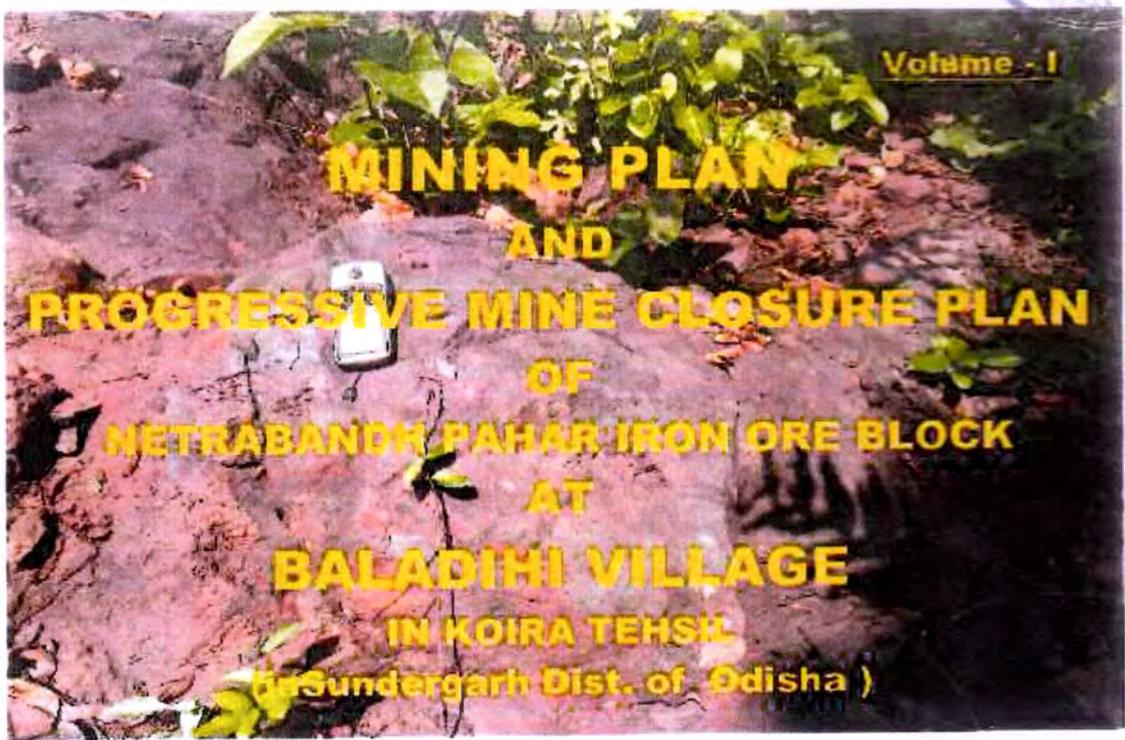




SPS Geomining Solution Private Limited  
 S. Raha, K C Jyotishi & K Naik  
 Qualified Person  
 Under Rule 15 of MCR, 2016

MINING PLAN OF NETRABANDH PAHAR  
 IRON ORE BLOCK OVER 139.223 Ha IN  
 SUNDERGARH Dist., ODISHA



- MINING BLOCK AREA - 139.223Ha.
- LoI for grant of ML issued on - 24.06.2017
- CATEGORY OF MINES - 'A' Mechanised.
- TYPE OF LAND - Forest: 112.621 Ha  
Non Forest :26.602Ha
- SUBMITTED UNDER - Rule 13( 1 ) of MCR, 2016

**-APPLICANT -**

**BHUSHAN POWER & STEEL LIMITED**  
 F. Block, 1<sup>st</sup> Floor,  
 International Trade Tower, Nehru Place,  
 New Delhi - 110 019

**PREPARED BY :**

**S. RAHA, K C JYOTISHI & K NAIK**  
 Qualified Person  
 ( Under Rule 15 of MCR, 2016 )  
**SPS GEOMINING SOLUTION PRIVATE LIMITED**  
 F. N. - 401, Star Plaza,  
 43/3 Feeder Road, Belghoria,  
 Kolkata - 700 056.

Site office :- At/PO-Bhadrasahi, via-Barbil -758035 dist-keonjhar (Odisha)  
 e-Mail : [spsgeomining@gmail.com](mailto:spsgeomining@gmail.com) / [info@spsgeomining.com](mailto:info@spsgeomining.com)  
 9830353767 / 9937010455 / 9437243582





Approved work letter No:-  
MP/PM/13-ORI/BHU/2017-18  
dated 18.10.2017



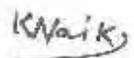
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S RAHA

BHUSHAN POWER & STEEL LIMITED

  
K C JYOTISHI

  
K NAIK



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S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
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MINING PLAN OF NETRABANDH PAHAR IRON  
ORE BLOCK OVER 139.223 Ha IN  
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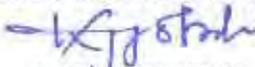


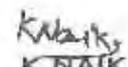
### LIST OF ANNEXURES:

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S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED

  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



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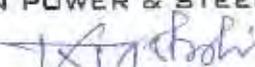


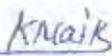
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K C JYOTISHI  
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K NAIK  
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Qualified Persons  
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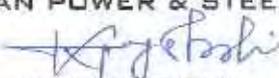
**MINING PLAN OF NETRABANDH PAHAR IRON  
ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA**

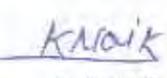


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**BHUSHAN POWER & STEEL LIMITED**

  
**S RAHA**  
*Qualified Person*

  
**K C JYOTISHI**  
*Qualified Person*

  
**K NAIK**  
*Qualified Person*



SPS GeoMining Solution Private Limited

S. RaHa, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR IRON  
ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

## INTRODUCTION

M/s Bhushan Power & Steel Limited ( henceforth be known as BPSL ) is a leading manufacturer of flat and long products and have state-of-the-art plants at Chandigarh, Derabassi, Kolkata and Odisha in India. These plants manufacture value added products covering entire steel value chain right from Coal Mining to manufacturing Pig Iron, DRI, Billets, HR Coils, CR Coils, GP/GC Sheets, Precision Tubes, Black Pipe/GI Pipe, Cable Tapes, Tor Steel, Carbon and Special Alloy Steel Wire Rods and Rounds conforming to IS and international standards. Present turn over of the company is above Rs 8700 Crores with large volume of exports. The Company has successfully implemented and commissioned a green field integrated steel plant with the present capacity of 2.3 Mln Tonnes which is being enhanced to 3.4 Million Tonnes of Steel and captive Power Plant in Odisha with HR Coil making facility - First in Private Sector in the State of Odisha.

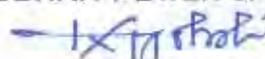
Despite such a progress in end use industry, BPSL was lacking an iron ore mine of its own. So when the Auction of Iron ore Blocks came in Odisha, BPSL joins the fray and was successful in becoming the successful bidder on the auction held on 19.05.2017 for Netrabandh Pahar Block for Iron Ore. Though this Block is not earmarked for captive use, a substantial quantity of the product from this block will be consumed in the Integrated Steel plant of BPSL, situated at Tholkoloi in Jharsuguda.

This block comprising of 139.223 Ha lies within the Baladihi village in Koira Tehsil in Sundergarh dist. In Odisha. The exploration under G2 category following UNFC guidelines was carried by the State Directorate of Geology; hence the block was auctioned for mining lease. As per the new MMDR Act 2017, the mining lease period will be for 50 years. The letter of intent for grant of mining lease was issued by the State Govt. vide its letter no. 5283/SM/IV(Misc)SM-51/2017, dt.24<sup>th</sup> June 2017. A copy of the Letter of Intent is enclosed as Annexure - I.

अनुमोदित  
**APPROVED**

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED

  
K C JYOTISHI  
Qualified Person

  
REGIONAL CONTROLLER OF MINES  
भारतीय खान ब्यूरो  
INDIAN BUREAU OF MINES  
भुवनेश्वर/BHUBANESWAR  
K NAIK  
Qualified Person



*SPS GeoMining Solution Private Limited*

*S. Raha, K C Jyotishi, K Naik*  
*Qualified Persons*  
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**MINING PLAN OF NETRABANDH PAHAR IRON  
ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist, ODISHA**

A panchayat road running from Koira to Patmunda / Khajurdih runs along the eastern boundary of the block; sometime through the lease area, sometime outside the lease area. This panchayat road joins NH 215 at a distance of about 7 KM from the lease area. SH 10(A) runs at a distance of about 8 KM from the lease area. Both the NH & SH joins the lease area to Rourkela via Tensa & Kalta, respectively. Rourkela is about 110 KM from the lease area. Barsuan on SE Railway is the nearest railway station.

Koira, at a distance of about 7 Km, is the nearest township with all the amenities.

There is no national park / sanctuary located within 10 km radius from the lease area.

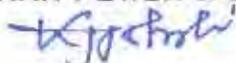
This Mining Plan covers the guidelines of the Mining Plan framed under 'IBM MANUAL ON APPRAISAL OF MINING PLAN 2014' and is based on the exploration data contained in the Geological Report prepared by the State Directorate of Geology, Odisha and the field mapping carried out by the consultants. It is supported by tables, calculations and drawings as considered necessary. As the Progressive Mine Closure plan is a part of mining plan / mining scheme and shall be valid up to the year for which mining plan / mining scheme is valid, with this view the said Progressive Mine Closure Plan has been prepared along with this Mining Plan and submitted to the authority concerned.

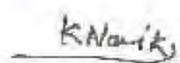
A Pre-Feasibility study of the target area has been made and the data have been included in the Pre-Feasibility Report annexed with this mining plan as a pre-requisite.

The mining proposal includes a target production of 2 Min T of ROM from 3rd year onward as the optimum production level. The incidence of hard ore is strikingly different from northern part of the block than the southern part of the block, to maintain a balance production of hard ore from the block, production of ore from two pits, namely N-Pit & S-Pit has been envisaged. The ROM will be mechanically

  
**S RAHA**  
*Qualified Person*

**BHUSHAN POWER & STEEL LIMITED**

  
**K G JYOTISHI**  
*Qualified Person*

  
**K NAIK**  
*Qualified Person*



*SPS GeoMining Solution Private Limited*

*S. Raha, K C Jyotishi, K Naik*  
*Qualified Persons*  
*( under Rule 15 of MCR, 2016 )*

**MINING PLAN OF NETRABANDH PAHAR IRON  
ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA**

processed through mobile crushing & screening plants and will be made ready for dispatch. No beneficiation of the same has been envisaged at this moment. A major part of the production will be consumed by the applicant itself which has a Integrated Steel Plant near Jharsuguda. Applicant is having a beneficiation plant in its Steel Plant complex.

**S RAHA**  
*Qualified Person*

**BHUSHAN POWER & STEEL LIMITED**

**K C JYOTISHI**  
*Qualified Person*

**K NAIK**  
*Qualified Person*



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S. RaHa, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

## PART - A

### 1.0 GENERAL

a) **Name and Address of the Applicant:**

M/s. Bhushan Power & Steel Limited,

Address of Regd. Office :

Bhushan Power & Steel Ltd.  
F. Block, 1<sup>st</sup> Floor,  
International Trade Tower, Nehru Place,  
New Delhi – 110 019

Address for Communication

Bhushan Power & Steel Ltd.  
N3/28, IRC Village, Nayapalli,  
Bhubaneswar-751015.  
Tel: 0674-2554533 / 2554726  
Fax: 0674-2554446  
Email - bpslbbsr@gmail.com

Copy of Certificate of Incorporation of M/s Bhushan Power & Steel Limited, as a company under Registrar of Companies is enclosed as Annexure – IV.

**Name & Designation of the Nominated Owner / Authorised Signatory :**

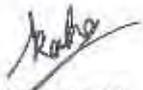
Name : Sri P K Mishra.  
Designation : Vice President

Copy of Board of Directors' resolution favouring Sri P K Mishra to act as an Authorised Signatory is enclosed as Annexure - VI

Name : P K Mishra  
Designation : Vice President  
Company : M/s.Bhushan Power & Steel Ltd  
Address : N3/28, IRC Village, Nayapalli, Bhubaneswar-751015.  
Tel: 0674-2554533 / 2554726  
Fax: 0674-2554446  
Email - bpslbbsr@gmail.com

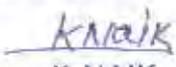
**Address :**

<u>Present</u>	<u>Permanent</u>
M/s.Bhushan Power & Steel Ltd N3/28, IRC Village, Nayapalli, Bhubaneswar-751 015. Tel: 0674-2554533 / 2554726 Fax: 0674-2554446 Email - <a href="mailto:bpslbbsr@gmail.com">bpslbbsr@gmail.com</a>	Plot No. 305, Unit – 3, Kharvel Nagar, Bhubaneswar, Bhubaneswar GPO, KHORDA, Odisha – 751 001

  
S. RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED

  
K C JYOTISHI  
Qualified Person

  
K NAIK  
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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

Copy of documentary proof of permanent & present address of Authorised Signatory is enclosed as Annexure – VIII.

**b) Status of the applicant:**

The applicant is a Limited company. Photocopy of the registration of the company is enclosed as Annexure – IV. The list of Directors of this company is enclosed as Annexure – V. The applicant is in the mineral sector for more than 10 years. This company is a leading manufacturer of flat and long products and have state-of-the-art plants at Chandigarh, Derabassi, Kolkata and Jharsuguda in Odisha. These plants manufacture value added products covering entire steel value chain right from manufacturing Pig Iron, DRI, Billets, HR Coils, CR Coils, GP/GC Sheets, Precision Tubes, Black Pipe/GI Pipe, Cable Tapes, Tor Steel, Carbon and Special Alloy Steel Wire Rods and Rounds conforming to IS and international standards.

The Company is certified to ISO 9001:2008 & TS-16949 Quality Standards and ISO 14001:2004 Environment Management Standards.

**c) Mineral(s) which is / are included in the prospecting license (For Fresh grant) :**

Not Applicable.

**d) Mineral(s) which is / are included in the letter of intent :**

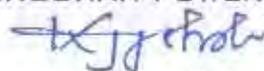
Government of Odisha has issued the letter of intent ( Lol ) for granting mining lease for 'IRON ORE' over an area of 139.223 Ha vide its letter no. 5283/IV(Misc)SM-51/2017/SM, dt. 24.06.2017. The Lol is enclosed as Annexure – I.

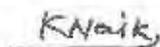
**e) Mineral(s) which is the applicant intends to mine :**

The Applicant intends to mine the iron ore for which letter of intent has been issued.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED

  
K C JYOTISHI  
Qualified Person

  
K NAIK  
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MINING PLAN OF NETRABANDH PAHAR  
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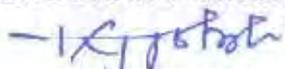
f) Name of Qualified Person ( QP ) :  
preparing the Mining Plan

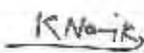
Sl No.	Name	Address	Qualification	Experience Certificate attached	Remarks
1	S Raha	F. No. – 401, 4 <sup>th</sup> Floor, STAR PLAZA, 43 / 3 Feeder Road, Belghoria, Kolkata – 700 056 West Bengal Mob. : 9830353767, eMail : spsgeomining@gmail.com	M Sc (Geol)	More than 13 years in different mines of S R Rungta Group	RQP since 1995
2	K C Jyotishi		M Sc (Geol)	More than 14 years in different mines of M/s P K Jain	RQP since 2000
3	K Naik		M Phil ( Geol )	Experience of more than 6 years in the mine of Orient Resources.	Presently RQP for minor minerals in Odisha

Copy of educational qualification, experience certificates & Photo IDs are enclosed as Annexure – IXA, IXB & IXC.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED

  
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Qualified Person

  
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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA



## 2.0 LOCATION AND ACCESSIBILITY :

- a) Lease Details ( Existing Mine ) : Not Applicable
- b) Details of applied / lease area with location map ( fresh area / mine ) :

FOREST		NON FOREST				
Government Land		Government Land			Tenanted Land	
Forest (Specify)	Area ( Ha )	Type	Sub-Type	Area ( Ha )	Type	Area ( Ha )
Proposed Reserved Forest	67.022	Reserved	Gochar *	7.587	Gharbari	0.645
DLC Forest	45.599		Road	0.376	Agricultural	12.142
			Habitation	3.947		
		Communal	Road	0.134		
			Devasthali *	0.732		
			Smasan *	0.599		
		Other	Nala	0.440		
<b>TOTAL</b>	<b>112.621</b>			<b>13.815</b>		<b>12.787</b>

### SUMMARY :

Govt Land	Forest	112.621 Ha
	Non Forest	13.815 Ha
Tenanted Land		12.787 Ha
	<b>TOTAL</b>	<b>139.223 Ha</b>

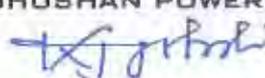
- Gochar : Grazing Land
- Devasthali : Place of Worship
- Smasan : Grave yard

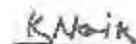
The area over 139.223 Ha in Netrabandh Pahar, village – Baladihi, Dist. – Sundergarh, Odisha was auctioned by the Govt. of Odisha and M/s Bhushan Power & Steel Limited became the preferred bidder in the auction held on 19<sup>th</sup> May 2017. After fulfilling different stipulated conditions, M/s Bhushan Power & Steel Limited has become the successful bidder and the letter of intent ( Lol ) for grant of mining lease for Iron Ore over the entire area of 139.223 Ha has been issued by Govt of Odisha. The DGPS map of the Block, duly authenticated by competent authority is enclosed as Annexure – II.

The area falls under the Survey of India topo sheet No. F45N5 (73 G/5); (Ref : Key Plan - Plate No. 1)

BHUSHAN POWER & STEEL LIMITED

  
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Qualified Person

  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



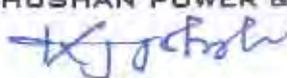
SPS GeoMining Solution Private Limited

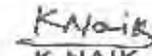
S. RaHa, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

- District & State : Sundergarh dist., Odisha
- Tehsil : Koira
- Village : Baladihi.
- Khasra No./Plot No./ Series etc. : Annexed as Annexure No. - III
- Lease Area (Hectares) : 139.223 Hectares ( Lol issued for grant of ML ).
- Whether the area falls under: Coastal Regulation Zone ( CRZ ) ? If yes, details. No.
- Existence of public road / Rallway line, if any nearby and approximate distance : A panchayat road running from Koira to Patmunda / Khajurdih runs along the eastern boundary of the block; sometime through the lease area, sometime outside the lease area. This panchayat road joins NH 215 at a distance of about 7 KM from the lease area. SH 10(A) runs at a distance of about 8 KM from the lease area. Both the NH & SH joins the lease area to Rourkela via Tensa & Kalta, respectively. Rourkela is about 110 KM from the lease area. Barsuan on SE Railway is the nearest railway station.
- Toposheet No. with Latitude & Longitude : The deposit falls in the Survey of India Toposheet No. F45N5 (73 G/5). The target area is bound by :  
Lat. : 21° 52' 05.242" N - 21° 52' 54.542" N  
Long. : 85° 17' 10.449" E - 85° 17' 56.810" E
- Land use pattern (forest, Agriculture, Grazing etc) : Detailed land schedule attached as Annexure - III.
- b) Attach a general location and vicinity map showing Area boundaries and existing and proposed access routes. It is preferred that the area : The location and vicinity map of the area in Topo sheet no 73 G/5 has been enclosed as Plate no. 1.

  
S RAHA  
Qualified Person

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K C JYOTISHI  
Qualified Person

  
K NAIK  
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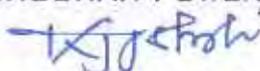
**MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA**

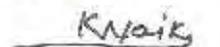


be marked on a Survey of India Topographical map or a Cadastral map or forest map as the case may be. However if more of these area available, the area should be shown on an Accurate sketch map on a Scale of 1:50000.

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**S RAHA**  
*Qualified Person*

  
**K C JYOTISHI**  
*Qualified Person*

  
**K NAIK**  
*Qualified Person*



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**MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA**

**3.0 DETAILS OF APPROVED MINING PLAN / SCHEME OF MINING ( if any ) :**

NOT APPLICABLE. This is a new block auctioned recently for mining lease; hence no previous mining plan available.

**S RAHA**  
*Qualified Person*

**BHUSHAN POWER & STEEL LIMITED**

**K G JYOTISHI**  
*Qualified Person*

**K NAIK**  
*Qualified Person*



SPS GeoMining Solution Private Limited

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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

## PART A

### 1.0 GEOLOGY & EXPLORATION

- a) Topography, drainage pattern, vegetation, climate, rainfall data of the area applied / mining lease area :

#### Topography :

Netrabandh Pahar Block lies in Southern continuation of Bonai Keonjhar belt of Ranchi Plateau. In general the Bonai-Keonjhar belt is deeply dissected giving rise to a rugged topography with high & narrow hill ranges interspersed by broad valley. It is a discrete physiographic unit marked by wide, flat, soil, & alluvium covered tracks separated by low lying hills. The high hills are, in fact, long ranges controlled by the out crop pattern of the BIF. The highest peak in the adjacent area is represented by Balia pahar(1010m).

The Netrabandh Pahar block represents an undulating to plain topography. At places flat topped low mounds are noticed with general gradient to NE and SE. The highest contour in this area is at 678 m ( north-central & south-central part of the block ) & lowest contour is at 618 m at the northeast part of the block.

#### Drainage pattern :

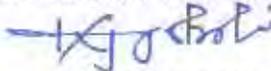
The drainage system of the area is controlled by Teherai Nala flowing to the North of the block and its tributaries. However Khajurdihi Nala flowing in the Southern part of the area controls the drainage in the southern part.

#### Climate & Rainfall :

The region experiences a temperate to sub-tropical monsoon climate. The area is influenced by the south-west monsoon which begins generally from June and continues till August. September and October is the transition period between rainy and winter seasons and it represents autumn. The period between November to mid February is characterised by cold and dry weather conditions. The period between mid February to first week of June is hottest.

  
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Qualified Person

BHUSHAN POWER & STEEL LIMITED

  
K C JYOTISHI  
Qualified Person

K NAIK  
Qualified Person



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May is found to be the driest & hottest month and July is the wettest month, December being the coldest. The average relative humidity is found to be highest in the month of July while December records the lowest relative humidity.

1	Mean Annual Rainfall	1600 mm
2	Temperature (December)	5°C
3	Temperature (May)	47°C

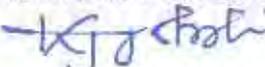
**b) Regional Geology :**

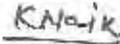
The area forms a part of the Bonai - Keonjhar belt of the famous "Horse Shoe Synclinorium" falling in Sundargarh and Keonjhar districts. The feebly metamorphosed Precambrian volcano-sedimentary rocks exposed in this belt between the Singhbhum granite on the east and Bonai granite on the west are classified as 'Iron Ore Group' (Sarkar & Saha, 1962) or 'Koira Group' (Murty and Acharya, 1975). These rocks are disposed in form of a low northerly plunging 'Horse-Shoe' shaped synclinorium (Jones, 1934). The litho-stratigraphic succession of this area, as worked out by earlier workers, based on regional field studies is shown below (Table-1).

TABLE - 1

  
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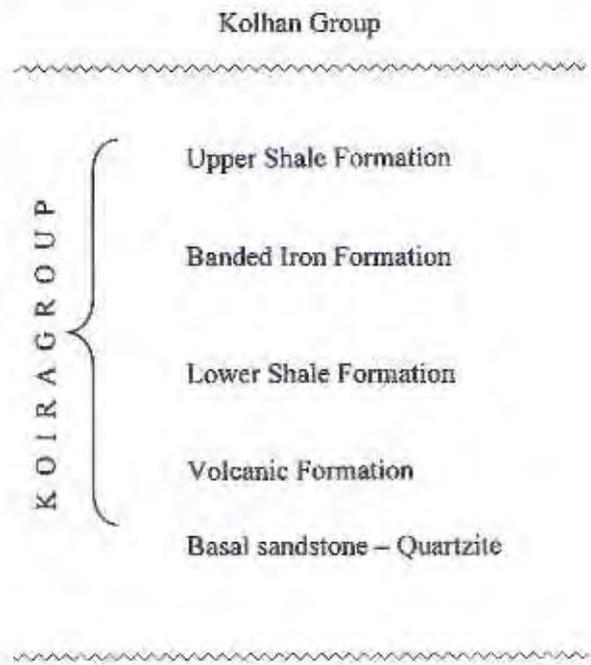
  
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Qualified Person



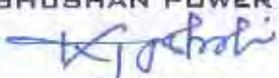
Jones (1934)	Saha(1994) Modified after Sarkar & Saha (1977)	Murthy & Acharya (1975)
Upper shale, epidiorite and ash bed B.H.Q with iron ore bodies	IRON Singhbhum granite	Mixed facies formation
Shales with occasional sandstones	ORE Upper Shale with volcanics	IRON Upper Shale Formation
Purple sandstone with basal conglomerate	SHALE BHJ with iron ore, ferruginous quartzite	IRON Banded Iron Formation
-----Unconformity-----	IRON Lower shale and acid, intermediate tuffs, local dolerite	IRON Volcanic Formation
Older Dharwars	IRON Basal sandstone- Quartzite	IRON Basal sandstone- Quartzite

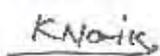
The stratigraphy of the area modified after Murty and Acharya (op. cit) is given below:



  
**S RAHA**  
Qualified Person

**BHUSHAN POWER & STEEL LIMITED**

  
**K C JYOTISHI**  
Qualified Person

  
**K NAIK**  
Qualified Person



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MINING PLAN OF NETRABANDH PAHAR  
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Singhbhum & Bonai Granites and  
metamorphosed sediments

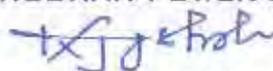
The base of the Koira Group is marked by a pronounced unconformity over the Singhbhum granite in the eastern side and has a sheared inter-fingering contact relationship with Bonai granite on the western side. The basal formation comprises of gritty sandstone, which ranges from ortho-quartzite on one hand to pebbly sandstone and conglomerate on the other. This arenaceous unit is followed by mafic volcanics which is found all along the outer periphery of the horse-shoe synclinorium. The volcanic formation comprises predominantly of Lower volcanic flows dominantly of mafic composition and an upper tuffaceous zone. The lava is pillowed at the bottom part and amygdaloidal at the top indicating its sub-aqueous and subsequent sub-aerial character. The lava grades into purple colour tuffaceous shale conformably towards the upper part and described as 'Lower Shale Formation' (Murty and Acharya, op. cit.). By the appearance of jasper and banded jasper inter banded with the greenish and black shale towards the top, the lower shale pass into the 'Banded Iron Formation' proper.

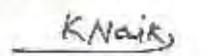
The 'Banded Iron Formation' is represented by Banded Hematite Jasper (BHJ)/ Banded Hematite Quartzite (BHQ)/ Banded Magnetite Quartzite (BMQ), inter-bedded black or green shale and banded ferruginous chert. Due to high resistance to erosion these litho-units form high ridges conspicuously marking the outline of the 'Horse-Shoe' Synclinorium and depict the major structural pattern of the belt.

The 'Banded Iron Formation' is overlain by the 'Upper Shale Formation' comprising thick sequence of tuffaceous purple, white and buff coloured shale, black shale, banded ferruginous shale with inter-bedded chert and Banded hematite jasper (BHJ) / Banded hematite quartzite (BHQ) / Banded magnetite quartzite (BMQ) bands and spreading over the entire core of the synclinorium. The 'Upper Shale Formation' can be divided into two horizons / zones namely, lower manganiferous shale horizon / zone and upper ferruginous shale horizon / zone. These two horizons / zones exhibit conformable

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED

  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



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S. Raha, K C Jyotishi, K Naik  
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MINING PLAN OF NETRABANDH PAHAR  
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SUNDERGARH Dist, ODISHA



relationship and are each characterised by their typical litho-assemblages. The manganiferous horizon/zone comprising predominantly of manganiferous greyish green shale, carbonaceous black shale with inter-beds of chert locally grading to dolomite hosts almost all the major manganese ore deposits of the area. Whereas, ferruginous shale horizon / zone comprising of banded ferruginous shale with inter-beds of BHJ / BHQ and Banded Ferruginous Chert (BFC) gives rise to isolated iron ore deposits within the core of the synclinorium.

A younger sequence of conglomerate and sandstone exposed on the northern and north eastern part of the belt are unconformably overlying the Koira Group of rocks. This arenaceous rock sequence have been described as Kolhan Series (Dunn, 1940) or Kolhan Group (Murty and Acharya, 1975) and it is differentiated from the basal sandstones and conglomerate by the presence of jasper pebbles, iron ore pebbles and fragments of BHJ.

The iron ore bodies associated with the 'Upper Shale Formation' occur at much lower topographic elevations (450-650 m) mostly covered by laterite within the core of the synclinorium compared to the major iron ore deposits of the 'Banded Iron Formation' occurring at the ridge tops (750-950 m). The present exploration programme is aimed to evaluate the resources of Netrabandha Pahar iron ore occurrence within the Koira syncline of the 'horse-shoe' shaped synclinorium (Plate-II).

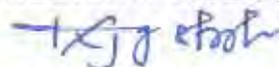
## 2.2 Local Geology:

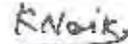
The local geology has been provided in the Geological Report provided by the Directorate of Geology. The same has been reproduced here as :

The area under investigation lies within the Upper Shale Formation of the Koira Group as described by Murthy & Acharya (1975). Litho units like iron ores of HLO, SLO, lateritised SLO type, limonitic ore, Fe-Shale, laterites both aluminous and ferruginous nature, float ores concealed under soil and alluvial cover at places are mapped in the

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED

  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



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S. RaHa, K C Jyotishi, K Naik  
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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA



Netrabandha Pahar Block (Plate-3). The local stratigraphic succession as worked out is as follows:

		Soil Laterite
Koira Group	Upper Shale Formation	Shales of different colour like purple, yellow with inter beds of Iron ore.
	Banded Iron Formation	Coarsely banded BHJ followed up by finely banded BHJ and iron ore.

### 2.3 Description of litho units

#### 2.3.1 Banded Iron Formation (BHJ):

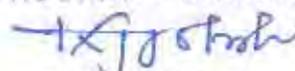
The BHJ is not ubiquitous in the area except few small patches near BH No-1&3. However, it is intersected in few boreholes like 1,3,4,19,26, 31 etc. Megascopically, the BHJ comprises alternate bands (laminations less than 5mm thick) of hematite and dark brown to red jasper. This unit is intersected nearer to the bottom parts of these boreholes.

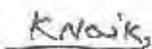
#### 2.3.ii Ferruginous Shale:

It occupies the valley portion represented by a finely laminated rock having varied shades /of colour ranging from white, maroon, dark grey, brownish and purple to green etc. The colouration of the shale is largely dependent on the mineral composition (Murthy & Acharya, 1975). It is mostly composed of clayey micaceous minerals, with lenses of chert. Most of the area containing this unit is lateritised extensively. It occurs sporadically in the in nala sections part of the mapped area.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED

  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



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S. Raha, K C Jyotishi, K Naik  
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MINING PLAN OF NETRABANDH PAHAR  
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SUNDERGARH Dist, ODISHA



### 2.3.iii Iron ore:

Based on surface exposures and sub-surface geology 5 (five) types of iron ore are recorded in the explored block (plate-III). These are Hard Laminated Ore (HLO), Soft Laminated Ore (SLO), blue dust (powdery ore) and float/Canga ores.

The area is mostly covered by float ore and soil. However, isolated exposures of SLO, Laterite and Float/Canga ores are encountered in the surface. HLO is not exposed but encountered in the sub-surface. The general strike of iron ore is in N10°W –S10°E direction, with 20° - 40° dip towards west in the area. It is continuing under laterite and SLO cover as observed in the BHs. The minor folds observed in the BIF shows 10° plunge towards N10°E.

Float ores and the cemented float ores (Canga) are demarcated in the map occurring over the lateritic. 'Canga' zones contain mostly iron ore floats which are deposited in the saddle region. The thinly laminated, hematitic ore bodies rarely exposed in the valley area are very often lateritised near the surface.

The isolated patches of SLO have been encountered on the surface. However thick zones of SLO were intersected in most of the boreholes at different depths given in the lithologs (Annexure-II, Plate-V).

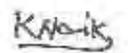
### 2.3.iv Laterites :

Most part of the area is covered by laterite of various types. The laterite has been developed mostly over the shale unit of the area and depending upon the composition of the shale, different types of laterites have been developed. The shale rich in alumina has given rise to aluminous laterite and those rich in iron have developed ferruginous laterites. Ferruginous laterite occupies most of the high lands in the vicinity and is widespread. Aluminous laterite occurs in form of small patches spread over the area.

Soil/ alluvium: The low lying areas, river and banks etc are filled up with alluvial soil.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

For the purpose of mining plan, the QPs had undertaken field traverses in the block. While making traverses, the interpretation of the surface geology of the block by the QPs differ slightly with the interpretation made in the GR of the Directorate of Geology. It was found that though in the most of the area the iron ore floats are embedded in a lateritic soil with a general thickness of about 1 mt., in the North-Central part of the block, a thick zone of hard bouldery formation has been found in a blanket type form, which should have a minimum thickness of 3 mt. Accordingly, the surface geological plan has been modified to a small extent.

#### 2.4 Structure:

In general the Iron Ore Super Group represented by the Bonai-Keonjhar Belt in Koira basin is disposed in the form of an "Omega" and referred to as "Horse shoe synclinorium" (Jones, 1934). This belt is 60 km long and 25 km wide extending from south of Malangtoli in Keonjhar district up to Chakradharpur in West Singhbhum district (Jharkhand). The structural fabrics in the above, feebly metamorphosed volcano-sedimentary litho-sequence indicate at least two phases of deformation and folding. The earlier phase is the most prominent and resulted in formation of two synclines intervened by an anticline trending NNE-SSW with a low north-north easterly plunge. The western limb is slightly overturned to the east and dip westernly ( $65^{\circ}$ - $75^{\circ}$ ) whereas, the eastern limb is a normal one with moderate to low ( $3^{\circ}$ - $45^{\circ}$ ) westerly dip. This phase of folding is affected by a later NW-SE to WNW-ESE trending fold axis resulting in broad warps and formation of structural domes and basins in the area. The western syncline known as Koira syncline, due to steep dip and overturned nature of its limb forms a deeper basin with thick sequence of younger shales in the core region. On the other hand, the eastern syncline known as Bamebari syncline is a shallower basin and exposes younger litho members within the core region as outliers. The Upper shale unit within the Koira syncline is more or less continuous.

#### 2.5. Metamorphism:

There is least record of metamorphism in the BIF of Bonai-Keonjhar iron ore Belt.

Geological sections up to the lease boundary have been prepared on a scale of 1:2,000.

S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED

K C JYOTISHI  
Qualified Person

K NAIK  
Qualified Person



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MINING PLAN OF NETRABANDH PAHAR  
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SUNDERGARH Dist, ODISHA

**d) Name of prospecting / exploration agency :**

Directorate of Geology, Ministry of Steel & Mines, Govt of Odisha had undertaken the exploration of this area.

Name : Directorate of Geology, Odisha,  
Bhu-Bigyan Bhawan, Bhubaneswar, Odisha – 751 001  
E mail : directorgeology\_orissa@yahoo.co.in  
Fax : 0674 2391776  
Phone :0674 2392374

**e) Exploration already carried out in the area :**

This block has been explored by the Directorate of Geology, Ministry of Steel & Mines, Govt of Odisha in two phases; first in 2012-13 and thereafter in 2014 – 2016.

The exploration was carried in the following manner :

- i) Topographic survey of the entire block,
- ii) Diamond core drilling ( Coring ) in 200 X 200 mt grid over the **entire block area of 139.223 Ha.**

**A. Total Area covered under Exploration :**

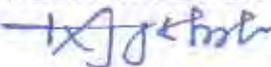
The entire Block area has been covered under exploration in G2 category of UNFC guidelines.

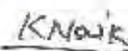
Northing		Easting	
From	To	From	To
2419212	2420727	322939	324253

**B. Total Area ( Ha ) covered under Exploration :**

Forest Land ( Ha )	Non Forest Land ( Ha )			Grand Total ( Ha )	Total Meterage Drilled ( Mt )
	Govt. Land	Private Land	Total		
112.621	13.815	12.787	26.602	139.223	1494.60

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

C. Total number of drilled holes :

MINERALISED ZONE		NON MINERALISED ZONE		TOTAL BLOCK AREA	
Area ( Ha )	No	Area ( Ha )	No	Area ( Ha )	No
112.123	33	27.100	6	139.223	39

D. Sampling : State Directorate of Geology has provided record of sampling & analysis of only drilled cores. The GR does not indicate analysis of any sample, other than drilled cores. Analysis drilled cores was done at the Departmental Laboratory, Directorate of Mines, Odisha. Details can be summarized as :

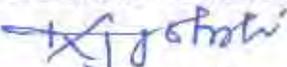
Sampling Scheme	Number of Samples Analysed	Elements Analysed
1.0 m	1044 nos	Fe, Mn, SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Lol

E. Summary of Block Area explored as per UNFC norms :

Sl No.	Name of the Mineral	Block area (Ha)	Block area explored as per UNFC norms (in Ha.)				Remarks / Comments including reasons for not carrying out the exploration as per UNFC norms.
			C=D+E+F+G				
			G1 Level	G2 Level	G3 Level	Other Lease area / Unexplored area	
A	B	C	D	E	F	G	H
1	Iron Ore	139.223	0.000	139.223	0.000	0.000	Explored as per UNFC norms

The details of Bore Holes drilled are tabulated as follows :

  
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Qualified Person

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Qualified Person

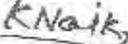
  
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Qualified Person



Table No. 1.1

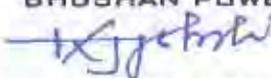
**DETAILS OF BOREHOLES DRILLED BY DIRECTORATE OF GEOLOGY**

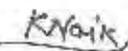
Sl No.	BH ID	Co-Ordinate		Collar RL ( mRL )	Depth ( M )	No of Samples Analysed	Land Type	Mineralised / Non Mineralised	
		Northing	Easting						
1	BH 1	2420277	323462	874.470	36.00	35	F	Mineralised	
2	BH 2	2419881	323523	676.635	37.70	1	F	Mineralised with SG Ore only	
3	BH 3	2420287	323660	655.270	27.20	27	F	Mineralised	
4	BH 4	2420080	323491	669.710	10.00	6	F	Mineralised with SG Ore only	
5	BH 5	2420100	323689	658.940	51.50	50	F	Mineralised	
6	BH 6	2420476	323430	641.390	46.80	46	F		
7	BH 7	2420317	323859	622.100	45.50	45	P		
8	BH 8	2420496	323630	631.020	41.35	42	F		
9	BH 9	2420120	323888	626.950	49.20	46	P		
10	BH 10	2420456	323230	642.790	51.00	51	F		
11	BH 11	2419901	323721	658.180	35.20	18	F		Mineralised with SG Ore only
12	BH 12	2419700	323750	655.895	33.00	19	F		MAINLY SG
13	BH 13	2419680	323553	669.710	77.50	78	F		Mineralised
14	BH 14	2420257	323260	663.850	76.60	60	F		
15	BH 15	2419721	323949	638.570	38.00	33	F		
16	BH 16	2419502	323779	622.275	37.50	30	F		
17	BH 17	2420679	323399	655.330	32.00	32	F		
18	BH 18	2419522	323978	623.290	39.10	0	P	Non mineralised	
19	BH 19	2420656	323199	631.840	31.50	24	NFG	Mineralised with SG Ore only	
20	BH 20	2419941	324116	627.390	38.40	32	P	Mineralised	
21	BH 21	2419303	323809	616.515	26.30	19	NFG		
22	BH 22	2419482	323582	633.740	54.50	32	P		
23	BH 23	2420059	323291	667.770	62.80	65	F		
24	BH 24	2419542	324188	662.060	63.20	17	F		Mineralisation with dominant Sub Grade Ore
25	BH 25	2419742	324144	625.760	19.85	8	NFG	Mineralised with SG Ore only	
26	BH 26	2420634	323004	634.515	18.80	19	P	Mineralised	
27	BH 27	2419921	323919	640.920	50.00	36	F		
28	BH 28	2419341	324193	625.830	50.40	27	P		
29	BH 29	2419322	324007	638.630	21.50	10	NFG		
30	BH 30	2419659	323355	657.070	28.60	28	F		
31	BH 31	2419861	323322	663.225	21.80	0	F		Non mineralised
32	BH 32	2419284	323612	638.620	49.20	44	P	Mineralised	
33	BH 33	2420437	323033	642.390	52.30	8	F	Mineralisation with dominant Sub Grade Ore	
34	BH 34	2419265	323417	641.340	34.80	18	F		
35	BH 35	2419462	323387	649.200	36.40	33	F	Non mineralised	
36	BH 36	2419638	323153	665.550	30.45	0	F		
37	BH 37	2420237	323083	665.360	33.10	0	F		
38	BH 38	2419841	323123	655.410	22.30	5	F		
39	BH 39	2420039	323093	661.260	33.45	0	F		

A. All the drilled bore holes are vertical coring type

B. F : Forest Land

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. RaHa, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.273 Ha IN  
SUNDERGARH Dist., ODISHA

NFG : Non Forest Govt Land  
P : Private Land

**f) Surface plan :**

Surface plan in a scale of 1 : 2000 with contour interval of 2 mt showing there in all the surface features including ground control point, boundary points, bore hole points, contours, safety zone etc. has been attached to this mining plan (Plate No. – 3).

**g) Surface Geological plan :**

A Surface Geological plan in a scale of 1 : 2000 with contour interval of 2 mt showing there in all the surface features including ground control point, boundary points, bench mark, contours, bore hole points, litho contacts, dip & strike, category of geological exploration, safety zone, etc. has been attached to this mining plan ( Plate No. – 4 ).

**Geological sections :**

i) Geological sections showing extension of litho units depthwise, category of geological exploration, bore hole position, safety zone have been prepared. Sections have been drawn in a scale of 1 : 1000.

In case of geological sections used for mineable ore reserve estimation, the ultimate pit slope has also been shown. The ultimate pit limit has been drawn on the surface geological plan by considering the following :

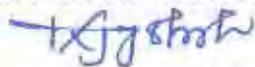
- i) Safety zone of 7.5 mt all along the block boundary,
- ii) Safety zone of 10 mt from the village road which passes along the block boundary,
- iii) 10 mt from the zone in the south-east corner of the block, formed by the presence of objectionable lands like bijesthali, smasan, nala, road etc.
- iv) 50 mt from perennial nala.

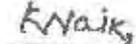
Sections are drawn from precise area boundary to boundary ( Plate No. – 5 ).

**h) Exploration proposed to be carried in the area :**

The precise area has been explored in a 200 X 200 mt grid which fits into the G2 category under UNFC guidelines. As per provision under Rule 12 (3) of MCDR 2017, It has been obligatory on the part of the holder of a mining lease to carry out detailed

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

exploration (G1 level) over the entire potentially mineralised area under the mining lease, within a period of five years from the date of opening of the mine after execution of such mining lease. Since the exploration, already carried out in this area conforms only to G2 category, a detailed yearwise exploration programme in 100 X 100 Mt grid has been prepared. The boreholes will be infilling type as the area has already been explored in 200 X 200 Mt grid. The locations of such proposed boreholes have been shown in the surface geological plan. All proposed boreholes will be drilled upto the end of the ore zone. Incase any such borehole does not encounter ore zone even at a depth of 40 mt same will be closed because of the fact that the maximum overburden encountered in the past exploration programme was 35 mt.

A. Total Area ( Ha ) to be covered under Proposed Exploration :

Forest Land ( Ha )	Non Forest Land ( Ha )			Grand Total ( Ha )	Expected Meterage to be Drilled ( Mt )
	Govt. Land	Private Land	Total		
112.621	13.815	12.787	26.602	139.223	4650.00

B. Total number of bore holes to be drilled :

Table No. 1.2

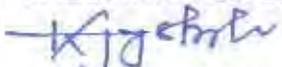
YEARWISE EXPLORATION PROGRAMME

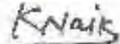
YEAR	No. of Boreholes ( Core / RC / DTH ) *	Grid interval	Total meterage	No. of pits Dimensions & Volumes	No. of trenches Dimensions & Volumes
I <sup>st</sup> Year	36	100 X 100 mt	4650 approximately considering average depth to be 50 mt	NIL	NIL
II <sup>nd</sup> Year	15			NIL	NIL
III <sup>rd</sup> Year	15			NIL	NIL
IV <sup>th</sup> Year	15			NIL	NIL
V <sup>th</sup> Year	12			NIL	NIL
<b>TOTAL</b>	<b>93</b>			<b>NIL</b>	<b>NIL</b>

\*All boreholes will be of coring.

The details of proposed bore holes with location, tentative depth, inclination etc. has been shown in Table No. 1.3. It is again clarified that the actual depth of holes will be the end of Ore Zone.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
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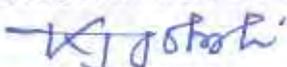
MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

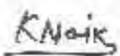
Though the entire block area has been explored providing ample idea for developing pits & dump areas, priority has been given while planning the future exploration programme. In the first year of proposed exploration, areas covering N-Pit, S-Pit, Waste dump, Sub grade stack yard will be taken up for exploration.

- C. Sampling : All the drilled cores containing iron ore will be subjected to logging & sampling. Samples will be drawn for each 1.0 m run or less, depending upon the variation. All the samples will be analysed in the in house laboratory of the applicant to be developed / already existing in the Steel Plant complex. 10% of the total samples will be analysed from any reputed NABL accredited laboratory as per the statute.

The details of Bore Holes drilled are tabulated as follows :

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



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S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA



Table No. 1.3

**DETAILS OF PROPOSED BOREHOLES TO BE DRILLED DURING FIRST PLAN PERIOD**

Sl No.	Year	PBH ID	Co-Ordinate		Collar RL (mRL)	Expected Depth (Mt)	Mineralised / Non Mineralised	Land Type	REMARKS
			Northing	Easting					
1	1st Year	PBH-1	2420583	323515	627.198	UPTO THE END OF MINERALISED ZONE	Potentially Non Mineralised / SG	P	Proposed SG Stack - A
2		PBH-2	2420445	323132	642.013		F	Proposed N-Pit	
3		PBH-3	2420466	323331	642.117		F		
4		PBH-4	2420486	323531	636.284		F		
5		PBH-5	2420346	323148	654.201		F		
6		PBH-6	2420356	323247	658.116		F		
7		PBH-7	2420367	323347	658.127		F		
8		PBH-8	2420377	323446	657.983		F		
9		PBH-9	2420387	323546	652.719		F		
10		PBH-10	2420397	323646	642.839		F		
11		PBH-11	2420247	323163	669.477		F		
12		PBH-12	2420266	323362	678.095		F		
13		PBH-13	2420286	323562	665.213		F		
14	40.00 m or upto the end of mineralisation increase penetrates through ore zone.	PBH-14	2420049	323194	661.993	Potentially Non Mineralised	F	Proposed Waste Dump	
15		PBH-15	2420070	323393	666.116		F		
16		PBH-16	2419940	323110	660.104		F		
17		PBH-17	2419951	323210	660.086		F		
18		PBH-18	2419961	323309	663.792		F		
19		PBH-19	2419971	323409	668.233		F		
20		PBH-20	2419981	323508	676.004		F		
21		PBH-21	2419851	323225	659.699		F		
22		PBH-22	2419871	323424	670.344		F		
23		UPTO THE END OF MINERALISED ZONE	PBH-23	2419572	323472		661.323		Potentially Mineralised
24	PBH-24		2419582	323571	671.621	F			
25	PBH-25		2419592	323671	662.036	F			
26	PBH-26		2419472	323487	658.329	F			
27	PBH-27		2419492	323686	661.74	F			
28	PBH-28		2419363	323403	645.784	F			
29	PBH-29		2419373	323503	651.846	F			
30	PBH-30		2419383	323602	653.683	F			
31	PBH-31		2419393	323702	647.402	F			
32	PBH-32		2419404	323802	645.132	F			

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Qualified Person

K C JYOTISHI  
Qualified Person

K NAIK  
Qualified Person



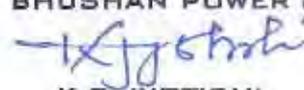
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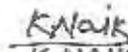
S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

Sl. No.	Year	PBH No.	S. No.	Area (Ha)	Grade	Potentially SG	Proposed SG Stack - B		
							F		
33	2 <sup>nd</sup> Year	PBH-33	2419551	323272	657.57		F		
34		PBH-34	2419452	323288	652.345		F		
35		PBH-35	2419353	323303	650.117		F		
36		PBH-36	2419434	324100	643.169		F		
37	2 <sup>nd</sup> Year	PBH-37	2420643	323101	634.280	A	M	F	
38		PBH-38	2420663	323300	625.768		M	P	
39		PBH-39	2420534	323017	641.350		M	F	
40		PBH-40	2420544	323116	635.128		M	F	
41		PBH-41	2420554	323216	635.212		M	F	
42		PBH-42	2420564	323216	633.841		M	F	
43		PBH-43	2420575	323415	632.089		M	F	
44		PBH-44	2420336	323048	654.185	B	M/NM	F	
45		PBH-45	2420138	323079	663.684		NM	F	
46		PBH-46	2420148	323179	665.329		NM	F	
47	PBH-47	2420158	323278	669.584	NM		F		
48	PBH-48	2420168	323378	672.296		NM	F		
49	PBH-49	2420177	323478	676.005	A	M	F		
50	PBH-50	2420187	323577	668.763		M	F		
51	PBH-51	2420197	323677	657.187		M	F		
52	PBH-52	2420407	323745	627.335		M	F		
53	PBH-53	2420306	243761	638.651		M	F		
54	PBH-54	2420206	323777	641.858		M	F		
55	PBH-55	2420217	323876	624.739		M	P		
56	PBH-56	2420090	323593	670.835	B	M/NM	F		
57	3 <sup>rd</sup> Year	PBH-57	2420111	323792	642.088	A	M	F	
58		PBH-58	2419991	323608	669.195		M	F	
59		PBH-59	2420001	323708	657.624		M	F	
60		PBH-60	2420012	323807	641.807		M	F	
61		PBH-61	2420022	323907	625.783		M	F	
62		PBH-62	2419891	323624	670.194	B	NM	F	
63		PBH-63	2419911	323823	640.022	A	M	F	
64		PBH-64	2419031	324022	620.181		M		
65		PBH-65	2419833	324038	619.789		M	NFG	
66		PBH-66	2419843	324137	625.492		M		
67	4 <sup>th</sup> Year	PBH-67	2419803	323739	657.293	A	M	F	
68		PBH-68	2419813	323839	640.009		M	F	
69		PBH-69	2419823	323938	639.137		M	F	
70		PBH-70	2419712	323854	646.728		M	F	
71		PBH-71	2419732	324054	636.086		M	NFG	
72		PBH-72	2419603	323770	654.763		M	F	
73		PBH-73	2419613	323870	644.62		M	F	
74		PBH-74	2419623	323970	635.896		M	F	
75		PBH-75	3419633	324069	632.115		M	NFG	

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
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SPS GeoMining Solution Private Limited

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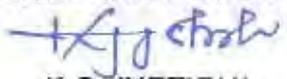
MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

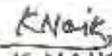
76		PBH-76	2419643	324169	630.082		M	NFG
77		PBH-77	2419513	323886	643.356		M/SG	F
78		PBH-78	2419533	324085	682.491	B	SG/NM	NFG
79		PBH-79	2419414	323901	646.059	A	M/SG	F
80		PBH-80	2419424	324001	634.255	B	SG/NM	NFG
81		PBH-81	2419276	323518	636.685	B	NM	F
82	5 <sup>th</sup> year	PBH-82	2419742	323141	660.339	B	NM	F
83		PBH-83	2419752	323241	660.017	B	NM	F
84		PBH-84	2419763	323340	660.232	B	M/NM	F
85		PBH-85	2419773	323440	667.135	B	M/NM	F
86		PBH-86	2419782	323540	672.422	B	M/NM	F
87		PBH-87	2419792	323639	667.519	A	M	F
88		PBH-88	2419650	323257	661.492	B	NM	F
89		PBH-89	2419671	323456	663.841	A	M	F
90		PBH-90	2419691	323655	662.467		M/SG	F
91		PBH-91	2419562	323372	653.882		M	F
92		PBH-92	2419444	324200	640.087		M	F
93	PBH-93	2419257	323319	636.239	M		F	

All the holes will be of vertical coring type. Size will be NX/NQ/BX/BQ.

1	M	Saleable Mineral Zone
2	NM	Non Mineralised Zone
3	SG	Sub grade Ore Zone
4	M/SG	Saleable / Sub grade Mineral Zone
5	SG/NM	Transitional between Sub grade & Non Mineralised Zone
6	M/NM	Transitional between Mineralised & Non Mineralised Zone
7	A	Upto the end of Mineralised Zone
8	B	40.00 m or upto the end of mineralisation incase penetrates through ore zone.
9	F	Forest Land
10	NFG	Non Forest Govt Land
11	P	Private Land

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K.C. Jyotishi, K. Naik  
Qualified Persons  
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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

1) **Reserves and Resources as per UNFC with respect to the threshold value :**

The Geological Report has been prepared by Directorate of Geology, Odisha and the said report has been provided to M/s Bhushan Power & Steel Limited alongwith other Tender documents. The summary of resource estimated in the report is .

Table No. 1.4

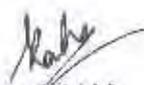
**SUMMARY OF RESOURCES AS ASSESSED BY DIRECTORATE OF GEOLOGY**

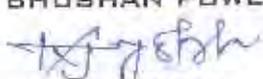
Grade Range	Type	Mln Tonnes	Fe%	Average grade		
				Fe%	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>
+ 55% Fe	HLO	0.968	63.569	61.071	4.523	2.438
	SLO	47.825	60.781			
	BD	13.862	65.647			
	Sub Total	62.655				
+ 45 – 55% Fe	SLO	19.318	50.572	50.572	10.376	8.885
+ 45% Fe	TOTAL	81.973				

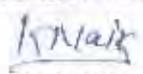
**Necessity of revision of Resource & estimation of Reserve :**

Since no attempt was made by Directorate of Geology to estimate the reserve of the deposit, same has plateto be estimated in this mining plan. While estimating the reserve it was kept in the mind that the resource of the area has been estimated is based on the exploration in 200 X 200 mt grid. Naturally there is a wide scope of assumption on the ore body pattern, shape & size. It differs from man to man. As the qualified persons, preparing this mining plan are having a vast experience of iron ore mining, we prefer to utilize that experience in delineating the ore bodies afresh. Secondly the geological sections included in the GR is in PDF format and not to the scale.

So geological sections have been drawn afresh. Based on the new geological sections, resource has been re-estimated. However recovery %age of ore has been taken same as was considered by Directorate of Geology. Similarly mineable sections are drawn and reserve has been estimated considering different constraints like safety zone due to block boundary, village road, objectionable lands.

