Pre – Feasibility Report of

Proposed Mining of Bauxite
in Pottangi Bauxite Deposit,
at Pottangi Village, Pottangi Tehsil,
Koraput District, Odisha State

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Pre-Feasibility Report

1. Executive Summary

NALCO is planning to set up the 5th Stream in its Alumina Refinery at Damanjodi based on Pottangi Bauxite Deposits as a part of the future expansion programme (3rd Phase expansion) for additional production of one million tons per annum (MTPA) of alumina. A pre-feasibility study has been conducted for the site and the observations made have been reported in the **Table 1.1**

Table 1.1

Project Details

<table>
<tr><th>S. No</th><th>Description</th><th>Details</th></tr>
<tr><td>1.</td><td>Name of the Project</td><td>Pottangi Bauxite Deposit, Pottangi Village, Pottangi Tehsil, Koraput District, Odisha</td></tr>
<tr><td>2.</td><td>Name and Address of the Applicant
(present & permanent address)</td><td>National Aluminium Company Limited (NALCO), NALCO Bhavan, Nayapalli, Bhubaneswar – 751 061</td></tr>
<tr><td>3.</td><td>Location of the mine</td><td>The mine is located near Pottangi Vilage, Pottangi Tehsil, Koraput District, Odisha State

Mining Lease area: 697.979 Ha (6.97 Sq.km)

Coordinates of the retention area are
<table>
<tr><th>Boundary Point</th><th>Latitude</th><th>Longitude</th></tr>
<tr><td>1</td><td>18°37'6.45"N</td><td>82°57'41.10"E</td></tr>
<tr><td>2</td><td>18°34'31.13"N</td><td>82°57'30.20"E</td></tr>
<tr><td>3</td><td>18°37'3.44"N</td><td>82°59'49.95"E</td></tr>
<tr><td>4</td><td>18°35'4.75"N</td><td>82°58'46.07"E</td></tr>
</table></td></tr>
<tr><td>4.</td><td>Production/Estimated reserves</td><td>Capacity: 3.5 MTPA
Geological reserve : Total : 111.794 MT</td></tr>
<tr><td>5.</td><td>Total area reserved for mining</td><td>Mining lease area: 697.979 Ha (6.97 Sq.km)</td></tr>
<tr><td>6.</td><td>Total water requirement & source</td><td>The total water requirement is around 700 m^3/day for different mine activities.
The water requirement for the Pottangi mines will be met from boreholes proposed in the bank of the Kunduli river.</td></tr>
<tr><td>7.</td><td>Working hours</td><td>Two operating shifts per day, each of 8 hour</td></tr>
</table>

		duration
8.	Manpower [Operation]	229 persons (Mine)
9.	Estimated cost of the project	Capital cost - Rs. 1,436.9 Crores
10.	Nearest railway station, sea port, airport	Damanjodi railway station – 19.4 km (NNW), Visakhapatnam sea port – 103. 4 km (SSE), Jaypore airport – 51 km (NW)
11.	Existence of public road, railway track nearby	NH 43 (Jaypore to Vizianagaram) – 1.3 km (S)
12.	Police station and other facilities	The district headquarters Koraput is having all facilities like police station, fire station hospital, bank, post office, school, workshops etc.

2. Introduction of the project

2.1 Identification of Project and Project proponent

The Pottangi bauxite deposit in Pottangi Tehsil of Koraput District, Odisha has been identified by NALCO to feed the proposed 5th stream of the alumina refinery at Damanjodi for additional production of one million tons per annum (MTPA) of alumina. The processing technology will be based on medium pressure digestion if it is found more economical compared with the existing atmospheric pressure digestion system. The deposit occupies the flat top of the hill, named as 'Sirimanda Parbat'.

National Aluminium Company Limited (NALCO), a Government of India undertaking and a Navaratna Company, owns and operates a large integrated Mines-Alumina-Aluminium Complex in India. It has multi-location operations as follows:

- Mines and Alumina Refinery, Damanjodi, Odisha
- Aluminium Smelter & Captive Power Plant, Angul, Odisha
- Port Handling Facilities, Visakhapatnam, Andhra Pradesh
  (for alumina export and caustic soda import)

2.2 Brief Description of Nature of the Project

The proposed project involves the mining of bauxite in an extent of around 697.979 Ha (6.97 Sq.km) of mining lease area and falls in schedule 1(a) (i) Mining of Minerals of Category 'A'.

2.3 Need for the Project and its Importance to the Country and or Region

It has been recommended for the opening of new areas in order to reduce the stress/impact on existing mining leases and this will also lead to exploring the mineral bodies using drilling etc. Proper exploration of mineral resources will delineate the quality/quantity and help to wrap up at the most suitable exploitation strategy with an eye on conserving the mineral and reducing waste handling. The bauxite produced from

the proposed mine will be sent to the 5th stream with a capacity of 1 MTPA, within the existing refinery at Damanjodi for processing.

2.4 Domestic and Export Market

India is endowed with large deposits of high quality bauxite ore, amounting to about 3 per cent of the world's reserves, totaling to about 3 billion tons. So there is no problem with respect to availability of raw materials for setting up of present and future projects of alumina. According to the Indian Mineral Year Book, India had imported around 534 tons and exported around 682 tons of Alumina during the year 2010-2011. The projected availability of alumina in domestic market beyond 2015-16 is estimated at about 8 million tons. In terms of global scenario, the anticipated shortfall of alumina in global market ranges from 2-10 million tons through years 2015, 2020 and 2025. It is thus clear that both the domestic as well as global scenario strongly favor creation of new capacities in alumina and the setting up of proposed bauxite mine by NALCO is uniquely advantageous in terms of both domestic and world market.

The bauxite produced from the proposed mine will be transported to the proposed expansion (5th stream) of the existing refinery through overland belt conveyor system to Damanjodi. The generated alumina will be supplied to local market and surplus will be exported.

2.5 Employment Generation (Direct and Indirect) due to the Project

The total manpower requirement for the mining activity is around 229 persons and contractual workers for different activities will be hired as per requirement.

3. Project Description

3.1 Type of the Project Including Interlinked and Interdependent Projects

The proposed project is for mining of bauxite. Total mining lease area is 697.979 Ha (6.97 sq.km). It is proposed to produce maximum of 3.5 MTPA of bauxite from the proposed mine. The bauxite is to be excavated by trench mining method comprising of a number of parallel trenches with staggered faces. Lease area is situated at Pottangi Village of Pottangi Tehsil, Koraput District, Odisha.

