

Executive Summary for 17.07 Ha Laterite mining lease

EXECUTIVE SUMMARY

1. PREAMBLE

Minerals are the chief source of present phase of industrialization, and play an important role in the present phase of the national economy and overall development of the nation.

India is endowed with significant mineral resources. India produces 89 minerals out of which 4 are fuel minerals, 11 metallic, 52 non-metallic and 22 minor minerals.

Life Indices: Some Important non-fuel Minerals			
S. No.	Mineral/Ore/Metal	Recoverable reserves estimated as on 1.4.2000 (Based on exploration/prospecting)	Life Index (years)
		Figure in million tonnes unless otherwise specified	
	1	2	3
1	Bauxite	2462*	211
2	Copper metal (tonnes)	5297,000	80
3	Lead metal (tonnes))	2381,000	45
4	Zinc metal (tonnes)	9707,000	45
5	Gold metal (tonnes)	68*	Not Estimated
6	Iron ore	13460*	131
7	Chromite Ore	97	46
8	Magnesite	245*	542
9	Manganese Ore	167*	47
10	Limestone	75679*	254
11	Phosphorite (Rock Phosphate)	142	79
12	Sillimanite	516*	Very large
11	Garnet	52*	90
16	Kyanite (tonnes)	2817000*	265
17	Dolomite	4387*	438
18	Diamond (Thousand carats)	982*	19

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		* Recoverable reserves estimated as on 1.4.1995. Estimates as on 1.4.2000 under preparation.	
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M/s Nector Mining Company, Bhopal is partnership firm. Register office at 188, Rizwan Bagh, Lalghati, Bhopal and Dist Bhopal and this firm is engaged in production of Laterite. The concern is proposed to have mining activity of Laterite at Village Kurro-Manasakra, Tehsil- Sihora, and District Jabalpur in the state of Madhya Pradesh for the anticipated production of mineral by 2000 tonnes per annum.

In order to assess the likely impacts on environment due to ongoing mining activity and to have a tool of environment management, M/s Nector Mining Company has submitted the Rapid Environment Impact Assessment study report for mining project.

2. LOCATION

17.07 Ha of Laterite mining lease area is located in village – Kurro-Manasakra, Taluka Sihora, Jabalpur District (M.P.). Land use of the area is govt. waste land. The mining lease was sanctioned under proposed for Laterite for 20 year from 2008 to 2028.

District/ State	Taluka	Village	Khasara No	Area
Jabalpur (MP)	Sihora	Kurro- Manasak ra	522/1,10	17.07 Ha

3. ENVIRONMENTAL SETTING

Environmentally lease area lies at the cross section of 23° 29' 04'' to 23° 29' 14'' N and 80°07' 18" To 80°07' 53" E and it is covered under Toposheet no 64A/3. Topography of the area is undulating topography having hillocks in western and eastern part of the area. Southern part of the area is part of the hill slope. There is depression of hillocks in eastern part of the

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area. Area is covering part of two villages. Northern part belongs to village Mansakra where as southern part of the area belongs to village Kurro. Highest elevation of the area is 465 m. located in western part of the hillock. Lowest elevation of the area is 367 m. located along the southern boundary of the area. Elevation difference between highest and lowest elevation is 98 m.

Details of Project Settings

S. No.	Particulars	Details
1	Latitude	23° 29' 04'' to 23° 29' 14'' North
2	Longitude	80°07' 18'' To 80°07' 53'' E
3	Height above mean sea level	465-367AMSL, Average mRL – 375m
4	Nearest City	Sihora about 2 km
5	Nearest Railway Station	Sihora Road -West Central Railway at 4 km
6	Nearest Airport	Jabalpur - 40km
7	Nearest Highway	NH-7-2.0km
8	Nearest Village	Kurro is 1.0 km
9	Hills/Valley	No
10	Ecological Sensitive Zone	No
11	Reserve Forest	Hargarh RF-3km-E Dhanwahi RF-4km-ENE
12	Historical Place	No
13	Nearest River/ Nalla	Bah Nalla – E -2.0km Kanari Nadi-NW- 0.5km Heran River-S-4.0km Belkund Nadi-E- 8.0 km
14	Annual Climatic Conditions	Max. Temperature – 47.6°C Min. Temperature – 4.0 °C Avg. Rainfall–1168 mm Max. RH (%) – 98% Min. RH (%) – 7%

4. TRANSPORT

Applied area is located at a distance of 42 km from Dist. HQ Jabalpur. Jabalpur to Sihora distance is 40 km on village road area is situated towards south of the road.

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Road up to Sihora is NH-7 from here area is connected by village road. Nearest village kurro is 1 km. east of the area, Sihora is about 2 km. west of the area post office facility telegraph facility and other important administrative facility at Tehsil level are available in Sihora. Area falls under jurisdiction of Police station Sihora situated 2 km west of the area. Nearest railway station Sihora is 4 km south west of the area. PWD rest house is in Sihora. Administrative facilities, Medical and schooling facilities are available in Sihora. Labour are available from the nearest villages. Sihora Kurro village road passes towards north of the area, regular transport facility available from the village road. Drinking water available from the hand pump located along the village road passes along the northern boundary of the area. An electric transformer and power line of 440 volts is there 150m North West of the area.

5. REASON FOR ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

The impact of mine on the environment depends to a large extent on its location with respect to Human settlements, meteorological conditions, ambient air quality, water bodies, agricultural and forest land etc.

Most of the adverse impacts of mines are amenable to technological control by providing necessary preventive and control measures and finally through effective environmental management of the operating mines. Keeping in view the likely impacts of mines on environment, this Rapid environment impact assessment report has been prepared for submission to State Pollution Control Board and Ministry for Environment and Forests (MoEF) for clearance of the proposed additional mining area.