  
S. RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
(under Rule 15 of MCR, 2016)

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

**Parameters considered:**

For the estimation of the Geological resources, the following factors have been considered :-

**a) Method of resource estimation :**

Cross-sectional method has been adopted for the estimation of resource / reserve. Since the general borehole spacing is in a 200 X 200 mt grid falling under G2 category of UNFC guidelines, an influence of 100 mt from a drilled bore holes have been considered under category '2' of geological axis.

**b) Threshold value:**

In the present market scenario, the threshold value of iron ore of this block has been considered at 45% Fe.

**c) Cut-off grade:**

+ 55% Fe has been kept as the cut-off grade for the iron ore deposit of this block.

**d) Recovery :**

The recovery factor has been taken as 80% in ore zone; similar to the consideration made by Directorate of Geology.

**e) Conversion factor:**

For Saleable / Sub grade iron ore :  $1 \text{ M}^3 = 3.3 \text{ MT}$

**1 RESERVES / RESOURCES**

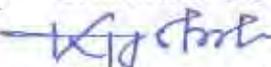
**(A) TOTAL MINERAL RESOURCES :**

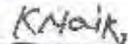
**Classification of Resources ( as per UNFC System ):**

UNFC system has been adopted to categorize the mineral Resources. For the estimation of different category of mineral resources, occurrences of mineral of intrinsic economic interest, location, grade, quantity, geological characteristic etc has been studied in detailed and are given here under:

**i) Indicated Mineral Resources (332):**

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



Based on the exploration which includes geological mapping, core drilling in 200 X 200 mt grid, thorough sampling and analysis by a government laboratory, mineralized zone has been demarcated. Physical Characteristic as well as tonnage factor had been studied. The Indicated Mineral Resources ( 332 ) has been estimated and shown in Table No. 1.5. Since the area comprises of forest & non forest land, resource has also been broadly divided into Resource in Forest Land & Resource in Non Forest Land.

Table No. 1.5  
**Tables showing estimation of Indicated Mineral Resources (332)**

**A. ORE RESOURCE IN NON FOREST LAND**

**a) Disseminated Float Ore**

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
AA'	32.48	96	3118.08	2494.46	8231.72
CC'	19.23	200	3846.00	3076.80	10153.44
EE'	284.27	170	48325.90	38660.72	127580.38
FF'	220.42	200	44084.00	35267.20	116381.76
<b>TOTAL</b>			<b>99373.98</b>	<b>79499.18</b>	<b>262347.30</b>

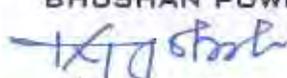
**b) Hard Bouldery Float Ore**

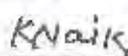
Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
DD'	835	200	167000.00	133600.00	440880.00
<b>TOTAL</b>			<b>167000.00</b>	<b>133600.00</b>	<b>440880.00</b>

**c) Soft Laminated Ore**

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
AA'	4692.90	150	703935.00	563148.00	1858388.40
CC'	438.28	200	87656.00	70124.80	231411.84

  
S RAHA  
Qualified Person

  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. RaHa, K C Jyotishi, K Naik  
Qualified Persons  
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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139,223 Ha IN  
SUNDERGARH Dist., ODISHA

DD'	1104.44	200	220888.00	176710.40	583144.32
EE'	1901.55	200	380310.00	304248.00	1004018.40
FF'	1254.42	200	250884.00	200707.20	662333.76
GG'	328.35	200	65670.00	52536.00	173368.80
HH'	9089.40	130	1181622.00	945297.60	3119482.08
<b>TOTAL</b>			<b>2890965.00</b>	<b>2312772.00</b>	<b>7632147.60</b>

d) Blue Dust

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
CC'	1199.81	200	239962.00	191969.60	633499.68
<b>TOTAL</b>			<b>239962.00</b>	<b>191969.60</b>	<b>633499.68</b>

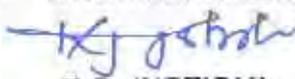
e) Subgrade ore

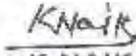
Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
CC'	176.44	200	35288.00	28230.40	93160.32
DD'	2607.04	200	521408.00	417126.40	1376517.12
EE'	884.72	200	176944.00	141555.20	467132.16
FF'	2820.34	200	564068.00	451254.40	1489139.52
GG'	1591.16	200	318232.00	254585.60	840132.48
HH'	392.73	130	51054.90	40843.92	134784.94
<b>TOTAL</b>			<b>1666994.90</b>	<b>1333595.92</b>	<b>4400866.54</b>

f) Gist of Indicated Mineral Resources (332) ( NON FOREST LAND)

		Category	in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)	Million Tones
Saleable ore	1	Disseminated Float Ore	79499.18	262347.31	0.26
	2	Hard Bouldery Float Ore	133600.00	440880.00	0.44
	3	Soft Laminated Ore	2312772.00	7632147.60	7.63
	4	Blue dust	191969.60	633499.68	0.63
Sub Total			<b>2717840.78</b>	<b>8968874.59</b>	<b>8.96</b>
Subgrade Ore			<b>1333595.92</b>	<b>4400866.54</b>	<b>4.40</b>
<b>TOTAL</b>			<b>4051436.70</b>	<b>13369741.10</b>	<b>13.36</b>

  
S RAHA  
Qualified Person

BHUBHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



## B. ORE RESOURCE IN FOREST LAND

## a) Disseminated Float Ore

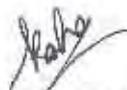
Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 60%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
BB'	587.91	190	111702.90	89362.32	294895.66
CC'	82.01	200	16402.00	13121.60	43301.28
DD'	31.46	200	6292.00	5033.60	16610.88
EE'	162.32	170	27594.40	22075.52	72849.216
FF'	861.22	200	172244.00	137795.20	454724.16
GG'	818.03	240	196327.20	157061.76	518303.81
<b>TOTAL</b>			<b>530562.50</b>	<b>424450.00</b>	<b>1400685.00</b>

## b) Hard Bouldery Float Ore

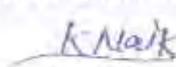
Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
BB'	735.32	150	110298.00	88238.40	291186.72
CC'	1293.68	200	258736.00	206988.80	683063.04
DD'	165.55	230	38076.50	30461.20	100521.96
<b>TOTAL</b>			<b>407110.50</b>	<b>325688.40</b>	<b>1074771.72</b>

## c) Soft Laminated Ore

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
AA'	2438.77	150	365815.50	292652.40	965752.92
BB'	18048.74	200	3609748.00	2887798.40	9529734.72
CC'	13513.89	200	2702778.00	2162222.40	7135333.92
DD'	8515.03	200	1703006.00	1362404.80	4495935.84
EE'	3853.5	200	770700.00	616560.00	2034648.00
FF'	12835.15	200	2567030.00	2053624.00	6776959.20
GG'	13241.46	200	2648292.00	2118633.60	6991490.88
HH'	9258.61	130	1203619.30	962895.44	3177554.95
<b>TOTAL</b>			<b>15570988.80</b>	<b>12456791.04</b>	<b>41107410.43</b>

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



## d) Blue Dust

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
AA'	3845.03	150	576754.50	461403.60	1522631.88
BB'	2024.25	200	404850.00	323880.00	1068804.00
CC'	9889.21	200	1977842.00	1582273.60	5221502.88
EE'	2524.57	200	504914.00	403931.20	1332972.96
FF'	6616.80	200	1323360.00	1058688.00	3493670.40
GG'	2351.30	200	470260.00	376208.00	1241486.40
<b>TOTAL</b>			<b>5257980.50</b>	<b>4206384.40</b>	<b>13881068.52</b>

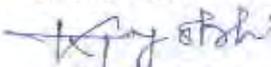
## e) Hard Laminated Ore

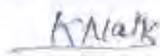
Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
GG'	1643.96	200	328792.00	263033.60	868010.88
<b>TOTAL</b>			<b>328792.00</b>	<b>263033.60</b>	<b>868010.88</b>

## f) Sub-grade ore

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
AA'	48.47	150	7270.50	5816.40	19194.12
BB'	481.33	200	96266.00	77012.80	254142.24
CC'	3209.25	200	641850.00	513480.00	1694484.00
DD'	2929.44	200	585888.00	468710.40	1546744.32
EE'	873.5	200	174700.00	139760.00	461208.00
FF'	4109.76	200	821952.00	657561.60	2169953.28
GG'	6814.7	200	1362940.00	1090352.00	3598161.60
HH'	1548.84	130	201349.20	161079.36	531561.89
<b>TOTAL</b>			<b>3892215.70</b>	<b>3113772.56</b>	<b>10275449.45</b>

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139,223 Ha IN  
SUNDERGARH Dist., ODISHA

g) Gist of Indicated Mineral Resources (332) ( FOREST LAND )

		Category	In M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)	Million Tones
Saleable ore	1	Disseminated Float Ore	424450.00	1400685.00	1.400
	2	Hard Bouldery Float Ore	325688.40	1074771.72	1.074
	3	Soft Laminated Ore	12456791.04	41107410.43	41.110
	4	Blue dust	4206384.40	13881068.52	13.881
	5	Hard Laminated Ore	263033.60	868010.88	0.868
Sub Total			17676347.44	58331946.55	58.333
Subgrade Ore			3113772.56	10275449.45	10.275
<b>TOTAL</b>			<b>20790120.00</b>	<b>68607396.00</b>	<b>68.608</b>

h) Gist of Total Indicated Mineral Resources (332) ( FOREST & NON FOREST LAND )

SI No	Category	SALEABLE ORE			SUB GRADE ORE		
		In M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)	Million Tones	In M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.0 MT)	Million Tones
1	Non –forest	2717840.78	8968874.59	8.968	1333595.92	4400866.54	4.400
2	Forest	17676347.44	58331946.55	58.333	3113772.56	10275449.45	10.275
<b>TOTAL</b>		<b>20394188.22</b>	<b>67300821.14</b>	<b>67.301</b>	<b>4447368.48</b>	<b>14676315.99</b>	<b>14.675</b>

The summarised resources based on the level of exploration with grade is as follows :

Table – 1.6

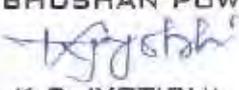
Table showing the resources based on the level of exploration with grade

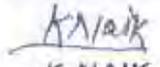
Level of Exploration	Resources in million Tons	Grade
G-1 – Detailed Exploration	0.000	---
G-2 – General Exploration	67.301	+ 55% Fe
	14.675	+ 45 – 55% Fe
G-3 – Prospecting	0.000	---
G-4 – Reconnaissance	0.000	---
<b>TOTAL</b>	<b>81.976</b>	

(B) **MINERAL RESERVES :**

Mineable reserve is that part of resources which can be calculated based on ultimate pit slope of the working leaving 7.5 m from the would be lease boundary, statutory barrier from nala, village road, non mining on objectionable land etc., floor space for

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person

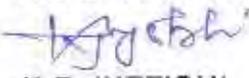


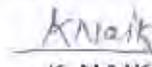
free movement of earth moving machineries, depth of pit floor so that ore can be taken out of the pit economically. While assigning the Codes the following aspects of the deposit have been taken into consideration.

#### A.1. ECONOMIC AXIS :

1. The quality of reserve has been established by bore hole drilling. A total of 1494.6 mt core drilling was accomplished in 39 vertical boreholes. Various types of iron ores have been encountered in 27 boreholes. 1044 numbers of meter wise core samples have been collected and analysed in the Departmental laboratory of the Directorate of Mines, Odisha by wet-cum-instrument method. Chemical analysis result indicates that iron content at 55% Fe cut off varies from 55 to 66.30% with average Fe content of 61.071%.
2. Quantity of resource / reserve has been computed based on data generated through field mapping & drilling, by the QPs.
3. Cut-off grade has been considered as + 55% Fe – ore of this quality from this belt is marketable. BPSL is already using this quality iron ore from this belt in his plant.
4. Iron ore from the mining leases operating in this belt in the nearby areas has great demand from the iron ore industries.
5. This block has good accessibility.
6. The iron ore of this block will have a readymade market in the own integrated steel plant of BPSL.
7. Since many of the existing iron ore mines of this belt will have their mining lease expired on 2020 and for auctioning of the same leases, their coming to production etc. may take a long period, iron ore produced from this block will have a high demand in the market after 2020.
8. The quality of saleable iron ore varies from +55% Fe to as high as 69.08 ( in BH 27 & BH 32 ).
9. Specific knowledge of forest / non-forest and other land use data is available.
10. Mining environment is conducive of large scale operation.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person

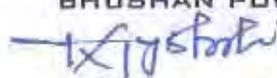


11. Since the deposit is having quality, quantity and marketability, the economic axis is considered as '1'.

#### A.2. FEASIBILITY AXIS :

1. The letter of intent ( Lol ) for grant of mining lease in favour of the applicant has already been issued.
2. The target area has already been explored through core drilling.
3. It is clarified that the exploration data available is sufficient to prepare a mining plan, so also the Pre-Feasibility report, as is being done now.
4. In this Mining plan mineable reserve has been estimated considering ore recovery, non-mineable areas like safety zone, objectionable land etc., calculation on the requirement of man & machinery, selection of suitable man power & equipment. Planning of waste disposal / reclamation, compilation of detailed land use data, have been made in Chapter 4 of this mining Plan.
5. Readymade market available for the iron ore to be produced from this block as a part of the production will be consumed in the own industry of BPSL.
6. Ore produced from the same geological formation in the nearby mining leases is having good market indicating marketability for the ore to be produced from this area.
7. It is presumed that after 2020, there will be dearth of production of iron ore in this belt. So the iron ore production from this block will have a high demand in the market.
8. The block comprises of a forest land but not falling under "Reserved Forest" or "Sanctuary" or "Biosphere". Many other leases having forest lands in the nearby areas have already been awarded Stage II clearance from MOEF&CC and are in operation / going to operate ( Neelachal Ispat Nigam Ltd. ). So there should not be any issue in getting forest clearance for this area also after the mining plan is approved, BPSL is capable of acquiring compensatory land for afforestation, paying the NPV, taking safeguard for safety zone etc.
9. Since this is a mining block, Environmental Clearance from MOEF&CC to be obtained. Many other mining leases surrounding this block have already obtained the clearances and are under active operation / newly executed like

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



Neelachal Ispat Nigam Ltd. So there should not be any issue in getting Environmental Clearance for this area also after the mining plan is approved, more particularly when BPSL has the ability and intention to take all precautionary measures for safeguard of the environment. Solid waste will be dumped in the proposed dump site. Retaining wall, garland drain etc. will be erected / dug. Sub grade ore will be stacked separately with all the measures to avoid washing out. Afforestation scheme will be implemented. Once this mining plan is approved, EIA studies and EMP including socio-economic impact will be made.

- 10.No Rehabilitation / Resettlement is required since there is no human habitation within the target area.
- 11.Crushing and Screening : Mobile crushing & screening units will be installed for processing the iron ore. The detail specification of the processing of ore is discussed in Chapter-8
- 12.Infrastructure and service construction activities : Only Mine office, a canteen, a dispensary and some weigh bridges will be located inside the lease. Other basic services are available around the target area.
- 13.Costing, Marketing, Economic viability : Pre-feasibility Report of the target area has been prepared including details on costing, marketing etc. The same is annexed with this mining plan.
- 14.Statutory provisions relating to labour, land, mining, taxation etc. : All will be cared off during mining.
- 15.Despite the fact that mining on the deposits is feasible as per the Pre-feasibility report, in absence of a mining plan and clearances from Ministry of Environment, Forest & Climate Change ( MOEF&CC ), the present status of feasibility axis is considered as '2'.
- 16.However, once the mining plan is approved, clearances from MOEF&CC will be obtained thereby changing the feasibility axis from '2' to '1'.

### A.3. GEOLOGICAL AXIS :

1. State Directorate of Geology has gone for detailed field mapping, drilling, sampling of this block.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raia, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

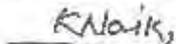
2. The iron ore deposit found within the block belongs to the Bonai - Keonjhar belt of the famous "Horse Shoe Synclinorium" falling in Sundargarh and Keonjhar districts. This synclinorium has been geologically studied by GSI, State Directorate of geology, many private geologists.
3. Geological mapping in 1 : 2,000 has been carried by the State DG.
4. State DG has proved the deposits through geological mapping, core drilling, sampling etc.
5. State DG has explored the target area through thirtynine ( 39 ) core drill holes in a grid of 200 X 200 mt.
6. Since the target area contains a bulk mineral, iron ore, belonging to Horse shoe synclinorium, very large in nature, continuous in habit, sedimentary in nature, the grid pattern followed is justified for proving the ore body in detail. However, due to larger spacing of borehole points, the exploration has been categorized as G2.
7. Thorough sampling and analysis of all the drilled cores containing ore body have been carried in the Departmental laboratory of the Directorate of Mines, Odisha by wet-cum-instrument method.
8. Mining in the nearby areas in the same synclinorium indicates affirmatively about the quality and quantity of the iron ore deposit.
9. For ore resource estimation, the entire thickness of iron ore bed, penetrated through core drill holes has been considered under category '2' of geological axis.

**i) Probable Mineable Reserve (122):**

As already discussed above, the block has been topographically surveyed with a scale of 1 : 2000 with contour interval of 2 mt. geological mapping has been done in the same scale of 1 , 2000. Core drilling in a grid of 200 X 200 mt has been carried. The reserve has been estimated based on the actual thickness of iron ore encountered in the drilled holes. Thus, the geological axis is kept under G2 due to large spacing of bore holes.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
(under Rule 15 of MCR, 2016)

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On feasibility axis, the factors considered are ; Mining plan has been prepared and is under submission. Once mining plan gets approved, Environmental clearance as well as Forest diversion proposal will be prepared and processed. The recovery of ore and the efficiency of mining machinery have been calculated. Manpower / equipment requirement has been estimated based on actual need. Resource for infrastructural development can be made. Thus, the ore reserve is kept under F2 of feasibility axis.

On economic front, factors considered are : Land use pattern is known, the quantity & quality of the deposit is known which are high, both in term of quality & quantity, Ore from this block will have a readymade market in the applicant's own steel industry. In addition, due to the expected void in the market as an aftermath of closure of most of the iron ore leases in India at 2020, it will have a great demand in the open market. More over scientific method of mining will be practiced to make the economics of the deposit more viable. As such the economic axis is considered as E1.

Thus mineable reserve, as on date, can be classified under 122 category. The estimated reserve has been shown in Table – 1.7.

**TABLE - 1.7**

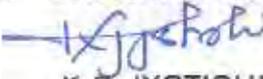
**Estimation of Pre-feasibility Mineral Reserve**

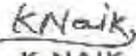
**A. ORE RESERVE IN NON FOREST LAND**

**a) Disseminated Float Ore**

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
AA'	32.48	96	3118.08	2494.46	8231.73
CC'	19.23	200	3846.00	3076.80	10153.44
EE'	284.27	170	48325.90	38660.72	127580.38
FF'	220.42	200	44084.00	35267.20	116381.76
<b>TOTAL</b>			<b>99373.98</b>	<b>79499.18</b>	<b>262347.31</b>

  
**S RAHA**  
Qualified Person

**BHUSHAN POWER & STEEL LIMITED**  
  
**K C JYOTISHI**  
Qualified Person

  
**K NAIK**  
Qualified Person



## b) Hard Bouldery Float Ore

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
DD'	835	200	167000.00	133600.00	440880.00
<b>TOTAL</b>			<b>167000.00</b>	<b>133600.00</b>	<b>440880.00</b>

## c) Soft Laminated Ore

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
AA'	4692.90	150	703935.00	563148.00	1858388.40
CC'	418.49	200	83698.00	66958.40	220962.72
DD'	49.48	200	9896.00	7916.80	26125.44
EE'	1901.55	200	380310.00	304248.00	1004018.40
FF'	1144.94	200	228988.00	183190.40	604528.32
GG'	303.02	200	60604.00	48483.20	159994.56
HH'	5581.27	130	725565.10	580452.08	1915491.86
<b>TOTAL</b>			<b>2192996.10</b>	<b>1754396.88</b>	<b>5789509.70</b>

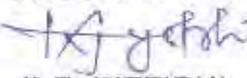
## d) Blue Dust

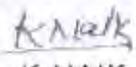
Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
CC'	844.56	200	168912.00	135129.60	445927.68
<b>TOTAL</b>			<b>168912.00</b>	<b>135129.60</b>	<b>445927.68</b>

## e) Subgrade ore

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
CC'	176.44	200	35288.00	28230.40	93160.32
DD'	1855.34	200	371068.00	296854.40	979619.52
EE'	884.72	200	176944.00	141555.20	467132.16
FF'	2767.89	200	553578.00	442862.40	1461445.92

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, & Naik  
Qualified Persons  
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MINING PLAN OF NETRABANDH PAHAR  
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GG'	1591.16	200	318232.00	254585.60	840132.48
HH'	200.03	130	26003.90	20803.12	68650.30
<b>TOTAL</b>			<b>1481113.90</b>	<b>1184891.12</b>	<b>3910140.70</b>

f) Gist of Probable Mineral Reserve (122) (NON FOREST LAND)

		Category	in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)	Million Tones
Saleable ore	1	Disseminated Float Ore	79499.18	262347.31	0.26
	2	Hard Bouldery Float Ore	133600.00	440880.00	0.44
	3	Soft Laminated Ore	1754396.88	5789509.70	5.78
	4	Blue dust	135129.60	445927.68	0.45
<b>Total</b>			<b>2102625.66</b>	<b>6938664.69</b>	<b>6.93</b>
<b>Subgrade Ore</b>			<b>1184891.12</b>	<b>3910140.70</b>	<b>3.91</b>
<b>TOTAL</b>			<b>3287516.78</b>	<b>10848805.39</b>	<b>10.84</b>

B. ORE RESERVE IN FOREST LAND

a) Disseminated Float Ore

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
BB'	587.91	190	111702.90	89362.32	294895.66
CC'	82.01	200	16402.00	13121.60	43301.28
DD'	31.46	200	6292.00	5033.60	16610.88
EE'	162.32	170	27594.40	22075.52	72849.21
FF'	761.22	200	152244.00	121795.20	401924.16
GG'	618.03	240	148327.20	118661.76	391583.81
<b>TOTAL</b>			<b>462562.50</b>	<b>370050.00</b>	<b>1221165.00</b>

b) Hard Bouldery Float Ore

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
BB'	1046.33	150	156949.50	125559.60	414346.68
CC'	1593.68	200	318736.00	254988.80	841463.04
DD'	165.55	230	38076.50	30461.20	100521.96
<b>TOTAL</b>			<b>513762.00</b>	<b>411009.60</b>	<b>1356331.68</b>

S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Rahta, K C Jyotishi, K Naik  
Qualified Persons  
(under Rule 15 of MCR, 2016)

MINING PLAN OF NETRABANDH PAHAR  
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SUNDERGARH Dist., ODISHA



c) Soft Laminated Ore

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				In M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
AA'	2270.37	150	340555.50	272444.40	899066.52
BB'	17727.75	200	3545550.00	2836440.00	9360252.00
CC'	13513.89	200	2702778.00	2162222.40	7135333.92
DD'	8515.03	200	1703006.00	1362404.80	4495935.84
EE'	3853.5	200	770700.00	616560.00	2034648.00
FF'	12835.15	200	2567030.00	2053624.00	6776959.20
GG'	13241.46	200	2648292.00	2118633.60	6991490.88
HH'	9017.87	130	1172323.10	937858.48	3094932.98
TOTAL			15450234.60	12360187.68	40788619.34

d) Blue Dust

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				In M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
AA'	2641.64	150	396246.00	316996.80	1046089.44
BB'	2024.25	200	404850.00	323880.00	1068804.00
CC'	9889.21	200	1977842.00	1582273.60	5221502.88
EE'	2524.57	200	504914.00	403931.20	1332972.96
FF'	6616.80	200	1323360.00	1058688.00	3493670.40
GG'	2351.30	200	470260.00	376208.00	1241486.40
TOTAL			5077472.00	4061977.60	13404526.08

e) Hard Laminated Ore

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				In M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
GG'	1643.96	200	328792.00	263033.60	868010.88
TOTAL			328792.00	263033.60	868010.88

S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

K NAIK  
Qualified Person



## f) Subgrade Ore

Sec line	Cross sectional area In M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				In M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
AA'	48.47	150	7270.50	5816.40	19194.12
BB'	481.33	200	96266.00	77012.80	254142.24
CC'	3209.25	200	641850.00	513480.00	1694484.00
DD'	2929.44	200	585888.00	468710.40	1546744.32
EE'	873.5	200	174700.00	139760.00	461208.00
FF'	4109.76	200	821952.00	657561.60	2169953.28
GG'	6789.37	200	1357874.00	1086299.20	3584787.36
HH'	1548.84	130	201349.20	161079.36	531561.89
<b>TOTAL</b>			<b>3887149.70</b>	<b>3109719.76</b>	<b>10262075.21</b>

## g) Gist of Probable Mineral Reserve (122) ( FOREST LAND )

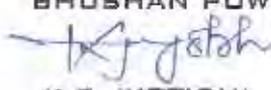
Category		SALEABLE ORE		
		in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)	Million tones
Saleable ore	Disseminated Float Ore	370050.00	1221165.00	1.222
	Hard Bouldery Float Ore	411009.60	1356331.68	1.356
	Soft Laminated Ore	12360187.68	40788619.34	40.788
	Blue dust	4061977.60	13404526.08	13.404
	Hard Laminated Ore	263033.60	868010.88	0.868
<b>Sub Total</b>		<b>17466258.48</b>	<b>57638652.98</b>	<b>57.638</b>
<b>Sub grade ore</b>		<b>3109719.76</b>	<b>10262075.21</b>	<b>10.262</b>
<b>Total</b>		<b>20575978.24</b>	<b>67900728.19</b>	<b>67.900</b>

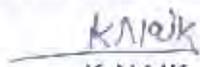
## h) Gist of Total Probable Mineral Reserve (122) ( FOREST &amp; NON FOREST LAND )

Table No. 1.7

Sl No	Category	SALEABLE ORE			SUB GRADE ORE		
		in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)	Million tones	in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.0 MT)	Million tones
1	Non -forest	2102625.66	6938664.69	6.939	1184891.12	3910140.70	3.910
2	Forest	17466258.48	57638652.98	57.638	3109719.76	10262075.21	10.262
<b>TOTAL</b>		<b>19568884.14</b>	<b>64577317.67</b>	<b>64.577</b>	<b>4294610.88</b>	<b>14172215.9</b>	<b>14.172</b>

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person

**( C ) PRE-FEASIBLE MINERAL RESERVES :**

It is found that some part of the ore body will not be feasible to be mined out due to 7.5 mt statutory barrier from the block boundary i.e. would be lease boundary, -10 mt statutory barrier from the public / village road, pit slope etc. as well as due to the presence of objectionable land like nala, smasan, devasthan etc. in the south-east corner of the block. This part of reserve which can not be extracted at the normal situation is termed as the pre-feasibility reserve. The pre-feasibility mineral resource has been calculated in Table – 1.8.

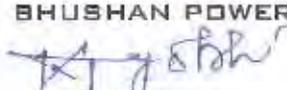
**TABLE - 1.8****Estimation of Pre-feasibility Mineral Resources, not Mineable due to 7.5 / 10 m Safety Zone, objectionable land and pit slope.****A. PRE-FEASIBILITY ORE RESERVE IN NON FOREST LAND****a) Soft Laminated Ore (Blocked due to 7.5 mt safety zone and its slope )**

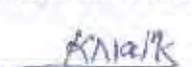
Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				In M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
CC'	19.79	200	3958.00	3166.40	10449.12
DD'	1054.96	200	210992.00	168793.60	557018.88
FF'	109.48	200	21896.00	17516.80	57805.44
HH'	719.99	130	93598.70	74878.96	247100.57
<b>TOTAL</b>			<b>330444.70</b>	<b>264355.76</b>	<b>872374.01</b>

**b) Blue Dust (Blocked due to 7.5 mt safety zone and its slope )**

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				In M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
CC'	355.25	200	71050.00	56840.00	187572
<b>TOTAL</b>			<b>71050.00</b>	<b>56840.00</b>	<b>187572</b>

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

c) Soft Laminated Ore (Blocked due to nala, debasthhali, smashan etc.)

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	in MT (1 M <sup>3</sup> =3.3 MT)
GG'	25.33	200	5066.00	4052.80	13374.24
HH'	2788.14	130	362458.20	289966.56	956889.65
<b>TOTAL</b>			<b>367524.20</b>	<b>294019.36</b>	<b>970263.89</b>

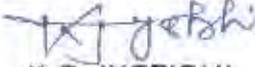
d) Sub Grade ore blocked in 7.5 Safety zone and its slope

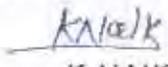
Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	in MT (1 M <sup>3</sup> =3.3 MT)
DD'	751.7	200	150340.00	120272.00	396897.60
FF'	52.45	200	10490.00	8392.00	27693.60
HH'	192.7	130	25051.00	20040.80	66134.64
<b>TOTAL</b>			<b>185881.00</b>	<b>148704.80</b>	<b>490725.84</b>

e) Gist of Pre-Feasibility Mineral Reserve (222) ( NON FOREST LAND )

	Category	SALEABLE ORE		
		in M <sup>3</sup>	in MT (1 M <sup>3</sup> =3.3 MT)	Million tones
Saleable ore	Soft Laminated Ore ( 7.5 m barrier )	264355.76	872374.01	0.872
	Soft Laminated Ore ( Debasthali etc. )	294019.36	970263.89	0.970
	Blue dust	56840.00	187572	0.187
<b>Sub total</b>		<b>615215.12</b>	<b>2030209.90</b>	<b>2.029</b>
<b>Subgrade</b>		<b>148704.80</b>	<b>490725.84</b>	<b>0.490</b>
<b>Total</b>		<b>763919.92</b>	<b>2520935.74</b>	<b>2.519</b>

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



## B. PRE-FEASIBILITY ORE RESERVE IN FOREST LAND

## a) Soft Laminated Ore (Blocked due to 7.5 mt safety zone and its slope )

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
AA'	168.40	150	25260.00	20208.00	66686.40
BB'	320.99	200	64198.00	51358.40	169482.72
TOTAL			89458.00	71566.40	236169.12

## b) Blue Dust (Blocked due to 7.5 mt safety zone and its slope )

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
AA'	1203.39	150	180508.50	144406.80	476542.44
TOTAL			180508.50	144406.80	476542.44

## c) Soft Laminated Ore ( Blocked due to Nala, Debasthali, Smanan etc. )

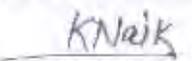
Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
HH'	240.74	130	31296.20	25036.96	82621.97
TOTAL			31296.20	25036.96	82621.97

## a) Subgrade Ore (Blocked due to 7.5 mt safety zone and its slope )

Sec line	Cross sectional area in M <sup>2</sup>	Length of influence in M	Volume in M <sup>3</sup>	Recovery %age of saleable (+55% Fe) ore : 80%	
				in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)
GG'	25.33	200	5066.00	4052.80	13374.24
TOTAL			5066.00	4052.80	13374.24

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
(under Rule 15 of MCR, 2016)

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist, ODISHA



b) Gist of Pre-Feasibility Mineral Reserve (222) ( FOREST LAND )

	Category	SALEABLE ORE		
		in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)	Million tones
Saleable ore	Soft Laminated Ore ( 7.5 m barrier )	71566.40	136169.12	0.136
	Soft Laminated Ore ( Debasthali etc. )	25036.96	82621.97	0.082
	Blue dust	144406.80	476542.44	0.476
<b>Sub total</b>		<b>241010.16</b>	<b>695333.53</b>	<b>0.695</b>
<b>Subgrade</b>		<b>4052.80</b>	<b>13374.24</b>	<b>0.013</b>
<b>Total</b>		<b>245062.96</b>	<b>708707.77</b>	<b>0.708</b>

c) Gist of Total Pre-Feasibility Mineral Reserve (222) ( FOREST & NON FOREST LAND )

Table No. 1.9

Sl No	Category	SALEABLE ORE			SUB GRADE ORE		
		in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)	Million tones	in M <sup>3</sup>	In MT (1 M <sup>3</sup> =3.3 MT)	Million tones
1	Non -forest	615215.12	2030209.90	2.029	148704.80	490725.84	0.490
2	Forest	241010.16	695333.53	0.695	4052.80	13374.24	0.013
<b>TOTAL</b>		<b>856225.28</b>	<b>2725543.4</b>	<b>2.724</b>	<b>152757.6</b>	<b>504100.08</b>	<b>0.503</b>

Table -1.10

**PRESENTATION OF MINERAL RESOURCES / RESERVE AS PER UNFC**

Total Resources = Reserve + remaining resource			Quantity Million Tons	Details break up constrain wise	
Reserves	Proved	(111)	-	-	forest land
				-	Non forest land
	Probable	(121)	-	-	Diverted forest land
				-	Non forest land
		(122)	64.577	57.638	forest land
			6.939	Non forest land	
B. Remaining Mineral Resources	Feasibility Mineral Resources	(211)			Ultimate pit limit
					Lease barrier/ safety barrier
					Non-diverted forest land

S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Rahe, K.C. Jyotishi, K. Naik  
Qualified Persons  
(under Rule 15 of MCR, 2016)

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA



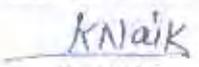
					Permanent infrastructure like Road, power lines, habitation
					Low grade part
					Non-beneficiable part
					Others( to specify
	Pre-feasibility Mineral Resources	(222)	17.399	3.147	Ultimate pit limit
					Lease barrier/ safety barrier
					Non-diverted forest land
					Permanent infrastructure like Road, power lines, habitation
				14.172	Low grade part
					Non-beneficiable part
				0.080	Others( Debasthali etc. )
	Measured Mineral Resources	(331)			Specify /outline
	Indicated Mineral Resources	(332)			
	Inferred Mineral Resources	(333)			
	Reconnaissance Mineral Resources	(334)			
SUBTOTAL	RESERVES(a)		64.577	57.638	Forest land
				6.939	Non forest land
	Remaining resources(b)		17,399		
All Total	Resources (a+b)		81.976		Specify forest land in brief

**Estimation of Recoverable reserves and life of the mine:**

From the above Table No- 1.10, it is clear that, the total recoverable iron ore of saleable type from this auctioned block is 64.577Mln Tonnes. Considering production of 2 Mln Tonnes in the first 2 years and the maximum production target of 2 million tonnes per year from 3<sup>rd</sup> year onwards, the life of the mine will be  $\{( 64.577 - 2 ) / 2\} + 2 = 31.288 + 2 = 33.288$  years or say 33 years. The life of the mine may increase after detailed exploration.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K NAIK  
Qualified Person



## 2.0 MINING

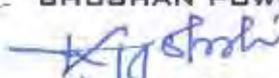
- a) Briefly describe the existing / proposed method for excavation with all design parameters.

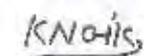
Fully Mechanized method with the deployment of earth moving machineries like crawler mounted drill rig, air compressor, backhoe shovels, rock breaker, 25 tonner dumpers etc. will be adopted. Mine working will be on three (3) shifts basis. Mining is envisaged based on consideration of large scale production of 2 Mln Tonnes per annum to cater to the open market as well as to partly feed own's integrated steel plant.

Benches will be developed systematically following the terrain condition of the area to attain the production of iron ore of 2 Mln Tonnes per annum at the end of 3<sup>rd</sup> year. The height and width of the benches will be kept at 6 mt & 10 mt respectively for easy vehicular movement. The individual bench faces will be kept at 80° whereas the overall quarry slope angle is proposed to be kept at around 45° with the horizontal. Massive hard iron ore beds / boulders will be loosened through drilling and blasting. Drilling will be carried out by means of 115 mm dia crawler drill with 610 HP compressor. For secondary breaking hydraulic rock breaker will be deployed. Thus secondary drilling and blasting is eliminated. Blasting will be carried out with the help of explosives (slurry type) boosters and ANFO and Class-VI explosives (TLD, electric detonators and detonating fuse). As per the general practice in this field, explosives will be supplied by any Explosive Dealers with whom the lessee will make an agreement for the purpose in Form 22 of Explosive Act. ROM containing mainly blasted hard ore will be fed to mobile crushing-screening plants fitted with grizzly. ROM with SLO, Fines, BD will be fed directly to mobile screening plants and these screening plants will also be fitted with grizzly. The oversized materials will be fed to crushing plant.

For ore haulage / waste handling shovel of 1.3 M<sup>3</sup> bucket capacity ( PC 300 ) in combination with 25 tonner dumpers ( Hyva 2510 ) will be utilised. Ten (10) meter wide haul road is proposed to be developed with the gradient of 1:12 to 1:16 for facilitating easy movement of machineries & transportation of ore and waste.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

Dumpers will be loaded with blasted / broken material with the help of backhoe shovels. Separate year wise development plan for the first five years has been prepared with systematic development of benches. The generation of saleable ore, sub grade ore and waste has been described in detail in the following paragraphs.

To negotiate the mechanized workings, the detailed requirement of machineries is calculated and list of machineries is given.

Two quarries which may be named as N-Pit & S-Pit, based on their location in the north & south part of the block, are proposed to be developed to produce the iron ore to meet the proposed requirement. This is because of the fact that :

*The geological mapping within the block area, carried out by the QPs indicated that there is a vast reserve of very hard lumpy ore in the northern part of the block where as southern block is deficient of hard lumpy ore. So to have a balanced production of hard & soft ore, simultaneous production from two pits, one in northern part ( named as N-Pit ) and another in southern part ( named as S-Pit ), have been proposed for production of iron ore.*

Details of layout of mine working have been illustrated in Plate No.7A1 to 7A5 and 7B1 to 7B5

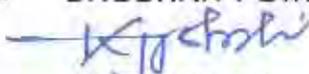
- b) Indicate year-wise tentative Excavation in Cubic Meters indicating development, ROM, pit wise as in table below :

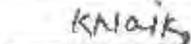
The future mining work shall be restricted within the ultimate pit limit, demarcated after consideration of various factors, mainly safety zone due to lease boundary, village road, objectionable land, depth of ore bed, physical as well as chemical quality of ore etc.

#### I. Insitu Tentative Excavation

The Year-wise production target, for the next five years of this plan period has been indicated in Table – 2.1.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



Geo Mining Solution Private Limited

S. Rafia, K C Jyotishi, K Naik  
Qualified Persons  
(under Rule 15 of MCR, 2016)

MINING PLAN OF NETRABANDH PAHAR IRON ORE BLOCK OVER  
139.223 Ha IN SUNDERGARH DIST., ODISHA

Table - 2.1

**TABLE SHOWING PRODUCTION OF SALEABLE ORE, SUB GRADE ORE, GENERATION OF O.B. & INTERCALATED WASTE FROM THE ORE ZONE AND THEIR STRIPPING RATIO**

YEAR	Pit No.	mRL	Total tentative Excavation (M <sup>3</sup> )	Top Soil (M <sup>3</sup> )	OB/SB/IB (M <sup>3</sup> )	ROM			ROM / Waste Ratio	
						Ore (M <sup>3</sup> )	Mineral Reject (M <sup>3</sup> )	Total ROM (M <sup>3</sup> )		
1 <sup>st</sup> year	N-PIT	674.50-670	25777.96	0.00	16943.82	7067.31	1766.63	8834.14	26092.58	1 : 0.60
		675.39-670	76686.91	0.00	45249.75	25148.73	6287.43	31437.16	99970.17	1 : 0.45
		670-664	99776.69	0.00	0.00	79381.35	19845.34	98226.69	315540.87	1 : 0.00
		664-658	22197.00	0.00	4417.14	4122.05	13657.81	17779.86	56539.96	1 : 0.08
		<b>Sub-Total</b>	<b>223888.56</b>	<b>0.00</b>	<b>66610.71</b>	<b>115720.44</b>	<b>41557.41</b>	<b>157277.85</b>	<b>500143.56</b>	<b>1 : 0.13</b>
2 <sup>nd</sup> Year	S-PIT	673.50-670	1113.86	0.00	0.00	881.088	222.77	1113.86	3542.07	1 : 0.00
		670-664	15569.16	0.00	0.00	12465.33	3113.83	15689.16	49509.94	1 : 0.00
		664-658	67168.54	0.00	0.00	18008.77	44169.87	62168.64	187696.27	1 : 0.00
		<b>Sub-Total</b>	<b>78851.65</b>	<b>0.00</b>	<b>0.00</b>	<b>31356.18</b>	<b>47496.47</b>	<b>78851.65</b>	<b>250748.25</b>	<b>1 : 0.00</b>
		<b>GRAND TOTAL</b>	<b>302740.19</b>	<b>0.00</b>	<b>66610.71</b>	<b>147075.6</b>	<b>47225.9</b>	<b>89053.88</b>	<b>750891.74</b>	<b>1 : 0.09</b>
2 <sup>nd</sup> Year	N-PIT	664-658	207344.34	0.00	13251.42	124998.82	69124.10	194092.92	617215.48	1 : 0.02
		658-652	46728.87	0.00	4751.34	17507.23	24470.30	41977.53	133488.55	1 : 0.04
		<b>Sub-Total</b>	<b>254073.21</b>	<b>0.00</b>	<b>18002.76</b>	<b>142476.05</b>	<b>93594.40</b>	<b>236070.45</b>	<b>750704.03</b>	<b>1 : 0.02</b>
S-PIT	664-658	72697.20	0.00	0.00	21058.64	51638.56	72697.20	231177.10	1 : 0.00	

BHUSHAN POWER & STEEL LIMITED

*K C Jyotishi*  
K C JYOTISHI  
Qualified Person

*S RAHA*  
S RAHA  
Qualified Person

*K NAIK*  
K NAIK  
Qualified Person





SRS Geomining Solution Private Limited

MINING PLAN OF NETRABANDH PAHAR IRON ORE BLOCK OVER  
139.223 Ha IN SUNDERGARH Disl, ODISHA

S. Rahia, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

3 <sup>rd</sup> Year	658-852	88660.41	0.00	3872.58	67830.26	16857.57	84787.83	269625.30	1 : 0.01
	<b>Sub-Total</b>	<b>161357.61</b>	<b>0.00</b>	<b>3872.58</b>	<b>88888.90</b>	<b>65598.13</b>	<b>157485.03</b>	<b>500802.40</b>	<b>1 : 0.01</b>
	<b>GRAND TOTAL</b>	<b>415430.82</b>	<b>0.00</b>	<b>21875.34</b>	<b>231364.95</b>	<b>78711.10</b>	<b>162190.53</b>	<b>1251506.43</b>	<b>1 : 0.02</b>
N-PIT	658-652	195749.16	0.00	17501.12	121185.35	57082.67	178248.04	588628.80	1 : 0.03
	655-67-652	15496.65	0.00	0.00	12397.32	3088.33	16488.65	49279.35	1 : 0.00
	652-646	303091.68	0.00	103727.18	159491.60	39872.80	199364.50	633879.11	1 : 0.16
	<b>Sub-Total</b>	<b>514337.49</b>	<b>0.00</b>	<b>121226.30</b>	<b>293054.30</b>	<b>100054.90</b>	<b>393109.19</b>	<b>1250087.26</b>	<b>1 : 0.10</b>
S-PIT	658-652	101718.92	0.00	4442.96	77820.77	18455.19	97275.96	309337.55	1 : 0.01
	655-00-652	31687.00	0.00	0.00	25349.60	5337.40	31687.00	100764.86	1 : 0.00
	652-646	130432.68	0.00	23327.76	73517.18	33587.73	107104.92	340593.62	1 : 0.07
	<b>Sub-Total</b>	<b>263838.60</b>	<b>0.00</b>	<b>27770.72</b>	<b>176687.55</b>	<b>53380.33</b>	<b>236067.88</b>	<b>750695.86</b>	<b>1 : 0.04</b>
	<b>GRAND TOTAL</b>	<b>778176.09</b>	<b>0.00</b>	<b>148999.02</b>	<b>469741.85</b>	<b>125835.4</b>	<b>189435.21</b>	<b>2000783.1</b>	<b>1 : 0.07</b>
4 <sup>th</sup> Year	N-PIT	91579.48	0.00	4516.82	64577.55	22455.11	87032.66	276753.86	1 : 0.02
	646-640	399132.48	0.00	93032.06	201835.79	104264.62	306100.42	873399.34	1 : 0.10
	<b>Sub-Total</b>	<b>490711.96</b>	<b>0.00</b>	<b>97578.88</b>	<b>256413.34</b>	<b>126719.74</b>	<b>393133.08</b>	<b>1250163.19</b>	<b>1 : 0.08</b>
	S-PIT	81401.32	0.00	10887.24	53851.62	18662.47	70514.06	224234.77	1 : 0.05
652-646	20795.40	0.00	0.00	11712.24	8883.15	20705.40	65843.17	1 : 0.00	
648-640	208581.50	1308.00	62595.30	76833.76	67844.44	144678.20	460075.88	1 : 0.14	
<b>Sub-Total</b>	<b>310688.22</b>	<b>1308.00</b>	<b>73482.54</b>	<b>142397.62</b>	<b>93500.07</b>	<b>235897.68</b>	<b>750154.62</b>	<b>1 : 0.10</b>	
	<b>GRAND TOTAL</b>	<b>801400.18</b>	<b>1308.00</b>	<b>171061.42</b>	<b>408810.96</b>	<b>125806.15</b>	<b>220219.80</b>	<b>2000317.82</b>	<b>1 : 0.09</b>
5 <sup>th</sup> Year	N-PIT	31489.92	0.00	986.40	5840.58	24862.94	30503.52	97001.19	1 : 0.01
	640-634	488753.64	0.00	125903.80	280546.03	81903.81	362848.84	1153882.48	1 : 0.11
	<b>Sub-Total</b>	<b>520243.56</b>	<b>0.00</b>	<b>126890.20</b>	<b>286586.61</b>	<b>106766.75</b>	<b>393353.36</b>	<b>1250863.68</b>	<b>1 : 0.10</b>
	S-PIT	170723.60	216.00	51737.80	92521.04	28248.76	18759.80	377687.96	1 : 0.14

BHUSHAN POWER & STEEL LIMITED

*K C Jyotishi*  
K C JYOTISHI  
Qualified Person

*S RAHA*  
S RAHA  
Qualified Person

*K NAIK*  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Rahe, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

PLAN OF NETRABANDH CONCESSION AREA IRON ORE BLOCK OVER  
139.223 Ha IN SUNDERGARH DIST., ODISHA

	640-634	193062.37	177.00	75607.86	43418.81	73858.70	117277.51	372942.48	1 : 0.20
	Sub-Total	363785.97	393.00	127345.66	135939.85	100107.46	236047.31	750630.45	1 : 0.17
	GRAND TOTAL	884029.53	393.00	254235.86	422526.46	125880.13	206874.21	2001494.13	1 : 0.13

*S. Rahe*

S RAHA

Qualified Person

*K C Jyotishi*

K C JYOTISHI

Qualified Person

BHUSHAN POWER & STEEL LIMITED

*K Naik*

K NAIK

Qualified Person





SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA



Table – 2.2

**Proposed production of ROM for the first five years**

YEAR	PIT NO	NORTHING	EASTING	AREA ( Ha )	PRODUCTION OF ROM	
					Min M <sup>3</sup>	Min T
1 <sup>st</sup> Year	N-PIT	2420260.820	323342.643	3.645	0.16	0.50
		2420358.520	323808.807			
	S-PIT	2419530.852	323347.835	1.789	0.08	0.25
		2419553.986	323574.733			
TOTAL				5.434	0.24	0.75
2 <sup>nd</sup> Year	N-PIT	2420373.258	323338.356	4.250	0.24	0.75
		2420262.104	323864.992			
	S-PIT	2419526.544	323279.085	3.465	0.16	0.50
		2419564.478	323659.814			
TOTAL				7.715	0.40	1.25
3 <sup>rd</sup> Year	N-PIT	2420282.296	323328.008	8.386	0.39	1.25
		2420448.452	323908.000			
	S-PIT	2419526.544	323279.085	6.229	0.23	0.75
		2419402.147	323715.988			
TOTAL				14.615	0.62	2.00
4 <sup>th</sup> Year	N-PIT	2420214.346	323319.678	11.554	0.39	1.25
		2420480.192	323924.838			
	S-PIT	2419526.544	323279.085	8.098	0.23	0.75
		2419345.874	323725.340			
TOTAL				19.652	0.62	2.00
5 <sup>th</sup> Year	N-PIT	2420560.348	323304.780	14.751	0.39	1.25
		2420266.575	323936.988			
	S-PIT	2419526.544	323279.085	10.953	0.23	0.75
		2419336.507	323698.000			
TOTAL				25.704	0.62	2.00

II. Dump rehandling ( for the purpose of recovery of mineral ) :

अनुमोदित  
**APPROVED**

Since this will be a new mine over a virgin land, there is no waste dump in within the block; as such there will be no necessity of rehandling of any dump.

c) Enclose individual yearwise development plans and sections showing pit layouts, dumps, stacks of mineral reject, if any, etc in case of 'A' category mines :

Since this will be an 'A' category mine, yearwise development plan has been attached with this mining plan as Plate no. 7A1 – 7A5 & 7B1 – 7B5. Detail of yearwise dumping of waste have been shown in Plate no. 8.

B RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

K NAIK  
Qualified Person

REGIONAL CONTROLLER OF MINES  
भारतीय खान ब्यूरो  
INDIAN BUREAU OF MINES  
भुवनेश्वर / BHUBANESHWAR



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA



d) Describe briefly giving salient features of the proposed method of working indicating category of mine :

Looking into the production proposed, thick zone of high grade iron ore, availability of resources with the successful bidder, both in terms of finance and in terms of man power and machinery, it is planned to work in a fully mechanized way which keep the mine under category 'A'.

Salient features of the mining method to be adopted are given below:

Mineral / Ore	:	Iron Ore
Mining Method	:	Mechanised Open Cast
Production Target	:	2 Mln Tonnes from 3 <sup>rd</sup> year
<b>Bench Parameters</b>		
Height	:	6 Mt
Width	:	10 Mt
Overall pit slope;	:	Not exceeding 45° from the horizontal
Width of haul road	:	Not less than 10 Mt
Gradient of haul road	:	1 : 16 to 1 : 20
Nature of overburden	:	Generally soft lateritic, limonitic, shaly and alluvial soil
Excavation	:	Through drilling / blasting, rock breaker, excavator
Drilling	:	By Wagon drill. Parameters will be 6.5 M X 3.0 M X 2.5 M
Blasting	:	Through external but authorized agency
Haulage of ROM, OB, Waste	:	Loader/ Excavator in combination with Hyva dumpers
Mechanical beneficiation	:	Mobile crushing & screening plants

e) Describe briefly layout of mine workings, pit road layout, the layout of faces and sites for disposal of overburden / waste along with ground preparation prior to disposal of waste, reject etc. A reference to the plans and sections

S RAHA  
Qualified Person

K C JYOTISHI  
Qualified Person

K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. RaHa, K C Jyotishi, K Naik  
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may be given. UPL or ultimate size of pit is to be shown for identification of the suitable dumping site :

Looking into the prospect of high demand of iron ore from this block after 2020 as well as to sustain the long term requirement of the own plant, the production target has been kept at 2 Mln Tonnes per annum. Since this is a virgin land, due to initial development work this production target is expected to be achieved from the 3<sup>rd</sup> year of production.

The ore geology of the block indicates that the concentration of saleable iron ore is concentrated in two parts – one in the northern part, the other in the southern part. But the major difference in the characteristics of these two deposits lies in the fact that while the northern part comprises of hard iron ore along with SLO & BD, the southern part contains no hard ore. So for proper utilization of resource it is proposed that simultaneous production from both the parts will be done. Two pits which may be named as N-Pit & S-Pit will be developed with ultimate production target of 0.75 Mln Tonnes from S-Pit & 1.25 Mln Tonnes from N-Pit.

The proposed waste dump is planned at the non mineralized zone in the west central part of the block area. Year-wise quantity of ore and waste to be excavated during the plan period has been indicated in the table below.

A separate plan ( Plate 6 ) showing the topography, lithology, location of proposed working, dumping etc. has been provided.

#### First Year Development:

In the first year of Plan period the development in N-Pit will begin with top slicing of 678 mRL level. at about 28 mt south of Geological section line CC'.

The proposed working RL in the northern part of the quarry shall be from 675.38 to 658mRL. In total of three no of benches shall be developed in almost east – west direction. Benches will have a height of 6 m and width of 10 m.

  
S RAHA  
Qualified Person

BHUBHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. RaHa, K C Jyotishi, K Naik  
Qualified Persons  
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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA



Bench parameters may be described as :

	Bench RL	Avg Length	Avg Width
Top Bench	670	343 m	10 m
2 <sup>nd</sup> Bench	664	399 m	83 m
3 <sup>rd</sup> Bench	658	97 m	57 m

In section line MM' the development shall be from 674.50 to 664 mRL and 68 mt in the bench 664-658 mRL. ( the 664-658 bench will be further developed in the 2<sup>nd</sup> year ). In section line NN' the development shall be from 675.38 to 664 mRL. Out of the total excavation, 66610.71 M<sup>3</sup> overburden waste and 91303.90M<sup>3</sup> ROM shall be generated. No top soil generation is anticipated in the first year of excavation. The detail excavation programme is shown below in the Table No-2.3.

In the S-Pit the development will start from the southern top (672 mRL). In the S-Pit, proposed working benches shall be from 673.50 to 558 mRL on section line SS'. A total of three no of bench shall be developed. Out of the total excavation 78851.66 M<sup>3</sup> ROM shall be generated. There will be no top soil or over burden waste generation in this year of excavation. The detail excavation programme is shown below in the Table No-2.3.

