accidental hazards the following measures will be taken:

- Emergency ambulance service will be kept ready.
- First aid and medical facilities will be provided at work place.

6.3.7 Other Miscellaneous Measures: Proper illumination in the mine area, workshop and other workplaces besides haul roads as mentioned above will be provided.

An efficient system to allow communication link amongst various work centers has been provided

Fire alarm and fire fighting system have been provided at project site and also on HEMMs.

6.4 HAZARD AND RISK ASSESSMENT

In any mining operations, whether opencast and/or underground, work safety is taken care of by the Mines Act, the Coal Mines Regulation, 1957 and Rules framed there under.

The risk to general public in the present case may arise from the following:

i) Failure of dumps created by stones dug from incline cutting.

ii) Flyrocks, during blasting operations, while driving inclines

iii) Plying of trucks etc on public roads

At proposed Manganese Ore Mine, there will be no risk to public from any of the factors listed above. Although surrounding area has plain undulating topography, no pathways or public roads are passing through the proposed lease area.

An assessment of risk at the proposed Manganese Ore due to each of the factors listed in para below:

The stone and earth material dug out while manual working for approach to the mine will be utilized for construction of ramps etc. The excess stone and rock will be placed on the ground in low height dumps which will be reclaimed through plantation.

The blasting operations will be so designed so that there are no fly rocks in normal situation. The blasting operations will be carried out after warning is given to people of surrounding bastes / habitations.

There will not be any bulk storage of fuel and oil at this mine. The permissible quantity of diesel and lubricants will be stored after observing necessary precautions as prescribed.

The tippers/trucks taking manganese ore to linked Cement plant will be plying on State Highway but entry from mine to highway will be kept away from nearby Villages so than the risk to persons is reduced.

6.5 CONCLUSION

With the adoption of preventive measures as enumerated above, the operation of this project will be safe as well as environmentally friendly.

CHAPTER- 7

PROJECT BENEFITS

7.1 STEPS TO BE TAKEN TO IMPROVE SOCIO-ECONOMIC CONDITIONS

The socio-economic conditions in the study area indicate the quality of life of the people. The important indicators which decide the quality of life and require to be improved for better living conditions are literacy levels, improved occupational structure, industrial development, infrastructural facilities, transportation, communication linkages, land development and improvement in cropping pattern. The project proponents are envisaging undertaking the following socio-economic measures.

7.2 Employment

It is proposed to employ the local population wherever possible in the proposed project activities. The work of reclamation of the entire area that will be damaged in mining operations and afforestation through plantation of 25 trees per year with survival rate of 80% to 85% has been envisaged.

7.2.1 Impact on Socio - Economic Aspects: It is obvious to assume that the activities of the mining operations will improve the socio-economic levels in the study area. The anticipated impact of this project on various aspects is described in the following sections:

7.2.2 Impact on Human Settlement: There is no human settlement in the ML area. No rehabilitation and resettlement is necessary for the mining operations. The mining operations will thus not disturb/relocate any village or settlement. No adverse impact is anticipated on any settlement.

7.2.3 Impact on Population Growth: All of the mine operating personnel will be accommodated in the nearby villages. Hence, there will not be any impact of the population growth on nearby surroundings.

7.2.4 Impact on Literacy and Educational Facilities: The literacy rate of the study area is poor. This is not likely to change as the mining activity does not envisage any inflow of educated manpower to the mine site. However, the socio economic benefits arise from the mining activities may increase the literacy and educational facilities in the buffer zone.

7.2.5 Impact on Civic Amenities: The civic amenities have already been developed due to mining operations in the area. However, there will not be a significant shift in terms of civic amenities due to the mining operations at mines.

7.2.6 Impact on Health Care Facilities: Mining activities involve accidents during operation phase. Thus, it is imperative to have proper health care facilities near the mining area.