The interlinked projects for the proposed mine are expansion (5th stream) of the existing refinery and steam cum co-generation power plant at Damanjodi.

3.2 Location

The proposed bauxite mine is located at Pottangi village of Pottangi Tehsil, Koraput District, Odisha. The deposit occupies the flat top of the hill, named as 'Sirimanda Parbat' falling in Survey of India Toposheet No. E44K14 and is situated about 2 km north of

Pottangi village on the National Highway No. 43 connecting Vizianagaram and Jaypore. The details are given in **Table 2.1.**

Table 2.1

Location Details

<table>
<tr><td>District and State</td><td>Koraput, Odisha</td></tr>
<tr><td>Tehsil</td><td>Pottangi</td></tr>
<tr><td>Village</td><td>Pottangi</td></tr>
<tr><td>Area</td><td>Mining lease area: 697.979 Ha (6.97 Sq.km)</td></tr>
<tr><td>Ownership/Occupancy</td><td>Govt. land (Forest)</td></tr>
<tr><td>Existence of Public Road, Railway nearby</td><td>NH 43 – 1.3 km (S)
Damanjodi railway station – 19.4 km (NNW)</td></tr>
<tr><td>Toposheet no, Latitude & Longitude</td><td>Topo sheet No : E44K14, E44K15, E44L2, E44L3 (New)
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<tr><th>Boundary Point</th><th>Latitude</th><th>Longitude</th></tr>
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<tr><td>Nearest Airport, Sea Port</td><td>Visakhapatnam sea port – 103. 4 km (SSE),
Jaypore airport – 51 km (NW)</td></tr>
<tr><td>Police station and other facilities</td><td>The nearest towns Damanjodi and Sunebada are having all admin facilities like police station, fire station, hospital, bank, post office, school, workshops etc.</td></tr>
</table>

The index map of the site is given in **Figure 3.1.** The location map is shown with 10 km radius from the periphery of mining lease in **Figure 3.2** and key plan of the site area is given in **Figure 3.3.** The entire mine lease area including 10 km radius area are represented in Survey of India (SOI) Toposheet No. E44K14, E44K15, E44L2, E44L3 (New).

3.3 Details of Alternative Sites

The Pottangi bauxite deposit has been initially explored by Geological Survey of India (GSI), subsequently Mineral Exploration Corporation Ltd (MECL) carried out exploration in two phases viz. Phase-I and Phase-II. The site has been infered to harbor significant deposits of bauxite ore and was found suitable for mining activity by both GSI and MECL. The project being site specific with respect to occurance of bauxite, no alternative sites were studied for the purpose.