6. PROJECT DESCRIPTION

6.1 RESERVES

Reserves of mineral in the area are estimated by graphical method in to proved category only. Existence of laterite is seen in almost all the trial pits excavated in the area which is followed by the phyllite there fore reserves

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of mineral are not taken in probable category. Existence of laterite is seen 1m below is considered as waste in the form of murrum Bulk density of mineral is taken 2.7 tonnes per cubic m.

PROVED

Existence of laterite is seen in almost all the trial pits excavated in the area. About 4.5m thickness of laterite is seen in trial pit no. 11,14,17,27 and 3m thickness of laterite is seen in trench no.TR-1 therefore 4.5 m. thickness of laterite is considered in proved category within the entire applied area.

RESERVES FOR MANSAKRA AND KURRO LATERITE DEPOSIT

CATEGORY	AS PER BUNFC CLASSIFICATION	AREA IN M ²	THICKNESS IN m.	VOLUME IN m ³
PROVED	111	170700	4.5	768150

WASTE 40% m ³	LATERITE 60% m ³	LATERITE IN TONNES	ORE PLETED	LEFT RESERVES M.T.	CODE AS PER UNFC
307260	460890	1244403	2494	1241909	111

Thus total geological reserves of laterite in tonnes is 1241909MT

BULK DENSITY OF LATERITE 2.7 TONNES /CUBE METER

6.2 Mineable Reserves & Anticipated Life of the Mine

Mineable reserve are those reserves, which are left after deducting mineral blocked in benches and barrier zone area of the lease area.

CATEGORY	AS PER UNFC CLASSIFICATION	GEOLOGICAL RESERVES IN TONNES.	BLOCKED DUE TO BARRIER ZONE IN TONNES.	BLOCKED DUE TO BENCHES (SLO PE) IN TONNES	LEFT MINEABLE RESERVES IN TONNES
PROVED	111	1241909	186441	372572	682896

THUS TOTAL MINEABLE RESERVES OF LATERITE 682896 TONNES.

GRADE

Laterite of the area is of cement grade.

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MINE LIFE

Average Yearwise production during the first five years will be 1661 say 2000 MT

EXPECTED LIFE OF THE MINE AND THE YEAR FROM WHICH EFFECTED

Mineable reserves = 1895 say 2000 tonnes/ year

Yearwise production = 2000 Tonnes.

Expected life of the mine = $682896/2000 = 341$ years

Expected life of the mine is 341 years, it will be effected from 2007-08

The life of the mine is worked out on the basis of the production projected presently. This will change depending upon the market conditions as well as the increase in reserves after proposed exploration.

Details of chemical analysis

Sample No. Pit No.	S-1 TP-26	S-2 TP-11	S-3 TP-20	S-4 TP-8	S-5 TP-24	S-6 TP-5	S-7 TP-1
LOI	-	-	4.040%	-	-	5.860%	13.40 %
Sio2	-	50.560 %	43.440 %	-	-	38.700 %	18.80 %
Fe2O3	-	-	30.540	-	-	34.150 %	50.00 %
R2O3	-	-	-	-	-	-	-
UD	-	-	-	-	-	-	0.60%
Al2O3	-	3.650%	12.850 %	-	-	11.800 %	13.70 %
Tio2	-	-	0.950%	-	-	0.800%	3.50%
Cao	-	-	1.880%	-	-	3.820%	-
Mgo	-	-	3.300%	-	-	0.900%	-
Combine d water	-	1.390%	-	-	-	-	-
Fe	23.90 %	30.730 %	21.360 %	24.74 %	36.75 %	23.880 %	35.00 %
P	-	0.062					

Laterite of the area is of cement grade will be sold to cement industry.

6.3 Salient feature of the lease area

M/s Nector Mining Company, Bhopal

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S. No.	Particulars	Details
1	Type of Mine	Open Cast
2	Mining Lease Area	17.07Ha
3.	Mineable Area	17.07 Ha
4.	Existing Pits & Quarries (27 trial pits)	0.0546Ha
5.	Existing Dumps	0.0149ha
6.	Infrastructure and road	0.1730
7.	Mineral Storage	Nil
8.	Plantation	Nil
9.	Barren Land	16.8275 Ha
10.	Geological Reserve	1241909.00 tonnes
11.	Recoverable Reserve	682896.00tonnes
12.	Method of mining	Manual
13.	Ultimate Depth of Mining	Upto 369.5AMSL
14.	Ultimate Pit Slope	25-30°
15.	Present capacity of mines	2000 tonnes per annum
16.	Expected Life of Mines	341 years
17.	Lease Period	20 year
18	Thickness	
18.1	Thickness of Laterite	
	Minimum	1.0 m
	Maximum	4.5 m
	Average	-
18.2	Thickness of top soil	
	Minimum	0.0 m
	Maximum	1.0 m
	Average	0.5 m
19	Stripping Ratio	1:0.23
20	Existing mode to transportation of Laterite	Road
21	Area to be covered under dumps in lease period	Nil
22	Area covered under pit in lease period	0.8250ha
23	Area to be reclaimed by lease period end	0.4050
24	Area to be covered under plantation by lease period end	0.54ha
25	Mean Sea level	465-367AMSL
	Average RL	375mRL
28	Ground water table	

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29	Monsoon period	17m (358mRL)
	Dry month	19m bgl (356mRL)

6.4 Mining Method

In this lease area opencast mining method has been adopted because laterite deposit is easily to reach from the surface.

About twenty seven trial pits are excavated in the area in which thickness of various lithounits seen along the faces of working pits.