	Bench RL	Avg Length	Avg Width
Top Bench	672	54 m	10 m
2 <sup>nd</sup> Bench	670	143 m	83 m
3 <sup>rd</sup> Bench	664	124 m	57 m
Quarry floor	654	112 X 116	

**First year Excavation of Top soil, Over burden & Floats**

Quarry	mRL	Sec line	Cross sectional area In M <sup>2</sup>			Length of influence In M	Volume in M <sup>3</sup>		
			Top soil	O.B	Float Iron Ore		Top soil	O.B	Float Iron Ore
N-Pit	674.50-670	MM'	0.00	95.19	49.63	178	0.00	16943.82	8834.14
	675.38-670	NN'	0.00	0.00	142.08	164	0.00	0.00	23301.12
	670-664	MM'	0.00	258.57	94.84	175	0.00	45249.75	16597.00
		NN'	0.00	0.00	112.18	221	0.00	0.00	24791.78
664-658	MM'	0.00	105.17	122.68	42	0.00	4417.14	5152.56	
<b>Total</b>							<b>0.00</b>	<b>66610.71</b>	<b>78676.60</b>

S RAHA  
Qualified Person

BHUBHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
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MINING PLAN OF NETRABANDH PAHAR  
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S-Pit	673.50-670	SS'	0.00	0.00	26.30	22	0.00	0.00	578.60
	670-664	SS'	0.00	0.00	68.83	46	0.00	0.00	3166.18
	664-658	SS'	0.00	0.00	43.97	124	0.00	0.00	5452.28
<b>Total</b>							0.00	0.00	9197.06

**First year Excavation of Soft Laminated Ore (SLO), Blue Dust (BD) & Sub grade (S.G)**

Quarry	mRL	Sec line	Cross sectional area in M <sup>2</sup>			Length of Influence in M	Volume in M <sup>3</sup>		
			SLO	BD	Sub grade		SLO	BD	Sub grade
N-Pit	674.50-670	MM'	0.00	0.00	0.00	178	0.00	0.00	0.00
	675.38-670	NN'	49.61	0.00	0.00	164	8136.04	0.00	0.00
	670-664	MM'	0.00	0.00	0.00	175	0.00	0.00	0.00
		NN'	261.71	0.00	0.00	221	57837.91	0.00	0.00
664-658	MM'	0.00	0.00	300.65	42	0.00	0.00	12627.30	
<b>Total</b>							65973.95	0.00	12627.30
S-Pit	673.50-670	SS'	24.33	0.00	0.00	22	535.26	0.00	0.00
	670-664	SS'	269.63	0.00	0.00	46	12402.98	0.00	0.00
	664-658	SS'	137.57	0.00	319.82	124	17058.68	0.00	39657.68
<b>Total</b>							29996.92	0.00	39657.68

Table No. 2.3

**Total First year Excavation of Top soil, Over burden, Float Iron Ore, SLO, BD & S.G**

Quarry	Top Soil in M <sup>3</sup>	O.B. In M <sup>3</sup>	ROM in M <sup>3</sup>					Sub grade	Total ROM M <sup>3</sup>
			Saleable				TOTAL		
			Float Iron Ore	SLO	BD	D= A+B+C			
A	B	C	E	F=D+E					
N-Pit	0.00	66610.71	78676.60	65973.95	0.00	144650.60	12627.30	157277.90	
S-Pit	0.00	0.00	9197.06	29996.92	0.00	39193.98	39657.68	78851.66	
<b>Total</b>	0.00	66610.71	87873.66	29996.92	0.00	117870.58	52284.98	170155.56	

**Recovery of Saleable, Subgrade and intercalated waste after screening and crushing**

Type	Recovery in Cum			Recovery in MT			
	Saleable (+55% Fe) 80 % of D	Sub grade (+45% 0% of -55% Fe) 80 % of E	Intercalated waste 20 % of (D +E)	Saleable 1 cum=3.3 MT	Sub grade 1 cum=3.3 MT	Intercalated waste 1 cum=2.7 MT	TOTAL

*S. Raha*  
**S RAHA**  
Qualified Person

*K C Jyotishi*  
**K C JYOTISHI**  
Qualified Person

*K Naik*  
**K NAIK**  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raia, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH BAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

N-Pit	115720.44	10101.84	31455.57	381877.45	33336.07	84930.04	500143.56
S-Pit	31355.18	31726.14	15770.33	103472.11	104696.28	42579.90	250748.28
Total	147075.62	41827.98	47225.90	485349.56	138032.35	127509.94	750891.84

Summary:	Production of Saleable ore	= 485349.56 MT
	Production of subgrade	= 138032.30 MT
	Total Ore	= 623381.91 MT
	Overburden waste	= 113836.61 M <sup>3</sup>
	Intercalated waste	= 47225.90 M <sup>3</sup>
	Total waste	= 120667.45 M <sup>3</sup>
	Stripping ratio (T : M <sup>3</sup> )	=1: 0.18

### Second Year Development:

During the second year of plan period the same quarries are proposed to be worked for the production of iron ore.

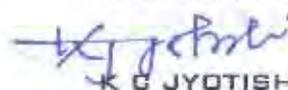
The proposed working mRL in the N-Pit shall be obtained by extending the 664-658 mRL towards east by about 331 m. Similarly 658 to 652 mRL bench having a dimension of 70 m X 130 m will be developed in the western part of the quarry.

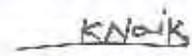
Out of the total excavation, 18002.76 M<sup>3</sup> over burden waste and 236070.45 M<sup>3</sup> ROM shall be generated. There is no top soil from this year excavation. The detail excavation programme is given below in the Table No-2.4.

In the S-Pit proposed working RL bench shall be from 664 to 652 mRL. In the eastern part of the quarry the 658 mRL bench will be extended further east and will cover an area of 140 m X 82 m. In the western part, the 658 mRL bench will be deepened to 652 mRL and will have a dimension of 118m X 125 m.

Out of the total excavation, 3872.58 M<sup>3</sup> overburden waste and 157485.03 M<sup>3</sup> ROM shall be generated. There will be no generation of top soil from this year of excavation. The detail excavation programme is given below in the Table No-2.4

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA



**Second year Excavation of Top soil, Overburden & Float Iron ore**

Quarry	mRL	Sec line	Cross sectional area in M <sup>2</sup>			Length of influence in M	Volume in M <sup>3</sup>		
			Top soil	O.B	Float Iron Ore		Top soil	O.B	Float Iron Ore
N-Pit	664-658	MM'	0.00	105.17	122.68	126	0.00	13251.42	15457.68
		NN'	0.00	0	109.23	273	0.00	0.00	29819.79
	658-652	MM'	0.00	68.86	114.61	69	0.00	4751.34	7908.09
<b>Total</b>							<b>0.00</b>	<b>18002.76</b>	<b>53185.56</b>
S-Pit	664-658	SS'	0.00	0.00	43.97	145	0.00	0.00	6375.65
	658-652	SS'	0.00	30.02	42.55	129	0.00	3872.58	5488.95
<b>Total</b>							<b>0.00</b>	<b>3872.58</b>	<b>11864.60</b>

**Second year Excavation of Soft Laminated Ore (SLO), Blue Dust (BD) & Sub grade**

Quarry	mRL	Sec line	Cross sectional area in M <sup>2</sup>			Length of influence in M	Volume in in M <sup>3</sup>		
			SLO	BD	Sub grade		SLO	BD	Sub grade
N-Pit	664-658	MM'	0.00	0.00	300.65	126	0.00	0.00	37881.90
		NN'	406.35	0.00	0.00	273	110933.55	0.00	0.00
	658-652	MM'	202.55	0.00	291.21	69	13975.95	0.00	20093.49
<b>Total</b>							<b>124909.50</b>	<b>0.00</b>	<b>57975.39</b>
S-Pit	664-658	SS'	137.57	0.00	319.82	145	19947.65	0.00	46373.90
	658-652	SS'	614.72	0.00	0.00	129	79298.88	0.00	0.00
<b>Total</b>							<b>99246.53</b>	<b>0.00</b>	<b>46373.90</b>

Table No-2.4.

**Total Second year Excavation of Top soil, Overburden, Float Iron Ore, SLO, BD & S.G**

Quarry	Top Soil in M <sup>3</sup>	O.B. in M <sup>3</sup>	ROM in M <sup>3</sup>					Sub grade	Total ROM M <sup>3</sup>
			Saleable				TOTAL		
			Float Iron Ore	SLO	BD	D= A+B+C			
			A	B	C				
N-Pit	0.00	18002.76	53185.56	124909.50	0.00	178095.06	57975.39	236070.45	
S-Pit	0.00	3872.58	11864.60	99246.53	0.00	111111.13	46373.90	157485.03	
<b>Total</b>	<b>0.00</b>	<b>21875.34</b>	<b>65050.16</b>	<b>224156.03</b>	<b>0.00</b>	<b>289206.19</b>	<b>104349.29</b>	<b>393555.48</b>	

*S Raha*  
S RAHA  
Qualified Person

*K C Jyotishi*  
K C JYOTISHI  
Qualified Person

*K Naik*  
K NAIK  
Qualified Person

**Recovery of Saleable, Subgrade and intercalated waste after screening and crushing**

Type	Recovery In Cum			Recovery in MT			
	Saleable (+55% Fe) 80 % of D	Sub grade (+45% 0% of ~55% Fe) 80 % of E	Intercalated waste 20 % of (D +E)	Saleable 1 cum=3.3 MT	Sub grade 1 cum=3.3 MT	Intercalated waste 1 cum=2.7 MT	TOTAL
N-Pit	142476.05	46380.31	47214.09	470170.96	153055.03	127478.04	750704.03
S-Pit	88888.90	37099.12	31497.01	293333.38	122427.10	85041.92	500802.40
<b>Total</b>	<b>231364.95</b>	<b>83479.43</b>	<b>78711.10</b>	<b>763504.34</b>	<b>275482.13</b>	<b>212519.96</b>	<b>1251506.43</b>

Summary :	Production of Saleable ore	= 763504.34 MT
	Production of subgrade	= 275482.13 MT
	Total Ore	= 1038986.47 MT
	Overburden waste	= 21875.34 M <sup>3</sup>
	Intercalated waste	= 78711.10 M <sup>3</sup>
	Total waste	= 100586.44 M <sup>3</sup>
	Stripping ratio (T : M <sup>3</sup> )	= 1 : 0.09

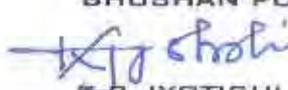
**Third Year Development:**

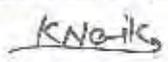
The proposed working mRL in the N-Pit of the block shall be from bench from 658 to 652 mRL. In the 3rd year the 652 mRL bench will be extended upto 412 m towards east. A new bench with floor RL of 646 will be developed in the western part of the quarry. The new bench will have an average dimension of 285 m X 170 m. Out of the total 121228.3 M<sup>3</sup> overburden waste and 393109.19 M<sup>3</sup> ROM shall be generated. The detail excavation programme is given below in the Table No-2.5.

. 3<sup>rd</sup> year eastern part. Again 652 to 646 – 380 X 80.

In the S-Pit proposed working RL quarry shall be from 658 to 646 mRL. The 652 mRL bench will be extended in an eastern direction for about 195 m. On the other hand the prevailing 652 mRL bench area will be deepened to 646 mRL. Out of the total excavation 27770.72 M<sup>3</sup> overburden waste and 236067.88 M<sup>3</sup> ROM shall be generated. No top soil will

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



be generated in this year of excavation. The detail excavation programme is given below in the Table No-2.5.

**Third year Excavation of Top soil, Over burden & Float Iron Ore**

Quarry	mRL	Sec line	Cross sectional area in M <sup>2</sup>			Length of influence in M	Volume in M <sup>3</sup>		
			Top soil	O.B	Float Iron Ore		Top soil	O.B	Float Iron Ore
N-Pit	658-652	MM'	0.00	68.86	114.61	92	0.00	6335.12	10544.12
		NN'	0.00	55.83	112.09	200	0.00	11166.00	22418.00
	655.87-652	OO'	0.00	0.00	132.45	117	0.00	0.00	15496.65
	652-646	MM'	0.00	407.64	115.19	200	0.00	81528.00	23038.00
		NN'	0.00	133.73	113.99	166	0.00	22199.18	18922.34
<b>Total</b>							<b>0.00</b>	<b>121228.30</b>	<b>90419.11</b>
S-Pit	658-652	SS'	0.00	30.02	42.55	148	0.00	4442.96	6297.40
	655.00-652	TT'	0.00	0.00	106.63	100	0.00	0.00	10663.00
	652-646	RR'	0.00	102.87	112.67	100	0.00	10287.00	11267.00
		SS'	0.00	119.64	42.27	109	0.00	13040.76	4607.43
<b>Total</b>							<b>0.00</b>	<b>27770.72</b>	<b>32834.83</b>

**Third year Excavation of Soft Laminated Ore (SLO), Blue Dust (BD) & Sub grade**

Quarry	mRL	Sec line	Cross sectional area in M <sup>2</sup>			Length of influence in M	Volume in in M <sup>3</sup>		
			SLO	BD	Sub grade		SLO	BD	Sub grade
N-Pit	658-652	MM'	202.55	0.00	291.21	92	18634.60	0.00	26791.32
		NN'	431.85	67.45	0.00	200	86370.00	13490.00	0.00
	655.87-652	OO'	0.00	0.00	0.00	117	0.00	0.00	0.00
	652-646	MM'	316.61	0.00	0.00	200	63322.00	0.00	0.00
		NN'	288.46	278.30	0.00	166	47884.36	46197.80	0.00
<b>Total</b>							<b>216210.96</b>	<b>59687.80</b>	<b>26791.32</b>
S-Pit	658-652	SS'	614.72	0.00	0.00	148	90978.56	0.00	0.00
	655.00-652	TT'	210.24	0.00	0.00	100	21024.00	0.00	0.00
	652-646	RR'	0.00	0.00	113.76	100	0.00	0.00	11376.00
		SS'	697.45	0.00	35.16	109	76022.05	0.00	3832.44
<b>Total</b>							<b>188024.61</b>	<b>0.00</b>	<b>15208.44</b>

*S. Raha*  
**S RAHA**  
Qualified Person

**BHUSHAN POWER & STEEL LIMITED**  
*K C Jyotishi*  
**K C JYOTISHI**  
Qualified Person

*K Naik*  
**K NAIK**  
Qualified Person



Table No-2.5.

## Total Third year Excavation of Top soil, Overburden, Float Iron Ore, SLO, BD &amp; S.G

Quarry	Top Soil in M <sup>3</sup>	O.B. In M <sup>3</sup>	ROM in M <sup>3</sup>					Total ROM M <sup>3</sup>
			Saleable				Sub grade	
			Float Iron Ore A	SLO B	BD C	TOTAL D= A+B+C		
N-Pit	0.00	121228.30	90419.11	216210.96	59687.80	366317.87	26791.32	393109.19
S-Pit	0.00	27770.72	32834.83	188024.61	0.00	220859.44	15208.44	236067.88
<b>Total</b>	<b>0.00</b>	<b>148999.02</b>	<b>123253.94</b>	<b>404235.57</b>	<b>59687.80</b>	<b>587177.31</b>	<b>41999.76</b>	<b>629177.07</b>

## Recovery of Saleable, Subgrade and intercalated waste after screening and crushing

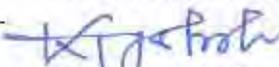
Type	Recovery in Cum			Recovery in MT			
	Saleable (+55% Fe) 80 % of D	Sub grade (+45% 0% of -55% Fe) 80 % of E	Intercalated waste 20 % of (D +E)	Saleable 1 cum=3.3 MT	Sub grade 1 cum=3.3 MT	Intercalated waste 1 cum=2.7 MT	TOTAL
N-Pit	293054.30	21433.06	78621.84	967079.18	70729.08	212278.96	1250087.22
S-Pit	176687.55	12166.75	47213.58	583068.92	40150.28	127476.66	750695.86
<b>Total</b>	<b>469741.85</b>	<b>33599.81</b>	<b>125835.42</b>	<b>1550148.10</b>	<b>110879.36</b>	<b>339755.62</b>	<b>2000783.08</b>

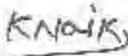
Summary :	Production of Saleable ore	=	1550148.10 MT
	Production of subgrade	=	110879.36 MT
	Total Ore	=	1661027.46 MT
	Overburden waste	=	148999.02 M <sup>3</sup>
	Intercalated waste	=	125835.42 M <sup>3</sup>
	Total waste	=	274834.43 M <sup>3</sup>
	Stripping ratio (T : M <sup>3</sup> )	=	1: 0.16

**Fourth Year Development:**

The proposed working mRL in the N-Pit will be in bench from 652 to 646 mRL and in bench of 646 to 640 mRL. In the 4<sup>th</sup> year 646 mRL bench will be extended upto 245 m towards east. One new bench ( 640 mRL ) with avg dimension 175 m X 170 m will be developed in the western part. Out of the total excavation, 97578.88 M<sup>3</sup> over burden waste and

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



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S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
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393133.08 M<sup>3</sup> ROM shall be generated. The detail excavation is given below in the Table No. 2.6.

In the southern quarry proposed working RL quarry shall be from 652 to 640 mRL. 646 mRL bench will advance towards east and will have a new surface area of 17m X 135 m. The 646 mRL bench will be deepened to 640 mRL in the western part and will cover an area of 195 m X 205 m. Out of the total excavation, 1308.00 M<sup>3</sup> top soil, 73482.54 M<sup>3</sup> overburden waste and 235897.68 M<sup>3</sup> ROM shall be generated. The detail excavation programme is given below in the Table No. 2.6.

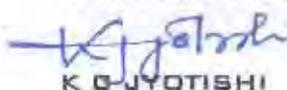
#### Fourth year Excavation of Top soil, Over burden & Floats

Quarry	mRL	Sec line	Cross sectional area In M <sup>2</sup>			Length of influence In M	Volume in M <sup>3</sup>		
			Top soil	O.B	Float Iron Ore		Top soil	O.B	Float Iron Ore
N-Pit	652-646	NN'	0.00	133.73	113.99	34	0.00	4546.82	3875.66
		OO'	0.00	0.00	156.90	148	0.00	0.00	23221.20
	646-640	MM'	0.00	351.34	48.15	144	0.00	50592.96	6933.60
		NN'	0.00	203.77	120.40	200	0.00	40754.00	24080.00
		OO'	0.00	20.55	146.89	82	0.00	1685.10	12044.98
<b>Total</b>							<b>0.00</b>	<b>97578.88</b>	<b>70155.44</b>
S-Pit	652-646	SS'	0.00	119.64	42.27	91	0.00	10887.24	3846.57
		TT'	0.00	0.00	48.05	90	0.00	0.00	4324.50
	646-640	RR'	11.60	484.67	46.91	90	1044.00	43620.30	4221.90
		SS'	2.40	172.50	19.48	110	264.00	18975.00	2142.80
<b>Total</b>							<b>1308.00</b>	<b>73482.54</b>	<b>14535.77</b>

#### Fourth year Excavation of Soft Laminated Ore (SLO), Blue Dust (BD) & Sub grade

Quarry	mRL	Sec line	Cross sectional area in M <sup>2</sup>			Length of influence In M	Volume in In M <sup>3</sup>		
			SLO	BD	Sub grade		SLO	BD	Sub grade
N-Pit	652-646	NN'	288.46	278.3	0.00	34	9807.64	9462.20	0.00
		OO'	232.13	0.00	42.64	148	34355.24	0.00	6310.72
	646-640	MM'	558.39	0.00	95.42	144	80408.16	0.00	13740.48
		NN'	340.64	303.5	0.00	200	68128.00	50700.00	0.00
		OO'	0.00	0.00	488.6	82	0.00	0.00	40065.20
<b>Total</b>							<b>192699.04</b>	<b>70162.20</b>	<b>60116.40</b>

  
S RAHA  
Qualified Person

  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

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S-Pit	652-646	SS'	697.45	0.00	35.16	91	63467.95	0.00	3199.56
	652-646	TT'	114.62	0.00	67.39	90	10315.80	0.00	6065.10
	646-640	RR'	0.00	0.00	498.05	90	0.00	0.00	44824.50
		SS'	815.25	0.00	34.65	110	89677.50	0.00	3811.50
Total							163461.25	0.00	57900.66

Table No-2.6.

Total Fourth year Excavation of Top soil, Overburden, Float Iron Ore, SLO, BD & S.G

Quarry	Top Soil in M <sup>3</sup>	O.B. in M <sup>3</sup>	ROM in M <sup>3</sup>					Sub grade	Total ROM M <sup>3</sup>
			Saleable				TOTAL		
			Float Iron Ore	SLO	BD	D= A+B+C			
			A	B	C				
N-Pit	0.00	97578.88	70155.44	192699.04	70162.20	333016.68	60116.40	393133.08	
S-Pit	1308	73482.54	14535.77	163461.25	0.00	177997.02	57900.66	235897.68	
<b>Total</b>	<b>1308</b>	<b>171061.42</b>	<b>84691.21</b>	<b>356160.29</b>	<b>70162.20</b>	<b>511013.70</b>	<b>118017.06</b>	<b>629030.76</b>	

Recovery of Saleable, Subgrade and intercalated waste after screening and crushing

Type	Recovery in Cum			Recovery in MT			TOTAL
	Saleable (+55% Fe) 80 % of D	Sub grade (+45% 0% of -55% Fe) 80 % of E	Intercalated waste 20 % of (D +E)	Saleable 1 cum=3.3 MT	Sub grade 1 cum=3.3 MT	Intercalated waste 1 cum=2.7 MT	
N-Pit	266413.34	48093.12	78626.62	879164.04	158707.30	212291.86	1250163.19
S-Pit	142397.62	46320.53	47179.54	469912.13	152857.74	127384.75	750154.62
<b>Total</b>	<b>408810.96</b>	<b>94413.65</b>	<b>125806.16</b>	<b>1349076.17</b>	<b>311565.04</b>	<b>339676.61</b>	<b>2000317.81</b>

Summary : Production of Saleable ore = 1349076.17 MT  
 Production of subgrade = 311565.04 MT  
 Total Ore = 1660641.21 MT  
 Overburden waste = 171061.42 M<sup>3</sup>  
 Intercalated waste = 125806.16 M<sup>3</sup>  
 Total waste = 296867.57 M<sup>3</sup>  
 Stripping ratio (T : M<sup>3</sup>) = 1: 0.17

BHUSHAN POWER & STEEL LIMITED

S RAHA  
Qualified Person

K C JYOTISHI  
Qualified Person

K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
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### Fifth Year Development:

During the fifth year of plan period the same quarries are proposed to be excavated with one new bench from 640 to 634 mRL which shall be developed for the production of iron ore.

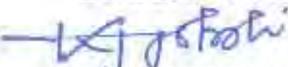
The proposed working mRL in the N-Pit of the block shall be in 646 to 640 mRL. 640 mRL bench will be extended in the north-east corner of the quarry and will have a dimension of 50 m X 40 m. A new bench 636 mRL ( 406 m X 260 m ) will be developed by cutting the pre-existing 642 mRL bench. Out of the total excavation, 126890.2 M<sup>3</sup> over burden waste and 393353.36 M<sup>3</sup> ROM shall be generated. The detail excavation is given below in the Table No. 2.7.

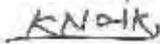
In the southern quarry proposed working RL quarry shall be from 646 to 634 mRL. 640 mRL bench will be developed by cutting the 646 mRL bench covering an area of 160 m X 165 m. Similarly the 640 mRL bench will be deepened to form 634 mRL bench with an area of 135 m X 200 m. Out of the total excavation, 393.00 M<sup>3</sup> top soil 127345.66 M<sup>3</sup> overburden waste and 236047.31 M<sup>3</sup> ROM shall be generated. The detail excavation programme is given below in the Table No. 2.7.

### **Fifth year Excavation of Top soil, Over burden & Float Iron Ore**

Quarry	mRL	Sec line	Cross sectional area In M <sup>2</sup>			Length of influence In M	Volume in M <sup>3</sup>		
			Top soil	O.B.	Float iron Ore		Top soil	O.B.	Float Iron Ore
N-Pit	646-640	OO'	0.00	20.55	146.89	48	0.00	986.40	7050.72
	640-634	MM'	0.00	466.91	110.65	134	0.00	62565.94	14827.10
		NN'	0.00	282.66	96.50	200	0.00	56532.00	19300.00
		OO'	0.00	101.58	59.96	67	0.00	6805.86	4017.32
<b>Total</b>						<b>0.00</b>	<b>126890.20</b>	<b>45195.14</b>	
S-Pit	646-640	SS'	2.40	172.50	19.48	90	216.00	15525.00	1753.20
		TT'	0.00	452.66	54.65	80	0.00	36212.80	4372.00
	640-634	RR'	0.00	708.70	0.00	80	0.00	56696.00	0.00
		SS'	3.0	320.54	0.00	59	177.00	18911.86	0.00
<b>Total</b>						<b>393.00</b>	<b>127345.66</b>	<b>6125.20</b>	

  
**B RAHA**  
Qualified Person

**BHUSHAN POWER & STEEL LIMITED**  
  
**K C JYOTISHI**  
Qualified Person

  
**K NAIK**  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
(under Rule 15 of MCR, 2016)

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139:223 Ha IN  
SUNDERGARH Dist., ODISHA

**Fifth year Excavation of Soft Laminated Ore (SLO), Blue Dust (BD) & Sub grade**

Quarry	mRL	Sec line	Cross sectional area In M <sup>2</sup>			Length of influence In M	Volume In In M <sup>3</sup>		
			SLO	BD	Sub grade		SLO	BD	Sub grade
N-Pit	646-640	OO'	0.00	0.00	488.60	48	0.00	0.00	23452.80
	640-634	MM'	815.62	0.00	0.00	134	109293.08	0.00	0.00
		NN'	578.90	269.94	20.18	200	115780.00	53988.00	4036.00
		OO'	507.12	0.00	113.90	67	33977.04	0.00	7631.30
<b>Total</b>							<b>259050.12</b>	<b>53988.00</b>	<b>35120.10</b>
S-Pit	646-640	SS'	815.25	0.00	34.65	90	73372.50	0.00	3118.50
		TT'	451.92	0.00	0.00	80	36153.60	0.00	0.00
	640-634	RR'	0.00	0.00	760.41	80	0.00	0.00	60832.80
		SS'	919.89	0.00	36.80	59	54273.51	0.00	2171.20
<b>Total</b>							<b>163799.61</b>	<b>0.00</b>	<b>66122.50</b>

Table No-2.7.

**Total Fifth year Excavation of Top soil, Overburden, Float Iron Ore, SLO, BD & S.G**

Quarry	Top Soil in M <sup>3</sup>	O.B. In M <sup>3</sup>	ROM in M <sup>3</sup>					Total ROM M <sup>3</sup>
			Saleable				Sub grade	
			Float Iron Ore	SLO	BD	TOTAL		
			A	B	C	D= A+B+C		
N-Pit	0.00	126890.20	45195.14	259050.12	53988.00	358233.26	35120.10	393353.36
S-Pit	393.00	127345.66	6125.20	163799.61	0.00	169924.81	66122.50	236047.31
<b>Total</b>	<b>393.00</b>	<b>254235.86</b>	<b>51320.34</b>	<b>422849.73</b>	<b>53988.00</b>	<b>528158.07</b>	<b>101242.60</b>	<b>629400.67</b>

**Recovery of Saleable, Subgrade and intercalated waste after screening and crushing**

Type	Recovery in Cum			Recovery in MT			
	Saleable (+55% Fe) 80 % of D	Sub grade (+45% 0% of-55% Fe) 80 % of E	Intercalated waste 20 % of (D +E)	Saleable 1 cum=3.3 MT	Sub grade 1 cum=3.3 MT	Intercalated waste 1 cum=2.7 MT	TOTAL
N-Pit	286586.61	28096.08	78670.67	945735.81	92717.06	212410.81	1250863.68
S-Pit	135939.85	52898.00	47209.46	448601.50	174563.40	127465.55	750630.45
<b>Total</b>	<b>422526.46</b>	<b>80994.08</b>	<b>125880.13</b>	<b>1394337.30</b>	<b>267280.46</b>	<b>339876.36</b>	<b>2001494.13</b>

Summary : Production of Saleable ore = 1394337.30 MT  
Production of subgrade = 267280.46 MT

BHUBHAN POWER & STEEL LIMITED

S RAHA  
Qualified Person

K C JYOTISHI  
Qualified Person

K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

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Total Ore	= 1661617.77 MT
Overburden waste	= 254235.86 M <sup>3</sup>
Intercalated waste	= 125880.13 M <sup>3</sup>
Total waste	= 380115.99 M <sup>3</sup>
Stripping ratio (T : M <sup>3</sup> )	= 1: 0.22

The Gist of the excavation to be undertaken including production of saleable, sub grade iron ore, alluvial soil, waste and generation of intercalated waste during the first five year plan period is given below:

Table No. 2.8.

**Table showing production of Top soil, Over burden and ROM during the First 5 Year Plan**

Year	Top Soil	Waste (Over Burden)	Production of ROM					
			Float Iron Ore	SLO	Blue Dust	Total ROM containing Saleable	Total ROM containing Sub grade	Total ROM
			M <sup>3</sup>	M <sup>3</sup>	M <sup>3</sup>	M <sup>3</sup>	M <sup>3</sup>	M <sup>3</sup>
I <sup>st</sup> year	0.00	66610.71	87873.66	29996.92	0.00	117870.58	52284.98	170155.56
II <sup>nd</sup> year	0.00	21875.34	65050.16	224156.03	0.00	289206.19	104349.29	393555.48
III <sup>rd</sup> year	0.00	148999.02	123253.94	404235.57	59687.80	587177.31	41999.76	629177.07
IV <sup>th</sup> year	1308.00	171061.42	84691.21	356160.29	70162.20	511013.70	118017.06	629030.76
V <sup>th</sup> year	393.00	254235.86	51320.34	422849.73	53988.00	528158.07	101242.60	629400.67
<b>Total</b>	<b>1701.00</b>	<b>662782.35</b>	<b>412189.31</b>	<b>1437398.54</b>	<b>183838.00</b>	<b>2033425.85</b>	<b>417893.69</b>	<b>2451319.54</b>

**Recovery of Saleable, Subgrade and intercalated waste after screening and crushing**

Year	Top Soil	Waste			Sub grade (+45% - 55% Fe)	Saleable (+55% Fe)	Stripping ratio (T : M <sup>3</sup> )
		O.B.	Intercalated	TOTAL			
		M <sup>3</sup>	M <sup>3</sup>	M <sup>3</sup>			
I <sup>st</sup> year	0.00	66610.71	47225.90	113836.60	485349.56	138032.35	1:0.18
II <sup>nd</sup> year	0.00	21875.34	78711.10	100586.40	763504.34	275482.13	1:0.09
III <sup>rd</sup> year	0.00	148999.00	125835.40	274834.40	1550148.10	110879.36	1:0.16
IV <sup>th</sup> year	1308.00	171061.40	125806.20	296867.60	1349076.17	311565.04	1:0.17
V <sup>th</sup> year	393.00	254235.90	125880.10	380116.00	1394337.30	267280.46	1:0.22
<b>Total</b>	<b>1701.00</b>	<b>662782.35</b>	<b>503458.70</b>	<b>1166241.00</b>	<b>5542415.47</b>	<b>1103239.34</b>	

*S Raha*  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
*K C Jyotishi*  
K C JYOTISHI  
Qualified Person

*K Naik*  
K NAIK  
Qualified Person



Table No. 2.9

**GIST OF EXCAVATION DURING FIRST 5 YEAR PLAN**

YEAR	EXCAVATION IN M3 FOR LOADING			EXCAVATION CONSIDERED FOR DRILLING		
	TS + OB	ROM	TOTAL	Waste	ROM	TOTAL
	100%	100%		100%	60%	
I <sup>st</sup> year	66610.71	170155.56	236766.27	66610.71	102093.34	168704.05
II <sup>nd</sup> year	21875.34	393555.48	415430.82	21875.34	236133.29	258008.63
III <sup>rd</sup> year	148999.02	629177.07	778176.09	148999	377506.24	526505.26
IV <sup>th</sup> year	172369.42	629030.76	801400.18	171061.42	377418.46	548479.88
V <sup>th</sup> year	254628.86	629400.67	884029.53	254235.86	377640.40	631876.26
<b>Total</b>	<b>664483.35</b>	<b>2451319.54</b>	<b>3115802.89</b>	<b>662782.35</b>	<b>1470791.72</b>	<b>2133574.07</b>

**Extent of Mechanization:****i) CALCULATION FOR REQUIREMENT OF SHOVELS / LOADERS AT MINE :**

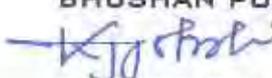
The Shovel will be backhoe type Komatsu PC300 with 1.3 M<sup>3</sup> bucket capacity with combination of Hyva dumpers of 25 MT (7.7 cum) capacity.

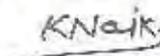
- a) Bucket fill Capacity = 1.3 M<sup>3</sup>  
b) Effective capacity of the Bucket ( 0.9 fill factor ) = 1.17 M<sup>3</sup>  
c) Capacity of the dumper = 7.7 M<sup>3</sup>  
d) Effective capacity of the dumper at 0.9 factor = 6.93 M<sup>3</sup>  
e) No. of bucket required to fill a dumper = (6.93 / 1.17) = 5.92  
f) Average cycle time for excavation, loading of material to a dumper including placement time = 4 minutes.  
g) Average utilization of time per shift with 80% utilization factor = 384 minutes.  
h) Number of cycle per shift = (384 / 4) = 96  
i) Average excavation, loading capacity of excavator per shift = (6.93 x 96) = 665.28 or say 665 M<sup>3</sup>  
j) Total working shifts in a year ( 2 shifts a day ) = 600 shifts  
k) Total Excavation and Loading capacity = 665 X 600 = 3,99,000 M<sup>3</sup>. Or say 4,00,000 M<sup>3</sup>

Table - 2.10

**Year-wise requirement of shovels for loading of total excavated materials:**

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
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SUNDERGARH Dist., ODISHA



	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year
Year-wise quantity of material to be excavated and loaded. (M <sup>3</sup> )	236766.27	415430.82	778176.09	801400.18	884029.53
Year-wise quantity of material to be excavated and loaded. (swelling factor 1.25) (M <sup>3</sup> )	295957.84	519288.53	972720.11	1001750.23	1105036.91
No. of working excavator required					
Or Say	0.74	1.30	2.43	2.50	2.76
With 1 Shovel as Standby	1	2	3	3	3
Requirement of Excavators	2	3	4	4	4

So, from the above table it is clear that to begin with, 2 shovels should be inducted and it is to be enhanced to 4 from the 3<sup>rd</sup> year of operation.

In addition to the above loading requirement 1 no of shovel & 2 nos of loaders will be required to load crushed / screened material into the dumpers for final despatch to different destination. One more loader may be required to be placed at weigh bridges for removal / shifting of overloaded materials from the dumpers / lippers.

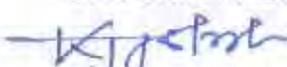
**ii) CALCULATION FOR REQUIREMENT OF DUMPERS FOR REMOVAL OF ORE AND WASTE.**

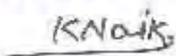
It may be noted here that the total ROM, produced at the mine face, will be dispatched to the mobile crushing and screening units operating within the block area. The processed iron ore will be despatched to different destination from the mobile plants. Local shifting will be avoided; however loaders / excavators will be deployed at the plants to avoid jamming of chutes.

**For ROM hauling :**

- a) Average Hauling distance both way (1.0 kms x 2) = 2 Kms.
- b) Average traveling time both way @ 20 kmph = 6 minutes
- c) Average Loading time = 4 minutes
- d) Average un-loading time = 2 minutes
- e) Average detention time at loading & unloading points = 4 minutes

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



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S. Raha, K C Jyotishi, K Naik  
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( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

- e) Average cycle per trip = 16 minutes
- f) Effective working time per shift with 80% utilization factor = 384 minutes
- g) Average no. of trips per shift per dumper =  $384 / 16 = 24$  nos
- h) Effective capacity of the Dumper = 6.93 M<sup>3</sup>
- i) Hauling capacity of dumper per shift ( 24 X 6.93 ) = 166.32 or say 166 M<sup>3</sup>
- l) Hauling capacity of dumper per year with 2 shifts/day = 99,600 M<sup>3</sup> and 300 day/year

Table – 2.11

**Year-wise requirement of dumpers for ROM transportation:**

	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year
Year-wise quantity of ROM to be transported. ( M <sup>3</sup> )	250427.60	417347.20	667042.67	667069.13	666908.31
Year-wise quantity of ore to be transported. (with swelling factor 1.25) ( M <sup>3</sup> )	313034.50	521684.00	833803.34	833836.41	833635.39
No. of Dumpers required	2.14	4.94	7.90	7.89	7.90
Or say	3	5	8	8	8
Stand by	1	1	2	2	2
Number of dumpers required	4	6	10	10	10

**For Waste / Mineral rejects / SG hauling :**

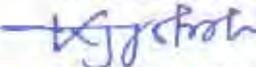
**The yearwise quantity of waste, alluvial soil, mineral rejects including sub grade ore :**

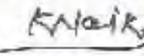
QUARRIES	QUANTITY IN M <sup>3</sup>				
	1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	4 <sup>th</sup> Year	5 <sup>th</sup> Year
N-Pit	131312.21	140092.37	279894.05	277581.29	290974.27
S-Pit	53767.51	90246.49	122488.56	196770.12	255034.09
<b>TOTAL</b>	<b>185079.71</b>	<b>230338.86</b>	<b>402382.61</b>	<b>474351.41</b>	<b>546008.36</b>

**From N-Pit :**

- a) Average Hauling distance both way (0.5 kms x 2) = 1.00 Kms.
- b) Average traveling time both way @ 20 kmph = 1.5 minutes or say 2 minutes
- c) Average Loading time = 8 minutes
- d) Average un-loading time = 2 minutes

  
S RAHA  
Qualified Person

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K G JYOTISHI  
Qualified Person

  
K NAIK  
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- e) Average cycle per trip = 12 minutes
- f) Effective working time per shift with 80% utilization factor = 384 minutes
- g) Average no. of trips per shift per dumper =  $384 / 12 = 32$  nos.
- h) Effective capacity of the Dumper = 6.93 M<sup>3</sup>
- i) Hauling capacity of dumper per shift ( 32 X 6.93 ) = 221.44 or say 221M<sup>3</sup>
- j) Hauling capacity of dumper per year with 2 shifts/day = 1,32,600 M<sup>3</sup> and 300 day/year

Table – 2.12

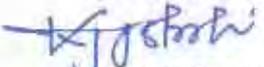
**Year-wise requirement of dumpers for Waste / Mineral Rejects / Sub Grade Ore Transportation from N-Pit:**

	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year
Year-wise quantity of Waste + SG / Mineral rejects to be transported. ( M <sup>3</sup> )	131312.21	140092.37	279894.05	277581.29	290974.27
Year-wise quantity of Waste + SG / Mineral rejects to be transported (with swelling factor 1.25) ( M <sup>3</sup> )	164140.26	175115.46	349867.56	346976.61	363717.84
No. of Dumpers required	1.24	1.32	2.64	2.62	2.74
OR say	2	2	3	3	3

**From S-Pit :**

- a) Average Hauling distance both way (0.720 kms x 2)= 1.44 Kms. Or say 1.5 KM
- b) Average traveling time both way @ 20 kmph =4.5 minutes or say 5 minutes
- c) Average Loading time = 8 minutes
- d) Average un-loading time = 2 minutes
- e) Average cycle per trip = 15 minutes
- f) Effective working time per shift with 80% utilization factor = 384 minutes
- g) Average no. of trips per shift per dumper =  $384 / 15 = 25.6$  nos or say 26
- h) Effective capacity of the Dumper = 6.93 M<sup>3</sup>
- i) Hauling capacity of dumper per shift ( 26 X 6.93 ) = 180.18 or say 180 M<sup>3</sup>
- l) Hauling capacity of dumper per year with 2 shifts/day = 1,08,000 M<sup>3</sup> and 300 day/year

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



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SUNDERGARH Dist., ODISHA



**Year-wise requirement of dumpers for Waste / Mineral Rejects / Sub Grade Ore Transportation from S-Pit:**

	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year
Year-wise quantity of Waste + SG / Mineral rejects to be transported. ( M <sup>3</sup> )	53767.51	90246.49	122488.56	196770.12	255034.09
Year-wise quantity of Waste + SG / Mineral rejects to be transported (with swelling factor 1.25) ( M <sup>3</sup> )	67209.39	112808.11	153110.70	245962.65	318792.61
No. of Dumpers required	0.62	1.04	1.42	2.28	2.95
OR say	1	1	2	3	3

Table – 2.13

**SUMMARY OF DUMPERS REQUIRED FOR WASTE / SG Etc. HANDLING**

PIT	No. of Dumpers required				
	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year
N-Pit	1	1	2	3	3
S-Pit	1	1	2	3	3
Total	2	2	4	6	6
Stand by	1	1	1	1	1
Number of dumpers required	3	3	5	7	7

The above calculation is based on the assumption that separate dumpers will be utilised for ore transportation and waste handling to maintain quality of ore.

**III) Calculation for Drilling Machines:**

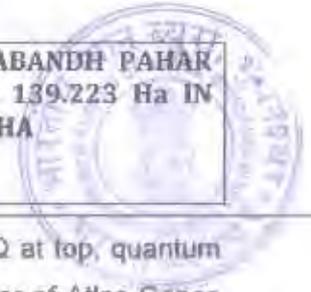
Mining will involve excavation of OB, Ore, intercalated waste etc. Due to different physical characteristics, parameters for excavation of different litho units will be different. It is presumed that alluvial soil removal will be done using dozer / excavator. Similarly about 40% of ore consisting of very soft iron ore & blue dust will be excavated through excavators only. Quantum of drilling, blasting for winning of ore will be required as per the following calculation :

1. 100% of OB will be excavated through drilling & blasting,
2. 60% of Ore bed will be excavated through drilling & blasting,

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Qualified Person

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K G JYOTISHI  
Qualified Person

K NAIK  
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3. Looking into the nature of formation, absence of BHJ / BHQ at top, quantum of ROM to be produced, LM-100 drill & XAH 210 compressor of Atlas Copco have been preferred to ROC F9 or DP 1100 ( Sandvik ).
4. To reduce blasting cost, to minimize ground vibration, secondary blasting will be replaced by the induction of rock breaker for further reduction in size of blasted boulders.

a) **Specification of Wagon Drills:**

Diameter of drill	-	110 to 115mm
Consumption of the compressed air	-	12.5 cum / min
Pressure of the air supplied to	-	10.5 kg /sq.cm

b) **Drilling Parameters**

Drilling parameters have been considered in two types :

1. **Actual depth of hole** : It has been considered as 6.5 mt. including sub grade drilling, for keeping bench height at 6 mt. This figure is effective to calculate the requirement of drill rig.
2. **Hole depth considered for out put calculation** : Since bench height is kept at 6 mt. and the blasting of 6.5 mt hole will produce a 6 mt high bench, the drill depth has been considered as 6 mt for output calculation.

* Burden (B)	=	2.50 m
* Spacing(S)	=	3.00 m
* Depth of the hole	=	6.5 m (Including sub-grade drilling)
* Output / hole	=	Burden x Spacing x Depth of the hole
	=	2.50 x 3.00 x 6.00 ( considering actual bench height )
	=	45 M <sup>3</sup> = 148.5 MT @ 3.3 MT per M <sup>3</sup>

c) **Powder Factor:**

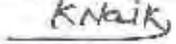
6 T per kg of explosive has been taken into consideration for the calculation of explosive consumption.

d) **Requirement of drills**

- a) Drilling penetration rate of the wagon drill 8 – 10 m/hour or say 9 m/hour
- b) Effective drilling hour per shift = 6 hours

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
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- c) Effective drilling hour per day in 2 shift a day = 12 hours
- d) Meterage of drilling to be achieved per day in a double shifts =  $9 \times 12 = 108$  m
- e) When a hole of 2.50 m x 3.00 m x 6.5 m is blasted, the total resultant will be 45 M<sup>3</sup>
- f) The maximum quantity of material to be excavated in 5<sup>th</sup> year = 883636.53 or say through drilling and blasting 8,83,637 M<sup>3</sup>
- g) Number of holes to be drilled in the 5<sup>th</sup> year =  $8,83,637 / 45 = 19,636.38$  Nos
- h) So the maximum number of holes to be drilled in a year = Say 19,637 Nos
- i) Number of holes to be drilled in a day (considering 300 working days in a year and 2 shifts per day ) will be  $19,637 / 300 = 65.46$  or say 66 holes per day.
- j) Number of holes to be drilled in a shift =  $66 / 2 = 33$  nos per shift per day
- k) Total meterage of drilling per shift for 6.5 m length of blast holes:  $33 \times 6.5 = 214.5$  Meter.
- l) Number of drills required  $214.5 / 54 = 3.97$  or say 4 ( four) drills in a single shift operation.

### III) Calculation for Blasting :

#### 1. Broad Blasting Parameter :

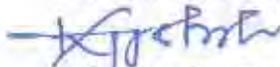
- |   |  |
|---|--|
| a) Average Drilling depth ( including sub-grade drilling )  | 6.5 mts.   |
| b) Burden   | 2.5 mts.   |
| c) Spacing  | 3.0 mts.   |
| d) Diameter of the hole   | 110 to 115 mm                                      |
| e) Length of the Explosive cartridge  | 400 mm   |
| f) Weight of each Cartridge   | 2.78 Kgs.  |
| g) Diameter of the cartridge  | 83 mm  |
| h) Tonnage conversion factor  | 3.3 T/Cu. M.                                       |
| i) Yield per hole : Burden X Spacing X Bench height X Tonnage factor =<br>( excluding 0.5 mt of subgrade drilling ) | $2.5 \times 3.0 \times 6.0 \times 3.3 = 148.5$ Mt. |
| j) Yield per KG of explosive : 6 T per kg.  |  |

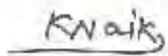
#### 1. Type of Explosive :

The most common type of explosive available and used in open cast mines are:

- Slurry explosive (AN based) viz. power gel, acquadyne, superdyne etc.
- Ammonium Nitrate Fuel Oil (ANFO) mixture.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



Out of these ANFO is the most popular, being most economical and hence cost effective, besides being safe to store and handle, and non-cap sensitive. It is used as a column charge and other explosives are used as booster to initiate the blast.

Free flowing prilled-granulated ammonium nitrate is mixed intimately with about 6% by weight of diesel oil. The mixture so prepared in the field is then used as explosive agent with about 20% to 30% of a booster charge at the bottom. ANFO however is hygroscopic and therefore cannot be loaded directly into wet/watery holes but can be so loaded packed in plastic tube bags.

### 2. Explosive Consumption per hole

Powder factor of Explosive 6 T / Kg.

Quantity of Explosive required per hole  $148.5 / 6 = 24.75$  Kgs

In each hole of 6.5 mtr including sub grade drilling a total of 24.75 kgs of explosive is required. So along with single cartridge of booster i.e. of 2.78 kgs remaining 22.03 kgs or say 22 kgs of Ammonium Nitrate prilled mixed with Diesel oil will be charged. The mixing of ammonium Nitrate prilled with Diesel oil shall be in the ratio of 6% by weight of diesel oil.

### 3. Explosive Consumption per day

As calculated 66 nos. of holes are to be charged and blasted per day to match the proposed excavation by drilling and blasting.

For blasting 66 nos. of hole we require booster cartridge of 83 mm dia with 2.78 kgs of weight for each hole.

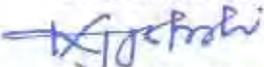
So total consumption of booster (AN based explosive class II) per day for 66 holes is :  $2.78 \text{ kgs} \times 66 = 183.48$  kgs. Or say 183 kg per day

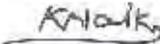
Similarly ANFO consumption will be 22 kg per hole with AN : FO = 94 : 6, i.e. 1,452 kg for 66 holes.

Diesel consumption per day for mixing of ammonium nitrate prilled will be (On the ratio of 6 ltrs of Diesel for every 100 kgs of ANFO)

$$= 6/100 \times 1452 = 87.12 \text{ ltrs. Or Say 87 ltrs}$$

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



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Hence details of explosive consumption per day are as follows: -

- i Ammonium Nitrate Prilled = 1,365 kgs
- ii Diesel = 87 ltrs.
- iii Booster Cartridge = 66 nos. or 183 kg.

**Storage of explosives (like capacity and type of explosive magazine):**

Following the general practice there will be an agreement with some authorized explosive agent to carry out the blasting. Hence, there will be no requirement of erecting any explosive magazine.

**iv) Crushing / Screening:**

About 40% of the excavated ore will require crushing but the total ore will require screening. It is proposed to engage 2 mobile crushing plants and 4 mobile screening plants for the purpose.

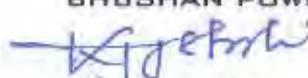
For feeding, clearing of chutes, loading into tippers / dumpers 2 excavators & 2 loaders will be kept.

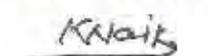
Table – 2.14

**Brief description of machineries (to be used) :**

Type	Nos	Size / Capacity	Make	Model
Shovel	5	1.3 M <sup>3</sup>	L&T Komatsu	Komatsu PC 300
Loaders	3	1.7 M <sup>3</sup>	BEML	BE 200-1
Wagon Drill	4	110 mm	Atlas Copco	LM-100 ( Drill ) XAH 210 ( Compressor )
Dumper	17	25 MT	Tata Hyva	Hyva 2510
Rock Breakers	1		Atlas Copco	MB 1500
Dozer	1		CATER PILLAR	D-80 A12
Mobile crushing plant	2	100 TPH	Power screen / Voltas	SR1000
Mobile Screening Plant	4	150 TPH	B.L. Pegson / Voltas	Chieftain 2100
Water Tanker	5	12000	Tata	Tata 1210
Staff vehicle	5		Mahindra & Co	Bolero

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
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S. Raha, K C Jyotishi, K Naik  
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Utility vehicle	3		Mahindra & Co	Camper
Ambulance	1		Mahindra & Co	

**f) Conceptual Mine planning upto the end of lease period taking into consideration the present available reserves and resources describing the excavation, recovery of ROM, Disposal of waste, backfilling of voids, reclamation and rehabilitation showing on a plan with few relevant sections.**

The estimated mineable reserve of iron ore within the block area is 64.577 Mln Tonnes lying within Forest and non-forest land. Considering the proposed average annual production of iron ore as 2 Mln Tonnes from the third year onwards, the anticipated life of mine is for broken forest area and non forest area is 33 years.

Table – 2.15

**Table showing dimension, top & bottom mRL of the quarry after Mining Plan period.**

	Length (m)		Width (m)		Top mRL		Bottom mRL	
	N-Pit	S-Pit	N-Pit	S-Pit	N-Pit	S-Pit	N-Pit	S-Pit
After Plan period	530	392	320	278	674.50	673.50	634	634

The fully mechanized opencast mining method shall be adopted with Excavator, Pay Loader, Tippers etc for the excavation work. During this four-year plan period, total two quarries are proposed to be developed. Height & width of individual bench is proposed to be kept 6m and width 10m. The overall pit slope would be kept at 31°. As the top part is hard in nature, so, drilling/blasting is required. The blasted ROM would be loaded into tipper for transportation. The haul road has been made and maintained to facilitate the movement of loaded and unloaded tippers with a width of 10 mt. The extracted waste would be transported to the dumpsite.

**4. Conceptual Mine planning upto the end of lease period taking into consideration the present available reserves and resources describing the excavation, recovery of ROM, disposal of waste, backfilling of voids, reclamation and rehabilitation showing on a plan with a few relevant sections :**

The precise area has been explored in a 200 X 200 mt grid which fits into the G2 category under UNFC guidelines. As per provision under Rule 12 (3) of MCDR 2017, It

S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K. Naik  
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has been obligatory on the part of the holder of a mining lease to carry out detailed exploration (G1 level) over the entire potentially mineralised area under the mining lease, within a period of five years from the date of opening of the mine after execution of such mining lease. Since the exploration, already carried out in this area conforms only to G2 category, a detailed yearwise exploration programme in 100 X 100 Mt grid has been prepared. The boreholes will be infilling type as the area has already been explored in 200 X 200 Mt grid. The locations of such proposed boreholes have been shown in the surface geological plan. All proposed boreholes will be drilled upto the end of the ore zone. Incase any such borehole does not encounter ore zone even at a depth of 40 mt same will be closed because of the fact that the maximum overburden encountered in the past exploration programme was 35 mt.

The details of proposed bore holes with location, tentative depth, inclination etc. has been shown in Table No. 1.3. It is again clarified that the actual depth of holes will be the end of Ore Zone.

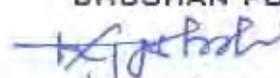
It is planned to produce iron ore by developing two pits, namely N-Pit & S-Pit as per their location in the block, during the next five years plan period. For this, lateral as well as depth-wise excavation is to be done. Some haul roads are to be developed for the transportation of ore and waste. At the end of this plan period, an area of 44.989 ha is required to be degraded for mining and allied activities.

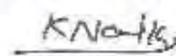
**Table showing dimension, top & bottom mRL of the quarry after Mining Plan period.**

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After Plan period	530	392	320	278	674.50	673.50	634	634

The fully mechanized opencast mining method shall be adopted with Excavator, Pay Loader, Tippers etc for the excavation work. During this four-year plan period, total two

  
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BHUSHAN POWER & STEEL LIMITED  
  
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Qualified Person

  
K NAIK  
Qualified Person



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quarries are proposed to be developed. Height & width of individual bench is proposed to be kept 6 mt and width 10 mt. The overall pit slope would be kept 31°. As the top part is hard in nature, so, drilling/blasting is required. The blasted ROM would be loaded into tipper for transportation. The haul road has been made and maintained to facilitate the movement of loaded and unloaded tippers with a width of 10m. The extracted waste would be transported to the dumpsite.

The estimated mineable reserve of iron ore within the block area is 64.577 Mln Tonnes lying within Forest and non-forest land. Considering the proposed average annual production of iron ore as 2 Mln Tonnes from the third year onwards, the anticipated life of mine is 33 years.

#### Ultimate Pit Limit :

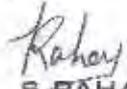
On the basis of the mineralized zone and keeping in view the statutory barriers of 7.5 mt from block boundary & 10 mt from village road as safety zone, keeping the objectionable land lying to the south-west corner of the block out of the purview of future mining, the ultimate pit limit has been demarcated and shown in Conceptual Plan (Plate –10). It has been calculated that at the ultimate stage, about 104.979 Ha area shall be degraded, including rain water harvesting system comprising 0.663 Ha. The pit limit at the ultimate stage will cover 102.010 Ha of degraded land.

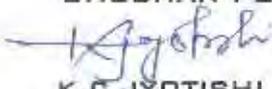
#### Final Slope Angle at the close of Mine:

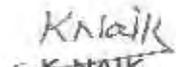
At present, the bench has been designed in such a way that to keep an overall pit slope at 31°. However, at ultimate stage, the height & width of benches would be kept at 6 mt & 6 mt each so that maximum ore can be extracted. So at ultimate stage, the final slope angle at the close of the mine will be 45°.

#### Waste management :

During the plan period waste will be generated in form of alluvial soil, ferruginous laterite & limonite ( both as overburden & intercalated waste ). Therefore, waste management should be concerned with dumping of alluvial soil, laterite & limonite. A part of the block area has been proved to be barren ( through core drilling ) and this patch of land has

  
S. RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NATK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

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been earmarked for waste dumping by State DG also. Same land will be utilized by the applicant. Since the depth of the ore zone is not very high it is likely that back filling of excavated area through generated waste, in future, seems a possibility. However once the block is thoroughly explored in a grid of 100 X 100 mt, a more rationale picture can be visualized regarding back filling.

**a) Existing Dump position:**

At present there is no any dump.