7.2.7 Impact on Economic Aspects: The proposed mining activities in the area will provide employment to persons of different skills and trades. The local population is the largest plausibility among these employees. The employment potential will ameliorate economic conditions of these families directly and provide employment to many other families indirectly who are involved in business and service oriented activities. This in-turn will improve the socio-economic conditions of the area.

7.2.8 Impact on Sensitive Locations: There are no buildings of public interest and monuments notified by archaeological department in and around the mine lease area. Thus, there will not be any adverse impact on the tourist/religious or historical important places due to mining project.

CHAPTER – 8

ENVIRONMENTAL COST

8.0 BUDGETARY COST ESTIMATES:

The cost estimates presented in this section are for the recommendations made above. These cost estimates give only a indication of the likely cost. The following are the assumptions made for computing the cost figures presents the budgetary cost figures against each recommendation. Similarly, the cost estimates for land reclamation and afforestation schemes are given separately.

Activity	Capital Investment	O & M Expenses per annum
Air pollution Control Dust Suppression by installing Rainguns, Foggers, sprinklers	Rs. 4.00 Lacs.	Rs. 20,000/- per annum
Dust Suppression by water spraying on internal Road by water tankers	Rs. 12.00 Lacs.	Rs.2.00 Lacs per annum
Plantation	Rs. 2.00 Lacs	Rs. 2.00 Lacs per annum
Providing Mask, ear muffs to workers	Rs. 1.00 Lacs	Rs. 10,000/- per annum

CHAPTER – 9

ENVIRONMENTAL MANAGEMENT PLAN

9.0 INTRODUCTION:

The purpose of the Environmental Management Plan (EMP) is to minimize the potential environmental impacts from the project and to mitigate the consequences. EMP reflects the commitment of the project management to protect the environment as well as the neighboring populations.

An Environment Management Plan (EMP) is required to ensure sustainable development in the mine area. The identification and quantification of impacts based on scientific analysis has been presented in Chapter-4 along with mitigation measures. It has been evaluated that the study area will not be affected significantly due to the mining activity. The Environment Management Plan aims at controlling pollution at the source level to the maximum possible extent. The specific environmental component wise mitigation measures are already presented in chapter -4; however the consolidated measures in conjunction with environmental monitoring Programme is discussed herewith.

The environmental management of mining area involves –

9.1 MANAGEMENT OF AIR POLLUTION:

In order to control the air pollution from various sources,

- Drilling units shall also be equipped with water spraying system;
- Wet drilling shall be carried out to contain the dust;
- Controlled blasting techniques with pre-line drilling and buffer blasting shall be adopted;
- Water sprinkler shall be provided to avoid dust generation during material unloading;

- Dust suppression systems (water spray) at loading faces and on roads used for transporting ore and waste material, whenever warranted;
- The muck pile sprayed with water prior to loading and after blasting;
- Dense plantation will be carried in and around the mine lease, which would also help in combating air pollution;
- Regular maintenance of vehicles and machinery shall be carried out in order to control emissions;
- A good housekeeping and proper maintenance shall be practiced which will help in controlling pollution.
- Plantation will be done on OB dumps to arrest the windblown dust from OB dumps.
- Regular monitoring of SPM, SO_2, NO_x will be carried out in and around the mines to assess the actual situation and its possible evolution in the future.

9.2 MANAGEMENT OF WATER POLLUTION:

As the groundwater is shallow in the area, it is anticipated that groundwater seepage into the mine pit will occur and mine dewatering is necessary. The dewatered water from the mine pit shall be used for:

- Spraying on haul roads for dust suppression;
- Equipment washing in the service center;
- Dust suppression in the mining area;
- Watering in greenbelt and afforestation areas;

The water reservoir created during course of mining will be use to develop pisciculture, as the agriculture practice is not that prominent in area. For this purpose the cooperative society of farmers of nearby village will be formed with the help of Maharashtra agricultural marketing board.

