

PRE- FEASIBILITY REPORT

For

Expansion of

MAINPAT BAUXITE MINE

From 0.75 MTPA to 2.25 MTPA capacity

Villages – Kudaridih, Kesra & Sapanadar,

Tehsil – Mainpat, District – Surguja,

State – Chhattisgarh

Area– 639.169 Ha



Of

M/S BHARAT ALUMINIUM COMPANY LIMITED

(BALCO)

[Aluminium Sadan, Core-6, 2nd Floor, 7 Lodhi Road, New Delhi – 110003]

1.0 INTRODUCTION:

M/s Bharat Aluminum Company Limited (BALCO) has an integrated aluminium plant at Korba district of Chhattisgarh. BALCO was established on 27th Nov 1965 and its production started from 1973. Initial capacity of BALCO was 1.0 Lakh Tonnes of Aluminium per Annum. Over the years, to meet the domestic requirement of aluminium, Balco has been gradually ramping up its production capacity and currently it stands at 5.70 lakh tons per annum.

Balco was the first public sector enterprise in the country which started producing aluminium in 1973. Government of India still holds 49% of Balco's share after the disinvestment in year 2001.

BALCO is having IMS (Integrated Management System) certificate (ISO 9001: 2008 QMS, ISO 14001: 2004 EMS, and OHSAS 18001: 2007) for all of its Bauxite mines. Aluminium produced from Balco is used in Energy Sector, Space Organization, Railways, Defence, Automobiles and other downstream sectors.

Balco was chosen by DRDO to supply special quality aluminium for Agni and Prithavi Missiles system.

1.1 Need for the proposed expansion and its importance to the Country or Region

Bharat Aluminum Co. Ltd. (BALCO) has been closely associated with the Indian aluminium industry for over fifty years. Today Balco imports approximately 50% of its alumina requirement from outside country. To align ourselves with Prime Minister's Vision of **"MAKE IN INDIA"** we have embarked on a journey to meet our requirement of alumina from our captive mines. This would help in reducing outflow of precious Foreign Exchange and also to generate additional employment potential in remote areas in line with Prime Minister's Vision of **"SKILL INDIA DEVELOPMENT"**. Furthermore addition of additional mining capacity would add revenue to the State Government.

Consequent to the expansion of Aluminium production capacity, there is an increased requirement of Alumina and therefore that of Bauxite.

The proposal is to increase the production of bauxite of the existing Mainpat bauxite mine from the level of 0.75 to 2.25 million tons per annum. The proposed increase is sought to be achieved by simply operating the mine on three shifts basis as against the current operations which are being carried out only in a single shift and introducing mechanization in crushing and screening of bauxite.

