STEEL AUTHORITY OF INDIA LIMITED

INTEGRATED BARSUA-TALDIH-KALTA IRON ORE MINING (ML-130 LEASE), BENEFICIATION AND PELLETISATION PROJECT

1. PRE-FEASIBILITY REPORT

2. ENVIRONMENTAL IMPACT IN MODIFIED PRODUCTION, BENEFICIATION & TRANSPORTATION ARRANGEMENTS FOR ML-130 *(as Annexure-1 of the Pre Feasibility Report)*

3. Covering Letter - Approved Scheme of Mining

MECON LIMITED
RANCHI – 834002
INDIA

11.S2.2014.PP2131 **October, 2015**

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1.0 EXECUTIVE SUMMARY

Steel Authority of India Limited (SAIL), a public sector undertaking under Ministry of Steel, Government of India, is the leading steel maker in the country and is having integrated steel plants at Bokaro, Durgapur, Rourkela, Bhilai and Burnpur. SAIL sources its entire requirement of iron ore and part of its requirement of limestone, manganese ore, dolomite and coking coal from its captive mines located in the states of Jharkhand, Odisha and Chhattisgarh.

SAIL has a iron ore mining lease area measuring 2486.383 ha, known as ML-130 in Bonai iron ore range in the Sundergarh district of Odisha. The lease area is consists of three deposits viz. Barsua, Taldih and Kalta, of which, Barsua (forming the southern part of the lease) and Kalta (forming the northern part of the lease) are being worked since 1960 and 1966 respectively. The ML area is 18 km long lease area. The virgin Taldih block is located between Barsua and Kalta deposits. At present, iron ore from ML 130 is sent to Rourkela Steel Plant and other SAIL plants. In order to ensure uninterrupted supply of iron ore to SAIL plants, SAIL has planned to operate an integrated mining complex at ML-130, comprising the three deposits at Barsua, Kalta and Taldih. Targeted production level will be 8.05 million tonnes per year (Mt/yr) and available estimated mineable reserve as on 01.04.2015 is 368.094 million tones (Mt).

The mine lease (ML-130) was first granted in favour of Rourkela Steel Plant on 06.01.1960 for a period of 30 years which expired on 05.01.1990. Subsequently lease renewal applications were made on 30.12.1988 and again on 11.09.2007. The Mining Lease has been renewed and lease deed for the 2nd renewal period from 06.01.2010 to 05.01.2030 has been executed on 13.11.2014.

Mining Plan was approved by IBM for production of 8.05 Mt/yr of iron ore (4.25 Mt/yr from Taldih + 2.5 Mt/yr from Barsua + 1.3 Mt/yr from Kalta) vide letter No. 314(3)/2007-MCCM(CZ)/MP-40 dated 28.07.2008. Environmental Clearance for the production of 8.05 Mt/yr of iron ore from ML–130 was granted by MoEF vide letter no. J-11015/351/2006–IA.II(M) dated 29th October, 2010 based on EIA/EMP study conducted for the project during 2007-2008. The scope of work under the EC included production of 8.05 Mt/yr (ROM) of iron ore (i.e. 2.5 Mt/yr from Barsua, 1.30 Mt/yr from Kalta and 4.25 Mt/yr from Taldih) along with setting up of beneficiation plant of 4.25 Mt/yr in addition to the existing plant of 2.5 Mt/yr and setting up of a pelletisation plant of 2 million TPA capacity involving mine lease area of 2486.391 ha. It was envisaged to transport ore from Taldih Block by Long Distance Belt Conveyor.

Stage–2 Forest Clearance for ML–130 has been granted by MoEFCC vide F.No. 8-90/2011-FC(pt), dated 06.03.2013. Subsequently, permission for tree felling (24.06 ha) has been issued on 28.10.2014. Presently, tree felling is under

progress in the 24.06 ha area at the Taldih Block. Further, Stage–1 FC along with Working Permission for the adjoining ML–162 Lease, which is a non-mineralized lease and being used for evacuation of ore from Barsua Mine and infrastructure facilities for the project, has been granted by MoEFCC vide No. 8-18/2014-FC, dated 10.02.2015.

Considering the significant delay in obtaining permission for the forest areas and finalization of the detailed project report, the envisaged facilities for Taldih Block could not be commenced. This is resulting in shortage of iron ore supply to the expanded and modernized SAIL steel plants. In order to meet the enhanced demand of iron ore from the already expanded / modernized steel plants, it is planned to redistribute iron ore production from the three blocks under ML – 130 (i.e. Barsua to 3.5 Mt/yr and Kalta to 2.5 Mt/yr and Taldih Block to 2.05 Mt/yr), keeping the total annual production capacity within the approved limit of 8.05 Mt/yr till originally envisaged and approved facilities are established and commissioned for Taldih Block, which is likely to take about 5 years. The proposed redistribution of production from the mining blocks under ML – 130 would also involve change in beneficiation plant capacity of existing Ore Beneficiation Plant at Barsua to 4.5 Mt/yr and mode of ore transport by road instead of earlier approved Long Distance Belt Conveyor. The above change in scope of work is being proposed only for a limited period of 5 years, during which the originally envisaged and approved infrastructure such as Long Distance Belt Conveyor (LDBC) and beneficiation facilities for Taldih Block are expected to be established and commissioned. Thereafter, the project will operate as per the originally approved scope of work.

Indian Bureau of Mines has approved Scheme of Mining for the period from 2015-16 to 2019-20 covering the planned changes under ML – 130 vide letter No. MS/FM/36-ORI/BHU/2014-15/1843 dated 04.09.2015. The instant proposal is for amendment of Environmental Clearance accorded for integrated Barsua-Taldih-Kalta Iron Ore Mining Project (ML–130) of M/s SAIL to allow the planned redistribution of mining production for the blocks under ML-130 by keeping total production as 8.05 Mt/yr and associated changes in beneficiation and mode of transport.

The salient features of the project include:

Proposal

The project was granted Environmental Clearance for 8.05 Mt/y iron ore by MoEF vide letter no. J - 11015 / 351 / 2006 – IA.II (M) dated 29th October, 2010. The present proposal is for seeking amendment in the Environmental Clearance as per the details given below:

Sr. No	Scope of Work as per EC granted		Modified present proposal	
ROM Production				
1.	Barsua Block	: 2.5 Mt/yr	Barsua Block	: 3.5 Mt/yr
2.	Taldih Block	: 4.25 Mt/yr	Taldih Block	: 2.05 Mt/yr
3.	Kalta Block	: 1.3 Mt/yr	Kalta Block	: 2.5 Mt/yr
	Total	: 8.05 Mt/yr	Total	: 8.05 Mt/yr
Mineral Beneficiation				
4.	Barsua	: 2.5 Mt/yr	Barsua: 4.5 Mt/yr (3.5 Mt/yr feed from Barsua Block and 1 Mt/yr from Taldih Block)	
5.	Taldih	: 4.25 Mt/yr		
	Total	: 6.75 Mt/yr	Total : 4.5 Mt/yr at existing Beneficiation Plant at Barsua	
Transportation				
6.	From Kalta to Roxy siding through NH-215 (1.3 Mt/yr)		From Kalta to Roxy siding through NH-215 (2.5 Mt/yr)	
7.	From Taldih to Barsua by Long Distance Belt Conveyor (4.25 Mt/yr)		From Taldih to Barsua valley by road (~1.05 Mt/yr). From Taldih to Barsua beneficiation plant by road and there from by covered conveyors to railway siding (~1.0 Mt/yr)	
8.	From Barsua to Barsua siding by covered conveyors (2.5 Mt/yr)		From Barsua to Barsua railway siding by covered conveyors (4.5 Mt/yr)	

(Mt/yr – million tonnes per year)

Note:

1. *The above stated modifications in scope of work is being proposed temporarily for a period of about 5 years to meet the immediate requirement of iron ore of the SAIL steel plants. During the intervening period of 5 years, the originally envisaged and approved infrastructure such as Long Distance Belt Conveyor (LDBC), beneficiation facilities for Taldih Block are expected to be established and commissioned. Thereafter, the project will operate as per*

	the originally approved scope of work. *2. As part of the infrastructure facilities of the project are located in the adjoining Mining Lease i.e. ML–162 (77.94 ha) and acquired area, which are located in non-mineralized areas and being used only for infrastructure facilities for the project, thereby forming part of the project area, it is requested that specific mention of these two areas may be made in the Environmental Clearance letter.* 3. *Further, slight change in the mine lease area from 2486.391 to 2486.383 ha based on the Joint Survey Committee Report of Govt. of Odisha may also be duly corrected in the Environmental Clearance letter.*
Location of Mine	Toda Reserve Forest, Tantra Village, Koira-tehsil, Koira- Tehsil, Sundargarh District, Odisha.
Latitude	21°49' 25.43800"N to 21°59' 50.88516"N
Longitude	85°07' 43.73832"E to 85°13' 53.48136"E
Land Use	About 95% (2347.673 ha) of the lease area is under forest land.114.696 ha is Govt. wasteland and 24.014 ha is private land. At the end of mining, 1708.751 haof area will come under utilization. Remaining 777.632 ha of area will be under safety zone / intermediate / un-disturbed.
Total Mineable Reserves	368.094 million tonnes of mineable reserves as on 01.04.2015 with Fe (+)57% as cutoff grade.
Life of Mine	46 years.
Method of Mining	Mechanized (in Barsua and proposed Taldih blocks) and Semi-mechanized (in Kalta block)Open cast mining by conventional shovel dumper combination
Quarries	Barsua Mines: 3; Kalta Mines: 5 ; Taldih Mines: 2 (proposed)
Waste disposal	External dumping for initial years. Backfilling of exhausted quarries subsequently including re-handling of external sub-grade dumps.
Mineral Processing	Crushing & screening. Beneficiation by dry and wet processes.
Mineral Transport	By covered conveyors from Barsua to Railway Siding. By trippers from Taldih to Barsua Plant /Railway siding. By trippers from Kalta to Roxy Railway Siding. Thereafter, dispatch from the sidings to steel plants by rail.
Number of working days	300 days, 3 shifts per day
Water Demand	Barsua:14170 m^3/day Kalta: 385 m^3/day Taldih: 325 m^3/day
Source of water	Barsua: *Kurarhi Nala (14050 m^3/day), Recycled water (120 m^3/day);* Kalta: *Najkura Nala(355 m^3/day), Recycled water (30 m^3/day);* Taldih: *Samaj Nala(300 m^3/day), Recycled water (25 m^3/day)*

Man Power	Existing 1562; Proposed 2364
Fuel Consumption	Existing 1950t/yr HSD; Proposed 6300 t/yr HSD + 36000 t/yr of LSHS
Explosive Consumption	Existing - 330 t/yr; Proposed-1530 t/yr
Electricity Consumption	Existing 16.8 Million kWh/yr; Proposed 195 Million kWh /yr
Infrastructure	Workshops, stores, railway siding, townships & amenities existing at Barsua and Kalta. Workshops, offices and amenities have to be built at Taldih. Haul road connecting Taldih mining pit to Barsua Plant is required to be made.
Proposed Investment	Rs. 5297Crores
Production Cost	Rs. 1245 per tonne at rated capacity
CSR Budget	Total Rs. 1.5 crores per year

In order to assess the likely impacts, if any, on the local road infrastructure as also the air quality of the area, due to the proposed change in the scope of work, specific environmental studies viz, Traffic Density Study and Air Quality Impact Predication Study have been carried out and incorporated in this report. It has been observed that adequate road capacity is available to undertake additional traffic load due to ore transportation by road from ML – 130 as proposed. Further, the air quality impact predication also shows the quality of air within the permissible limit

The proposed redistribution of mining from mining blocks under ML–130 including associated changes in beneficiation capacities of existing Ore Processing Plant at Barsua and mode of ore transport will facilitate supply of adequate quantity and consistent quality of iron ore from ML–130 to Rourkela Steel Plant as well as other steel plants. This project will also generate much needed employment to the local people. Economy of the area will get a boost and there will be overall growth of the region in terms of education, health, training, transport etc. The local people's standard of living is also expected to improve.

2.0 INTRODUCTION OF THE PROJECT / BACKGROUND INFORMATION

2.1 IDENTIFICATION OF PROJECT AND PROJECT PROPONENT

Mine lease for ML- 130 (Barsua and Kalta mines), was first granted in favour of Rourkela Steel Plant on 06.01.1960 for a period of 30 years which expired on 05.01.1990. Subsequently lease renewal applications were made on 30.12.1988 and again on 11.9.2007. The Mining Lease has been renewed and lease deed for the 2nd Renewal Period has been executed on 13.11.2014 for the period from 06.01.2010 to 05.01.2030. Mining Plan had been approved by IBM for production of 8.05 Mt/yr of iron ore (4.25 Mt/yr from Taldih + 2.5 Mt/yr from Barsua + 1.3 Mt/yr from Taldih) vide letter No. 314(3)/2007-MCCM (CZ)/ MP-40 dated 28.07.2008. Environmental Clearance for production of 8.05 Mt/y iron ore

from ML – 130 was also granted by MoEF vide letter no. J - 11015 / 351 / 2006 – IA.II (M) dated 29th October, 2010 as per the mining plan i.e. (4.25 Mt/yr from Taldih + 2.5 Mt/yr from Barsua + 1.3 Mt/yr from Kalta).

The instant proposal is for redistribution of iron ore production from the three blocks under ML–130 i.e. Barsua to 3.5 Mt/yr and Kalta to 2.5 Mt/yr and Taldih Block to 2.05 Mt/yr, keeping the total annual production capacity within the approved limit of 8.05 Mt/yr till originally envisaged and approved facilities are established and commissioned, which is likely to take about 5 years. The proposed redistribution of production from the mining blocks under ML–130 would also involve change in beneficiation plant capacity of existing Ore Beneficiation Plant at Barsua to 4.5 Mt/yr and mode of ore transport by road instead of earlier approved Long Distance Belt Conveyor. The above change in scope of work is being proposed only for a limited period of 5 years, during which the originally envisaged and approved infrastructure such as Long Distance Belt Conveyor (LDBC), beneficiation facilities for Taldih Block are expected to be established and commissioned. Thereafter, the project will operate as per the originally approved scope of work.

Scheme of Mining for the proposed changes in production from the mining blocks under ML–130 i.e. 3.5 Mt/yr iron ore from Barsua +2.5 Mt/yr from Kalta +2.05 Mt/yr from Taldih (i.e. Total of 8.05 Mt/yr) has been approved by IBM vide No. MS/FM/36-ORI/BHU/2014-15/1843 dated 04.09.2015.

Steel Authority of India Limited (SAIL), a Maharatna public sector undertaking under Ministry of Steel, Government of India, is the leading steel maker in the country and is having integrated steel plants at Bokaro, Durgapur, Rourkela, Bhilai, Burnpur, alloys steel plant at Durgapur and special steel plant at Bhadrawati and Chandrapur. Also, SAIL has the second largest mining outfit in the country after Coal India Limited. SAIL's mines are spread over the states of Jharkhand, Orissa and Chhattisgarh. These mines commenced their operations as captive sources of raw materials for its integrated steel plants.

2.2 BRIEF INFORMATION ON NATURE OF THE PROJECT

One of iron ore leases under SAIL is the Barsua-Taldih-Kalta deposit, also known as ML–130, located in Sundargarh District of Odisha. The lease comprises of three blocks, Barsua, Kalta and Taldih. Barsua and Kalta blocks are in operation, whereas Taldih is virgin. Earlier the lease was under Rourkela Steel Plant (RSP) and was RSP's captive iron ore source. However, presently the lease is under the Raw Materials Division (RMD) of SAIL and supplies ore to all steel plants of SAIL as per the requirement.

At present Barsua and Kalta blocks are in operation with rated capacities of 2.5 Mt/yr and 1.30 Mt/yr respectively. Ore from Barsua mine faces is transported to

Barsua Beneficiation Plant and the beneficiated ore is transported by covered conveyors to Barsua railway siding and loaded into railway wagons for dispatch. Ore from Kalta is transported by road trucks to Roxy railway siding through National Highway No. 215 over a distance of 22 km. It was planned to develop the Taldih block with a rated capacity of 4.25 Mt/yr. The ore from Taldih was planned to be brought by long distance belt conveyors to new beneficiation plant to be set up at Barsua.

However, during the last five years (i.e. from 2010-11 to 2014-15), the envisaged facilities and production from Taldih block could not be commenced due to significant delay in obtaining permission for forest areas involved in the project and finalization of the project. This is resulting in shortage of iron ore supply to the SAIL steel plants, which have already been expanded. In order to meet the additional iron ore requirement from the plants, SAIL has planned to redistribute the production from the three mining blocks under ML-130 keeping the overall production unchanged at 8.05 Mt/yr from the entire lease till the complete development of the Taldih Block including LDBC, which may take about 5 years. In the intervening period transportation shall be done by road. The complete modified proposed project will be as detailed below:

Sr. No	Scope of Work as per EC granted	Modified present proposal
ROM Production		
1.	Barsua Block : 2.5 Mt/yr	Barsua Block : 3.5 Mt/yr
2.	Taldih Block : 4.25 Mt/yr	Taldih Block : 2.05 Mt/yr
3.	Kalta Block : 1.3 Mt/yr	Kalta Block : 2.5 Mt/yr
	Total : 8.05 Mt/yr	Total : 8.05 Mt/yr
Mineral Beneficiation		
4.	Barsua : 2.5 Mt/yr	Barsua: 4.5 Mt/yr (3.5 Mt/yr feed from Barsua Block and 1 Mt/yr from Taldih Block)
5.	Taldih : 4.25 Mt/yr	
	Total : 6.75 Mt/yr	Total: 4.5 Mt/yr at existing Beneficiation Plant at Barsua
Transportation		
6.	From Kalta to Roxy siding through NH-215 (1.3 Mt/yr)	From Kalta to Roxy siding through NH-215 (2.5 Mt/yr)
7.	From Taldih to Barsua by Long Distance Belt Conveyor (4.25 Mt/yr)	From Taldih to Barsua valley by road (~1.05 Mt/yr). From Taldih to Barsua beneficiation plant by road and there from by covered conveyors to railway siding (~1.0 Mt/yr)
8.	From Barsua to Barsua siding by covered conveyors (2.5 Mt/yr)	From Barsua to Barsua railway siding by covered conveyors (4.5 Mt/yr)

Note:

1. *The above stated modifications in scope of work is being proposed temporarily for period of about 5 years to meet the immediate requirement of iron ore of the SAIL steel plants. During the intervening period of 5 years, the originally envisaged and approved infrastructure such as Long Distance Belt Conveyor (LDBC), beneficiation facilities for Taldih Block are expected to be established and commissioned. Thereafter, the project will operate as per the originally approved scope of work.*
2. *As part of the infrastructure facilities of the project are located in the adjoining Mining Lease i.e. ML–162 (77.94 ha) and acquired area, which are non-mineralized and being used only for infrastructure facilities for the project, thereby forming part of the project area, it is requested that specific mention of these two areas may be made in the environmental clearance letter.*
3. *Further, slight change in mine lease area from 2486.391 to 2486.383 ha based on the Joint Survey Committee Report of Govt. of Odisha may also be duly corrected in the Environmental Clearance letter.*

The total mineable reserves available are 368 million tonnes of iron ore. The average expected life of the lease is 46 years.

2.3 NEED FOR THE PROJECT AND ITS IMPORTANCE TO THE COUNTRY OR REGION :

SAIL's expansion & modernization program has increased hot metal production capacity to 23.2Mt/yr. Further, SAIL is also working on long term strategic plan "**VISION 2025**", which will steer the company towards a target of 50 Mt/yr hot metal productionin line with the Prime Minister's vision of enhancing India's steel-making capacity to 300 Mt/yr by 2025. Iron ore is one of the key inputs for hot metal production, therefore continuous supply of quality iron ore from mines is a pre-requisite for the success of the expansion & modernization programme. Plant-wise hot metal production & iron ore requirement for steel plants of Eastern Sector is given below.

Table 1: Plant-wise hot metal production & iron ore requirement

Steel Plant	Hot metal production, Mt/yr	Iron ore requirement, Mt/yr
Bokaro Steel Limited	5.80	10.73
Durgapur Steel Plant	2.50	4.63
Rourkela Steel Plant	4.50	8.33
IISCO Steel Plant	2.90	5.37
Total	**15.70**	**29.06**

Entire iron ore requirement of SAIL steel plants of eastern region is being met from RMD mines located at Kiriburu, Meghahataburu, Gua, Chiria, Barsua, Kalta & Bolani iron ore mines. Accordingly RMD, SAIL has also planned augmentation of production & infrastructure facilities of their mines to commensurate with SAIL's expansion plan. Iron ore from ML 130 is supplied to Rourkela Steel Plant as well as other steel plants in eastern region as per the requirement. In order

to meet the requirement for increased hot metal production from the eastern region, SAIL plants particularly Rourkela Steel Plant, re-distribution of iron ore production from the mining blocks under ML 130 has been planned. The project will not only help in supply of increased iron ore demand from already expanded Rourkela Steel Plant from 2015-16 onwards and but also help in the overall growth of the region.

2.4 DEMAND AND SUPPLY GAP

The major application of iron ore in India is for manufacture of iron and steel. India is one of the major producers and exporters of high grade iron ore. The iron ore production in India was 152.43 Mt for the year 2013-14. Out of total production of 152.43 Mt, domestic iron ore consumption was estimated to be 110.50 Mt for the same year which means the entire domestic demand is satisfied by domestic supplies of iron ore. The major iron ore producing states are Odisha, Jharkhand, Chattisgarh, Karnataka and Goa. India is world's 4th largest iron ore producer and 3rdexporter after Australia and Brazil. India iron ore export during 2013-14 was 16.30 Mt showing decline in export from previous years.

SAIL is implementing its growth plan to enhance hot metal production capacity to 23.46 Mt/yr by 2015-16 with an investment of about Rs 72,000 crore. The iron ore requirement for the current expansion will increase to about 43 Mt/yr. In order to meet enhanced requirement of iron ore, production capacity of existing mines at Gua, Bolani, Kiriburu, Meghahatuburu, Barsua and Kalta is being expanded to its maximum potential and new mines are planned to be developed at Rowghat, Chiria and Taldih.

Iron ore produced from SAIL's captive mines are used up in the company's steel plants. SAIL's steel plants are being modernized and expanded. The proposed re-distribution of iron ore production from the mining blocks under ML – 130 will help SAIL to meet its increased iron ore requirement from expanded steel plants.