The action program to prevent surface water pollution focuses on prevention of wash off and mine water directly flowing into nearby natural drainage channels. Adequate control measures would be adopted to check not only the wash-off from soil erosion but also uncontrolled flow of mine water. The following measures shall be adopted for prevention of water pollution:

- The mine discharge water shall be treated in sedimentation tanks; however, no secondary treatment is necessary as no toxic elements are envisaged in the water collected in mine sump;
- Sufficient number of retaining walls/check walls shall be provided in order to avoid the soil wash out;
- The domestic sewage generated will be treated in septic tank followed by soak pit.
- Plantation of Agave species in the gullies, below and above check dam and check filters;
- Putting of Elephant Grass, Ipomea along the roadside slopes;
- Shrubs shall be planted towards down of the slope;
- Planting appropriate shrub/grass species on the slopes shall stabilize the worked out slopes. This prevents wash-off of material from these slopes;
- Road cuttings shall be stabilized;
- Suitable drainage system like garland drain shall be provided to prevent surface water from entering into mines directly, to reduce soil wash off;
- Regular monitoring of groundwater levels and quality in the observation wells shall be done; and
- The mine discharge water shall be regularly tested for presence of any undesirable elements and appropriate measures shall be taken in case any element is found exceeding the limits prescribed by CPCB.

9.3 MANAGEMENT OF NOISE POLLUTION AND GROUND VIBRATIONS

The noise is generated from drilling, blasting, and movement of heavy machinery and air blast. Air blast is caused due to unconfirmed or partially confined explosion and detonating cords exposeding Atmosphere.

The following control measures shall be adopted to keep the ambient noise levels well below the Limits:

- Blasting shall be well designed and arranged in such a way that only one or two holes are blasted at a time with the use of short delay detonators in combination with sequential blasting machine;
- The blasting shall be carried out during favorable atmospheric conditions and less human activity timings;
- Explosives shall be blasted into confined stage or optimum stemming column shall be maintained for holes during charging of hole;
- The prime movers/diesel engines shall be properly maintained;
- A thick greenbelt shall be provided in phased manner around the periphery of the mining activities to attenuate noise;
- Trees shall be planted on both sides of haul roads.
- Provision of protective devices like ear muffs/ear plugs;

9.4 LAND RECLAMATION AND REHABILITATION

Land degradation is one of the major adverse impacts of opencast mining activities and any effort to control adverse impacts would be incomplete without appropriate land reclamation strategy.

In general, it is necessary to reclaim the disturbed land in the mining areas to fulfill the following objectives:

- To put the land to productive uses such as agriculture, forestry, water reservoir etc;

- To restore the aesthetic beauty of the area.

As far as possible, reclamation activity will be commenced only after optimum thickness of the deposit has been excavated. Prior to that whatsoever alluvial soil will be generated will be stacked along the lease boundaries so that it can be used for reclamation purpose if so required, otherwise it will be used for Afforestation purpose. The thickness of alluvial soil is less compared to the thickness of Manganese Ore in the area. For this reason it may not be possible to reclaim the area fully by alluvial soil and it can be done partially, if allowed to do so. Reclamation operation will commence after attaining the optimum depth in phased pattern after getting proper clearance from the competent authority of IBM.

The reclamation activities shall be taken up concurrently with the mining operations. The slopes of the mining benches shall be suitably dressed and vegetated. In order to accomplish this activity, the top edges of benches are suggested to be blasted so as to form a gently sloping surface by the screen of the blasted material. The sloping face is then covered with a veneer of topsoil occurring in the area. After spreading the topsoil, tillage operations have to be carried out for providing soil aeration, reducing compaction in the soil and facilitating moisture infiltration.

As the ultimate aim is to provide a vegetation cover over the sloping faces, if necessary, it may be graded by bulldozer so as to provide a maximum slope of about 35 degrees. Wherever necessary, pitting and gauging has to be done to hold the water in place. Vegetation covers in and around the mine workings generally helps in:

- Stabilizing slopes;
- Dust control;
- Enhancement of aesthetic value;
- Minimizing run-off; and

- Reducing noise.