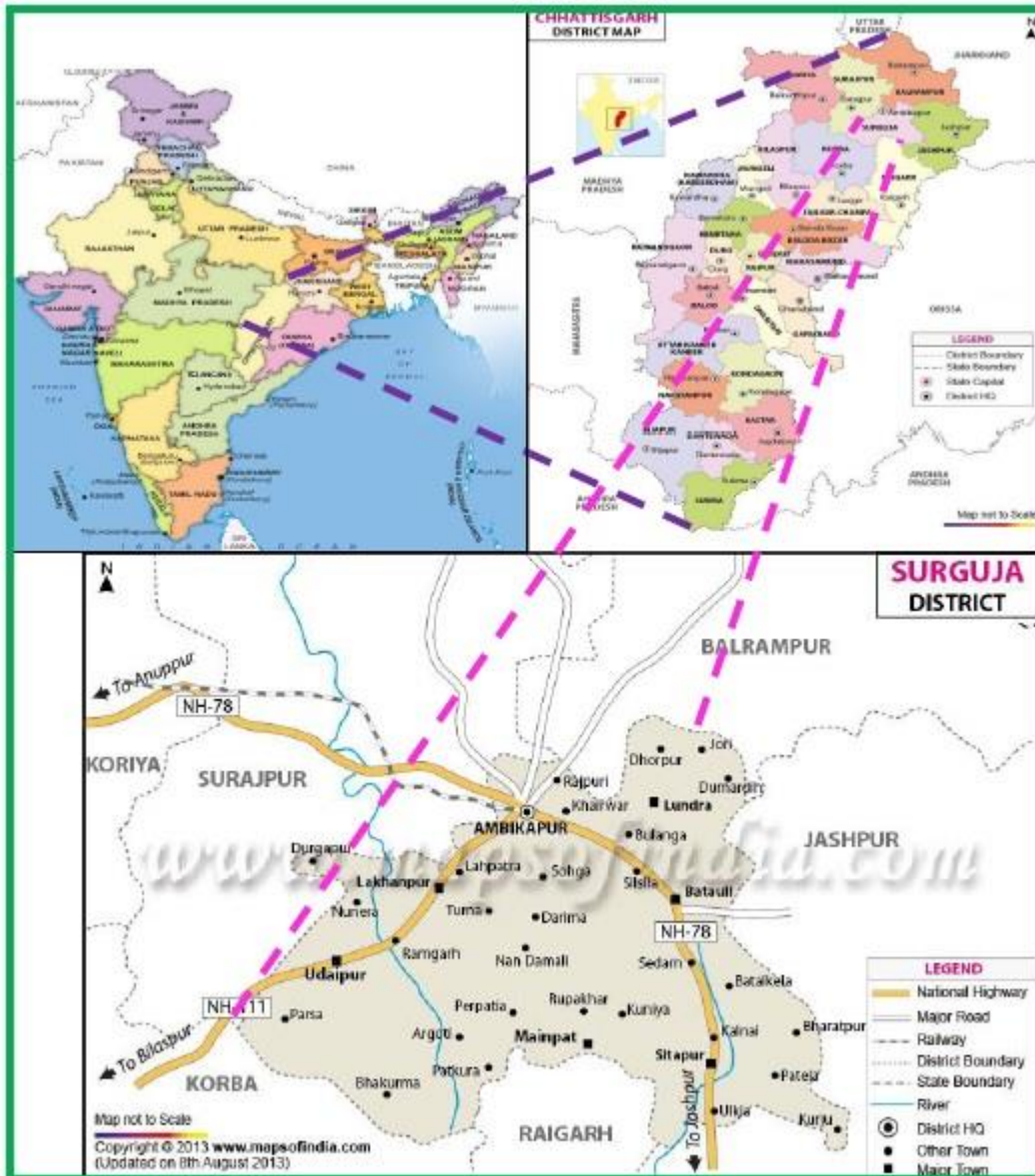
This proposal has multi-dimensional advantages not just for the company but for the people of this region and country. The salient advantages are as follows-

- (a) Given the current stripping ratio of this mine, proposed increase in production of bauxite will create additional indirect employment opportunities for more than 100 persons. Greater employment opportunities therefore going to be beneficial for the people of Mainpat Tahsil, where this mine is located.
- (b) It is also beneficial for the country and the company, as the productive assets like HEMM existing infrastructure etc. shall be utilized round the clock as opposed to current utilization during one shift only.
- (c) Environmentally also this proposal, offers following major advantages
 - (i) Simultaneous back filling of mined out areas shall virtually eliminate the need of dumping of over burden and rejects. This use for direct backfilling shall reduce the emission due to multiple handling of over burden / rejects from dumps.
 - (ii) Proposed increased production & simultaneous back filling would result in faster rehabilitation of mined out areas either through enhanced rate of afforestation or creation of a secured water body.
 - (iii) Considering that proposals involve mining of bauxite containing even 30% Al_2O_3 and the same would be made feed grade to alumina plant, offers the "Environmental Advantage" of not looking at opening of another mine if 30% Al_2O_3 containing bauxite is considered as rejects. In nutshell it eliminates early offsite pollution elsewhere.

2.0 Location and Accessibility:

The Mainpat Bauxite Mine, District Surguja (Ambikapur) of BALCO is located in Mainpat plateau, which is about 50 kms from the district headquarter Ambikapur. The lease-hold area can be approached from Ambikapur by an all-weather road. There are 3 villages in the leasehold area namely Kudaridih, Kesra and Sapanadar.