Figure 3.1

Location Map

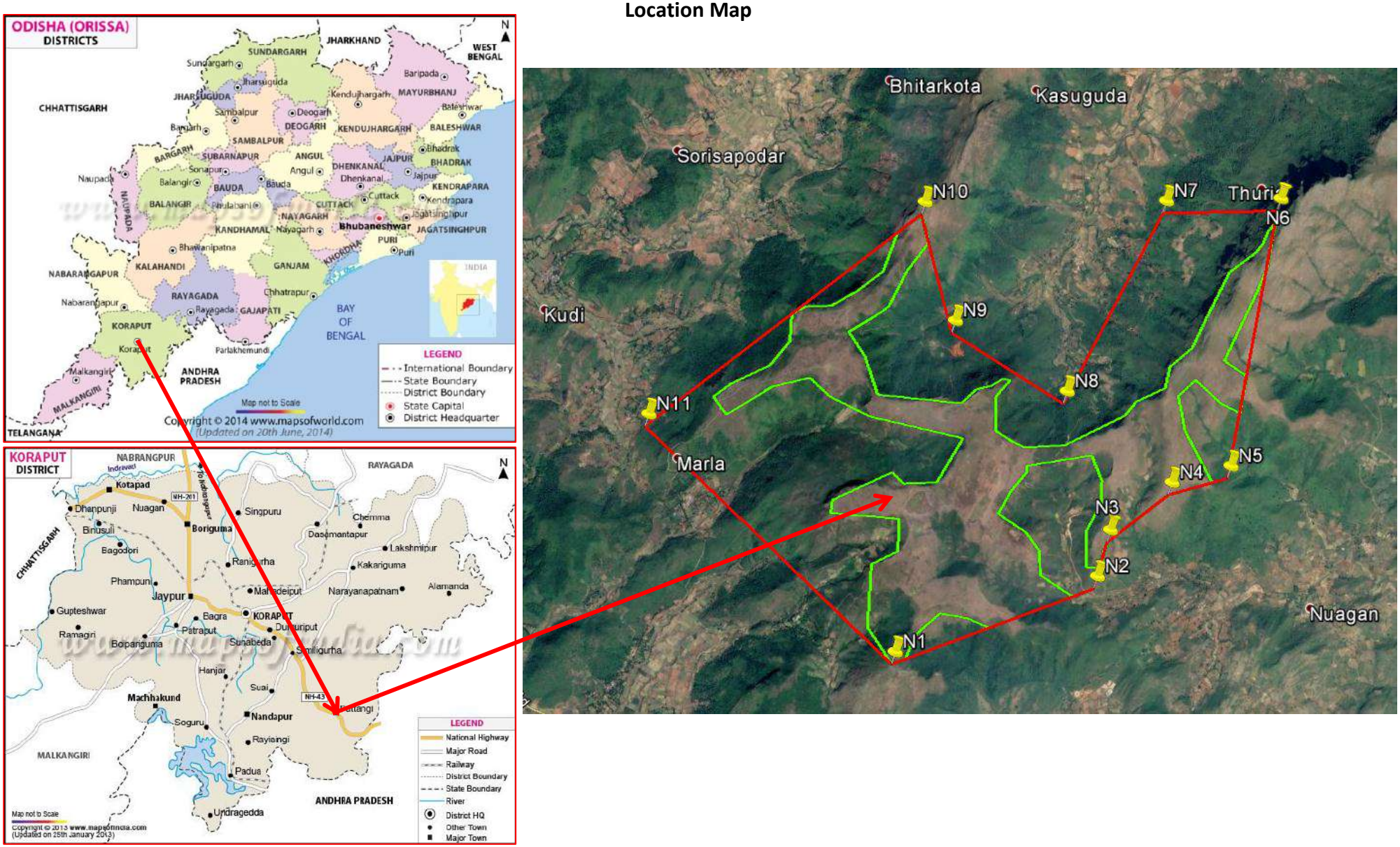


Figure 3.2

Topographical Map of the Site

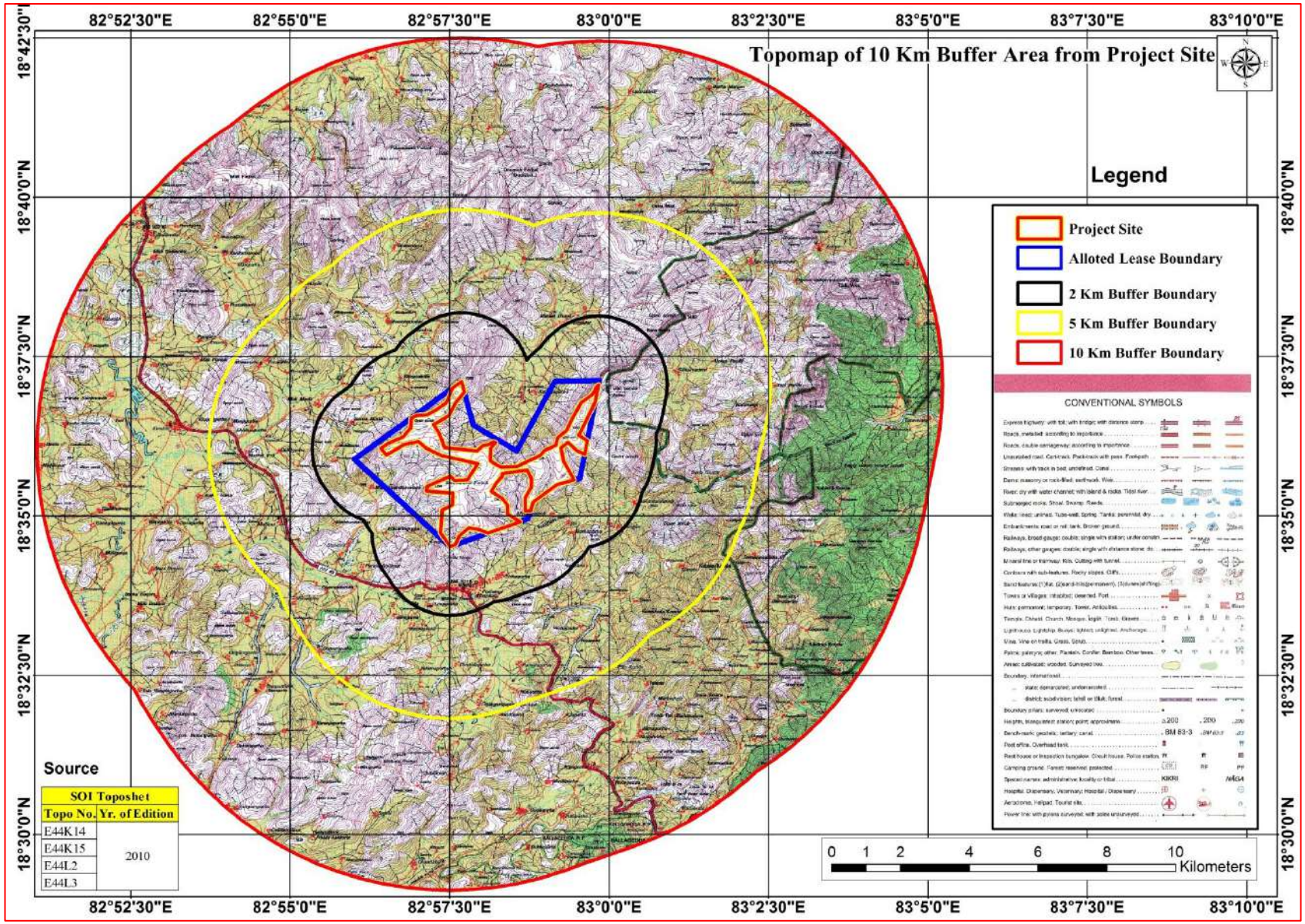
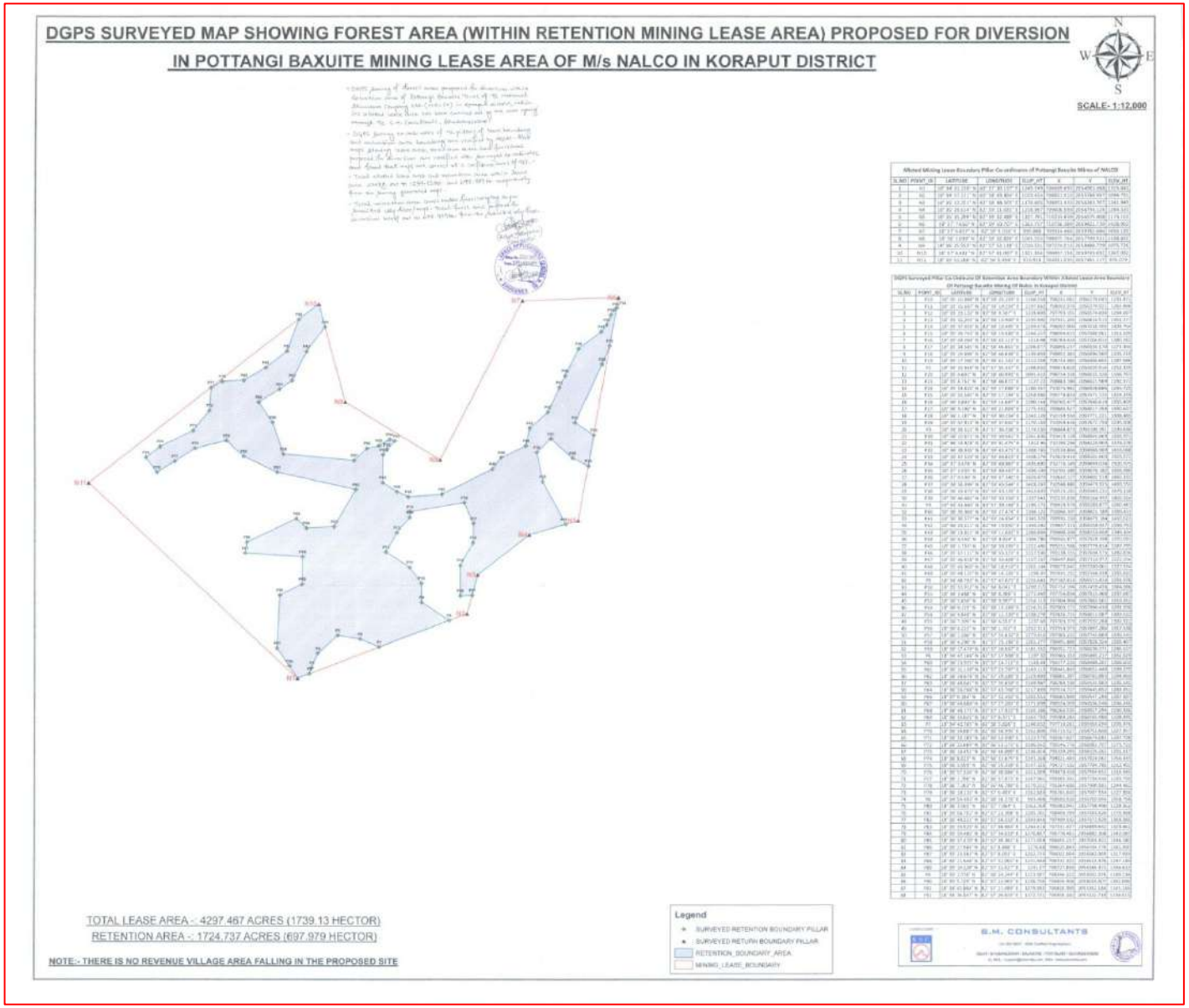