2.5 IMPORT VS INDIGENOUS PRODUCTION

Although the production of iron ore in India was about 152.43 Mt during 2013-14, the domestic production of iron ore has seen a decline in the past few years due to regional shortages in some States like Karnataka due to legal and regulatory issues. However, during 2013-14 there has been an increase in the production of iron ore as compared to the previous year. About 33% of the total production was shared by Public Sector Companies like SAIL, NMDC, OMC etc. The share of Private Sector was 67%. Almost entire production of iron ore (99%) was accrued from Odisha, Goa, Chhattisgarh, Jharkhand and Karnataka during the year. The remaining production was reported from Andhra Pradesh,

Chhattisgarh, Maharashtra and Rajasthan. Although import of iron ore was 3.05 MT in 2012-13, it has seen a fall in 2013-14 to 0.37 Mt. Import of Steel has also declined in the year 2013-14 as compared to imports during previous years.

2.6 EXPORT POSSIBILITIES

Iron ore produced from this project will be entirely consumed in SAIL's plants. There is no proposal for export of iron ore from this project.

2.7 DOMESTIC / EXPORT MARKET

Iron ore is used in the iron & steel industry as the basic raw material required for manufacture of various grades of iron and steel. India is a net exporter of iron ore.

2.8 EMPLOYMENT GENERATION

Each of the mining blocks under ML–130 i.e. Barsua, Taldih & Kalta, will be headed by the respective Mine Manager who will be responsible for the supervision, control and management of the block. The Mine Managers shall report to the Mines Agent, all of whom shall be provided residential accommodation at townships. The senior most executive of Barsua–Taldih–Kalta Blocks will normally be the Mines Agent for the entire complex. Director (Raw Material & Logistics) is the nominated owner of Barsua–Taldih–Kalta iron ore mines.

All statutory supervision i.e. Mines Foreman, Mining Mate etc.are being employed as specified in the Metalliferous Mines Regulation, 1961. Total employees at the Barsua, Taldih and Kalta iron ore mines shall be around 2364 nos. Most of the unskilled, semi-skilled and skilled workers will be local persons. The officers and highly skilled workers and some of the other employees will be housed in the existing Township, which is being expanded.

3.0 PROJECT DESCRIPTION

Barsua-Taldih-Kalta Iron Ore Mines, a captive Iron Ore Mine of Raw Materials Division of SAIL has been the traditional supplier of iron ore to Rourkela Steel Plant (RSP). Presently iron ore from the mines is also supplied to SAIL's other plants. Expansion of mining and beneficiation capacities at ML 130 was planned by development of Taldih block with total production of 8.05 Mt/yr including installation of pelletisation plant. Environmental Clearance for the production of 8.05 Mt/yr iron ore from ML–130 was also granted by MoEF vide letter no. J-11015/351/2006–IA.II(M) dated 29th October, 2010 (4.25 Mt/yr from Taldih + 2.5 Mt/yr from Barsua + 1.3 Mt/yr from Kalta).

However, production from the Taldih Block could not commence due to the non-availability of forest area permissions and finalization of project. This is resulting shortage in supply of iron ore to SAIL's steel plants, which have already been expanded. In order to meet the additional iron ore requirement for the plants, SAIL has planned to redistribute iron ore production from the three blocks under ML–130 (i.e. Barsua to 3.5 Mt/yr, Kalta to 2.5 Mt/yr and Taldih to 2.05 Mt/yr), keeping the total annual production capacity within the approved limit of 8.05 Mt/yr till originally envisaged and approved infrastructure are established and commissioned, which will take about 5 years. The planned redistribution of production from the mining blocks under ML–130 will also involve change in beneficiation plant capacity of existing Ore Beneficiation Plant at Barsua and mode of ore transport as detailed in para 2.2 above.

ML-130 leasehold area measures 2486.383 ha. Out of 2486.383 ha lease area, forest land is 2347.673 ha *(including 5.742 ha of un-disturbed area as per Scheduled Tribe & Other Traditional Forest Dwellers Act-2006)* and the remaining is non-forest land. The leasehold area extends for 18 km, aligned north–south, as a narrow plateau on a hill range.

3.1 TYPE OF PROJECT INCLUDING INTERLINKED & INTER DEPENDED PROJECT

The proposed project falls under Category "A", as per EIA notification – 2006, Amendment in Dec '2009, April '2011, Dec. '2012, March '2013, Sept. '2013, June '2014, October '2014 & April '2015 of the Ministry of Environment, Forest & Climate Change, New Delhi. This is a self dependent project. The mine is captive source of iron ore for SAIL's plants.

3.2 LOCATION

Barsua-Taldih-Kalta deposit is located in the southern extreme of Bonai iron ore range in Koira Tehsil of Bonai subdivision in Sundargarh District of Orissa. ML-130 lease area forms part of Survey of India toposheet no : 73 G/1 and is bounded by latitudes 21°49'25.43800"N to 21°59'50.88516"N and longitudes 85°07' 43.73832"E to 85°13'53.48136"E. The location of project is shown in **Drg. No. MEC/196H/11/S2/1.**

3.3 DETAILS OF ALTERNATE SITE

Since the proposed project envisages iron ore mining within the leasehold, possibility of alternate site is out of question.

3.4 SIZE AND MAGNITUDE OF OPERATION

ML-130 leasehold area measures 2486.383 ha. Out of 2486.383 ha, forest land is 2347.673 ha. The leasehold area extends for 18 km, aligned north – south, as a narrow plateau on a hill range. Three mining blocks (Barsua, Kalta and proposed Taldih) are in ML-130 lease. There is an Ore Beneficiation Plant to process ore from the Barsua Block and is partly located within ML 130. Few other ancillary facilities viz. Railway siding, stock piles, tailings dam etc. are outside the ML 130, partly in an adjoining non mineral lease (ML 162) and partly in adjoining acquired area.

Environmental Clearance for production of 8.05 Mt/yr iron ore from ML – 130 was granted by MoEF vide letter no. J - 11015 / 351 / 2006 – IA.II (M) dated 29th October, 2010 as per the mining plan i.e. (4.25 Mt/yr from Taldih + 2.5 Mt/yr from Barsua + 1.3 Mt/yr from Kalta). The present proposal is for re-distribution of iron ore production from the mining blocks within the ML–130 keeping the total ROM production from the lease within the limit till the approved & envisaged conveyor facilities at Taldih Block is established & commissioned as per the details given in para 2.2 above.

3.5 MINE DESCRIPTION

3.5.1 Geology

Regional geology: The regional Geological set up constitutes part of the Precambrian Meta Sedimentary Sequence, known in Indian Geology as “Iron Ore Series”. The regional structure of the sedimentary iron ore bearing formations (iron ore series) was assumed as an asymmetrical overturned synclinorium plunging towards north (or anticlinorium plunging south). The western limb of the structure comprising of Bonai iron ore range (Kiriburu – Bolani, Kalta–Taldih-Barsua) was overturned and dips at high angle (30º - 70º) westward with regional strike of the area as NNE – SSW. The eastern limb of the structure was folded complicatedly and dips at 10º - 20º west. The regional overturned fold closes in the south (covering Khandadhar – Malangtoli blocks) while opens to the south in two separate limbs assuming a “horse shoe structure“. The western portion of the structure continuously comprises of BHJ/BHQ which forms the hanging wall of the Bonai iron ore body.

The regional stratigraphic succession of the area is as follows :

Kolhan series		Sandstone / Quartzite / Limestone/ Conglomerate
---------- UNCONFORMITY ----------		
Singhbhum Granite	-	Granite massif
Epidiorite	-	Meta intrusives
Upper shale	-	Shale with volcanics

Iron Ore series	-	Banded Hematite Quartzite
	-	Lower shale
	-	Lava
	-	Sandstone and shale
	-	Black phyllite, conglomerate
Older metamorphics	-	Schists and gneisses

---------- UNCONFORMITY ----------

Local geology: Litho units encountered in Barsua-Taldih-Kalta are as follows:

- Upper shale
- Banded Hematite Jasper(BHJ)
- Massive iron ore (only in Barsua)
- Lower shale with basic intrusives

Upper shale forms the central shale and clay band in entire Barsua and part of Taldih block after which it gradually swings towards east and passes along the eastern margin of the ore body in Kalta block. BHJ constitutes the hanging wall of the iron ore deposit overlooking the western valley. The BHJ grades into Banded Haematite charts and Quartzite (BHQ) in the south. This kind of gradation is also present within the main ore body and on the western periphery. Iron ore occurs massively as disseminated patches along the western flank of the hill range.

The iron ore body was formed by secondary process of leaching and enrichment of iron bearing rocks (BHJ/BHQ) under certain structural and meteorological controls. These produced different ore types of varying physical, textural and chemical compositions. Pockets of unreplaced or partly replaced parent rocks are present in ore body bearing evidence of replacement / enrichment origin for the iron ore body. The ore body is bounded in the west by continuous exposures of BHJ while its eastern periphery is generally devoid of rock exposures and is covered with iron ore floats and talus.

General strike pattern varies from N60ºE - S60ºW to N-S and N20ºW – S20ºE to E-W

Salient feature of the ore body is generalized as follows:

Length of ore body	: 9.7 km
Width of ore body	: 7 m - 401.96 m, avg. width : 250.07 m
Thickness of ore body	: 21 – 83 m , average – 50 m
Highest and Lowest level of the ore body	: Highest point and lowest point of the ore body on the western limb are 903.4 mRL and 715 mRL respectively. The lowest point on the eastern limb is 620 mRL.
Thickness of ore body	: Maximum thickness of overburden, mainly laterite, is 40 m though at some places it is non-existent. Average thickness is 4.5 m

The iron ore occurrence in Barsua-Kalta belt is characterized by mineral assemblages of predominantly Haematite, Martite, Limonite as principal phase, typical of secondary enrichment deposits derived from pre-existing ferrugineous sedimentary rocks. Kaolinite and Gibbsite constitute the chief gangue minerals.

The Iron occurrence of the area is broadly grouped into the following litho types.

Massive Ore (MO)	:	Dense hard and cross jointed with predominant hematite. General chemical composition: Fe (+) 60%, SiO_2 (-) 2.5%, Al_2O_3 (-) 4.0%
Hard Laminated Ore (HLO)	:	Alternating hard (Hematite) and soft lemonite (shale): Fe (+) 60%, SiO_2 (-) 2.5%, Al_2O_3 (-) 6.0%
Soft Laminated Ore (SLO)	:	Porous and laminated, Hematite, limonite, martite occur as alternate bands with goethite and Limonite. Fe (+) 59%,
Friable Ore (FO)	:	SiO_2 (-) 3.5%, Al_2O_3 (-) 6.0%
Lateritic Ore (LO)	:	Purple, yellowish and red coloured. Most of the mineral ore goethic, limonite. Fe (+) 57%, SiO_2 (-) 4%, Al_2O_3 (-) 8.0%
Blue Dust (BO)	:	Soft, Platy and powdery with metallic blue colour, generally rich in quality.
Mineable Transitional Ore (MTO)	:	Generally poor grade ore.
Non Mineable transitional Ore (NMTO)	:	
BHQ / BHJ		-

General sequence of occurrence of the ore types from surface are: laterite/float ore, Lateritic ore, hard laminated ore/soft laminated ore, friable ore/blue dust/transitional ore. Massive ore mostly occur as isolated patches in contact with BHJ and sometime grades into friable ore and blue dust.

Status of Exploration: Initial exploration in ML-130 was carried out by Indian Bureau of Mines (IBM). Realising the inadequacy, further exploration was undertaken under consultancy services of Berbau Dussel Drof, West Germany in 1970-72. Total 389 boreholes were drilled proving the full thickness of the ore body. Similar exploration was undertaken at Kalta during 1972 – 1975 when 168 boreholes were drilled. Subsequently exploration were undertaken in the Taldih block which is subdivided into four blocks, 'A','C','B' and 'D' sequencing from Barsua end towards Kalta end. 371 nos. of boreholes were drilled. Exploration, drilling and evaluation were completed in respect of block 'B'

and block 'D' of Taldih block. Taldih block 'C' was prospected by IBM and subsequently by prospecting division of RSP. In block 'C' total 108 holes were drilled during 1975 – 78. Exploration of block 'A' was interrupted at different phases.

Geological plan of ML-130 mining lease is shown in **Plate-IV** of the Mining Scheme and representative composite sections of Barsua, Taldih and Kalta blocks have been shown in **Plates V, V(F), V(R), VS and V-Z3** of the Mining Scheme respectively**.**

3.5.2 Mineral Reserves

The mineable Reserves of Barsua, Kalta and Taldih iron ore deposits as on 01.04.2015 with Fe (+) 57% as cut-off grade for mining by mechanized opencast method are as follows:

Block		**Mineable reserve (Mt)**	
Barsua			64.570
Taldih	B	33.350	
	D	113.894	
	C	70.600	
	A	23.830	241.674
Kalta			61.850
Total			**368.094**

3.5.3 Mining

Deposit wise area coverage of the Barsua, Taldih and Kalta blocks are as follows:

Block	**Area (ha)**
Barsua	976.429
Taldih block A & C	617.024
Taldih block B&D	556.460
Kalta	336.470

Mining operation commenced in Barsua deposit in 1960 which forms the southernmost part of the leasehold. With total strike length of 5.3 km, the Barsua deposit has been sub-divided into 5 parts viz. Area 1, Area 2, Area 3, Area 4 & Area 5. Iron ore at Area 1, 2 & 4 located in central part of the mine have already been exhausted and presently mining activities are confined to Area 3 and Area 5 located at both the flanks of the mine. Mining operations at Kalta deposit commenced during 1966, which forms the northern part of the lease area and has been sub-divided into A, B and C blocks from South to North. Presently, mining is being carried out in A & C blocks. Taldih deposit with a strike length of 9.9 km constitute the central part of the leasehold and has been sub-divided into A,C, B and D blocks from Barsua end.

Barsua Block

The mining operations at Barsua Block commenced operation as a fully mechanized mine in 1961. With total strike length of 5.3 km, the Barsua deposit has been sub-divided into 5 parts viz. Area 1, Area 2, Area 3, Area 4 & Area 5. Iron ore at Area 1, located in the central part of the mine has already been exhausted and at 2 & 4 is partially exhausted and presently mining activities are confined to Area 3 and Area 5 located at both the flanks of the mine. Existing approved capacity of the Barsua Deposit is 2.5 Mt/yr of ROM iron ore. Under the proposed change in calendar excavation plan, ROM excavation from the Barsua Block will 3.5 Mt/yr till the development of Taldih Block i.e. upto 2020.

The iron ore deposit is presently being worked by drilling and blasting of 150 mm dia. blast holes with 125 mm dia. explosive cartridges, loading the blasted material by bucket shovels (Hydraulic- electric & diesel) into dumpers, for transportation to their destination. The following equipment will be deployed in the mine.

AREA 3			
Sl. No.	**Equipments**	**Specification**	**Numbers**
1.	Excavator	7.5 m^3 capacity	2
2.	DTH drill	150 mm	4
3.	Rock breaker	50 TPH	1
4.	Dozer	BEML-D-355, 450 H.P	2
5.	Loader	2.5 m^3 bucket.	2
6.	Tippers	100 T and 85T	3 and 7
7.	Water Tanker	TMB	4
AREA 5			
1.	Excavator	5.5M^3 capacity	2
2.	DTH drill	150mm	2
3	Tippers	100 T and 85T	3 and 8
4	Loader	2.5 m^3bucket.	2
5	Rock breaker	50 TPH	1
6	Dozer	BEML-D-355, 450 H.P	2
7	Water Tanker	TMB	3

The mine is being worked by fully mechanised method of mining in three shift basis with tipper and excavator combination. Till 2019-20, the mining activities will be confined to only three blocks i.e. Area 3E, Area 3W and Area 5. It has been planned in such a way so as to merge the quarries of 3E and 3W. Conceptually, the quarry will have a dimension of 415.03 ha and planned to backfill the excavated area using the generated wastes.

Kalta Block

Kalta Block located in the extreme northern end of the ML-130 was opened in 1966 to supply high grade iron ore lumps. This is a semi mechanized opencast mine having three Blocks namely, Block A, Block B and Block C. Block A is in the south, Block B at the centre and Block C in the north. So far mining operations have been going on in Block A and Block C and Block B is virgin. The Block A has four working sections. Two working sections on North side are called Local Pit and New Area Pit. The two working sections on south side area called Challan Gate East Pit and Challan Gate West Pit. The Block C has two sub sections namely (i) Mayur Nachan Area (2) Kala Pahar Area.

Both manual and mechanized method of mining are adopted in Kalta Block. Benches of 6 m height and more than 6 m wide have been developed. DTH drills are used for drilling blast holes in ore zone. After blasting ROM iron ore produced from the mine, except oversize boulders, is loaded by hydraulic shovels / Front End Loaders into 15t tippers and transported to mobile in pit screening plant. In this process, two products viz. (-)50 mm to (+) 10 mm size lumps and (-) 10 mm size fines are separated. The screened lumpy and fine ores are then transported by 10, 15, 25 t tippers to Roxy Railway siding, ~22 km. away from the mine, for final despatch by railway wagons to SAIL's steel plants. The block operates on three shifts basis. All the mining activities like deep hole drilling, blasting, excavation, loading and transportation will be carried out by using heavy earth moving machineries and maximum production capacity of iron ore will be 2.5 Mt/yr. The following equipment will be deployed in the mine.

BLOCK-A

Sl. No.	Type of Machinery	Nos.	Capacity / H.P.
1.	DTH Blast hole Drill (100 mm dia.)	2	125-140 m. per shift
2.	Rock Breakers	2	50 t/hr
3.	Hydraulic shovels	2	0.9—2.5 cu.m. bucket
4.	Front End Loader	2	2.5 cu.m. bucket
5.	Bulldozers	1	250 H.P.
6.	Tipper Trucks	4	15-25 t
7.	Mobile in-pit crushing cum screening plant	1	250 tph
8.	In-pit Mobile crusher cum screening Plant	1	450 tph
9.	Auxiliary Machinery (water sprinklers Road Graders)	4	15-28 kl water sprinklers

BLOCK-C

Sl. No.	Type of Machinery	Nos.	Capacity / H.P.
1.	DTH Blast hole Drill (100 mm dia)	2	125-140 m. per shift
2.	Rock Breakers	1	--

3.	Hydraulic shovels	1	0.9-2.5 cu.m. bucket
4.	Front End Loader	2	2.5 cu.m. bucket
5.	Bulldozers	1	250 H.P.
6.	Tipper Trucks	3	15-25 t
7.	Auxiliary Machinery (water sprinklers Road Graders)	5	15-28 kl water sprinklers

Mineable Iron Ore Reserves in Kalta as on 01.04.2015 are 61.85 Mt. Conceptually, both the blocks of Kalta will extend over an area of 191.06 ha and proposed to backfill using the generated wastes.

Taldih Block

From South to North, Taldih deposit consists of four major blocks A, C, B & D. Prior to 1980, mining operations on a very small scale have been carried out in Taldih Block D. But this was soon discontinued. Thus, most of Taldih deposit is virgin. It has originally planned to develop the Taldih block with installation of separate Crushing Plant and beneficiation plant with a capacity of 4.25 Mt/yr. However, during the last five years production from Taldih block could not be commenced. SAIL has planned to develop the new Taldih block for a rated production capacity of 2.05 Mt/yr of ROM iron ore per annum as against the originally envisaged capacity of 4.25 Mt/yr till establishment of all the envisaged facilities like LDBC conveyor, crushing & screening plant, beneficiation plant etc., which may take about 5 yrs.

At Taldih block, the mining operations will be started in the Block – C and Block – A initially. By the time the Mineable Reserves of Block-C and Block-A are exhausted, the developed pits in Block-B and Block-D will be ready for production.

Both the pits i.e. A & C will be simultaneously developed with 6.0 m. bench height and 20-25m. average bench width. The overall slope will be maintained at $<45^0$. The benches will be drilled by deploying drills capable of drilling 100 mm. dia blast holes and blasted with slurry explosives. The burden and spacing of the blasting pattern will be 3 m and 4 m respectively. The blasted material will be loaded into 25 t dumpers Highway Trucks with the help of 0.9 m^3 bucket hydraulic excavators for transportation to the in-pit Crushing and Screening plants / Barsua Ore Processing Plant based on quality of ore.

The proposed requirement of equipment at Taldih Iron Ore Mine is as follows:

Sr. No.	Type of Machinery	Nos. to be deployed	Capacity / H.P.
BLOCK A + C			
1.	DTH Blasthole Drill (100 mm dia)	3	125-140 m. per shift
2.	Rock Breakers	2	50 t/hr

3.	Hydydraulic shovels	3	0.9 m^3 bucket
4.	Front End Loader	8	2.5 m^3 bucket
5.	Bulldozers	2	250 H.P.
6.	Tipper Trucks	13	25 t
7.	Mobile in-pit crushing cum screening plant	1	250 tph
8.	In-pit Mobile crusher cum screening Plant	1	450 tph
9.	Auxiliary Machinery (water sprinklers Road Graders)	2+2	28 kl water sprinklers

Conceptually, the quarry will have a dimension of 431.79 ha. When mineral reserves are exhausted, the mine shall be closed down in accordance with the approved mine closure plan. All waste dumps will be stabilized and biologically reclaimed.

3.5.4 Mineral Processing:

Mineral Beneficiation at Barsua

Ore beneficiation plant of Barsua consists of two stages of crushing followed by screening. Each line consists of hopper, apron feeder, grizzly and primary crusher. The plant has a dry circuit (DO circuit) and a wet circuit (BO circuit).

The dry circuit consists of two stage crushing followed by screening to get lumps and fines of iron ore respectively. The Primary Jaw crusher crushes the ROM ore to 150 mm size which is screened on 50 mm screen. The oversize (+) 50 mm fraction on the top of the screen goes to secondary Gyratory crusher and gets crushed to (-) 50 mm size. The crushed product is taken either to Dry circuit or wet circuit through reversible conveyor, depending upon the type of ROM feed to primary crusher.

In DO circuit (dry circuit), crushed lumps and fines are, after secondary crushing fed to screening plant in Barsua valley through downhill conveyors (700 tph). After screening at Barsua valley lumps are conveyed to lumps overhead bins and fines to ore siding through fines ore conveyor and stacker.