FIGURE -1 LOCATION MAP OF MAINPAT BAUXITE MINES



2.1 Location: Co-ordinates:

Topo sheet No. with Latitude & Longitude

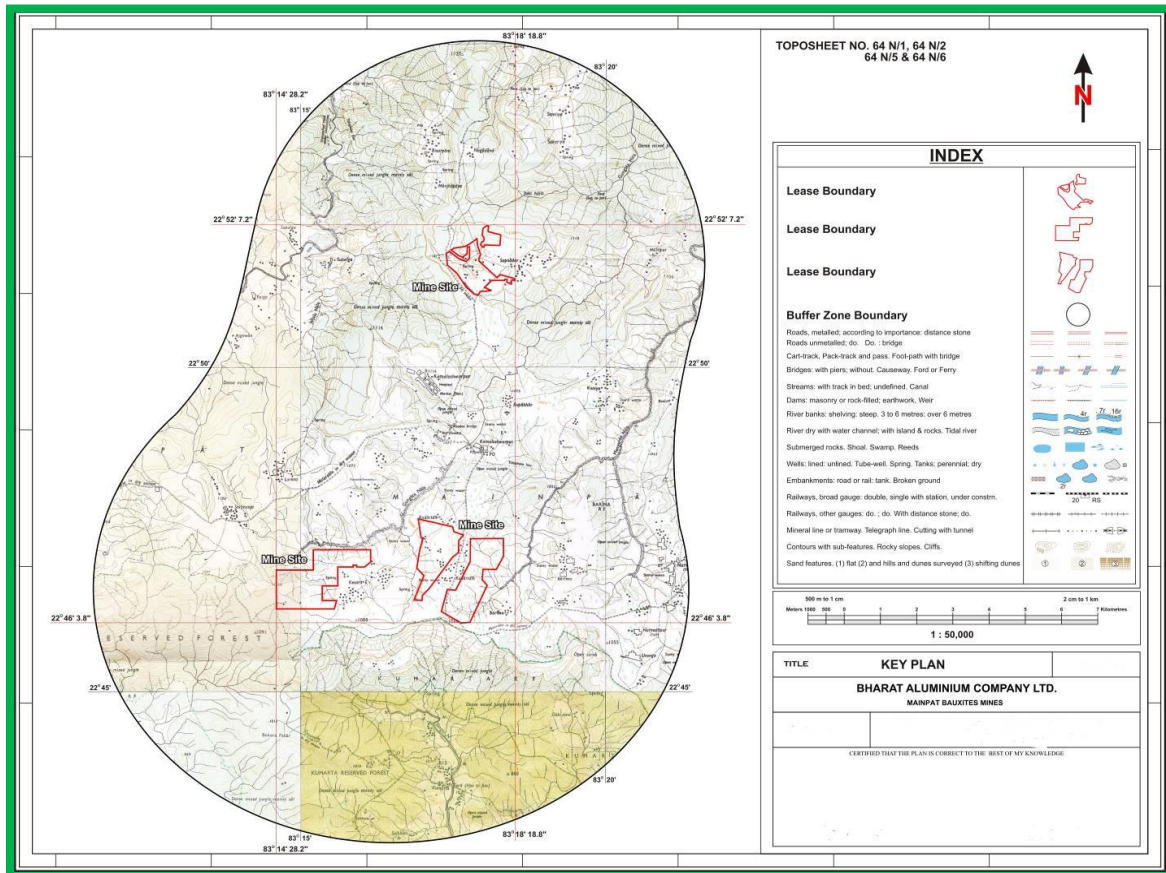
Old Topo sheet No. 64 N/1 and 64 N/5

New Topo sheet No. F44L/1, F44L/5

The Latitudes and Longitudes of different blocks are as follows:

SN	Name of Block	Latitude	Longitude
1.	Kesra	22°46'16" to 22°47'13" N	83°14'26 to 83°15'57" E
2.	Kudardih East	22°46'14" to 22°47'21" N	83°17'11 to 83°18'10" E
3.	Kudardih West	22°46'25" to 22°47'40" N	83°16'46" to 83°17'31" E
4.	Sapnadar	22°51'41" to 22°52'07" N	83°17'14" to 83°18'19" E

FIGURE -2 Lease area of Mainpat Bauxite Mine on Toposheet



2.2 Road Link:

The mine can be approached from Ambikapur by an all-weather road which is about 50 kms.