For vegetation, the plants and saplings suitable for the existing soils and site conditions shall be considered.

1) Stabilization of Mined Slopes: Opencast mining will leave behind slopes of 35° to 50° with intermediate benches at various levels, which are usually convex, straight or concave type depending on the deposition of the ore body. The rocks are usually hard but the closely spaced jointing makes them friable and brittle at some places. This process of disintegration is further accentuated by weathering. Such type of slopes will not show any sign of failure by major landslides. To check minor debris slides, stabilization of these slopes shall be done at regular intervals.

2) Stabilization of Overburden Dump: The mining area does comprise rejects in the form of Manganese Ore. The rejects (soil) are stacked in the dump yard in a systematic manner. The dumps shall be provided with required slope. Tree saplings shall be planted above and on slopes of the dumps to prevent soil erosion. However, these soil dumps shall be temporary and entire soil is either used for plantation or for backfilling.

3) Stabilization of Nallah / Stream Courses: The control of excess runoff water during monsoon is to be given priority to check the soil and erosion. During rains, numerous gullies will form in the mine area, especially in loosely stacked areas. During heavy rain, these gullies connected to stream move further by head ward erosion and if gullies are not plugged at initial stage, these go on widening and deepening resulting in massive soil erosion. Therefore, vegetation and check ams shall be constructed for plugging these gullies. The design of these check dams will allow safe passage to runoff water.

4) Reclamation of Mined out Areas: It is not practicable to reclaim the mined out area. The area is devoid of any water reservoir, so the mine pit would be utilized to use as the source of water. The overburden shall be re-handled and

used for backfilling. Topsoil is used for intensive plantation and greenbelt development in the non mineral bearing areas, along haul roads, ultimate limit of benches and all along the lease periphery. Mined out pits shall be connected to seasonal nala flowing through the area so as to divert the run off during monsoon into the pit.

The deeper portions of the mined out areas shall be converted into water harvesting ponds for pisciculture.

9.5 MANAGEMENT OF ECOLOGY

Green Belt Development

Areas for Green Belt Development

Plantation or tree cover should be developed around:

1. Along the boundary or the fence of mining
2. Manganese Ore handling and storage sites
3. Road sides: Internal roads
4. Around Overburden dump area.

B. Selection of Species

Successful Afforestation program largely depends on species selection and protection given to the newly planted saplings. The green belt development program should aim at development of vegetation, which will enhance the species diversity and richness of the surrounding ecosystems. Afforestation program should include following elements:

a. Reuse of the mine water
b. Development of green cover with the help of native species
c. Enhancement of the floral and faunal diversity by creating habitat mosaic
d. Mitigation of adverse impacts at various locations

e. Addressing social concerns and creating economic opportunities for affected population.

C. Criteria for Selection of Plant species

Plant species should be selected on following basis:

i) Native or non-native
ii) Biomass Production
iii) Cost effectiveness
iv) Growth rate and suitability in terms of climatic conditions
v) Easy to propagate in nurseries
vi) Ability of the tree species as Screen
vii) Key stone species in the ecosystems so that it will enhance diversity
viii) Commercial Importance and immediate local use
ix) Tree architecture and aesthetics

Proposed Plantation Around The Mining Area:

The selection of plant species for plantation around the mining area needs to provide special attention. The priority should be given to local/ indigenous species, which can support the local fauna. Further, the plantation should be planned by, considering the aesthetic view of the area. The species must have the property of holding the soil and protecting it from erosion. They should be thick enough to work as windbreaker. While planning the plantation, a combination of trees and shrubs of indigenous and exotic species will be helpful. To overcome the problem of soil erosion during the operation phase, the following plant species are suggested.