In BO circuit (wet circuit), the crushed ore (-50 mm size) is subjected to washing in scrubber and trommel washers. The washed product is then subjected to double deck screening through 20 mm and 10 mm size screens. The (+)10 mm size fraction of washed lumps separated through screening is conveyed through the dry screening area to lump ore bins located at the Barsua valley. The fine ore fraction of (-)10 mm size mixed with water flows down under gravity through 252 m long launder to the jigging plant. The launder discharge, after getting arrested by a damper is wet screened with 8 mm and 2 mm screens. (-)10 – (+)8 mm size fractions are conveyed to final conveyor belt leading to fines stack yard. The middle fraction of (-)8 mm – (+)2 mm size is conveyed to jig bins and the (-) 2 mm fraction is conveyed through water channel to

spiral classifiers. The overflow of classifiers mostly of gangues (-) 65/100 mesh sizes are channeled to hydrocyclones. The underflows of hydrocyclones (slimes) along with the other effluent are discharged to tailing pond & overflow of hydrocyclone goes to thickner for recovery of water after settling of slime. The clarified overflow from the Thickener is recycled back to the system and under is discharged to the Tailing Pond for further solid – liquid separation. The area of tailing pond measures 35.88 ha and the pond is located at the foothill of hill range in lease ML-162. 27.17 ha of pond area lies within ML-162 and the rest of the area is in acquired land. Dam top is at 420.5 m AMSL. Maximum settled slime level is at 416.5 m AMSL and the spill way is at 418.0 m AMSL. At present about 1.1 Mm^3 - 1.4 Mm^3 (or around 3.4 million tonnes of tailing) of tailing is stored in the pond.

Flow sheet for the wet beneficiation process (BO circuit) is given as **Fig. 1**.

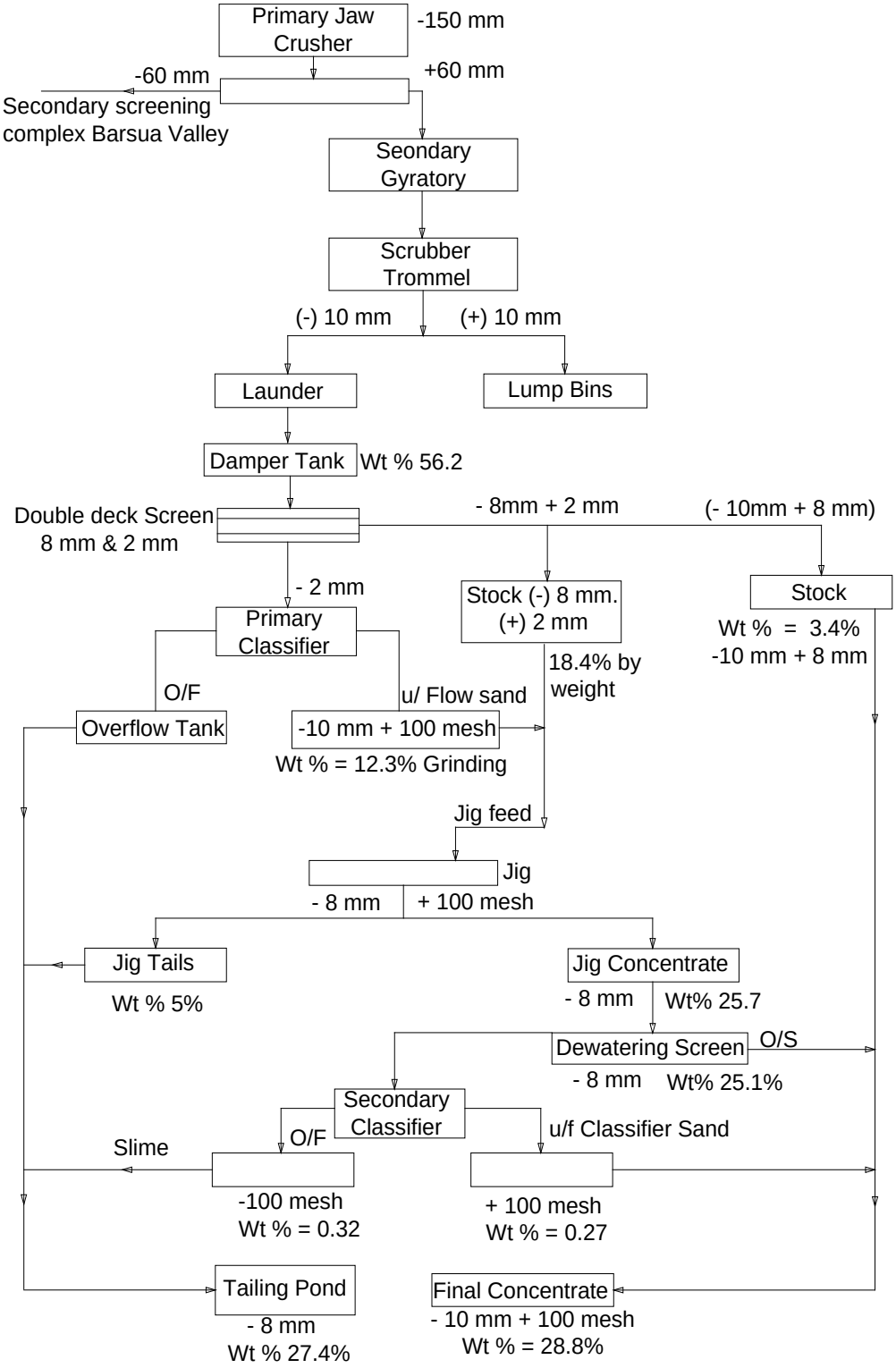

Fig 1: Flow sheet of existing beneficiation plant at Barsua

Proposed Modification in Existing Beneficiation Plant at Barsua Iron Mine: The existing Beneficiation Plant at Barsua is presently being operated with a processing capacity of 2.50 Mt/yr. Till the new Beneficiation Plant for processing of ore for Taldih will be commissioned, it is proposed to operate the existing Beneficiation Plant at Barsua on three shift basis with modification of few critical belt conveyers for increasing their conveying capacity of fine ore to process the ROM ore to the tune of 4.5 Mt/yr. The following **Fig.-2** shows the proposed processing of ore at ML – 130.

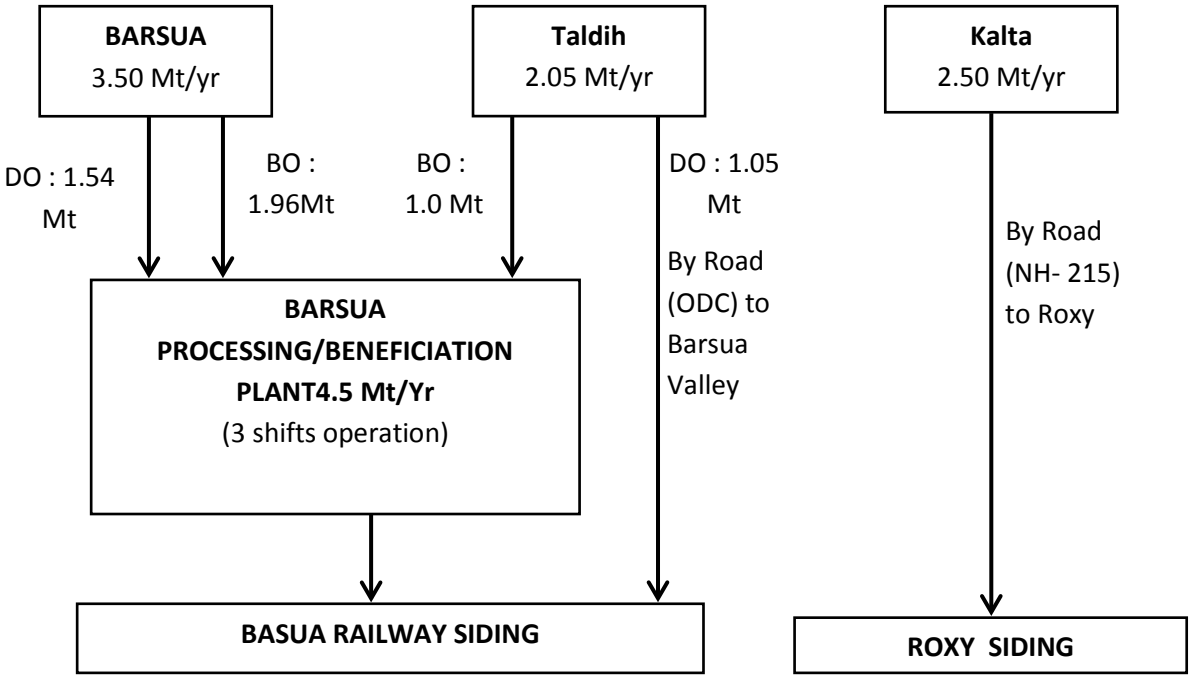

Fig.2: Proposed Ore Processing Route at ML – 130

The total production of ore from Barsua Block shall be 3.5 Mt/yr of which, 1.96 Mt/yr will be Beneficiable Ore. The balance 1.54 Mt/yr will be only crushed and screened.

Of the 2.05 Mt/yr ore produced from Taldih, 1.05 Mt/yr. direct ore will be transported by road directly to Barsua railway siding after in-pit crushing and screening. The balance 1.0 Mt/yr. beneficiable ore will be transported by road to Barsua Beneficiation Plant.

Mineral Beneficiation at Taldih

As per the original proposal, processing facilities planned for Taldih block comprises of primary crushing plant, primary crushed iron ore stock piles, long distance belt conveyor (LDBC) system, secondary iron ore stockpiles, beneficiation plant, product stockpiling and loading system and pelletisation plant. The primary crushing plant and primary iron ore stock pile will be located in Taldih 'C' block on the eastern side. The secondary iron ore stock piles, beneficiation plant, product stockpiles as well as loading system shall be located in Barsua valley near the site of proposed pelletisation plant and existing railway loading system. Presently, detailed engineering of the project is under progress and likely to take about 5 years for installation and commissioning of the envisaged facilities as per the original proposal.

Till the originally proposed new Beneficiation Plant are set up for Taldih block, it is planned to process the ore from Taldih block through dry processing method for Direct Ore and sending to Barsua valley railway siding and wet processing method for Beneficiable Ore through existing Beneficiation Plant at Barsua from 2015-16.

Direct Ore produced from the mine except oversized boulders, produced after heavy blasting will be loaded by shovels into 25 t tipper trucks and sent to mobile in-pit screening plant for screening to segregate into (+)50 mm and (-)50 mm size ore. These screened fractions will again be loaded into tipper trucks and separately stacked near mobile in-pit crushing and screening plant.

The oversize boulders produced after blasting will be broken by Rock Breakers. This broken fraction of oversize boulders will also be sent to (+)50 mm screened lump ore stack for stacking, near mobile in-pit crushing and screening plant. The screened lump ore from the stack will be fed by Front end loader to the Mobile in-pit crushing and screening plant for crushing and screening. As a result, (+)10 mm (-)50 mm size lump ore fraction and (-)10 mm size fines fraction will get separated. These will be separately stacked for final dispatch to Barsua Valley Railway siding, after stack sampling. In a similar manner, screened (-)50 mm fines fraction will also be processed in the mobile crushing and screening plant to separate (-)10 mm size fines fraction and (+)10 mm (-)50 mm size lump ore fraction. These separate final fractions will be stacked on the respective ore fines stack and lump ore stack near mobile in-pit crushing and screening plant for final dispatch. After stack sampling, lump ore and iron ore fines will be separately loaded by front end loaders into 16 / 20 t tipper trucks and transported to either Barsua Valley Railway Siding by road for dispatch to steel plants of SAIL or these will be transported by 20 t trucks to Barsua Ore Processing Plant by road for further processing and conveyed through conveyers to the Barsua Railway Siding based on the quality of ore assessed by stack sampling and analysis.

3.5.5 Mineral Transport

In Barsua, ROM ore from the mine pits shall be transported by dumpers to the receiving hopper of the ore processing plant. Beneficiated ore shall be transported by covered conveyors and mechanically loaded onto railway wagons at Barsuan railway siding for dispatch to SAIL's plants.

In case of Taldih, ~1 Mt/yr (Beneficiable Ore) shall be transported by dumpers to Barsua ore processing plant for beneficiation and subsequently loaded on to railway wagons at Barsuan siding. The rest processed direct ore ~1.05 Mt/yr shall be transported by trucks to Barsuan railway siding for loading on to railway wagons.

In case of Kalta, the entire production shall be transported through NH 215 to Roxy siding located on Kiriburu-Bimalagarh-Bondamunda branch line of SE Railways (haulage distance ~22 km). From Roxy, the ore shall be transported by railway wagons to SAIL's plants.

In order to assess the likely impacts, if any, on the local road infrastructure as also the air quality of the area, due to the proposed change in the scope of work, specific environmental studies viz., Traffic Density Study and Air Quality Impact Predication Study have been carried out and incorporated in this Report as **Annexure-1**. It has been observed that adequate road capacity is available to undertake additional traffic load due to ore transportation by road from ML – 130 as proposed. Further, the air quality impact predication also shows the quality of air within the permissible limit

3.6 RAW MATERIALS

The project is for mining & processing of iron ore from the leasehold. Therefore, major resources / materials required for the project are fuels & explosives.

There are three Explosive Magazines two under Barsua, one under Kalta with valid licenses and adequate capacities for storage of different types of explosives. The Explosive Magazine of Barsua which is located near Taldih Block, has sufficient capacity to store and supply explosives for both Barsua and Taldih mines.

In order to supply of fuel to the Dumpers, Shovels and other mining machinery deployed in the Mines, a HSD storage and distribution has been provided at Barsua. The requirement of fuel and explosive at the ML–130 for mining and associated activities are given in the following table (Table-2).

Table 2: Requirement of fuel and explosive at the ML–130

Type	Expected Daily Requirement (TPD)	
	Existing	Proposed
HSD	6.5	21
LSHS	-	119
Explosives	1.43	5.1

3.7 RESOURCE OPTIMIZATION / RECYCLING AND RESOURCE

Slimes generated during wet beneficiation of ore will be further beneficiated in a slime beneficiation plant and the beneficiated slimes will be pelletised or sent to steel plants by blending with high grade fines.

3.8 SITE SERVICES

3.8.1 Water Requirement :

Water requirement for Barsua, Kalta and Taldih mines are given in **Tables 3, 4** and **5** respectively.

Table 3: Water Requirement at Barsua Block Figures are in m^3 /day

Purpose	Average Demand	Peak Demand
Drilling and Spraying	20	25
Dust Suppression	100	120
Equipment Washing	12	15
Mineral beneficiation	11157	11157
Pellet plant	1188	1188
Green Belt	115	120
Drinking at mine site	15	15
Township	1530	1530
Fire Service	-	200
Total	14137	14170 + 200 for fire services

Table 4: Water Requirement at Kalta Block Figures are in m^3 /day

Purpose	Average Demand	Peak Demand
Drilling and Spraying	7	10
Dust Suppression	100	115
Equipment Washing	10	15
Green Belt	27	30
Drinking at mine site	10	15
Township	200	200
Fire Service		60
Total	**354**	**385 + 60 for fire services**

Table 5: Water Requirement at Taldih Mine

Purpose	Average Demand	Peak Demand
Drilling and Spraying	30	35
Dust Suppression	145	170
Equipment Washing	25	30
Green Belt	55	75
Drinking at mine site	15	15
Fire Service		60
Total	270	325 + 60 for fire services
		Figures are in m^3 /day

Part of the water requirement for Barsua shall be met by drawing water from Kurarhi Nala (14050 m^3/day). The balance shall be met by recycling effluents (120 m^3/day). In case of Kalta Mine, the source of water shall be Najkura Nala (355 m^3/day) and recycled water (30 m^3/day). In case of Taldih Mine, the source of water shall be Samaj Nala (300 m^3/day) and recycled water (25 m^3/day).

3.8.2 Power Requirement

Power will be required for some of the mining equipment, beneficiation plant, conveyors, pellet plant, illumination and water supply. Presently the electricity consumption of Barsua and Kalta mines are 15.0 Million kWh/yr and 1.8 million kWh/yr respectively. The required electricity consumption is expected to be 15 Million kWh/yr, 1.8Million kWh/yr and 178.2 Million kWh/yr for Barsua, Kalta and Taldih respectively.

3.8.3 Amenities

The leasehold area hosts statutory facilities *viz.* crèche, canteen, first – aid centre, vocational training centre etc. and also Administration block, servicing and repairing shops, fuel pump station and a medical unit. Residential accommodations for staffs and executives have been provided.

Some of the existing site facilities (main administrative building, central workshop and main store) will be modified or replaced with new facility or will be strengthened.

A residential colony at Tensa and another at Barsua valley exist at present. The colony in Tensa has schools, hospital, bank, post office etc. while the colony at Barsua valley has only residential accommodation and caters to employees working at washing plant, loading plant and water intake pump house. Tensa has a well laid township with 913 Nos. pucca houses and 48 No. temporary accommodation for residential purposes together with other government establishments. In Barsua valley, there is another

township of 318 No. pucca houses, and 95 No. temporary accommodations for residential purpose of the employees working in that area. Kalta has a small township spread over 33.9 ha area outside mining lease. It has 163 pucca houses and 102 temporary units making up a total of 265.

3.9 WASTES

Barsua Block:

Most of the ore bearing area of Barsua Block has little or no top soil left at present. The same has been used earlier for leveling low lands and preparation of parks, playgrounds etc in the township, stabilization of dumps. The small layer of top soil available in virgin parts of Area 5 and Area 3W, is poor in quality and cannot be used for plantation. The same will, therefore, be used for topping aggregates laid on mine roads and filling pot holes**.**

In the Mine, overburden / mineral rejects consist of (i) overburden, mostly laterite and (ii) poor quality low grade ore with (-)57% Fe and more than 6% Al_2O_3. As per Gazette Notification No. T-45031/CGBM/2007 (PF)–dated 16th October, 2009, "Threshold value" of all hematitic ores has been notified, as minimum 45% Fe. Any sub-grade ore containing more than 45% Fe, are required to be separately stacked, if cannot be used at recent. At this Mine, most of the old overburden dumps contain hematitic ores with more than 45% Fe and therefore, these are now re-categorised as "Sub grade ore". There are in all nine such dumps containing about 5.1 Mm^3 of subgrade ore. Most portion these dumps has already been stabilized over the years.

Over the next 5 years i.e. up to 2019-20, 3.49 million m^3 (Area 3 – 2.02 Mm^3 and 1.47 Mm^3) of sub-grade ore is expected to be generated. The entire sub-grade generated from the Area – 5 will be stacked in Area 2 & 4, while the sub-grade generated from Area – 3 will be stored partly on the exhausted portion of the Pit-3 E and partly on the Dump – 9.

To prevent surface erosion from the sub-grade dumps, it has been planned to stabilize these dumps through coir matting and plantation with china grass & bamboo grass. It is proposed to backfill and rehabilitate through plantation the exhausted portion of Area 3 with the wastes to be generated from Quarry 3E & 3W in the first two years i.e. in 2015-16 & 2016-17. A total of 3.83 ha will be backfilled and rehabilitated through planting of 10000 saplings.

Kalta Block:

The entire top soil from Block-A and Block-C of Kalta Block has been removed and used for plantation on the degraded forest land. The meager quantities of sub-soil which is available in the working pits, is removed along with overburden by blasting and Shovel dumper combination. These overburden wastes generated from the Kalta mine consists

of Fe above the threshold value i.e. >45% Fe. So, all these waste dumps are now considered as sub-grades. So there will be no waste generation from the quarry.

There are total of 11nos. of sub-grade stacks in Kalta containing about 0.65 Mm^3. Over the next 5 years 0.283 Mm^3 of sub-grade ore is expected to be generated. There is no barren and suitable area in Kalta A & C block to stack the generated sub grade. So in the ensuing 5 years i.e. up to 2019-20, it has been proposed to stack these sub-grades temporarily within pits. The sub-grade to be generated from Block A during the scheme period is proposed to be stacked within NW side of local area pit having expansion of 4.5 ha and those of Block C within the Kala pahar pit over an area of 3 ha. Both these stacks will have a height of around 4m.

Taldih Block:

Taldih Block has only a very thin layer of lateritic soil in form of over burden. Except a few patches of iron ore outcrop, the entire mineralized area of Taldih hill is covered with laterite, shale and non-mineable transitional ore. These will have to be removed as waste before touching the ore. There are some bare laterite and shale patches also without any vegetation. While opening the proposed Taldih Iron Ore Mine, the top lateritic soil and shrubs etc. will be dozed and heaps of available soil will be made. This soil will then be removed and dumped in the area of site services for using the same for plantation as well as for filling up the depressions along mine roads for leveling the ground. Mostly the waste to be generated from the Taldih deposit will be in form of Overburden of lateritic soil and shale.

Over the next 5 years ~0.68 Mm^3 of over-burden is expected to be generated. The waste generated from mines is proposed to be dumped at flatter slopes at lower level on eastern side. The proposed dumping area will have N-S spread over a distance of 264 m and width of 156 m on the eastern flank of Taldih hill. Overburden from the top laterite benches and waste from other working benches of Taldih Block will be excavated and transported to the proposed waste dump by 25 t dumpers. Waste will be stacked in an area of 4.727 hectares with a dump height of 30 m with 3 Nos. of terrace. The dump will be designed on retreating Pyramid form, so that reclamation can be started, when second terrace of dump is formed.

3.10 EMPLOYMENT

Existing manpower of the project consisting of mainly Barsua and Kalta mine is 1562. After commencement of Taldih block, it will increase to 2364.

4.0 SITE ANALYSIS

4.1 CONNECTIVITY

The lease area can be approached by two separate macadam roads leading to the northern end (Kalta Block) and the southern end (Barsua Block) of ML-130 from Rajamunda on NH 23, connecting Barakot on NH 6 with Rourkela and Ranchi. On western side 35 km long road connects Barsua iron ore mine to Rajamunda. From Rajamunda, NH 215 leads to Panikoili on NH 5 via Kalta Mine, Koira, Barbil and Keonjhar (NH 215 crosses NH 6 at Keonjhar). The distance from Rajamunda to Kalta is ~ 50 km. About 5 km from Rajamunda on NH 215 is a road junction at Lahunipada, from where a 37 km long metalled road leads to Tensa (the entry point of Barsua Iron Mine) via Barsua. The Lahunipada–Barsua–Tensa road proceeds further to towards east a 12 km long road connects Koira on NH 215 located between Kalta and Barbil.

Nearest railhead is at Barsua on Bondamunda–Bimalagarh-Barsuan branch line at a distance of 14 km by road from Barsua mine. A 79 km broad gauge line connects the Barsua valley installations with Bondamunda railway station on Howrah-Nagpur-Mumbai trunk line. The line was set up for transporting iron ore from Barsua valley to Rourkela steel plant. In case of Kalta mines, the nearest railhead is Roxy Siding on Bondamunda–Bimalagarh-Kiriburu branch line at a distance of 22 km by road from Kalta mine

4.2 LAND FORM, LAND USE, OWNERSHIP

Most of the mine lease area falls within Toda Reserved Forest under Bonai Forest Division in Sundargarh District, Odisha. The length of the mine lease area measures 18 km along the ridge of a narrow hill range. The maximum and minimum altitudes of 860 m AMSL and 540 m AMSL within the ML area occur in the southern and northern part of ML area respectively. The slope is steeper in western part in comparison to the eastern part of the mine lease area. The hill range is characterized by a steep western scarp face and milder eastern slope. Several isolated peaks are present in the narrow ridge of the lease hold area, the prominent ones are listed below starting from south.