Figure 3.3

Key plan of the Site



3.4 Size or Magnitude of Operation

The maximum production capacity of the proposed mine is 3.5 MTPA. The bauxite will be excavated by trench mining method comprising of a number of parallel trenches with staggered faces and mining in each trench will take place in two distinct slices. The deposit spreads over an area of 2.7 Sq.km and is divided into four blocks viz., South, Central, North and Extension blocks. The mining operations have been planned to be started from south and central blocks, which contain bauxite reserves almost in equal proportions. It has been assumed that the mining operations in the block will be started after acquiring all the necessary regulatory approvals.

3.5 Project Description and Project Details

The detailed exploration has been carried out by GSI and MECL, the details of estimation of reserves/resources are given in GSI/MECL report. However, fresh reserves/resources have been estimated by geological cross section method using the same exploration data by considering the IBM threshold value of 30% Al_2O_3 and reactive silica -SiO_2 5% maximum. The exploration details are given in **Table 3.1.**

Table 3.1

Summary of block wise Reserves / Resources (MT)

Category	South block	Central Block	North Block	Extension East Block	Extension West Block	Total
Probable Mineral Reserve (121&122)	23.138	19.641	-	-	-	42.779
Pre- Feasibility Mineral Resource (221&222)	-	0.321	-	-	-	0.321
Inferred Mineral Resource (333)	-	0.052	13.970	19.765	34.907	68.694
Total Reserves + Resources	**23.138**	**20.014**	**13.970**	**19.765**	**34.907**	**111.794**

Table 3.2

Land Use Pattern

Type of land use	Existing (Ha)	This Plan period (Ha)	Conceptual (Ha)
Mining & Backfilling	0.113*	46.113#	354.777
Waste /Soil dump	-	5.23	-
Statutory buildings/Infrastructure	-	33.859	28.326
Power Corridor	-	12.40	12.40
Primary Crusher/Conveyor belt	-	10.23	10.23
Roads	1.840	16.150	8.139
Safety zone/Greenbelt	23.400	23.400	284.107
Area untouched	672.626	550.597	-
Total	**697.979**	**697.979**	**697.979**

Note: * This area includes pits/trenches made by GSI/MECL

This area includes 21.33 ha of backfilling area and further this area involve about 18.44 ha plantation.

3.5.1 Method for Excavation

It is a new mining area and is proposed to operate after execution of mining lease. Considering the major factors like topography, estimated reserve & grade, thickness and nature of ore/overburden, fully mechanized opencast of mining (trench method) is proposed with the deployment of heavy earth moving machineries (HEMM) like ripper dozer, blast hole drill, front-end loader, back-hoe, dumper, semi mobile crusher with conveyor, double roll toothed crusher etc. It is proposed to produce a maximum quantity of 3.50 million tons of Bauxite from south block as it contains sufficient mineral reserves under minable category for this plan period.

The ground water level in the area is observed to be at a depth of 140 m to 150 m. Mining will be done up to a maximum of 40 m below ground/plateau level. Therefore, there is no possibility of ground water puncture during the plan period of 5 years as well as life of the mine. The year wise working details are given in **Table 3.3.**

Before commencement of mining operation a suitable access road of 10 m width to the Pottangi mine will be developed for regular transportation of employees from the township at Damanjodi, maintenance of overland conveyor installation and also to maintain a regular surface linkage between the mine and the alumina refinery. This access road from the alumina refinery will be of 10 m in width and about 30 km in length.

Table 3.3

Year wise working details – in tons

Year	Total tentative Excavation	Top Soil	OB/SB /IB	ROM		ROM/ Waste Ratio
				Bauxite	Mineral Reject	
First	31,09,860	1,15,200	1,59,660	28,35,000	-	1: 0.10
Second	35,16,891	1,36,335	2,30,256	31,50,300	-	1: 0.12
Third	37,76,001	64,605	2,11,356	35,00,040	-	1: 0.08
Fourth	37,97,468	37,350	2,60,118	35,00,000	-	1: 0.08
Fifth	38,94,350	47,850	3,46,500	35,00,000	-	1: 0.11

3.6 Availability of Water - its Source, Energy/ Power Requirement and Source

3.6.1 Water Source

The required water for the Pottangi mine activity will be met from boreholes proposed in the bank of the Kunduli River. The details of total water requirement for various activities is given in **Table 3.4**

Table 3.4

Total Water Requirement

S. No	System	KLD
1	Mines road sprinkling	525
2	Industrial use	75
3	Horticulture	60
4	Drinking and sanitation	40
Total		**700**

3.6.2 Energy/Power Source

The power requirement for the bauxite mine and alumina refinery plant will be met from two sources, viz., 1 x 18.5 MW from captive power generation system (TG unit presently under execution) and drawl of power from NALCO, Angul by wheeling through the grid to existing 220/132 kV MRSS of alumina refinery.