Proposed mining will be carried out by open cast manual method of mining using hand tools such as chisel, hammer and crowbar etc. Cane baskets and tagadies will be used for haulage of mineral and waste, Manual loading of mineral in to truck dumpers will be done. Hired truck dumpers will be used for transport on mineral. It is anticipated that use of explosive will not required but if hard boulder/ rock encountered explosive will be used for blasting purposed. In the already excavated trial pits it is seen that recovery of mineral is 60% by volume and remaining 40% volume is in the form of murrum and weathered phyllite, accordingly 60% recovery of mineral is taken and remaining 40% volume is considered as waste in the form of murrum. Bulk density of laterite is 2.7 tonnes per cubic m. Top soil generated during the proposed mining will be placed in the from of one dump for each year in south western barrier zone. Mine waste generated during the proposed mining will be placed in the form of one dump each year till third year, later on top soil and mine waste will be used for reclamation purpose.

During the first five years proposed mining will be carried out towards south western part of the area. Pit developed during the proposed mining will be extended towards east and south. Out of 1875m² excavated areas, 531m² area will be reclaimed during the five year mining and during the lease period out of 8250m² excavated areas, 4050m² area will be reclaimed. Remaining 4200m² area will be developed as water

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reservoir. Depth of water reservoir will be 4.5m. during the lease period 1350m² barrier zone area and 4050m² reclaimed area covered by plantation. Proposal of mining is given in such a way that simultaneous mining and reclamation can start from one to end of lease period. By the end of lease period proposed plantation will grow up and will improve the aesthetic beauty of the area.

6.5 Proposed Rate of Production

It will be about 2000 tonnes per year of saleable Laterite for full year after complete development of the mine.

6.6 Loading

Loading of Laterite will be done by manually to the trolley/trucks and will be sending to the end users. The overburden will be removed and stacked in a place in the surface. Subsequently it will be manually loaded to the tipper for onward dumping to the predetermined space in the lease boundary.

6.7 Hauling/Transport

The Laterite will be transported to the sorting yards by means of tubs on tracks.

6.8 Mine Drainage

Depth of ground water is about 17m deep (RL 358m) from average RL 375m which is reported in a dug well located at a distance of 600m east of the area in agricultural fields, proposal of mining is given up to 5.5m depth (RL 369.5m), therefore no possibility of seepage of water in to working pit. Rain water may get accumulated in to working pit which will be dewatered using 5HP pump having capacity to life 10000 liter water per hour. Rain water will pass through the settling tank proposed towards south of the location of proposed working. The pumped out water will be used for agricultural purpose for the surrounding agricultural land. The discharge water will first pass through the settling tanks where suspended

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particles will settled before its discharge for agricultural use. A settling tank is proposed in south western part of the area.

6.9 Solid Waste Management

The waste produced during mining operations consists of lateritic soil & weathered phyllite from Laterite. During the proposed mining about 1875m³ soil will be dumped in south western barrier zone area and 2370 m³ mine waste (weathered phyllite) will be generate during first to third year will be placed in the form of temporary dumps in south western barrier zone area. During the fifth year to lease period about 14742cum mine waste and 8475cum top soil will be generated same will be used for reclamation purpose. Reclamation will start from fourth year, temporary mine waste dump will be used for reclamation purpose and mine waste generated from fourth year will be used for reclamation simultaneously along with mining. The by the end of lease period no dumps of top soil or mine waste will remain in the area.

Year	Top Soil m ³	Mine Waste m ³
1 st	375	318
2 nd	375	513
3 rd	375	513
4 th	375	513
5 th	375	513
	1875	2370

6.9.1 Maximum Height & Spread of Dump:

As mentioned earlier the area was worked for laterite. Mine waste generated during the first to third year will be placed in the form of temporary dump in south western barrier zone area. Reclamation will start from fourth year, temporary mine waste dump will be used for reclamation purpose and mine waste generated from fourth year will be used for reclamation simultaneously along with mining. By the end of lease period no area will remain covered by dumps but during the period

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of five year temporary dumps of soil and three years dump of mine waste will be placed in south western barrier zone of the area. Details of configuration of proposed temporary dumps are given below.

DETAILS OF TEMPORARY MINE WASTE DUMP:-

Year	Quantity in m ³	Length in m.		Width in m		Height m.	Angle of slope	Dum p no.	Location barrier zone
		To p	Bott.	Top	Bott.				
1 st	318	23	30	5	7	1.5	35 ⁰	SD-1	South west
2 nd	513	37	49	5	7	1.5	35 ⁰	SD-2	South west
3 rd	513	37	49	5	7	1.5	35 ⁰	SD-3	South west

Area covered by mine waste dump 896 m²

Mine waste generated from 4th year onward will be used for concurrent reclamation.

Detail of soil dump

Year	Quantity in m ³	Length in m.		Width in m		Height m.	Angle of slope	Dum p no.	Location barrier zone
		To p	Bott.	Top	Bott.				
1 st	375	29	38	5	7	1.5	35 ⁰	SD-1	South west
2 nd	375	29	38	5	7	1.5	35 ⁰	SD-2	South west
3 rd	375	29	38	5	7	1.5	35 ⁰	SD-3	South west
4 th	277	28	38	5	7	1.5	35 ⁰	SD-4	South west
5 th	276	28	38	5	7	1.5	35 ⁰	SD-5	South west

Area covered by top soil dump 1330m²

6.10 Resource Requirement

The present proposal is to carry out mining for Laterite at Village Kurro-Manasakra, Tehsil Sihora, Dist Jabalpur (MP) for efficient operation of the Mining all necessary utilities will be made available, a brief description of the same is given below.