Dandrahar Pahar	860 m AMSL
Bichakhani Pahar	714 m AMSL
Samalabar Pahar	846 m AMSL
Erua Pahar	762 m AMSL
Karaspani Pahar	802 m AMSL
Majuranchana Pahar	820 m AMSL

The leasehold area has already undergone topographical changes, particularly in Barsua and Kalta areas, due to open cast excavations and external dumping since 1960.

Topographical alterations are visible in Barsua and Kalta whereas Taldih section is yet to be opened. In this hill top mining at plateau, mining excavations have sliced a few small mounds whereas depressions have been created at places. External dumping of overburden materials has also degraded land and landscape. SAIL is operating the mine since 1960 and is the owner of the lease.

4.3 TOPOGRAPHY

The leasehold area lies at the peak of the hill ranges combining Dandrahar Pahar (at 860mRL), Bichakhan Pahar (at 714 mRL), Samalabar Pahar (at 846 mRL), Karasapani Pahar (at 802 mRL) and Majuranachana Pahar (at 820 mRL) from south to north. Most of the deposit area is located in Toda Reserve Forest. Small villages are located in the valley region on either side of the central ridge that hosts the deposit. Average ground level on eastern side valley is 600 mRL whereas on western side plain tract the average ground level slopes from about 400 to 500 mRL

The study area has a distinct dendritic drainage pattern due to hilly terrain. The area forms part of Kurarhi nadi sub-basin which is perennial by nature. The Kurarhinadi originates in the southern part of buffer zone at the foot hills of Dandrahar pahar and travels about 15 km towards NW in Barsua valley and joins river Brahmani at about 200 km from the study area. Samij Nala originates below slope region near Taldih and runs along the core zone ridge, crosses the core zone near Kalta and runs towards western side beyond study circle. Eastern flank waters from the northern parts of the lease (KIM) drain into the south-flowing Najkura Nala which joins the Samij Nala before it turns west. The mine lease area is acting as a water shed at core zone, and the east and west flowing streams join the Kurarhi nadi just 5 km beyond the buffer zone. The Kurarhi nadi flows on gneisses rock beds on its entire course of traverse in the study area. In the eastern side, the ML is characterized by four streams viz. Erua nala, Gera nala, Gerianala and Sirkinala. These streams flow perpendicular to ML whereas the western part is characterized by Samij nallah which flows parallel to the ML. The entire stretch of core zone (ML) is devoid of any perennial stream but few initial stage drainage impressions are observed at mine lease area.

4.4 LAND USE

As indicated earlier, most of the lease area is designated forest land (2347.673 ha out of 2486.383 ha).

Existing land utilization is as follows:

Sl. No.	Type of land use	Area (in ha)
1	Excavated Area (Mining)	279.224
2	Sub grade Ore Dump	100.282
3	Infrastructure	18.420
4	Roads	42.922

5	Green Belt	54.28
6	Undisturbed, Safety zone, etc.	1991.255
	Total	**2486.383**

4.5 EXISTING INFRASTRUCTURE

All the required infrastructure including offices, roads, beneficiation plant, loading facilities, workshops, rest shelters, townships etc. are already existing within Barsua and Kalta blocks. Taldih block is virgin with only a few forest roads. The existing infrastructure at Barsua & Kalta will be suitably augmented to cater to the increased production. At Taldih all necessary infrastructure has to be created including a haul road connecting from mining pit to Tensa Barsua road and from Tensa Barsua road to Barsua Plant.

4.6 SOIL CLASSIFICATION

The soil is lateritic, typical of the area. The thickness of the top soil varies from nil (due to outcropping of iron ore to maximum of 60 cm.

4.7 CLIMATE

The study area lies in tropical region where climate is characterised by very hot summers and cool winters. Summer is typically from March to June when monthly temperature ranges from a maximum of 42°C during daytime to a minimum of 15°C at night. Winter is from November to February when the maximum temperature during day goes up to 33°C and minimum temperature at night becomes as low as 8°C. The average annual rainfall as recorded at IMD observatory at Keonjhar is 1269.1 mm. The Southwest monsoon lasts from mid June to mid September and the area gets more than 80% of the annual rainfall during this period.

4.8 SOCIAL INFRASTRUCTURE AVAILABLE:

The mine has been operating since the 1960s. SAIL, has been providing social amenities for local villagers, most of whom are tribals. SAIL has made arrangements for supply of clean drinking water to nearby villages. The company has built roads, community halls, bus shelters in villages. Village schools have been provided financial and material assistance. Financial grants have been given to village events / festivals. SAIL has a well equipped52 bed hospital at Barsua Township to cater to the needs of the mine's employees and their dependents. There is a18 bedded hospital at Kalta Mine. Serious cases which cannot be treated at the mines' hospitals are referred to SAIL's Rourkela Steel Plant Hospital or elsewhere. The mines hospitals' facilities are also available to local villagers at nominal charge. SAIL's doctors hold free medical camps twice in a week, where medicines are also provide free of charge. SAIL has also been distributing good quality saplings of fruit bearing trees to local villagers free of charge.

5.0 PLANNING BRIEF :

5.1 PLANNING CONCEPT:

Mine lease for ML- 130 was first granted in favour of Rourkela Steel Plant, SAIL on 06.01.1960 for a period of 30 years which expired on 05.01.1990. Subsequently lease renewal applications were made on 30.12.1988 and again on 11.09.2007. The Mining Lease has been renewed and lease deed for the 2nd renewal period has been executed on 13.11.2014 for the period from 06.01.2010 to 05.01.2030.

In order to ensure uninterrupted supply of iron ore to SAIL plants, SAIL had planned to operate the integrated mining complex at ML-130, comprising the three deposits at Barsua, Kalta and Taldih with targeted production level of 8.05 Mt/yr. Total mineable reserves as on 01.04.2015 in the ML – 130 is 368.094 Mt. Mining Plan was approved by IBM for production of 8.05 Mt/yr of iron ore (4.25 Mt/yr from Taldih + 2.5 Mt/yr from Barsua + 1.3 Mt/yr from Kalta), vide letter No. 314(3)/2007-MCCM(CZ)/MP-40 dated 28.07.2008. Environmental Clearance for the proposal for production of 8.05 Mt/y iron ore from ML – 130 was granted by MoEF vide letter no. J-11015/351/2006–IA.II(M) dated 29th October, 2010. Stage–2 Forest Clearance for ML–130 has been granted by MoEFCC vide F.No. 8-90/2011-FC(pt), dated 06.03.2013. Subsequently, permission for tree felling (24.06 ha) has been issued on 28.10.2014. Presently, tree felling is under progress in the 24.06 ha area at the Taldih Block. Further, Stage–1 FC along with Working Permission for the adjoining ML–162 Leases, which is a non-mineralized lease and being used for evacuation of ore from Barsua Mine and infrastructure facilities for the project, has been granted by MoEFCC vide No. 8-18/2014-FC, dated 10.02.2015. The detailed project report is under finalization. Considering the significant delay in obtaining permission for the site clearances and finalization of project report, the envisaged facilities and production from Taldih block could not be commenced. This is resulting in shortage of iron ore supply to the SAIL steel plants.

In order to meet the enhanced demand of iron ore from the already expanded / modernized steel plants i.e Rourkela Steel Plant in particular, it is planned to redistribute iron ore production from the three blocks under ML–130 i.e. Barsua to 3.5 Mt/yr and Kalta to 2.5 Mt/yr and Taldih Block to 2.05 Mt/yr, keeping the total annual production capacity within the approved limit of 8.05 Mt/yr till originally envisaged and approved facilities are established and commissioned, which will take about 5 years. The planned redistribution of production from the mining blocks under ML–130 will also involve change in beneficiation plant capacity of existing Ore Beneficiation Plant at Barsua and mode of ore transport as detailed in para 2.2.

The proposed changes in production configuration from the mining blocks under ML –130 has been incorporated in the Scheme of Mining for the period 2015 - 2020 and has been approved by IBM vide No. MS/FM/36-ORI/BHU/2014-15/1843, dated 04.09.2015.

Presently, the mine development work at Taldih Block is under progress including tree felling. The proposed changes in excavation plan from the mining blocks under ML – 130 is planned to commence from the 2015-16 onwards.

5.2 LAND USE PLANNING:

The existing land use and the land use at the end of the 5th year and at the end of work are as follows:

Sl. No.	Type of land use	Area of land use (in ha)		
		Existing	At End of 5th Year	At End of Work
1	Excavated Area (Mining)	279.224	305.728	1128.574
2	Sub-grade / Waste / Top Dump/ Mineral Storage	100.282	107.229	407.432
3	Infrastructure	18.420	18.434	115.137
4	Roads	42.922	45.562	57.608
5	Safety Zone / Green Belt / Intermediate / Undisturbed	2045.535	2009.430	777.632
	Total	**2486.383**	**2486.383**	**2486.383**

When the reserves are exhausted, the mine will be shut down as per the approved Mine Closure Plan. Some of the infrastructure will be dismantled. Others will be handed over to the State Government or the local village panchayats. The waste dumps will be stabilized and biological reclaimed. Plantations will be carried out on benches and floors of unfilled quarries.

5.3 ASSESSMENT OF INFRASTRUCTURE DEMAND

Most of the infrastructure necessary for mining is already in place. The existing workshop, stores, railway siding, water pump house etc. of Barsuan and Kalta mines (for mining iron ore) are being expanded as part of the mine's expansion plan and will be easily capable of catering to the needs of expansion also. Taldih block will be developed and necessary infrastructure would be created including a haul road connecting from mining pit to Tensa Barsua road and from Tensa Barsua road to Barsua Plant.

The mines will employ 2364 persons. All the officers, highly skilled workers and clerical staff may come from outside. These people will be provided accommodation in the

existing townships at Tensa and Kalta, which have all amenities. Most of the unskilled workers will be local villagers.

5.4 AMENITIES / FACILITIES

The leasehold area hosts statutory facilities *viz.* crèche, canteen, first–aid centre, vocational training centre etc. and also Administration block, servicing and repairing shops, fuel pump station and a medical unit. Residential accommodations for staffs and executives have been provided.

Some of the existing site facilities (main administrative building, central workshop and main store) will be modified or replaced with new facility or will be strengthened.

A residential colony at Tensa and another at Barsua valley exist at present. The colony in Tensa has schools, hospital, bank, post office etc. while the colony at Barsua valley has only residential accommodation and caters to employees working at washing plant, loading plant and water intake pump house. Tensa has a well laid township with 913 Nos. pucca houses and 48 No. temporary accommodation for residential purposes together with other government establishments. In Barsua valley, there is another township of 318 No. pucca houses, and 95 No. temporary accommodations for residential purpose of the employees working in that area. Kalta has a small township spread over 33.9 ha area outside mining lease. It has 163 pucca houses and 102 temporary units making up a total of 265. Tensa township will be expanded and additional 802 nos. of dwelling units will be constructed.

6.0 PROPOSED INFRASTRUCTURE:

The area is well connected by road and rail network. The area is self sufficient to cater the needs of the proposed expansion project, hence, no additional infrastructure, other than some offices and rest shelters for workers, is proposed. Townships with necessary amenities are already in existence. At Taldih all necessary infrastructure will be created including a haul road connecting from mining pit to Tensa Barsua road and from Tensa Barsua road to Barsua Crusher.

Green Belt: Plantation will be done along the periphery of lease boundary. Further plantation will be done all around the infrastructure of the lease area. Sapling will be planted with different species like Neem, Kusum, Jamun, Mahua, Semal, Karanj other locally growing trees etc. Worked out quarries and unutilized sub-grade dumps shall be biologically reclaimed at end of mining as part of the mine closure. Both “Artificial Regeneration and Aided Natural Regeneration” techniques shall be applied for green belt development and eco-restoration of mined out areas.

CSR Activities: SAIL has formulated CSR policy for showing its commitments towards economic as well as social development. The company’s CSR policy recognizes that its

business activities have direct and indirect impact on the society. The policy also aims improving the quality of life of the workforce and their families as well as of the local community and society at large.

In line with CSR policy of SAIL, Raw Materials Division (RMD) has also contributed for social up-liftments of regions in and around its mining complexes. RMD has adopted local villages 'as Model Steel Village' in its mines. The major CSR activities of SAIL, RMD can be grouped as following:

- Free Medical Camp with medicine
- Solar light
- Distribution of School bags and stationary
- Construction of Community Hall
- Approach Road
- Drinking Water supply
- Digging of Tank in villages
- Self employment / Income generation programme

Barsua & Kalta Mines, RMD are committed to ensure better living standards, employment generation and training of local youth on a long term sustainable basis. The expenditure made under CSR activities by Barsua & Kalta Iron Mines during the last 5 years area as follows;

CSR Expenditure made by Barsua & Kalta Mines (Rs. Lakh)

Year	Barsua	Kalta	Total
2010-11	67.75	23.58	91.33
2011-12	111.02	33.58	144.60
2012-13	56.46	29.68	86.14
2013-14	70.78	45.70	116.48
2014-15	44.12	38.85	82.97
Total	**350.13**	**171.39**	**521.52**

7.0 REHABILITATION & RESETTLEMENT (R&R) PLAN :

The project does envisage any leasing or acquisition of private land. Hence there would not be any land oustees who have to be resettled our rehabilitated.

8.0 PROJECT SCHEDULE & COST ESTIMATE

8.1 LIKELY DATE OF START OF CONSTRUCTION AND LIKELY DATE OF COMPLETION:

The Barsua and Kalta Mine are in operation since last five decades and equipped with all the necessary facilities to increase the production to the

envisaged levels. Further, the mine development work at Taldih Block is under progress including tree felling. The proposed of changes in excavation plan from various mining blocks under ML–130 is planned to commence from the 2015-16 onwards. Scheme of Mining for the proposed changes in production from various mining pits under the ML–130 and associated changes in beneficiation and transport system, has already been approved by IBM.

8.2 ESTIMATED PROJECT COST AND ECONOMIC VIABILITY OF THE PROJECT

The total estimated project cost involving facilities at Barsua, Kalta and Taldih is Rs. 5297 Crores. The project economically viable and the payback period is 6.31 years with IRR of 12.85%. Further, the project is very much essential and technical necessity to ensure adequate & uninterrupted supply of iron ore to the modernized / expanded steel plants including the Rourkela Steel Plant, which has already been expanded to 4.5 Mt/yr hot metal production requiring about 8.4 Mt/yr iron ore.

8.2.1 Cost of Mining & Cost of Mineral :

The entire production of iron ore from Barsua-Taldih-Kalta Mines will be consumed in SAIL's own steel plants. Cost of Production of iron ore will claim on transfer price Rs. 1,245 per tonne.

9.0 ANALYSIS OF PROPOSAL (FINAL RECOMMENDATION)

The instant proposal is for amendment of Environmental Clearance granted to the integrated project of ML – 130 vide letter no. J - 11015 / 351 / 2006 – IA.II (M) dated 29th October, 2010 so as to incorporate the modified scope of work as per the details given below;

- Redistribution of ROM production from the mining blocks under the mining lease (ML-130), keeping total production to the approved level of 8.05 Mt/yr
- To operate the existing Barsua Ore Processing Plant at 4.5 Mt/yr by changing critical conveyor belts and operating on three shift basis till Ore Processing Plant for Taldih is established and commissioned which is expected to take about 5 years.
- Permission to transport ore by road till the envisaged LDBC facility at Taldih Block is established & commissioned, which is likely to take about 5 years.
- Specific mention to be made in the EC letter regarding the project area of the integrated project of ML – 130 which includes the adjoining ML – 162, the non-mineralized lease, as also acquired area being used for the infrastructure for the project.

- Updating the lease area of ML – 130 as 2486.383 ha in place of 2486.391 ha mentioned earlier, based on the recent Joint Survey Committee Report of Govt. of Odisha, in the Environmental Clearance letter.

The project will have the following benefits:

- The project will provide increased requirement of iron ore for the SAIL steel plants, which have already been expanded.
- In addition, it will add to revenue generation of the District / State.
- There will be social benefits from the mining operation in the region. The underlying benefits through the proposed project are :
  - Additional direct / indirect employment to the local population of the area.
  - Fulfillment of social sustainable responsibility through promoting and maintaining permanent structure as follows :
    - Facility for village school including classroom, toilet construction, ceiling fan/coolers or books for school library.
    - Vocational training to be provided to the persons for improving their skills in income generation techniques like stitching, Hatchery. Plumber, carpenter, blacksmith etc.
    - Formation of self help groups to develop the saving and helping each other with financial resources instead of going for heavy interest debts.

Considering the above points, the proposed modification in scope of work of the ML – 130 has become necessary.

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Annexure - 1

INTEGRATED BARSUA-TALDIH-KALTA IRON ORE MINING (ML-130 LEASE), BENEFICIATION AND PELLETISATION PLANT PROJECT

Koira Tehsil, District- Sundargarh, Odisha

ENVIRONMENTAL IMPACT IN MODIFIED PRODUCTION, PROCESSING AND TRANSPORTATION ARRANGEMENT

Project Proponent

RAW MATERIALS DIVISION
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CERTIFICATE NO: NABET/EIA/1013/031

INTEGRATED BARSUA-TALDIH-KALTA IRON ORE MINING (ML-130 LEASE), BENEFICIATION AND PELLETISATION PLANT PROJECT

Koira Tehsil, District- Sundargarh, Odisha

ENVIRONMENTAL IMPACT IN MODIFIED PRODUCTION, PROCESSING AND TRANSPORTATION ARRANGEMENT

11.S2.2014.PP2131

October, 2015

Project Proponent

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1.0 BACKGROUND

Steel Authority of India Limited (SAIL), a public sector undertaking under Ministry of Steel, Government of India, is the leading steel maker in the country and is having integrated steel plants at Bokaro, Durgapur, Rourkela, Bhilai, and Burnpur. Also, SAIL has the second largest mining outfit in the country after Coal India Limited. Spread over the states of Jharkhand, Orissa and Chhattisgarh, the mines of SAIL commenced their operations as captive sources of raw materials for its integrated steel plants.

One of the iron ore leases under SAIL is the Barsua-Taldih-Kalta deposit, also known as ML–130, located in Sundargarh District of Odisha. The lease comprises of three blocks, Barsua, Kalta and Taldih. Barsua and Kalta blocks are in operation, whereas Taldih is virgin. Earlier the lease was under Rourkela Steel Plant (RSP) and was RSP's captive iron ore source. However, presently the lease is under the Raw Materials Division (RMD) of SAIL and supplies ore to all steel plants of SAIL.

At present Barsua and Kalta Blocks are in operation with rated capacities of 2.5 million tonnes per year (Mt/yr) and 1.30 Mt/yr respectively. Ore from Barsua mine faces is transported to Barsua Beneficiation Plant and the beneficiated ore is transported by covered conveyors to Barsua railway siding and loaded into railway wagons for despatch. Ore from Kalta is transported by road to Roxy railway siding through National Highway No. 215 over a distance of 22 km. It was planned to develop the Taldih Block with a rated capacity of 4.25 Mt/yr. The ore from Taldih was planned to be brought by long distance belt conveyors to the new beneficiation plant to be set-up at Barsua after primary crushing at Taldih Block. The proposal received Environmental Clearance from Ministry of Environment and Forests vide letter no. J-11015/351/2006–IA.II(M) dated 29th October, 2010 for annual production capacity of 8.05 Mt/ y [with 2.5 Mt/y from Barsua, 4.25 Mt/y from Taldih and 1.3 Mt/y from Kalta] along with setting up of beneficiation plant of 4.25 Mt/yr in addition to the existing plant of 2.5 Mt/yr and setting up of a pelletisation plant of 2 million TPA capacity.

However, during the last five years (i.e. from 2010-11 to 2014-15), the envisaged facilities and production from Taldih block could not be commenced due to significant delay in obtaining permission for forest areas involved in the project and finalization of the project. This is resulting in shortage of iron ore supply to the SAIL steel plants, which have already been expanded. In order to meet the additional iron ore requirement from the plants, SAIL has planned to redistribute the production from the three mining blocks under ML - 130 keeping the overall production remain unchanged at 8.05 Mt/yr from the entire

lease till the complete development of the Taldih Block including LDBC, which may take about 5 years. Also it is being planned to transport ore from Taldih to Barsua Beneficiation Plant and Barsuan Railway Siding by road through existing public road (Barsua – Tensa Road) till the planned LDBC transport is commissioned. The proposed changes in production, beneficiation and transportation arrangements are as follows:

Sr. No	Scope of Work as per EC granted		Modified present proposal	
ROM Production				
1.	Barsua Block	: 2.5 Mt/yr	Barsua Block	: 3.5 Mt/yr
2.	Taldih Block	: 4.25 Mt/yr	Taldih Block	: 2.05 Mt/yr
3.	Kalta Block	: 1.3 Mt/yr	Kalta Block	: 2.5 Mt/yr
	Total	: 8.05 Mt/yr	Total	: 8.05 Mt/yr
Mineral Beneficiation				
4.	Barsua	: 2.5 Mt/yr	Barsua : 4.5 Mt/yr (3.5 Mt/yr feed from Barsua Block and 1 Mt/yr from Taldih Block)	
5.	Taldih	: 4.25 Mt/yr		
	Total	: 6.75 Mt/yr	Total : 4.5 Mt/yr at existing Beneficiation Plant at Barsua	
Transportation				
6.	From Kalta to Roxy siding through NH-215 (1.3 Mt/yr)		From Kalta to Roxy siding through NH-215 (2.5 Mt/yr)	
7.	From Taldih to Barsua by Long Distance Belt Conveyor (4.25 Mt/yr)		From Taldih to Barsua valley by road (~1.05 Mt/yr). From Taldih to Barsua beneficiation plant by road and there from by covered conveyors to railway siding (~1.0 Mt/yr)	
8.	From Barsua to Barsua siding by covered conveyors (2.5 Mt/yr)		From Barsua to Barsua railway siding by covered conveyors (4.5 Mt/yr)	

The above modification in production of iron ore from the mining blocks under ML–130 is incorporated in the Scheme of Mining and the same has been approved by IBM vide No. MS/FM/36-ORI/BHU/2014-15/1843 dated 04.09.2015.

As the above proposed change of scope of work is likely to impact the local road infrastructure as also the air quality of the area, specific environmental studies viz., Traffic Density Study and Air Quality Impact Predication Study have been carried out and presented in the report.