3.7 Quantity of Wastes Generated (Liquid and Solid) and Scheme for their Management /Disposal

The overburden consists of top soil of about 0.5 m depth which is proposed to be removed separately by scraping with dozer and the heaps so formed will be lifted by loader-dumper combination. This material initially for three years of this plan period shall be stacked separately, temporarily on the ground earmarked for top soil i.e. northwest part of central block. Thereafter, i.e. in the fourth and fifth year it will be used for backfilling of the mined-out areas of South block for growing trees and vegetation.

Liquid waste i.e. waste water which includes rain water generated due to rains and sewage due to the domestic activities by the workers or residents close to mine site. The domestic waste water generated from the residential colony will be treated in the existing STP located at the Damanjodi plant while the waste water from the workers temporary workshop and admin buildings will be treated in the STP located at the mining site. The waste water from vehicle washing and workshop will be treated in ETP. The treated water from STP and ETP will be reused for greenbelt development and dust suppression within the lease area. As the mine is located atop the hill, in-situ peripheral barrier will be maintained to prevent muddy runoff of rain water down the valley. Since the bottom of the mined out area will be soft, water will not be retained but will percolate into the ground thus recharging the ground water table.

The water accumulated in the mine site during rainy season will be collected through garland drains based on the contour levels in a collection pond for settlement of solids and then pumped to the overhead tank located within the mine lease area.

3.8 Schematic Representations of the Feasibility which give Information of EIA Purpose

Detailed schematic representations of the feasibility covering the purpose of EIA will be given in the Environmental Impact Assessment report.

4. Site Analysis

4.1 Connectivity

The site is well connected with district headquarters Koraput, by means of road ways and railways, the details of which are summarised in **Table 4.1.**

Table 4.1

Details of Connectivity

Existence of Public Road, Railway nearby	NH 43 (Jaypore to Vizianagaram) – 1.3 km (S)
Nearest Railway station, Sea Port, Airport	Damanjodi railway station – 19.4 km (NNW), Visakhapatnam port – 103. 4 km (SSE), Jaypore Airport – 51 km (NW)
Police station and other facilities	The district headquarters Koraput is having all facilities like police station, fire station hospital, bank, post office, school, workshops etc.

4.2 Topography

The deposit occupies the flat top of the hill, named as 'Sirimanda Parbat'. The area around Pottangi forms a series of hills ranging in height from 1000 m to 1400 m above M.S.L. The deposit is nearly flat with prominent slopes on the north and east. The slopes are gentle to moderate, rarely steep. When the slopes are gentle to moderate, they are congenial for formation of thick bauxite profile. The slope gradient varies from 1:6 to 1:12. The peak portions of the deposit are occupied by khondalites forming the ridges.

Peripheral escarpments are conspicuously developed on the eastern and northern fringes of North block and the northern and southern peripheries of the Central block. The South block, however, shows relatively less pronounced escarpments, except on its southern fringe. Caves, at places, are developed in steep peripheral escarpments. The drainage pattern, as indicated by the numerous streams and nalas, is of dendritic type. A few perennial springs sprout from the hill slopes and drain into the nearby streams. Two such perennial streams originate from the western slopes of Sirimanda Parbat and flow to the west. Pottangi bauxite capping (Sirimanda Parbat) is devoid of much vegetation.

The rock types exposed on the Pottangi deposit include laterite, bauxite and khondalite with occasional patches of soil. The major part of the capping is occupied by sheeted out crops of bauxite/laterite. At places, bauxites display a crude relict foliation conformable with that of khondalites. Khondalite crops out as linear ridges at the higher elevations.

These follow a general strike trend of NE-SW with moderate to occasional steep dips to S. Also, bands of weathered khondalites are observed at places, within the bauxite on the surface of the capping.

4.3 Existing Land Use Pattern

The total mine lease area is 697.979 Ha. The deposit occupies the flat top of the hill, named as 'Sirimanda Parbat'. The total lease area is Government land and NLACO has obtained lease to carry out the mining activity.

4.4 Existing Infrastructure

The proposed lease area is a virgin block and no mining has been undertaken so far and hence there are no existing infrastructure facilities available at the site. The various temporary site services proposed to be constructed will be:

1. Administrative building
2. Mine site office
3. Service center area
4. Repair and maintenance shop
5. Stores
6. Gatehouse and check post
7. Time office
8. Training center
9. Canteen
10. Fuel filling station
11. Watch tower
12. Transport
13. Crushing plant
14. Belt conveyors
15. Explosive magazine
16. Access road
17. STP and ETP
18. Water intake structure

4.5 Soil Classification

Topography of Pottangi mines is characterized by undulating table land scattered with hundreds of little hillocks which are mostly covered with low shrubs. The soil, mostly associated with laterite and rarely with bauxite, occurs in areas of shallow depressions or on flat grounds. At places, it is mixed with reddish brown "morrum". The thickness of soil cover varies from a few centimetres to a maximum of one metre.

4.6 Meteorological Data

4.6.1 Climate

The study area has tropical climate, characterised by high temperature, high humidity, medium to high rainfall and short and mild winters. The climate of the district varies in different physiographic regions due to difference in altitude, rainfall and temperature. The general climate of the district is characterized by hot summer (March to mid-June), heavy rains (mid June to September) and a cold winter (October to February). The summer is severe in Rayagada and Malkangiri but in Koraput zone it is mild and even pleasant.

4.6.2 Temperature

As per the monthly average of daily maximum and minimum temperatures for the period 1981 to 2010, collected from IMD station, Visakhapatnam, the monthly mean of minimum temperatures ranged from 18.4°C in January to 27.8°C in May and the monthly mean of maximum temperature ranged from 29.5°C in January to 36.3°C in May.

4.6.3 Rainfall

Rainfall does not show any cyclic occurrences and shows wide and erratic variations. The average annual rainfall as per IMD Visakhapatnam for the period 1981 to 2010 was 1031.7 mm. The monsoon season is spread over the months from June to September. However, the total rainfall is 1429.3 mm.

4.6.4 Wind Velocity and Wind Direction

The wind speed and direction analyzed from 1981-2010 have been studied through the windrose diagrams supplied by IMD, Visakhapatnam. An observation of the windrose shows that the predominant wind direction is from NE during October - January and SW during March – September with an average annual wind speed of 6.7 kmph.