6.10.1 Storage facility

M/s Nector Mining Company, Bhopal

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It is proposed to provide adequate storage facilities for the excavated mineral, explosives and waste dumps, which is generated/used during mining process. Proposed excavated minerals and waste dumps will be kept in the existing mining lease area.

6.10.2 Project Cost

Project	Estimated Cost in Lac of Rupees
Mining of Laterite	Rs 2.0 Lac

6.10.3 Electric System

The power requirement for the project has been met by M P State Electricity Board, which is available at village Manasakra.

6.10.4 Water Supply

The total fresh water needs to be pumped is about 6KL per day for consumption of domestic and mining purpose. This quantity of water will be taken from the ground water. The details of water balance of existing /proposed mining project are given below:

WATER BALANCE OF MINING PROJECT

Process		Total
a) Mine Site		
Dust suppression	4kl	4kl
Green Belt	1kl	1kl
b) Domestic		
Drinking & Washing	1kl	1kl
Total (A + B)	6kl	6kl
Domestic waste water	0.7	0.7kl

7. EXISTING ENVIRONMENT SCENARIO

7.1 Climate

The region has a tropical monsoon climate with long and humid summer and short winters. The maximum temperature goes upto 47.6°C during summer in the month of May and the minimum temperature goes down to 4.0°C during winter in the month of January. The average annual

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rainfall is observed to be 1168mm. The winds in the area are light to moderate during summer and winter. However, the speed of the wind increases during the end of the summer season and monsoon season.

The brief discussion over the meteorological condition of the area is as below:

- **Temperature:** The winter season starts from December and continues till the end of February. January is the coolest month with the mean daily maximum temperature at 34°C and the mean daily minimum temperature at 12°C. Both the night and day temperatures increase rapidly during the onset of the pre-monsoon season from March to May. During pre-monsoon season, the mean maximum temperature (May) was observed to be 47.6°C with the mean minimum temperature (March) at 22°C. The mean maximum temperature in the monsoon season (Sep.) observed to be 34°C whereas the mean minimum temperature was observed to be 16°C. By the end of September with the onset of post-monsoon, the day temperatures increase slightly, with the mean maximum temperature at 26°C and the mean minimum temperature at 12°C.
- **Relative Humidity:** The air is generally humid in this region during the monsoon when the average relative humidity at 0830 hr. was observed to be with a maximum of 100% and a minimum of 52%. Similarly, at 1730 hr., the average value was observed to be with a maximum of 94% and a minimum of 60%. Generally, the weather during Post monsoon seasons was observed to be with a maximum of 90% and a minimum of 15%.
- **Rainfall:** Monsoon in the area comes from southwesterly winds. The average annual rainfall based on the last 10-year IMD data, was observed to be 1140-1900 mm. The monsoon sets in the month of June and continues till mid observed in the evenings, with clear mornings.

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During the monsoon season, both in the mornings and evenings, the skies were found to be clouded.

- **Cloud:** 30 years average data reveal that maximum cloud cover was observed around 7.0 oktas in the month of July, August. Whereas cloud cover was observed around 2.2 (in oktas) in the month of November, December, January, February and March.

- **Wind Pattern**

Generally light to moderate winds prevail throughout the year. Winds were light and moderate particularly during the morning hours. While during the afternoon hours the winds were stronger. A review of the wind rose diagram shows that predominant winds are mostly from S, SSE, NW, WNW, W and N directions followed by W direction.

- **Wind Patterns during study period**

The predominant directions of wind were observed from NW; WNW & W.

7.2 AIR QUALITY

To establish the ambient air quality, sampling and testing were conducted. Air sampling stations were established at eight (8) locations around the proposed mining area to assess the background air pollution levels.

COMPARISON OF AIR SAMPLING RESULTS WITH CPCB NORMS

	A1	A2	A3	A4	A5	A6	A7	A8	CPCB Norms	
									Indl. & Mixed used area	Residential & Rural Area
15 th March to 14 th June 2008										
SPM Concentration										
Average	146.33	120.66	171	129.37	111.83	95.91	115.08	112.41		

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Maximum	170	134	210	140	134	106	132	128	500	200
Minimum	120	105	134	115	88	79	98	98		
RPM Concentration										
Average	64.58	88.28	85.75	96.45	81.91	69.75	83.83	81.08	150	100
Maximum	84	110	112	113	94	80	96	93		
Minimum	42	60	62	68	44	52	66	60		
SO2 Concentration										
Average	8.33	6.26	8.95	7.69	5.86	5.37	5.86	5.86	120	80
Maximum	9.23	7.1	10.5	8.6	6.6	5.8	6.5	6.5		
Minimum	7.45	5.3	8	6.3	4.67	5.1	5.2	5.2		
NOX Concentration										
Average	10.11	7.83	11.60	9.49	7.56	6.76	7.25	7.25	120	80
Maximum	10.65	8.76	12.36	10.4	8.5	7.8	8.3	8.3		
Minimum	9.42	6.4	11.0	8.1	6.8	5.8	6.3	6.3		

7.3 NOISE LEVEL

Ambient noise levels were measured at different locations (same as ambient air monitoring locations for two days on hourly basis) to establish present scenario which shall be described as follows.

- All the values are well within the norms prescribed by CPCB for industrial and commercial area.
- Main source of noise are traffic movements.

7.4 WATER QUALITY

Surface Water

The Surface water bodies in the study area mainly Heran River, Belkund Nadi, Kanari Nadi & Bah Nalla located S, E, NW & E direction at about 4km, 8km, 0.5km & 2km respectably from mine. The water from Heran River, Belkund Nadi & Kanari Nadi is used for domestic as well as drinking purpose. In addition, most of the water bodies are dry during the summer months excluding those water bodies (worked out quarries), which are situated in the study area. These water bodies are filled with rainwater and seepage/discharge water from abandoned mine works.