2.0 LOCATION

Barsua-Taldih-Kalta deposit is located in the southern extreme of Bonai iron ore range in Koira tehsil of Bonai subdivision in Sundargarh district of Orissa. ML-130 lease area forms part of Survey of India toposheet no : 73 G/1 and is bounded by latitudes 21°49'25.43800"N to 21°59'50.88516"N and longitudes 85°07'43.73832"E to 85°13'53.48136"E. ML-130 leasehold area measures 2486.383 ha. Out of 2486.383 ha lease area forest land is 2347.673 ha. The leasehold area extends for 18 km, aligned north – south, as a narrow plateau on a hill range. The mines (Barsua, Kalta and proposed Taldih) are in ML-130 lease. Locations of ML-130 is shown in **Drawing No. MEC/G24H/11/S2/1.0.**

The lease area can be approached by two separate macadam roads leading to the northern end (Kalta) and the southern end (Barsua) of ML-130 from Rajamunda on NH 23, connecting Barakot on NH 6 with Rourkela and Ranchi. From Rajamunda, NH 215 leads to Panikoili on NH 5 via Kalta, Koira, Barbil and Keonjhar (NH 215 crosses NH 6 at Keonjhar). The distance from Rajamunda to Kalta is ~50 km. About 5 km from Rajamunda on NH 215 is a road junction at Lahunipada, from where a 37 km long metalled road leads to Tensa (the entry point of Barsua Iron Mine) via Barsua. The Lahunipada–Barsua–Tensa road proceeds further to Towards east a 12 km long road connects Koira on NH-215 located between Kalta and Barbil.

The ore from Barsua Block is evacuated through the Bondamunda – Bimalagarh-Barsuan branch line at a distance of 14 km by road from Barsua. This ~70 km long broad gauge line, which was set up for transporting iron ore from Barsua valley to Rourkela Steel Plant, connects Barsuan with Bondamunda Junction on Howrah-Nagpur-Mumbai trunk line. Rourkela is ~7 km from Bondamunda.

The ore from Kalta Block is transported by dumpers through NH 215 to Roxy railway siding (haulage distance 22 km) on the Bondamunda-Bimalagarh-Kiriburu branch line, where the ore is manually loaded onto railway wagons for despatch.

The despatch route from Kalta and the proposed dispatch route from Taldih are illustrated in **Drawing Nos. MEC/G24H/11/S2/2.1** and **MEC/G24H/11/S2/2.2** respectively.

3.0 PHYSIOGRAPHY

The leasehold area lies at the peak of the hill ranges combining Dandrahar Pahar (at 838 mRL), Bichakhan Pahar (at 714 mRL), Samalabar Pahar (at 846 mRL), Karasapani Pahar (at 802 mRL) and Majuranachana Pahar (at 820 mRL) from south to north. Most of the deposit area is located in Toda Reserve Forest. Small villages are located in the valley region on either side of the central ridge that hosts the deposit. Average ground level on eastern side valley is 600 mRL whereas on western side plain tract the average ground level slopes from about 400 to 500 mRL

There is no national park, biosphere reserve, sanctuary, habitat for migratory birds, archeological site, defense installation, and airports within 10 km of the periphery of the lease area. The area is located in Seismic Zone II and is not a landslide prone zone.

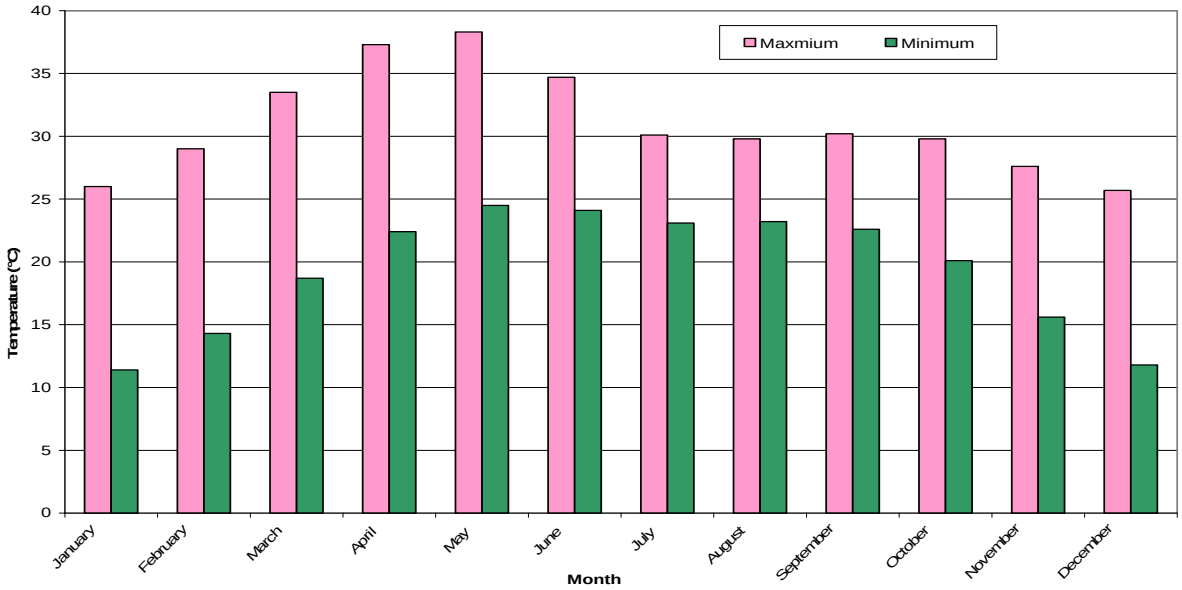
The area has a distinct dendritic drainage pattern due to hilly terrain. The area forms part of Kurarhi nadi sub-basin which is perennial by nature. The Kurarhi nadi originates in the southern part of buffer zone at the foot hills of Dandrahar pahar and travels about 15 km towards NW in Barsua valley and joins river Brahmani at about 200 km from the study area. Samij Nala originates below slope region near Taldih and runs along the core zone ridge, crosses the core zone near Kalta and runs towards western side beyond study circle. Eastern flank waters from the northern parts of the lease (KIM) drain into the south-flowing Najkura Nala which joins the Samij Nala before it turns west. The entire stretch of core zone (ML) is devoid of any perennial stream but few initial stage drainage impressions are observed at mine lease area.

4.0 CLIMATE

The area lies in tropical region where climate is characterized by very hot summers and cool winters. Summer is typically from March to June when monthly temperature ranges from a maximum of 42°C during daytime to a minimum of 15°C at night. Winter is from November to February when the maximum temperature during day goes up to 33°C and minimum temperature at night becomes as low as 8°C. Monthly variation in daily average maximum and minimum temperature as recorded at India Meteorological Department's (IMD) observatory at Keonjhar (about 50 km away) is illustrated as **Fig. 1**.

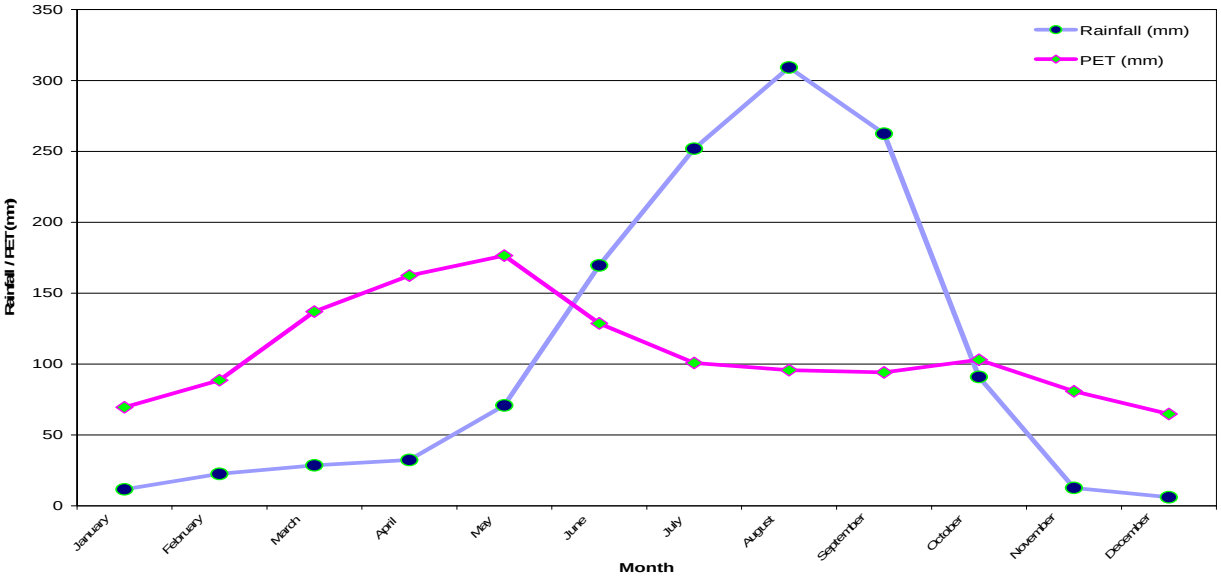
The average annual rainfall as recorded at IMD observatory at Keonjhar is 1269.1 mm. The Southwest monsoon lasts from mid June to mid September and

the area gets more than 80% of the annual rainfall during this period. Monthly Variation in rainfall vis-a-vis potential evapotranspiration as recorded at IMD's observatories at Keonjhar and Chaibasa respectively are illustrated as **Fig. 2**.



Source: Climatological Tables and Observations in India, IMD, Keonjhar.

Fig.1: Monthly variation of daily avg. max. and min. temperature



Source : Climatological Tables and Observations in India, IMD, Keonjhar and Chaibasa

Fig. 2: Monthly variation of Rainfall vis-à-vis Potential evapo-transpiration

As per windrose studied by IMD (at Keonjhar) the predominant wind direction is from West. Local terrain feature may be responsible for local variation in predominant wind direction. Winds had been monitored at Tensa round the clock for the entire summer season (March – May), 2007. The wind rose as monitored is illustrated as **Fig. 3**.

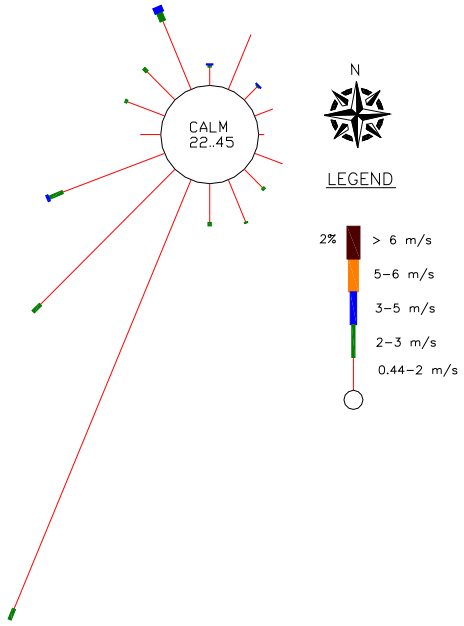


Fig.3: Wind Rose at Tensa Guest House, Summer'2007 (24 hours overall)

5.0 TRAFFIC SURVEY

5.1 EXISTING TRAFFIC ARRANGEMENTS

Ore produced at Barsua Block is transported by dumpers from the mine faces to the receiving hopper of Barsua Plant. Barsua Beneficiation Plant is located on the slope of a hill. The ore is beneficiated as it moves downhill through a series of covered conveyors. The beneficiated ore is mechanically loaded onto railway wagons at Barsua Siding located at the bottom of the hill in Barsua Valley. No ore is transported through public roads.

As mentioned above, screened and crushed ore from Kalta mines is transported by dumpers through NH 215 to Roxy railway siding over a distance of 22 km. This stretch of NH 215 is a two lane road but in poor condition and with ~1.2 m shoulder on each side. Average speed of vehicles on this road is ~ 15–20 km/hr.

5.2 PROPOSED TRAFFIC ARRANGEMENTS

The proposed Taldih Block is linked to Tensa – Barsua Public Road by an haul road of about 2.5 km within the lease area. Further, another road shall be developed from Zero Point on the Tensa – Barsua Road to Barsua Plant with in the lease area of about 4 km.

The existing Tensa-Barsua Road is a 2 lane metalled road with ~1.2 m shoulders on both sides and is in fairly good condition. Just before reaching the outskirts of Barsua, another road, this goes to Rourkela via Lahunipada, branches off from the Tensa – Barsua road.

Ore from Taldih Block (2.05 Mt/yr) will be brought by road by trippers. Out of this 2.05 Mt/yr, ~1.05 Mt/yr will be considered as direct ore and will be transported directly to Barsuan siding through the Tensa Barsua Road over a distance of 11 km for loading into railway wagons for despatch to SAIL's steel plants. The balance ~ 1.0 Mt/yr beneficiable ore will have to be beneficiated at the existing Barsua Beneficiation Plant. This ore will be transported 1.5 km towards Tensa from where the road from Taldih meets the Tensa-Barsuan road. The beneficiable ore will be fed in the receiving hopper of Barsua Beneficiation Plant.

5.3 TRAFFIC DENSITY

In order the assess the existing traffic on various ore transporting roads, traffic survey on 24 hourly basis was conducted at the following 3 locations:

1. NH 215 on the Kalta – Roxy siding stretch.
2. On Tensa - Barsua Road
3. Near Barsua Railway Station.

The above locations are marked in **Drawing No. MEC/G24H/11/S2/01**.

At each of the above locations number of two wheelers (motor-cycles & scooters), light vehicles (cars, jeeps / SUVs) and heavy vehicles (buses and trucks) were passing either way were counted hourly continuously for 24 hours.

The results of the traffic density survey on NH 215, Barsua - Tensa Road and Near Barsua Railway Station are given in **Tables 1, 2** and **3** respectively.

Table 1: Results of Traffic Density Survey on NH 215 between Kalta and Roxy Siding

from 1000 hrs. on 24-10-2013 to 1000 hrs on 25-10-13

Time (Clock Hours)	Towards Roxy Siding				Towards Koira				TOTAL
	2-wheelers	Light Vehicles	Heavy Vehicles	Sub-total	2-wheelers	Light Vehicles	Heavy Vehicles	Sub-total	
1000 - 1100	0	3	21	24	2	4	126	132	156
1100 - 1200	2	1	12	15	0	6	94	100	115
1200 - 1300	7	7	138	152	0	1	111	112	264
1300 - 1400	1	2	140	143	2	6	53	61	204
1400 - 1500	0	5	162	167	1	0	41	42	209
1500 - 1600	4	1	207	212	4	4	55	63	275
1600 - 1700	0	3	54	57	2	4	53	59	116
1700 - 1800	3	3	77	83	0	3	47	50	133
1800 - 1900	0	0	203	203	0	0	47	47	250
1900 - 2000	0	0	63	63	0	0	49	49	112
2000 - 2100	0	0	55	55	0	0	29	29	84
2100 - 2200	0	0	91	91	0	0	58	58	149
2200 - 2300	0	0	60	60	0	0	37	37	97
2300 - 0000	0	0	52	52	0	0	47	47	99
0000 - 0100	0	0	58	58	0	0	41	41	99
0100 - 0200	0	0	55	55	0	0	51	51	106
0200 - 0300	0	0	64	64	0	0	56	56	120
0300 - 0400	0	0	55	55	0	0	98	98	153
0400 - 0500	0	0	85	85	0	0	120	120	205
0500 - 0600	0	0	52	52	0	0	95	95	147
0600 - 0700	6	4	37	47	5	0	69	74	121
0700 - 0800	4	6	59	69	2	5	53	60	129
0800 - 0900	5	1	58	64	8	7	56	71	135
0900 - 1000	5	8	27	40	1	2	30	33	73
TOTAL	**37**	**44**	**1885**	**1966**	**27**	**42**	**1516**	**1585**	**3551**

Table 2: Traffic Density on Tensa - Barsua Road

(from 1400 hrs. on 22-10-2013 to 1400 hrs on 23-10-13)

Time (Clock Hours)	Towards Barsua				Towards Tensa				TOTAL
	2 - wheelers	Light Vehicles	Heavy Vehicles	Sub-total	2 - wheelers	Light Vehicles	Heavy Vehicles	Sub-total	
1400 - 1500	41	57	185	283	37	48	146	231	514
1500 - 1600	26	20	146	192	22	27	85	134	326
1600 - 1700	19	43	85	147	18	32	112	162	309
1700 - 1800	37	22	97	156	4	8	160	172	328
1800 - 1900	2	9	82	93	11	19	65	95	188
1900 - 2000	3	7	96	106	3	12	42	57	163
2000 - 2100	2	11	17	30	0	5	38	43	73
2100 - 2200	7	7	22	36	11	3	19	33	69
2200 - 2300	0	0	0	0	0	10	36	46	46
2300 - 0000	0	0	0	0	0	5	48	53	53
0000 - 0100	0	0	10	10	0	1	18	19	29
0100 - 0200	3	0	35	38	0	0	39	39	77
0200 - 0300	1	0	16	17	3	0	45	48	65
0300 - 0400	0	0	46	46	1	8	84	93	139
0400 - 0500	1	0	102	103	0	3	106	109	212
0500 - 0600	3	7	57	67	1	2	127	130	197
0600 - 0700	8	3	88	99	2	5	203	210	309
0700 - 0800	5	2	80	87	5	6	195	206	293
0800 - 0900	10	7	124	141	4	4	46	54	195
0900 - 1000	17	13	111	141	12	9	156	177	318
1000 - 1100	17	7	98	122	13	8	86	107	229
1100 - 1200	9	6	105	120	18	12	87	117	237
1200 - 1300	5	7	96	108	9	5	76	90	198
1300 - 1400	12	3	145	160	5	8	65	78	238
TOTAL	**228**	**231**	**1843**	**2302**	**179**	**240**	**2084**	**2503**	**4805**

Table 3: Traffic Density on Road to Barsua Rly. Siding

(from 1400 hrs. on 22-10-2013 to 1400 hrs on 23-10-13)

Time (Clock Hours)	Towards Barsua Rly. Siding				Towards Tensa				
	2-wheelers	Light Vehicles	Heavy Vehicles	Sub-total	2-wheelers	Light Vehicles	Heavy Vehicles	Sub-total	TOTAL
1400 - 1500	13	14	62	89	10	10	52	72	161
1500 - 1600	15	20	45	80	15	15	35	65	145
1600 - 1700	16	10	35	61	10	10	45	65	126
1700 - 1800	28	12	87	127	17	7	76	100	227
1800 - 1900	28	9	120	157	15	6	137	158	315
1900 - 2000	6	6	20	32	7	3	50	60	92
2000 - 2100	3	0	20	23	0	3	10	13	36
2100 - 2200	5	4	31	40	4	0	60	64	104
2200 - 2300	2	2	13	17	0	1	27	28	45
2300 - 0000	0	0	20	20	0	0	14	14	34
0000 - 0100	0	0	0	0	0	0	0	0	0
0100 - 0200	0	0	0	0	0	0	0	0	0
0200 - 0300	0	0	0	0	0	0	0	0	0
0300 - 0400	0	3	30	33	0	5	30	35	68
0400 - 0500	1	0	43	44	1	0	12	13	57
0500 - 0600	1	1	56	58	0	2	59	61	119
0600 - 0700	3	2	74	79	5	3	85	93	172
0700 - 0800	12	6	74	92	12	7	85	104	196
0800 - 0900	3	11	119	133	8	20	115	143	276
0900 - 1000	6	4	66	76	5	7	52	64	140
1000 - 1100	18	8	97	123	19	11	63	93	216
1100 - 1200	17	6	89	112	17	17	83	117	229
1200 - 1300	21	7	64	92	8	12	60	80	172
1300 - 1400	7	4	56	67	3	4	56	63	130
TOTAL	**205**	**129**	**1221**	**1555**	**156**	**143**	**1206**	**1505**	**3060**

On NH-215, very few two-wheelers and light vehicles were plying and that too only during daylight hours. Movement of heavy vehicles, mostly trucks, takes place round the clock with hardly any let up during night.

On the Tensa - Barsua Road the number of vehicles plying at night, especially after 10 p.m., was noticeably less as compared to traffic during day time. Between 10 p.m. and 5 a.m. there was hardly any movement of 2-wheelers and light vehicles. Truck movement continued during this period but at a noticeably less rate.

Near the Barsua Railway siding, too the traffic density was noticeably less at night.

Traffic density survey was again conducted on NH – 215 and Tensa – Barsua Road during August, 2015 for three days (23 – 26, August, 2015). The detailed measured traffic densities at the roads are given in the following tables.