4.6.5 Relative humidity

The relative humidity varies from 62% in (February) to 76% (September) during evening and 67% (April) to 78% (September) during morning.

The details of temperature, humidity, rainfall and wind speed as per IMD Visakhapatnam for the period 1981 to 2010 have been given in **Table 4.2**

4.7 Social Infrastructure Available

The nearest towns Damanjodi (18 km) and Sunebada (18.2 km) are having all administrative facilities like police station, fire station, hospital, bank, post office, school, workshops etc. The district headquarters –Koraput is located at a distance of 34 km in South West direction.

Table 4.2

IMD Table

Visakhapatnam, Lat:17 43' N & Lon:83 14' E, MSL 3m, Distance from proposed site 99.4 km SSW											
Month	**Temperature º C**				**Humidity %**		**Rainfall**		**Mean Wind speed kmph**	**pre dominant direction**	
	Mean Min	**Mean Max**	**Lowest**	**Highest**	**8.30 Hrs**	**17.30 Hrs**	**Monthly mm**	**No of rainy days**		**1st**	**2nd**
Jan	18.4	29.5	14.5	32	77	63	10.5	0.9	5.2	E	SE
Feb	20.5	31.6	16.5	34.7	75	62	12.1	0.9	5.5	S	SW
Mar	23.7	34.2	19.9	37.5	71	63	11.4	0.6	6.1	SW	S
Apr	26.3	35.4	22.7	37.9	67	67	21.8	1.5	8.5	SW	S
May	27.8	36.3	23.6	40.1	67	68	63.0	3.4	8.8	SW	S
Jun	27.8	35.4	24	40.2	71	67	117.6	6.4	8.3	SW	W
Jul	26.7	33.4	23.9	37.5	76	71	130.4	8.8	7.8	SW	W
Aug	26.3	33	23.9	36.5	77	73	157.8	8.4	7.3	SW	W
Sep	26.1	33	24.1	35.8	78	76	202.1	9.8	5.2	SW	W
Oct	24.9	32.3	21.6	34.8	75	73	209.3	8.1	5.1	E	NE
Nov	22.0	30.9	17.1	32.9	69	66	87.9	3.4	6.1	E	NE
Dec	18.8	29.5	14.9	31.5	70	63	7.9	0.9	5.9	E	SE
Source: GOI, Ministry of Earth Sciences, IMD, Climatological Tables - 1981-2010											

5. Planning Brief

5.1 Planning Concept

The probable reserves estimated are 42.779 million tons. However another 69.015 million tons are present as resources which will be converted into reserves (proved category) during first plan period and with the proposed production of 3.50 MTPA, the life of mine will be about 32 years.

In the lease area about 354.664 Ha is mineralized. Considering the current exploration data and geology, pit layout is designed in South block only in this plan period. The mining will be carried out in other blocks also in the conceptual stage. The final pit limit is designed based on the ultimate pit slope and ultimate pit limit.

Fully mechanized method of mining with two shift basis working will be adopted. Mining machineries like ripper dozer, blast hole drill, front-end loader, back-hoe, dumper, semi mobile crusher with fixed long distance conveyor, double roll tooth crusher and cable belt conveyor will be deployed.

Before commencement of bauxite mining operation in South block, it is proposed to remove the topsoil to gain easy access to the bauxite benches in the respective areas. The overburden consists of top soil of about 0.5 m depth is proposed to be removed separately by scraping with dozer and the heaps so formed will be lifted by loader-dumper combination. This material shall be stacked separately on the ground earmarked

for top soil. Thereafter, this will be used for backfilling of the mined-out areas for growing trees and vegetation.

The bauxite is proposed to be excavated by trench mining method comprising of a number of parallel trenches with staggered faces. Mining in each trench will take place in distinct slices of 8 m each. Top bauxite will be loosened either by ripper dozer or drilling-blasting depending upon physical characteristics of the material. Loosened bauxite will be loaded by hydraulic shovel/loaders on to the dumpers for transportation to the proposed crusher.

It is proposed to start the trench from western part at the South block and extending them towards east. At Pottangi, the bauxite shows variable thickness, in South block it generally varies between 6 m to 37 m considering the above it is planned to mine with 8 m bench height with width of the benches varying from 150-200 m for the purpose of safety of working and ease of movement of machinery. The individual bench faces will be kept nearly vertical whereas the overall quarry slope angle will be maintained at 45^0 with the horizontal to keeping the overall pit design stable. Ripper will be deployed for bauxite production, where bench height is low. Drilling and blasting technique will be adopted in benches where the strata are too hard for economically loosened by ripping. The bottom of the bauxite shall be excavated using hydraulic Back-hoe shovels. The mined out Bauxite will be transported through dumpers to crusher unit for crushing to -150mm size and this crushed ore will be sent by conveyor method of transportation to NALCO's Alumina Refinery located Damanjodi.

The list of equipment proposed to be provided for production of 3.5 million tons of bauxite per year is given in **Table 5.1.**

Table 5.1

List of Equipment Required for Mining

S.No	Class of machinery	Description	Model	Size/ Capacity	H.P / Unit	No. of units
1	Ripper Dozer	Dozer	475A	450 TPH	510	8
2	Wheel Dozer	Dozer	WD 600-3	350 YPH	485	2
3	Blast Hole Drill	Blast Hole Drill	IDM30	150 mm Ø	276	6
4	Rock Breaker	Rock Breaker	---	5 T	120	2
5	Hydraulic Excavator	Shovel	1200 V	3.0 M^3	325	4
6	Wheel Loader	Loader	WA-700	8.7 M^3	641	10
7	Dumpers	Rigid Dumper	210 M	50 T	641	5
		Rigid Dumper	BH50M	55 T	641	25
8	Water Sprinkler	Sprinkler	---	28 KL	380	2
		Sprinkler	---	28 KL	380	3
9	Motor	Motor Grader	---	5.0 M^3	280	2

	Grader	Motor Grader	---	4.5 M^3	240	1
10	Hydraulic Crane	Crane	Hydra- 12	12 T	49	1
11	ANFO Van	Van	---	5 T	240	2
12	Explosive Van	Explosive Van	---	10 T	100	4
13	Diesel Bowser	Diesel Bowser	---	9 KL	120	3
14	EDSON vacuum suction drill	Exploration Drill	ED-2000	25 mm	60	2
15	Light Mass	Truck mounted	---	---	---	14
16	Crusher	Semi mobile		900tph		

5.2 Population Projection

Due to proposed project, around 551 persons will be in the mining activities, most of them would be from nearby villages, and the remaining people will be accommodated at the residential colony located at Damanjodi plant. Few others will be accommodated at the site, such as security persons and emergency staff in rest shelter. The details of manpower requirement are given in **Table 5.2.**

Table 5.2

Summary of Manpower requirement

S.No	Class of Personnel	Number	Percentage
1	Highly skilled (Management, supervisory & clerical)	24	10%
2	Skilled	65	28%
3	Semi-skilled	80	35%
4	Un-skilled	60	26%
Total		**229**	**100%**
Note: Contractual workers for different activities will be hired as per requirement			

5.3 Land Use Planning

The total mining lease area is 697.979 Ha for mining activity and is forest land.