The main aim of plantation in the mined out areas is to stabilize the land to protect it from rain and wind erosion. As the leftover working area shall contain broken material and fine particles, stabilization against wind erosion is also a must. The plantation scheme broadly covers the following areas:

- Greenbelt around peripheral portions of mine and other built-up structures;
- Afforestation of barren areas in the lease hold;
- Gardens, parks and haul road plantation; and
- Plantation by way of reclamation /rehabilitation of mined out blocks.

Apart from the greenbelt and aesthetic plantations for fugitive emissions and noise control, all other massive plantation efforts shall be executed with the assistance and co-operation of the local community.

Provision of wide greenbelt around the mine has been foreseen to reduce any adverse impacts on the surrounding population from the emissions from the mining activity. The greenbelt formation and development of greenery in the mine shall not only enhance the air quality and attenuate noise in the surrounding area but also enhances the aesthetic value.

Plantation Species: The plantation species shall be considered based on the following:

- Adoption to the geo-climatic conditions of the area;
- Mix of round, spreading, oblong and conical canopies;
- Different heights ranging from 4 m to 20 m;
- Preferably evergreen trees;
- Fast growing type;
- A thick canopy cover;
- Preferably of native origin; and
- Having large leaf area index.

Plantation in areas with good soil cover especially for greenbelt around the mine shall be initially started by direct seeding synchronous with the onset of rains. This involves preparation of local site with regard to water harvesting, soil and

water conservation measures, strip cultivation and weeding. It also gives the initial advantage of time saving by eliminating nursery, transport and planting. It also has the advantage of improving the form of the tree and its rooting pattern. Otherwise the plantation would have been generally done using saplings grown in the nurseries. The different species that have history of good survival and growth under similar site conditions shall be planted. The suggested species for plantation are given below:

Plant Species for Mine Area and its Boundary

• Acacia nilotica	• Leuceana leucocephala
• Albizzia species	• Morus indica/alba
• Acacia auriculiformis	• Prosopis species
• Azadirachta indicata	• Syzygium cuminii
• Annona squamosa	• Tamarindus indica
• Bauhinia variegata	• Terminelia arjuna
• Butea monosperma	• Zizyphus species
• Cassia festula	• Carissa species
• Dalbergia sisoo	• Feronia species
• Erythrina indica	• Phylanthus species
• Ficus bengalensis	• Madhuca species
• Ficus religiosa	• Magnifera species
• Grewia species	• Leuceana leucocephala

Plant Species for Arresting Dust

• Alstonia scholaris	• Ficus religiosa
• Cassia fistula	• Butea monosperma
• Bauhinia purpurea	• Tamarindus indica
• Cassia siamea	• Melia azedarach
• Peltoferrum ferrugineum	• Azadirachta indica
• Polyalthia longifo/ia	• Terminalia arjuna

Plantation to absorb Sulphur dioxide (SO_2) Emissions

• Alstonia scholaris	• Poloyalthia long/folia
• Lagerstroemia flosregineae	• Terminalia arjuna
• Mimusops elangi	• Azadirachta indica
• Albizia lebbeck	• Melia azedarach
• Ficus religiosa	• Poloyalthia longifolia

Plantation to Reduce Noise Pollution

Plantation for Road Borders

• Alston/a scholaris	• Polyalthia longifolia
• Lagerstroemia flosreginae	• Peltoferrum ferrugineum
• Mimusops elangi	• Cassia siamea
• Cassia fistula	• Melia azedarach
• Bauhinia purpurea	• Delonix regia
• *Grew/tea* pteridifolia	• Anthocephalus cadamba
• Pongamia pinnata	• Michelia champaca

Plantation Schedule

A stage-wise comprehensive afforestation program is prepared and shall be implemented. Keeping the master plan at abandoned stage in mind, the stage wise plantation is prepared. The locations of the proposed greenbelt along with area of the green cover are given in the conceptual plan.

In initial stage the green belt will be developed in following manner.