**b) At the end of plan period:**

During this plan period, the generation of waste shall be over burden and intercalated waste. The waste material generated during the plan period has been calculated and it comes to 1166241 M<sup>3</sup> (In situ) or 1146241 x 1.25 (swelling factor) = 1432801 M<sup>3</sup> (loose). This waste material is planned to be dumped in the proposed dump site proposed in the west-central part of the lease area over non mineralised zone.

**c) At conceptual stage:**

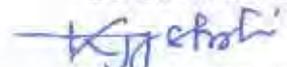
At ultimate stage all the waste material will be utilized for the reclamation of dead benches and no external waste dump will be available. The area occupied by waste dump shall be planted and handed over to the forest authority.

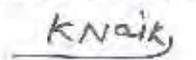
**Land Degradation / Reclamation / Afforestation:**

During the first five years plan period 44.989 Ha land is required for mining and allied activities. During conceptual plan period iron ore will be exploited laterally as well as in depth. It has been stated earlier that on the basis of the mineralized zone, statutory requirements as laid down by mining laws, the ultimate pit limit has been demarcated.

At conceptual stage, an area of 45.632 Ha shall be reclaimed by backfilling about 10502550 M<sup>3</sup> and plantation, an area of 17.008 ha shall have bench plantation and an area of 39.008 ha shall be converted into water lagoon.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

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**Reclamation :**

Based on the present exploration data, near flat topography, high length & breadth of the block, it is presumed that the entire mineralized zone will be extracted through mining. As such, there is possibility of back filling of exhausted pits with waste materials / sub grade materials. However, the actual picture will be cleared once G1 category exploration is carried out during the first 5 years plan period

Alluvial soil, generated during the first 5 year plan period can be utilized to spread over the back filled waste for afforestation purpose. Till then alluvial soil, generated during mining will be kept dumped properly.

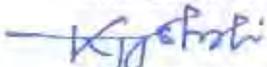
**Afforestation:**

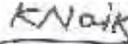
Plantation along the block boundary shall be taken up as per schedule in a phased manner to enhance the ecology and environment of the area. A scheme of plantation has been chalked out which is given in Table – 2.17. During this plan period about 1.00 Ha shall be planted whereas about 77.08 Ha shall come under plantation at ultimate stage. The proposed plantation has been shown in Conceptual plan.

Thus, at ultimate stage, reclamation and post mining land use pattern of the area shall emerge as follows:-

- i) At ultimate stage about 102.010 Ha of land shall be degraded due to mining. It is presumed that except for a part of the land where there will exist sub grade ore, the balance mineralized area is expected to be excavated fully thereby exposing the below lying barren zone. In the area with exposure of barren zone at depth, back filling by waste & sub grade materials will be made. After back filling, alluvial soil, stacked properly, will be spread over the back filled material. However till both the leases are merged, afforestation can be and will be done. Plantation will be done by making pits of 1' X 1' X 1' dimension and pouring soil with manure. However the entire excavated land can not be back filled fully due to shortage of waste / sub grade material. About 39.008 Ha of land will be left to form a water lagoon.
- ii) Massive plantation shall be done along the block boundary as shown in Conceptual Plan (Plate – 10).

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raia, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

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Table No. 2.17

**Afforestation scheme for plan period**

Year	Area in Ha	Number	Location	Plant Type	Expected survival rate
I <sup>st</sup> year	0.20	500	Along the safety zone of non forest area (Northern)	Karanj, Chakunda, Asan, Sisoo, Neem, Mahula Mahaneem, etc.	It is expected that the survival rate of 90% can be maintained due to prevailing land type 7 the proper care to be taken. About 50 saplings will be planted in the previous year's plantation area to make up the casualties.
II <sup>nd</sup> year	0.20	550	Along the safety zone of non forest area (Eastern side)		
III <sup>rd</sup> year	0.20	550	Along the safety zone of non forest area (Eastern side)		
IV <sup>th</sup> year	0.20	550	Along the safety zone of non forest area (Eastern side)		
V <sup>th</sup> year	0.20	550	Along the safety zone of non forest area (Eastern side)		
<b>TOTAL</b>	<b>1.00</b>	<b>2700</b>			

**Afforestation scheme for Life of the Block**

Sl no	Location	Area in Ha.	Number
1	All along the safety zone of non forest area.	2.143	5893
2	Mining	Back filled & planted	125488
		Bench plantation	47768
3	Sub grade stack	2.154	5924
4	Storage of Top soil	0.500	1375
5	Dump	23.195	63786
<b>Total</b>		<b>90.994</b>	<b>250234</b>

At the end of the life of the mine, the whole degraded area shall be reclaimed and handed over to the local authority in a useful manner. The existing and proposed land use pattern is given in Table- 2.18 & 2.19.

S RAHA  
Qualified Person

K C JYOTISHI  
Qualified Person

K NAIK  
Qualified Person

BHUSHAN POWER & STEEL LIMITED



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

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Table – 2.18

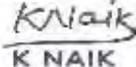
**Existing & Proposed Land-Use at the end of Plan Period & at the Ultimate Stage**

(Figures are in Ha).

Sl. No.	Pattern of Utilization	Existing	At the end of Plan Period	At ultimate stage
1	Mining	Nil	25.704	102.010 (45.632 ha shall be backfilled and planted, 17.370 ha shall be reclaimed by bench plantation and handed over to the forest authority. Rest 39.008 ha shall be converted into water lagoon.(616mRL).
2	Storage of Top soil	Nil	0.500	Nil (use in plantation)
3	Dump	Nil	9.607	Nil (all the waste shall be utilized in backfilling)
4	Infrastructure	Nil	1.817	Will be handed over to local authority
5	Mine Road	Nil	2.306	2.306 (To be utilized by local People).
6	S.G. stack	Nil	2.154	Nil (Blending with high grade and removed).
7	Plantation on safety zone	Nil	1.00	3.783 (To be utilized for plantation).
8	Water harvesting	Nil	0.066	0.066 (To be utilized by local People).
9	Ore stack	Nil	1.835	Nil (To be utilized and sold out).
10	Plant Area (Crusher, screening, ore stack, ore shoring)	Nil	Nil	
<b>Total</b>		<b>Nil</b>	<b>44.989</b>	<b>108.762</b>

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. RaHa, K C Jyotishi, K Naik  
Qualified Persons  
(under Rule 15 of MCR, 2016)

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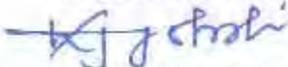
Table – 2.19

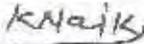
Proposed Land-Use at the end of each year of Plan Period

(Figures are in Ha).

Sl. No.	Pattern of Utilization	At the end of 1 <sup>st</sup> Year of Plan Period	At the end of 2 <sup>nd</sup> Year of Plan Period	At the end of 3 <sup>rd</sup> Year of Plan Period	At the end of 4 <sup>th</sup> Year of Plan Period	At the end of 5 <sup>th</sup> Year of Plan Period
1	Mining	5.434	7.715	14.815	19.652	25.704
2	Storage of Top soil	Nil	Nil	0.500	0.500	0.500
3	Dump	1.030	2.040	3.450	5.100	9.607
4	Infrastructure	1.817	1.817	1.817	1.817	1.817
5	Mine Road	2.306	2.306	2.306	2.306	2.306
6	S.G. stack	0.500	1.000	1.500	2.000	2.154
7	Plantation on safety zone	0.200	0.400	0.600	0.800	1.000
8	Water harvesting	0.066	0.066	0.066	0.066	0.066
9	Ore stack	1.835	1.835	1.835	1.835	1.835
10	Plant Area (Crusher, screening, ore stack, ore shorting)	Nil	Nil	Nil	Nil	Nil
<b>Total</b>		<b>13.188</b>	<b>17.179</b>	<b>26.689</b>	<b>34.076</b>	<b>44.989</b>

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



### 3.0 MINE DRAINAGE :

Suna nadi controls the drainage system of the area. Tehrai nala & Khejurdih nala controls the local drainage of the block area.

a) **Minimum and maximum depth of water table based on observations from nearby wells and water bodies :**

Maximum depth of water level in wells has been observed to be at 10 mt depth below ground level during summer. Simillary during rainy season, the water level has been observed to be at 4 mt depth from ground level.

b) **Indicate maximum and minimum depth of Workings.**

Excavation of pits will be carried out in two locations – N-Pit & S-Pit. The maximum depth of workings will be :

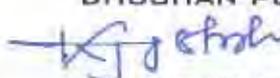
Table No. 3.1

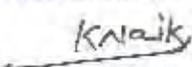
Quarry	Top mRL	Bottom mRL
North quarry	674.50	634.00
South Quarry	673.50	634.00

c) **Quantity and quality of water likely to be encountered, the pumping arrangements and places where the mine water is finally proposed to be discharged**

No water table has been reported to be encountered even at a depth of 575.432 mRL ( BH 28 which was drilled for 50.40 mt from ground level ) during core drilling. Excavation will not be done beyond the already proved ( by core drilling ) base of ore zone. So there seems no chance of encountering any water table during mining; atleast during the first 5 year plan period as the floor level ( 634 mRL ) to be attained at the end of 5<sup>th</sup> year plan period will be above the lowest contour ( 618 mRL ) our present in the block.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Nalk  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

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However, the applicant has decided to get the hydrogeological study of the block being carried by one reputed service provided to understand the hydrogeology of the area, its effect on future mining, incase of any effect the precautionary measures to be adopted etc.

d) Describe regional and local drainage pattern. Also indicate annual rain fall, catchments area, and likely quantity of rain water to flow through the lease area, arrangement for arresting solid wash off etc.

**Drainage pattern :**

The drainage system of the area is controlled by Teherai Nala flowing to the North of the block and its tributaries. However Khajurdihi Nala flowing in the Southern part of the area controls the drainage in the southern part.

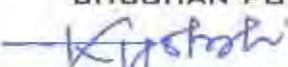
**Climate & Rainfall :**

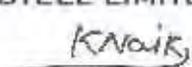
The region experiences a temperate to sub-tropical monsoon climate. The area is influenced by the south-west monsoon which begins generally from June and continues till August. September and October is the transition period between rainy and winter seasons and it represents autumn. The period between November to mid February is characterised by cold and dry weather conditions. The period between mid February to first week of June is hottest.

May is found to be the driest & hottest month and July is the wettest month, December being the coldest. The average relative humidity is found to be highest in the month of July while December records the lowest relative humidity.

1	Mean Annual Rainfall	1600 mm
2	Temperature (December)	5°C
3	Temperature (May)	47°C

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



#### 4.0 STACKING OF MINERAL REJECTS / SUB GRADE MATERIAL AND DISPOSAL OF WASTE:

- a) Indicate briefly the nature and quantity of top soil, overburden/waste and mineral rejects likely to be generated during the next five years.

In the target area three types of waste is expected to be generated during the excavation and production of Iron ore. These are :-

- (a) Alluvial soil - Overburden waste. ( OB )
- (b) Ferruginous Laterite- Overburden waste. ( OB )
- (c) Limonite - Overburden waste. ( OB )
- (d) Shale - Both as Overburden waste & Intercalated waste ( OB & ICW )
- (e) SLO ( - 45% Fe ) - Intercalated waste ( ICW )
- (f) SLO ( +45% - 55% Fe ) - Sub grade Ore ( SG )

The alluvial soil capping the rock bed is the loose overburden that exists in some part of the block. During mining in the first 5 year plan period, a part of this soil will be excavated.

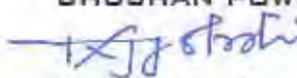
But the main overburden covering the mining zone will be ferruginous laterite with float iron ore. The thickness of such over burden is about 1.0 mt.

Below the over burden of ferruginous laterite, lies an ob of limonite in a part of the block as evidenced by BH

In addition to the over burden, there will be intercalated waste that will be generated during mining. This waste will include some shale patches, SLO with less than 45% Fe.

Considering the above, the quantum of alluvial soil & total waste including OB & ICW which will be generated during the next five years, has been shown in Table - 4.1. Generation of sub grade ore has been tabulated in Table - 4.2.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



Table – 4.1

**Table showing generation of Top soil / waste during the  
First 5 years plan period.**

Year	Topsoil ( M <sup>3</sup> )			Waste ( M <sup>3</sup> )		
	Generation	Reuse / Spreading	Storage	Generation	Backfilling	Storage
I <sup>st</sup> year	0.00	0.00	0.00	113836.60	NIL	113836.60
II <sup>nd</sup> year	0.00	0.00	0.00	100586.40	NIL	100586.40
III <sup>rd</sup> year	0.00	0.00	0.00	274834.40	NIL	274834.40
IV <sup>th</sup> year	1308.00	25.00	1283.00	296867.60	NIL	296867.60
V <sup>th</sup> year	393.00	25.00	368.00	380116.00	NIL	380116.00
<b>TOTAL</b>	<b>1701.00</b>	<b>50.00</b>	<b>1651.00</b>	<b>1166241.00</b>	<b>NIL</b>	<b>1166241.00</b>

Table – 4.2

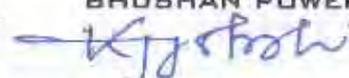
**Table showing generation of Sub Grade Ore during the  
First 5 years plan period.**

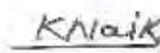
Year	Sub Grade Ore from N-Pit ( M <sup>3</sup> )			Sub Grade Ore from S-Pit ( M <sup>3</sup> )		
	Generation	Use	Storage	Generation	Use	Storage
I <sup>st</sup> year	10101.84	10101.84	10101.84	31726.14	31726.14	31726.14
II <sup>nd</sup> year	46380.31	46380.31	46380.31	37099.12	37099.12	37099.12
III <sup>rd</sup> year	21433.06	21433.06	21433.06	12166.75	12166.75	12166.75
IV <sup>th</sup> year	48093.12	48093.12	48093.12	46320.53	46320.53	46320.53
V <sup>th</sup> year	28096.08	28096.08	28096.08	52898.00	52898.00	52898.00
<b>TOTAL</b>	<b>154104.41</b>	<b>154104.41</b>	<b>154104.41</b>	<b>180210.54</b>	<b>180210.54</b>	<b>180210.54</b>

- b) The proposed dumping ground within the lease area be proved for presence or absence of mineral and be outside the UPL unless simultaneous backfilling is proposed or purely temporary dumping for a short period is proposed in mineralized area with technical constraints & Justification.

It has been stated earlier that the target area is fully explored through core drilling in a grid of 200 X 200 mt. A part of the block has been proved to be barren and this patch of land has been earmarked for waste dumping by State DG also. Same land will be utilized by the applicant also. This barren area lies in the western part of the block and is almost at same distance from from the Pits. The proposed area is having sufficient space to accommodate the waste to be generated during the first 5 year plan.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
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There will be considerable amount of generation of subgrade ore from both the Pits. Since sub grade ore is stacked with a expectation of selling these at later period, proper stacking of the same is essential. Since there is a difference in physical quality of ore between N-Pit & S-Pit, it is proposed to stack sub grade ore from these two pits separately and near to each source of generation. As such an area near N-Pit with co-ordinates 2420512 / 323598 has been selected to accommodate sub grade from N-Pit. Similarly, an area near south west corner of the block boundary with co-ordinates 2419212 – 2419512 and 323098 – 323198 has been selected for accommodating sub grade ore from S-Pit. Both these areas are not having any saleable ore deposits as evidenced from exploration, already carried in the block.

- b) **Attach a note indicating the manner of disposal of waste, configuration and sequence of year wise build up of dumps along with the proposals for protective measures.**

The year-wise spread and height of the proposed waste dump is given in Table No. 4.3A & 4.3B and shown in Plate – 8. The year-wise spread and height of the proposed sub grade stacks are given in Table No. 4.4A / 4.4B & Table No. 4.5A / 4.5B and shown in Plate – 9.

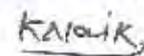
Table No. 4.3A

Quantity of Waste generation during plan period

Year	Co-ordinates		Generation of waste in M <sup>3</sup>		
	Northing	Easting	In -Situ (A)	Loose B=Ax1.25	Compact 85% of B
I <sup>st</sup> year	2419995.092	323211.449	113836.60	142295.75	120951.39
II <sup>nd</sup> year	2419961.709	323253.811	100586.40	125733	106873.05
III <sup>rd</sup> year	2419943.773	323302.014	274834.40	343543	292011.55
IV <sup>th</sup> year	2419917.594	323349.679	296867.60	371084.5	315421.83
V <sup>th</sup> year	2419850.470	323471.890	380116.00	475145	403873.25
<b>Total</b>			<b>1166241.00</b>	<b>1457801.25</b>	<b>1239131.06</b>

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. RaHa, K C Jyotishi, K Naik  
Qualified Persons  
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Table No. 4.3B

Table showing spread & height of proposed dump

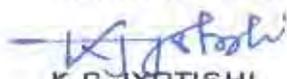
Year	Compact Waste in M <sup>3</sup>	Spread in Ha	Avg Height in M	Proposed Top mRL
I <sup>st</sup> year	120951.39	0.741	18	680
II <sup>nd</sup> year	106873.05	0.706	18	680
III <sup>rd</sup> year	292011.55	1.675	18	680
IV <sup>th</sup> year	315421.83	1.935	17	680
V <sup>th</sup> year	403873.25	4.55	10	680
<b>Total</b>	<b>1239131.06</b>	<b>9.607</b>		

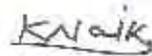
**PRECAUTIONERY MEASURES TO BE TAKEN :**

Simultaneous to dumping of waste, necessary steps will be observed to keep the dump levels stabilized by taking the following steps:

- i) A boulder wall with 3 m base and 1 m top width and length of 1200 shall be erected at the foot of the dump; at a distance of 10 m from the dump toe, to prevent any wash-off during the rainy season.
- ii) Garland drains with 1 m depth and 1 m width will be dug for about 1400 m around the dump with some soak pits to arrest any wash-off. The garland drain will help in gravitational settling of the solid waste and clean water will pass downwards.
- iii) A terrace will be formed with 20 mt width at 10 m height to maintain the overall slope of the dump.

  
**S RAHA**  
Qualified Person

**BHUSHAN POWER & STEEL LIMITED**  
  
**K C JYOTISHI**  
Qualified Person

  
**K NAIK**  
Qualified Person



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S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA



Table No. 4.4A

Quantity of Sub Grade ore generation from N-Pit during plan period

Year	Co-ordinates		Generation of waste in M <sup>3</sup>		
	Northing	Easting	In -Situ (A)	Loose B=Ax1.25	Compact 85% of B
I <sup>st</sup> year	2420525.742	323577.657	10101.84	12627.30	10733.21
II <sup>nd</sup> year	2420500.668	323619.602	46380.31	57975.39	49279.08
III <sup>rd</sup> year	2420489.446	323638.414	21433.06	26791.33	22772.63
IV <sup>th</sup> year	2420465.306	323678.884	48093.12	60116.40	51098.94
V <sup>th</sup> year	2420446.510	323710.393	28096.08	35120.10	29852.09
<b>Total</b>			<b>164104.41</b>	<b>192630.51</b>	<b>163735.94</b>

Table No. 4.4B

Table showing spread & height of proposed dump

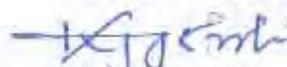
Year	Compact Waste in M <sup>3</sup>	Spread in Ha	Avg Height in M	Proposed Top mRL
I <sup>st</sup> year	10733.21	0.11	10	640.80
II <sup>nd</sup> year	49279.08	0.46	10	640.80
III <sup>rd</sup> year	22772.63	0.21	10	640.80
IV <sup>th</sup> year	51098.94	0.48	10	640.80
V <sup>th</sup> year	29852.09	0.26	10	640.80
<b>Total</b>	<b>163735.94</b>	<b>1.54</b>		

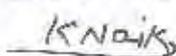
**PRECAUTIONERY MEASURES TO BE TAKEN :**

Simultaneous to dumping / stacking of waste / sub grade ore, necessary steps will be observed to keep the dump / stack levels stabilized by taking the following steps:

- A boulder wall with 3 m base and 1 m top width and length of 282 shall be erected at the foot of the dump; at a distance of 10 m from the dump toe, to prevent any wash-off during the rainy season.

  
S RAHA  
Qualified Person

  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. RaHa, K C Jyotishi, K Nalk  
Qualified Persons  
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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139,223 Ha IN  
SUNDERGARH Dist., ODISHA



- ii) Garland drains with 1 m depth and 1 m width will be dug for about 290 m around the dump with some soak pits to arrest any wash-off. The garland drain will help in gravitational settling of the solid waste and clean water will pass downwards.

Table No. 4.5A

Quantity of Sub Grade ore generation from S-Pit during plan period

Year	Co-ordinates		Generation of waste in M <sup>3</sup>		
	Northing	Easting	In -Situ (A)	Loose B=Ax1.25	Compact 85% of B
I <sup>st</sup> year	2419212	323098	31726.14	39657.68	33709.02
II <sup>nd</sup> year			37099.12	46373.90	39417.82
III <sup>rd</sup> year	2419512	323198	12166.75	15208.44	12927.17
IV <sup>th</sup> year			46320.53	57900.66	49215.56
V <sup>th</sup> year			52898.00	66122.50	56204.13
<b>Total</b>			<b>180210.54</b>	<b>225263.18</b>	<b>191473.70</b>

Table No. 4.4B

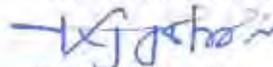
Table showing spread & height of proposed dump

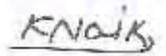
Year	Compact Waste in M <sup>3</sup>	Spread in Ha	Avg Height in M	Proposed Top mRL
I <sup>st</sup> year	31726.14	0.31	12	663.60
II <sup>nd</sup> year	37099.12	0.36	12	663.60
III <sup>rd</sup> year	12166.75	0.12	12	663.60
IV <sup>th</sup> year	46320.53	0.46	12	663.60
V <sup>th</sup> year	52898.00	0.38	12	663.60
<b>Total</b>	<b>180210.54</b>	<b>1.64</b>		

**PRECAUTIONERY MEASURES TO BE TAKEN :**

Simultaneous to dumping / stacking of waste / sub grade ore, necessary steps will be observed to keep the dump / stack levels stabilized by taking the following steps:

  
B RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



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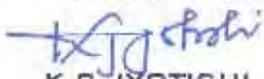
S. RaHa, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

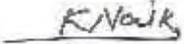
MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA



- i) A boulder wall with 3 m base and 1 m top width and length of 415 shall be erected at the foot of the dump; at a distance of 10 m from the dump toe, to prevent any wash-off during the rainy season.
- ii) Garland drains with 1 m depth and 1 m width will be dug for about 420 m around the dump with some soak pits to arrest any wash-off. The garland drain will help in gravitational settling of the solid waste and clean water will pass downwards.

  
B RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person

**5. USE OF MINERAL AND MINERAL REJECT**

- a) Describe briefly the end use of the mineral (sale to intermediary parties, captive consumption, export, industrial use).

The deposit consists of iron ore of different types, both physical & chemical which caters as a good raw material suitable for iron ore industries. This block was auctioned by the State Govt without any "end use" restriction i.e. the iron ore produced from this mine can be sold in the open market. Simultaneously, the applicant himself requires iron ore for its own Integrated Steel Plant situated at Tholkoloi, near Jharsuguda in Odisha. Even export possibility will also be thought of.

In general it can be concluded that the product of this block will be sold to different industries within India, will be consumed by own industry and may be exported if such a situation arises.

- b) Indicate physical and chemical specifications stipulated by buyers:

The market requirement varies widely from min 57% Fe to 63% Fe. However the present demand is mainly 62 – 63% Fe grade materials. Other constituents should be as shown below :

Table No. 5.1

Chemical Specification			Physical Specification for Crushing unit	
Constituents	%age	Limit	Size in MM	Limit
Fe	62	+ 57	Varies from : -10 mm 10-18 mm 10-30 mm	5% +/-
MgO	3	Max		
SiO <sub>2</sub> + Al <sub>2</sub> O <sub>3</sub>	5	Max		
CaO + MgO	2	Max		
Phos	0.03	Max		
Sulphur	0.03	Max		

S RAHA  
Qualified Person

BHUSHAN POWER &amp; STEEL LIMITED

K C JYOTISHI  
Qualified PersonK NAIK  
Qualified Person



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S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA



- c) Give details in case blending of different grades of ores is being practiced or is to be practised at the mine to meet specifications stipulated by buyers:

So far as chemical quality is concerned, no special blending process is required to be adopted. This is because iron ore with different grades are available through out the block and during mining there will be natural blending of different grades. Only to maintain separation of +55% Fe ore from -55% Fe ore.

S RAHA  
Qualified Person

K C JYOTISHI  
Qualified Person

K NAIK  
Qualified Person

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## 6. PROCESSING OF ROM AND AND MINERAL REJECT

- a) If processing / beneficiation of the ROM or Mineral Reject is planned to be conducted, briefly describe nature of processing / beneficiation. This may include size and grade of feed material and concentrate ( finished marketable product ), recovery etc. :

There will be no beneficiation of ore because of the fact that :

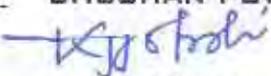
1. Most of the consumers are having their own beneficiation plant,
2. BPSL, the present applicant also has its beneficiation plant at his Integrated Steel Plant location.
3. There is not sufficient space available in the block to erect a beneficiation plant.

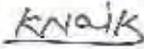
However processing in the form of mechanical breaking using mobile crushing & screening plants will be made. The market demand is for Fines ( -5 MM ) & Sized ore ( 5-18 MM, 10-30 ).

Mineral processing units inform of mobile crushing & screening plants will be deployed in the block. The Run off Mine, produced during the excavation from the pits, will be fed to the Mobile screening units for size segregation. The oversized material from screen grizzly will be fed to the mobile crushing unit of 100 TPH capacity.

The ROM ( - 200 mm ) raised from the quarry is being feed to the 4 nos. of Screening plant to be deployed for getting the iron fines -10mm +2mm, calibrated lump ore +10 mm -30 mm and +30 mm -80 mm lumps after screening. The grizzly over size which is +80 mm size boulders are segregated at the initial stage. Mobile Screening plants will be of 150 TPH capacity which goes for higher output based upon type of feed, nature of material and weather condition in the mines.

  
B RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA



Screening Capacity	150 TPH
No. of Screening units (MOBILE)	4 nos - Primary Screening Plant
Feed Size	-200 mm
Product Size	-10 MM, FINES +10 MM -30MM CLO +30MM -80MM LUMPS +80 MM GRIZZLY OVER SIZED BOULDERS -

The oversize products of grizzly during screening ie +80 mm boulders and +30mm - 80 mm LUMPS generated are fed to mobile crusher units to get 10-30 mm crushed CLO and fines.

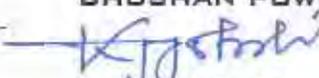
- b) Give details on Production of finished ore/concentrate, generation of reject/tailings & subgrade material indicating recovery at every stage of processing.

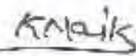
The average percentage of Fines produced in the Screening Plant is assumed as 70% of the feed. The Fines generated during production period will be stacked separately around the Screening plant by the help of payloaders..

All steps are being taken to market the Iron Ore fines and the fines being generated during mining operation are dispatched regularly for domestic industries as well as export purpose depending upon government policy for promoting export.

- c) Give a material balance chart with a flow sheet or schematic diagram of the processing procedure indicating feed, product, recovery, and its grade at each stage of processing.

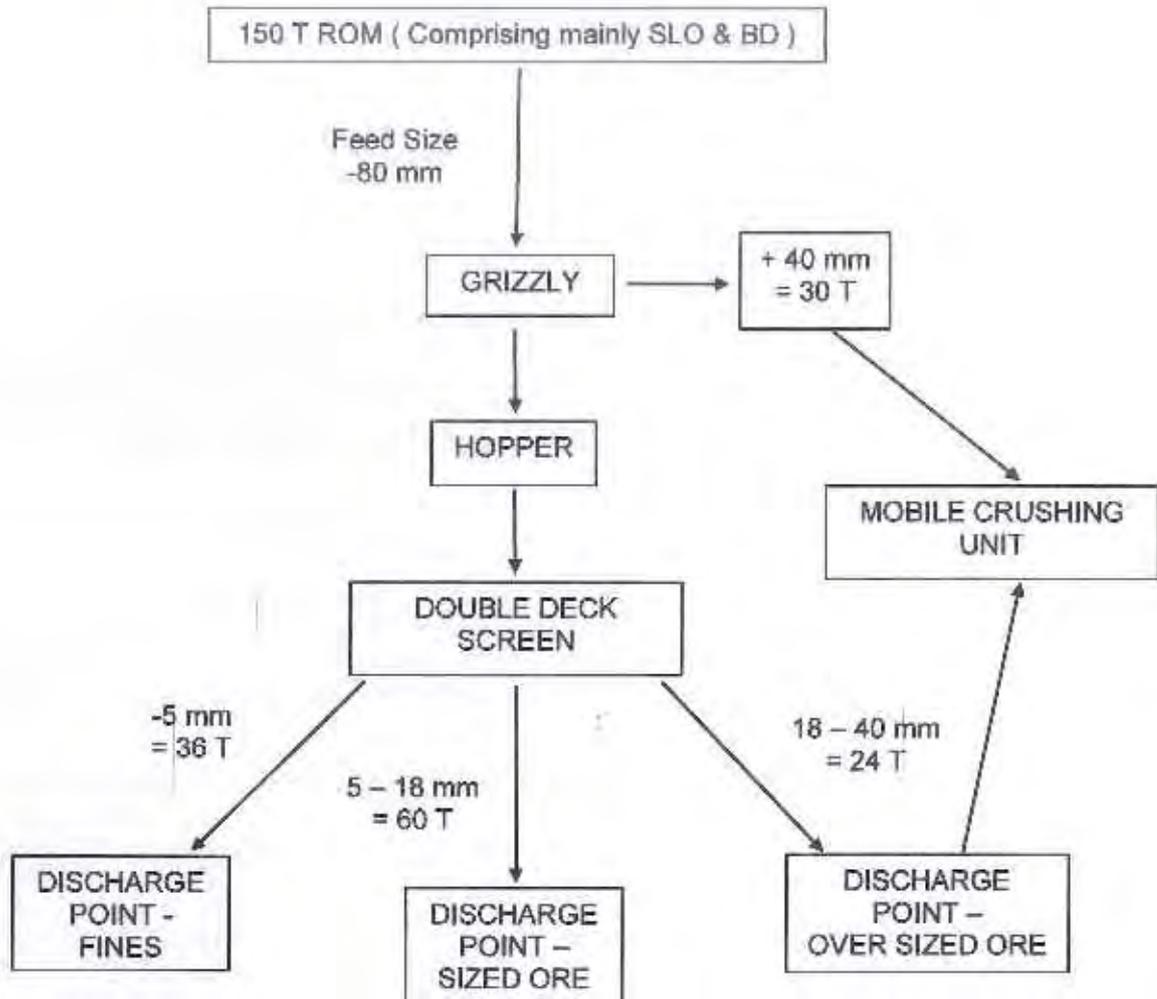
  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

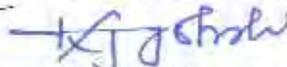
  
K NAIK  
Qualified Person

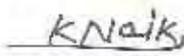


### FLOW CHART OF MOBILE SCREENING UNIT 150 TPH



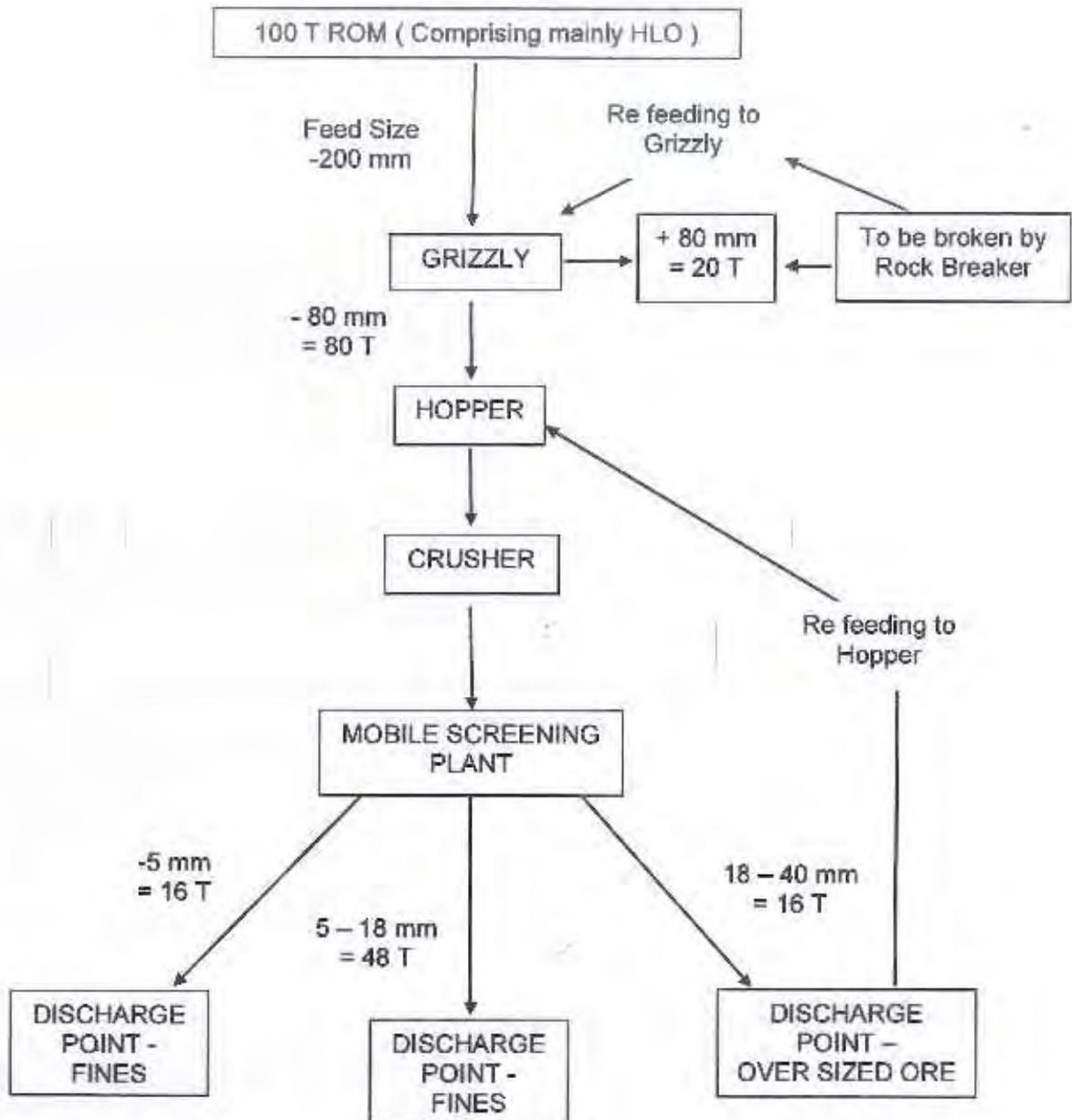
  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



### FLOW CHART OF MOBILE CRUSHING UNIT 100 TPH



S RAHA  
Qualified Person

BHUBHAN POWER & STEEL LIMITED  
  
K G JYOTISHI  
Qualified Person

K NAIK  
Qualified Person



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S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA



d) Explain the disposal method for tailings or waste from the processing plant (quantity and quality of tailings proposed to be discharged, size and capacity of tailing pond, toxic effect of such tailings, if any, with process adopted to neutralize any such effect before their disposal and dealing of excess water from the tailing dam).

Does not arise.

e) Specify quantity and type of chemicals to be used in the processing plant.

Does not arise.

f) Specify quantity and type of chemicals to be stored on site / plant.

Does not arise.

g) Indicate quantity (cum per day) of water required for mining and processing and sources of supply of water, disposal of water and extent of recycling. Water balance chart should be given.

**Water requirement:**

Water will be utilized for wet drilling, sprinkling on haul roads and drinking purpose during mining operations. The total water requirement will be 167 KLD. It is proposed that about 163 KL/Day water will be withdrawn from Tehrai Nala and balance 4 KL/Day of water will be withdrawn from a borewell to be dug by the applicant. Requisite permissions for withdrawal of water from respective sources will be taken from the competent authority.

The water balance is given below :

S RAHA  
Qualified Person

K C JYOTISHI  
Qualified Person

K NAIK  
Qualified Person

BHUSHAN POWER & STEEL LIMITED

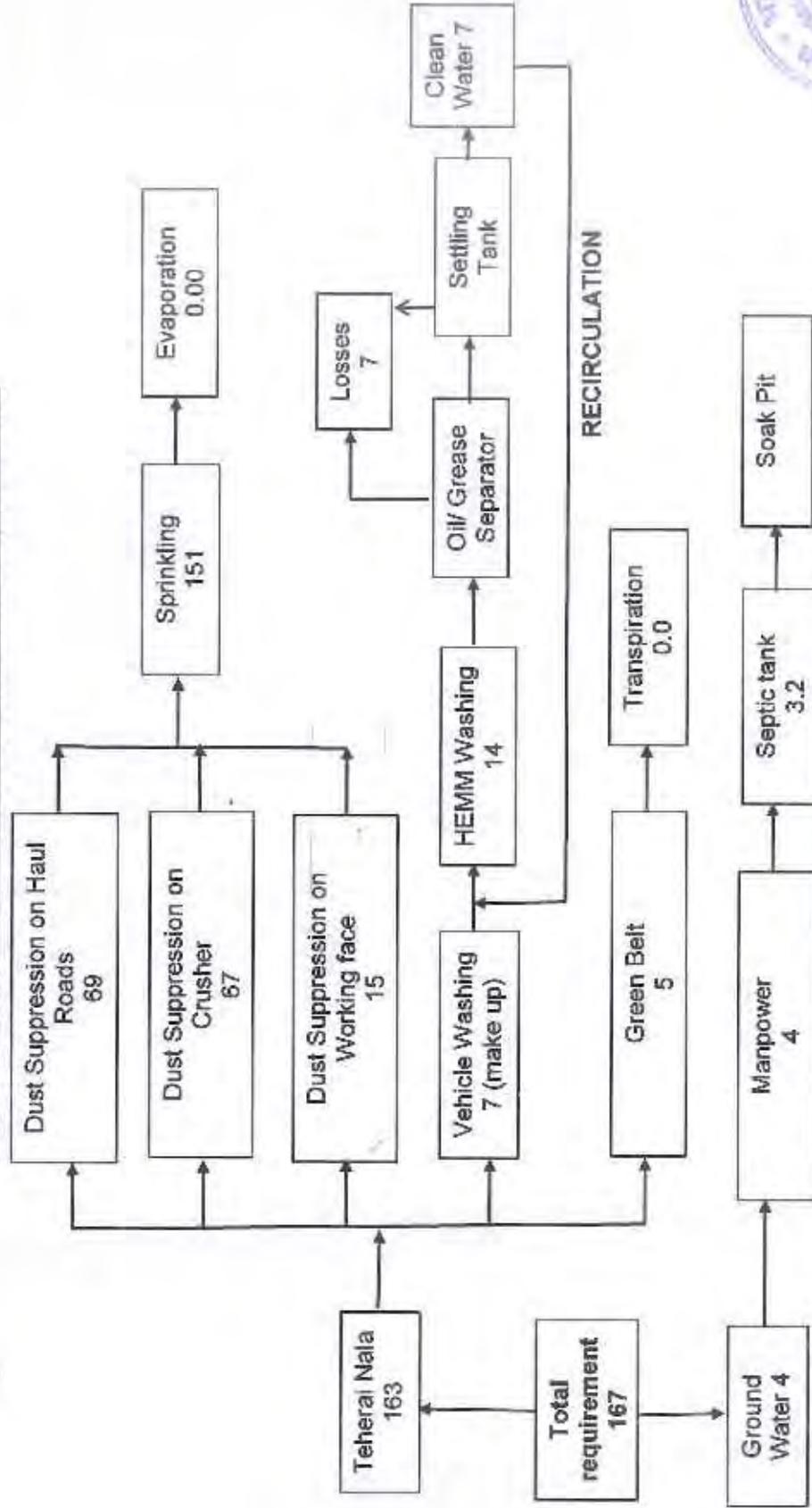


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S. Raña, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR IRON ORE BLOCK OVER  
139.223 Ha IN SUNDERGARH Dist., ODISHA

### PROPOSED DAILY WATER BALANCE (KL / Day)



*S. Raña*  
**S RAHA**  
Qualified Person

*K C Jyotishi*  
**K C JYOTISHI**  
Qualified Person

*K Naik*  
**K NAIK**  
Qualified Person





## 7. OTHERS:

### a) Site Services :

Site services such as temporary rest-shed, blasting shed etc. near the working pits will be erected during mining. For mine administration an office will be made near the northern block boundary. A store, a garage, one staff canteen, a small dispensary will also be developed near the office.

A weigh bridge will be there near the eastern boundary through which iron ore will be despatched to different destinations.

A small camp for accommodating the operators / helpers will also be erected within the block area.

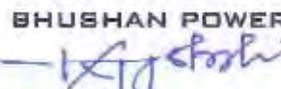
Other staffs / executives will be accommodated in hired flats in the nearby township of Koira.

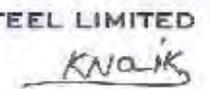
While considering the man power, two shift of mining operation, the requirement of mining equipment, their availability on hire basis etc. are kept in mind. The table shown below indicates the status of equipment.

Table No. 7.1

Sl No.	Equipment	Number of equipment	Status of procurement
1	Shovel	5	To be hired
2	Loaders	3	To be hired
3	Wagon Drill	4	To be hired
4	Dumper	17	To be hired
5	Rock Breakers	1	To be hired
6	Dozer	1	To be hired
7	Mobile crushing plant	2	To be hired
8	Mobile Screening Plant	4	To be hired
9	Water Tanker	5	To be hired
10	Passenger Vehicles	5	To be owned
11	Utility vehicle	3	To be owned
12	Ambulance	1	To be owned

  
B RAHA  
Qualified Person

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K NAIK  
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MINING PLAN OF NETRABANDH-DANAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist, ODISHA



**b) Employment Potential :**

**i) Management & Supervisory Personnel:**

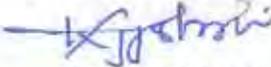
<u>Designation</u>	<u>Qualification</u>	<u>Nos.</u>
Mines Manager	First class Manager's certificate	1
Mining Engineers	Second Class Manager's certificate	4
HR	M.A. in Sociology, Labour Welfare	1
Geologist	M.Sc. in Geology	3
Environmental Engg.	M.Sc. in Environment Science	1
Surveyor	Certificate of Competency from DGMS	2
Mining Foreman	Certificate of Competency from DGMS	4
Mining Mate	Certificate of Competency from DGMS	8
Mechanical Engg.	Degree in Mechanical Engg.	1
Mechanical Foreman	Diploma in Mechanical Engg.	2
Electrical Engg.	Degree in Electrical Engg.	1
Electrical Foreman	Diploma in Electrical Engg.	2
Blaster	Certificate of Competency from DGMS	1
Accountant		1
Accountant / Clerical / Weighbridge Clerk		25
<b>TOTAL</b>		<b>57</b>

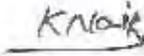
**ii) Skilled / Semi-skilled Workers' Requirement :**

Since all the equipment will be on hire basis, man power will be provided by the contractor.

In addition to the above, there will be sufficient number of security personnel.

  
**S RAHA**  
Qualified Person

**BHUSHAN POWER & STEEL LIMITED**  
  
**K C JYOTISHI**  
Qualified Person

  
**K NAIK**  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist, ODISHA

**8. PROGRESSIVE MINE CLOSURE PLAN UNDER RULE 22 OF MCDR'2017 :**

**8.1 Environment Base line information : Attach a note on the status of base line information with regard to the following :**

**I) Existing land use pattern :**

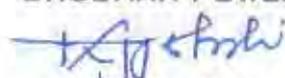
Topographically the target area represents a undulating to plain topography with some barren and uncultivated land, a small nala, a place of worship, a land reserved for grazing of domestic animals, a grave yard ( smasan ). A village road passes adjacent to the block boundary and in places, through the block area. As there is no activity of any sort within this land, forest growth have developed.

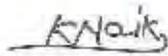
**II) Water regime :**

No perennial nala / stream except a small one, flowing at the south-east corner of the block, exists within the target area. No water table has been reported to be encountered even at a depth of 575.432 mRL ( BH 28 which was drilled for 50.40 mt from ground level ) during core drilling. Excavation will be done not beyond the already proved ( by core drilling ) base of ore zone. So there is no chance of encountering any water table during mining. Excavation will not be done beyond the already proved ( by core drilling ) base of ore zone. So there seems no chance of encountering any water table during mining; atleast during the first 5 year plan period as the floor level ( 634 mRL ) to be attained at the end of 5<sup>th</sup> year plan period will be above the lowest contour ( 618 mRL ) our present in the block. However, the applicant has decided to get the hydrogeological study of the block being carried by one reputed consultant to understand the hydrogeology of the area, its effect on future mining, incase of any effect the precautionary measures to be adopted etc.

The block is located at the hill slope, therefore there is no chance of inundation of pits from rain water. The surface run off water during rainy season will be drained to the Khajurdihi nallah through dry nallas present in the area.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA



### iii) Flora & Fauna:

#### Flora & Fauna :

The block shows vegetational cover comprising of different trees and bushes. Most of the area falls under proposed reserved forest and DLC forest category. However there is no record of wild life of any significance which has been encountered or reported to be encountered excepting domestic animals.

There is no reported species of endangered flora & fauna within the target area.

### iv) Quality of Air ambient, noise level and water:

#### AIR QUALITY :

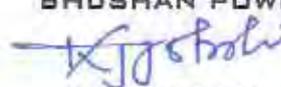
The block is amidst an active mining area. Previously there were a number of crushing plants surrounding the block; however at present there is none. The block is almost a virgin area except for a few months when core drilling was undertaken. As such there is no record of baseline data for air, water, noise and soil at present.

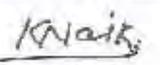
Once mining activity begins in this block which will involve, drilling, blasting, transportation crushing, screening etc. there will be emission of dust which is a common phenomenon of mining belt. However, the dust fall rate will be reduced by adopting regular water spraying on haul roads and by plantation in the area.

#### NOISE QUALITY :

The source of noise in the area will be due to drilling, blasting, compressor operation, crushing & screening and tipper movement. Noise due to drilling blasting and movements of trucks/dumpers will be negligible. During the plan period, there will be generation of noise due to use of HEMM also.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
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MINING PLAN OF NETRABANDH PABAR  
IRON ORE BLOCK OVER 139,223 Ha IN  
SUNDERGARH Dist, ODISHA



**WATER QUALITY :**

The only source of water near the block area is the Teheral nala which is about 1km away. The Khajurdihi nala which is seasonal in nature is situated at the south - eastern corner and flows along south-north. Since mining will be restricted in the south eastern corner, away from the nala, there is very little chance of water pollution. Water quality of surface as well as ground water will not be affected due to mining activities. There will be no discharge of water from the mine.

**SOIL QUALITY :**

In general the soil is shaly/lateritic and seems infertile so far as growing of paddy or pulses are concerned.

**v) Climatic Condition:**

The area is directly influenced by the South West monsoon. As noted from the records of "Koiravally" the minimum temperature in cold season varies between 5° C and 25° C. Summer is not very hot. However sometimes it reaches 47° C. The atmosphere of this region is not so dry because of good vegetation cover. The seasonal duration of this area is :-

- SUMMER SEASON : March to May
- RAINY SEASON : June to October
- WINTER SEASON : November to February

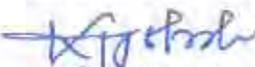
Rainfall in the rainy season is well distributed in this area and the average annual rainfall as collected from the block office is about 1600 mm.

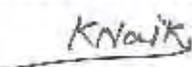
From the study the overall predominant wind direction has been from SSW to NNE followed by SW to NE and West to East. The average wind velocity is 1.4 m/s and the calm period is around 25%.

**vi) Human Settlement:**

There is no human settlement within the block area. The region is having a population density of about 100 heads per sq. km. within the buffer zone of 5 km radius. Agriculture

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
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is the main occupation of the population and paddy is the principal crop of this region. The land adjacent to this mining area is mostly agriculture land and most of the people do agriculture once in a year on rain water. However of late mining has been accepted as a main occupation by the locals.

**vii) Public buildings, places of worship & monuments:**

The area is devoid of any notable public buildings, National monuments, places of worship etc. There is also no Natural Park of tourist interest or wild life sanctuary near the area. However there small areas used as place of worship and place of graveyard in the south eastern corner of the block. There is no proposal for any type of mining activities in these areas; on the other hand a 10 mt safety zone has been proposed to keep this area away from any mining activities.

**viii) Any sanctuary located in the vicinity of are / leasehold :**

No sanctuary exists in the vicinity of the target area.

**ix) Does area (partly of fully) fall under notified area under water (prevention & control of pollution) Act 1974 :**

The area does not fall under notified area under water act 1974.

**8.2 Impact Assessment : Attach an Environmental Impact Assessment Statement describing the impact of mining and beneficiation on environment on the following over the next five years.**

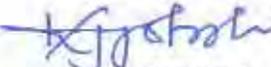
**i) Land area indicating the area likely to be degraded due to quarrying/pitting, dumping, roads, workshop, processing plant, tailing pond/dam, township etc.**

At present the block represents a virgin land. During mining, there will be degradation of land due to excavation, dumping, infrastructure development etc.

As the block area comprises mainly of PRF & DLC forest proposed mining will be carried out within both forest and non forest area, but after getting statutory clearances.

The existing and proposed land use pattern for the next five years is given in table below:

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA



Table No. 8.1

**Proposed Land-Use at the end of each year of Plan Period ( In Ha )**

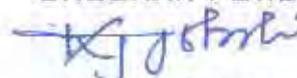
Sl. No.	Pattern of Utilization	Existing	At the end of 1 <sup>st</sup> Year of Plan Period	At the end of 2 <sup>nd</sup> Year of Plan Period	At the end of 3 <sup>rd</sup> Year of Plan Period	At the end of 4 <sup>th</sup> Year of Plan Period	At the end of 5 <sup>th</sup> Year of Plan Period
1	Mining	NIL	5.430	7.710	14.600	19.640	25.704
2	Storage of Top soil	NIL	Nil	Nil	0.500	0.500	0.500
3	Dump	NIL	1.030	2.040	3.450	5.100	9.607
4	Infrastructure	NIL	1.817	1.817	1.817	1.817	1.817
5	Mine Road	NIL	2.306	2.306	2.306	2.306	2.306
6	S.G. stack	NIL	0.500	1.000	1.500	2.000	2.154
7	Plantation on safety zone	NIL	0.200	0.400	0.800	0.800	1.000
8	Water harvesting	NIL	0.066	0.066	0.066	0.066	0.066
9	Ore stack	NIL	1.835	1.835	1.835	1.835	1.835
10	Plant Area (Crusher, screening, ore stack, ore shorting)	NIL	Nil	Nil	Nil	Nil	Nil
<b>Total</b>		<b>NIL</b>	<b>13.184</b>	<b>17.174</b>	<b>26.674</b>	<b>34.064</b>	<b>44.989</b>

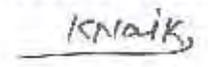
**ii) Air Quality:**

Air pollution to some degree may be caused by blasting fumes and dust generation during drilling, blasting and haulage. However the scale of mining proposed, the thick bushy surroundings will cause restriction on large scale air pollution. Further, limestone will be transported in the form of boulders / lump, as such, loading & unloading of the same will not involve any dust generation. During the next five years of working, disposal of waste shall generate dust which may affect the ambient air quality of the area. Fly rocks is not a problem because of small scale drilling/blasting.

The block will be developed as a mechanised mine. Loading and transportation of ore and waste materials, dumping and storage of minerals and waste disposal will contribute to the air borne dust & gaseous emissions. Measures like water sprinkling on haul road, wet drilling, equipment maintenance, etc. are required to reduce the dust levels & other emissions and keep them well within the safe limits.

  
**S RAHA**  
Qualified Person

**BHUSHAN POWER & STEEL LIMITED**  
  
**K C JYOTISHI**  
Qualified Person

  
**K NAIK**  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
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Since the proposed mining will be in shape of scientific mechanized method with the deployment of excavator, drills and tippers, there will be limited generation of dust during drilling, movement of trucks and due to excavation.

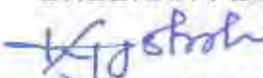
The area is also surrounded by other mines. To ensure the SPM level within safe limit, adequate provisions have been made for water sprinkling for further controlling the air pollution. In Mining activities, the sources of fugitive dust are drilling, blasting and hauling. The following control measures are proposed:

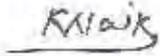
- i) The wet drilling system will be adopted.
- ii) To control dust adequate water sprinkling over haul road by water spray/mist spray under pressure will be done. Total length of haul road of 2.7 kms within the lease area and 1.65 km out side the lease area will be water sprinkled by tankers (6 Nos.) making total 5 trips a day in summer season and as required.
- iii) Phased reclamation of mined out areas & waste dumps and tree plantation will also help to reduce the generation of fugitive dust.
- iv) Air quality at strategic points like pits, dump, crushing unit, weigh bridge, office area etc. will be tested four times a year.

**iii) Water Quality:**

There is a small nala flowing through the block area in the south-east corner. But this part of the block has been proposed to be kept out of any mining activity. Water table is likely not to be encountered during mining as the ground level was not encountered in any drilled holes and quarry floor will not be lower than the explored level. Water quality of surface as well as ground water will not be affected due to mining activities as there will be no water discharge from the quarries. Mine will have no wet process. Only the rain water run off is likely to cause turbidity for which check dams / silt ponds are proposed to be constructed in the course of seasonal nalla. The check dams will be constructed by boulders to check the speed of the water, as well, the wash off material also gets arrested. The water after passing through the check dam is collected in a sump.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
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MINING PLAN OF NETRABANDH PAHAR  
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Parapet walls shall be provided around dumps to check and channelized the runoff. Coco filters will be used so that silt free runoff is discharged outside the lease area.

The existing plantation and proposed tree plantation will also definitely check the flow of turbid water to the Khajurdihi nala.

Water quality of inlet & out let point of the Khejurdihi nala passing through the block area will be tested in **three seasons a year**.

**iv) Noise levels :**

The mining activities will generate noise mainly due to (a) operating mining equipment (b) drilling & blasting and (c) movement of vehicles. The impact of noise will be more on the operating personnel and on the persons working nearby and not so much on the surrounding where human habitation are located at a fairly far distance.

In target area, mining operation will be carried by fully mechanised method. There will be drilling and blasting during mining operation. Also there will be movement of dumpers. But since the area is mostly surrounded by forest, path of the noise will be interrupted and it will not be felt at distance from the operation site.

Noise level at strategic points like pits, crushing unit, weigh bridge, office area etc. will be tested **four times a year**.