2.3 Rail Link:

Nearest Railway station is Ambikapur at a distance of 50km in North East Direction.

2.4 Air Link:

The mine is about 400 kms from nearest airport at Raipur

2.5 Climate:

During peak summer the temperature rises to 37⁰C, while winter temperature falls down to 01⁰C (average 15⁰ C). The rain fall is confined to the rainy season from July to September and annual average rain fall is 1439 mm.

3.0 Topography

The average elevation of the area is 1060 MSL. The plateau extends about 40 km from east to west in length and about 14 km from North to south in width and is characterized by steep scarps along its edges. At places these scarps are dissected by steep valleys and at some places valleys are upto 150m deep. The Sapnadar block of the lease area is oval shaped and its general elevation is 1088 meter above MSL. Kudardih and Kesra blocks form southern most parts of the plateau and are bounded by valleys of Kaljiba and Barima Nallas. The maximum elevations of Kudardih and Kesra blocks are 1070 m and 1095 m respectively above MSL.

The mining lease area extends over mainly three villages; Kudaridih, Kesra and Sapanadar. These blocks are separated from each other by Kesra Nallah. Density of trees on the plateau is very thin while on the slopes, there is thick vegetation.

4.0 Drainage:

The drainage in the area is controlled by seasonal water channels. The drainage pattern of the area is generally radial. The drainage in the area is towards north easterly and north westerly directions. The drainage of plateau is controlled by Rer River which starts from the plateau and forms the principle drainage of the area and is tributary of River Son.

Mahadeomunda and Manchan Nalla are two major streams in the area. Mahadeomunda Nallah originates from elevated portion near village Kadraj, and is about 8 km. away from lease boundary and flows in northern direction through western part of the region. Small seasonal streams of second degree, namely Latmatia, Kharbusariga and Marghatia flow through the lease area.

5.0 Lease Area and Land Details-

The lease area of Mainpat mines is 639.169 Hectares. For expanded capacity, no addition in lease hold area is envisaged.

The details of lease-hold area as per revenue records (All figure in Ha):

Area in Hectares

S. No.	Village Name	Non-forest land		Revenue forest land	Total
		Pvt. Land	Govt. (Rocky) Land	Chhote Bade Jhad ka Jungle	
1.	Kudardih	94.837	40.107	154.375	289.319
3.	Kesra	91.276	0.00	158.913	250.189
4.	Sapnadar	36.025	0.00	63.636	99.661
Total		222.138	40.107	376.924	639.169

5.1 Present Land Status

All leasehold land is under possession for mining. The private land has already been acquired under land Acquisition Act 1894, and is in possession. Forest Clearance has been obtained for the revenue forest land under FC Act 1980.

6.0 Regional geology:

Areas are mostly covered by soil or laterite / bauxite capping. The low plateau consists of rocks of Achaean age. These include mica schist and quartzites, calc silicate rocks, amphibolites, granite and granite gneiss, pegmatite's and quartz veins. Immediately overlying the Achaean with an unconformity occur over rocks of Gondwana age consisting of coarse ferruginous sandstone and conglomerate. The Gondwana's are overlain by Lameta with an unconformity. The Lameta starts with conglomerate at the base and other rock units include ferruginous grits, sometimes with shaly & clayey partings and calcareous grits. Overlying the Lameta occur almost horizontal Deccan Trap basalts which are massive, dark grey, hard and compact, finally overlying this trap rock occurs laterite with lithomarge clays and weathered basalts in between.

LITHO- STRATIGRAPHIC SUCCESSION

<u>AGE</u>	<u>FORMATION</u>	<u>ROCK TYPE</u>
Recent to sub Recent		Soil Laterite Lithomarge Clays
Eocene	Deccan Trap Lametas	Basalt Calcareous Grits Grits with Variegated colour Shaly & Clayey intercalation. Ferruginous grits Conglomerate
Turonian		
Cretaceous		
-----Unconformity-----		
Upper Gondwana		Coarse ferruginous sandstone & conglomerate.
-----Unconformity-----		
Archaeans		Pegmatites and quartz veins Granite and granite gneiss Amphibolites Calc silicate rocks Mica schist and quartzites

6.1 Local Geology:

On the basis of detailed study of outcrops, scarp sections and borehole data, the following general lithological sequence has been established in the lease area.