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The data conform to the water quality standards for most of the parameters. The dissolved oxygen levels range between 4.2 to 4.64mg/l, Total Hardness ranges from 684 to 780 mg/l; BOD levels are as low as 5.8 to 8.2 mg/l. The heavy metal content has been observed within the limit. The analysis of the sample indicates that the organic pollution of River is insignificant. The physico-chemical and biological analysis revealed that all the parameters are well within the prescribed limits of IS: 2296.

Ground Water

Water supply in the most of the villages depends on ground water resources. Well water is used for domestic as well as irrigation purposes. Ground Water quality analysis was carried out at 4 locations and the frequency of sampling was once /month/station. Ground water samples were examined for physico-chemical, heavy metals and bacteriological parameters in order to assess the effect of industrial and other activities on ground water. The samples were collected and analysed as per the procedures specified in "standard Methods for the examination of water & Wastewater" published by American Public Health association (APHA). pH in ground water sample was observed to be in the range 7.2 to 7.62 while conductivity was observed in the range of 948-980 umhos/cm. The value of alkalinity and hardness were observed in the range of 182 – 232mg/l and 240 to 260 mg/l respectively. Whereas heavy metal was found to be within the limit.

The physico-chemical and biological analysis revealed that all the parameters were well within the prescribed limits of IS: 10500.

7.5 SOIL QUALITY

Five locations within 10 km radius of the project site were selected for soil sampling. At each location, soil samples were collected from three different depths viz. 30 cm, 60 cm and 90 cm below the surface and homogenized. The homogenized samples were analyzed for physical and

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chemical characteristics. For general characterisation of soil a few random samples from the study area to the depth of about 15 cm were collected. Soil samples so collected were brought to the laboratory for analysis.

It has been observed that the texture of the soil was observed to be clay. The organic carbon was found to be in the range of 1.6% to 2.4% The nitrogen and phosphorus were observed to be in the ranges of 518 to 542Kg/ha and 26 to 32kg/ha respectively the pH range at the soil vary in between 6.05 to 6.42. The soil has high percentage of iron, zinc and chloride.

7.6 Biological Environment

Flora

(i) Forest

Two vegetation types are found in the buffer zone (i.e. within the 10 Km radius of mining project), moist deciduous forest & dry deciduous forest. The forest cover in buffer zone is reported in the range of 4.30%. The moist deciduous forest type is dominated by Sal or Sarai (*Shorea robusta*). This dipterocarp is commonly associated with *Terminalia* sp., *syzygium cumnil* and *largerstroomia parviflora*. The forest floor in the valley bottom is commonly vegetated with *Fleminga* spp. However, on the lower slopes *Dendrocalamus strictus* becomes the dominant undergrowth.

The dry deciduous forest with discontinuous canopy, but has many more species common species are *Anogeissus latifolia*, *Terminalia* spp. *Gamelina* sp. *Gardenia latifolia*, *sterculia uresna* and *Bauhinia retusa*. The understory is generally bamboo on the slopes and grass with shrubs on the flat ground.

The forest trees are in healthy appearance and showed no stress symptoms. The forest floor showed significant organic matter

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accumulation in the soil, due to which seed, germination and establishment of saplings are in healthy state. Trees are planted in garden and along roadside as avenue and roadside plantation, respectively.

(ii) Grassland:

Grassland of the region is secondary in origin and has originated due to frost, fire and ungulate browsing. However, some browsing and frost resistant trees such as *Butea monspersma*, *Cassia fistula*, *Diospyros Melanoxylon* and *Zizyphus jujube* have encroached the grass land especially at the edge of the forest. The large trees which dot the grassland such as *shorea robusta*, *erminalia spp.*, *Ficus spp.* And *Madhuca indica* is probably relicts of the original vegetation or their descendents.

(iii) Agriculture

The predominant crops grown here are Soyabeen, Rice, Wheat, Tuar etc.

AGRICULTURAL CROPS

Family name	Botanical name	Local name
Malvaceae	<i>Abelmoschus esculentus</i>	Bhendi
Fabaceae	<i>Cajanus cajan</i>	Tur
Solanaceae	<i>Capsicum annum</i>	Merchi
Chenopodiaceae	<i>Chemopodium album</i>	
Fabaceae	<i>Cicer arieantum</i>	Chena
Cucurbiataceae	<i>Coccinia indica</i>	Kundru
Cucurbiataceae	<i>Cucumis sativus</i>	Kakidi
Fabaceae	<i>Dolichus lablab</i>	Wahl
Cucurbiataceae	<i>Lagenaria siceraria</i>	Kaddu

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Cucurbitaceae	<i>Momordica choranta</i>	Kerala
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Fauna:

The climate, rainfall and vegetation type contribute to decide the type of faunal community in the area. In the region the flat hilltops, varying degree of slopes and Rolling Meadows in the valley create diverse type of habitats and form ideal niches for varied forms of animals.