5.4 Assessment of Infrastructure Demand

It is obvious to have some of the essential infrastructure to facilitate the employees. For this purpose it is planned to have administrative building, mine site office, service centre area, repair and maintenance shop, stores, etc...

5.5 Amenities/ Facilities

All infrastructure facilities such as education, health care facilities and other social facilities are available at district headquarter Koraput due to which the proposed site is facilitated with adequate amenities. As most of the workers are employed from the surrounding villages, they would be using medical facilities available in the nearest primary health center.

6. Proposed Infrastructure

6.1 Industrial Area

It is proposed to establish the temporary structures having the facilities like administrative building, mine site office, service centre area, repair and maintenance shop, stores, etc...

6.2 Residential Area

It is proposed to accommodate the employees in the existing staff quarters at Damanjodi plant site to cater essential services.

6.3 Greenbelt

A 7.5 m wide buffer area around the mining area will be left as protection wall/safety zone, which will be used for greenbelt development.

6.4 Social Infrastructure

This project is providing employment to local people directly and indirectly. Indirect employers are shopkeepers, mechanics, drivers, transporters etc. The lessee will be responsible for providing better social infrastructure facilities such as drinking water, health care facilities, educational facilities, facilities for promotion of culture and religious activities in surroundings, etc.

6.5 Connectivity (Traffic and transportation Road/Rail/Metro/Water ways etc)

6.5.1 Availability of Roads

The site is connected to NH 43 (Jaypore to Vizianagaram) through a village road which is located at a distance of 1.3 km (S).

6.5.2 Nearest Railway station

Damanjodi railway station is the nearest railway station to the mining site located at a distance of 19.4 km (NNW).

6.5.3 Nearest Sea Port

Visakhapatnam Sea port is the nearest sea port located at a distance of 103.4 km (SSE) from the proposed mining site.

6.5.4 Nearest Airport

The nearest airport is Jaypore Airport, which is located at 51 km (NW) from the site location.

6.6 Water Management

The total water requirement for the Pottangi mines is around 700 KLD, which will be met from boreholes proposed in the bank of the Kunduli river. Proper drainage network will

be provided without disturbing the existing local drainage network within the mine site. As the mine is located atop the hill, in-situ peripheral barrier will be maintained to prevent muddy runoff of rain water down the valley. Since the bottom of the mined out area will be soft, water will not be retained but will percolate into the ground thus recharging the ground water table.

6.7 Sewerage System

The sanitary waste water including canteen waste water would be treated in a sewage treatment plant and the effluent from vehicle washing and workshop will be treated in ETP. The treated water would be reused for dust suppression and maintenance of greenbelt.

6.8 Solid Waste Management

The overburden consisting of top soil of about 0.5 m depth is proposed to be removed separately by scraping with dozer and the heaps so formed will be lifted by loader-dumper combination. Top soil would be dumped temporarily for the first three years of this plan period and in the fourth and fifth year, it will be backfilled in worked out areas for growing trees and vegetation. The overburden dumping site would be selected based on proximity to the mining area as well as easier reclamation and backfilling of exhausted mine workings.

Table 6.1

Year Wise Quantity of Waste and Others

Year	Topsoil (tons)		Waste (tons)		Mineral rejects (tons)		
	Reuse / Spreading	Storage	Backfilling	Storage	Blending	Storage	Beneficiation
First	-	1,15,200	-	1,59,660	-	-	-
Second	-	1,36,335	-	2,30,256	-	-	-
Third	-	64,605	-	2,11,356	-	-	-
Fourth	37,350	-	2,60,118	-	-	-	-
Fifth	47,850	-	3,46,500	-	-	-	-

6.9 Energy/Power Source

The power requirements of the bauxite mine and alumina refinery plant will be met from two sources, viz., 1 x 18.5 MW from captive power generation system (TG unit presently under execution) and drawl of power from NALCO, Angul by wheeling through the grid to existing 220/132 kV MRSS of alumina refinery.

6.10 Health and Safety Policy

A health & safety policy will include personal protective equipment, transportation, storage, usage and disposal of hazardous materials, construction traffic, etc. This policy will address and safeguard the health and safety concerns of personnel associated with construction of the plant, as well as operators and maintenance personnel, associated

with the running of the various construction equipments and commissioning of the production units.

The health & safety policy will also frame 'safety rules' for construction work that will be undertaken at site, prior to commencement of any work related to the project. These rules will have to be finalized considering good practice; and in cognizance of the prevalent state legislative laws, central legislative laws and statutory regulations as provided for in the various industrial acts

6.11 Measures to Control Hazards of Blasting

The major hazards associated with blasting are generally:

a) Ground vibration and resulting damage to structures and surrounding rock strata
b) Fly rock that endangers safety of operating personnel and nearby structures
c) Noise and air overpressure, and
d) Dust and fumes.

Type of explosives:

Charging: Blasting will be done with the help of 70% Ammonium Nitrate Fuel Oil (ANFO) mixture and 30% high explosives. Top part of the hole over 2m will be used/subjected for stemming by the drill cuttings and remaining hole length will be charged by the ANFO & high explosives as base charge. During rainy season and in wet ground, large dia cartridge (120 mm dia) of slurry/emulsion explosive will be used.

Stemming: Stemming is a process of filling of inert materials to pack the explosives in the blast hole. Proper and compact stemming withholds the gas after blasting. More stemming (than optimum) allows less explosives into the hole, decreases blasting efficiency and increases ground vibration while less stemming causes air blast and noise. Keeping in view the above facts, optimum top stemming column in the blast hole will be 3.75 m which is 25 times of blast hole diameter to obtain sufficient burial depth of explosive charge to prevent premature venting of explosive gas energy and to reduce the noise level. This length of stemming also prevents fly rock occurrence & movements.