Soil	0 to 2.0 m.
Soil with Morrum (SOB)	0 to 4.0 m.
Laterite (HOB)	0 to 4.0 m.
Bauxite (Gibbsite)	0.4 to 4.0 m.
Ferruginous laterite	1.0 to 4.0 m
Lithomarge	1.5 to 3.0 m.
Basalt trap	20 to 35m

The bauxite occurs in lensoid form within the laterite horizon which comprises various recognizable lithologic units.

The zone of lithomarge is quite distinctive and well defined and forms the lowest horizon of the laterite profile. It occurs just above the trap and thus separates it at few places in deep nalla beds and also along the scarps. The lithomarge is quite soft and plastic in nature. The average thickness of this zone is varies from 1.5 to 3.5 m.

The bauxite occurs in lensoid forms in laterite profile, generally below soil and pisolitic laterite. The bauxite can be put into two categories, i.e. pisolitic bauxite and massive bauxite. The pisolitic bauxite consists of closely packed pisolites ranging from few mm to 5 cm. It occurs mostly in upper horizon of the laterite above bauxite zone. The main mineral constituent is Gibbsite. These ore bodies persist up to maximum depth of 10 m. from the surface. The average thickness of bauxite deposit varies from 0.4 m. to 4.0 m. in the form of lenses. The intensity of bauxite is more in central part of the plateau and decreases towards the scarps. The upper contact of bauxite with overlying pisolitic laterite is quite sharp where as its lower contact is gradational.

7.0 Physical Property of the Bauxite:

The bauxite & laterite are composed essentially of varying mixture of hydroxides of Al and Fe and small percentage of TiO_2 and show a great deal of variation.

The bauxite is mostly light pink and gray in colour, hard, compact and massive in texture, pisolitic, oolitic and brecciated with sub-conchoidal fracture. Mineralogically, bauxite is mainly in the form of gibbsite with minor hematite and good amount of anatase (TiO_2) with traces of kaolinite.

The quality of bauxite can be judged from its colour, texture and specific gravity. Higher alumina content is indicated by light shades of colour, lack of cavities and greater density. The ferruginous bauxite has different shades of pink colour and the dark coloured patches contain more iron due to which its specific gravity is also normally high. The clayey bauxite is characterized by high porosity and in turn low specific gravity.

Colour– pinkish, Form– pisolitic / botryoidal and massive, Lustre– earthy, Streak– white to yellowish brown, Hardness– variable maximum 3, Sp. gr. – 2.3.

7.1 Plant Feed Grade Bauxite:

Bauxite having Alumina up to +42% and having reactive silica less than 5% is suitable for producing alumina at our Alumina Plant. This can be achieved with Al_2O_3 cut off of 30%.

8.0 Exploration work carried out in the area:

The exploration by drilling in total potential and non-potential area has been done on 50 M x 50M grid interval to establish the ore reserves in proved category. Therefore other than production support drilling, additional exploration is not envisaged in the lease area.

The details of exploration in the total mining leasehold area 639.169 ha; are given in the following table:

DETAILS OF EXPLORATION CARRIED OUT IN MAINPAT BAUXITE MINES								
Year	KUDARDIH		KESRA		SAPNADAR		TOTAL	
	No. of B.H.	Mtrs.	No. of B.H.	Mtrs.	No. of B.H.	Mtrs.	No. of B.H.	Mtrs.
1993-94	65	543.80	0	0.00	0	0.00	65	543.80
1994-95	63	501.10	0	0.00	0	0.00	63	501.10
1995-96	96	817.30	49	221.30	0	0.00	145	1038.60
1996-97	63	754.40	106	945.60	0	0.00	169	1700.00
1997-98	87	806.70	54	456.50	0	0.00	141	1263.20
1998-99	75	732.60	189	1492.90	0	0.00	264	2225.50
1999-00	165	1449.10	74	627.10	0	0.00	239	2076.20
2000-01	101	1212.00	0	0.00	0	0.00	101	1212.00
2001-02	90	1107.20	13	153.80	0	0.00	103	1261.00
2002-03	267	2693.20	268	2682.06	565	4919.45	1100	10294.71
2003-04	221	2077.90	18	165.40	0	0.00	239	2243.30
2004-05	244	2149.40	0	0.00	0	0.00	244	2149.40
2007-08	65	669.00	82	678.80	0	0.00	147	1347.80
Total	1602	15513.70	853	7423.46	565	4919.45	3020	27856.61

9.0 Reserves:

The entire lease area has been covered by detailed exploration to establish the ore reserves in proved category.