4Year	**Quantity**	**Area**	**Type of Plantation**	**Proposed Rate of Survival**
1st	150	1000 m^2	Sheobabul/Neem	80%
2nd	150	1000 m^2	Sheobabul/Neem	80%
3rd	150	1000 m^2	Sheobabul/Neem	80%
4th	150	1000 m^2	Sheobabul/Neem	80%

5th	150	1000 m^2	Sheobabul/Neem	80%

During the course of mine and after mining the proposed plantation is at the rate of 250 saplings per hectare, except for reclamation mine areas, for which the density is 500 saplings per hectare. The proposed green cover including greenbelt is 3.502 ha. The total number of saplings to be planted during the entire life of mine shall be 9 Years. Considering the estimated cost of planting and maintaining a sapling for three years as about Rs.300/-, the afforestation plan for the ML area is given in Table-9.1.

Table-9.1

Afforestation Plan for the ML Area

Interval of Mining Operation	**Afforestation No. of Saplings**
1 to 5 years	1250
5 to 10 years	2500
10 to 15 years	3750

The plantation will be done during rainy season July to September every year. The plantation will be done on dumps, around ultimate pit limits, in quarry and open area etc. Following precautions shall be taken for survival and protection of plantation: Plantation shall be done during rainy season;

- Inter-cultural operations like weeding, soil turning basin making.
- Watering to the plants with regular interval till well developed;
- Organic and inorganic fertilizers shall be put for proper development of plants;
- Spraying of insecticides, pesticides and growth regulators for disease free growth of plants;

- Pruning and trimming of plants shall be done at regular interval;
- Barbed wire fences shall be provided around plantation and any fences damaged by miscreants and cattle shall be repaired frequently to prevent the animal nuisance; and
- Watchmen shall be employed to prevent the cutting of trees by outsiders and also control of public movement through planted area.

9.6 MEASURES TO IMPROVE SOCIO-ECONOMIC CONDITIONS OF THE REGION:

Social welfare activities shall be taken up on a large scale. The social welfare activities can be planned in the following areas:

- Medical assistance;
- Primary education;
- Animal husbandry;
- Rural water supply;
- Agricultural improvement;
- Vocational training; and
- Assistance in utilizing government programs.

The following activities can be implemented in each of these areas:

9.6.1 Medical Assistance

- Providing better medical care to local people by extending them the hospital facilities or first aid facilities;
- Regular immunization programs;
- Medical assistance including provision of ambulance in emergencies; and

- Periodic specialist camps

9.6.2 Education

- Institution of scholarship and prizes;
- Supporting adult education programs.

9.6.3 Vocational Training

Orientation programs for self-employment in collaboration with District Industries Centre and Rural Development Agencies.

9.6.4 Agricultural Improvement

- Organize with the help of Agricultural Department, training programs for farmers in relevant areas such as pisciculture, animal husbandry, dairy development, modern cultivation, scientific storage of grain, water conservation etc;
- Arrange supply of high yielding variety of seeds together with subsidy or interest free loan for their purchases; and
- Arrange if necessary, for soil testing and technical inputs for increasing yield.

9.6.5 Assistance in Utilizing Government Programs: Collecting and disseminating information pertaining to various government schemes and providing guidance and assistance to eligible persons for making good use of these schemes e.g. getting loans for setting up small businesses.

9.6.7 Employment: Preference shall be given to local population while inducting the new manpower. The proponent has proposed to incurred the 5% of the total

profit towards the implementation of above socio economic Program and same shall be routed through District Collector and committee contrasted by the collector to execute the decided Program.

9.6.8 Communication: The proponent shall maintain roads to the project site from nearest state roads and shall also help in establishing the facilities like post office, telegraph office, telex office etc through government bodies.