Initiation: In order to mitigate blast induced noise, only non-electric initiating system (NONEL) will be used for in-hole as well as hole to hole initiation.

Some of the measures proposed to be adopted to restrict the hazards within acceptable limit are:

a) Provision of a safe zone of 500 m radius around the blasting location; controlled blasting wherever the safe zone is not available.

b) Ripping instead of blasting in a zone wherever, maintaining a safe distance from any structure is not possible
c) Computing the quantity of safe charge per delay to restrict the peak particle velocity of ground vibration as per USBM norm
d) Avoiding excessively large burden in relation to bench height
e) Providing adequate height of stemming column
f) Muffling the blasting using wire netting and gunny bags or empty cartridge boxes filled with drill cuttings
g) Covering the detonating cords by soil layers, and
h) Use of in hole delay detonating device.
i) Delayed blasting by use of NONELs

It may be noted that some of the steps envisaged for hazard control are inherently associated with the efficient blasting. Further, detrimental effect of air overpressure, dust and fumes which dissipate rapidly in space after blasting in opencast mining is not significant, particularly when the 'safe zone' of 500 m radius is maintained around blasting location. However, controlled blasting will be adopted whenever safety zone becomes less than 500 m. The use of AN-FO reduces the generation of toxic gasses

Explosive magazine: It is proposed to build a magazine of 25 ton capacity for storing conventional slurry/emulsion explosives and other blasting accessories at East extension block. However, considering the security hazards in the surrounding area, possibility of carrying out contractual blasting will also be explored before actual execution stage. Capacity of the magazine has been determined based on maximum rate of explosive consumption and a storage requirement for about 45 days.

For storing of ammonium nitrate, space has been provided in the store. However, considering the security hazards in the surrounding area, possibility of carrying out contractual blasting may also be explored before actual execution stage.

7. Rehabilitation and Resettlement (R & R) Plan

The mining lease area is devoid of any settlements and hence R&R plan is not envisaged.

8. Project Schedule and Cost Estimation

8.1 Likely Date of Start and Date of Completion

The mining operations will be started after obtaining all necessary statutory clearances from the required departments.

8.2 Cost Estimation of the Project

The capital cost estimate of the project is Rs.1436.9 Crores. The capital cost estimate of the mine includes plant cost, pre-project activities, and interest during construction. The detailed break up of capital cost is given in **Table 8.1.**

Table 8.1

Capital Cost Estimate of the Mine

S. No	Description	Capital Cost (Rs. Crore)
1	Land & Site development	130.4
2	Civil and structural steelwork	218.2
3	Plant and equipment including erection	782.0
4	Township	30.7
5	Design, engineering, consultancy and ADC	43.8
6	Contingency	60.3
	Total plant cost	**1,265.4**
7	Pre project activities	3.3
8	Interest during construction	168.2
	Total capital cost	**1436.9**

9. Analysis of Proposal

9.1 Socio-economic Benefits

The socio-economic conditions of the surrounding villages near the mine site will be improved as the mine will provide both direct and indirect employment to the people.

10. Environmental Management Plan

10.1 Air Pollution Control Measures

Mining would lead to generate significant emissions of fugitive dusts (FD) to the air environment. The sources of such FD emissions in the open area are mainly during drilling and blasting and in haul roads. The closed areas for FD emission would be crushing, screening, transfer through chutes etc. FD emission during drilling may be controlled by water injection through drill, that is, wet drilling. The haul road FD would be mitigated keeping haul road surface wet by controlled sprinkling of water from the water sprinkle tanker prior to movement of dumpers/material transportation trucks. The fixed sprinklers will be kept all along the haul roads, stock piles, etc. to control the dust emissions to maximum level. The closed zone dust would be controlled by dry fogging (DF).

Besides the dry fog system, water would be sprinkled at the receiving hopper through appropriate header, pipeline and sprinklers to control generation of dust. All the conveyors carrying sized material would be of covered type. The sized products would be stored in a covered bin or silo with air tight discharge chute. A 7.5 m buffer zone would be left all around the mine as a safety barrier, will be developed as greenbelt which would also help in controlling air pollution.

10.2 Water Pollution Control Measures

The domestic waste water generated from the residential colony will be treated in the existing STP located at the Damanjodi plant and the waste water from the workers temporary workshop and admin buildings will be treated in the STP at the mining site. The waste water from vehicle washing and workshop will be treated in ETP. The treated water from STP and ETP will be reused for greenbelt development and dust suppression within the lease area. As the mine is located atop the hill, in-situ peripheral barrier will be maintained to prevent muddy runoff of rain water down the valley. Since the bottom of the mined out area will be soft, water will not be retained but will percolate into the ground thus recharging the ground water table.

10.3 Solid Waste Management

The overburden consisting of top soil of about 0.5 m depth is proposed to be removed separately by scraping with dozer and the heaps so formed will be lifted by loader-dumper combination. Excavated top soil would be dumped temporarily for the first three years of this plan period and in the fourth and fifth year, it will be backfilled in worked out areas for growing trees and vegetation. The overburden dumping site would be selected based on proximity to the mining area as well as easier reclamation and backfilling of exhausted mine workings.

10.4 Noise and Vibration Control Measures

Noise pollution by mining activities is mainly because of excavation, handling and transportation of ore and overburden and operation of processing equipment. To reduce noise/air overpressure as well as ground vibration, deck charging has been recommended for 8 m to 10 m deep holes. Using deck charge, the maximum explosive charge/delay will be reduced. This results better fragmentation of rock which is also observed in various experimental blasts. However, large diameter explosive of slurry/emulsion shall be used in rainy season.

The management plan for controlling noise pollution include providing noise insulation/padding in plant and machinery wherever practicable, limiting the speed of haulage vehicles/tippers, proper maintenance of noise generating parts of the machine, provision of earmuffs to workers as a measure to protect their ears etc.

10.5 Afforestation Program

Greenbelt would be developed in an area of around 23.4 Ha of the mine lease area and also the mined out area will be developed as vegetation/greenbelt by backfilling with excavated top soil. The greenbelt area includes peripheral boundary, gardening and tree plantation. This would arrest wind borne dust, minimize noise pollution and also improve the appearance from aesthetic point of view.