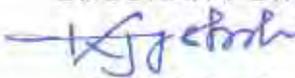
**v) Vibration levels (due to blasting) :**

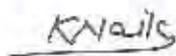
As stated above, drilling / blasting will be carried out in the target area for the production of iron ore. Wagon drills will be used for deep hole drilling. Drill holes will be up to a depth of 6.5 mt and with 115 mm dia. But the vibration caused due to drilling / blasting will be negligible. And also the ground vibrations due to blasting shall be monitored as per DGMS norms and guidelines.

Delay detonators are adopted to control the vibrations & throw of blasted material, noise & ensure better fragmentation. Following will ensure the above :

- a. Use of nonel help in controlled blasting using bottom initiation method wherein the time delay is there between initiation of bottom booster and intermediate booster.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA



- b. The blasting due to controlled nature will produce the minimum impact of vibration. Delay detonators will be used in deep holes so that blasting is not instantaneous.
- c. The drill holes will be properly charged and stemmed so that possibility of air blast will be eliminated.
- d. Blasting will be done before & after working hours when the number of the working persons are very less. The blasters and helpers are provided earplugs.
- e. Proper maintenance of machineries and transport vehicles will be done to reduce the noise and keep the same within reasonable limit.

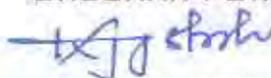
Further, noise level measurements in the mine area will be carried out once in every three months.

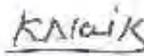
vi) **Water regime :**

No perennial nala / stream except a small one, flowing at the south-east corner of the block, exists within the target area. No water table has been reported to be encountered even at a depth of 575.432 mRL ( BH 28 which was drilled for 50.40 mt from ground level ) during core drilling. Excavation will not be done beyond the already proved ( by core drilling ) base of ore zone. So there seems no chance of encountering any water table during mining; atleast during the first 5 year plan period as the floor level ( 634 mRL ) to be attained at the end of 5<sup>th</sup> year plan period will be above the lowest contour ( 618 mRL ) our present in the block. However, the applicant has decided to get the hydrogeological study of the block being carried by one reputed service provided to understand the hydrogeology of the area, its effect on future mining, incase of any effect the precautionary measures to be adopted etc.

The block is located at the hill slope, therefore there is no chance of inundation of pits from rain water. The surface run off water during rainy season will be drained to the Khajurdihi nallah through dry nallas present in the area. Also no adverse effect has ever been observed on water regime due to mining in this region.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K G JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH DIST, ODISHA



**Water requirement :**

Water will be utilized for wet drilling, sprinkling on haul roads and drinking purpose during mining operations. The quantity of water will be met from the Teherai nalla of perennial nature. Hence no impact is envisaged on ground water potential.

**Water Balance :**

Total Water requirement is 167 KL/Day. Out of this 163 KL/Day will be withdrawn from Teherai Nala. Balance 4 KL/Day will be withdrawn from a borehole to be dug within the block area. The details water balance has been shown in Page 87.

**Rain Water Harvesting and Water Conservation Measures :**

The area has a good rainfall of around 1600 mm per annum. Major part of annual rain is distributed between June to September. Hence water conservation through rain water harvesting has an advantage over other methods. It is proposed to use the rain water of the area for rain water harvesting which will recharge the ground water table. The rain water will be stored in the lease area by making 3 nos of settling tanks in low lying areas and used to recharge through recharging well. It is also proposed to use the settling sump as Rain Water Harvesting pit. The size of each pit will be approximately 5 x 4 x 8 m. The pit will have a recharge well and filter chamber. In the conceptual stage it is also proposed to use 39.008 ha of mined out area for storing of rain water which will recharge ground water.

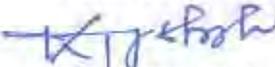
**vii) Acid mine drainage :**

There will be no mine water discharge is anticipated. Also iron ore beds do not contain any hazardous element. So no anticipation of acid mine drainage is there.

**viii) Surface subsidence :**

Though some soft / friable natured rocks will be encountered during mining no subsidence is anticipated because of low height of benches, proper slope of benches, not much deep mining etc.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. RaHa, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA



ix) **Socio-economics** ::

It is a fact that iron ore deposits of Jamda-Koira belt is located in backward areas where general living condition of the people is below poverty line. Agriculture has not been developed in the region to the extent that it should have been because of lack of proper irrigation. People, therefore, depend mostly on the mines for their livelihood. This has got a positive impact on the living condition of the local inhabitants. At least, these people have been assured of their daily bread. Local people will also be trained in many disciplines required for running the mine and the plant. Because of much increased economic activities, business activities of the local population will also be substantial.

Besides the direct employment in the mines, indirect engagement may be two to three times. Mining activity in the area will bring some positive effect like better employment potentiality, better health care, better living, better sanitation conditions, better education facilities etc.

x) **Historical Monuments etc.** :

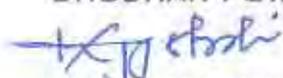
The area is devoid of any notable historical monuments.

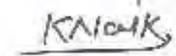
Based on the environmental impact assessment made in the preceding section, an Environmental Management Plan has been chalked out and is discussed in the following heads.

xi) **Monitoring aspect** :

Sl No.	Category	Monitoring Aspects
1	Air Quality	4 times in a year
2	Noise Quality	4 times in a year
3	Water Quality	3 times in a year (excluding rainy season)
4	Hydrological Study	Consultant already engaged for the study
5	Socio Economic Study	Consultant already engaged for the study

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Rahe, K C Jyotishi, K Nalk  
Qualified Persons  
(under Rule 15 of MCR, 2016)

MINING PLAN OF NETRABANDH  
IRON ORE BLOCK OVER 139.22  
SUNDERGARH Dist., ODISHA



### 8.3.1 Mined-Out Land :

At present, no area has been broken except 39 of bore holes.

It is proposed to develop two no of quarry having an area of 25,704 ha by the end of the plan period.

The estimated mineable reserve of iron ore within the block area is 64.577 Mln Tonnes lying within Forest and non-forest land. Considering the proposed average annual production of iron ore as 2 Mln Tonnes from the third year onwards, the anticipated life of mine is for broken forest area and non forest area is 33 years.

Based on the mineralized zone, the ultimate pit limit has been chalked out which has been shown in Conceptual Plan (Plate – 10). It has been calculated that at ultimate stage, total 124.078 ha of land shall be degraded, out of which, 102.010 ha area shall come under excavation. At conceptual stage, the total mined out area shall be reclaimed and rehabilitated by plantation. An area of 45.632 ha shall be reclaimed by backfilling and planted, an area of 17.008 ha shall be bench plantation and an area of 39.008 ha shall be converted into water lagoon.

**The present and future land use of the area will be as follows:**

In the present case, total area which will come under excavation will be 25.704 hectares. Reclamation by backfilling of any pit is not proposed due to non-exhaustion of ore in any pit.

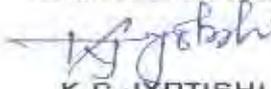
Since, the ore is not exhausted in any pit or part of the pits, even after not getting the additional forest area, none of the pit shall be reclaimed by backfilling. Only plantation on dump shall be done. This has been shown in Conceptual plan.

In this case, the post mining land use will emerges as follows:

Plantation along block boundary shall be taken up to make a green belt as per provisions of Forest Conservation Act, 1980. At the ultimate stage, reclamation and post mining land use pattern of the area shall emerge as follows:-

- i) Dead benches of all the quarries shall be rehabilitated by plantation.
- ii) Total dump area shall be planted by different species.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NALK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
(under Rule 15 of MCR, 2016)

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist, ODISHA



- iii) Roads shall be kept and handed over to the forest authority for their use, after negotiation. If not required, the same shall also be rehabilitated by plantation.
- iv) The entire degraded area shall be reclaimed and rehabilitated at ultimate stage and handed over to the forest authority.
- iii) At ultimate stage, there will be no waste dump as the entire waste material of the dumps will be utilized for the reclamation of void created by pits, by backfilling.

### 8.3.2 Topsoil Management :

The top soil is kept separately for sweating of the soil. A separate top soil stack shall be proposed in the north boundary for store of top soil. The top soil shall be used for plantation purpose.

### 8.3.3 Tailing Dam Management :

There will be no tailing dam in the block.

### 8.3.4 Acid mine drainage, if any :

No acid mine drainage is anticipated here.

### 8.3.5 Surface subsidence mitigation measures :

No surface subsidence is anticipated here; so mitigation measure is not required.

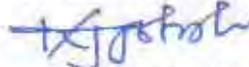
Table – 8.2

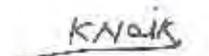
### SUMMARY OF YEARWISE PROPOSAL FOR ITEM NO. 8.3

#### SUMMARY OF 1<sup>st</sup> YEAR PROPOSAL FOR ITEM NO. 8.3

Items	Details	Proposed	Actual	Remarks
Dump management	Area afforested (ha)	Nil		This is a fresh area, the dump shall be active one so there is no proposal for plantation, Boulder wall shall be constructed to prevent wash-off material, A garland drain is to be maintenance all along the waste dump with soak pits in between.
	No of saplings planted	Nil		
	Cumulative no of plants	Nil		
	Cost including watch and care during the year	Rs.57500 /-		
Management of worked out benches	Area available for rehabilitation (ha)	Nil		At this stage is not proposed as the mineral is not exhausted in any part
	Afforestation	Nil		

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K G JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. RaHa, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139,223 Ha IN  
SUNDERGARH Dist., ODISHA



	done(ha)			of the pit.
	No of saplings planted in the year	Nil		
	Cumulative no of plants	Nil		
	Any other method of rehabilitation (specify)	Nil		
	Cost including watch and care during the year	Nil		
Reclamation and Rehabilitation by backfilling	Void available for Backfilling (L x B x D) pit wise /slope wise			Since the topography is a hilly terrain, so backfilling on hill slope is not possible
	Void filled by waste /tailings			
	Afforestation on the backfilled area			
	Rehabilitation by making water reservoir			
	Any other means (specify)			
Rehabilitation of waste land within lease	Area available (ha)			The waste land available in the lease area shall be used for dumping of waste material and subgrade stacking.
	Area rehabilitated			
	Method of rehabilitation			
Others (specify)	500 no of plant shall be planted along safety zone	Rs. 1960 /-		Karani, Chakunda, Asan, Sisoo, Neem, Mahaneem, Mahula etc. shall be Planted. in an area of 0.20 ha.

SUMMARY OF 11<sup>th</sup> YEAR PROPOSAL FOR ITEM NO. 8.3

Items	Details	Proposed	Actual	Remarks
Dump management	Area afforested (ha)	Nil		This is a fresh area, the dump shall be active one so there is no proposal for plantation, Boulder wall shall be constructed to prevent wash-off material, A garland drain is to be maintenance all along the waste dump with soak pits in between.
	No of saplings planted	Nil		
	Cumulative no of plants	Nil		
	Cost including watch and care during the year	Rs.34500 /-		

BHUSHAN POWER & STEEL LIMITED

S RAHA  
Qualified Person

K G JYOTISHI  
Qualified Person

K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist, ODISHA



Management of worked out benches	Area available for rehabilitation (ha)	Nil		At this stage is not proposed as the mineral is not exhausted in any part of the pit.
	Afforestation done(ha)	Nil		
	No of saplings planted in the year	Nil		
	Cumulative no of plants	Nil		
	Any other method of rehabilitation (specify)	Nil		
	Cost including watch and care during the year	Nil		
Reclamation and Rehabilitation by backfilling	Void available for Backfilling (L x B x D) pit wise /slope wise			Since the topography is a hilly terrain, so backfilling on hill slope is not possible
	Void filled by waste /tailings			
	Afforestation on the backfilled area			
	Rehabilitation by making water reservoir			
	Any other means (specify)			
Rehabilitation of waste land within lease	Area available (ha)			The waste land available in the lease area shall be used for dumping of waste material and subgrade stacking.
	Area rehabilitated			
	Method of rehabilitation			
Others (specify)	500 no of plant shall be planted along safety zone	Rs. 1960 /-		Karanj, Chakunda, Asan, Sisoo, Neem, Mahaneem, Mahula etc. shall be Planted. in an area of 0.20 ha.

SUMMARY OF III<sup>rd</sup> YEAR PROPOSAL FOR ITEM NO. 8.3

Items	Details	Proposed	Actual	Remarks
Dump management	Area afforested (ha)	Nil		This is a fresh area, the dump shall be active one so there is no proposal for plantation. Boulder wall shall be constructed to prevent wash-off material, A garland drain is to be maintenance all
	No of saplings planted	Nil		
	Cumulative no of plants	Nil		

BHUSHAN POWER & STEEL LIMITED

S RAHA  
Qualified Person

K C JYOTISHI  
Qualified Person

K NAIK  
Qualified Person



SPS-GeoMining Solution Private Limited

S. RaHa, K C. Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist, ODISHA



	Cost including watch and care during the year	Rs.34500 /-		along the waste dump with soak pits in between.
Management of worked out benches	Area available for rehabilitation (ha)	Nil		At this stage is not proposed as the mineral is not exhausted in any part of the pit.
	Afforestation done(ha)	Nil		
	No of saplings planted in the year	Nil		
	Cumulative no of plants	Nil		
	Any other method of rehabilitation (specify)	Nil		
	Cost including watch and care during the year	Nil		
Reclamation and Rehabilitation by backfilling	Void available for Backfilling (L x B x D) pit wise /slope wise			Since the topography is a hilly terrain, so backfilling on hill slope is not possible
	Void filled by waste /tailings			
	Afforestation on the backfilled area			
	Rehabilitation by making water reservoir			
	Any other means (specify)			
Rehabilitation of waste land within lease	Area available (ha)			The waste land available in the lease area shall be used for dumping of waste material and subgrade stacking.
	Area rehabilitated			
	Method of rehabilitation			
Others (specify)	500 no of plant shall be planted along safety zone	Rs. 1960 /-		Karanj, Chakunda, Asan, Sisoo, Neem, Mahaneem, Mahula etc. shall be Planted. in an area of 0.20 ha.

SUMMARY OF IV<sup>th</sup> YEAR PROPOSAL FOR ITEM NO. 8.3

Items	Details	Proposed	Actual	Remarks
Dump management	Area afforested (ha)	Nil		This is a fresh area, the dump shall be active one so there is no proposal for
	No of saplings	Nil		

S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K G JYOTISHI  
Qualified Person

K NAIK  
Qualified Person



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S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
(under Rule 15 of MCR, 2016)

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist, ODISHA



	planted			plantation. Boulder wall shall be constructed to prevent wash-off material, A garland drain is to be maintenance all along the waste dump with soak pits in between.
	Cumulative no of plants	Nil		
	Cost including watch and care during the year	Rs.57500 /-		
Management of worked out benches	Area available for rehabilitation (ha)	Nil		At this stage is not proposed as the mineral is not exhausted in any part of the pit.
	Afforestation done(ha)	Nil		
	No of saplings planted in the year	Nil		
	Cumulative no of plants	Nil		
	Any other method of rehabilitation (specify)	Nil		
	Cost including watch and care during the year	Nil		
Reclamation and Rehabilitation by backfilling	Void available for Backfilling (L x B x D) pit wise /slope wise			Since the topography is a hilly terrain, so backfilling on hill slope is not possible
	Void filled by waste /tailings			
	Afforestation on the backfilled area			
	Rehabilitation by making water reservoir			
	Any other means (specify)			
Rehabilitation of waste land within lease	Area available (ha)			The waste land available in the lease area shall be used for dumping of waste material and subgrade stacking.
	Area rehabilitated			
	Method of rehabilitation			
Others (specify)	500 no of plant shall be planted along safety zone	Rs. 1960 /-		Karanj, Chakunda, Asan, Sisoo, Neem, Mahaneem, Mahula etc. shall be Planted in an area of 0.20 ha.

S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED

K C JYOTISHI  
Qualified Person

K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

S. RaHa, K C Jyotishi, K Naik  
Qualified Persons  
(under Rule 15 of MCR, 2016)

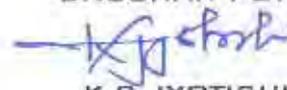
MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

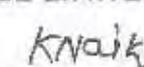


SUMMARY OF V<sup>th</sup> YEAR PROPOSAL FOR ITEM NO. 8.3

Items	Details	Proposed	Actual	Remarks
Dump management	Area afforested (ha)	Nil		This is a fresh area, the dump shall be active one so there is no proposal for plantation, Boulder wall shall be constructed to prevent wash-off material, A garland drain is to be maintenance all along the waste dump with soak pits in between.
	No of saplings planted	Nil		
	Cumulative no of plants	Nil		
	Cost including watch and care during the year	Rs.57500 /-		
Management of worked out benches	Area available for rehabilitation (ha)	Nil		At this stage is not proposed as the mineral is not exhausted in any part of the pit.
	Afforestation done(ha)	Nil		
	No of saplings planted in the year	Nil		
	Cumulative no of plants	Nil		
	Any other method of rehabilitation (specify)	Nil		
	Cost including watch and care during the year	Nil		
Reclamation and Rehabilitation by backfilling	Void available for Backfilling (L x B x D) pit wise /slope wise			Since the topography is a hilly terrain, so backfilling on hill slope is not possible
	Void filled by waste /tailings			
	Afforestation on the backfilled area			
	Rehabilitation by making water reservoir			
	Any other means (specify)			
Rehabilitation of waste land within lease	Area available (ha)			The waste land available in the lease area shall be used for dumping of waste material and subgrade stacking.
	Area rehabilitated			
	Method of rehabilitation			
Others (specify)	500 no of plant shall be planted along safety zone	Rs. 1960 /-		Karanj, Chakunda, Asan, Sisoo, Neem, Mahaneem, Mahula etc. shall be Planted.

  
S RAHA  
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BHUSHAN POWER & STEEL LIMITED  
  
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Qualified Person

  
K NAIK  
Qualified Person



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Qualified Persons  
(under Rule 15 of MCR, 2016)

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist, ODISHA

in an area of 0.20 ha.

#### 8.4 Disaster Management and Risk Assessment :

- Climatic hazards such as Landslide, subsidence and inundation are not expected due to opencast mining of hard rock beds with proper bench formation in a small area of about 100 Ha.
- Though earthquake is felt rarely in this area but damage to man & materials have not been recorded.
- Small scale fire may be possible which can be extinguished by fire extinguisher.
- The nearest township, Koira, is having a Police Station, a well developed hospital, a fire brigade camp.

However precautionary measures as described below will be followed to avoid any risk in mining.

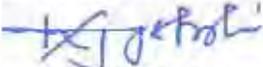
- Mine working will be fenced off to prevent falling down of man and animals.
- Security guards will be employed to prevent pilferage or theft.
- Blasting danger zone will be identified and indicated to the concerned mine people and nearby locality to avoid inadvertent trespassing.
- Whistle or siren will be blown at the time of blasting to aware the man & animals for not entering in to the blasting danger zone.
- A board will be displayed at the office showing the details of the contact person for emergency. Detail is :  
Mr P K Mishra : 0674-2554533 / 2554726

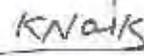
#### 8.5 Care and maintenance during temporary discontinuance :

Temporary discontinuance may happen due to various causes such as :

- Court order
- Natural calamities
- Accident (mine related)
- Slope failure
- Failure in fulfillment of statutory requirement.
- Local issues or

  
S RAHA  
Qualified Person

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K C JYOTISHI  
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S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist, ODISHA



- Any other unforeseen circumstances.

If there will be temporary discontinuance, the following measures can be undertaken depending upon the causes :

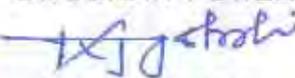
- Intimation to local mine & legal administrative authorities regarding the discontinuance.
- All the roads will be closed by fencing to stop unauthorized entry / entry of any animal into the abandoned mining sites.
- It is also proposed to put notice at the fences prohibiting entry into any of the pits by unauthorized persons.
- All the machinery form working sites would be withdrawn and brought to the safe place so that these do not get buried due to bench collapse, if any, and get damaged during the period of discontinuance.
- Listing of the machines & materials.. Care and maintenance of machinery as per the machine operating manuals will be made.
- Tightening of the security to keep the machine and materials safe & secured.
- All the entrances and strategic point, watchmen will be posted to guard the mine areas.
- The mine area will be kept illuminated during night-time by electric power arrangement.
- Managerial, supervisory and competent persons of the mine would be engaged for supervising machinery maintenance and house keeping of the mining areas.
- Preparation of plans & sections at the time of discontinuance.
- Regular monitoring of air, water, noise etc in the permitted area.

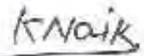
#### 8.6 FINANCIAL ASSURANCE:

The present and future land use of the area will be as follows:

This block is virgin area except for core drilling of 39 bore holes. . During first five year mining plan period total area which will come under excavation will be 25.704 hectares. It has been stated earlier that no pit/quarry is exhausted and as such, reclamation by backfilling and rehabilitation cannot be undertaken at the present stage.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
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K NAIK  
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( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH-PAHAR  
IRON ORE BLOCK OVER 139,223 Ha IN  
SUNDERGARH Dist., ODISHA



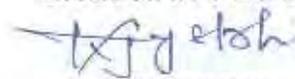
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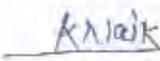
Existing & Proposed Land-Use.

Sl. No.	Pattern of Utilization	Existing In Ha	At the end of Plan period In Ha
1	Mining	Nil	25.704
2	Storage of Top soil	Nil	0.500
3	Dump	Nil	9.607
4	Infrastructure	Nil	1.817
5	Mine Road	Nil	2.306
6	S.G. stack	Nil	2.154
7	Plantation on safety zone	Nil	1.000
8	Water harvesting	Nil	0.066
9	Ore stack	Nil	1.835
10	Plant Area (Crusher, screening, ore stack, ore shorting)	Nil	Nil
<b>Total</b>		<b>Nil</b>	<b>44.989</b>

The land to be degraded after five years and area to be considered for financial assurance is given herewith in a tabular form. A Progressive Mine Closure Plan ( Plate no. 15 ) in a scale of 1 : 2000 has been enclosed showing there in the present and after 5 year land use pattern.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



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S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
(under Rule 15 of MCR, 2016.)

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA



Table – 8.4  
**FINANCIAL ASSURANCE PLAN ( Ha )**

Sl.No.	Head	Area put on use at the start of plan (Existing land use)	Additional requirement during plan period.	Total	Area considered as fully reclaimed & rehabilitated	Net area considered for calculation
A	B	C	D	E E = (C+D)	F	G G = (E - F)
1.	Area under mining	Nil	25.704	25.704	Nil	25.704
2.	Storage for top soil.	Nil	0.500	0.500	Nil	0.500
3.	Waste dump site	Nil	9.607	9.607	Nil	9.607
4.	Mineral storage (S/G)	Nil	2.154	2.154	Nil	2.154
5.	Infrastructure (Workshop, administrative building).	Nil	1.817	1.817	Nil	1.817
	Plantation on Safety Zone	Nil	1.000	1.000	Nil	1.000
6.	Roads.	Nil	2.306	2.306	Nil	2.306
7.	Railways	Nil	Nil	Nil	Nil	Nil
8.	Tailing Pond	Nil	Nil	Nil	Nil	Nil
9.	Effluent Treatment Plant	Nil	Nil	Nil	Nil	Nil
10.	Mineral separation plant	Nil	1.835	1.835	Nil	1.835
11.	Township area	Nil			Nil	
12.	Others to specify. Rain water Harvesting	Nil	0.066	0.066	Nil	0.066
<b>Total</b>		<b>Nil</b>	<b>44.989</b>	<b>44.989</b>		<b>44.989</b>

अनुमोदित  
**APPROVED**

Hence financial assurance is considered for the area of 44.989 Ha.

Rate of financial assurance = Rs. 3,00,000 /- per Ha.  
for Category 'A' mines.

Assurance amount = 44.989 x 3,00,000 = Rs. 1,34,96,700 /-

REGIONAL CONTROLLER OF MINES  
भारतीय खान ब्यूरो  
INDIAN BUREAU OF MINES  
भुवनेश्वर / BHUBANESHWAR

**S RAHA**  
Qualified Person

**K C JYOTISHI**  
Qualified Person

**K NAIK**  
Qualified Person



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S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist, ODISHA



The financial assurance for Rupees One crore thirtythree lakh ninety six thousand & seven hundred in the form of Bank Guarantee will be submitted once the mining lease is executed.

S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED

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Qualified Person

K NAIK  
Qualified Person



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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist, ODISHA

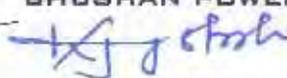


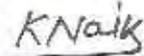
PART - B

9.0 Certificates / Undertakings/ Consents (As detailed below) :

- A. CONSENT LETTER/ UNDERTAKING/ CERTIFICATE FROM THE APPLICANT
- B. CERTIFICATE FROM RQP

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K G JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



*SPS GeoMining Solution Private Limited*  
*S. Raha, K C Jyotishi, K Naik*  
*Qualified Persons*  
*( under Rule 15 of MCR, 2016 )*

**MINING PLAN OF NETRABANDH PAHAR  
 IRON ORE BLOCK OVER 139.223 Ha IN  
 SUNDERGARH Dist., ODISHA**



**Bhushan Power & Steel Ltd.**  
 Registered Office: F-Block, 1<sup>st</sup> Floor,  
 International Trade Tower, Nehru Place,  
 New Delhi-110 019, INDIA  
 CIN - U27100DL1999PLC108350

T +91(0) 11 30451000  
 T +91(0) 11 30451200  
 F +91(0) 11 26282737  
 Email : delhi@bpsl.net  
 Website : [www.bpsl.net](http://www.bpsl.net)



### CONSENT FROM THE APPLICANT

- A. The Mining Plan in respect of **NETRABANDH PAHAR BLOCK** over an area of 139.223 Ha, in village Baladihi, P.O. Koira, District. : Sundergarh, Odisha, under Rule 13(1) of MCR, 2016 / Rule 11 of MCDR 2017 has been prepared by **Qualified Persons S Raha, K C Jyotishi & K .Naik.**

This is to request the Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar, to make any further correspondence regarding any correction of the Mining Plan / Scheme of Mining with the said recognized person at his address below :-

1.	Snehasis Raha	C/o SPS Geo Mining Solution Private Limited. F.N. 401, 4 <sup>th</sup> Floor, Star Plaza, Belghoria, Kolkata – 700 056, West Bengal.
2.	Krishna Chandra Jyotishi	
3.	Khageswar Naik	

We hereby undertake that all modifications / updating as made in the said Mining Plan/Scheme of Mining by the said recognized person be deemed to have been made with our knowledge and consent and shall be acceptable on us and binding in all respects.

- B. It is certified that the Progressive Mine Closure plan of Netrabandh Pahar Block of M/s Bhushan Power & Steel Limited over an area of 139.223 Ha complies with all statutory rules, Regulations, Orders Made by the Central or State Government, Statutory organization, Court etc.which have been taken into consideration and wherever any specific permissionis required the lessee will approach the concerned authorities.

The information furnished in the **Progressive Mine Closure plan** is true and correct to the best of our knowledge and records.

- C. It is certified that all the measures proposed in this closure plan will be implemented in a time bound manner as proposed.
- D. It is certified that any change in address of Nominated Owner or any member of Board of Directors during pendency of approval of *mining plan* of Netrabandh Pahar Block of M/s Bhushan Power & Steel Limited over an area of 139.223 Ha will be intimated to the IBM offices as per provisions of MCDR 1988.

E. Contd...P/2



SPS GeoMining Solution Private Limited  
S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist, ODISHA



Block of M/s Bhushan Power & Steel Limited over an area of 139.223 Ha will be intimated to the IBM offices as per provisions of MCDR 1988.

E. Contd...P/2

Continuation Sheet



-: 2 :-

F. It is certified that the applicant is not working in any other firm, company or organization.

G. "The provisions of **Mines Act, Rules and Regulations** made there under have been observed in the Mining Plan/Scheme of Mining over an area of 139.223 hectares in Sundergarh district in Odisha state belonging to Netrabandh Pahar Block, and where specific permissions are required, the applicant will approach the D.G.M.S. Further, standards prescribed by D.G.M.S. in respect of miners' health will be strictly implemented".

Sincerely,

Signature of Authorised Signatory

Name : P K Mishra  
Designation : Vice President  
Company : M/s.Bhushan Power & Steel Ltd  
Address : N-3/28, IRC Village, Nayapalli,  
Bhubaneswar-751015, Odisha.  
Tel: 0674-2554533 / 2554726  
Fax: 0674-2554446  
Email - bpslbbbsr@gmail.com

Date : 02.09.2017

Place : Bhubaneswar



SPS GeoMining Solution Private Limited  
S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist, ODISHA



## CERTIFICATE

The provisions of the Mineral Conservation and Development Rules 2017 have been observed in the preparation of the Mining Plan for Netrabandh Pahar Iron Ore Block over an area of 139.223 Ha, of M/s Bhushan Power & Steel Limited, in Village Baladihi, P.O. Koira, District Sundergarh of Odisha State and whenever specific permissions are required, the applicant will approach the concerned authorities of Indian Bureau of Mines & Directorate General of Mines Safety.

The information furnished in the Mining Plan is true and correct to the best of our knowledge.

( S Raha )

Qualified Person

( K C Jyotishi )

Qualified Person

( K Naik )

Qualified Person

Place : Kolkata

Date : 05.10.2017



SPS GeoMining Solution Private Limited  
S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
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MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist, ODISHA



10.0 LIST OF PLANS & SECTIONS :

<u>Sl. No.</u>	<u>Description</u>	<u>Scale</u>	<u>Plate No.</u>
1.	Key Plan of the area	1 : 50,000	1
2.	Authenticated DGPS Map	16" : 1 mile	2
3.	Surface Plan	1 : 2,000	3
4.	Surface Geological Plan	1 : 2,000	4
5.	Surface Geological Sections	1 : 2,000	5
6.	Plan showing the Topography, lithology, location of proposed Pits, Waste Dump & SG Stacks	1 : 2,000	6
7.	Development Plan & Sections of I <sup>st</sup> Year of Plan Period_N-Pit.	1 : 2,000	7A1
8.	Development Plan & Sections of II <sup>nd</sup> Year of Plan Period_N-Pit.	1 : 2,000	7A2
9.	Development Plan & Sections of III <sup>rd</sup> Year of Plan Period_N-Pit.	1 : 2,000	7A3
10.	Development Plan & Sections of IV <sup>th</sup> Year of Plan Period_N-Pit.	1 : 2,000	7A4
11.	Development Plan & Sections of V <sup>th</sup> Year of Plan Period_N-Pit.	1 : 2,000	7A5
12.	Development Plan & Sections of I <sup>st</sup> Year of Plan Period_S-Pit.	1 : 2,000	7B1
13.	Development Plan & Sections of II <sup>nd</sup> Year of Plan Period_S-Pit.	1 : 2,000	7B2
14.	Development Plan & Sections of III <sup>rd</sup> Year of Plan Period_S-Pit.	1 : 2,000	7B3
15.	Development Plan & Sections of IV <sup>th</sup> Year of Plan Period_S-Pit.	1 : 2,000	7B4

S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED

K C JYOTISHI  
Qualified Person

K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited  
S. Raia, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist, ODISHA



16.	Development Plan & Sections of V <sup>th</sup> Year of Plan Period_S-Pit.	1 : 2,000	7B5
17.	Dump Plan & Sections	1 : 2,000	8
18.	Sub Grade Stacks & Sections	1 : 2,000	9
19.	Conceptual Plan	1 : 2,000	10
20.	Conceptual Sections	1 : 2,000	11
21.	Environment Plan	1 : 5000	12
22.	Environmental Management Plan	1 : 2,000	13
23.	Reclamation Plan	1 : 2,000	14
24.	Progressive Mine Closure Plan	1 : 2,000	15

S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED

K C JYOTISHI  
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K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited  
 S. Rahe, K C Jyotishi, K Naik  
 Qualified Persons  
 ( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
 IRON ORE BLOCK OVER 139.223 Ha IN  
 SUNDERGARH Dist., ODISHA



SOME PHOTOGRAPHS OF THE NETRABANDH PAHAR IRON ORE BLOCK



BOUNDARY PILLAR



BOUNDARY PILLAR



BOUNDARY PILLAR BESIDE VILLAGE



INTERMEDIATE BOUNDARY

BHUSHAN POWER & STEEL LIMITED

*S. Rahe*  
 S RAHA  
 Qualified Person

*K C Jyotishi*  
 K C JYOTISHI  
 Qualified Person

*K Naik*  
 K NAIK  
 Qualified Person



SPS GeoMining Solution Private Limited  
 S. Raia, K C Jyotishi, K Naik  
 Qualified Persons  
 ( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
 IRON ORE BLOCK OVER 139.223 Ha IN  
 SUNDERGARH Dist, ODISHA



ROAD

PILLAR



SAFETY ZONE PILLAR



BOUNDARY PILLAR ALONGWITH  
SAFETY ZONE PILLAR



SAFETY ZONE PILLAR

*S Raia*  
**S RAHA**  
 Qualified Person

**BHUSHAN POWER & STEEL LIMITED**  
*K G Jyotishi*  
**K G JYOTISHI**  
 Qualified Person

*K Naik*  
**K NAIK**  
 Qualified Person



SPS (Sundergarh) Section, Bhushan Limited

S. Raha, K. C. Jyotishi, K. Naik  
Qualified Person  
(under Rule 15 of M.R., 2016)

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist., ODISHA

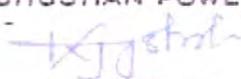


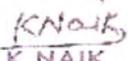
HARD BOULDERY IRON FORMATION



GRASSY SURFACE WITHIN THE IRON ORE BLOCK

  
S RAHA  
Qualified Person

  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person





SPS Geo/Mining Solution Private Limited  
S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 189,223 Ha IN  
SUNDERGARH Dist., ODISHA



BORE HOLE PILLAR



BORE HOLE PILLAR



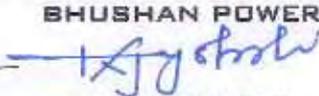
BORE HOLE PILLAR

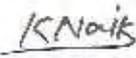


BORE HOLE PILLAR

BHUSHAN POWER & STEEL LIMITED

  
S RAHA  
Qualified Person

  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person

SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha. IN  
SUNDERGARH Dist., ODISHA



MINING BLOCK AREA	- 139.223Ha.
LoI for grant of ML issued on	- 24.06.2017
CATEGORY OF MINES	- 'A' Mechanised.
TYPE OF LAND	- Forest: 112.621 Ha Non Forest :26.602Ha
SUBMITTED UNDER	- Rule 13( 1 ) of MCR, 2016

**--APPLICANT --**

**BHUSHAN POWER & STEEL LIMITED**  
**F. Block, 1<sup>st</sup> Floor,**  
**International Trade Tower, Nehru Place,**  
**New Delhi – 110 019**

**PREPARED BY :**

**S. RAHA, K C JYOTISHI & K NAIK**

**Qualified Person**

**( Under Rule 15 of MCR, 2016 )**

**SPS GEOMINING SOLUTION PRIVATE LIMITED**

**F. N. – 401, Star Plaza,**

**43/3 Feeder Road, Belghoria,**

**Kolkata – 700 056.**

Site office :- At/po-Bhadrasahi,via-Barbil -758035 dist-keonjhar (Odisha)

e-Mail :[spsgeomining@gmail.com](mailto:spsgeomining@gmail.com) / [info@spsgeomining.com](mailto:info@spsgeomining.com)

9830353767 / 9937010455 / 9437243582



GOVERNMENT OF ODISHA  
DEPARTMENT OF STEEL & MINES

No. 5283 /SM,  
IV(Misc)SM- 52/2017

Dt. 26/06/17



Sri Biranchi Narayan Rath  
Additional Secretary to Government

To,

**Bhushan Power and Steel Limited**  
F-Block, 1<sup>st</sup>Floor,  
International Trade Tower,  
Nehru Place,  
New Delhi -110019

**Sub:** Letter of Intent with reference to e-auction dated 19.03.2017 for grant of a mining lease for **NetrabandhaPahar Block for Iron Ore** in Baladihi Village, Koira Taluka, Sundargarh District on 139.00 Hectare Area

1. **Background:**

- 1.1. The Government of Odisha, pursuant to the Mines and Minerals (Development and Regulation) Act, 1957 (the "Act") and the Mineral (Auction) Rules, 2015 (the "Rules"), issued the notice inviting tender dated March 07.03. 2017 to commence the auction process for grant of mining lease for **NetrabandhaPahar Block** located in **Sundargarh District** of Odisha. The e-auction process was conducted in accordance with the tender document for the said mineral block and **Bhushan Power and Steel Limited** was declared as the 'Preferred Bidder' under Rule 9(4)(b)(iii) of the Rules.
- 1.2. As required under Rule 10(1) of the Rules and the tender document for the said mineral block, **Bhushan Power and Steel Limited** has made payment of the first instalment, being ten per cent of the upfront payment of Rs 3,43,25,432 (Rupees Three Crore Forty Three Lakh Twenty Five Thousand Four Hundred Thirty Two) through e-challan of Treasury dated 01.06.2017, which was received on 01.06.2017.

2. **Grant of Letter of Intent**

- 2.1. Accordingly, the Government of Odisha has been pleased to issue this Letter of Intent as per Rule 10(2) of the Rules, for grant of Mining Lease for **Netrabandha Pahar Block for Iron Ore** in Baladihi Village, Koira Taluka, of Sundargarh District on 139.00 Hectare Area to **Bhushan Power and Steel Limited** for a period of 50 years.

*Rath*

*5/10*

*KNR*

### 3. Conditions

- 3.1. This Letter of Intent and the subsequent grant of aforesaid mining lease shall be subject to the provisions of the Act and the rules made thereunder, as amended from time to time, and the **Bhushan Power and Steel Limited** shall be designated as the 'successful bidder' and subsequently granted the mining lease only upon satisfactory completion of all the requirements under the Act and the rules made thereunder.
- 3.2. This Letter of Intent shall be valid only if **Bhushan Power and Steel Limited** ensures that the Bid Security is valid until the Performance Security is furnished to the Government of Odisha, failing which this Letter of Intent shall become invalid from the date of expiry of the Bid Security.
- 3.2. For reference, the requirements under the Rules for designation of **Bhushan Power and Steel Limited** as the 'successful bidder' and subsequent grant of the mining lease are reiterated below. It is clarified that the requirements mentioned below are only for reference and in the event of any change in the Act or the rules made thereunder, the requirements under the modified Act or the rules made thereunder, as the case may be, shall be applicable.

(a) **Designation as the "Successful Bidder":**

**Bhushan Power and Steel Limited** shall be considered to be the 'successful bidder' upon:

- (i) continuing to be in compliance with all the terms and conditions of eligibility;
- (ii) payment of the second instalment being ten per cent of the upfront payment;
- (iii) furnishing performance security;
- (iv) satisfying the conditions specified in clause (b) of sub-section (2) of section 5 of the Act with respect to a mining plan; and

(b) **Signing of the Mine Development and Production Agreement**

**Bhushan Power and Steel Limited** shall sign the Mine Development and Production Agreement with the Government of Odisha upon obtaining all consents, approvals, permits, no-objections and the like as may be required under applicable laws for commencement of mining operations.

(c) **Grant of mining lease**

Subsequent to signing of the Mine Development and Production Agreement, **Bhushan Power and Steel Limited** shall make payment of the third



*Kaiba*

*AM*

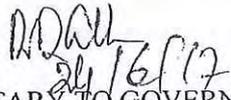
*KNOIK*

instalment being eighty per cent of the upfront payment and thereafter the Government of Odisha shall grant the aforementioned mining lease.

4. Validity

- 4.1. This letter of intent is valid for a period of 3 (three) years from the date of its issuance, within which time all the above conditions must be fulfilled and the Mining Lease deed must be executed between **Bhushan Power and Steel Limited** and the Government of Odisha. In case the Preferred Bidder is unable to fulfil all or any of the above conditions, then it may submit an application to Government of Odisha, requesting for further extension. Provided that the validity of this Letter of Intent shall be subject to **Bhushan Power and Steel Limited** ensuring that the Bid Security remains valid until the performance security is furnished to the Government of Odisha failing which the validity of this Letter of Intent shall expire from the date of expiry of the Bid Security.
- 4.2. If the Government of Odisha is satisfied that a longer period is required to enable the Preferred Bidder to satisfy all or any of the above conditions, it may extend the validity of this Letter of Intent for such period or periods as the Government of Odisha may specify. Provided that: (a) this Letter of Intent shall be extended for a maximum period of 2 years; and (b) the total period for which this Letter of Intent would remain valid must not exceed 5 (five) years from the date of issuance.
- 4.3. **Bhushan Power and Steel Limited** shall furnish acceptance of the terms and conditions of the Letter of Intent with Board resolution to this Department within fifteen days from the date of issue of this letter.

Yours faithfully

  
24/6/17  
ADDITIONAL SECRETARY TO GOVERNMENT

Memo No. 5284 /SM

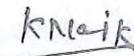
Dated 24.6.2017

Copy forwarded to the Director of Mines, Odisha, Bhubaneswar, Collector, Sundargarh/DDM, Koira, for information and necessary action.

  
24/6/17  
ADDITIONAL SECRETARY TO GOVERNMENT







GOVERNMENT OF ODISHA  
DEPARTMENT OF STEEL & MINES

No. IV(Misc)SM-52/2017

6285

\*\*\*

/SM, Dt.

27-7-2017



From,

Sri Biranchi Narayan Rath  
Additional Secretary to Government

To

Bhushan Power and Steel Limited,  
F-Block, 1st Floor,  
International Trade Tower,  
Nehru Place,  
New Delhi-110019

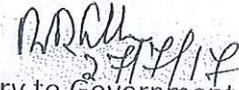
Sub: Letter of Intent with reference to e-auction dt.19.05.2017 for grant of a mining lease for **Netrabandha Pahar Block** for **Iron ore** in Baladihi village, Koira Taluka, Sundargarh district on 139.00 Hectare Area.

X Sub: Corrigendum regarding actual area to be 139.223 hecets. Instead of 139.00 hecets. Sir,

Inviting reference to this Department letter No-5283/SM, Dated-24.6.2017 on the subject mentioned above, it is stated here that the area mentioned in para-2 of the Letter of Intent issued vide the aforesaid letter under reference for grant of mining lease for **Netrabandha Pahar Block** for **Iron ore** in Baladihi village, Koira Taluka, Sundargarh district may be read as **139.223 Hecets**. Instead of 139.00 Hectare.

It is, therefore, requested to take further action accordingly.

Yours faithfully

  
Additional Secretary to Government

Memo No-

6286

Dated-

27-7-2017

Copy forwarded to the Director of Mines, Odisha, BBSR/ Collector, Sundargarh / DDM, Koira for information and necessary action with reference to this Department Memo no-5284/SM, dated-24.6.2017.

  
Additional Secretary to Government

KNaik



ODISHA SPACE APPLICATIONS CENTRE (ORSAC)

Department of Science & Technology, Government of Odisha



To

Bhusan Power & steel Limited  
Vill-Thekoloji, P.O-Lapanga768212.  
Teh-Rengali, Dist-Sambalpur(Odisha), India

Sub: DGPS survey map of Netrabandha Pahar Iron Block in Sundergarh district.  
Ref: Your Letter No: Nil, dt.26.09.2017.

Sir,

With reference to the subject cited above, I am directed to inform you that the geo-referenced hard copy output map generated from field DGPS survey of Netrabandha Pahar Iron Block submitted for verification/authentication in the letter under reference is forwarded to you as per your request.

You are requested to receive the deliverable as mentioned above and acknowledge the same to this office. Further, it is to inform you that the output should not be used for any other purpose than it is meant for.

Thanking you.

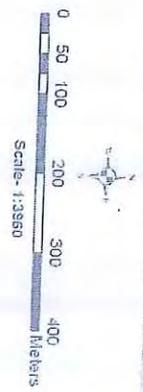
Yours faithfully

(P.K.TRIPATHY)  
SCIENTIST

Encl: 2 Maps.



**DGPS SURVEYED NETRA BANDHA PAHAR IRON ORE BLOCK  
DISTRICT SUNDARGARH, ODISHA**



Sl. No	Pillar Id	Easting	Northing	Latitude	Longitude
1	1	323197.874	2419213.855	21°52'05.24314"	85°17'20.07535"
2	2	324153.702	2419314.866	21°52'03.63087"	85°17'56.6137"
3	3	324224.957	2419777.567	21°52'23.23297"	85°17'55.6587"
4	4	324223.050	2418822.720	21°52'23.66557"	85°17'55.7177"
5	5	324184.621	242001.326	21°52'21.22957"	85°17'54.1337"
6	6	323902.454	241973.532	21°52'33.2267"	85°17'41.4877"
7	7	323982.104	242062.297	21°52'35.3367"	85°17'41.0257"
8	8	323939.055	242031.577	21°52'41.2007"	85°17'43.8687"
9	9	323970.422	2420397.466	21°52'45.63697"	85°17'43.8687"
10	10	323774.750	2420466.116	21°52'46.13397"	85°17'43.8687"
11	11	323584.497	2420614.732	21°52'50.0327"	85°17'42.9597"
12	12	323405.497	2420727.704	21°52'54.5177"	85°17'42.7207"
13	13	322957.424	2420378.615	21°52'59.7717"	85°17'40.4487"
14	14	322112.068	2419597.033	21°52'17.57504"	85°17'16.9324"
15	15	322228.713	2419521.977	21°52'16.52766"	85°17'20.59112"
16	16	322321.076	2419555.652	21°52'16.53056"	85°17'20.51007"
17	17	322316.987	2419495.620	21°52'14.62350"	85°17'20.63184"
18	18	322300.0	2419243.96	21°52'08.89350"	85°17'20.15772"

Surveyed total area = 139.223 Ha.

**Legend**

- Block Pillars
- Block Boundary
- Plot Boundary

**Odisha Space Applications Centre**  
Dept. of Science and Technology  
Govt. of Odisha  
Bhubaneswar

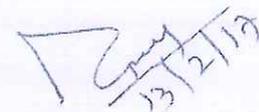
## ANNEXURE : III

## LAND SCHEDULE OF THE PROPOSED ML AREA DECIDED FOR AUCTION FOR NETRABANDH IRON ORE BLOCK OVER 139.223 HECTS. IN VILLAGE BALDIHI UNDER KOIRA TAHASIL OF SUNDARGARH DISTRICT.

Sl.No	Village	Khata No	Plot_No	Tenant's name	Kissam	Area As per ROR in Hects.	Area in Hects as per DGPS Survey	District	Remarks (ST Land In Hects)
1	Baldihi	68	100	A.A.A	pahad(DLC)	12.101	12.101	Sundargarh	
2	Baldihi	68	101	A.A.A	pahad(PRF)	17.669	17.669	Sundargarh	
3	Baldihi	65	102	Rakhit	Jungle(PRF)	5.877	5.877	Sundargarh	
4	Baldihi	65	103	Rakhit	Jungle(PRF)	1.725	1.725	Sundargarh	
5	Baldihi	68	104	A.A.A	pahad(PRF)	20.247	20.247	Sundargarh	
6	Baldihi	68	105	A.A.A	pahad(DLC)	19.836	19.836	Sundargarh	
7	Baldihi	68	106	A.A.A	pahad(PRF)	1.506	1.506	Sundargarh	
8	Baldihi	65	107	Rakhit	Bad-Jungle(PRF)	1.322	1.322	Sundargarh	
9	Baldihi	65	108	Rakhit	Bad-Jungle(PRF)	6.387	6.387	Sundargarh	
10	Baldihi	11	109	Jandu Naik	Goda-II	0.057	0.057	Sundargarh	0.057
11	Baldihi	40	111	Şantu Naik	Goda-I	0.121	0.121	Sundargarh	0.121
12	Baldihi	39	119	Sadan Naik	Goda-I	0.291	0.291	Sundargarh	0.291
13	Baldihi	68	121	A.A.A	Nala	0.44	0.44	Sundargarh	
14	Baldihi	66	125	Sarba sadharana	Debastali	0.732	0.732	Sundargarh	
15	Baldihi	35	126	Rama Dehury	Goda-I	0.215	0.215	Sundargarh	0.215
16	Baldihi	19	127	Nanda Giri	Goda-II	0.386	0.386	Sundargarh	0.386
17	Baldihi	27	128	Bimadhhar Patra	Goda-II	0.763	0.763	Sundargarh	
18	Baldihi	65	129	Rakhit	Sarba sadharan	0.252	0.252	Sundargarh	
19	Baldihi	66	131	Sarba sadharan	Rasta	0.063	0.063	Sundargarh	
20	Baldihi	19	137	Nanda Giri	Goda-II	0.133	0.133	Sundargarh	0.133
21	Baldihi	15	138	Dasaru Naik	Goda-II	0.082	0.082	Sundargarh	0.082
22	Baldihi	35	139	Rama Dehury	Goda-I	0.091	0.091	Sundargarh	0.091
23	Baldihi	68	16	A.A.A	pahad(DLC)	0.517	0.517	Sundargarh	
24	Baldihi	11	21	Jandu Naik	Goda-II	0.16	0.16	Sundargarh	0.16
25	Baldihi	65	214	Rakhit	Bagayat-2	0.016	0.016	Sundargarh	
26	Baldihi	65	215	Rakhit	Sadak	0.102	0.102	Sundargarh	
27	Baldihi	3	216	Anirudha Patra	Goda-I	0.091	0.091	Sundargarh	
28	Baldihi	30	217	Bhuban Patra	Goda-I	0.273	0.273	Sundargarh	
29	Baldihi	65	218	Rakhit	Gochar	7.587	7.587	Sundargarh	
30	Baldihi	65	219	Rakhit	Sadak(kachha)	0.021	0.021	Sundargarh	
31	Baldihi	19	23	Nanda Giri	Goda-II	0.2	0.2	Sundargarh	0.2
32	Baldihi	41	24	Sambhu Naik	Goda-I	0.906	0.906	Sundargarh	0.906
33	Baldihi	11	25	Jandu Naik	Goda-II	1.111	1.111	Sundargarh	1.111
34	Baldihi	42	26	Sambhu Naik	Goda-II	0.412	0.412	Sundargarh	0.412
35	Baldihi	64/32	27	Brijesh Sarda	Ghara bari	0.645	0.645	Sundargarh	
36	Baldihi	4	28	Chudamani Dehury	Goda-II	0.395	0.395	Sundargarh	0.395
37	Baldihi	16	29	Dinabadiu Patra & Others.	Goda-II	0.444	0.444	Sundargarh	
38	Baldihi	65	30	Rakhit	Sadak(kachha)	0.031	0.031	Sundargarh	
39	Baldihi	3	539	Anirudha Patra	Goda-I	0.019	0.019	Sundargarh	
40	Baldihi	32	548	Mohanty Kolha & Others	Goda-I	0.085	0.085	Sundargarh	0.085
41	Baldihi	27	549	Bimbadhar Patra	Patit	0.649	0.649	Sundargarh	
42	Baldihi	26	555	Bimala Dehury	Patit	0.026	0.026	Sundargarh	0.026
43	Baldihi	20	558	Panchu Naik	Patit	0.208	0.208	Sundargarh	0.208
44	Baldihi	43	559	Siba Patra	Patit	0.152	0.152	Sundargarh	
45	Baldihi	23	560	Panu Naik	Patit	0.75	0.75	Sundargarh	0.75
46	Baldihi	41	563	Sambhu Naik	Bagayat-2	0.037	0.037	Sundargarh	0.037
47	Baldihi	7	564	Gopi Kolha	Patit	0.182	0.182	Sundargarh	0.182
48	Baldihi	33	565	Bada-Machhu Kolha	Goda-II	0.543	0.543	Sundargarh	0.543
49	Baldihi	46	566	Parityakta(Bedakhal Govt.)	Patit	0.046	0.046	Sundargarh	
50	Baldihi	46	567	Parityakta(Bedakhal Govt.)	Patit	0.133	0.133	Sundargarh	
51	Baldihi	33	568	Bada-Machhu Kolha	Goda-II	0.648	0.648	Sundargarh	0.648
52	Baldihi	65	569	Rakhit	Basti Yogya	3.679	3.679	Sundargarh	
53	Baldihi	65	570	Rakhit	Gramya-Jungle (DLC)	11.086	11.086	Sundargarh	
54	Baldihi	65	571	Rakhit	Gramya-Jungle (DLC)	2.059	2.059	Sundargarh	
55	Baldihi	66	574	Sarba sadharan	Smasana	0.599	0.599	Sundargarh	
56	Baldihi	66	91	Sarba sadharan	Rasta	0.071	0.071	Sundargarh	

57	Baldihi	65	92	Rakhit	Sadak	0.222	0.222	Sundargarh	
58	Baldihi	28	93	Benudhar Patra	Goda-II	0.861	0.861	Sundargarh	
	Baldihi	29	94	Manohar Patra & Others.	Goda-I	0.58	0.58	Sundargarh	
60	Baldihi	45	95	Sundermani Patra & Others.	Goda-I	0.647	0.647	Sundargarh	
61	Baldihi	64/55	96	Purander Patra	Goda-I	0.187	0.187	Sundargarh	
62	Baldihi	28	98	Benudhar Patra	Goda-I	0.258	0.258	Sundargarh	
63	Baldihi	68	99	A.A.A	pahad	12.289	12.289	Sundargarh	
Total						139.223	139.223		7.039

ABSTRACT								
Village	Govt. Land (in Hects.)	Private Land (in Hects.)	Land with PR + Jungl in Hects.	ST Land in Hects.	Total			
Baldihi	13.994	5.569	13.145	7.039				
	13.994	5.569	112.621	7.039	139.223			



**Chief Surveyor**  
**Directorate of Mines, Odisha**  
**Bhubaneswar**

*Raho*

*Patra*

*Rakhit*

COMPANY NO. 55-108350 *CINU74999 Dh 2000 pke 108350*

Certified True Copy  
For Bhushan Power & Steel Ltd.

**FRESH CERTIFICATE OF INCORPORATION  
CONSEQUENT UPON CHANGE OF NAME**

*[Signature]*  
President & Secretary

In the office of the Registrar of Companies, NCT of Delhi & Haryana [ under the Companies Act, 1956 (1 of 1956) ]

IN THE MATTER OF M/s BHUSHAN LIMITED (CO. TFR. FROM CHANDIGARH TO DELHI)

I hereby certify that BHUSHAN LIMITED (CO. TFR. FROM CHANDIGARH TO DELHI)

which was originally incorporated on Twenty Second February of one thousand nine hundred and ninety nine under the Companies Act, 1956 ( Act 1 of 1956 ) under the name

**BHUSHAN LIMITED**

Having duly passed the necessary resolution in terms of Section 21 of the Companies Act, 1956 and the approval of the Central Government signified in writing having been accorded thereto under Section 21 read with Government of India, Department of Company Affairs, Notification No. G.S.R. 507(E) dated 24-06-1985 by Registrar of Companies, NCT of Delhi & Haryana, New Delhi vide letter No. ROC/21/55-108350/1120 dated 01/12/2005 the name of the said company is this day changed to

**BHUSHAN POWER & STEEL LIMITED**

and this Certificate is issued pursuant to Section 29(I) of the said Act.