Table 4: Traffic Density on Tensa - Barsua Road

(from 0800 hrs. on 23-08-2015 to 0800 hrs on 24-08-15)

	TOWARDS BARSUA				TOWARDS TENSA				Total
TIME	2 - Wheelers	Light Vehicles	Heavy Vehicles	Sub-total	2 - Wheelers	Light Vehicles	Heavy Vehicles	Sub-total	
0800 - 0900	15	8	75	98	20	17	82	119	217
0900 - 1000	11	9	59	79	4	10	75	89	168
1000 - 1100	6	3	23	32	2	6	50	58	90
1100 - 1200	17	11	64	92	12	4	82	98	190
1200 - 1300	18	13	134	165	15	6	72	93	258
1300 - 1400	13	7	67	87	11	15	60	86	173
1400 - 1500	19	11	101	131	10	25	82	117	248
1500 - 1600	18	18	105	141	16	28	70	114	255
1600 - 1700	11	23	116	150	4	23	61	88	238
1700 - 1800	12	28	85	125	12	35	78	125	250
1800 - 1900	6	14	41	61	5	25	71	101	162
1900 - 2000	4	8	77	89	1	1	11	13	102
2000 - 2100	10	11	50	71	12	10	112	134	205
2100 - 2200	2	1	35	38	6	8	42	56	94
2200 - 2300	3	1	27	31	3	0	37	40	71
2300 - 0000	2	1	39	42	1	2	19	22	64
0000 - 0100	0	1	27	28	0	0	28	28	56
0100 - 0200	0	0	23	23	1	0	20	21	44
0200 - 0300	0	0	22	22	0	0	28	28	50
0300 - 0400	0	0	40	40	2	1	37	40	80
0400 - 0500	0	0	85	85	1	0	86	87	172
0500 - 0600	4	3	91	98	3	0	52	55	153
0600 - 0700	6	2	133	141	9	5	142	156	297
0700 - 0800	6	11	142	159	12	6	128	146	305
Total	**183**	**184**	**1661**	**2028**	**162**	**227**	**1525**	**1914**	**3942**

Table 5: Traffic Density on Tensa - Barsua Road

(from 0800 hrs. on 24-08-2015 to 0800 hrs on 25-08-15)

	TOWARDS BARSUA				TOWARDS TENSA				
TIME	2 - Wheelers	Light Vehicles	Heavy Vehicles	Sub-total	2 - Wheelers	Light Vehicles	Heavy Vehicles	Sub-total	Total
0800 - 0900	10	5	75	90	6	10	95	111	201
0900 - 1000	18	4	130	152	18	7	106	131	283
1000 - 1100	8	1	102	111	3	6	76	85	196
1100 - 1200	13	6	116	135	6	7	94	107	242
1200 - 1300	5	4	121	130	5	6	88	99	229
1300 - 1400	7	6	126	139	9	8	92	109	248
1400 - 1500	6	9	159	174	8	4	145	157	331
1500 - 1600	8	1	109	118	2	3	79	84	202
1600 - 1700	1	2	106	109	2	2	102	106	215
1700 - 1800	2	0	126	128	1	2	112	115	243
1800 - 1900	10	5	75	90	6	10	95	111	201
1900 - 2000	18	4	130	152	18	7	106	131	283
2000 - 2100	0	2	90	92	0	1	74	75	167
2100 - 2200	0	2	114	116	0	0	87	87	203
2200 - 2300	0	2	75	77	0	1	56	57	134
2300 - 0000	0	0	64	64	0	1	49	50	114
0000 - 0100	0	1	43	44	0	0	37	37	81
0100 - 0200	0	2	35	37	0	1	28	29	66
0200 - 0300	0	1	64	65	0	1	73	74	139
0300 - 0400	0	0	36	36	0	0	37	37	73
0400 - 0500	0	2	61	63	0	1	43	44	107
0500 - 0600	0	1	77	78	1	1	62	64	142
0600 - 0700	0	2	72	74	2	2	67	71	145
0700 - 0800	3	2	89	94	3	4	73	80	174
Total	**109**	**64**	**2195**	**2368**	**90**	**85**	**1876**	**2051**	**4419**

Table 6: Traffic Density on Tensa - Barsua Road

(from 0800 hrs. on 25-08-2015 to 0800 hrs on 26-08-15)

	TOWARDS BARSUA				TOWARDS TENSA				
TIME	2 - Wheelers	Light Vehicles	Heavy Vehicles	Sub-total	2 - Wheelers	Light Vehicles	Heavy Vehicles	Sub-total	Total
0800 - 0900	3	4	107	114	2	2	81	85	199
0900 - 1000	1	4	83	88	1	2	91	94	182
1000 - 1100	3	5	112	120	5	4	84	93	213
1100 - 1200	4	5	97	106	5	3	88	96	202
1200 - 1300	5	3	70	78	7	5	63	75	153
1300 - 1400	4	3	117	124	3	7	83	93	217
1400 - 1500	2	4	112	118	5	2	73	80	198
1500 - 1600	5	8	92	105	1	3	87	91	196
1600 - 1700	9	11	94	114	4	5	125	134	248
1700 - 1800	4	2	48	54	3	4	72	79	133
1800 - 1900	5	3	68	76	2	5	53	60	136
1900 - 2000	1	4	56	61	0	6	88	94	155
2000 - 2100	4	3	117	124	2	5	98	105	229
2100 - 2200	2	4	76	82	4	8	86	98	180
2200 - 2300	0	2	75	77	0	0	92	92	169
2300 - 0000	0	0	64	64	1	3	75	79	143
0000 - 0100	0	1	43	44	0	2	71	73	117
0100 - 0200	0	2	35	37	0	0	52	52	89
0200 - 0300	0	1	64	65	0	0	39	39	104
0300 - 0400	0	0	36	36	0	2	51	53	89
0400 - 0500	0	2	61	63	3	1	86	90	153
0500 - 0600	0	1	77	78	3	4	132	139	217
0600 - 0700	0	2	72	74	5	7	93	105	179
0700 - 0800	3	2	89	94	6	9	87	102	196
Total	**55**	**76**	**1865**	**1996**	**62**	**89**	**1950**	**2101**	**4097**

Table 7: Traffic Density Survey on NH 215 between Kalta and Roxy Siding

from 1000 hrs. on 23-10-2013 to 1000 hrs on 24-10-13

	TOWARDS KALTA				TOWARDS ROXY SIDING				Total
TIME	2 - Wheelers	Light Vehicles	Heavy Vehicles	Sub-total	2 - Wheelers	Light Vehicles	Heavy Vehicles	Sub-total	
1000 - 1100	5	2	46	53	13	3	58	74	127
1100 - 1200	0	3	53	56	7	1	66	74	130
1200 - 1300	5	3	45	53	4	3	64	71	124
1300 - 1400	6	3	36	45	7	2	49	58	103
1400 - 1500	3	2	33	38	3	1	36	40	78
1500 - 1600	5	3	37	45	7	3	42	52	97
1600 - 1700	4	9	41	54	9	11	53	73	127
1700 - 1800	6	6	44	56	6	5	61	72	128
1800 - 1900	3	5	33	41	4	4	45	53	94
1900 - 2000	4	2	36	42	1	2	33	36	78
2000 - 2100	2	4	31	37	0	1	26	27	64
2100 - 2200	1	2	27	30	0	0	43	43	73
2200 - 2300	0	2	39	41	0	0	15	15	56
2300 - 0000	0	1	17	18	0	0	12	12	30
0000 - 0100	0	0	15	15	0	0	7	7	22
0100 - 0200	0	0	6	6	0	0	3	3	9
0200 - 0300	0	0	4	4	0	0	1	1	5
0300 - 0400	0	0	13	13	0	0	21	21	34
0400 - 0500	0	1	31	32	0	0	45	45	77
0500 - 0600	0	0	37	37	0	0	46	46	83
0600 - 0700	2	3	43	48	1	1	53	55	103
0700 - 0800	1	5	39	45	3	3	43	49	94
0800 - 0900	3	2	36	41	5	4	27	36	77
0900 - 1000	2	3	48	53	2	3	47	52	105
Total	**52**	**61**	**790**	**903**	**72**	**47**	**896**	**1015**	**1918**

Table 8: Traffic Density Survey on NH 215 between Kalta and Roxy Siding

from 1000 hrs. on 24-10-2013 to 1000 hrs on 25-10-13

	TOWARDS KALTA				TOWARDS ROXY SIDING				Total
TIME	2 - Wheelers	Light Vehicles	Heavy Vehicles	Sub-total	2 - Wheelers	Light Vehicles	Heavy Vehicles	Sub-total	
1000 - 1100	2	4	57	63	0	2	35	37	100
1100 - 1200	1	2	48	51	1	3	53	57	108
1200 - 1300	0	3	39	42	0	2	48	50	92
1300 - 1400	0	0	32	32	0	0	56	56	88
1400 - 1500	0	1	37	38	0	2	59	61	99
1500 - 1600	0	2	41	43	0	1	45	46	89
1600 - 1700	2	5	32	39	1	3	43	47	86
1700 - 1800	0	2	46	48	2	2	46	50	98
1800 - 1900	3	3	33	39	0	0	44	44	83
1900 - 2000	0	3	28	31	3	4	38	45	76
2000 - 2100	1	2	30	33	1	2	42	45	78
2100 - 2200	0	0	23	23	0	0	30	30	53
2200 - 2300	1	4	45	50	3	2	18	23	73
2300 - 0000	0	3	34	37	1	4	21	26	63
0000 - 0100	2	2	21	25	3	2	12	17	42
0100 - 0200	0	0	18	18	1	0	9	10	28
0200 - 0300	0	0	23	23	0	1	22	23	46
0300 - 0400	0	0	34	34	0	2	32	34	68
0400 - 0500	2	0	45	47	0	0	56	56	103
0500 - 0600	4	2	51	57	0	0	67	67	124
0600 - 0700	3	7	48	58	0	0	79	79	137
0700 - 0800	5	6	33	44	7	11	83	101	145
0800 - 0900	7	11	32	50	12	6	77	95	145
0900 - 1000	10	9	59	78	14	9	55	78	156
Total	**43**	**71**	**889**	**1003**	**49**	**58**	**1070**	**1177**	**2180**

Table 9: Traffic Density Survey on NH 215 between Kalta and Roxy Siding

from 1000 hrs. on 25-10-2013 to 1000 hrs on 26-10-13

	TOWARDS KALTA				TOWARDS ROXY SIDING				Total
TIME	2 - Wheelers	Light Vehicles	Heavy Vehicles	Sub-total	2 - Wheelers	Light Vehicles	Heavy Vehicles	Sub-total	
1000 - 1100	3	8	62	73	4	9	42	55	128
1100 - 1200	0	12	61	73	9	17	61	87	160
1200 - 1300	0	17	35	52	11	22	54	87	139
1300 - 1400	0	27	45	72	14	18	78	110	182
1400 - 1500	1	34	52	87	22	24	76	122	209
1500 - 1600	0	22	49	71	15	9	41	65	136
1600 - 1700	0	24	66	90	9	14	48	71	161
1700 - 1800	6	29	61	96	11	12	43	66	162
1800 - 1900	6	33	42	81	6	20	49	75	156
1900 - 2000	13	30	52	95	12	17	67	96	191
2000 - 2100	17	22	67	106	4	23	54	81	187
2100 - 2200	24	26	44	94	8	19	35	62	156
2200 - 2300	0	2	50	52	2	3	29	34	86
2300 - 0000	1	5	41	47	0	6	32	38	85
0000 - 0100	0	0	27	27	0	0	19	19	46
0100 - 0200	1	0	28	29	0	0	11	11	40
0200 - 0300	0	1	17	18	0	0	34	34	52
0300 - 0400	0	0	45	45	0	0	43	43	88
0400 - 0500	0	0	57	57	1	1	70	72	129
0500 - 0600	2	0	66	68	3	3	72	78	146
0600 - 0700	5	4	60	69	2	5	88	95	164
0700 - 0800	8	8	44	60	13	16	85	114	174
0800 - 0900	12	16	38	66	18	24	91	133	199
0900 - 1000	17	15	49	81	22	19	41	82	163
Total	**116**	**335**	**1158**	**1609**	**186**	**281**	**1263**	**1730**	**3339**

Summarised traffic density data are given in the following tables.

Table 10: Summarized traffic data : Barsua – Tensa Road

Date	Total Traffic on both ways (nos.)				Traffic in PCU/day
	Two Wheelers	Light Vehicles	Heavy Vehicles	Total	
23-24, August, 2015	345	411	3186	3942	10142
24-25, August, 2015	199	149	4071	4419	12462
25-26, August, 2015	117	165	3815	4097	11669
Average:	**220**	**242**	**3691**	**4153**	**11424**

Table 11: Summarized traffic data : NH – 215 (Kalta – Roxy Siding Road)

Date	Total Traffic on both ways (nos.)				Traffic in PCU/day
	Two Wheelers	Light Vehicles	Heavy Vehicles	Total	
23-24, August, 2015	124	108	1686	1918	5228
24-25, August, 2015	92	129	1959	2180	6052
25-26, August, 2015	302	616	2421	3339	8030
Average:	**173**	**284**	**2022**	**2479**	**6437**

It has been observed from the above data that the traffic density of heavy vehicles in 2015 is reduced by about 13% in Barsua -Tensa Road and about 65 % in NH-215 as compared the traffic in 2007. The change in heavy vehicle traffic in these roads are shown in the following figures.

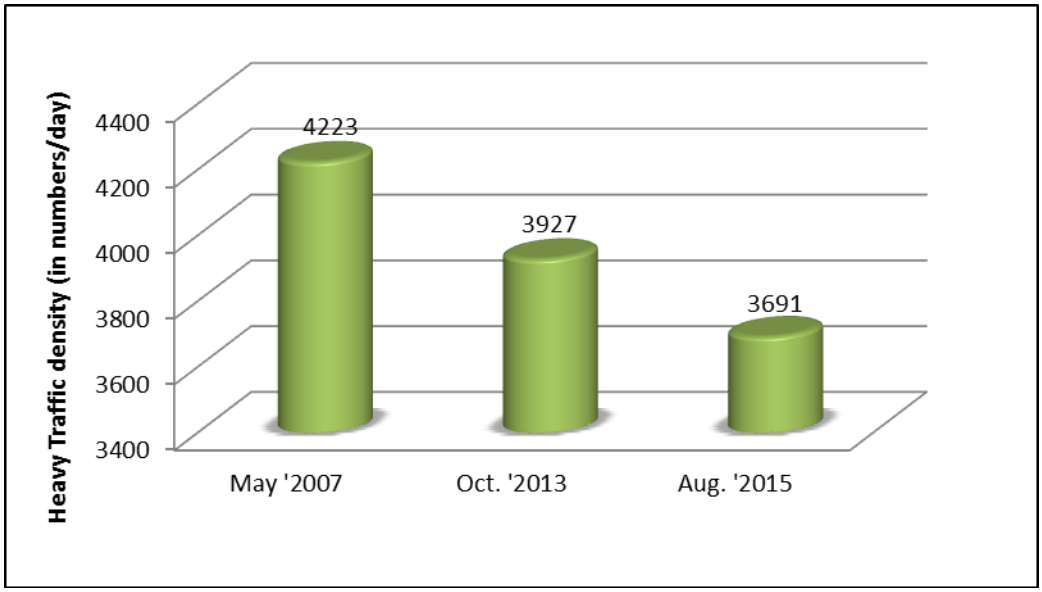


Fig.4: Traffic Density of Heavy vehicles on Barsua – Tensa Road (Both ways)

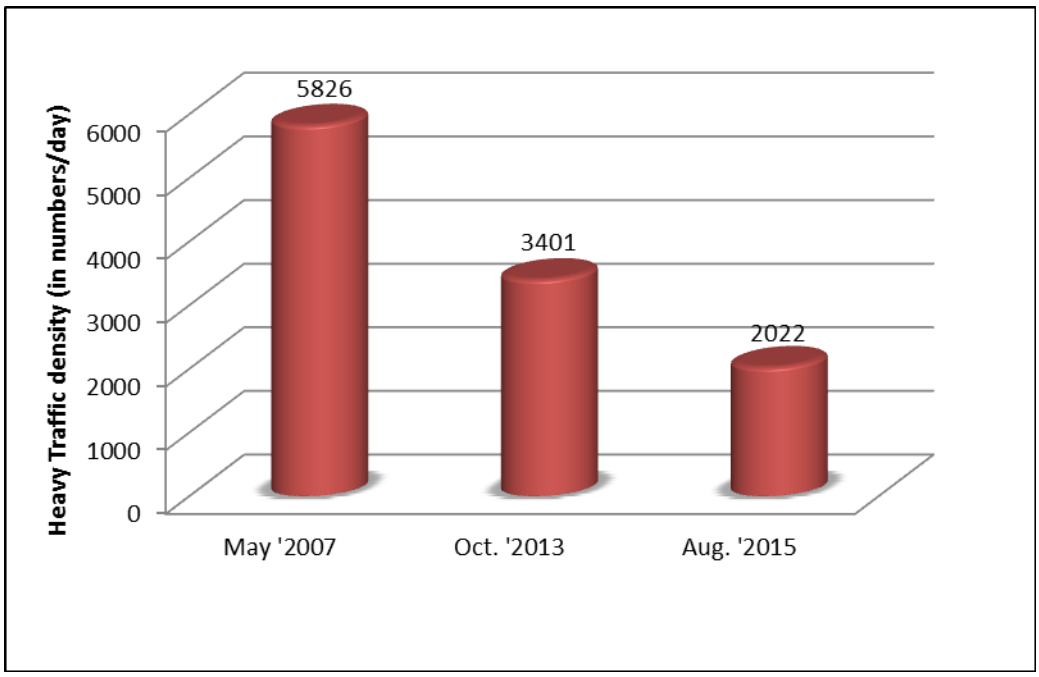


Fig.5: Traffic Density of Heavy vehicles on NH-215 at Kalta – Roxy Road (Both ways)

It has also been observed that the total traffic in terms of Pasenger Car Units (PCU) has also been reduced over the priod. Time series data on traffic density in terms of PCUs in perticular stretch of Barsua-Tensa Road and on NH-215 is depicted in the following graphs.

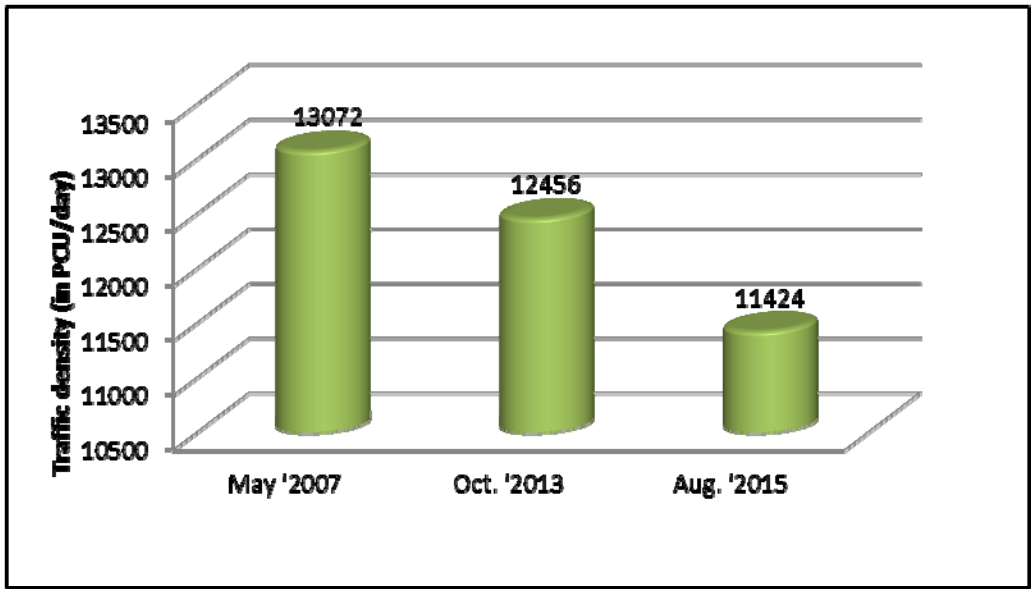


Fig.6: Traffic Density on Barsua – Tensa Road (Both ways)

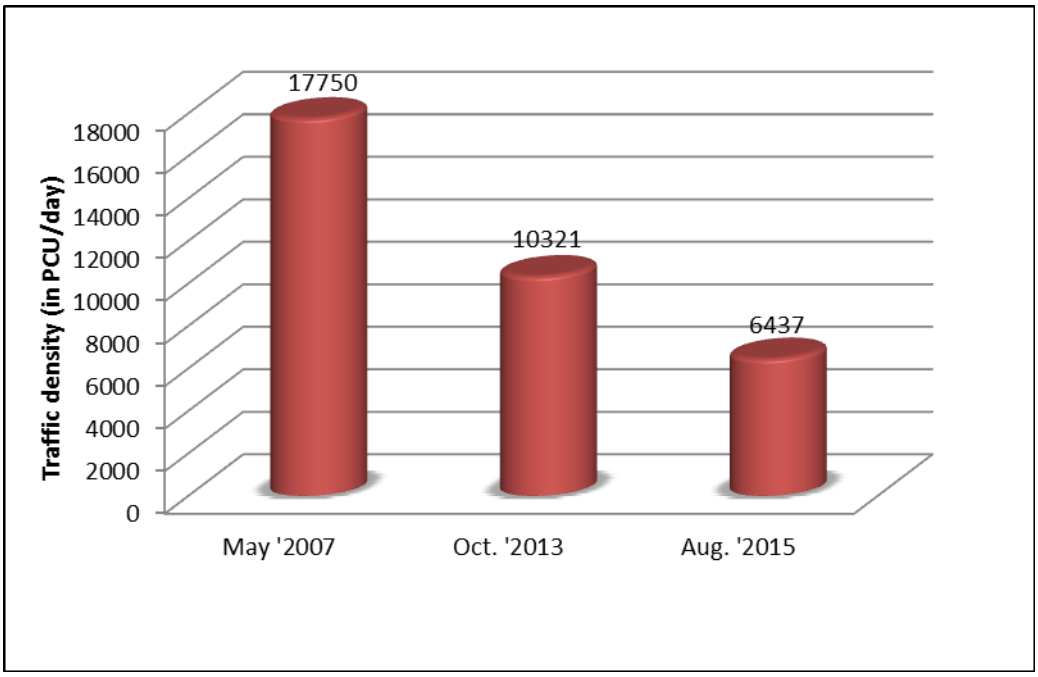


Fig.7: Traffic Density on NH-215 at Kalta – Roxy Road

It can be observed from the above graphs, that the traffic density at strategic locations on 'Barsua-Tensa Road' and on 'NH-215' is depicting a reducing trend. This may be due to suspension of mining operations at some of the mines as well as prohibition on illegal mining in the state of Odisha.

5.4 POSSIBLITY OF INCREASING TRUCK TRAFFIC FROM SAIL'S MINES

As per IRC:64 "Guidelines for Capacity of Roads in Rural Areas, the recommended design service volume for two lane roads on plain terrain is 15000 Passenger Car Units (PCUs) per day and the reduction factor for shoulder width of 1.2 m is 0.92. Accordingly, the recommended design service volume comes down to 13800 PCUs/day.

The heavy vehicle traffic on NH-215 (Kalta-Roxy) has been reduced from 5826 nos./day during 2007 to 3401 nos./day in 2013 and 2022 nos./day in 2015. The proposed additional traffic load from Kalta is expected to be about 444 trucks/day, hence the total expected heavy vehicle traffic on Kalta-Roxy stretch will be about 2466 nos./ day, which is about 42 % of the traffic load on the road during 2007.

The traffic volume on NH 215 was 10321 PCUs during October, 2013 {64 2-wheelers + 86 passenger cars + 3470 trucks; one truck is equivalent to 3 PCUs, one two-wheeler is equivalent to 0.5 PCU) during October, 2013. The traffic density on the NH – 215 has come down to 6437 PCU during August, 2015. Further, the NH – 215 is under expansion to four way lane, which is under progress. Even cosnidering the maximum existing traffic

desnity of 8030 PCU/day (on 25-26, August, 2015), the road has addtional capacity of of 5770 PCUs/day i.e. 1923 trucks/day can ply on the Kalta – Roxy stretch of NH 215. Therefore even if Kalta Mine's capacity is raised by 1.2 Mt/yr, there is still spare capacity on this road (increasing despatch by 1.2 Mt/yr will require despatch of ~222 nos. 18 t trucks / day i.e. 1332 PCU/day).

As regards the Tensa - Barsua road the heavy vehicle traffic on the road has been reduced from 4223 nos./day during 2007 to 3927 nos./day in 2013 and 3691 nos./day in 2015. The proposed additional traffic load from Taldih Block on the road is expected to be about 375 trucks/day, hence the total expected heavy vehicle traffic on Tensa - Barsua road shall be about 4061 nos./ day, which is even less than the heavy vehicle traffic on the road during 2007.