LIST OF FLORA & FAUNA OF THE STUDY AREA

NATURALLY OCCURRING SPECIES	
Kohu (<i>Terminalia arjuna</i>)	Karanji (<i>Pongamia pinnata</i>)
Sisham (<i>Dalbergia sissoo</i>)	Babul (<i>Acacia arabica</i>)
Neem (<i>Azadirachta indica</i>)	Kachnar (<i>Bauhinia variegata</i>)
Akasneem (<i>Millingtonia hertonsia</i>)	Bargad (<i>Ficus bengalensis</i>)
Gular (<i>Ficus glomerata</i>)	Jamun (<i>Syzygium cumini</i>)
Aam (<i>Mangifera indica</i>)	Palas (<i>Butea monosperma</i>)
Mahua (<i>Madhuca latifolia</i>)	Ber (<i>Zizyphus mauritiana</i>)
Bel (<i>Aegle mermelos</i>)	Saj (<i>Terminalia tomentosa</i>)
Kanker (<i>Flacorita indica</i>)	Tendu (<i>Diospyros melanoxylon</i>)
	Reunjha (<i>Acacia leucophloea</i>)
CULTIVATED TREES GROWING IN THE VILLAGES	
Bargad (<i>Ficus bengalensis</i>)	Gular (<i>Ficus glomerata</i>)
Pipal (<i>Ficus religiosa</i>)	Imli (<i>Tamarindus indica</i>)
Aam (<i>Mangifera indica</i>)	Jamun (<i>Syzygium cumini</i>)

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Munga (<i>Moringa olderfera</i>)	Ber (<i>Zizyphus mauritiana</i>)
Bel (<i>Aegle marmelos</i>)	Lasora (<i>Cordia dichotoma</i>)
Neem (<i>Azadirachta indica</i>)	Mahua (<i>Madhuca latifolia</i>)
Sitaphal (<i>Anona squamosa</i>)	
LIST OF FAUNA OF THE STUDY AREA	
Bengal Monkey (<i>Macasus rhesus</i>)	Jungle cat (<i>Felischaus</i>)
Mongoose (<i>Herpests mingo</i>)	Sambhar (<i>Crevus unicolor</i>)
Kalmuha monkey (<i>Semnapthecus on lellccs</i>)	Common hawcuckoo (<i>Cuculus micropterces</i>)
House sparrow (<i>Passer domesticus</i>)	House crow (<i>carvus splendens</i>)
Common maina (<i>Acrido tehras tristis</i>)	

7.7 LAND USE PATTERN

Present landuse pattern of the 17.07 hectares mining lease area is as given below:

Land Use Pattern of Mining Lease Area

Items	Existing	At the end of lease period
Total lease area	17.07ha	
Total Mineable area	17.07ha	16.245ha
Geological Reserve	1241909.00 tonnes	-
Ultimate depth of mining	4.5-5.0 m	5.5m
Ultimate pit slope	45 degree	45 degree
Area under dumps	0.0149ha	Nil
Area under pits	0.0546ha	0.8250ha
Mine waste quantity	200cum	14742cum
Area to be reclaimed	Nil	0.4050ha
Water reservoir	Nil	0.4200ha
Infrastructure &	0.1730	0.1730

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Road		
Mineral storage	Nil	Nil
Plantation	Nil	0.54ha
Top soil	100cum	8475cum

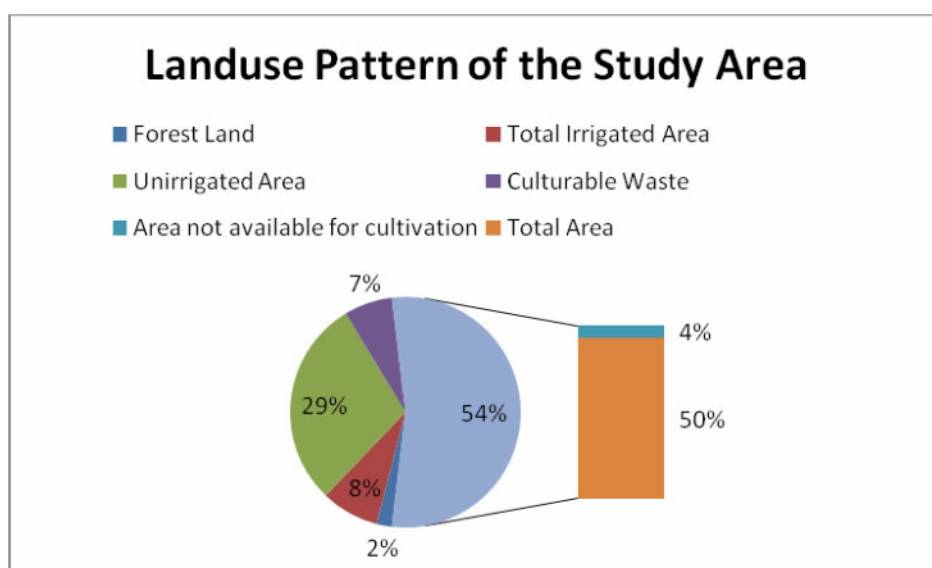
The study area covers about 14725 ha. For computation of the land use pattern in the study area based on the village-wise land-use data given in the census records, the geographical area of all settlements covered within the study area, though many villages in the peripheries of the circular study area are partially covered. Perfect delineation and quantification of land uses for the partially covered parts of villages of the study area is not possible, hence the entire village area is considered for the study, irrespective of its coverage within the village boundary.

The land use is classified into four types – viz. forests, area under cultivation, culturable waste and the area not available for cultivation. The land under cultivation is further sub-divided into two types viz. irrigated and un-irrigated.

Land-use Pattern in the Study Area

S. N.	Particulars	Study Area (ha)	Percentage Coverage
1.	Forest Land	633	4.3
2.	Land under Cultivation		
	a) Irrigated Land	2.86	16.20
	b) Un irrigated Land	8597	58.38
3.	Culturable Waste Land	1993	13.53
4.	Area not available for cultivation	1116	7.58
	Total Area	14725	100

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7.8 SOCIO-ECONOMIC CONDITIONS

The study area comprises of total 56 Villages. These villages fall under one tehsil – Sihora. The Estimated basic statistics structure of the study area is presented in below Table. The demographic details have been abstracted from Primary Census Abstract- 2001(CD) of Madhya Pradesh obtained from Office of Registrar General India, New Delhi.