Given under my hand at New Delhi this Twenty Eighth February of Two Thousand and Six



*[Signature]*  
**(DR. NAVSARUP SAINI)**  
REGISTRAR OF COMPANIES,  
N.C.T. OF DELHI AND HARYANA

*[Signature]*

*[Signature]*

*[Signature]*

Bhushan Power & Steel Ltd.  
Registered Office : F-Block, 1st Floor  
International Trade Tower, Nehru Place  
New Delhi -110019 INDIA

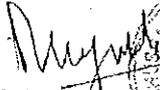
T +91 (0)11 30451000  
F +91 (0)11 26282737  
delhi@bpsl.net  
www.bpsl.net  
CIN : U27100DL1999PLC108350

**Bhushan**  
POWER & STEEL

### LIST OF BOARD OF DIRECTORS

S.No	Name & Designation	Address	Phone No.	Fax	E.Mail
1	Sh.Sanjay Singal (Chairman & Mg. Director)	H.No. 53, Jor Bagh, N.Delhi-110003	011-30451000	011-26282737	cmd@bpsl.net
2	Smt. Aarti Singal (Vice Chairman & Director)-Admin	H.No. 53, Jor Bagh, N.Delhi-110003	011-30451000	011-26282737	cmd@bpsl.net
3	Sh. Dinesh Kumar Behal (Independent - Director)	3235, Urban Estate, Phase -II, Dugri Road, Ludhiana- 142 027	9316920517		dkbehal@hotmail.com
4	Sh. R.P. Goyal (Director-Commercial)	157, Sector 16, Panchkula, Haryana- 134112	011-30451000	011-26282737	rpgoyal@bpsl.net
5	Sh. R.N.Yadav (Director-Technical)	14/4A, Burdwan Road, Alipore, Kolkata -700027	0663-2535000	0663-2562007	rny@bpsl.net
6	Sh. H.C.Verma (Director)	14/4A, Burdwan Road, Alipore, Kolkata -700027	0663-2535000	0663-2562007	hcverma@bpsl.net
7	Sh.Sanjiv Kumar Sachdev (Nominee Director- IDBI Bank)	H.NO-53, Maker Kundan Garden, Juhu Tara Road, Santa Cruz (West), Mumbai- 400049	8860180406		Sk.sachdev@idbi.co.in
8	Sh. Dinesh Kumar Yadav (Director-Project)	H. No. 1/1, Bhushan Township, Village Thelkoloji, PO Lapanga, Distt Sambalpur, Odisha - 768232	0663-2535000	0663-2562007	dineshyadav@bpsl.net

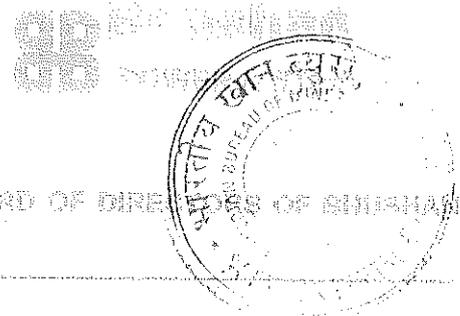
For Bhushan Power & Steel Ltd

  
(R.K.Gupta)  
Company Secretary

Place : New Delhi  
Date : 06-07-2017

Bhushan Power & Steel Ltd.  
Legal Office  
3 Block, 1st Floor,  
International Trade Area,  
Helen Place, New Delhi - 110017

11-07-2017  
Bhushan Power & Steel Ltd.  
Legal Office  
3 Block, 1st Floor,  
International Trade Area,  
Helen Place, New Delhi - 110017



**EXTRACTS FROM THE MINUTES OF MEETING OF BOARD OF DIRECTORS OF BHUSHAN POWER & STEEL LIMITED HELD ON 6<sup>TH</sup> JULY 2017**

**APPROVAL TO ACCEPT THE TERMS AND CONDITIONS OF LETTER OF INTENT FOR GRANT OF NETRABANDHA PAHAR BLOCK AND AUTHORITY TO EXECUTE DOCUMENTS**

Chairman informed the Board that Company has participated in the e-auction of Netrabandha Pahar Block for iron ore in Baladihi Village, Koira Taluka Sundergarh in the State of Odisha and the Company has been declared as the "Preferred Bidder". Now Government of Odisha, Department of Steel & Mines vide letter No. 5283/SM/IV(Misc) SM-52/2017 dated 24.06.2017 has issued the letter of intent containing the terms and conditions for grant of iron ore mines. Authority is required to accept the terms and conditions for grant of iron ore mines and to execute the necessary documents with authorities.

Board after discussion passed the following resolution:-

"Resolved that approval be and is hereby accorded to accept the terms and conditions contained in letter of intent 5283/SM/IV(Misc) SM-52/2017 dated 24.06.2017 issued by Government of Odisha, Department of Steel and Mines, for grant of Netrabandha Pahar Block for iron ore in Baladihi Village, Koira Taluka Sundergarh in the State of Odisha."

"Resolved further that Mr R. P. Goyal; Director (Commercial) or Mr. P. K. Mishra, Vice President or Mr Rakesh Khandelwal, Authorized Person of the Company ("Authorised Person") be and is hereby authorised to accept the terms and conditions of Letter of Intent and also authorized to sign, execute and file documents, letters, undertakings and affidavits in respect of grant of Netrabandha Pahar Block for iron ore, appear before the authority and represent the company, deposit the requisite fee, engage consultants and affix the common seal of the Company in accordance of Articles of Association, if so required on such documents as may be directed, and to do all other acts, deeds and things necessary, incidental to for commencement of operation / production of mine and consequential to give effect to this resolution."

"Resolved further that the Authorized Person of the Company, be and is also hereby severally authorized to execute power of attorney (ies) in favour of any other Person to do the aforesaid acts."

Certified True Copy  
For Bhushan Power & Steel Limited

President & Company Secretary



*Rakesh*

*PKM*

*P. K. Mishra*



ପ୍ରମାଣ କ୍ରମାଙ୍କିତ  
PUNBAY MUMBAI  
ମୁଦ୍ରିତ / DUES  
ପୁର / MALE

2210 5952 2903



ମୋ ଆଧାର, ମୋ ପରିଚୟ



भारतीय विशिष्ट पहचान प्राधिकरण  
UNIQUE IDENTIFICATION AUTHORITY OF INDIA

Date: 29/07/2017

ଠିକଣା:

ପ୍ଲଟ ନଂ-305, ଉତ୍ତର-3,  
ଖାରବେଳ ନଗର, ଭୁବନେଶ୍ୱର,  
ଭୁବନେଶ୍ୱର ଗଠପଠଠଠ, ଖୋର୍ଦ୍ଧା,  
ଓଡ଼ିଶା - 751001

Address:

PLOT NO-305, UNIT-3,  
KHARVEL NAGAR,  
BHUBANESWAR,  
Bhubaneswar G.P.O., Khorda,  
Odisha - 751001

2210 5952 2903



1947  
1800 300 1947

help@uidai.gov.in

www.uidai.gov.in

P.O. Box No. 1947,  
Bengaluru-560 001

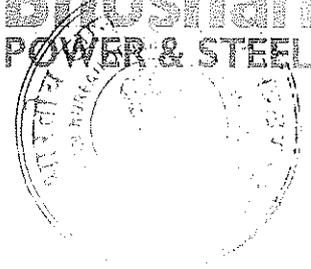
*Kaba*

*KT*

*Knaik*

**Bhushan Power & Steel Ltd.**  
Registered Office: F-Block, 1<sup>st</sup> Floor,  
International Trade Tower, Nehru Place,  
New Delhi-110 019, INDIA  
CIN - U27100DL1999PLC108350

T +91(0) 11 30451000  
T +91(0) 11 30451200  
F +91(0) 11 26282737  
Email: delhi@bpsl.net  
Website : www.bpsl.net



6<sup>th</sup> September 2017

TO WHOM SOEVER IT MAY CONCERN

This is to certify that Mr. Prabhat Kumar Mishra is presently working as Vice President in our organization and residing in his own Residence at Plot No. 305, Kharavela Nagar, Unit-III, Bhubaneswar-751 001.

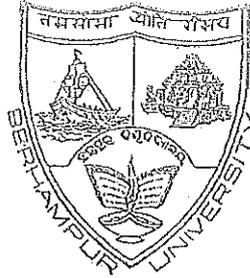
This certificate is being issued him as address proof.

For Bhushan Power & Steel Ltd.

Authorised Signatory

17982

# Berhampur University



## DIPLOMA FOR MASTER OF SCIENCE

This is to certify that

*Snehasis Routra*  
of *Khallikote College, Berhampur*  
who passed the examination  
for the degree of

## MASTER OF SCIENCE

held in the month of *September, 1984*,  
and was placed in the *First*  
Class in *Geology*  
was this day admitted to the degree.

BERHAMPUR UNIVERSITY  
BERHAMPUR-7

The 14. July 1986

*Jmes*  
Vice-Chancellor.

SECTION OFFICER  
ASSISTANT REGISTRAR

*KAT*

*Knaik*

*Kaba*

# Rungta Mines Limited

RUNGTA HOUSE, CHAIBASA - 833 201 ( JHARKHAND )

PHONE : ( 06582 ) 256861, 256761, 256691

FAX : 91 - 6582 - 256442 CABLE : RUNGTA

E-mail: [rungtas@satyam.net.in](mailto:rungtas@satyam.net.in)

Website: <http://www.rungtamines.com>

BARAJAMDA

14.07.2003

## TO WHOM IT MAY CONCERN

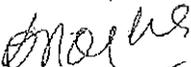
This is to certify that Sri Snehasis Raha, M.Sc. ( Geology ) has worked in this Organisation as Manager ( Geology ) from May' 1990 to February' 2002 in different mines of the Organisation in the Koira sector when he was responsible for Quality control, Environmental Assessment, preparation of Mining Plans / Schemes of different mines and execution of the same in field.

He has acted as A.G.M. ( Geology ) from March' 2002 to May' 2003 in Jajang Iron & Mn Mine of the Organisation when he was responsible for Quality control, preparation and execution of Development plans, logging and sampling of Boreholes and preparation of Mining Scheme.

He was sincere, responsible and hard working

I wish him all success.

For Rungta Mines Limited,

  
( D.R. Ojha )  
Sr. General Manager









भारतीय विशिष्ट पहचान प्राधिकरण  
भारत सरकार  
Unique Identification Authority of India  
Government of India



E-Aadhaar Letter

ভালিকাভুক্তির নম্বর/Enrolment No.: 1111/11891/26411

Snehasis Raha (স্নেহাশীষ রাহা)

ক্রমিক

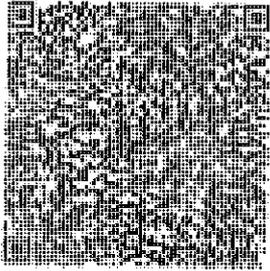
S/O: Harisadhan Raha, 43/3, FEEDER ROAD,  
Belgharia, North 24 Parganas,  
West Bengal - 700056

- আধার পরিচয়ের প্রমাণ, নাগরিকত্বের প্রমাণ নয়
- পরিচয়ের প্রমাণ অনলাইন অথেন্টিকেশন দ্বারা লাভ করুন
- এটা এক ইলেক্ট্রনিক প্রক্রিয়ায় তৈরী পত্র

Date: 08/10/2015

আপনার আধার সংখ্যা/Your Aadhaar No.:

4403 5256 2084



INFORMATION

- Aadhaar is a proof of identity, not of citizenship.
- To establish identity, authenticate online.
- This is electronically generated letter.

আধার-সাধারণ মানুষের অধিকার

1847  
1800 300 1847

help@uidai.gov.in

www.uidai.gov.in

Signature valid

Digitally signed by Sandeep Bhardwaj  
Date: 2015.02.06 20:01:33 IST

- আধার সারা দেশে মান্য
- আধারে আধারের জন্য আপনার একবারই ভালিকাভুক্তি করার আবশ্যিকতা আছে।
- অনুগ্রহ করে আপনার বর্তমান মোবাইল নম্বর এবং ই-মেইল ঠিকানা পরীক্ষা করুন। এতে ভবিষ্যতে আপনার বিভিন্ন সুবিধা পাওয়া সহজ হবে।

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भारत-सरकार  
GOVERNMENT OF INDIA



भारतीय विशिष्ट पहचान प्राधिकरण  
UNIQUE IDENTIFICATION AUTHORITY OF INDIA



স্নেহাশীষ রাহা  
Snehasis Raha  
জন্মতারিখ/ DOB: 23/06/1961  
পুরুষ / MALE



ঠিকানা:

S/O: হরিসাধন রাহা, 43/3,  
ফীডার রোড, বেলঘড়িয়া,  
উত্তর ২৪ পরগনা,  
পশ্চিম বঙ্গ - 700056

Address:

S/O: Harisadhan Raha, 43/3,  
FEEDER ROAD, Belgharia, North  
24 Parganas,  
West Bengal - 700056

4403 5256 2084

4403 5256 2084

আধার-সাধারণ মানুষের অধিকার

Raha

KNAIK

Aadhaar-Aam Admi ka Adhikar

KNAIK

# RANCHI UNIVERSITY



## PROVISIONAL CERTIFICATE

I certify that

Krishna Chandra Tyagi

Passed the

M.Sc. (Geology)

Examination

of this University held in the month of

April 1988

and was Placed in the

First

Division/Class

Dated Ranchi the

21/4/88

Registrar

Kaba

KTR

K Mark

CHAKRAVARTI CONSULTANTS

Phone: 233221  
E-mail: chakravarti@rediffmail.com

Plot No. 10, D. CHABASA, D.L.L. West Singhbhum (Jharkhand) 833201

TIN: 2083201001

REGD. OFFICE: BHILAI, JHARKHAND

Chabasa - 833201

TO WHOM IT MAY CONCERN

This is to certify that Sri Krishna Chandra Jyoti - S/o B.K. Jyotshi has been working in our Thakurani Iron Ore Mines since 19.06.2003 having more than 10 years of experience as a Sr. Geologist.

The nature of job is over a supervision of mining activity, Quality control of ore, keeping records of chemical analysis and geological data of mines. He is also preparing mining plan of our Thakurani iron ore Mines as well as Rajabari Iron Ore Mines.

Presently he is residing at Shree Niketan Apartment, Flat No B/207, A/9, Barabani Dist. Seonjhar, Odisha - 758035.

*(Signature)*  
24.07.14  
Chief Manager (HR)  
Thakurani Iron Ore Mines  
Chabasa, West Singhbhum  
Jharkhand  
Post: Chabasa - 833201  
Dist: West Singhbhum (Jharkhand)

*(Signature)*      *(Signature)*      *(Signature)*



Government of India

ଭାରତ ସରକାର  
ଭାରତୀୟ ଚଳାଣି ପ୍ରଣାଳୀ  
କେନ୍ଦ୍ରୀୟ ଚଳାଣି ପ୍ରଣାଳୀ  
ପୁରୁ / MALE



6641 8079 2396

ମୋ ଆଧାର, ମୋ ପରିଚୟ



Unique Identification Authority of India

**ଠିକଣା:**  
S/O ହରା କୁମାର ଜ୍ୟୋତିଷୀ, ବ/207, ଶ୍ରୀ  
ନିକେତନ ଆପାର୍ଟମେଣ୍ଟ, ଆଇ ଓପାଫିସ  
ପାଖ, ବର୍ଡ ନ-15, ବର୍ବିଲ, କେନ୍ଦୁଝର  
(ଏମ୍ ), କେନ୍ଦୁଝର,  
ଓଡ଼ିଶା - 758035

**Address:**  
S/O Hara Kumar Jyotishi,  
B/207, Sri Niketan Appertment,  
Near RI Office, Ward No-15,  
Barbil, Barbil (m), Kendujhar,  
Odisha - 758035

6641 8079 2396



<http://uidai.gov.in>

[www.uidai.gov.in](http://www.uidai.gov.in)

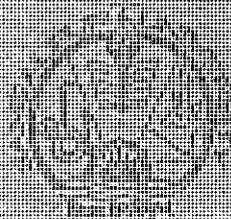
*Kaha*

*ATM*

*10/10/11*

Sanjivani University

ॐ नमो भगवते वासुदेवाय



ॐ नमो भगवते वासुदेवाय

MASTER OF SCIENCE

This is to Certify that

*Shreyansh Chitambar*  
of *Shri. P. G. Dept. College, Jalgaon*  
who passed the examination for the degree of

MASTER OF SCIENCE

held in the month of *April* 1992, and was placed  
in the *First* Class in *Geology*  
with optional group in *Examinic Geology* was this  
day admitted to the degree.

SANJIVANI UNIVERSITY  
WADGAON, JALGAON, GUJARAT

600001  
Date: 01/03/1992

*[Handwritten signatures]*

01/03/1992

# ORIENT RESOURCES

orichedn

Ref No: ORC/HR/34/15/16

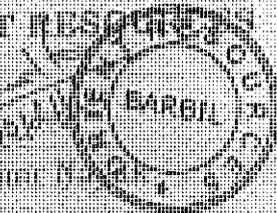
Date: 21/02/2018

## TO WHOMSOEVER IT MAY CONCERN

This is to certify that Sri Khageswar Malik, S/o-Jaduram Malik, A/PO-  
Kuarbaga, Dist-Sundergarh-769011 has been worked in our organization  
from as "Senior Geologist" from 2<sup>nd</sup> July 2010 to till date. During this  
period he has been involved and experienced in doing the following  
different operational sites i.e. Thakurani Iron ore Mines, Rajsheda Iron  
ore Mines of M/s Padam Kumar Jain. The tenure of his stay, the services  
we found satisfactory in carrying out the job duties, his assignment of  
job were as:- Preparation of Mining plan, Scheme of mining, Forest  
diversion proposals and other statutory activity required time to time.  
Involved in production planning and scheduling, preparing of monthly  
excavation plan. Prospecting new area of minerals like Iron and  
Manganese for excavation tasks and maintaining safety regulations  
etc. Geological Exploration (Topography, geological mapping, Drilling,  
Logging, Grade wise reserve estimation)

We wish him all the best in his future.

For ORIENT RESOURCES  
Sd/-  
Sudesh Kumar Jaiswal



*[Handwritten signature]*

*[Handwritten signature]*

ORIENT RESOURCES  
SUNDERGARH  
INDIA  
BARGIL


 ଶ୍ରୀରାଜ ଚକ୍ର  
 Government of India  
 ଶ୍ରୀରାଜ ଚକ୍ର  
 KHAGESWAR NAIK  
 ଶ୍ରୀରାଜ ଚକ୍ର  
 Father: JADUMANI NAIK  
 ଜନ୍ମ ତାରିଖ / DOB: 03/11/1958  
 ଲିଙ୍ଗ / Sex: Male  
 4728 3581 1228  


ଆଧାର - ସାଧାରଣ ଲୋକର ଅଧିକାର


 ଭାରତୀୟ ଉପାଧି ଲୋକନିର୍ଣ୍ଣୟ  
 Unique Identification Authority of India  
 ଠିକଣା: କୁଆରବାଗା, ସୁନ୍ଦରଗଡ଼  
 ପୁସ୍ତକଭୋଗ, ଭୁବନେଶ୍ୱର, ଚେ.ଉ. 770011  
 Address: KUARBAGA,  
 Kuarbaga, Sundergarh,  
 Kuarboga, Odisha, 770011  
 4728 3581 1228  
 1947  
 1800 300 1947  
 help@uidai.gov.in  
 www.uidai.gov.in

Kakra

*KNAIK*

KNAIK

Government of India  
Ministry of Labour  
Directorate-General of Mines Safety

No. Exam/Exempt/SMR/W 27

Dhanbad,

Dated the 26/2/2002

To NIROD KUMAR MOHANTY  
C/o: RABINDRA NATH MOHANTY  
(RETIRED HEAD ASSTA.)  
AT & PO: KANAKPUR, VIA: TIRTOL,  
DIST: JAGATSINGHPUR, PIN: 754 136.



MEMORANDUM

Ref- His application dated 07.01.2002

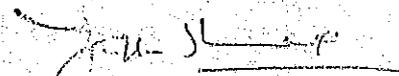
By virtue of Government Notification No: 712(E) dated 13.12.74,

Shri NIROD KUMAR MOHANTY S/o. RABINDRA NATH MOHANTY  
of Village KANAKPUR Thana TIRTOL, District JAGATSINGHPUR  
State ORISSA born on 12th April, 1973 (Seventythree)

possessing a Diploma/Degree in Mining Engineering and Mine Surveying approved under Regulation 17 of the Metalliferous Mines Regulation, 1961 and on completion of the prescribed experience has become eligible to work in a capacity requiring possession of Surveyor's Certificate in a Metal Mine having opencast workings only.

This Certificate is effective from 7.2001 till the above notification remains in force.

- Enclosures :-  
1. Diploma/Degree Certificate.  
2. S.S. Certificate.  
3. First Aid Certificate.  
4. Mark Sheet.

  
Secretary,  
Board of Mining Examinations

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GOVERNMENT OF ODISHA  
DIRECTORATE OF GEOLOGY  
BHU-BIGYAN BHAWAN, BHUBANESWAR-751 001  
Phone: 0674 2392374, Fax: 0674 2391776, E-mail: [director@geology.odisha.gov.in](mailto:director@geology.odisha.gov.in)

No .GXVI (h) 5/17- 6115 /DG, Dt. 3.10.17

From

The Director of Geology, Odisha  
Bhubaneswar

To

Bhushan Power & Steel Ltd.  
N-3/28, Nayapalli, I.R.C. Village,  
Bhubaneswar-751015, Odisha, India

Sub: Authenticated GR of Netrabandha Pahar Iron Ore Block, Sundargarh district.

Ref: (i) Letter No. 8725 /DM, Dt. 26.09.17 of Director of Mines, Odisha, Bhubaneswar  
and (ii) Your letter dated 20<sup>th</sup> September 2017.

Sir,

Please find enclosed herewith the authenticated Geological Report on investigation of Iron ore around Netrabandha Pahar, Sundargarh district in duplicate for further action at your end.

Yours faithfully,

Encl: As above

*Amr*  
*26/09/17*  
DIRECTOR OF GEOLOGY, ODISHA

Memo No. \_\_\_\_\_ /DG, Dt. \_\_\_\_\_

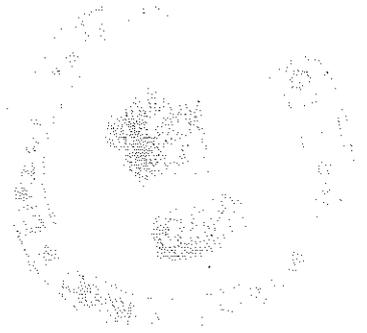
Copy along with an authenticated copy of the report forwarded to the Director of Mines, Odisha, Bhubaneswar for kind information and necessary action.

DIRECTOR OF GEOLOGY, ODISHA

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GOVERNMENT OF ODISHA  
DEPARTMENT OF STEEL AND MINES  
DIRECTORATE OF GEOLOGY

REPORT ON  
INVESTIGATION OF IRON ORE AROUND  
NETRABANDHA PAHAR, SUNDARGARH  
DISTRICT, ODISHA

F. S.: 2012-13  
2015-17

VOLUME - I  
(Text)

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Director of Geology  
Odisha, Bhubaneswar

List of Contributors



- 1 P. K. PANIGRAHI, GEOLOGIST
- 2 N. N. SINGHDEO, GEOLOGIST
- 3 SUJIT DAS, GEOLOGIST
- 4 RAMESH BEHERA, GEOLOGIST
- 5 R.K. MOHNATA, D.D.G

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Executive Summary

SUMMARY OF THE MINERAL BLOCK

[To be made available on the website of e - auction platform]

PART A - GENERAL INFORMATION ABOUT MINERAL BLOCK

Features		Details
1.	Location	
	Mineral Block	Netrabandha Pahar Iron ore Block
	Latitude	
	1	21° 52' 05.242" N
	2	21° 52' 08.908" N
	3	21° 52' 22.320" N
	4	21° 52' 28.665" N
	5	21° 52' 31.206" N
	6	21° 52' 30.236" N
	7	21° 52' 36.366" N
	8	21° 52' 41.204" N
	9	21° 52' 43.649" N
	10	21° 52' 46.169" N
	11	21° 52' 50.932" N
	12	21° 52' 54.542" N
	13	21° 52' 52.774" N
	14	21° 52' 17.675" N
	15	21° 52' 18.527" N
	16	21° 52' 16.368" N
	17	21° 52' 14.422" N
	18	21° 52' 06.879" N
	Longitude	
	1	85° 17' 20.075" E
	2	85° 17' 56.810" E
	3	85° 17' 55.650" E
	4	85° 17' 55.717" E
	5	85° 17' 54.139" E
	6	85° 17' 47.457" E
	7	85° 17' 47.026" E
	8	85° 17' 45.466" E
	9	85° 17' 43.360" E
	10	85° 17' 39.684" E
	11	85° 17' 32.999" E
	12	85° 17' 26.720" E
	13	85° 17' 10.449" E
	14	85° 17' 16.938" E

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Director of Geology  
Odisha, Bhubaneswar

	15	85° 17' 20.991" E		
	16	85° 17' 20.751" E		
	17	85° 17' 20.631" E		
	18	85° 17' 20.157" E		
	Village	Baladihi		
	Tahasil/Taluka	Koira		
	District	Sundargarh		
	State	Odisha		
2.	<b>Area(Hectares/square km)</b>			
	Total area	1.39 sq km		
	Mineralised area	1.120 sq km		
	Non-mineralised area	0.271 sq km		
3.	<b>Exploration</b>			
	Status (G2/G3/G4 etc.)	G 2 (General Exploration)		
	Exploration Agency	Directorate of Geology, Odisha		
	Total No. of BHs with meterage	39 boreholes, 1544.6 m		
	Borehole spacing (Density)	200m x 200m (28 BHs/sq km)		
4.	<b>Quantity of Minerals(Grade wise)</b>			
	Mineral	Iron		
	Total Geological Resources(Resource)	High Grade Ore (55% Fe cut off)	62.655 mt	HLO (lumpy):0.968 mt SLO(fines) :47.825 mt Blue dust:13.862 mt
		Low grade ore (45 to 55% Fe)	19.318 mt	
		<b>Grand Total</b>	81.973 mt	
	Number of mineral zones	01(one)		
	Trend(Dip and strike)	Strike: N10 <sup>0</sup> W -S10 <sup>0</sup> E direction, with 20° - 40° dip towards west and east		
6.	<b>Grade</b>	High Grade Ore (55% Fe cut off)	HLO (LUMPS) Fe: 63.569%, SiO <sub>2</sub> :1.723% Al <sub>2</sub> O <sub>3</sub> :2.439%.	SLO (Powdery ore) Fe:60.781 %, SiO <sub>2</sub> : 5.031% Al <sub>2</sub> O <sub>3</sub> :3.424 %.
		Low grade ore (45 to	Fe: 50.572%, SiO <sub>2</sub> : 10.376%	Blue dust Fe: 65.647%, SiO <sub>2</sub> :1.76% Al <sub>2</sub> O <sub>3</sub> :1.684%. Al <sub>2</sub> O <sub>3</sub> : 8.885%.

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Director of Geology  
Odisha, Bhubaneswar

		55% Fe) (Lumps)			
	Mineral	Iron			
7.	<b>Accessibility</b>				
	Nearest Rail head	Barsuan under SE Railways is located at a distance of 32 km from Baladihi village			
	Road	The distance from the district headquarter is about 210km via Rourkela			
	Airport	Bhubaneswar. A small air strip exists at Barbil at a distance of 35 km.			
8.	<b>Hydrography</b>				
	Local Surface Drainage Pattern (Channels)	The drainage system of the area is controlled by Teherei Nala flowing to the North of the block and its tributaries. However Khajuridihi Nala flowing in the Southern part of the area controls the drainage.			
	River/Streams	Suna Nadi River			
9.	<b>Climate</b>				
	Mean Annual Rainfall	1600 mm			
	Temperature (December)	5 <sup>0</sup> C			
	Temperature (May)	47 <sup>0</sup> C			
10.	<b>Topography</b>				
	Topo Sheet Number	F45N45 (73G/5).			
	Morphology of the area	The area in general represents an undulating to plain topography. At places flat topped low mounds are noticed with general gradient to NE and SE.			

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28/11/17  
Director of Geology  
Orissa, Bhubaneswar

## ABSTRACT



General exploration of Netrabandha Pahar Iron Ore Block in Koira Tahasil of Sundargarh district featured in Toposheet No. F45N5 (73 G/5) was taken up by the Directorate of Geology, Odisha for assessment of iron resource during the F.S.2012-13 and 2015-17. The work comprised geological mapping on 1:2000 scale, core drilling, core sampling at 1m interval and chemical assay of core samples. The area of exploration is bounded by the following latitudes & longitudes.

Pillar ID	Latitude	Longitude
1	21° 52' 05.242" N	85° 17' 20.075" E
2	21° 52' 08.908" N	85° 17' 56.810" E
3	21° 52' 22.320" N	85° 17' 55.650" E
4	21° 52' 28.665" N	85° 17' 55.717" E
5	21° 52' 31.206" N	85° 17' 54.139" E
6	21° 52' 30.236" N	85° 17' 47.457" E
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10	21° 52' 46.169" N	85° 17' 39.684" E
11	21° 52' 50.932" N	85° 17' 32.999" E
12	21° 52' 54.542" N	85° 17' 26.720" E
13	21° 52' 52.774" N	85° 17' 10.449" E
14	21° 52' 17.675" N	85° 17' 16.938" E
15	21° 52' 18.527" N	85° 17' 20.991" E
16	21° 52' 16.368" N	85° 17' 20.751" E
17	21° 52' 14.422" N	85° 17' 20.631" E
18	21° 52' 06.879" N	85° 17' 20.157" E

During course of investigation, an area of 1.39 sq km has been covered by theodolite survey and gridded at 50 m interval. An exposure map of the area was prepared depicting the litho units & structural features and borehole points were fixed at 200 m square grid along the strike and dip. The litho units encountered include Soil, Laterite & BIF. The BIF exhibit general strike of N10°W-S10°E with 20°-40° dips west ward dip. The BIF as encountered during exploration include hard laminated ore, soft laminated ore, blue dust, ferruginous shale, banded hematite jasper (BHJ), Conga. The litho units have been affected by folding exhibiting 10° plunge towards NE.

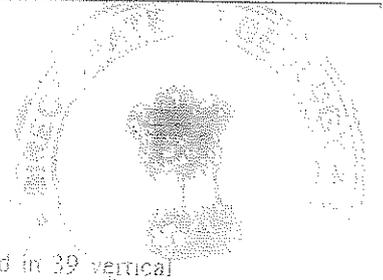
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Director of Geology  
Odisha, Bhubaneswar



During exploration a total of 1544.6 m core drilling was accomplished in 39 vertical boreholes depth ranging from 10 m to 50 m at 200 m square grid. Various types of iron ores have been encountered in 27 boreholes & BHs are devoid of workable iron ore basing on which an area of 0.271 sq km has been identified as non mineralised zone and 1.120 sq km accounts for mineralised area. Examination and Chemical assay log of lithology indicates thickness of iron ore varies between 1m to 44.1m. 1044 numbers of meter wise core samples have been collected and analysed in the Government Departmental laboratory, Odisha by wet-cum-instrument method. Chemical analysis result indicates that iron content at 55% Fe cut off varies from 55 to 71.29 % with average Fe content of 61.071%. Resource estimation by Transverse section method up to 576 m datum level indicated a resource of 62.48 mt million tonnes of iron ore at 55% Fe cut off and 19.318 million tonnes of iron ore at 45 to 55% Fe cut off. Thus a total indicated resource of 81.973 mt million tonnes of iron ore of all grades have been estimated for the block of which blue dust accounts for 13. 862 million tonnes. These resources estimated by General Exploration stage of UNFC comes under indicated mineral resource category (332) of UNFC.

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Pradyumn K. Sahoo  
Director of Geology  
Odisha, Bhubaneswar



## CHAPTER-I INTRODUCTION

### 1.1 INTRODUCTION:

In view of rapid industrialisation policy and the changing steel scenario of the state, assessment of iron ore resources is indispensable. Based on the preliminary investigation conducted during F.S. 2008-2009 in the area around Netrabandha Pahar, where a possible resource of 0.84 million metric tonnes (mt) of iron ore was estimated, detailed assessment of iron ore by General Exploration stage was taken up by the Directorate of Geology, Odisha in order to assess the resource & grade of iron ore around Netrabandha Pahar in Sundargarh district during the F.S - 2012-13 and 2015-17 as per Minerals (Evidence & Mineral Content) Rules, 2015 to make it auction worthy.

### 1.2 BLOCK DESCRIPTION:

#### 1.2.1 Location & Accessibility:

The area covered is featured in S. I. T. S. No. F45N5 (73G/5) (plate-1). It is located around west of Baladihi village in Koira Block and Tahasil of Sundargarh district of Odisha. Koira, the Block Headquarter, at a distance of 110 km from Rourkela town, is well connected by N.H -215 and S.H-10(A) via Kalta and Tensa respectively. The deposit can be negotiated from Koira by fair weather Panchayat roads. The explored block is bounded by the following geo coordinates. The nearest Railway Station, Barsuan under SE Railway is located at a distance of 32 km from Baladihi village.

Pillar ID	Latitude	Longitude
1	21° 52' 05.242" N	85° 17' 20.075" E
2	21° 52' 08.908" N	85° 17' 56.810" E
3	21° 52' 22.320" N	85° 17' 55.650" E
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11	21° 52' 50.932" N	85° 17' 32.999" E
12	21° 52' 54.542" N	85° 17' 26.720" E

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Director of Geology  
Odisha, Bhubaneswar

13	21° 52' 52.774" N	85° 17' 10.449" E
14	21° 52' 17.675" N	85° 17' 16.938" E
15	21° 52' 18.527" N	85° 17' 20.991" E
16	21° 52' 16.368" N	85° 17' 20.751" E
17	21° 52' 14.422" N	85° 17' 20.631" E
18	21° 52' 06.879" N	85° 17' 20.157" E

### 1.3 Physiography, Drainage & Climate:

The area exhibits an undulating topography with mounds in the central part. The maximum elevation is 676 m above MSL and the minimum elevation in valleys is 620 m above MSL. In general, the area slopes towards NE and SE. The Suna Nadi with its numerous ephemeral to perennial tributaries controls the drainage system in the area. Teherei Nala, a tributary of Suna Nadi, flowing to the North of the block and Khajuridihi Nala flowing in the Southern part of the area controls the drainage. The area enjoys sub-tropical climate with moderate to heavy rainfall. The area experiences hot dry summer with temperature rising up to 47<sup>0</sup>C with chilled winter with temperature dropping up to 5<sup>0</sup>C.

### 1.4 Previous work:

Previously, the area of exploration has been studied time and again by various geo-scientists of different organisations. Prominent among them are Jones (1934), Dunn (1934), Prasad Rao et. al (1964), Saha et. al. (1984), Chakrabarty et. al (1986), Acharya et. al (1986, 2000, 2002, 2005). The area around Mankamacha to the west of the present block has been investigated by the erstwhile Directorate of Mines during field season 1969-70 and 1985-86. The Balia Pahar found to SW of present area was investigated during F.S-1992-95 for iron ore by the former Directorate of Mining & Geology, Odisha. With the growing demand, assessment of iron ore resources was again resumed. Basing on the preliminary investigation conducted during F.S. 2008-09 by the Directorate of Geology, a possible resource of 0.84 mt of iron ore was estimated in the area.

### 1.5 Objective and scope of present investigation:

The objective of present investigation is to assess the resource of iron ore of different grades present in the area through large scale mapping on 1:2, 000 scale, core drilling at 200 m x 200 m square grid and meter wise sampling satisfying the norms of exploration inputs of General Exploration stage (G2) of UNFC, and assessment of indicated resource as per Minerals (Evidence and Mineral Content) Rules, 2015 which follows UNFC and CRISCO norms.

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Director of Geology  
Odisha, Bhubaneswar

CHAPTER II  
GENERAL GEOLOGY

2.1 GEOLOGICAL STUDIES:

2.1.1 Regional Geology

The area forms a part of the Bonai - Keonjhar belt of the famous "Horse Shoe Synclinorium" falling in Sundargarh and Keonjhar districts (Plate-2). The feebly metamorphosed Precambrian volcano-sedimentary rocks exposed in this belt between the Singhbhum granite on the east and Bonai granite on the west are classified as 'Iron Ore Group' (Sarkar & Saha, 1962) or 'Koira Group' (Murthy and Acharya, 1975). These rocks are disposed in form of a low northerly plunging 'Horse-Shoe' shaped synclinorium (Jones, 1934). The litho-stratigraphic succession of this area, as worked out by earlier workers, based on regional field studies is shown below (Table-1).

TABLE - 1

Jones (1934)	Saha(1994) Modified after Sarkar & Saha (1977)	Murthy & Acharya (1975)		
Upper shale, epidiorite and ash bed	I R O N	Singhbhum granite	K O I R A	Mixed facies formation
B.H.Q. with iron ore bodies				Upper Shale with volcanics
Shales with occasional sandstones	O R E S U P E R	BHJ with iron ore, ferruginous quartzite	G R O U P	Banded Iron Formation
Purple sandstone with basal conglomerate				Lower shale and acid, intermediate tuffs, local dolerite
-----Unconformity-----	G R O U P			Basal sandstone-Quartzite
Older Dharwars				

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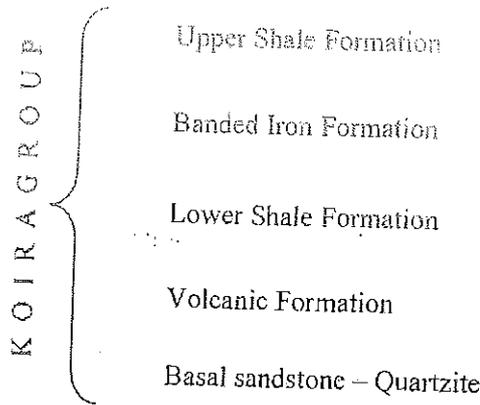
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Director of Geology  
Odisha, Bhubaneswar



The stratigraphy of the area modified after Murty and Acharya (op. cit) is given below:

Kolhan Group



Singhbhum & Bonai Granites and metamorphosed sediments

The base of the Koira Group is marked by a pronounced unconformity over the Singhbhum granite in the eastern side and has a sheared inter-fingering contact relationship with Bonai granite on the western side. The basal formation comprises of gritty sandstone, which ranges from ortho-quartzite on one hand to pebbly sandstone and conglomerate on the other. This arenaceous unit is followed by mafic volcanics which is found all along the outer periphery of the horse-shoe synclinorium. The volcanic formation comprises predominantly of Lower volcanic flows dominantly of mafic composition and an upper tuffaceous zone. The lava is pillowed at the bottom part and amygdaloidal at the top indicating its sub-aqueous and subsequent sub-aerial character. The lava grades into purple colour tuffaceous shale conformably towards the upper part and described as 'Lower Shale Formation' (Murty and Acharya, op. cit.). By the appearance of jasper and banded jasper inter banded with the greenish and black shale towards the top, the lower shale pass into the 'Banded Iron Formation' proper.

The 'Banded Iron Formation' is represented by Banded Hematite Jasper (BHJ)/ Banded Hematite Quartzite (BHQ)/ Banded Magnetite Quartzite (BMQ), inter-bedded black

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Director of Geology  
Odisha, Bhubaneswar



or green shale and banded ferruginous chert. Due to high resistance to erosion these litho-units form high ridges conspicuously marking the outline of the 'Horse-Shoe' Synclinorium and depict the major structural pattern of the belt.

The 'Banded Iron Formation' is overlain by the 'Upper Shale Formation' comprising thick sequence of tuffaceous purple, white and buff coloured shale, black shale, banded ferruginous shale with inter-bedded chert and Banded hematite jasper (BHJ)/ Banded hematite quartzite (BHQ)/ Banded magnetite quartzite (BMQ) bands and spreading over the entire core of the synclinorium. The 'Upper Shale Formation' can be divided into two horizons/ zones namely, lower manganiferous shale horizon/ zone and upper ferruginous shale horizon/ zone. These two horizons/ zones exhibit conformable relationship and are each characterised by their typical litho-assemblages. The manganiferous horizon/zone comprising predominantly of manganiferous grayish green shale, carbonaceous black shale with inter-beds of chert locally grading to dolomite hosts almost all the major manganese ore deposits of the area. Whereas, ferruginous shale horizon/ zone comprising of banded ferruginous shale with inter-beds of BHJ/ BHQ and Banded Ferruginous Chert (BFC) gives rise to isolated iron ore deposits within the core of the synclinorium.

A younger sequence of conglomerate and sandstone exposed on the northern and north eastern part of the belt are unconformably overlying the Koira Group of rocks. This arenaceous rock sequence have been described as Kolhan Series (Dunn, 1940) or Kolhan Group (Murty and Acharya, 1975) and it is differentiated from the basal sandstones and conglomerate by the presence of jasper pebbles, iron ore pebbles and fragments of BHJ.

The iron ore bodies associated with the 'Upper Shale Formation' occur at much lower topographic elevations (450-650 m) mostly covered by laterite within the core of the synclinorium compared to the major iron ore deposits of the 'Banded Iron Formation' occurring at the ridge tops (750-950 m). The present exploration programme is aimed to evaluate the resources of Netrabandha Pahar iron ore occurrence within the Koira syncline of the 'horse-shoe' shaped synclinorium (Plate-II).

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Director of Geology  
Odisha, Bhubaneswar



## 2.2 Local Geology:

The area under investigation lies within the Upper Shale Formation of the Koira Group as described by Murthy & Acharya (1975). Litho units like iron ores of HLO, SLO, lateritised SLO type, limonitic ore, Fe-Shale, laterites both aluminous and ferruginous nature, float ores concealed under soil and alluvial cover at places are mapped in the Netrabandha Pahar Block (Plate-3). The local stratigraphic succession as worked out is as follows:

		Soil Laterite
Koira Group	Upper Shale Formation	Shales of different colour like purple, yellow with inter beds of Iron ore..
	Banded Iron Formation	Coarsely banded BHJ followed up by finely banded BHJ and iron ore.

## 2.3 Description of litho units

### 2.3.i Banded Iron Formation (BHJ):

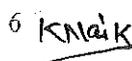
The BHJ is not ubiquitous in the area except few small patches near BH No-1&3. However, it is intersected in few boreholes like 1,3,4,19,26, 31 etc. Megascopically, the BHJ comprises alternate bands (laminations less than 5mm thick) of hematite and dark brown to red jasper. This unit is intersected nearer to the bottom parts of these boreholes.

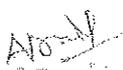
### 2.3.ii Ferruginous Shale:

It occupies the western valley portion represented by a finely laminated rock having varied shades of colour ranging from white, maroon, brownish and purple to gray etc. The colouration of the shale is largely dependent on the mineral composition (Murthy & Acharya, 1975). It is mostly composed of clayey micaceous minerals, with lenses of chert. Most of the area containing this unit is lateritised extensively. It occurs sporadically in the in nala sections part of the mapped area.







  
Director of Geology  
Odisha, Bhubaneswar

### 2.3.iii Iron ore:

Based on surface exposures and sub-surface geology 5 (five) types of iron ore are recorded in the explored block (plate-III). These are Hard Laminated Ore (HLO), Soft Laminated Ore (SLO), blue dust (powdery ore) and float/Canga ores.

The area is mostly covered by float ore and soil. However, isolated exposures of SLO, Laterite and Float/Canga ores are encountered in the surface. HLO is not exposed but encountered in the sub-surface. The general strike of iron ore is in  $N10^{\circ}W - S10^{\circ}E$  direction, with  $20^{\circ} - 40^{\circ}$  dip towards west in the area. It is continuing under laterite and SLO cover as observed in the BHs. The minor folds observed in the BIF shows  $10^{\circ}$  plunge towards  $N10^{\circ}E$ .

Float ores and the cemented float ores (Canga) are demarcated in the map occurring over the lateritic. 'Canga' zones contain mostly iron ore floats which are deposited in the saddle region. The thinly laminated, hematitic ore bodies rarely exposed in the valley area are very often lateritised near the surface.

Few isolated patches of SLO have been encountered on the surface. However thick zones of SLO were intersected in most of the boreholes at different depths given in the lithologs (Annexure-II, Plate-V).

### 2.3.iv Laterites :

Most part of the area is covered by laterite of various types. The laterite has been developed mostly over the shale unit or low grade iron ores of the area and depending upon the composition of the shale, different types of laterites have been developed. The shale rich in alumina has given rise to aluminous laterite and those rich in iron have developed ferruginous laterites. Ferruginous laterite occupies most of the high lands in the vicinity and is not wide-spread. Aluminous laterite occurs in form of small patches spread over the area.

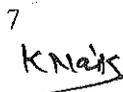
**Soil/ alluvium:** The low lying areas, nala banks etc are filled up with alluvial soil.

### 2.4 Structure:

In general the Iron Ore Super Group represented by the Bonai-Keonjhar Belt in Koira basin is disposed in the form of an "Omega" and referred to as "Horse shoe synclinorium" (Jones, 1934). This belt is 60 km long and 25 km wide extending from south of Malangtoli in Keonjhar district up to Chakradharpur in West Singhbhum district (Jharkhand). The structural fabrics in the above, feebly metamorphosed volcano-sedimentary litho-sequence





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Orissa, Bhubaneswar



indicate at least two phases of deformation and folding. The earlier phase is the most prominent and resulted in formation of two synclines intervened by an anticline trending NNE-SSW with a low north-north easterly plunge. The western limb is slightly overturned to the east and dip westerly ( $65^{\circ}$ - $75^{\circ}$ ) whereas, the eastern limb is a normal one with moderate to low ( $30^{\circ}$ - $45^{\circ}$ ) westerly dip. This phase of folding is affected by a later NW-SE to WNW-ESE trending fold axis resulting in broad warps and formation of structural domes and basins in the area. The western syncline known as Koira syncline, due to steep dip and overturned nature of its limb forms a deeper basin with thick sequence of younger shales in the core region. On the other hand, the eastern syncline known as Bamebari syncline is a shallower basin and exposes younger litho members within the core region as outliers. The Upper shale unit within the Koira syncline is more or less continuous.

**2.5. Metamorphism:**

There is least record of metamorphism in the BIF of Bonai-Keonjhar iron ore Belt.

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Odisha, Bhubaneswar



## CHAPTER III EXPLORATION

### 3.1 DETAILED MAPPING . . .

#### 3.1.i Geological mapping & survey:

The topographical features as well as ore geometry was taken into consideration while fixing the base line. The survey work was carried out with the help of Theodolite, Dumpy level and Prismatic compass. The Base Line (0-0) was fixed parallel to the trend of the ore body i.e.  $N10^{\circ}W-S10^{\circ}E$  and the offset grid lines parallel to Base line, at an interval of 50 m towards north and named as N-1, N-2, N-3 etc and similarly towards south named as S-1, S-2, S-3 etc. The section lines were laid at 50 m interval perpendicular to the base line. These are named as E-1, E-2, E-3 etc towards east of the 0/0 location on the map, and similarly W-1, W-2, W-3 etc towards west. The R.L. of base and section lines was connected from the nearest culvert located near road junction close to Baladihi village by dumpy level and calibrated with the GPS data. Contouring was carried out at 2m interval (Plate-IV).

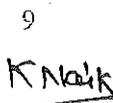
Detailed geological mapping on 1:2000 scale was carried out and the litho units exposed in the mapped area comprises iron ore bodies mostly lateritised on the surface, ferruginous shale and soil cover. Iron ore in this area occur as isolated bodies associated with buff coloured variegated shale and ferruginous shale. The iron ore is capped by ferruginous laterite. Litho-structural details are depicted in Plate – III.

#### 3.1.ii Drilling:

Out of total area of 1.391 sq km. mineralised area comprises 1.120 sq km and non mineralised area 0.271 sq km. A total of 39 vertical boreholes were drilled in the block for cumulative drilling meterage of 1544.6 m. These boreholes are drilled at strike intervals of 200m and at 200m spacing along dip direction. The borehole locations are shown in the geological map of the Block (Plate - III). The summarized litho log of the boreholes drilled is given in Annexure-II. Details of drilling depths, ore zone as intersected and grade in different boreholes of the block are given in Annexure - III. The bore holes were closed either in BHJ or in ferruginous shale and rarely in ore due to drilling difficulties or after thick shale horizon where there is least possibility of further continuation of iron ore.





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Director of Geology  
Odisha, Bhubaneswar



### 3.1. iii Results of drilling:

The details of the drilling and ore horizons intersected in different boreholes, depth of bore holes drilled and overburden thickness is given in Annexure - (II). The maximum overburden thickness of 22 m is found in BH 22 though it contains 32.3 m high grade ore. Basing on the observations of the litholog (Plate-V) and assay log of the BH 38, 31, 36, 37, 39, 24, 2 non mineralised zone area has been demarcated in the geological map (Plate-III) and BH 11 did not intercept any ore body.

### 3.2 Mineralisation details

Depth of boreholes varies from 10 m (BH 4) to 77.50 m (BH 13) and cumulative thickness of ore bodies intersected at + 55% Fe cut off is 655.4 m having average iron content of 61.071% Fe. The thickness of low grade ore zone (45 - 55% Fe) intersected in the boreholes varies from 1 to 44.1m (BH 35) having average iron content of 50.572% with a cumulative thickness of 195.85 m. Buff coloured ferruginous shale and BHJ are found in the foot wall side, where as lateritised ferruginous shale occur as overburden. The ore is mainly soft laminated type towards top and grades over to hard laminated and blue dust towards bottom. Ferruginous shale occurring as partings within the ore zone shows gradual decrease of iron content towards bottom. Iron ore in the Netrabandha Pahar area occur as isolated bodies associated with buff coloured variegated shale and ferruginous shale. The ore bodies are capped by ferruginous laterite on surface. Though the ore types show outcrops of hard ore, lateritic ore and float ore on the surface but soft laminated and powdery ore constitutes the bulk thickness of the ore zone as evidenced from drill cores.

The ore is mostly soft laminated varieties with partings of ferruginous shale. Layers of soft laminated ore are present on the surface, followed by hard laminated and blue dust at depth, which are inseparable during dry drilling. At depths thin bands of hard laminated ore also occur along with powdery and soft laminated ore having less thickness. High grade and sub grades are intercalated in few holes. The ore is mainly hematite but limonite and goethite also occur at places.

### 3.3 Sampling details

From the drill cores, 1044 samples were collected at 1 m interval and processed. The samples were mostly of 1 m length but at times 0.50 m core length was also sampled depending upon the width of the particular type of iron ore or variation of lithology. Since

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Director of Geology  
Odisha, Bhubaneswar

different types of ores i.e. hard and soft laminated and blue dust occur together in varying proportions, individual ore types were not processed separately. The drill core was made into two equal halves and one part is preserved in the core box and the other half was powdered to -100 mesh size and after repeated coning and quartering, one part is being submitted for chemical analysis and the rest were preserved as duplicate samples.

### 3.3.ii Chemical analysis details.

The analysis of drill core samples is given in the Annexure-III. 1044 samples are analysed by Wet-cum- Instrument method in the Departmental Government Laboratory. Repeat analysis of some of the samples was carried out maintaining the same condition in the same laboratory for cross checking. The chemical analysis result for the Netrabandha Pahar area shows iron content (at 55 % Fe cut off) to vary from 55 to 71.2 %. Higher  $Al_2O_3$  % (10-20%) is seen in few samples of low grade lateritic & SLO ore having Fe content varying from 45% to 55%. However, the weighted average of all the core samples of borehole 1 to 39 of Netrabandha Pahar deposit analysed at +55% Fe cut off shows average values of Fe 61.071%,  $SiO_2$ : 4.523% and  $Al_2O_3$  : 2.438%. The low grade ores show iron content from 45.11 to 54.96 % %,  $SiO_2$  from 4.28 to 20.07 % and  $Al_2O_3$  from 3.719 to 15.74 %. The weighted average of all low grade samples of the boreholes of Netrabandha Pahar deposit at 45 to less than 55% Fe shows Fe: 50.572 %,  $SiO_2$  10.376 % and  $Al_2O_3$ : 8.885 %. Blue dust shows average content of Fe: 65.467%,  $SiO_2$ : 1.76% and  $Al_2O_3$ : 1.684%. The Bar diagram plotted for analytical values of Fe,  $SiO_2$  and  $Al_2O_3$  of samples of both high grade and low grade iron ores show that the low grade ore (45 to 55% Fe) contain more alumina and silica indicating that the iron ore in this valley area is shale hosted. The plot of iron, silica and alumina for samples of each borehole is given in Annexure- VII. Even at places, occurrence of fragments of soft laminated ores within the profile or conga zones gives iron content more than 55%.

### 3.4 Data density and verification

39 nos. of boreholes are located within the Netrabandha iron ore block occupying an area of 1.39 sq km. of which 1.120 sq km is mineralised area. All the boreholes are vertical in nature. The borehole density in the block is 28 nos. per sq km. which is drilled with grid interval of 200 m along strike and 200 m spacing along dip direction. Out of 39 BHs, iron ore of various grades have been encountered in 27 BHs while 12 BHs encountered

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Odisha, Bhubaneswar



ferruginous shale with few thin layers of SLO or low grade iron ore at depth levels beyond 20 m which were considered not feasible for mining purpose and considered for ancillary area.

3.5 Quality/Grade:

Chemical analysis results of core samples received for various boreholes, the grade of different types of iron ore were computed borehole wise with cut off grade at + 55% Fe and 45%-55% Fe. Weighted averaging technique was used to obtain the average grade of all categories. Similarly average grade of each section line was obtained by taking weighted average of all the boreholes lying in that particular section line (Annexure - VI). Accordingly average grade of individual block was obtained. The Ore: OB ratio calculated for block is 1: 0.21 (Annexure -VII).

High Grade Ore (55% Fe cut off)	Fe: 61.071%	SiO <sub>2</sub> : 4.523%	Al <sub>2</sub> O <sub>3</sub> : 2.438%
Low grade ore (45 to 55% Fe)	Fe: 50.572 %	SiO <sub>2</sub> : 10.376 %	Al <sub>2</sub> O <sub>3</sub> : 8.885 %.

High Grade Ore (55% Fe cut off)	HLO(Lumps)	Fe: 63.569%, SiO <sub>2</sub> :1.723% Al <sub>2</sub> O <sub>3</sub> :2.439%.
	*SLO :	Fe:60.781 %, SiO <sub>2</sub> : 5.031% Al <sub>2</sub> O <sub>3</sub> :3.424 %.
	Blue dust	Fe: 65.467%, SiO <sub>2</sub> : 1.76% Al <sub>2</sub> O <sub>3</sub> : 1.684%.
Low grade ore (45 to 55% Fe)	SLO, Lateritic, limonitic, iron rich shale etc	Fe: 50.572 %, SiO <sub>2</sub> 10.376 % Al <sub>2</sub> O <sub>3</sub> : 8.885 %.