Further, the daily traffic volume on the Tensa – Brsua road in October, 2013 was 407 numbers 2-wheelers + 471 passenger cars + 3929 heavy vehicles i.e. 12456 PCUs/day. The traffic density on the road has come down to 11,424 PCU during August, 2015. Even cosnidering the maximum existing traffic desnity of 12462 PCU/day (on 25-26, August, 2015), the road has addtional capacity of of 1338 PCUs/day i.e. 446 trucks/day can ply on the road. Therefore another 223 trucks can be despatched daily. If 18 t trucks are used daily additional tonnage which can be desptached is 4000 t i.e. 1.2 Mt/yr. Therefore, the road can take care of proposed road transport of about 1 million Tonnes per annum from Taldih mine for temporary period of about 5 years i.e. till the envisaged Conveyor facility is estblished & commissioned.

On the road near Barsuan siding the daily traffic volume is 361 numbers 2-wheelers + 272 passenger cars + 2427 heavy vehicles i.e. 7733 PCUs/day. There is sufficient spare capacity.

6.0 ENVIRONMENTAL IMPLICATIONS OF CHANGED SCENARIO

The following environmental attributes may be affected due to changes in production planning:

1. Land use
2. Ecology
3. Emmissions and air quality

Production from the virgin Taldih deposit will be reduced to less than half of what was originally planned. Thus less forest area will be cleared for development of new quarries and external dumps. The production from Barsua and Kalta blocks will be increased but

since these blocks are already well developed, much less virgin forest land will have to be diverted for expansion of quarries and dumps.

In any open cast mine, quarries, external waste dumps and unmetalled haul roads are the biggest sources of pollution on account of emissions of fugitive dust.

The present ambient air quality level:

The existing ambient air quality data monitored during Summer, 2015 in and around ML-130 is shown below:

Table 12: Air quality data - Tantra Village; Summer 2015 *(Fig. in µg/m^3)*

S. No	Date	PM_{10}	$PM_{2.5}$	SO_2	NO_x
1	26.03.2015	57	22	9.0	12.0
2	06.04.2015	61	24	4.5	18.5
3	09.04.2015	62	22	4.4	16.6
4	13.04.2015	66	28	4.2	17.2
5	17.04.2015	58	23	5	21.4
6	20.04.2015	60	22	5.2	22.8
7	23.04.2015	67	27	5.5	23.5
8	27.04.2015	55	22	8.0	12.0
9	04.05.2015	66	29	5.5	22.8
10	07.05.2015	59	21	5	20.4
11	16.05.2015	53	21	9	11
12	18.05.2015	62	34	4	16.8
13	21.05.2015	66	37	4.2	17.2
14	25.05.2015	58	26	5.2	21.5
15	28.05.2015	63	27	4.5	18.4
	Max.	**67.0**	**37.0**	**9.0**	**23.5**
	AVG.	**60.9**	**25.7**	**5.5**	**18.1**
	C_{98}	**66.72**	**36.16**	**9.0**	**23.304**

Table 13: Air quality data - Tensa township; Summer 2015 *(Fig. in µg/m^3)*

S. No	Date	PM_{10}	$PM_{2.5}$	SO_2	NO_x
1	22.03.2015	66	26	8.0	13.0
2	07.04.2015	68	28	5	22.4
3	10.04.2015	71	34	4.8	20.4
4	14.04.2015	70	33	5.4	22.3
5	17.04.2015	65	29	5.1	21.8
6	21.04.2015	72	38	5.6	23.4
7	24.04.2015	68	36	5.2	21.2

8	26.04.2015	56	23	8.0	11.0
9	05.05.2015	67	38	4.8	19.6
10	08.05.2015	62	29	5.2	21.5
11	13.05.2015	58	24	8	12
12	19.05.2015	70	32	5.5	23.2
13	22.05.2015	59	27	5.4	22.3
14	26.05.2015	69	33	5.6	23
15	29.05.2015	71	32	5.2	22.4
	MAX	**72.0**	**38.0**	**8.0**	**23.4**
	AVG	**66.1**	**30.8**	**5.8**	**20.0**
	C_{98}	**71.7**	**38.0**	**8.0**	**23.3**

Table 14: Air quality data - Barsua Valley; Summer 2015 *(Fig. in µg/m^3)*

S. No	Date	PM_{10}	$PM_{2.5}$	SO_2	NO_x
1	22.03.2015	61	23	11.0	15.0
2	07.04.2015	67	26	4.7	21.8
3	10.04.2015	72	28	5.1	22.6
4	14.04.2015	61	22	4.8	21.2
5	17.04.2015	58	25	4.9	21.6
6	21.04.2015	73	32	4.8	20.4
7	22.04.2015	57	26	10.0	14.0
8	24.04.2015	72	35	4.6	19.4
9	05.05.2015	68	37	4.6	19.2
10	08.05.2015	75	38	4.8	20.4
11	13.05.2015	56	23	9.0	13.0
12	19.05.2015	61	23	5	21.6
13	22.05.2015	67	29	5.4	22.5
14	26.05.2015	71	33	5.4	22.6
15	29.05.2015	67	32	5.2	21.8
	MAX	**75.0**	**38.0**	**11.0**	**22.6**
	AVERAGE	**65.7**	**28.8**	**6.0**	**19.8**
	C_{98}	**74.4**	**37.7**	**10.2**	**22.6**

Table15: Air quality data - Kalta township; Summer 2015 *(Fig. in µg/m^3)*

S. No	Date	PM_{10}	$PM_{2.5}$	SO_2	NO_x
1	24.03.2015	64	29	14.0	18.0
2	10.04.2015	76	36	4.9	21.8
3	11.04.2015	72	38	5	21.8
4	13.04.2015	77	37	5.1	22.6

5	20.04.2015	69	38	4.8	21.2
6	22.04.2015	71	40	4.9	21.6
7	24.04.2015	54	22	11	15
8	27.04.2015	66	37	4.8	20.4
9	08.05.2015	72	36	4.6	19.6
10	09.05.2015	77	39	4.8	20.2
11	14.05.2013	59	23	12	16
12	20.05.2015	68	38	5.2	22.4
13	23.05.2015	78	37	4.7	20.8
14	27.05.2015	75	38	4.5	19.8
15	28.05.2015	70	39	5	21.6
	MAX	**78.0**	**40.0**	**14.0**	**22.6**
	AVERAGE	**69.9**	**35.1**	**6.4**	**20.2**
	C_{98}	**77.7**	**39.7**	**13.4**	**22.5**

Further, in order to check the environmental impact of the proposed alteration in production and transportation of iron ore on air pollution, air quality modelling has been carried out for PM_{10} keeping in view the proposed altered scenario. The levels of PM_{10} at nearby villages during Summer Season, 2015 are given in **Table 16**.

Table 16: PM_{10} Levels in Ambient Air in Villages around ML-130

Sl. No.	Location	Distance from lease boundary	PM_{10} (C_{98}) ($\mu g/m^3$)
1.	Tantara	* Core zone	66.72
2.	Kalta	0.15 km	71.7
3.	Tensa	1.00 km	74.4
4.	Barsua valley	1.75 km	77.7

** About 1 km from Taldih block*

6.1 Prediction of Changes in Air Quality

In order to assess the change in air quality, Air Quality Impact Prediction Models have been used to predict maximum GLCs of PM10, NOx and SO_2 considering the proposed in changes production from the mining blocks under the ML – 130 and transportation ore through roads. The details of the expected GLCs of PM10, Oxides of Nitrogen and Sulphur Dioxide are discussed in the following sections.

6.2 Prediction of Changes in Fugitive Dust (PM_{10}) Levels :

The fugitive dust emissions have been estimated using the methodologies outlined in the AP-42 (USEPA) and National Pollutant Inventory (NPI) Emission Estimation Technique Manual (EET) for Mining Version 2.3 (DEH 2001) (Australia)

For modeling, following sources were considered to estimate the pollution load for revised condition.

- Drilling
- Blasting of waste material and ore
- Loading of material into haul trucks
- Vehicle (wheel) generated dust
- Truck dumping of waste material and ore
- Bulldozer operations
- Wind erosion from waste and product stockpiles and unsealed areas
- Fugitive emissions from crushing and screening

Dust estimate summary

Activity wise dust emissions during excavation of ore have been estimated. A summary of the dust emission rates for each source identified at proposed mine are summarized below in **Table 17**.

Table 17: Summary of dust estimations

Sl. No	Source	Estimated emissions
1	Waste dumps	0.00014997 $g/m^2/s$
2	Quarries	0.00007503 $g/m^2/s$
3	Crushers	0.01142 $g/m^2/s$
4	From haul roads	0.01469 g/s

Modeling Methodology

Air quality impacts from the altered proposed mining and processing operations have been assessed using the ISC3 computer dispersion model, developed by US EPA. Using the model, maximum 24-hour ground-level PM10 concentrations at the nearest sensitive receiver to the site has been predicted.

ISC3 model is designed to predict ground-level concentrations or dry deposition of pollutants emitted from one or more sources, which may be stacks, area sources, volume sources, open pits or any combination of these. ISC3 is essentially a statistical Gaussian plume model that requires a time series of both meteorological and source emission data.

For the present study all queries have been modeled using Open pit option of ISC3. Also all waste dumps have been considered as area sources.

Grid System

ISC3 can calculate concentrations both on a set grid (typically Cartesian) or at specified locations. In the present study the model was configured to predict the ground-level concentrations on discrete receptors. This grid approach was chosen to restrict the duration of model runs.

Meteorological Data

So that comparison of the proposed altered scenario with production and transportation scenario becomes possible, the earlier meteorological data generated at Barsua during Summer 2007 has been used, predominant wind direction was from South-south-western (SSW) . During day time predominant wind direction was found to be SSW (prevailing for about 25.55% of the time) followed by WSW (12.08%) and SW (9.86%). Calm conditions prevailed for 14.46% of the time. During night time wind direction was found to be SSW (32.49%) followed by SW (14.71%). Calm condition prevailed for 30.44 % of the time. Overall (24 hours) also the predominant wind direction was SSW (29.02%), followed by SW (12.29%) and WSW (7.70%). Calm condition prevailed for 22.45% of the time.

A time series air quality meteorological data file, containing hourly averaged values of (i) Wind speed and direction; (ii) Ambient air temperature (iii) Pasquill- Gifford stability class; and (iv) Atmospheric mixing height were required for the for the modeling studies. The wind speed, direction and temperature data were obtained from meteorological measurements recorded at site. Atmospheric stability categories were determined using the net radiation index method, or Turner's method as described in USEPA (1998). This method estimates stability from solar altitude, wind speed and cloud observations. Mixing heights were collected from the CPCB publication on "spatial variations of mixing heights over India". Stability, wind speeds, and mixing heights on the day when maximum GLC occurred is given below (**Table 18**)

Table 18: Meteorological data used for GLC prediction

Hour	Wind dir. (from)	Wind speed (m/s)	Temp. (°K)	Stability class	Mixing height (m)
01	SSW	0.89	294.5	6	100.0
02	SSW	1.17	294.0	6	100.3
03	SSW	1.19	294.0	6	200.6
04	SSW	1.44	294.0	6	248.9
05	SSW	1.39	294.0	5	380.2
06	SSW	1.75	294.0	4	411.5
07	SSW	1.25	294.5	3	542.8
08	SSW	1.14	296.5	3	974.1
09	WSW	1.42	298.5	2	995.5

Hour	Wind dir. (from)	Wind speed (m/s)	Temp. (°K)	Stability class	Mixing height (m)
10	W	0.87	300.0	2	1036.8
11	SW	1.45	301.0	1	1068.1
12	SSW	1.47	303.0	1	1099.4
13	W	1.17	306.5	1	1130.7
14	SW	1.54	307.0	2	1162.0
15	SW	1.32	305.5	3	1162.0
16	SW	1.43	303.0	3	1162.0
17	SSW	0.50	302.5	4	1162.0
18	SSW	0.50	300.0	5	954.7
19	SSW	0.78	298.5	6	546.8
20	WSW	1.09	298.0	6	438.8
21	WSW	0.75	297.0	6	330.9
22	WSW	1.28	294.5	6	223.0
23	SSW	0.92	291.0	6	215.0
24	SSW	2.22	291.0	6	207.1

Predicted Futuristic Ground-level Dust Concentrations

The results represent the maximum GLC that are predicted to occur in the areas surrounding the lease area. Isopleths have presented in **Fig. 8.**

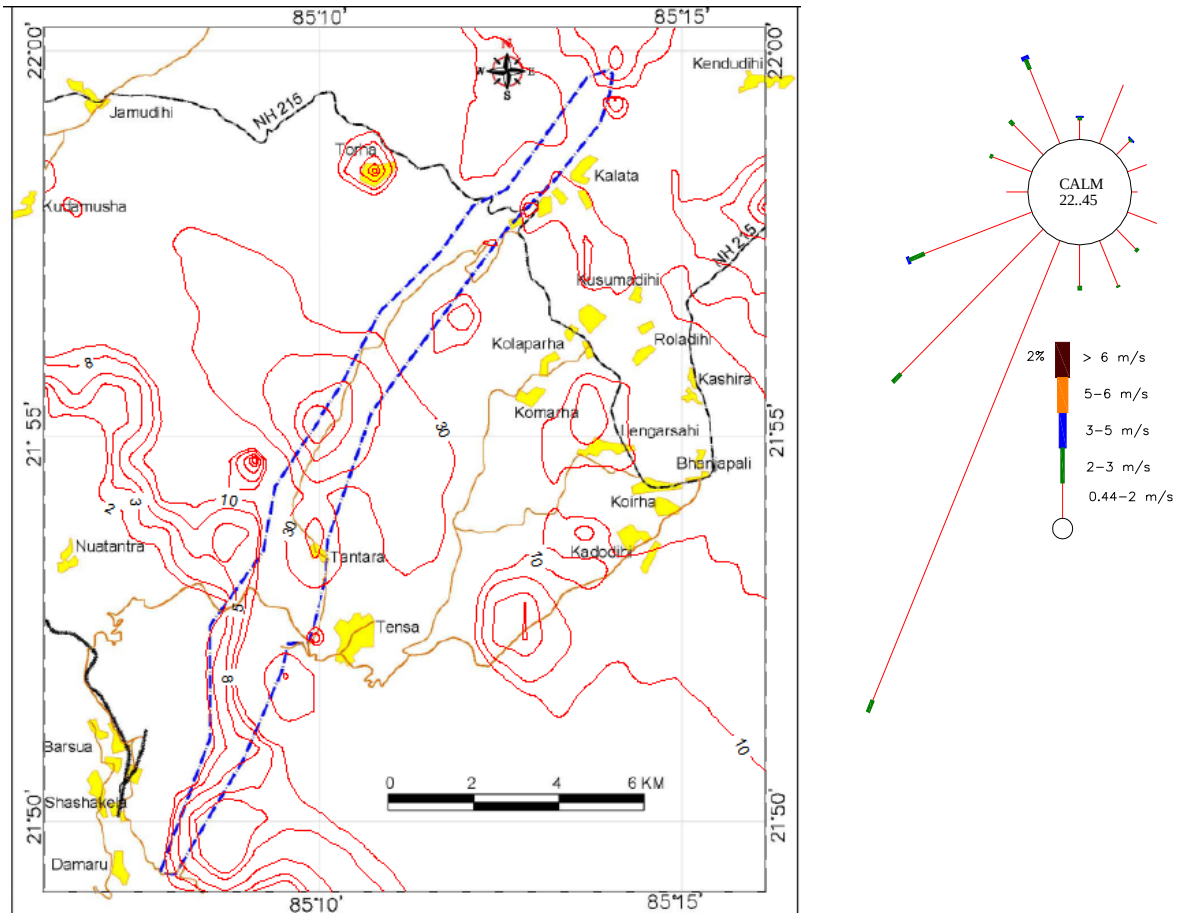


Fig. 8: Isopleths representing maximum ground-level PM_{10} concentrations

When overlaying the additional contribution for the altered scenario with the monitored PM_{10} values Summer 2015, it can be seen that the resultant data are in general, well within norms (**Table 19**)

Table 19: Predicted Resultant Air Quality

Sl. No.	**Location**	**Distance** from lease boundary	**Monitored** PM_{10} (C_{98}) Summer 2015 ($\mu g/m^3$)	**Contribution** as per the proposed alteration ($\mu g/m^3$)	**Resultant values** ($\mu g/m^3$)
1.	Tantara	*Core zone	66.72	30	96.72
2.	Tensa	1.00	71.7	18	89.7
3.	Barsua valley	1.75	74.4	0.1	74.5
4.	Kalta	0.15	77.7	9	86.7

** About 1 km from Taldih block*

6.3 Prediction of Maximum GLCs of NOx and SO_2

The maximum expected GLC's of Sulphur Dioxide (SO_2) and Oxides of Nitrogen (NOx) have been estimated using AERMOD line source algorithm considering the various roads proposed for transportation of ore.

As per the BS-II Norms and from Indian literatures, the emission factors for NOx and SO_2 for Heavy vehicles are considered as 9.3 g/km and 0.2 g/km respectively. The speed corresponding to the vehicles is assumed as 20 km/hr. Based on the quantity of ore transported from the various mining blocks under the Mining Lease (ML – 130) and capacity of vehicle as 18 Tonnes, number of trips required per day are estimated. Following roads are considered for prediction of GLCs where traffic is expected to increase due to transportation of ore from the ML – 130.

- Taldih Block to Barsua Siding
- Taldih Block to Barsua Plant
- Kalta to towards Roxy
- Barsua Mine to Barsua Plant

The predicted GLCs values are insignificant in both the cases of NOx and SO_2. However the maximum GLC for 24 hours are as follows:

Maximum GLC of NOx : 4.2µg/m^3
Maximum GLC of SO2 : 0.09µg/m^3

The location of maximum GLCs are obtaining with the core zone and in the predominant down wind direction. The isopleths of NOx and SO_2 are given in the following figures.

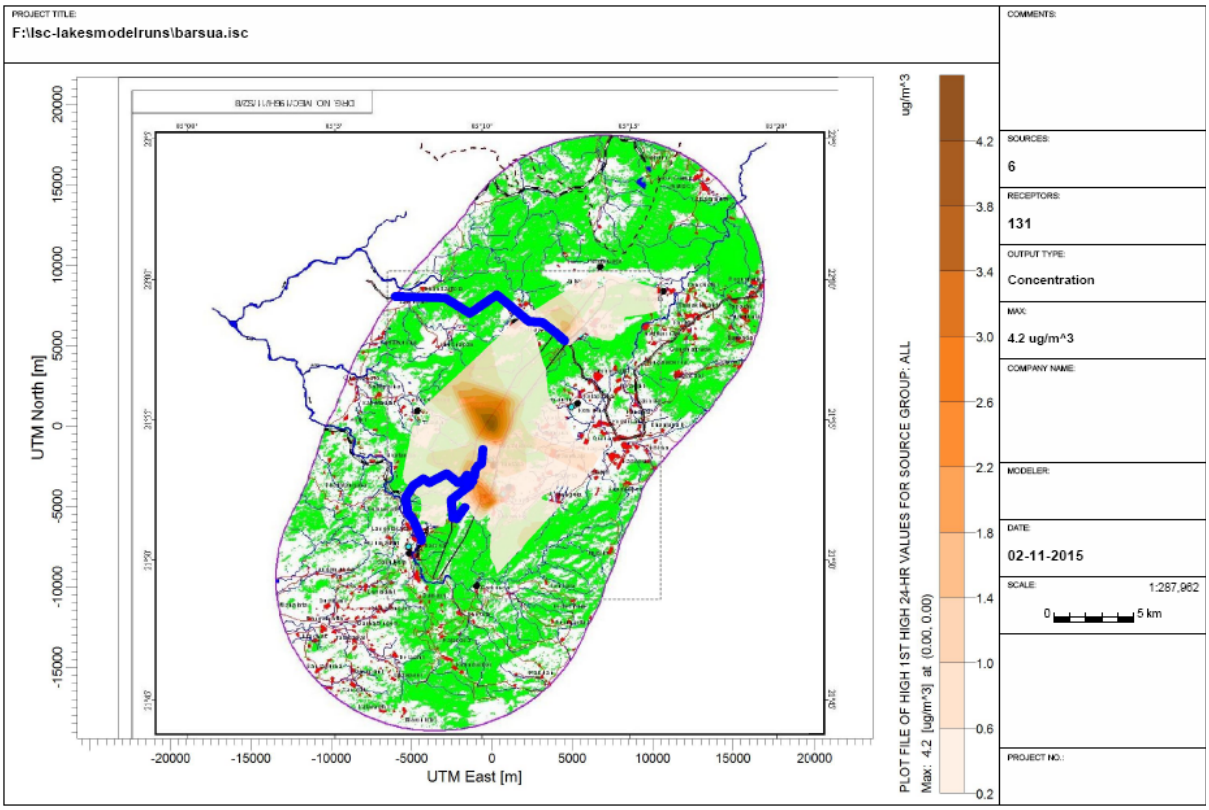


Fig. 9: Isopleths representing the maximum GLC of NOx

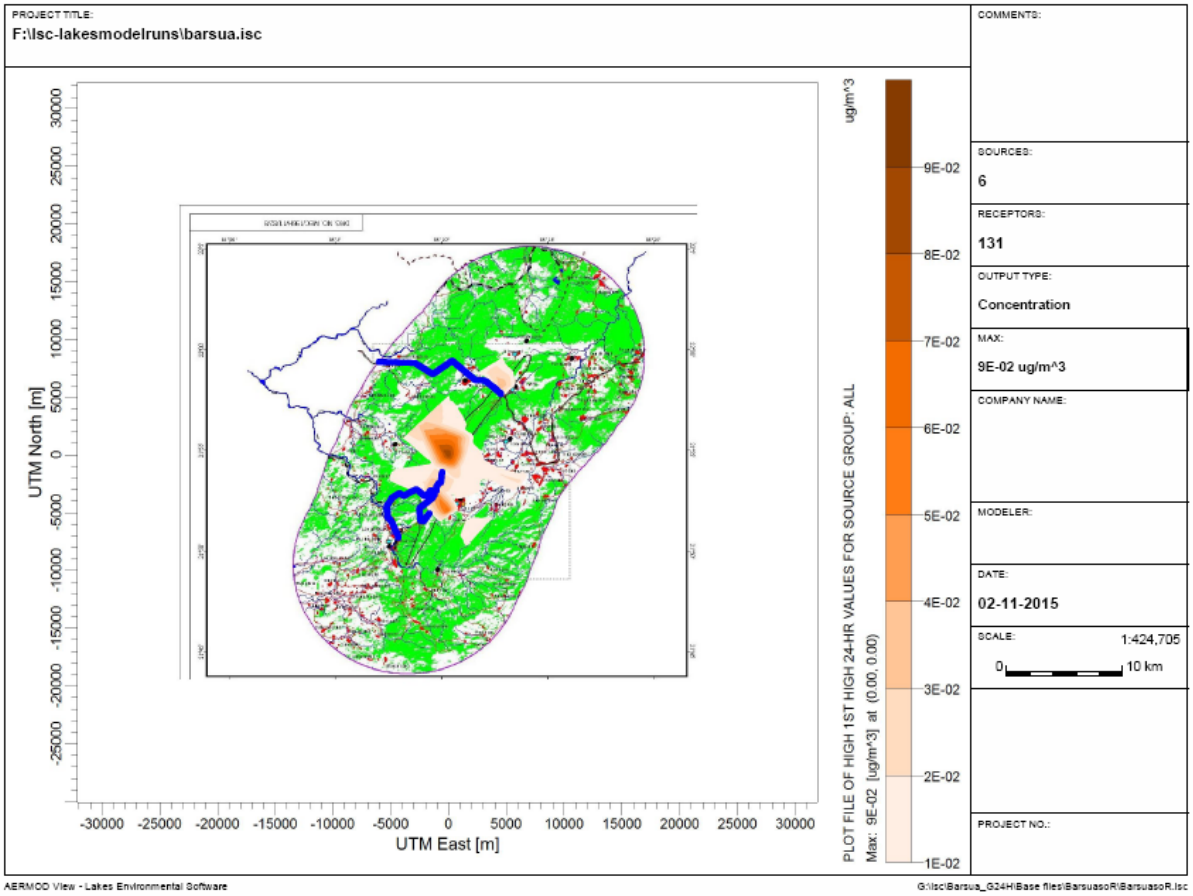


Fig. 10: Isopleths representing the maximum GLC of SO_2

The maximum observed ambient NOx and SO_2 levels during summer 2015 are 23.5 µg/m^3 and 14.0 µg/m^{3}respectively.