The salient features of the study area are as follows:

- Total population of the villages in the study area is 34126
- The total no of household in the study area is 9159
- Sex ratio (no. of females per 1000 males) is 958
- The literacy rate in the study area is 65.3%
- The percentage of scheduled tribe in the study area is 17.34% while only 12.30% population is of scheduled caste
- Out of total population maximum people are workers i.e. 55.22% Followed by main workers 49% and marginal workers 51%.

ESTIMATED BASIC STATISTICS OF THE STUDY AREA

1. Households	9159
2. Population	40499
Male	20683

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Female	19816
3. Schedule Tribe	7023
4. Schedule Cast	4982
5. Literacy Rate	65.3%
6. Occupational Pattern:	
(A) Main workers	49%
(% of total population)	
i) Cultivators (% of main worker)	46.66%
ii) Agricultural Labors (% of main worker)	38.35%
iii) Other Workers (% of main worker)	15.99%
(B) Marginal Workers	51%
(% of total population)	

8. IMPACT ASSESSMENT

Mining activities is bound to have an adverse impact on existent environment. An understanding of the nature and extent of various impacts is essential in devising the methods and advance planning to mitigate the impacts and ultimately restore the land to useful conditions.

9. IMPACT EVALUATION

An attempt has been made to evaluate the impact of project in terms of both quality and quantity by using modified matrix method for crucial environmental parameters. The environmental impact evaluation of possible effects as a result of proposed mining area is primarily based on study of objectives, process, surrounding environment etc. The aspects such as water, air, land and related issues have been assessed on the basis of mining operations for similar activity. The environmental impacts identify the possible relationship of proposed mining operations with respect to environmental parameters. Their relationship can be beneficial or adverse and can be further classified as short term, long term, reversible, irreversible, local or regional. The evaluation of the impact of proposed activity are presented in Table below

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Parameters	Weight PIU	Baseline EIU (a)	Without EMP EIU (b)	With EMP EIU (c)	Change EIU (c-b)	Change EIU (c-a)
Biological Environment	300	205	186	209	25	+ 4
Environmental Pollution	450	344	313	342	29	-2
Aesthetic	100	79	66	79	13	0
Human Interest	150	119	111	128	17	+9
Grand Total	1000	747	674	758	84	+11

10. ENVIRONMENT MANAGEMENT PLAN

10.1 Solid waste management

Proposed mining operations will be carried out by manual method of mining using hand tools such as spades, hammer, crowbar & chisel etc. Proposal of mining is given in south western part of the area. The area proposed to be excavated in at the end of lease period is about 0.8250 Ha. Presently the area covered by pits and queries is 0.0546 ha. While, the Area covered by the lateritic soil and waste dumps are about 0.0149ha. Considering the rate of production, it has been estimated that almost 39.5 cum of overburden & 31.25cum of lateritic soil will be generated average on monthly basis. The waste produced during mining operations consists of lateritic soil & weathered from laterite. During the proposed mining about 1875m³ soil will be dumped in south western barrier zone area and 2370 m³ mine waste (weathered phyllite) will be generate during first to third year will be placed in the form of temporary dumps in south western barrier zone area. During the fifth year to lease period about 14742cum mine waste and 8475cum top soil will be generated same will be used for reclamation purpose.

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The top soil is removed by hand tools and transported by manual to the temporary dumping yard of soil in the near by proved non-mineralised area. The soil dumps are kept for not more than six months to preserve its fertility. After proper levelling to backfilled area by dozer the soil spared over the backfilled area for plantation purpose.

The year wise generation of OB and mine waste as given in following table:

Year	Top Soil m ³	Mine Waste m ³
1 st	375	318
2 nd	375	513
3 rd	375	513
4 th	375	513
5 th	375	513
	1875	2370

10.2 Reclamation of Land

Simultaneously reclamation will be done during lease period. Since further exploration is proposed to completely delineate ore bearing areas within the leasehold, complete reclamation programme cannot be given at this juncture but waste will be spread in worked out areas to the maximum extent possible.

Reclamation will start from fourth year, temporary mine waste dump will be used for reclamation purpose and mine waste generated from fourth year will be used for reclamation simultaneously along with mining. Out of 1875m² excavated areas, 531m² area will be reclaimed during the five year mining and during the lease period out of 8250m² excavated areas, 4050m² area will be reclaimed. Remaining 4200m² area will be developed as water reservoir. Depth of water reservoir will be 4.5m.

Details of reclamation during the proposed mining are mentioned below

Year	Mine waste m ³	Area in m ²	Thickness in	Location
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4 th	2389	25.4x21=531	4.5	South west
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Total area to be reclaimed 531 m²/0.0531 ha having 4.5 m thickness

Details of lease period reclamation using mine waste

Year	Mine waste m ³	Area m ²	Thickness in m.	Location
5 th year to lease period	10000	75x30=2250	4.5	South west

Area to be reclaimed using mine waste 2250m²/0.2250 ha having 4.5 m. thickness.

Details of lease period reclamation using top soil

Year	Top Soil m ³	Area m ²	Thickness in m.	Location
5 th year to lease period	Five year soil 1875 + Lease period soil 6600 total soil 8475	60x30=1800	4.5	South west

Area to be reclaimed using top soil 1800m²/0.1800ha having 4.5 m thickness

Total area to be reclaimed in lease period 4050 m² /0.405 ha

- (1) Area to be covered by dumps - Nil
- (2) Area to be reclaimed - 0.4050 ha
- (3) Area to be rehabilitated by way of afforestation - 0.54ha
- (4) Area to be covered under water reservoir - 0.4200ha

10.3 Green Belt Development

The massive afforestation planned for the project shall generate a forest having greater tree density (about 10 trees for first five year per 90m²). The proposed extensive will enhance the vegetation quality as well as aesthetic quality of the area. Thus there is no adverse impact is envisaged over biological environment due to proposed mining activity.