- SLO may be assumed as powdery ore though at times contain few lumps.

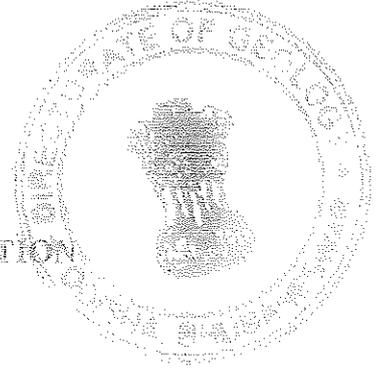
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Odisha, Bhubaneswar

CHAPTER - IV  
RESOURCE ESTIMATION AND CLASSIFICATION



4.1 RESOURCE ESTIMATION:

Two different methods were adopted for estimation of resource of Netrabandha Pahar iron ore block. 1. Transverse section method and 2. Horizontal Longitudinal Projection method. The total resource estimated by Transverse section method at 55% Fe cut off is 62.655 million tones and total resources of low grade ores between 45 to 55% Fe is 19.318 million tones. The different types of ore intersected in the boreholes are Hard Laminated Ore (HLO), Soft Laminated Ore (SLO), Lateritic ore, Limonitic ore and Blue dust. The Soft Laminated Ore being friable in nature is recovered in the form of powdery ore & fragments in the drill core. Though Hard Laminated Ore (HLO) is present as thin bands in some of the boreholes and resource has been calculated separately as lumps can be recovered. For all practical purposes the total resource has been estimated up to a datum level of 576 m above MSL considering the highest RL of 676 m aMSL. The estimation of resource & grade by the above two methods are discussed below.

4.1.i Transverse Section Method.

The cross sectional area method of resource estimation was adopted for the ore zone intersected in the boreholes. The area along individual cross sections is calculated graphically due to irregular nature of ore bodies. The tonnage has been calculated by considering average bulk density of various types of ore found to be 3.3, maximum being 7 m for HLO and minimum is 2.9 for SLO having Fe content from 45 % to < 55%. The bulk density has been determined for different ore types following the procedure of Bureau of Indian Standards "IS" 5842 (1986). The resource estimation charts for Netrabandha Pahar Iron ore Block for Blue dust, HLO, SLO at 55% Fe cut off and for the low grade ores at 45-55% Fe cut-off are given below. All total 8 section lines were prepared incorporating BHs. The influence length has been calculated as per disposition of the section lines.

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Blue dust



Section line/Bore hole No	Cross-sectional area in sq m	Strike influence (m)	Volume in cu m	Bulk density	Tonnage in tonnes	Avg. Grade for each line (Fe%)
AA'	4109	150	616350	3.3	2033955	68.05
BB'	3176	200	635200	3.3	2096160	66.260
CC'	10,014	200	2002800	3.3	6609240	65.651
DD'	0	200	0	3.3	0	62.326
EE'	2154	200	430800	3.3	1421640	65.785
FF'	5602	200	1120400	3.3	3697320	65.809
GG'	2226	200	445200	3.3	1469160	68.05
Total					17327475	65.647
					Or 17.327 mt	
- 20% towards accuracy in sampling and other variables					(-) 3.465 mt	
					13.862 mt	

High grade iron (at 55 % Fe cut off other than HLO & Blue dust)

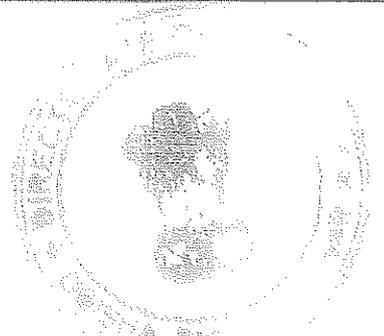
Section line/Bore hole No.	Cross-sectional area in sq m	Strike influence (m)	Volume in cu m	Bulk density	Tonnage in tonnes	Avg. Grade for each line (Fe%)
AA'	6176	150	926400	3.3	3057120	63.784
BB'	18701	200	3740200	3.3	12342660	62.4485
CC'	10625	200	2125000	3.3	7012500	60.704
DD'	11403	200	2280600	3.3	7525980	57.62033
EE'	3276	200	655200	3.3	2162160	61.191
FF'	10697	200	2139400	3.3	7060020	59.6584
GG'	12309	200	2461800	3.3	8123940	59.93625
HH'	25246	150	3786900	3.3	12496770	60.906
Total					59781150	60.781
					Or 59.781 mt	
- 20% towards accuracy in sampling, and other variables					(-) 11.956 mt	
Net resource					47.825 mt	

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HLO (Lumpy ore) (at 55 % cut off Fe)

Section line/Bore hole No.	Cross-sectional area in sq m	Strike influence (m)	Volume in cu m	Bulk density	Tonnage in tonnes	Avg. Grade for each section (Fe %)
BB'	568	200	113600	3.3	374880	63.618
GG'	1265	200	253000	3.3	834900	63.52
Total					1209780	63.569
					Or 1.21 mt	
- 20% towards accuracy in sampling and other variables					(-) 0.242 mt	
Net resource					0.968 mt	

#### 4.1.ii Horizontal Longitudinal Projection Method

Since the iron ore body is shallow dipping ( $< 45^{\circ}$ ), an alternate method of resource estimation viz: Horizontal Longitudinal projection method was also adopted to calculate the tonnage of iron ore (Annexure-IV) for comparison with the tonnage estimated by cross sectional method. Horizontal projections of the ore body are made along strike and the panel blocks were prepared by taking area of influence along strike as well as dip. The panel area of each block is calculated and multiplied with the ore zone thickness as intersected in the particular borehole falling within the panel to get the volume. The tonnage is calculated by multiplying volume with bulk density which was determined to be 3.3 (average) for all varieties of iron ores. The calculation chart for the blocks is given below. The barren areas in the panel blocks have been excluded for area calculation.

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Calculation chart for iron ore resource by Horizontal Longitudinal Projection method

High grade ore (More than 55% Fe)

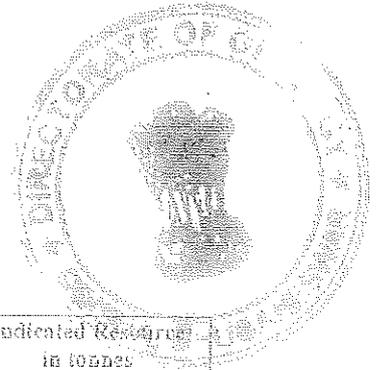
Block No	B.R. No	Panel area in m <sup>2</sup>	Bulk Density	Thickness in m	Indicated Resource in tonnes
1	27	23250	3.3	33.6	2577960
2	20	29700	3.3	27.75	2719777.5
5	10	40000	3.3	36.85	4864200
6	6	40000	3.3	36.4	4804800
8	8	31000	3.3	35.3	3611190
9	14	40000	3.3	42	5544000
10	1	40000	3.3	31.4	4144800
11	3	40000	3.3	14.85	1960200
12	7	31520	3.3	31.7	3297307.2
14	24	40000	3.3	0.8	105600
16	5	40000	3.3	46.7	6164400
17	9	38100	3.3	12.7	1596771
22	16	38950	3.3	16.9	2172241.5
23	21	28760	3.3	11.5	1091442
25	30	40000	3.3	18.5	2442000
26	13	40000	3.3	61	8052000
27	12	40000	3.3	3	396000
28	15	40000	3.3	6	792000
29	26	35420	3.3	5	584430
30	35	40000	3.3	6.2	818400
31	23	40000	3.3	53.6	7075200
32	17	40000	3.3	25.3	3339600
35	34	27430	3.3	2.6	235349.4
36	32	27450	3.3	38.75	3510168.75
37	22	27480	3.3	32.3	2929093.2
38	29	27500	3.3	1.9	172425
39	28	19860	3.3	14.8	969962.4
4	33	31220	3.3	8	824208
<b>Total</b>				655.4	76795525.95
Total Resource in Million tonnes					76.796 mt
20% less due to mining loss, Calculation error and human error					(-) 15.359 mt
Net resource in million tonnes					61.437 mt

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Odisha, Bhubaneswar*



Low grade ore (45 to 55% Fe)

Block No	B.H. No	Panel area in m <sup>2</sup>	Bulk Density	Thickness in m	Indicated Resource in tonnes
1	27	23250	3.3	2	153450
2	20	29700	3.3	2	196020
5	10	40000	3.3	4	528000
6	6	40000	3.3	3	396000
8	8	31000	3.3	1.65	168795
9	14	40000	3.3	6.2	818400
10	1	40000	3.3	4.5	594000
11	3	40000	3.3	9	1188000
12	7	31520	3.3	7.7	800923.2
14	24	40000	3.3	4	528000
16	5	40000	3.3	1	132000
17	9	38100	3.3	21.65	2722054.5
22	16	38950	3.3	9.8	1259643
23	21	28760	3.3	7	664356
25	30	40000	3.3	7.6	1003200
26	13	40000	3.3	11	1452000
27	12	40000	3.3	7.55	996600
28	15	40000	3.3	11	1452000
29	26	35420	3.3	12	1402632
30	35	40000	3.3	25.2	3326400
31	23	40000	3.3	6.6	871200
32	17	40000	3.3	1	132000
33	19	40000	3.3	13	1716000
34	25	31550	3.3	2.9	301933.5
35	34	27430	3.3	7	633633
36	32	27450	3.3	1	90585
39	28	19860	3.3	6.5	425997
				195.85	23953822.2
Total Resource in Million tonnes					23.954 mt
20% less due to mining loss, Calculation error and human error					(-) 4.791 mt
Net resource in million tonnes					19.163 mt

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Odisha, Bhubaneswar



The comparison in resource estimation by two different methods shows variation of 1.94% for iron ore having +55% Fe but in case of iron ore having 45-55 % Fe shows variation of 0.80% which may be attributed to occurrence of thin bands of low grade ore within the vertical profile sandwiched by either ferruginous shale or soft laminated ore. However the resource estimation by transverse section method is considered more appropriate for this block.

The maximum depth of exploration in the block is up to 77.5m but the resource has been estimated up to a datum level of 576 m above MSL. Based on the inputs of the General Exploration, and assessment thereof, the resource thus estimated can be categorized as indicated resource (G2 stage) of UNFC as per Minerals (Evidence and Mineral Content) Rules, 2015 which follows UNFC and CRISCO norms. The following Table shows the comparison between the resources estimated by two methods.

Netrabandha Pahar Iron ore Block	RESOURCE ( MILLION TONNES)	
	Transverse Section Method	Horizontal Longitudinal Projection Method
High Grade Ore (55% Fe cut off)	62.655	61.437
Low grade ore (45 to 55% Fe)	19.318	19.163
<b>Grand Total</b>	<b>81.973</b>	<b>80.60</b>

**Average Grade**

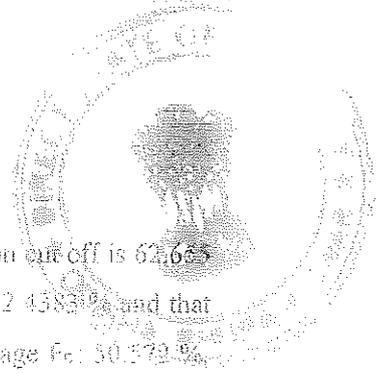
High Grade Ore (55% Fe cut off)	Fe: 61.071%, SiO <sub>2</sub> : 4.523 % and Al <sub>2</sub> O <sub>3</sub> : 2.438 %	Fe 61.416%, SiO <sub>2</sub> : 4.086 % and Al <sub>2</sub> O <sub>3</sub> : 2.472%
Low grade ore (45 to 55% Fe)	Fe: 50.572 %, SiO <sub>2</sub> 10.376 % Al <sub>2</sub> O <sub>3</sub> : 8.885 %.	Fe: 50.524 %, SiO <sub>2</sub> : 10.736% and Al <sub>2</sub> O <sub>3</sub> : 8.575%

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Odisha, Bhubaneswar



Hence the resource of Netrabandha pahar iron ore block at 55% iron cut off is 62.665 mt having average grade of total Fe, 61.071%, SiO<sub>2</sub>: 4.323 % and Al<sub>2</sub>O<sub>3</sub>: 2.4385% and that of low grade ores (45% - 55% Fe) of this block is 19.318 mt having average Fe: 50.572 %, SiO<sub>2</sub>: 10.376 % and Al<sub>2</sub>O<sub>3</sub>: 8.885 %. Out of 62.655 mt, estimated resource of HLO is 0.968 mt, SLO is 47.825 mt and that of Blue dust is 13.862 mt. Iron ores other than HLO and blue dust having +55 % Fe content may be assumed as powdery ore although small amount of lumpy variety encountered at places.

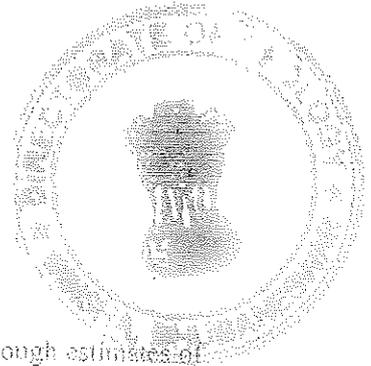
**Grade wise categorisation**

High Grade Ore (55% Fe cut off)	HLO(Lumps)	Fe: 63.569%, SiO <sub>2</sub> :1.723% Al <sub>2</sub> O <sub>3</sub> :2.439%.
	*SLO	Fe:60.781 %, SiO <sub>2</sub> : 5.031% Al <sub>2</sub> O <sub>3</sub> :3.424 %.
	Blue dust	Fe: 65.467%, SiO <sub>2</sub> : 1.76% Al <sub>2</sub> O <sub>3</sub> : 1.684%.
Low grade ore (45 to 55% Fe)	SLO, Lateritic, limonitic, iron rich shale etc	Fe: 50.572 %, SiO <sub>2</sub> 10.376 % Al <sub>2</sub> O <sub>3</sub> : 8.885 %.

- May be assumed as powdery ore though it contains few lumps

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Director of Geology  
Odisha, Bhubaneswar



#### 4.2 UNFC Classification

##### Economic axis (E)

Detailed geological study and general exploration has been made. Rough estimates of tonnage and grades are known. General idea about forest /non-forest and land use status is known. Economic Viability categories, however, cannot in general be defined from the Geological Study because of the lack of detail necessary for an Economic Viability evaluation. The resource quantities estimated may indicate that the deposit is of intrinsic economic interest, i.e. in the range of economic to potentially economic (E-3).

##### Feasibility Axis (F)

The area under investigation is well within the existing mining belt. The geographical conditions are favorable. Infrastructures like public utilities, roads & railways and manpower exists in the area. Geological study under G-2 stage has been carried out and can be sufficient for deciding whether a Pre-feasibility Study and Detailed Exploration are warranted. Hence the Feasibility axis can be F-3.

##### Geological axis (G)

The present work is under General Exploration which involves initial delineation of the ore deposit. Large scale mapping (1:2000 scale) and contour surveying are carried out at 2 m interval. Core sampling at 1 m interval have been done, Boreholes are widely spaced (200mX200m) tonnage, grade and mineral content estimated with reasonable level of confidence. Hence the present exploration in the geological axis may be put under G-2 category.

**Thus the UNFC code for this deposit may be 332 (Indicated Mineral resource)**

##### Mineral Resource

The iron ore resource of Netrabandha Pahar has not been upgraded to (111) category of UNFC classification. Hence, it does not fall under reserve category.

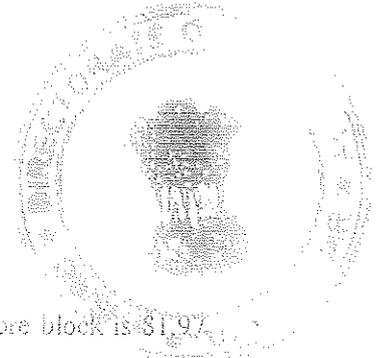
##### Pre-Feasibility study

The pre-feasibility study includes only geological study of the block. The other studies have to be carried out.

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Odisha, Bhubaneswar

CHAPTER - V  
CONCLUSION & RECOMMENDATIONS



1. The total resource of iron ore estimated for Netrabandha Pahar iron ore block is 81.97 million tonnes of all grades. Out of which iron ore having 55% Fe cut off is 62.655 million tonnes with average grade of Fe: 61.071%, SiO<sub>2</sub>:4.523%, Al<sub>2</sub>O<sub>3</sub>: 2.438% and that of low grade ores (45% - 55% Fe) of this block is 19.318 million tonnes having average Fe: 50.572 %, SiO<sub>2</sub> 10.376 %, Al<sub>2</sub>O<sub>3</sub>: 8.885 %. Out of 62.655 mt, resource of HLO is 0.968 mt with Fe: 63.569%, SiO<sub>2</sub>: 1.723 % and Al<sub>2</sub>O<sub>3</sub>: 2.439 %; SLO which may be considered as powdery ore is 47.825 mt with Fe: 60.781 %, SiO<sub>2</sub>: 5.031% Al<sub>2</sub>O<sub>3</sub>:3.424 % and that of Blue dust is 13.862 mt with Fe: 65.467%, SiO<sub>2</sub>: 1.76% and Al<sub>2</sub>O<sub>3</sub>: 1.684%.
2. The maximum explored depth in the block is up to 77.5 m but the resource of 81.97 million tonnes of all grades has been estimated up to 576 m above MSL datum level.
3. These resources estimated by General Exploration stage of UNFC comes under indicated mineral resource category (332) of UNFC.
4. The iron ore is found as alternate bands of Soft laminated ore and shale.
5. The thickness of ore zone increases along the down dip direction.
6. The comparison in resource estimation by two different methods shows minor variation of 1.94 % for iron ore having +55 % Fe and in case of iron ore having 45-55 % Fe shows variation of 0.80 % which may be attributed to occurrence of thin bands of low grade ore within the vertical profile sandwiched either by ferruginous shale or soft laminated ore.
7. The Ore: OB ratio calculated for block is 1: 0.21.

**Recommendation:**

1. Keeping in view of the high grade and thickness of ore body intersected in the boreholes, more close spaced boreholes may be drilled in the area to establish the subsurface geometry of iron ore bodies in the Block.
2. The ore zone intersection towards the down dip side shows continuity of ore body at depth. Hence few more boreholes may be planned along dip at 100 m interval to trace the ore body to the west.

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Odisha, Bhubaneswar,



3. The western part of the Netrabandha Pahar block exposes patches of laminated ore within ferruginous laterite. In some of the cross sections, the ore body is thick at depth towards down dip. Few more boreholes may be planned within the ferruginous laterite cover in the western part of the blocks, to assess the resource.

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Odisha, Bhubaneswar



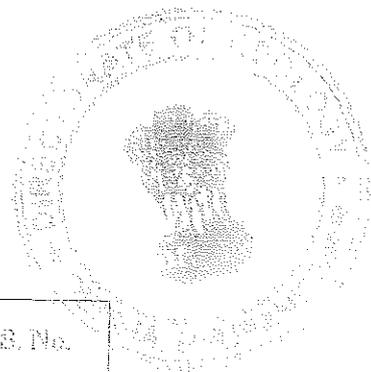
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Director of Geology  
Odisha, Bhubaneswar



**Annexure - I  
LOCALITY INDEX**

Sl. No.	Name of locality	Latitude (N)	Longitude (E)	T.S. No.
1	Baladihi	21°52'22"	85°18'05"	73 G/5
2	Bhaliadihi	21°52'45"	85°17'00"	73 G/5
3	Koira	21°54'32"	85°15'13"	73 G/5

**Annexure - II  
Borehole litho log and chemical assay log of Netrabandha Pahar Iron ore block,  
Sundargarh district**

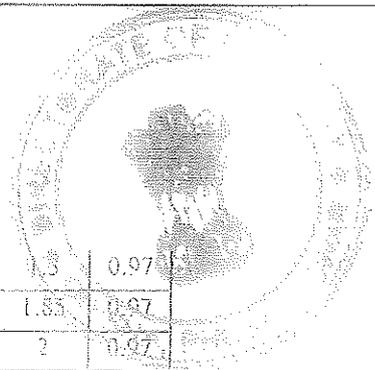
B.H. No. - 1					Date of Commencement - 07.01.2013				
Grid Location - 0/0					Date of Completion - 14.03.2013				
R.L. of B.H. Collar - 674.47 m					Total Depth - 36.00 m				
Depth of Water Table - -					Total Core Length - 36.00 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	1	1	1	SLO	3.96	4.5	57.16	8.62	0.32
1	2	1	1	SLO	4.13	3.4	59.38	6.15	0.65
2	3	1	1	SLO	2.95	2	62.16	4.68	0.65
3	4	1	1	SLO	2.56	3.26	62.16	3.88	0.32
4	5	1	1	SLO	4.66	5	57.16	7.12	0.65
5	6	1	1	SLO	7.94	8.7	50.5	8.7	0.65
6	7	1	1	SLO	6.42	4	56.61	4	0.65
7	8	1	1	SLO	2.02	1.56	63.82	1.56	0.32
8	9	1	1	SLO	1.81	3.14	64.93	1.12	0.32
9	10	1	1	SLO	2.46	1.56	62.16	1.56	0.65
10	11	1	1	SLO	1.66	0.58	66.66	0.96	0.16
11	12	1	1	SLO	2.11	2.3	62.17	5.37	0.16
12	13	1	1	SLO	2.99	2.88	61.61	4.62	0.32
13	14	1	1	SLO	2.38	4.16	62.17	3.26	0.16
14	15	1	1	SLO	3.16	4.76	58.28	7.09	0.32
15	16	1	1	SLO	2.88	2.26	62.17	4.2	0.32
16	17.5	1.5	1.5	SLO	4.96	9.42	52.09	8.8	0.48
17.5	18.5	1	1	Shale	-	30.86	25.76	17.89	0.65

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Cuttack, Bhubaneswar*



18.5	19.5	1	1	Blue dust	-	4.12	62.72	1.3	0.97
19.5	20.5	1	1	Blue dust	-	2.54	63.28	1.85	0.97
20.5	21.5	1	1	Blue dust	-	1.63	63.84	2	0.97
21.5	22.5	1	1	Blue dust	-	0.64	65.52	1.6	0.63
22.5	23.5	1	1	Blue dust	-	0.78	66.64	0.62	0.97
23.5	24.5	1	1	Blue dust	-	3.48	65.52	0.85	1.3
24.5	25.5	1	1	Blue dust	-	0.6	66.08	2	0.97
25.5	26.5	1	1	Blue dust	-	1.12	61.04	5.5	0.97
26.5	27.5	1	1	Blue dust	-	0.54	64.96	1.9	2.27
27.5	28.5	1	1	Blue dust	-	5.12	59.36	4.26	0.97
28.5	29.5	1	1	Blue dust	-	0.72	64.96	3.2	0.97
29.5	30.5	1	1	Blue dust	-	0.68	64.96	3	0.65
30.5	31.5	1	1	Blue dust	-	1.1	62.16	5	1.3
31.5	32.25	0.75	0.75	Blue dust	-	0.94	62.16	4.9	0.97
32.25	33.25	1	1	SLO	-	13.62	48.16	8.72	0.65
33.25	34.25	1	1	Blue dust	-	4.08	61.6	2.76	0.97
34.25	35.9	1.65	1.65	SLO	-	9.32	56.56	4.7	0.97
35.9	36	0.1	0.1	BHJ	-	-	-	-	-

<b>B.H. No. - 2</b>					<b>Date of Commencement - 03.02.2013</b>				
<b>Grid Location - 0/S400</b>					<b>Date of Completion - 15.02.2013</b>				
<b>R.L. of B.H. Collar - 676.635m</b>					<b>Total Depth - 37.70m</b>				
<b>Depth of Water Table - -</b>					<b>Total Core Length - 37.70m</b>				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	1.4	1.4	1.4	Laterite					
1.4	37.4	36	36	Shale	23.48	14.72	44.6	12.35	0.54
37.4	37.7	0.3	0.3	BHJ					

<b>B.H. No. - 3</b>					<b>Date of Commencement - 22.02.2013</b>				
<b>Grid Location - 0/E200</b>					<b>Date of Completion - 22.03.2013</b>				
<b>R.L. of B.H. Collar - 655.27m</b>					<b>Total Depth - 27.2 m</b>				
<b>Depth of Water Table - -</b>					<b>Total Core Length - 27.2 m</b>				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn

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Director of Geology  
Odisha, Bhubaneswar

0	0.3	0.3	0.3	Soil	-	-	-	-	-
0.3	1.3	1	1	SLO	9.25	6.6	49.77	8.98	0.32
1.3	2.3	1	1	SLO	4.37	1.5	61.93	3.4	0.16
2.3	3.3	1	1	SLO	3.63	1.56	63.59	2.23	Trace
3.3	4.3	1	1	SLO	3.24	2.2	61.38	4.29	-
4.3	5.3	1	1	SLO	3.01	2.29	61.93	3.2	-
5.3	6.3	1	1	SLO	4.29	2	59.73	3.26	0.16
6.3	7.3	1	1	SLO	4.87	1.9	58.06	5.63	0.16
7.3	8.3	1	1	SLO	6.39	10.8	50.32	6.99	0.32
8.3	9.3	1	1	SLO	4.52	6.1	55.3	7.08	0.32
9.3	10.3	1	1	SLO	6.99	12.3	47	9.83	0.32
10.3	11.3	1	1	SLO	6.46	18.8	43.68	8.18	0.16
11.3	12.3	1	1	SLO	4.11	9	53.08	7.14	0.32
12.3	13.3	1	1	SLO	4.02	9.1	52.53	7.13	0.16
13.3	14.3	1	1	Shale	5.42	19.7	44.51	6.89	0.32
14.3	15.3	1	1	Shale	4.22	22.34	40.64	10.62	0.32
15.3	16.3	1	1	SLO	3.67	12.2	54.19	3.16	0.16
16.3	17.3	1	1	SLO	5.49	16.8	45.89	7.32	0.32
17.3	18.3	1	1	SLO	5.16	16.52	47	6.14	0.32
18.3	19.3	1	1	SLO	3.74	13.18	54.74	2.18	0.32
19.3	20.3	1	1	SLO	2.88	6.26	60.55	1.18	0.16
20.3	21.3	1	1	SLO	1.67	3.36	64.14	0.55	-
21.3	22.3	1	1	SLO	2.42	3.86	63.04	1.12	-
22.3	23.3	1	1	SLO	0.6	1.52	68.01	-	-
23.3	24.3	1	1	SLO	1.05	2.8	65.8	0.38	0.16
24.3	25.3	1	1	SLO	1.14	2.78	65.25	0.56	0.16
25.3	26.3	1	1	SLO	1.16	3.22	64.69	0.66	0.16
26.3	27.15	0.85	0.85	SLO	2.16	13.22	55.29	1.1	0.32
27.15	27.2	0.05	0.05	BHJ	-	-	-	-	-

B.H. No. - 4				Date of Commencement - 18.03.2013					
Grid Location - 0/S200				Date of Completion - 22.03.2013					
R.L. of B.H. Collar - 669.71m				Total Depth - 10.00 m					
Depth of Water Table -				Total Core Length - 10.00 m					
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	1.1	1.1	1.1	Shale	8.72	12.02	34.28	25.7	0.32

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 Odisha, Bhubaneswar

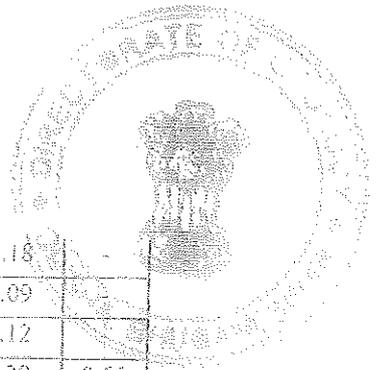


1.1	2.1	1	1	Shale	7.48	10.27	37.6	23.14	0.32
2.1	3.1	1	1	Shale	6.58	7.52	39.81	25.58	0.32
3.1	4.1	1	1	SLO	5.3	6.63	45.89	16.72	0.16
4.1	5.1	1	1	SLO	4.2	4.11	50.87	13.48	0.16
5.1	6	0.9	0.9	SLO	3.13	4.76	48.11	16.52	0.32
6	6.1	0.1	0.1	BHJ	-	-	-	-	-
6.1	10	3.9	3.9	Shale	-	-	-	-	-

B.H. No. - 5					Date of Commencement - 27.03.2013				
Grid Location - S200/E200					Date of Completion - 19.05.2013				
R.L. of B.H. Collar - 658.94m					Total Depth - 51.50m				
Depth of Water Table --					Total Core Length - 51.50m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	1	1	1	SLO	6.62	6	55.55	4.82	0.01
1	2	1	1	SLO	5.3	1.4	62.15	1.31	1.35
2	3	1	1	SLO	3.69	1.38	63.25	2.12	1.01
3	4	1	1	SLO	5.57	1.89	57.35	6.38	1.35
4	5	1	1	SLO	2.94	1.46	63.25	2.62	0.67
5	6	1	1	SLO	3.04	1.1	64.9	1.06	0.67
6	7	1	1	SLO	4.76	1.5	61.6	2.88	1.01
7	8	1	1	SLO	4.13	2.08	61.05	2.37	1.35
8	9	1	1	SLO	2.5	2.37	65.45	0.88	1.01
9	10	1	1	SLO	3.08	2.96	64.9	1.08	1.01
10	11	1	1	SLO	1.62	1.52	66.55	1.01	0.67
11	12	1	1	SLO	4.19	4.02	60.77	3.26	1.35
12	13	1	1	SLO	4	0.58	62.76	2.12	-
13	14	1	1	SLO	3.28	1.86	62.48	2.02	-
14	15	1	1	SLO	4.06	2.4	61.38	2.09	1.16
15	16	1	1	SLO	6.38	8.84	55.85	4.52	0.66
16	17	1	1	Shale	8.74	12.94	42.02	12.38	0.66
17	18	1	1	Shale	11.26	12.88	37.6	16.05	0.33
18	19	1	1	Shale	17.29	7.88	27.09	30.01	0.38
19	20	1	1	SLO	11.33	10.84	48.09	15.74	0.33
20	21	1	1	SLO	6.76	5.58	55.02	3.88	0.33
21	22	1	1	SLO	6.14	2.54	59.17	4.55	0.16
22	23	1	1	SLO	5.1	2.72	59.77	3.07	0.33
23	24	1	1	SLO	4.07	2.26	61.38	2.09	0.16

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Odisha, Bhubaneswar



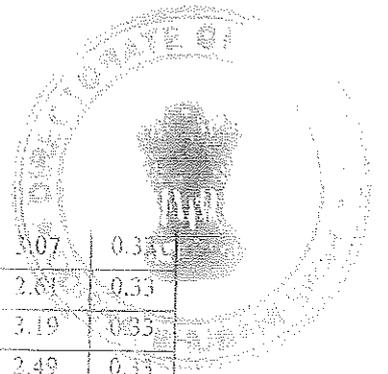
24	25	1	1	SLO	5.67	4.01	59.98	1.18	-
25	26	1	1	SLO	4.49	3.16	61.38	2.09	-
26	27	1	1	SLO	5.78	1.9	62.48	1.12	-
27	28	1	1	SLO	5.35	1.12	62.71	2.39	0.66
28	29	1	1	SLO	3.26	1	62.93	1.52	0.33
29	30	1	1	SLO	2.44	0.8	66.04	1.13	0.33
30	31	1	1	SLO	5.05	1.22	62.71	2.79	0.33
31	32	1	1	SLO	5.12	1.24	63.27	1.29	0.66
32	33	1	1	SLO	4.15	1.34	63.82	1.31	0.99
33	34	1	1	SLO	4.08	1.62	62.71	2.29	0.99
34	35	1	1	SLO	5.18	1.32	60.49	5.06	0.99
35	36	1	1	SLO	2.64	1.1	65.49	1.22	0.33
36	37	1	1	SLO	3.23	1.6	63.54	2.41	0.66
37	38.3	1.3	1.3	SLO	1.11	0.3	67.71	0.45	0.33
38.3	39.3	1	1	SLO	0.4	0.32	67.98	0.66	0.16
39.3	40.3	1	1	SLO	0.34	0.22	68.54	0.36	0.16
40.3	41.3	1	1	SLO	0.32	0.24	68.54	0.38	0.16
41.3	42.3	1	1	SLO	0.41	0.32	68.54	0.38	0.16
42.3	43.3	1	1	SLO	0.51	0.22	68.54	0.38	0.16
43.3	44.45	1.15	1.15	SLO	1.06	0.52	68.03	-	-
44.45	45.45	1	1	SLO	3.51	1.36	64.42	0.85	-
45.45	46.45	1	1	SLO	1.63	0.54	67.75	-	-
46.45	47.45	1	1	SLO	5.15	2.34	59.97	3.01	0.16
47.45	48.45	1	1	SLO	4.2	1.72	64.42	0.65	-
48.45	49.7	1.25	1.25	SLO	5	1.68	62.75	2.14	0.16
49.7	50.7	1	1	SLO	3.65	1.94	64.97	0.46	-
50.7	51.5	0.8	0.8	Shale	-	-	-	-	-

<b>B.H. No. - 6</b>					<b>Date of Commencement - 29.03.2013</b>				
<b>Grid Location - 0/N200</b>					<b>Date of Completion - 14.05.2013</b>				
<b>R.L. of B.H. Collar - 641.39m</b>					<b>Total Depth - 46.60m</b>				
<b>Depth of Water Table - -</b>					<b>Total Core Length - 46.60m</b>				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	1	1	1	SLO	4.16	9.42	57.2	2.17	0.33
1	2	1	1	SLO	6.27	4.18	61.09	0.31	0.33
2	3	1	1	SLO	6.3	9.1	55.53	2.15	0.33
3	4	1	1	Shale	10.5	20.82	43.87	3.71	0.33

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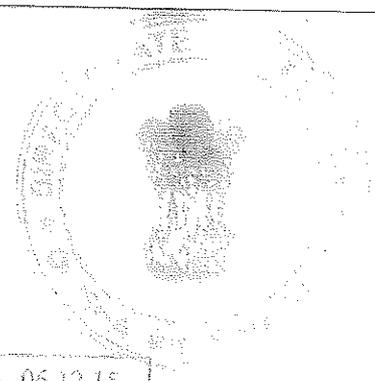
4	5	1	1	Shale	7.49	30.62	39.98	3.07	0.33
5	6	1	1	Shale	6.61	27.18	45.59	2.67	0.33
6	7	1	1	Shale	8	27.24	41.93	3.19	0.33
7	8	1	1	Shale	9	27.14	41.93	2.49	0.33
8	9	1	1	SLO	12.11	5.88	50.75	4.82	0.54
9	10	1	1	SLO	9.89	7.2	55.77	1.8	0.16
10	11	1	1	SLO	5.1	5.84	58.01	2.81	0.33
11	12	1	1	SLO	7.85	14.04	49.08	4.77	0.33
12	13	1	1	Shale	9.33	22.26	41.27	6.33	0.33
13	14	1	1	Shale	10.33	24.14	34.02	11.22	0.54
14	15	1	1	SLO	7.79	12.22	46.85	8.85	0.33
15	16	1	1	SLO	4.7	7.54	55.22	4.59	0.33
16	17	1	1	SLO	3.7	6.94	58.01	2.81	0.33
17	18	1	1	SLO	3.46	6.44	59.02	2	0.16
18	19	1	1	SLO	1.12	1	67.48	0.21	Trace
19	20	1	1	SLO	3.21	7.16	60.79	0.85	0.16
20	21	1	1	SLO	1.78	1.18	66.37	0.26	0.16
21	22	1	1	SLO	2.56	1.4	65.81	0.49	0.16
22	23	1	1	SLO	3.45	4.34	63.02	0.65	0.16
23	24	1	1	SLO	5.05	3.38	62.46	0.32	0.72
24	25	1	1	SLO	3.75	3.04	64.14	0.16	0.76
25	26	1	1	SLO	3.25	1.98	64.7	Trace	0.65
26	27	1	1	SLO	4.57	2.06	63.58	0.32	0.75
27	28	1	1	SLO	4.05	1.92	64.14	0.16	0.65
28	29	1	1	SLO	4.55	1.12	64.12	0.32	1.18
29	30	1	1	SLO	5	1.32	63.53	0.32	1.38
30	31	1	1	SLO	3.26	0.8	64.96	0.32	1.68
31	32	1	1	SLO	2.64	0.8	65.52	0.32	1.48
32	33	1	1	SLO	3.36	1.32	65.4	0.32	1.78
33	34	1	1	SLO	4.86	1	63.84	0.32	1.68
34	35	1	1	SLO	1.62	0.72	66.92	0.16	0.48
35	36.3	1.3	1.3	SLO	3.16	1	64.48	0.32	1.18
36.3	37.3	1	1	SLO	2.22	0.68	66.36	-	1.58
37.3	38.3	1	1	SLO	0.22	0.22	68.6	-	0.38
38.3	39.3	1	1	SLO	0.42	0.22	68.32	0.16	0.38
39.3	40.3	1	1	SLO	1	0.68	66.64	0.16	1.18
40.3	41.3	1	1	SLO	5.55	1.12	62.72	0.66	1.28
41.3	42.3	1	1	SLO	0.2	0.22	68.88	-	0.28
42.3	43.3	1	1	SLO	2	1	68.08	0.16	1.08
43.3	44.3	1	1	SLO	3.26	1.1	64.96	0.32	1.18
44.3	45.7	1.4	1.4	SLO	3.26	0.26	66.08	-	0.38
45.7	46.4	0.7	0.7	SLO(Blue)	3.22	-	59.36	0.66	2.22
46.4	46.6	0.2	0.2	BHJ	-	-	-	-	-

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B.H. No. - 7					Date of Commencement - 06.12.15				
Grid Location - 0/E400					Date of Completion - 07.01.16				
R.L. of B.H. Collar - 622.10 m					Total Depth - 45.50 m				
Depth of Water Table - 29.00 m					Total Core Length - 45.50 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	1	1	1	Laterite	5.23	17.88	47.39	7.15	0.34
1	2	1	1	Laterite	3.88	6.3	57.67	5.45	0.26
2	3	1	1	Laterite	8.02	10.48	46.82	12.7	0.26
3	4	1	1	Limonite	6.13	6.3	56.52	4.77	0.17
4	5	1	1	Limonite	13.04	11.84	43.96	10.4	0.17
5	6	1	1	Limonite	12.81	13.08	39.4	15.92	0.17
6	7	1	1	Limonite	13.04	16.34	35.4	17.98	0.17
7	8	1	1	SLO	13.3	9.3	45.11	10.9	0.17
8	9	1	1	SLO	11.54	9.54	46.82	10.13	0.17
9	10	1	1	SLO	10.2	7.38	49.67	9.65	0.17
10	11	1	1	SLO	6.33	3	58.36	5.31	0.17
11	12	1	1	SLO	6.02	2.08	62.32	0.93	0.17
12	13	1	1	Limonite	13.02	9.04	43.62	13.03	0.17
13	14	1	1	SLO	6.03	3.6	61.75	0.36	0.17
14	15	1	1	SLO	6.5	3.8	57.8	5.01	0.25
15	16	1	1	SLO	6.9	6.7	53.26	8.11	0.25
16	17	1	1	SLO	7.5	6.74	53.26	7.41	0.17
17	18.1	1.1	1.1	SLO	5.74	5.64	60.62	0.83	0.25
18.1	19.1	1	1	Limonite	13.77	4.4	40.16	9.72	0.25
19.1	20.1	1	1	Limonite	15.4	3.54	40.16	9.48	0.25
20.1	21.8	1.7	1.7	SLO	15.63	3.29	47.47	9.95	0.17
21.8	22.8	1	1	SLO	4.52	7.64	56.05	2.45	0.17
22.8	23.8	1	1	Blue dust	1.27	2.42	66.35	Nil	Nil
23.8	24.8	1	1	Blue dust	2.33	4.48	61.2	2.59	0.25
24.8	25.8	1	1	Blue dust	1.08	1.46	66.92	Nil	Nil
25.8	26.8	1	1	Blue dust	0.32	1.1	67.78	Nil	Nil
26.8	27.8	1	1	Blue dust	0.68	1	67.49	Nil	Nil
27.8	28.8	1	1	Blue dust	0.42	0.4	68.3	Nil	Nil
28.8	29.8	1	1	Blue dust	1	1.05	67.21	Nil	Nil
29.8	30.8	1	1	Blue dust	0.54	1.6	67.21	Nil	Nil
30.8	31.8	1	1	Blue dust	1.49	3.34	60.96	6.58	Nil

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31.8	32.8	1	1	Blue dust	0.59	1.4	67.89	0.08	Nil
32.8	33.8	1	1	Blue dust	0.77	1.5	67.37	0.12	Nil
33.8	34.8	1	1	Blue dust	0.79	1.9	66.23	1.25	Nil
34.8	35.8	1	1	Blue dust	0.69	0.82	67.89	0.08	Nil
35.8	36.8	1	1	Blue dust	0.81	1.2	67.89	0.08	Nil
36.8	37.8	1	1	Blue dust	0.84	1.2	67.89	0.04	Nil
37.8	38.8	1	1	Blue dust	0.85	1.46	66.23	1.55	Nil
38.8	39.8	1	1	Blue dust	0.83	0.98	67.89	0.08	Nil
39.8	40.8	1	1	Blue dust	0.69	1.24	67.89	0.05	Nil
40.8	41.8	1	1	Blue dust	0.87	1.38	67.34	0.17	Nil
41.8	42.8	1	1	Blue dust	0.96	2.14	65.13	2.43	Nil
42.8	43.8	1	1	Blue dust	2.94	11.86	55.19	5.03	Nil
43.8	44.8	1	1	Blue dust	1.7	4.06	62.92	2.88	Nil
44.8	45.4	0.6	0.6	Blue dust	1.3	2.08	66.79	0.06	Nil
45.4	45.5	0.1	0.1	BHJ					

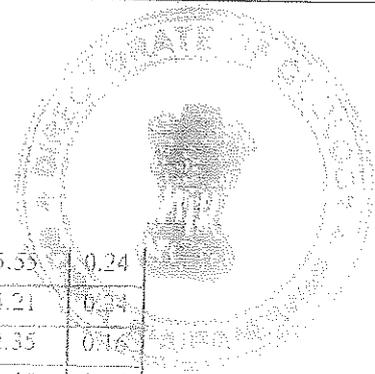
B.H. No. - 8					Date of Commencement - 13.12.15				
Grid Location - N200/E200					Date of Completion - 14.01.16				
R.L. of B.H. Collar - 631.02 m					Total Depth - 41.35 m				
Depth of Water Table - 35 m					Total Core Length - 41.35 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	1	1	1	Laterite	7.82	6.78	54	6.5	0.24
1	2	1	1	Laterite	9.45	5.46	54	6.08	0.32
2	3	1	1	Laterite	7.29	6.22	55.67	7.38	0.48
3	4.2	1.2	1.2	HLO	5.08	2.2	61.8	2.62	0.32
4.2	5.2	1	1	SLO	11.21	4.58	51.78	8.46	0.24
5.2	6	0.8	0.8	SLO	6.99	3.64	58.46	4.3	0.08
6	7	1	1	HLO	3.64	2.36	62.91	2.5	0.08
7	8	1	1	SLO	4.24	2.34	60.68	4.7	0.48
8	9	1	1	SLO	5.15	2.12	59.57	5.69	0.48
9	10	1	1	SLO	5.15	2.14	60.13	5.16	0.24
10	11	1	1	SLO	7.18	2.9	57.9	5.44	0.32
11	12	1	1	Shale	9.3	3.5	52.89	9.64	0.48
12	13	1	1	Shale	10.3	3.8	48.99	11.76	0.64
13	14	1	1	SLO	4.22	0.8	63.47	2.56	0.24
14	15	1	1	SLO	4.92	3.08	56.23	9.92	0.32
15	16	1	1	SLO	3.91	0.84	61.24	6.04	0.24

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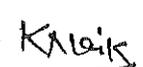
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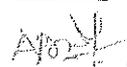


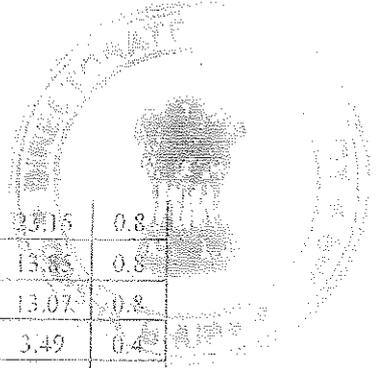
16	17	1	1	SLO	3.51	0.92	61.8	5.55	0.24
17	18	1	1	SLO	4.54	1.04	62.35	4.21	0.24
18	19	1	1	SLO	2.54	1.82	64.58	2.35	0.16
19	20	1	1	SLO	1.27	0.46	64.58	4.43	0.16
20	21	1	1	SLO	0.93	0.86	65.7	2.76	0.16
21	22	1	1	SLO	1.78	1.68	65.97	0.75	0.08
22	23	1	1	SLO	3.86	2.24	63.19	2.1	Nil
23	24	1	1	SLO	3.68	2.74	62.63	2.6	Nil
24	25	1	1	SLO	1.9	1.22	66.67	0.23	Nil
25	26	1	1	SLO	3.85	2.5	64.44	0.11	Nil
26	27	1	1	SLO	1.91	3.44	64.58	0.91	Nil
27	28	1	1	SLO	1.04	2.42	65.7	1.22	Nil
28	29	1	1	SLO	2.48	2.94	64.58	0.81	Nil
29	30	1	1	SLO	7.12	5.56	55.67	6.18	0.16
30	30.65	0.65	0.65	SLO	11.15	5.02	51.78	8.17	0.24
30.65	31.65	1	1	Blue dust	5.61	3.46	59.02	5.03	0.24
31.65	32.65	1	1	Blue dust	3.67	2.75	61.24	3.58	Nil
32.65	33.65	1	1	Blue dust	4.58	3.85	58.46	6.66	Nil
33.65	34.65	1	1	Blue dust	0.18	1.82	65.7	2.2	Nil
34.65	35.65	1	1	Blue dust	0.12	0.84	68.6	Nil	Nil
35.65	36.65	1	1	Blue dust	0.22	0.86	68.48	0.24	Nil
36.65	37.65	1	1	Blue dust	0.1	0.6	68.48	0.34	Nil
37.65	38.65	1	1	Blue dust	0.12	0.9	68.48	0.24	Nil
38.65	39.65	1	1	Blue dust	0.32	2.08	65.14	2.81	Nil
39.65	40.95	1.3	1.3	Blue dust	0.22	1.3	67.37	1.33	Nil
40.95	41.35	0.4	0.4	BHJ	0.52	6.98	51.78	8.6	Nil

B.H. No. - 9					Date of Commencement - 10.01.16				
Grid Location - S200/E400					Date of Completion - 21.02.16				
R.L. of B.H. Collar - 626.95 m					Total Depth - 49.20 m				
Depth of Water Table - 16.00 m					Total Core Length - 49.20 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	1.4	1.4	1.4	Soil	-	-	-	-	-
1.4	2.4	1	1	SLO	6.29	5.12	55.9	3.79	0.4
2.4	3.4	1	1	Shale	7.65	8.46	48.65	8.98	0.4
3.4	4.4	1	1	Shale	9.19	17.84	40.26	9.33	0.64



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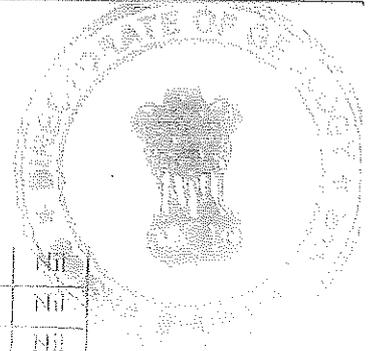
4.4	5.4	1	1	Shale	10.37	22.34	27.4	29.16	0.8
5.4	6.4	1	1	Shale	10.38	25.24	30.75	13.85	0.8
6.4	7.2	0.8	0.8	Shale	8.51	17.55	38.58	13.07	0.8
7.2	8.2	1	1	SLO	5.36	4.96	56.48	3.49	0.4
8.2	9.5	1.3	1.3	SLO	5.67	5.3	55.08	6.19	0.4
9.5	10.5	1	1	Shale	10.36	14.66	39.14	13.27	0.8
10.5	11.5	1	1	Shale	10.81	19	35.27	17.3	0.96
11.5	12.5	1	1	SLO	8.12	11.08	46.41	9.08	0.8
12.5	13.5	1	1	SLO	9.11	7.68	48.37	8.69	0.64
13.5	14.5	1	1	SLO	6.36	3.2	61.79	4.14	0.64
14.5	15.5	1	1	SLO	9.11	13.18	48.65	4.08	0.8
15.5	16.5	1	1	SLO	13.37	8.06	46.69	7.26	1.12
16.5	17.5	1	1	SLO	13.26	3.62	51.44	4.29	0.8
17.5	18.5	1	1	SLO	13.81	1.72	52.75	6.22	1.6
18.5	19.5	1	1	SLO	14.03	3.28	48.43	10.43	1.76
19.5	20.5	1	1	SLO	14.15	4.28	46.11	13.21	1.2
20.5	21.5	1	1	Shale	14.59	6.46	41.2	17.83	1.2
21.5	22.5	1	1	Shale	12.62	7.38	43.98	14.69	0.96
22.5	23.5	1	1	SLO	14.09	4.92	45.09	12.5	0.96
23.5	24.5	1	1	SLO	10.97	5.94	49.55	8.73	0.96
24.5	25.5	1	1	SLO	10.49	3.6	54.56	5.93	1.2
25.5	26.8	1.3	1.3	SLO	8.59	6.08	52.33	8.85	0.56
26.8	27.8	1	1	SLO	15.13	3.36	45.65	12.06	2
27.8	29	1.2	1.2	Shale	13.24	10.9	41.75	11.53	2
29	30	1	1	SLO	3.33	6.78	58.46	5	0.16
30	31	1	1	SLO	2.62	5.36	62.91	0.58	0.16
31	32	1	1	SLO	1.56	3.14	64.03	2.41	Nil
32	33	1	1	SLO	1.96	2.86	64.03	2.21	Nil
33	34	1	1	SLO	1.68	4.82	64.03	1.68	Nil
34	35	1	1	SLO	2.16	4.3	62.63	2.33	Nil
35	36.4	1.4	1.4	SLO	3.2	7.86	58.46	3.76	Nil
36.4	36.95	0.55	0.55	Limonite	5.71	24.02	42.31	8.07	Nil
36.95	37.95	1	1	Shale	8.35	21.58	38.97	12.73	Nil
37.95	38.95	1	1	Shale	6.76	15.36	43.98	13.35	Nil
38.95	39.95	1	1	SLO	6.12	16.44	46.77	8.96	Nil
39.95	40.95	1	1	SLO	6.29	15.02	46.21	11.02	Nil
40.95	41.95	1	1	SLO	3.65	7.4	54.56	9.45	Nil
41.95	42.95	1	1	SLO	3.97	8.6	55.12	6.87	Nil
42.95	43.95	1	1	SLO	4.72	8.94	53.45	8.36	Nil
43.95	44.95	1	1	SLO	4.74	10.48	51.22	10.88	Nil

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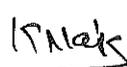
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Odisha, Bhubaneswar



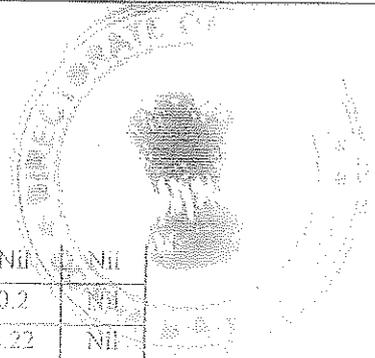
44.95	45.95	1	1	SLO	5.59	15.1	48.44	8.17	Nil
45.95	46.95	1	1	SLO	4.05	12.82	52.06	6.99	Nil
46.95	48.3	1.35	1.35	SLO	3.75	10	54.84	6.19	Nil
48.3	49.2	0.9	0.9	Shale	-	-	-	-	-

B.H. No. - 10					Date of Commencement - 20.01.16				
Grid Location - N200/W200					Date of Completion - 03.03.16				
R.L. of B.H. Collar - 642.79 m					Total Depth - 51.00 m				
					Total Core Length - 51.00 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
1	2	3	4	5	6	7	8	9	10
0	1	1	1	Laterite	9.82	4	50.11	12.8	Nil
1	2	1	1	Laterite	6.52	1.92	55.67	6.84	Nil
2	3	1	1	HLO	3.12	1.12	61.24	4.68	Nil
3	4	1	1	SLO	8.58	3	52.33	10.61	Nil
4	5	1	1	Shale	11.82	5.9	41.44	18.19	Nil
5	6	1	1	Shale	13.27	7.74	39.7	17.93	0.64
6	7	1	1	Shale	13.05	8.28	40.8	16.06	0.64
7	8	1	1	Shale	10.77	10.56	42.48	15.66	0.64
8	9	1	1	SLO	5.82	2.94	57.01	7.44	0.28
9	10	1	1	SLO	7.97	6.26	49.19	13.51	0.4
10	11	1	1	SLO	5.18	3.04	55.9	10.06	0.16
11	12	1	1	SLO	2.36	1.6	63.16	4.05	0.2
12	13	1	1	SLO	4.61	1.52	58.69	7.58	0.16
13	14	1	1	SLO	3.21	1.8	60.93	5.98	0.16
14	15	1	1	SLO	4.24	3.7	58.13	7.14	0.2
15	16	1	1	SLO	4.3	6.8	51.98	11.97	0.36
16	17	1	1	SLO	3.3	6.4	59.25	1.38	0.16
17	18	1	1	SLO	1.51	3.06	64.84	1.27	0.08
18	19	1	1	SLO	3.33	6.36	54.22	10.38	0.24
19	20	1	1	SLO	3.43	4.3	60.93	2.82	0.12
20	21	1	1	SLO	2.01	3.98	62.82	2.72	Nil
21	22	1	1	SLO	0.71	1.74	67.17	0.1	Nil
22	23	1	1	SLO	1.7	1.12	67.17	Nil	Nil
23	24	1	1	SLO	2.34	1.64	65.99	0.2	Nil
24	25	1	1	SLO	2.6	2.38	64.5	1.32	Nil
25	26	1	1	SLO	1.87	1.34	66.62	0.2	Nil