In conservative way, when overlaying the additional contribution for the altered scenario with the monitored NOx and SO_2, the resultant NOx and SO_2 are expected to be 27.7 µg/m^3 and 14.1 µg/m^3 respectively. These resultant levels of both NOx and SO_2 are much below the standards of 80 µg/m^3.

7.0 RESULTS AND DISCUSSIONS

The following conclusion can be drawn from the studies conducted towards changes in air quality and also the Isopleths:

1. PM_{10} dispersion in the altered scenario, has been more distributed in comparison to earlier scenario. This is expected because the proposed production has been more evenly distributed in the three blocks.

2. Because of the altered distribution at certain points, the additional contribution in the altered scenario has increased. But this increase is by small extent only without having appreciable repercussions.

3. Changes in air quality with respect to Oxides of Nitrogen and Sulphur Dioxide are very low and insignificant.

4. In effect it can be concluded that due to the altered distribution, the predicted PM_{10} level has come down.

--- XXX ---

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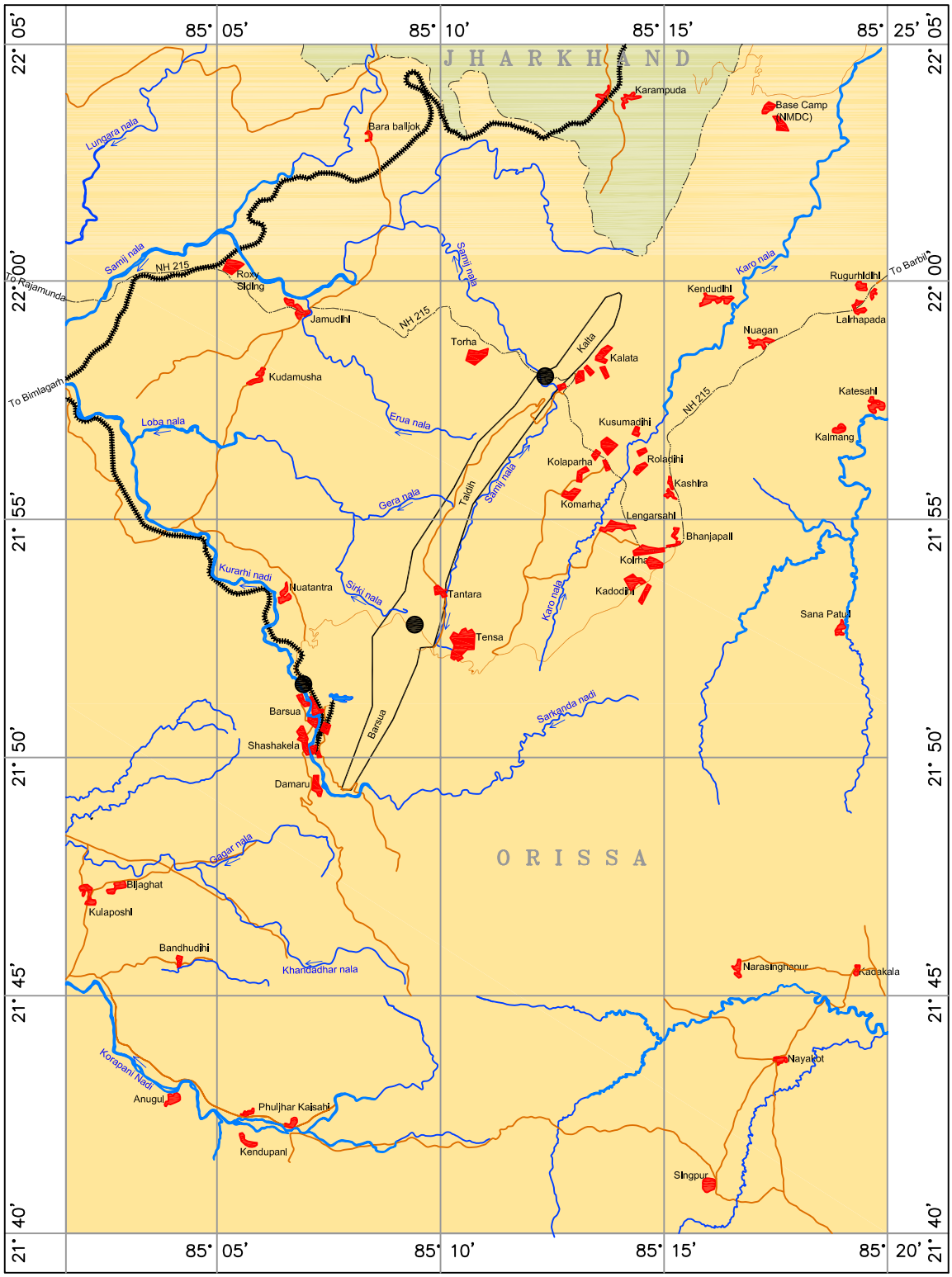

N
W E
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LEGEND

- STATE BOUNDARY
- NATIONAL HIGHWAY
- ROAD
- RAILWAY
- MAJOR SETTLEMENTS
- WATER BODIES
- LEASE AREA
- TRAFFIC SURVEY POINTS

0 4 8 12 KM

SOI TOPOSHEET NOS. 73F4, 73F8, 73G1 , 73G2 ,73G5 AND 73G6

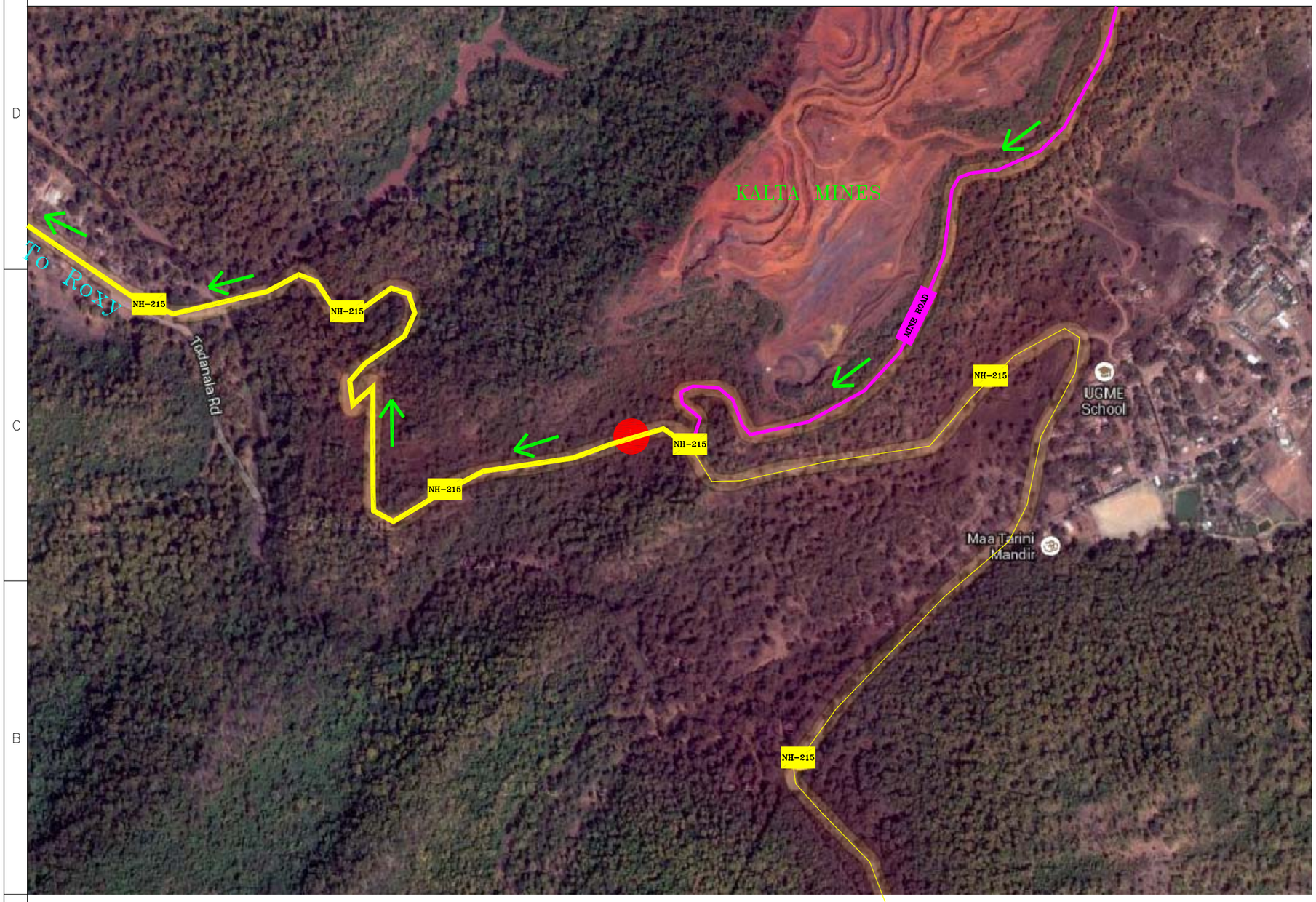
REFERENCES

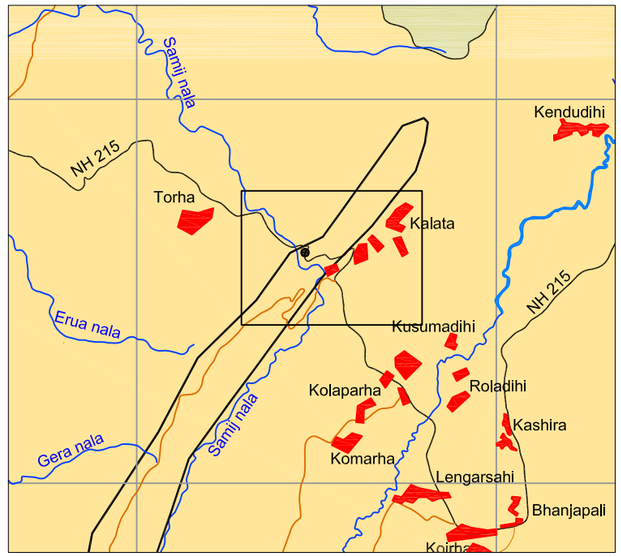
मेकान लिमिटेड

MECON LIMITED

SECTION	ENV.ENGG.	
LOCATION	RANCHI	
DESIGNED	PB 02.12.13	BARSUA-TALDIH-KALTA MINING PROJECT OF SAIL / KIOCL
DRAWN	MP 02.12.13	LOCATION OF TRAFFIC SURVEY POINTS
CHECKED & VERIFIED	MKM 02.12.13	
APPROVED		SCALE : As shown / REV
		DRG.NO. MEC/G24H/11/S2/1 / 0

DRG.NO. MEC/G24H/11/S2/2.1





TRAFFIC SURVEY LOCATION

DESPATCH ROUTE

0 200 400 600m

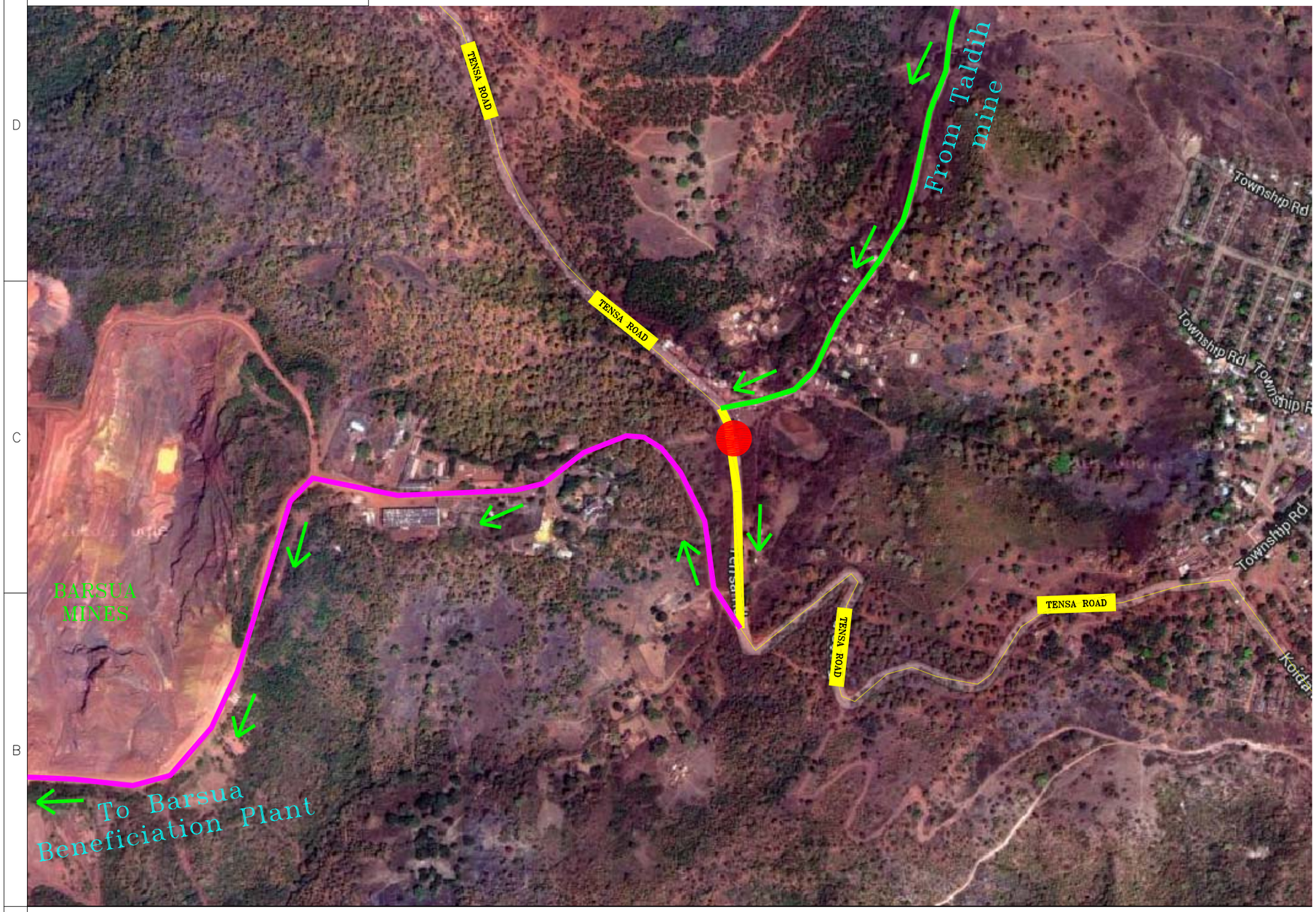
REFERENCES

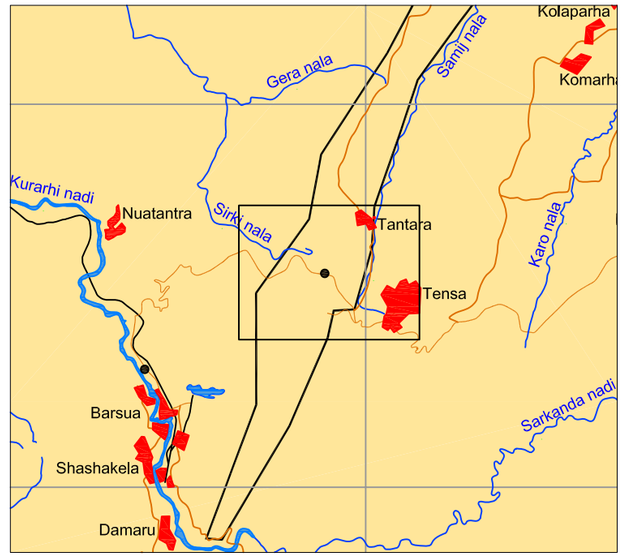
मेकान लिमिटेड

MECON LIMITED

SECTION	ENV.ENGG.		BARSUA–TALDIH–KALTA MINING PROJECT OF SAIL / KIOCL
LOCATION	RANCHI		
DESIGNED	PB	03.12.13	
DRAWN	PB	03.12.13	DESPATCH ROUTE OF KALTA MINE
CHECKED & VERIFIED	MKM	03.12.13	
APPROVED			SCALE : As shown — REV
			DRG.NO. MEC/G24H/11/S2/2.1 — 0

DRG.NO. MEC/G24H/11/S2/2.2





TRAFFIC SURVEY LOCATION

DESPATCH ROUTE

0 200 400 600m

	मेकान लिमिटेड		
	MECON LIMITED		
SECTION	ENV.ENGG.		BARSUA–TALDIH–KALTA MINING PROJECT OF SAIL / KIOCL
LOCATION	RANCHI		
DESIGNED	PB	03.12.13	
DRAWN	PB	03.12.13	DESPATCH ROUTE OF PROPOSED TALDIH MINE
CHECKED & VERIFIED	MKM	03.12.13	
APPROVED			SCALE : As shown — REV
			DRG.NO. MEC/G24H/11/S2/2.2 — 0

REFERENCES

REGD. PARCEL
Fax No. (0674) 2744430
E- mail: ro.bhubaneshwar@ibm.gov.in

भारत सरकार
खान मंत्रालय
भारतीय खान ब्यूरो
क्षेत्रीय खान नियंत्रक का कार्यालय

No. MS/FM/36-ORI/BHU/2014-15 /1843

महानी काम्प्लेक्स, दूसरी मंजिल
308, डिस्ट्रिक सेन्टर चंद्रशेखरपुर
भुवनेश्वर–751016

दिनांक / Date: .09.2015

To

Shri H Bara, General Manager,
Barsua Iron Ore Mine,
M/s Steel Authority of India Ltd,
At/P.o – Barsua, Tensa,
Dist – Sundargarh, Odisha - 770042

Sub: Approval of Scheme of Mining along with Progressive Mine Closure Plan in respect of Barsua-Kalta-Taldih Iron Ore Mine (ML -130) over an area of 2486.392 Ha. of M/s Steel Authority of India Ltd in Sundargarh district of Odisha state submitted under Rule 12 of MCDR,1988.

Ref: i) Your letter No. Nil dated 28.11.2014.
ii) This office letter of even no. dated 05.12.2014.
iii) This office letter of even no. dated 08.12.2014 & 10.04.2015 addressed to the Director of Mines, Govt. of Odisha, copy endorsed to you.
iv) This office letter of even no. dated 28.01.2015.
v) Your RQP's letter No. 27/15-16 dated 27.04.2015.
vi) This office letter of even no dated 05.06.2015.
vii) Your letter No. GIM/BIM/551 dated 22.06.2015
viii) Your letter No. GM/BIM/618 dated 30.07.2015.

Sir,

In exercise of the power conferred by Sub-rule (4) of Rule-12 of Mineral Conservation & Development Rules, 1988, I hereby approve the Scheme of Mining including Progressive Mine Closure Plan of Barsua-Kalta-Taldih Iron Ore Mine of M/s Steel Authority of India Ltd over an area of 2486.392 Ha. in Sundargarh district of Odisha State submitted under rule 12 of MCDR, 1988. This approval is subject to the following conditions:

i. The Scheme of mining is approved without prejudice to any other law applicable to the mine area from time to time whether made by the Central Government, State Government or any other authority and without prejudice to any order or direction from any court of competent jurisdiction.

ii. The proposals shown on the plates and/or given in the document is based on the lease map /sketch submitted by the applicant/ lessee and is applicable from the date of approval.

iii. It is clarified that the approval of aforesaid Scheme of Mining does not in any way imply the approval of the Government in terms of any other provision of Mines & Minerals (Development & Regulation) Act, 1957, or the Mineral Concession Rules, 1960 and any

other laws including Forest (Conservation) Act, 1980, Environment (Protection) Act, 1986 or the rules made there under, Mines Act, 1952 and Rule & Regulations made there under.

iv. Indian Bureau of mines has not undertaken verification of the mining lease boundary on the ground and does not undertake any responsibility regarding correctness of the boundaries of the leasehold shown on the ground with reference to lease map & other plans furnished by the applicant / lessee.

v. At any stage, if it is observed that the information furnished, data incorporated in the document are incorrect or misrepresent facts, the approval of the document shall be revoked with immediate effect.

vi. If this approval conflicts with any other law or court order/ Direction under any statute, it shall be revoked immediately.

vii. Your attention is invited to the Supreme Court judgment in W.P. (C) No.435 of 2012, dated 21.04.2014 for compliance. This approval is therefore, issued without prejudice to and is subject to the said directions of the Supreme Court as applicable in your case.

viii. Validity of this document shall expire on 31.03.2020.

ix. Next Financial Assurance shall be due for submission on 31.03.2020.

भवदीय / yours faithfully,

Encl: - One copy of approved Scheme of Mining.

4/9/15

(M BISWAS)
क्षेत्रीय खान नियंत्रक / Regional Controller of Mines

Copy for kind information to:-

1. Shri Chandrabhanu, RQP, M/s Geo Consultants Pvt. Ltd., 853, Gobind Prasad (Medical Lane), Mahavir Nagar, Laxmisagar, Bhubaneswar – 751006.
2. The Director of Mines, Directorate of Mines, Government of Odisha, Heads of the Department Building, New Capital, Bhubaneswar– 751001, Odisha along with one copy of approved Scheme of Mining by **REGISTERED PARCEL**.

(M BISWAS)
क्षेत्रीय खान नियंत्रक / Regional Controller of Mines