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

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S. No.	Year	Afforestation in Ha	Plantation in No.
1	1 st	0.090	10
2	2 nd	0.090	10
3	3 rd	0.090	10
4	4 th	0.090	10
5	5 th	0.090	10
Total		0.045	50

During the course of mine and after mining the proposed plantation is at the rate of 2000 saplings per hectare, except for reclamation mine areas, for which the density is 1500 saplings per hectare. The proposed green cover including greenbelt is 0.02 ha. The total number of saplings to be planted during the entire life of mine shall be 757no. Considering the estimated cost of planting and maintaining a sapling for one year as about Rs.1000/-, the afforestation plan for the ML area is given in Table.

Table
Afforestation Plan for the ML Area

Interval of Mining Operation	Reclaimed Mine Pit Area		Afforestation other than Reclaimed Area	
	Area (ha)	No. of	Area (ha)	No. of
1 to 5 years	-	-	0.045	50
5 to 10 years	-	-	0.045	50
10 to the end of the	0.405	607	0.045	50
Total	0.405	607	0.1350	150

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

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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.

10.4 Measures to Improve Socio-Economic Conditions

The impacts of the project would be felt in an integrated manner on the socio-economic environment in the study area. There is no village in core zone and further no displacement is required for the proposed project and therefore impact will be positive side rather negative. The impacts on the different components viz employment, housing, educational, and medical and transport facilities, fuel availability, economics, status, health agriculture is not significant because size of project is very small. However, it would definitely increase the employment opportunity (primary as well as secondary) in the project area. Some of these impacts would be beneficial.

- The project will have a strong positive employment and income effect, both direct as well as indirect.

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- Migrant-Non migrant ratio shall shift towards migrant side. This will happen because of (i) better employment opportunities due to this project and (ii) relatively low agricultural yield through traditional agricultural practice with monocrops.
- The project shall speed up the growing view on importance of education among people in study area.
- The project is going to bring about changes in the pattern of demand from food to non-food items if sufficient income is generated.
- The project is not going to influence the existing traditional agricultural situation significantly. It may help to improve agricultural production by way of providing additional income to the farms from supplementary sources.
- People perceive that the project will bring handful gains by way of creating significant job opportunities along with development of social infrastructure.

10.5 Air Pollution Control Measures

Following measures shall be taken to mitigate the effect of mining operation over ambient air environment:

1. Regular spraying of water by water sprinkling system over haulage roads.
2. To reduce dust generation during loading operation water shall be sprayed over the muck pile to the loaded;
3. To reduce dust generation during plying of dumpers on the haul road. Water sprinkling is done at frequent intervals. Water sprinklers shall be installed at the mine haulage road;
4. To reduce spread of dust, plantation along the mining lease boundary and plantation shall be also done along haul roads.
5. Periodic maintenance of haulage roads.

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6. All over burden dumps shall be stabilized with legumes and grass to prevent the erosion of soil and arrest the dust emission during windy days.

In addition to the above following additional mitigation measures shall be adopted and it is expected to continue in future also:

1. Dust due to drilling shall be minimised by using wet drilling method like water injection system.
2. Dust mask shall be provided to all workers working in dusty atmosphere.
3. Tree Saplings shall be planted at the periphery of mining lease
4. Regular maintenance of vehicles and machinery's shall be carried out in order to control emissions;
5. A good house keeping and proper maintenance shall be practiced which will help in controlling pollution.

10.6 Noise Pollution Control Measures

The main sources of noise in mining activity are drilling, blasting, material handling machinery, loading equipment, etc. Following mitigation measures should be taken to control noise pollution:

1. Wherever the noise levels exceed 85 dBA, workers should be provided with earmuffs, ear plugs etc.
2. Hydraulic drills shall be used for drilling;
3. All moving parts of machine shall be properly lubricated;
4. Non-moving parts of machine shall be properly fastened;
5. A barrier of overburden at mine boundaries shall be made and three rows of trees are proposed to be planted to reduce propagation of noise;
6. Noise barriers, silencers and enclosures shall be incorporated for equipments, which emit high noise levels.

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7. All the basic equipments and various machinery shall be kept well maintained.
8. Thick green belt around the mining pit and along the haulage roads.
9. As far as possible heavy and noisy workers shall be avoided during nighttime.

10.7 Water Pollution Control measures

Following measures have been taken to avoid accumulation of water:

1. Pump having required capacity shall be installed to lift accumulated rain water from working pit.
2. There shall not be no over flow on wash off from dumps nor is there any beneficiation plant. Only rainwater is pumped out of the mine;
3. There is no toxic constituent in water and soil so water collected in sump is free from any toxic substances.
4. A silt-settling tank shall be constructed in northern barrier zone area to settle heavy particle before discharging water into drain.
5. Quality of water accumulated in the working pit may be checked during monsoon.
6. It shall be ensured that silt content in the mines discharged is minimum.
7. It shall be ensured that quality of drinking water for the worker is hygienic and good sanitation system is available.

11.0 Conclusion

The Latertie mining project of M/s Nector Mining Company, village –Kurro-Manasakra, Tehsil Sihora, and Jabalpur District (MP) will be environmental compatible to the surrounding due to the high standards of pollution control measures to be adopted during the operation activity. Thus it can be safely stated that the mining activities will not have any adverse effect

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on the surroundings, if the proper environmental management plan is adopted.