9.6.9 Implementation Schedule of Mitigation Measures: The mitigation measures suggested above shall be implemented so as to reduce the impact on environment due to the operations of the proposed plant. In order to facilitate easy implementation of mitigation measures, these are phased as per the priority implementation as **given in Table-9.2.**

Sr. No	**Recommendations**	**Time Requirement**	**Schedule**
1	Air pollution control measures	Stage wise implementation	Immediate and progressive
2	Water pollution control measures		Immediate continual
3	Noise control measures		Immediate continual
4	Ecological preservation and up gradation		Immediate & Progressive

9.7 OCCUPATION, HEALTH AND SAFETY MEASURES:

The method of mining will be in moderate scale and opencast in nature. There will be excavators cum loaders and tippers will be mostly used for removing and loading of overburden.

Occupational safety and health is very closely related to productivity and good employer-employee relationship. The main factors of occupational health in Manganese Ore are fugitive dust and noise. Safety of employee during blasting operation and maintenance of mining equipment and handling of explosive materials are taken care of as per Mine Regulations, 1961. To avoid any adverse effect on the health of workers due to dust, heat, noise and vibration, sufficient measures have been proposed in the mining project. These include:

- Provision of wet drilling and dust collectors;
- Provision of rest shelters for mine workers with amenities like. drinking water, fans, toilets
- Provision of personal protection devices to the workers;
- Rotation of workers exposed to noise premises;
- Closed control room in crusher house with proper ventilation;
- Dust suppression of haul road; and
- First-aid facilities in the mining area.

However, to adhere to safety measures Safety helmets, safety boots, safety goggles will be provided to the workers. To minimize the dust problem periodic water spraying will be made. An emergency First Aid Kit as per St. John Ambulance approved Norm will be maintained at the mine office. Though there will be deployment of machines in the area for carrying out mining operation but noise and air pollution will be in the permissible limit. There will not be any other

operational hazards due to presence of machines. Precaution is required to be observed during drilling with jack hammer against dust and handling of explosive material. Apart from these no other factors are envisaged during future mining operation.

Occupational Health Survey of the employees should be carried out at regular intervals

The following measures will be taken to prevent occupational diseases and health hazards.

- Regular monitoring of working environment and implementation of safety and control measures.
- Use of protective equipment, clothing, helmets, gas mask, shoes, etc.
- Periodical medical examination of every worker is necessary to be done once in five years to detect preventable and curable diseases at an early stage.
- Cases suspected having Pneumoconiosis are to be examined by a Special Board constituted by the Chief Medical Officer. Established cases will be suitably compensated and their job shall be changed if required.

9.8 ENVIRONMENTAL MANAGEMENT PROGRAMME:

For implementation and monitoring of pollution control measures and for overall environmental management, environmental cell at the Unit and Corporate levels shall take necessary care. It should look after the following aspects of environmental management

- Establishment and updating of environmental data bank.
- Evolving micro environmental management plan for the project in collaboration with other agencies and consultants.
- Monitoring project implementation along with environmental control measures.
- Co-ordination with other project activities to ensure timely implementation of the project.

- Co-ordination with MoEF, CPCB and MPPCB for prevention and control of water and air pollution.

  This organization is also responsible for the following:

- Enforcing implementation of environmental control and prediction measures.
- Monitoring of the implementation system.

9.9 ENVIRONMENT MONITORING CELL:

The responsibility for implementing environmental management plan rests with the Agent / Mines Manager, who is assisted by a team of environmentally qualified and trained personnel. Organization for environmental management in proposed Opencast Project will comprise of an Environmental Cell at the Unit levels to carry out the tasks and responsibilities connected therewith.

9.10 ENVIRONMENTAL MONITORING AND CONTROL:

For effective implementation and midterm corrective measures (if required) monitoring and control of program implementation is essential. The scope of environmental management includes plantation, surface drainage, industrial water treatment plant, air, water and noise pollution control, etc.

Air, water and noise pollution control measures are implemented by monitoring in all the four seasons as per the guidelines prescribed by the legislation. Based on the results of monitoring corrective measures are reviewed and if necessary modified for implementation.