The Proved Mineral Reserves and the Remaining Resources of bauxite estimated and arrived as above is furnished block wise in the following table:

Balance Reserve as on 01st April 2016

Category of Reserve	Quantity (Tonnes)
Geological Reserve	92,93,709
Mineable Recoverable Reserve	69,70,282

9.1 Recovery Factor:

There is 75% of recovery of bauxite from the ROM to achieve the plant feed grade. The rest 25% of the ROM has very high silica content and is treated as reject . ROM reject is simultaneously backfilled in already mined out area .

Thus, 75% of the Proved Reserves has been considered as recoverable reserves which is $92,93,709 \times 75\% = 69,70,282$ tonnes.

10.0 Mining:

The bauxite deposit of Mainpat Bauxite mines is situated over the plateau and the surface terrain is generally flat.

As the Bauxite deposit is found in shallow depth ranging from 0.40-10.0 meter, the method of mining of Bauxite is mechanized opencast mining, crushing, sizing, and sorting, by using excavator of 1- 5 Cum bucket size, dumper of 15-25 tons capacity, water sprinkler, blast hole drill machine, 100 mm dia, dozer, grader, crusher, screens and belt conveyor etc.

The over burden is top soil & soft laterite of 0 to 3.00 meters thickness after which there is a hard overburden of thickness varying from 0 to 5.70 meters. The thickness of ore zone is 0.40 m to 4 m. In general working is of shallow depth of avg. 4 to 5 m (maximum 10 m).

The general practice is to scrap the top soil separately by dozer or excavator dumper combination and use it for directly spreading over already backfilled compacted area.

Drilling and blasting is practiced in hard OB benches and ore benches. Excavation is done by excavator dumper combination.

Since the deposits are strata-bound irregular and bouldery in nature, bauxite needs to be separated from laterite and murrum. It is proposed to mechanically crush and screen the ore so as to obtain desired grade bauxite with acceptable silica content.

The backfilling is done in same sequence as it is found in the nature, i.e. hard OB in bottom, then soft OB above the hard OB, then top soil.

The height of OB benches is kept maximum of 6 meters and the ore benches are kept generally of 1 to 4 meters of height as per thickness of ore body.

The blast boreholes of 2 to 4 m depth are being drilled by DTH drills, which are required for blasting. Controlled blast technique is used for keeping the ground vibration, blast through and noise within permissible limit. The blast design and charge per delay are kept strictly as per the requirement of DGMS.

For getting the bauxite of desired grade and size, from blasted ore muck, it is subjected to mineral dressing, and this will be carried out by two ways.

- Where the deposits is homogeneous in quality, then the ROM will be processed, through mechanized way of mineral dressing by crusher and screening plant sets
- And, where deposit is of heterogeneous w.r.t. Quality, then the ROM will be subjected to manual method of sorting and sizing.

The sized and sorted bauxite found after crushing /screening or manual sorting is stored and analyzed for its quality before dispatch to plant by truck.

The mining are planned in such a way that, a consistent plant feed grade can be obtained. For this, the quality analysis of the bore hole data is done and various patches are selected in such a way that the blended quality is in line with plant feed grade.

10.1 Summary of the proposed year wise production is as under:

Year	OB Quantity (Tonnes)			Bauxite Production (From ORE)	Generation of Rejection (from ORE)	Stripping Ratio
	Soft OB	Hard OB	ORE	75%	25%	Tonnes
2016- 17	2833260	2036688	2999460	2249595	749865	1.62
2017-18	2833763	2044128	2999933	2249951	749983	1.63
2018-19	2825789	2072715	2999776	2249832	749944	1.63
2019-20	277968	185585	294539	220904	73635	1.57
Total	8770780	6339116	9293708	6970282	2323427	1.63

11.0 Working Hours

Working will be carried out in three shifts.

12.0 Concurrent backfilling of mined out area:

After removal of entire bauxite from the mined out area, the same is being back-filled in the order of occurrence of different types of material in nature, like hard laterite at bottom, then soft laterite and subsequently top soil. Five mined out pits have been developed as water reservoir for storing of rain water for increasing the surface water availability and at the same time for ground water recharging. In this way, after removal of bauxite the mined out areas are concurrently backfilled with generated OB (hard /soft laterite) and reject material. Leveling and compaction of backfilled area is being done from time to time by dozer so as to restore the topography in its original shape. Thereafter, the back-filled leveled areas are being covered with top soil for plantation. The species for plantation are selected in consultation with State Forest department and also with involvement of locals.

13.0 Land details

Current Land Use Details- As on as on 1st April 2016 Area in Ha

SN	Total Lease Area	Mined Out Area	Backfilled & Reclaimed Area	Afforested Area	Remaining Area for	Undisturbed Area
1	639.169	375.00	352.00	350.00	206.049	58.120

14.0 Equipment and Machineries for mining operation and allied activities :

S.N.	Name	Nos.	Capacity	Purpose
1	DTH Drills	4	100 mm dia	For drilling above 1.5 m hole
2	Jack Hammer	3	32 mm dia	For drilling upto 1.5 m hole
3	Compressor	4	--	For operation of drill machines, & jack hammers
4	Hydraulic Excavators, 2 cum size nos of above 300 HP	4	2.0 cum	To excavate OB and ore
5	Hydraulic Excavators, 1 cum size	1	1 Cum	To excavate OB and ore
6	Hydraulic rock breaker	3	Attachment with excavator	For breaking big boulders
7	Portable small Dozer	2	-	For leveling of blasting surface and back-filled area
8	Loader	3	1.50 cum bucket	For crusher feeding & reject loading from crusher yard
9	Dumpers	15	20 tonner	For transportation of OB and ore
10	Diesel Tanker	1	2000 liters	For filling diesel to different equipment
11	Water Tanker	2	10000 liters	For sprinkling of on quarry road
12	Service-Van (well-equipped)	1	-	For repairs / maintenance of machines.
13	Explosive Van	1	3 Tonner	For bringing explosive from magazine to quarry at blasting site
14	DG set	2	50 KVA	For water pump & Lightening
15	Diesel Gen set	3	100 KVA	For electricity generation in case of normal electric supply failure.
16	Diesel Gen set	1	15 KVA	For electricity generation at LAB
17	Water pump	1	5 HP	For pumping of water
18	Crusher & Screening plant	2	150 TPH-	For Sizing & Sorting of bauxite from ore
19	Portable light tower mask	6		For lighting purpose.

15.0 Employment Potential :

With the capacity addition approximately more than 100 additional indirect employment would be generated. Most of these jobs will be given to local people, specially tribals.

S. No.	Management and Supervisory Personnel	Qualification	Nos. required
1	Agent Mines	B.E. Mining with 1 st class Mine Manager's certificate	1
2	Mine Manager	B.E. Mining with 1 st class Mine Manager's certificate	1
3	Asstt. Manager (Mines)	B.E. Mining with 2class Mine Manager's certificate	9
4	Geologist	M.Sc. or M. Tech Geology	1
5	Mechanical Engineer	B. E. Mechanical/Electrical	1
6	Mining Foreman	2 nd class Mine Manager's certificate	15
7	Mining Mate	B.E. Mining	4
8	Mining Mate	Matriculation with Mining Mate's certificate	12
9	Manager for Safety, Training and environment	B. E. Mining with 2 nd class manager certificate.	1
10	Blaster	Certificate holder / Mining Mate's certificate	5
11	Medical Officer	MBBS	1
12	Surveyor	Surveyor certificate of competency	1
	Total		52

16.0 Infrastructure and Services: The essential facilities like office, first-aid station, drinking water arrangement, canteen, rest shelter, maintenance shed etc. already existing at mine site and are adequate for proposed increased production.