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26	27	1	1	SLO	1.4	1.34	67.17	Nil	Nil
27	28	1	1	SLO	1.28	1.16	67.17	0.2	Nil
28	29.3	1.3	1.3	SLO	2.64	2.36	63.94	2.22	Nil
29.3	30.3	1	1	SLO	2.35	1.28	66.6	Nil	Nil
30.3	31.3	1	1	SLO	1.51	1.3	67.17	Nil	Nil
31.3	32.3	1	1	SLO	1.74	0.82	66.75	0.6	Nil
32.3	33.3	1	1	SLO	2.59	1	65.62	1.12	Nil
33.3	33.95	0.65	0.65	SLO	4.96	3.9	61.7	1.2	0.32
33.95	34.7	0.75	0.75	Shale	12.54	25.54	30.84	15.78	0.64
34.7	35.7	1	1	HLO	0.2	1.2	67.94	Nil	Nil
35.7	37.1	1.4	1.4	HLO	2.52	1.42	65.42	0.31	Nil
37.1	38.1	1	1	Shale	7.89	20.52	40.26	11.29	Nil
38.1	39.1	1	1	Shale	9.95	21.6	33.27	14.7	Nil
39.1	40.1	1	1	Shale	9.1	18.84	34.95	20	Nil
40.1	41.3	1.2	1.2	Shale	7.56	13.28	43.61	10.11	Nil
41.3	42.3	1	1	Blue dust	2.46	1.62	65.42	0.21	Nil
42.3	43.3	1	1	Blue dust	Nil	0.72	68.22	Nil	Nil
43.3	44.3	1	1	Blue dust	2.27	1.28	65.7	Nil	Nil
44.3	45.3	1	1	Blue dust	1.57	0.42	67.38	Nil	Nil
45.3	46.3	1	1	Blue dust	Nil	1.02	68.22	Nil	Nil
46.3	47.3	1	1	Blue dust	Nil	0.94	68.22	Nil	Nil
47.3	48.3	1	1	Blue dust	0.6	1.22	67.66	Nil	Nil
48.3	49.3	1	1	Blue dust	0.63	1.42	66.54	Nil	Nil
49.3	50.3	1	1	Blue dust	0.2	0.7	68.22	Nil	Nil
50.3	50.8	0.5	0.5	Blue dust	0.22	0.68	68.22	Nil	Nil
50.8	51	0.2	0.2	BHJ					

B.H. No. - 11					Date of Commencement - 01.03.16				
Grid Location - S400/E200					Date of Completion - 27.03.16				
R.L. of B.H. Collar - 658.18 m					Total Depth - 35.20 m				
					Total Core Length - 35.20 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	1	1	1	Laterite	6.5	9.26	53.12	7.07	0.32
1	2.4	1.4	1.4	Laterite	9.19	7.2	51.72	8.37	0.32
2.4	3.4	1	1	Laterite	11.71	16.6	39.7	12.99	0.48
3.4	4.4	1	1	Shale	10.38	16.38	39.98	14.75	0.32
4.4	6	1.6	1.6	Shale	9.73	14.42	42.22	13.95	0.32
6	7	1	1	Shale	6.84	12.1	48.09	10.86	0.32

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7	8	1	1	Shale	8.05	20.32	38.86	14.27	0.32
8	9	1	1	Shale	5.03	10.5	35.23	32.44	0.32
9	10	1	1	Shale	5.02	11.14	51.16	9.19	0.4
10	11	1	1	Shale	6.53	16.04	44.73	11.66	0.32
11	12	1	1	Shale	6.53	16.64	42.22	14.67	0.4
12	13	1	1	Shale	9.4	14.72	36.34	22.16	0.4
13	14	1	1	Shale	14.94	16.32	25.16	31.06	0.48
14	15	1	1	Shale	13.93	13.36	26.84	32.29	0.56
15	16	1	1	Shale	11.48	22.3	25.72	26.71	1.04
16	17	1	1	Shale	11.11	26.8	21.25	28.34	0.64
17	18	1	1	Shale	10.21	21.72	28.51	23.29	0.56
18	19	1	1	Shale	7.41	12.2	43.61	16.19	0.48
19	35	16	16	Shale	-	-	-	-	-
35	35.2	0.2	0.2	BHJ					

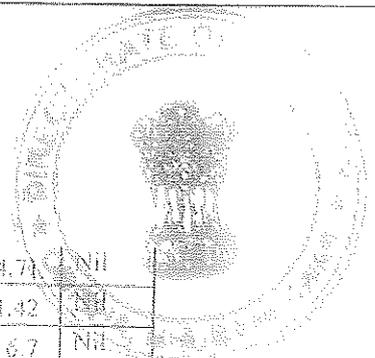
<b>B.H. No. - 12</b>					<b>Date of Commencement - 04.03.16</b>				
<b>Grid Location - S600/E200</b>					<b>Date of Completion - 08.04.16</b>				
<b>R.L. of B.H. Collar - 655.695 m</b>					<b>Total Depth - 33m</b>				
					<b>Total Core Length - 33 m</b>				
<b>Depth in m</b>		<b>Total in m</b>	<b>Core recovery in m</b>	<b>Lithology</b>	<b>Chemical assay values in Percentage</b>				
<b>From</b>	<b>To</b>				<b>L.O.I.</b>	<b>SiO<sub>2</sub></b>	<b>Fe</b>	<b>Al<sub>2</sub>O<sub>3</sub></b>	<b>Mn</b>
0	1	1	1	Laterite	4.02	8.32	56.2	5.24	0.35
1	2	1	1	Laterite	14.85	15.88	28.52	23.48	0.35
2	3	1	1	Laterite	12.25	24.31	28.66	17.63	0.26
3	4	1	1	Laterite	11.93	23.69	28.38	18.28	0.17
4	5	1	1	Laterite	12.21	21.48	30.06	18.63	0.17
5	5.8	0.8	0.8	Laterite	12.07	19.96	31.19	19.86	0.35
5.8	6.8	1	1	SLO	5.96	7.53	53.95	8.78	0.26
6.8	7.8	1	1	Shale	10.67	12.65	42.15	14.59	0.26
7.8	8.8	1	1	SLO	10.77	5.74	48.61	12.8	0.26
8.8	10	1.2	1.2	Shale	10.2	14.87	41.3	13.95	0.26
10	11	1	1	SLO	12.7	4.29	49.45	9.21	0.26
11	12	1	1	SLO	12.03	2.57	51.7	9.29	0.26
12	13	1	1	SLO	12.54	5.23	48.33	10.18	0.26
13	14	1	1	Shale	Nil	3.36	44.76	17.24	Nil
14	15	1	1	SLO	8.75	4.06	57.79	1.62	Nil
15	16.45	1.45	1.45	Shale	-	-	-	-	-

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16.45	17.45	1	1	SLO	5.86	4.04	58.08	4.71	Nil
17.45	18.45	1	1	SLO	4.29	6.04	59.78	1.42	Nil
18.45	19	0.55	0.55	SLO	5.84	2.16	47.59	16.7	Nil
19	20	1	1	SLO	11.5	3.52	48.16	6.08	Nil
20	32.8	12.8	12.8	Shale	-	-	-	-	Nil
32.8	33	0.2	0.2	BHJ	-	-	-	-	-

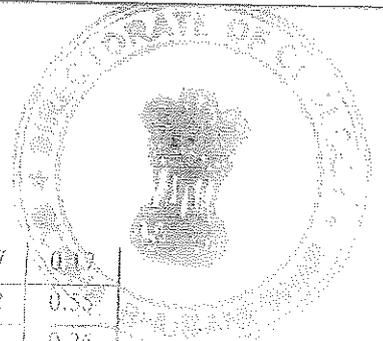
B.H. No. - 13					Date of Commencement - 06.03.16				
Grid Location - 0/S600					Date of Completion - 19.05.16				
R.L. of B.H. Collar - 669.71m					Total Depth - 77.5 m				
Depth of Water Table - 70.5 m					Total Core Length - 77.5 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
1	2	3	4	5	6	7	8	9	10
0	1	1	1	Shale	9.51	19.56	40.74	8.88	0.35
1	2	1	1	SLO	7.65	4.08	53.95	7.17	0.35
2	3	1	1	SLO	11.43	5.25	49.45	8.98	0.35
3	4	1	1	Shale	14.01	10.28	39.34	17.43	0.35
4	5	1	1	SLO	5.96	4.89	56.76	5.18	0.35
5	6	1	1	SLO	5.23	2.18	59.57	4.81	0.35
6	7	1	1	SLO	9.31	3.29	52.54	9.59	0.35
7	8	1	1	SLO	5.6	2.13	56.8	7.15	0.35
8	9	1	1	SLO	5.23	1.64	54.56	12.62	0.35
9	10	1	1	SLO	4.93	4.29	55.27	8.38	0.17
10	11	1	1	SLO	4.11	2.08	59.22	6.54	0.35
11	12	1	1	SLO	4.84	3.35	57.52	7.28	0.35
12	13	1	1	SLO	5.46	1.98	55.97	9.49	0.26
13	14	1	1	SLO	7.54	5.38	48.5	14.50	0.26
14	15	1	1	SLO	3.95	2.02	58.93	7.88	0.17
15	16	1	1	SLO	2.64	1.05	60.63	8.14	0.26
16	17	1	1	SLO	3.64	1.04	60.34	7.18	0.26
17	18	1	1	SLO	5.46	0.87	59.09	7.25	0.17
18	19	1	1	SLO	4.17	0.82	61.63	5.32	0.17
19	20	1	1	SLO	2.74	0.7	64.87	2.86	0.17
20	21	1	1	SLO	2.98	0.56	64.17	2.98	0.17
21	22	1	1	SLO	5.85	0.98	58.1	8.48	0.17
22	23	1	1	SLO	5.16	3.22	57.11	6.54	0.17
23	24	1	1	SLO	6.71	6.84	52.18	8.75	0.17
24	25	1	1	SLO	3.6	5.58	59.51	3.20	0.17

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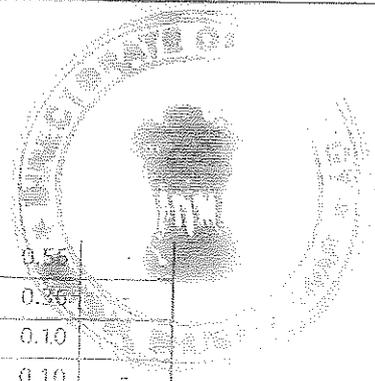
25	26	1	1	SLO	5.76	14.75	50.2	4.37	0.17
26	27	1	1	Shale	6.62	23.65	42.73	3.62	0.55
27	28	1	1	Shale	6.28	22.85	43.72	4.34	0.26
28	29	1	1	SLO	2.11	6.48	61.2	1.18	0.17
29	30	1	1	SLO	3.3	10.35	52.46	7.56	0.17
30	31	1	1	SLO	3.98	15.42	52.74	2.40	0.17
31	32	1	1	SLO	5.52	18.79	47.38	3.45	0.17
32	33	1	1	Shale	5.8	24.18	43.72	3.25	0.26
33	34	1	1	SLO	2.38	10.14	58.81	1.20	0.17
34	35	1	1	SLO	1.11	3.62	65.29	0.52	0.17
35	36	1	1	SLO	0.6	2.28	66.56	0.25	0.17
36	37	1	1	SLO	1.05	2.65	65.44	1.18	0.17
37	38	1	1	SLO	1.1	3.28	65.71	0.50	-
38	39	1	1	SLO	0.98	1.88	66.83	0.59	-
39	40	1	1	SLO	0.89	2.28	66.83	0.19	-
40	41	1	1	SLO	4.4	13.94	49.42	9.07	-
41	42	1	1	Blue dust	1.43	3.46	64.59	1.40	-
42	43	1	1	Blue dust	0.79	2.5	66.83	0.19	-
43	44	1	1	Blue dust	1.37	4.3	64.59	0.90	-
44	45	1	1	Blue dust	0.77	2.24	66.27	2.09	-
45	46	1	1	Blue dust	0.83	3.04	65.99	1.00	-
46	47	1	1	Blue dust	0.84	2.76	65.99	0.70	-
47	48	1	1	Blue dust	1.14	1.46	67.11	0.21	-
48	49	1	1	Blue dust	0.48	0.94	67.95	0.12	-
49	50	1	1	Blue dust	1.73	1.36	66.83	0.10	-
50	51	1	1	Blue dust	0.88	2.06	66.83	0.21	-
51	52	1	1	Blue dust	0.65	1.48	67.4	0.21	-
52	53	1	1	Blue dust	0.71	2.62	66.55	0.11	-
53	54	1	1	Blue dust	1.15	3.4	65.71	0.15	-
54	55	1	1	Blue dust	1.38	3.14	64.02	1.95	-
55	56	1	1	Blue dust	1.13	2.68	65.71	0.81	-
56	57	1	1	Blue dust	0.53	1.08	67.95	0.10	-
57	58	1	1	Blue dust	0.74	1.42	67.4	0.11	-
58	59	1	1	Blue dust	1.15	3.8	65.15	0.43	-
59	60	1	1	Blue dust	2.93	10.76	55.6	5.11	-
60	61	1	1	Blue dust	1.37	4.83	63.46	1.56	-
61	62	1	1	Blue dust	1.54	4.8	61.78	3.86	-
62	63	1	1	Blue dust	0.97	3.06	65.43	0.93	-
63	64	1	1	Blue dust	1.26	2.92	65.71	0.43	-
64	65	1	1	Blue dust	1	2.9	65.55	0.85	-

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65	66	1	1	Blue dust	1.06	2.7	65.99	0.56	-
66	67	1	1	Blue dust	0.7	1.68	67.11	0.36	-
67	68	1	1	Blue dust	0.65	2.08	67.08	0.10	-
68	69	1	1	Blue dust	1	1.8	67.08	0.10	-
69	70	1	1	Blue dust	1.2	2.04	66.7	0.09	-
70	71	1	1	Blue dust	1.3	4.08	67.08	1.30	-
71	72	1	1	Blue dust	1.03	3.14	64.84	1.84	-
72	73	1	1	Blue dust	0.99	2.12	66.7	0.09	-
73	74	1	1	Blue dust	1.07	3.32	65.4	0.74	-
74	75	1	1	Blue dust	0.98	3.04	65.4	1.14	-
75	76	1	1	Blue dust	0.8	1.88	66.7	0.59	-
76	77	1	1	Blue dust	0.64	2	67.08	0.15	-
77	77.5	0.5	0.5	BHJ	-	-	-	-	-

<b>B.H. No. - 14</b>					<b>Date of Commencement - 15.03.16</b>				
<b>Grid Location - 0/W200</b>					<b>Date of Completion - 16.05.16</b>				
<b>R.L. of B.H. Collar - 673.850 m</b>					<b>Total Depth - 76.60m</b>				
					<b>Total Core Length - 76.60 m</b>				
<b>Depth in m</b>		<b>Total in m</b>	<b>Core recovery in m</b>	<b>Lithology</b>	<b>Chemical assay values in Percentage</b>				
<b>From</b>	<b>To</b>				<b>L.O.I.</b>	<b>SiO<sub>2</sub></b>	<b>Fe</b>	<b>Al<sub>2</sub>O<sub>3</sub></b>	<b>Mn</b>
0	7.3	7.3	7.3	Shale	-	-	-	-	-
7.3	8.3	1	1	Laterite	2.94	4.68	59.83	4.99	0.32
8.3	9.5	1.2	1.2	Shale	11.51	26.6	26.28	22.76	0.08
9.5	10.5	1	1	Laterite	6.07	15.04	45.29	12.46	0.16
10.5	11.3	0.8	0.8	Laterite	3.55	9.9	55.36	5.55	0.32
11.3	12	0.7	0.7	Shale	7.82	22.82	36.34	15.51	0.16
12	13	1	1	Laterite	3.68	4.74	57.03	8.44	0.16
13	14	1	1	Laterite	4.42	10.44	52	9.18	0.16
14	15.6	1.6	1.6	Laterite	4.98	9.8	51.44	9.91	0.32
15.6	16.3	0.7	0.7	Shale	7.29	17.66	38.58	18.28	0.08
16.3	17.3	1	1	SLO	4.59	12.1	49.77	10.56	0.16
17.3	18.3	1	1	SLO	4.13	11.74	52	8.14	0.08
18.3	19.5	1.2	1.2	SLO	3.83	10.22	53.12	8.4	0.16
19.5	23.3	3.8	3.8	Shale	-	-	-	-	-
23.3	24.1	0.8	0.8	SLO	2.51	5.6	59.53	4.57	0.16
24.1	27.2	3.1	3.1	Shale	-	-	-	-	-
27.2	27.9	0.7	0.7	SLO	1.49	0.8	67.4	Nil	Nil
27.9	28.6	0.7	0.7	Shale	3.16	26.76	37.07	14.83	0.4

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28.6	29.6	1	1	SLO	7.59	4.72	58.9	2.13	Trace
29.6	30.8	1.2	1.2	SLO	2.38	2.9	63.46	3.03	0.56
30.8	33.75	2.95	2.95	Shale	8.4	19.02	38.19	15.03	0.4
33.75	34.75	1	1	SLO	1.39	0.82	66.83	Nil	Nil
34.75	35.75	1	1	SLO	1.59	0.86	65.43	2.1	0.4
35.75	36.75	1	1	SLO	1.61	0.92	66.83	Nil	Nil
36.75	38.4	1.65	1.65	SLO	3.05	0.94	63.46	3.31	0.4
38.4	39.4	1	1	Shale	8.8	12.14	40.44	17.66	0.96
39.4	40.4	1	1	Shale	10.43	25.44	25.83	23.64	0.64
40.4	41.6	1.2	1.2	Shale	11.32	17.42	29.2	22.87	0.4
41.6	42.6	1	1	SLO	2.99	1.74	61.78	5.16	0.88
42.6	43.6	1	1	SLO	5.25	1.18	57.29	8.34	0.4
43.6	44.6	1	1	SLO	1.3	1.02	66.83	Nil	Nil
44.6	45.6	1	1	Shale	7.85	9.32	44.45	17.5	0.48
45.6	46.6	1	1	SLO	8.75	3.12	49.21	15.78	0.8
46.6	47.6	1	1	SLO	2.2	2.2	64.86	1.25	0.16
47.6	48.6	1	1	SLO	3.65	7.28	55.92	7.47	0.32
48.6	49.6	1	1	SLO	2.33	1.46	58.15	7.24	0.16
49.6	50.6	1	1	SLO	6.51	8.74	49.21	12.32	0.96
50.6	51.6	1	1	SLO	0.83	Nil	68.78	Nil	Nil
51.6	52.6	1	1	SLO	1.76	1.56	65.42	1.55	0.16
52.6	53.6	1	1	SLO	8.6	2.02	48.09	18.64	0.64
53.6	54.6	1	1	Blue dust	2.4	1.48	64.58	2.41	Nil
54.6	55.6	1	1	Blue dust	1.37	0.74	67.94	Nil	0.16
55.6	56.6	1	1	Blue dust	2.42	1.02	64.86	2.15	0.16
56.6	57.6	1	1	Blue dust	1.9	0.88	65.98	1.41	Nil
57.6	58.6	1	1	Blue dust	3.98	0.64	61.51	6.36	0.24
58.6	59.6	1	1	Blue dust	0.8	Nil	68.78	Nil	Nil
59.6	60.6	1	1	Blue dust	0.8	Nil	68.78	Nil	Nil
60.6	61.6	1	1	Blue dust	0.48	0.3	68.22	0.21	Nil
61.6	62.6	1	1	Blue dust	0.51	Nil	68.78	Nil	Nil
62.6	63.6	1	1	Blue dust	0.7	Nil	68.5	Nil	Nil
63.6	64.6	1	1	Blue dust	0.46	Nil	68.78	Nil	Nil
64.6	65.6	1	1	Blue dust	0.7	0.21	67.66	1.02	Nil
65.6	66.6	1	1	Blue dust	0.42	Nil	68.78	Nil	Nil
66.6	67.6	1	1	Blue dust	1.28	Nil	68.22	Nil	Nil
67.6	68.6	1	1	Blue dust	2.84	2.22	64.02	2.01	Nil
68.6	69.6	1	1	Blue dust	1.93	1.86	64.86	1.74	Nil
69.6	70.6	1	1	Blue dust	1.22	0.2	67.66	0.42	Nil
70.6	71.6	1	1	Blue dust	0.78	Nil	68.5	Nil	Nil

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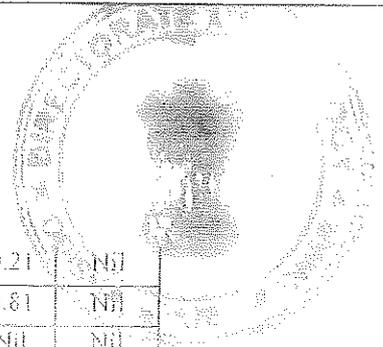
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Chitoba, Mumbai, India

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71.6	72.6	1	1	Blue dust	0.55	0.2	68.22	0.21	Nil
72.6	73.6	1	1	Blue dust	0.36	1.45	67.1	0.81	Nil
73.6	74.6	1	1	Blue dust	0.52	Nil	68.5	Nil	Nil
74.6	75.6	1	1	Blue dust	0.37	Nil	68.78	Nil	Nil
75.6	76.5	0.9	0.9	Blue dust	0.46	Nil	68.78	Nil	Nil
76.5	76.6	0.1	0.1	BHJ	-	-	-	-	-

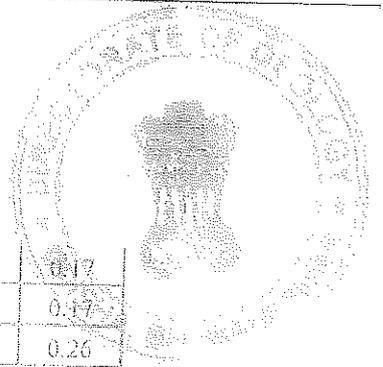
B.H. No. - 15					Date of Commencement - 27.03.16				
Grid Location - S600/E400					Date of Completion - 03.05.16				
R.L. of B.H. Collar - 638.570 m					Total Depth - 38 m				
					Total Core Length - 38 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	1	1	1	Laterite	13.45	10.03	40.89	14.19	0.7
1	3	2	2	Laterite	16.45	16.71	30.17	17.07	0.7
3	4	1	1	SLO	2.72	1.13	64.86	2.27	0.52
4	5	1	1	SLO	7.94	4.52	57.24	5.24	0.26
5	6	1	1	SLO	5.23	12.45	48.78	6.54	0.26
6	7	1	1	SLO	4.65	4.85	58.09	4.6	0.17
7	8.85	1.85	1.85	Shale	12.48	18.34	35.95	13.47	0.26
8.85	9.15	0.3	0.3	Shale	11.5	9.46	44.83	12.42	0.26
9.15	9.65	0.5	0.5	Shale	Nil	Nil	Nil	Nil	Nil
9.65	11	1.35	1.35	Shale	10.57	11.68	43.71	11.24	0.26
11	12	1	1	Shale	11.52	9.48	37.5	20.38	26
12	13	1	1	Shale	9.76	10.26	46.67	8.95	0.17
13	14	1	1	Shale	11.49	9.14	43.14	12.86	0.17
14	15	1	1	Shale	9.47	14.75	42.3	10.28	0.26
15	16	1	1	SLO	9.18	8.3	51.04	5.42	0.52
16	17	1	1	SLO	4.08	15.46	52.45	3.15	0.26
17	18	1	1	SLO	4.68	18.52	49.35	2.18	0.26
18	22	4	4	Shale	Nil	Nil	Nil	Nil	Nil
22	23	1	1	SLO	4.45	15.69	50.76	4.34	0.26
23	24	1	1	SLO	3.21	14.35	53.58	2.85	0.26
24	25	1	1	SLO	Nil	14.1	54	3.15	Nil
25	26	1	1	SLO	3.64	8.12	57.52	3.88	0.26
26	27	1	1	SLO	4.21	8.1	56.68	4.22	0.26
27	28	1	1	SLO	2.82	8.05	58.65	2.48	0.26
28	29	1	1	SLO	2.4	14.26	54.7	2.3	0.26

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29	30	1	1	SLO	1.88	21.47	49.63	1.9	0.17
30	31	1	1	Shale	1.4	35.84	40.6	0.63	0.17
31	32	1	1	SLO	1.9	23.25	48.78	3.53	0.26
32	33	1	1	SLO	1.6	28.16	45.68	1.32	0.17
33	34	1	1	Shale	1.82	39.42	44.41	2.71	0.35
34	35	1	1	Shale	0.56	42.73	36.09	1.73	0.17
35	36	1	1	Shale	0.76	68.64	17.48	1.13	0.17
36	37	1	1	Shale	3.04	30.14	43.28	1.7	0.17
37	37.5	0.5	0.5	Shale	2.82	41.57	34.4	1.77	0.26
37.5	38	0.5	0.5	BHJ	2.45	46.78	31.3	1.71	0.35

B.H. No. - 16					Date of Commencement - 27.03.16				
Grid Location - S400/E400					Date of Completion - 08.05.16				
R.L. of B.H. Collar - 622.275 m					Total Depth - 37.50 m				
Depth of Water Table - 21.00 M					Total Core Length - 37.50 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O. I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	6	6	6	Shale	-	-	-	-	-
6	7	1	1	Shale	7	23.92	35.23	15.8	0.56
7	7.9	0.9	0.9	SLO	5.71	14.2	46.41	10.94	0.24
7.9	9.5	1.6	1.6	Shale	8.82	20	35.23	16.72	0.64
9.5	10.5	1	1	SLO	5.74	7.02	53.12	9.65	0.24
10.5	11.9	1.4	1.4	SLO	3.7	4.64	59.27	5.26	0.24
11.9	12.9	1	1	Shale	9.8	19	33.55	10.24	0.72
12.9	13.9	1	1	Shale	10.35	12.1	41.38	14.77	0.4
13.9	14.9	1	1	Shale	10.95	11.44	41.94	14.67	0.8
14.9	15.9	1	1	SLO	10.1	2.06	54.8	7.59	0.4
15.9	16.9	1	1	SLO	12.51	2.8	48.65	12.88	0.8
16.9	17.8	0.9	0.9	SLO	12.7	2	48.65	12.02	1.36
17.8	18.8	1	1	SLO	8.6	1.26	54.8	9.65	0.64
18.8	19.8	1	1	SLO	11.84	1.45	51.16	11.59	Nil
19.8	20.8	1	1	SLO	15.28	2	46.69	13.98	Nil
20.8	21.8	1	1	Blue dust	5.58	2.51	58.15	7.3	Nil
21.8	22.8	1	1	Blue dust	4.77	1.39	59.83	6.8	Nil
22.8	23.8	1	1	Blue dust	3.95	0.8	65.42	0.31	Nil
23.8	24.8	1	1	Blue dust	2.11	1.09	65.14	2.21	Nil
24.8	25.8	1	1	Blue dust	3.91	1.74	62.35	3.8	Nil
25.8	26.8	1	1	Blue dust	1.9	2	64.86	1.91	Nil

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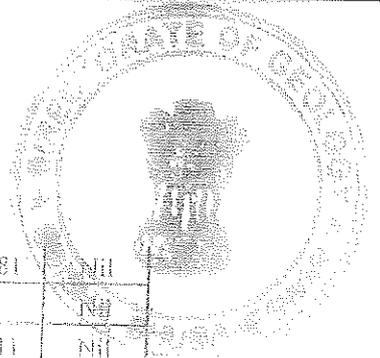
26.8	27.8	1	1	Blue dust	2.33	2.51	62.91	3.8	Nil
27.8	28.8	1	1	Blue dust	2.68	4.95	59.83	3.8	Nil
28.8	29.8	1	1	Blue dust	3.65	5.5	54.8	9.69	Nil
29.8	30.8	1	1	SLO	3.18	6.7	55.92	8.29	Nil
30.8	31.8	1	1	Blue dust	2.72	4.6	60.39	4.8	Nil
31.8	32.8	1	1	Blue dust	1.83	3.6	62.63	3.6	Nil
32.8	33.8	1	1	Blue dust	1.78	4.1	62.07	4	Nil
33.8	34.8	1	1	Blue dust	1.15	3.32	65.42	0.56	0.08
34.8	35.8	1	1	Blue dust	1.48	3.38	65.42	0.12	0.08
35.8	37.3	1.5	1.5	Blue dust	1.7	0.86	64.3	3.75	0.32
37.3	37.5	0.2	0.2	BHJ	-	-	-	-	-

<b>B.H. No. - 17</b>					<b>Date of Commencement - 12.04.16</b>				
<b>Grid Location - S800/E200</b>					<b>Date of Completion - 13.05.16</b>				
<b>R.L. of B.H. Collar - 655.330 m.</b>					<b>Total Depth - 32 m</b>				
					<b>Total Core Length - 32 m</b>				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	1	1	1	Conga ore	3.97	6.06	58.8	3.88	Nil
1	2	1	1	Shale	11.57	14.94	39.76	12.49	0.34
2	3	1	1	Shale	11.62	22.04	35.28	13.59	0.34
3	4	1	1	Shale	10.41	24.32	33.03	13.71	0.34
4	5	1	1	Shale	8.36	18.6	40.32	11.49	Nil
5	6.6	1.6	1.6	Shale	10.33	29.42	26.31	17.51	0.34
6.6	7.6	1	1	SLO	5.22	14.82	49.28	5.38	Nil
7.6	8.6	1	1	SLO	3.79	7.8	59.91	1.29	Nil
8.6	9.6	1	1	SLO	3.57	7.62	60.48	1.38	Nil
9.6	10.6	1	1	SLO	3.34	7.4	58.41	2.24	Nil
10.6	11.6	1	1	SLO	3.67	6.94	59.53	1.44	Nil
11.6	12.6	1	1	SLO	2.19	5.8	63.46	-	Nil
12.6	13.6	1	1	SLO	3.14	6.04	60.65	1.24	Nil
13.6	14.6	1	1	SLO	2.88	5.92	61.22	0.82	Nil
14.6	15.6	1	1	SLO	2.9	4.78	62.22	0.42	Nil
15.6	16.6	1	1	SLO	1.29	2.74	65.99	-	Nil
16.6	17.6	1	1	SLO	2.42	3.82	61.78	0.92	Nil
17.6	18.6	1	1	SLO	1.69	2.28	65.71	0.21	Nil
18.6	19.6	1	1	SLO	0.78	1.06	67.39	-	Nil
19.6	20.6	1	1	SLO	2.54	6.64	57.01	7.84	Nil

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20.6	21.6	1	1	SLO	1.8	2.34	65.42	0.81	Nil
21.6	22.6	1	1	SLO	1.06	0.68	67.8	-	Nil
22.6	23.6	1	1	HLO	1.1	1.22	66.54	1.11	Nil
23.6	24.6	1	1	HLO	1.37	1.48	65.98	1.31	Nil
24.6	25.6	1	1	HLO	1.3	1.02	67.45	-	Nil
25.6	26.6	1	1	HLO	1.86	1.22	66.96	-	Nil
26.6	27.6	1	1	HLO	2.52	1.64	64.86	1.71	Nil
27.6	28.6	1	1	HLO	3.08	1.8	65.42	0.11	Nil
28.6	29.6	1	1	HLO	2.72	1.66	65.42	0.71	Nil
29.6	30.6	1	1	SLO	2.13	2.12	65.98	0.11	Nil
30.6	31.6	1	1	SLO	2.86	3.7	62.63	2.5	Nil
31.6	31.9	0.3	0.3	SLO	3.94	8.58	56.48	5.29	Nil
31.9	32	0.1	0.1	BHJ	-	-	-	-	-

B.H. No. - 18			Date of Commencement - 20.04.16		
Grid Location - 0/N400			Date of Completion - 04.05.16		
R.L. of B.H. Collar - 623.29 m			Total Depth - 39.10 m		
Depth of Water Table -			Total Core Length - 39.10 m		
Depth in m		Total in m	Core recovery in m	Lithology	Remarks
From	To				
1	2	3	4	5	6
0	14.8	14.8	14.8	Shale	No ore intercepted.
14.8	15.95	1.15	1.15	Shaly ore	
15.95	25.1	9.15	9.15	Shale	
25.1	27.6	2.5	2.5	Limonite	
27.6	39.1	11.5	11.5	Shale	

B.H. No. - 19					Date of Commencement - 04.05.16				
Grid Location - S800/E400					Date of Completion - 23.05.16				
R.L. of B.H. Collar - 631.94 m					Total Depth - 31.5 m				
					Total Core Length - 31.5 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	1	1	1	SLO	10.67	8.38	49.89	7.7	Nil
1	6.8	5.8	5.8	Shale	12.03	26.46	27.76	10.98	Nil
6.8	9.5	2.7	2.7	Shale	12.49	33.52	20.96	14.28	Nil

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9.5	10.2	0.7	0.7	Shale	12.34	18.44	36.83	7.01	Nil
10.2	11.3	1.1	1.1	Shale	13.17	16.44	35.69	11.2	Nil
11.3	12.3	1	1	SLO	1.85	14.2	56.94	Nil	Nil
12.3	13.3	1	1	SLO	2.31	18.63	54.11	Nil	Nil
13.3	14.3	1	1	SLO	1.32	18.3	54.96	Nil	Nil
14.3	15.3	1	1	SLO	0.99	21.44	53.38	Nil	Nil
15.3	16.3	1	1	SLO	0.85	22.02	53.1	Nil	Nil
16.3	17.3	1	1	SLO	0.72	19.92	54.48	Nil	Nil
17.3	18.3	1	1	SLO	0.58	23.3	52.54	Nil	Nil
18.3	19.3	1	1	SLO	0.45	26.26	50.86	Nil	Nil
19.3	20.3	1	1	SLO	0.8	28.36	48.63	Nil	Nil
20.3	21.3	1	1	SLO	0.81	27.08	49.75	Nil	Nil
21.3	22.3	1	1	SLO	0.49	29.16	48.08 7	Nil	Nil
22.3	23.3	1	1	SLO	0.45	28.56	48.63	Nil	Nil
23.3	24.3	1	1	Shale	0.41	34.28	41.92	2.9	Nil
24.3	25.3	1	1	Shale	0.97	33.8	44.72	Nil	Nil
25.3	26.3	1	1	Shale	0.64	38.78	41.36	Nil	Nil
26.3	27.3	1	1	Shale	0.92	38.9	41.36	Nil	Nil
27.3	28.3	1	1	Shale	1.12	42.62	38.57	Nil	Nil
28.3	29.3	1	1	Shale	1.76	38.4	40.24	0.95	Nil
29.3	30.3	1	1	Shale	0.91	50.48	32.42	2	Nil
30.3	31	0.7	0.7	Shale	-	-	-	-	-
31	31.5	0.5	0.5	BHJ	-	-	-	-	-

<b>B.H. No. - 20</b>					<b>Date of Commencement - 24.3.16</b>				
<b>Grid Location - N400/W200</b>					<b>Date of Completion - 26.05.16</b>				
<b>R.L. of B.H. Collar - 627.39 m</b>					<b>Total Depth - 38.40 m</b>				
<b>Depth of Water Table - 18.00 m</b>					<b>Total Core Length - 38.40 m</b>				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	5.85	5.85	5.85	Shale	-	-	-	-	-
5.85	6.85	1	1	SLO	7.26	10.84	51.16	6.43	0.16
6.85	7.85	1	1	SLO	5.41	6.18	55.92	6.3	0.32
7.85	8.85	1	1	SLO	4.29	5.08	59.83	3.31	0.08
8.85	9.85	1	1	SLO	3.37	5.74	59.27	3.89	0.16
9.85	10.85	1	1	SLO	4.23	6.44	57.59	5.04	0.24
10.85	11.85	1	1	SLO	4.08	7.92	53.03	4.5	0.24

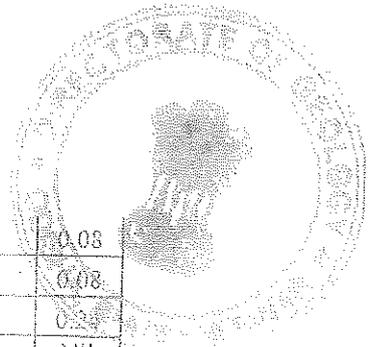
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11.85	12.85	1	1	SLO	2.83	5.2	60.39	3.7	0.08
12.85	13.85	1	1	SLO	3.64	5.78	60.95	1.58	0.08
13.85	14.85	1	1	SLO	3.6	3.12	60.39	2.26	0.24
14.85	15.85	1	1	SLO	4.62	7.5	59.83	Nil	Nil
15.85	16.85	1	1	SLO	3.62	7.84	58.71	2.74	Nil
16.85	17.85	1	1	SLO	2.89	5.66	59.83	4.07	0.08
17.85	18.85	1	1	SLO	4.49	5.74	57.03	5.61	0.16
18.85	19.85	1	1	SLO	3.67	7.9	57.59	3.29	0.24
19.85	20.85	1	1	SLO	2.49	4.68	62.63	1.01	Nil
20.85	21.85	1	1	SLO	4.22	6.64	58.71	2.74	0.08
21.85	22.85	1	1	SLO	Nil	2.86	64.86	1.42	Nil
22.85	23.85	1	1	SLO	Nil	3.92	64.3	0.72	Nil
23.85	24.85	1	1	SLO	Nil	2.78	64.86	1.42	Nil
24.85	25.85	1	1	SLO	Nil	4.6	61.51	3.41	Nil
25.85	26.85	1	1	SLO	Nil	1.84	66.54	0.12	Nil
26.85	27.85	1	1	SLO	Nil	1.04	66.54	0.52	Nil
27.85	28.8	0.95	0.95	SLO	Nil	0.1	66.54	1.62	Nil
28.8	29.8	1	1	Shale	Nil	6.98	38.58	23.17	Nil
29.8	31.4	1.6	1.6	Shale	Nil	24.98	35.51	12.16	Nil
31.4	32.4	1	1	SLO	Nil	2.3	64.3	2.22	Nil
32.4	33.4	1	1	SLO	Nil	2.54	64.86	1.32	Nil
33.4	34.4	1	1	SLO	Nil	3.69	62.63	3.01	Nil
34.4	35.4	1	1	SLO	Nil	1.68	66.54	0.82	Nil
35.4	36.4	1	1	SLO	Nil	2.56	65.98	0.32	Nil
36.4	37.4	1	1	SLO	Nil	2.46	65.98	0.22	Nil
37.4	38.2	0.8	0.8	SLO	Nil	2.38	65.98	0.22	Nil
38.2	38.4	0.2	0.2	Shale	-	-	-	-	-

B.H. No. - 21					Date of Commencement - 11.05.16				
Grid Location - S400/E600					Date of Completion - 29.05.16				
R.L. of B.H. Collar - 616.515 m					Total Depth - 26.30 m				
Depth of Water Table - 16.00 m					Total Core Length - 26.30 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	5.8	5.8	5.8	Shale	-	-	-	-	-
5.8	6.8	1	1	SLO	4.72	12.14	49.2	11.06	0.24
6.8	7.8	1	1	Shale	7.5	22.2	39.14	12.55	0.32
7.8	8.8	1	1	SLO	5.72	13.8	46.41	12.44	0.24
8.8	9.8	1	1	SLO	4.78	13.2	49.76	9.18	0.2

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9.8	10.8	1	1	SLO	6.22	7.26	50.88	12.15	0.16
10.8	11.8	1	1	SLO	5.2	10.8	51.44	8.79	0.2
11.8	12.85	1.05	1.05	Limonite	2.77	5.5	57.59	7.74	0.16
12.85	13.85	1	1	SLO	1.9	4.58	61.24	3.94	0.16
13.85	14.85	1	1	SLO	1	2.44	64.58	1.16	0.32
14.85	15.85	1	1	SLO	1.33	2.96	64.03	2.01	0.32
15.85	16.85	1	1	SLO	1.51	4.38	59.57	6.08	0.32
16.85	17.85	1	1	SLO	1.16	4.32	59.57	7.02	0.08
17.85	18.85	1	1	SLO	1.67	5.86	61.24	3.11	0.16
18.85	19.85	1	1	SLO	3.06	14.06	50.11	7.81	0.48
19.85	20.85	1	1	SLO	2.32	12.32	51.78	9.26	0.32
20.85	21.85	1	1	SLO	1.36	10.76	59.01	1.7	0.08
21.85	22.85	1	1	SLO	0.6	7.8	61.24	2.24	0.16
22.85	23.85	1	1	SLO	0.83	6.4	62.35	1.92	0.08
23.85	25.3	1.45	1.45	SLO	0.72	7.4	62.35	1.11	0.08
25.3	26.2	0.9	0.9	Shale	-	-	-	-	-
26.2	26.3	0.1	0.1	BHJ	-	-	-	-	-

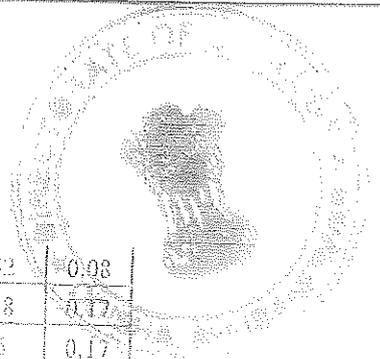
B.H. No. - 22					Date of Commencement - 16.05.16				
Grid Location - S1000/E200					Date of Completion - 20.06.16				
R.L. of B.H. Collar - 633.74m					Total Depth - 54.5 m				
Depth of Water Table - 32.0 m					Total Core Length - 54.5 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	22	22	22	Shale	-	-	-	-	-
22	23	1	1	SLO	2.7	7.09	60.63	1.52	0.35
23	24	1	1	SLO	1.39	3.85	64.57	0.94	0.35
24	25	1	1	SLO	1.91	3.35	64.86	0.27	0.35
25	26	1	1	SLO	1.96	4.37	62.6	2.01	0.26
26	27	1	1	SLO	1.57	3.05	65.7	0.19	0.26
27	28	1	1	SLO	1.63	4.24	64.57	0.09	0.26
28	29	1	1	SLO	1.91	1.45	65.7	1.16	0.17
29	30	1	1	SLO	2	4.2	64.15	1.05	0.26
30	31	1	1	SLO	1.79	2.32	65.14	1.25	0.17
31	32	1	1	SLO	1.12	1.05	65.84	0.52	0.17
32	33	1	1	SLO	0.92	1.18	65.84	0.58	0.17
33	34	1	1	SLO	1.02	1.84	65.7	1.18	0.17
34	35	1	1	SLO	0.86	1.4	65.7	0.4	0.17
35	36	1	1	SLO	1.06	1.14	65.98	0.04	0.08

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36	37	1	1	SLO	1.56	1.33	65.98	0.52	0.08
37	38	1	1	SLO	0.99	1.5	65.52	0.58	0.17
38	39	1	1	SLO	0.55	0.38	65.66	0.5	0.17
39	40	1	1	SLO	0.81	0.8	65.8	0.65	0.17
40	41	1	1	SLO	0.81	0.95	65.66	0.7	0.17
41	42	1	1	SLO	1.01	1.02	65.52	0.7	0.17
42	43	1	1	SLO	1.17	1.02	65.38	0.75	0.17
43	44	1	1	SLO	0.71	0.85	65.66	0.95	0.17
44	45	1	1	SLO	0.71	1.07	65.66	0.92	0.17
45	46	1	1	SLO	1	1.05	65.8	0.85	0.17
46	47	1	1	SLO	0.93	0.5	65.8	1.51	0.17
47	48	1	1	SLO	0.86	1.1	66.97	1.48	0.17
48	49	1	1	SLO	0.9	1.11	66.97	2.21	0.17
49	50	1	1	SLO	0.84	1.05	66.55	1.66	0.35
50	51	1	1	SLO	9	1.08	66.83	1.38	0.26
51	52	1	1	SLO	0.93	1.01	66.83	1.86	0.26
52	53	1	1	SLO	0.95	0.75	66.97	1.96	0.43
53	54.3	1.3	1.3	SLO	1.14	0.8	66.69	2.94	0.35
54.3	54.5	0.2	0.2	BHJ	-	-	-	-	-

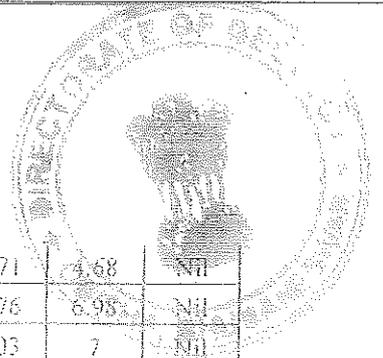
B.H. No. - 23					Date of Commencement - 22.05.16				
Grid Location - 0/S800					Date of Completion - 18.07.16				
R.L. of B.H. Collar - 667.770 m					Total Depth - 62.8m				
					Total Core Length - 62.8 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
1	2	3	4	5	6	7	8	9	10
0	1	1	1	SLO	5.39	4.88	57.01	6.13	Nil
1	2	1	1	SLO	4.53	4	58.71	5.89	Nil
2	3	1	1	HLO	4.43	1.92	60.95	4.98	Nil
3	4	1	1	SLO	10.34	4.34	57.87	0.98	Nil
4	5	1	1	SLO	7.33	5.2	56.2	5.53	Nil
5	6	1	1	SLO	8.67	6.46	46.97	15.02	Nil
6	7	1	1	SLO	11.37	7.42	45.85	12.84	Nil
7	8	1	1	SLO	5.89	4.08	55.92	6.86	Nil
8	9	1	1	SLO	7.79	9.06	50.32	9.29	Nil
9	10	1	1	SLO	5.85	6.44	55.92	6.06	Nil
10	11	1	1	SLO	4.17	6.28	56.48	7.13	Nil
11	12	1	1	SLO	3.04	2.36	63.19	2.73	Nil

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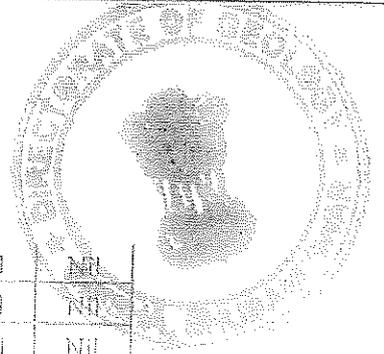
12	13	1	1	SLO	3.85	5.9	58.71	4.68	Nil
13	14	1	1	SLO	9.16	8.48	49.76	6.98	Nil
14	15	1	1	SLO	6.17	3.72	57.03	7	Nil
15	16	1	1	Shale	16.2	4.14	43.05	12.69	Nil
16	17	1	1	SLO	9.96	7.1	54.8	2.71	Nil
17	18	1	1	SLO	8.98	1.88	58.97	1.13	Nil
18	19	1	1	SLO	14.56	15.08	38.19	8.03	Nil
19	20	1	1	SLO	8.05	3.44	56.16	4.24	Nil
20	21	1	1	SLO	13.84	6.46	51.67	2.36	Nil
21	22	1	1	SLO	10.15	7.32	58.97	Nil	Nil
22	22.6	0.6	0.6	SLO	16.11	6.9	46.05	6.19	Nil
22.6	23.1	0.5	0.5	SLO	9.57	3.34	55.6	4.35	Nil
23.1	23.6	0.5	0.5	Shale	22.22	5.82	39.87	11.02	Nil
23.6	24.6	1	1	SLO	3.87	0.12	65.71	0.2	Nil
24.6	25.6	1	1	SLO	2.28	0.16	68.52	Nil	Nil
25.6	26.6	1	1	SLO	3.63	0.1	65.15	1.2	Nil
26.6	27.6	1	1	SLO	3.56	0.16	64.59	1.8	Nil
27.6	28.6	1	1	SLO	3.28	0.28	66.27	Nil	Nil
28.6	29.6	1	1	SLO	1.77	0.24	68.52	Nil	Nil
29.6	30.6	1	1	SLO	2.57	0.26	67.4	Nil	Nil
30.6	31.6	1	1	SLO	4.63	3.08	61.49	2.13	Nil
31.6	32.6	1	1	SLO	4.8	0.84	64.31	0.5	Nil
32.6	33.6	1	1	SLO	3.88	1.18	64.59	0.3	Nil
33.6	34.6	1	1	SLO	4.72	1.46	60.92	3.24	Nil
34.6	35.6	1	1	SLO	4.5	1	64.31	0.7	Nil
35.6	36.6	1	1	SLO	3.48	1	65.72	Nil	Nil
36.6	37.6	1	1	SLO	2.97	1.18	66.28	Nil	Nil
37.6	38.6	1	1	SLO	3.7	1.2	64.59	0.2	Nil
38.6	39.6	1	1	SLO	4.22	1.46	62.9	2.62	Nil
39.6	40.6	1	1	SLO	4.18	1.5	62.9	2.44	Nil
40.6	41.6	1	1	SLO	3.92	2.14	62.33	2.52	Nil
41.6	42.6	1	1	SLO	3.06	2.1	63.74	1.81	Nil
42.6	43.6	1	1	SLO	3.07	1.9	64.87	0.2	Nil
43.6	44.6	1	1	SLO	1.12	3	66.56	Nil	Nil
44.6	45.6	1	1	SLO	Nil	Nil	68.82	Nil	Nil
45.6	46.6	1	1	SLO	1.1	0.8	67.13	Nil	Nil
46.6	47.6	1	1	SLO	2.52	0.86	66.56	Nil	Nil
47.6	48.6	1	1	SLO	1.02	2.86	66.09	Nil	Nil
48.6	49.6	1	1	Blue dust	1.73	2.02	62.91	5.2	Nil
49.6	50.6	1	1	Blue dust	5.18	4.26	58.99	4.5	Nil

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50.6	51.6	1	1	Blue dust	4.35	0.5	65.7	Nil	Nil
51.6	52.6	1	1	Blue dust	0.34	0.3	68.78	Nil	Nil
52.6	53.6	1	1	Blue dust	0.45	1.32	66.82	1.21	Nil
53.6	54.6	1	1	Blue dust	1.47	0.43	71.29	Nil	Nil
54.6	55.6	1	1	Blue dust	1.63	0.22	67.94	Nil	Nil
55.6	56.6	1	1	Blue dust	1.26	0.3	68.22	Nil	Nil
56.6	57.6	1	1	Blue dust	1.27	1.25	66.54	1	Nil
57.6	58.6	1	1	Blue dust	1.11	0.8	67.66	Nil	Nil
58.6	59.6	1	1	Blue dust	4.1	0.5	65.42	0.51	Nil
59.6	60.6	1	1	Blue dust	3.37	1.5	64.86	1.01	Nil
60.6	61.6	1	1	Blue dust	4.49	1.04	59.83	7.2	Nil
61.6	62.1	0.5	0.5	Blue dust	1.7	0.54	67.1	Nil	Nil
62.1	62.7	0.6	0.6	Blue dust	2.43	0.64	65.7	0.11	Nil
62.7	62.8	0.1	0.1	BHJ	-	-	-	-	-

B.H. No. - 24					Date of Commencement - 23.05.16				
Grid Location - S200/W200					Date of Completion - 30.06.16				
R.L. of B.H. Collar - 662.06 m					Total Depth - 63.20 m				
					Total Core Length - 63.20 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	35	35	35	Shale	-	-	-	-	-
35	36	1	1	SLO	2.4	13.54	54.37	4.87	-
36	37	1	1	Shale	4.03	20.78	42.77	12.35	0.32
37	38	1	1	Shale	3.84	21.06	44.15	10.34	0.16
38	39	1	1	Shale	3.85	22.68	42.5	11.31	0.16
39	40	1	1	Shale	3.79	20.08	43.88	11.58	0.32
40	41	1	1	Shale	4.01	23.24	40.57	12.43	0.4
41	42	1	1	SLO	3.45	23.3	46.91	4.44	0.32
42	52	10	10	Shale	-	-	-	-	-
52	53	1	1	Shale	2.02	32.48	41.39	4.53	0.32
53	54	1	1	Shale	3.87	54.16	16	17.47	0.16
54	55	1	1	Shale	3.79	30.74	36.43	11.93	0.32
55	56	1	1	SLO	2.3	18.7	50.78	4.68	0.16
56	57	1	1	Shale	2.18	31.96	32.56	17.71	0.16
57	58	1	1	Shale	6.57	54.94	9.65	19.8	0.4
58	59	1	1	Shale	2.4	19.04	51.05	3.84	0.4
59	60	1	1	Shale	2.7	23.7	41.67	12.38	0.32

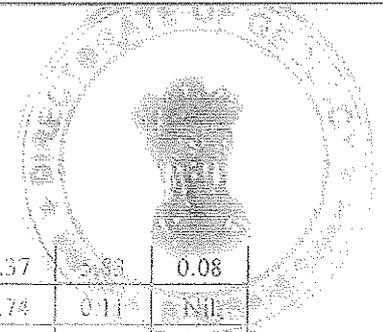
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60	61	1	1	SLO	1.5	13.5	54.37	5.83	0.08
61	61.8	0.8	0.8	SLO	1.3	5.6	63.74	0.11	Nil
61.8	63.2	1.4	1.4	White shale	-	-	-	-	-

B.H. No. - 25					Date of Commencement - 25.03.16				
Grid Location - S800/E600					Date of Completion - 12.06.16				
R.L. of B.H. Collar - 625.760 m					Total Depth - 19.85 m				
					Total Core Length - 19.85 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	5.6	5.6	5.6	Shale	-	-	-	-	-
5.6	8	2.4	2.4	Shale	12.23	28.94	25.27	19.59	Nil
8	9.7	1.7	1.7	Shale	-	-	-	-	-
9.7	11	1.3	1.3	Shale	11.43	18.94	37.63	13.13	Nil
11	12.85	1.85	1.85	Shale	9.51	15.92	41.56	12.75	Nil
12.85	14	1.15	1.15	Shale	8.95	13.82	46.05	9.27	Nil
14	14.7	0.7	0.7	Shale	7.03	16.1	42.68	11.48	Nil
14.7	16.05	1.35	1.35	SLO	4.93	11.72	50.26	9.12	Nil
16.05	17.6	1.55	1.55	SLO	3.59	13.58	53.07	4.41	Nil
17.6	18.8	1.2	1.2	Shale	1.92	35.06	39.87	1.05	Nil
18.8	19.85	1.05	1.05	BHJ	-	-	-	-	-

B.H. No. - 26					Date of Commencement - 01.06.16				
Grid Location - S600/E600					Date of Completion - 13.06.2016				
R.L. of B.H. Collar - 634.515 m					Total Depth - 18.80 m				
					Total Core Length - 18.80 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	1	1	1	SLO	6.29	9.06	53.45	5.48	0.32
1	2	1	1	SLO	7.06	9.14	48.99	10.08	0.32
2	3	1	1	SLO	5.41	10.02	50.66	9.52	0.48
3	4	1	1	SLO	5.39	12.5	48.44	9.62	0.48
4	5	1	1	SLO	6.6	13.4	46.05	12.32	0.48
5	6	1	1	SLO	5.1	11.78	51.11	8.35	0.32
6	7	1	1	SLO	4.29	8.94	55.04	6.39	0.32
7	8	1	1	SLO	5.37	11.7	51.11	8.05	0.32
8	9	1	1	SLO	4.14	9.64	53.92	7.51	0.24

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9	10	1	1	SLO	4.05	11.12	51.67	9.25	0.32
10	11	1	1	SLO	3.11	8.2	55.88	7.29	0.16
11	12	1	1	SLO	1.31	3.92	64.31	1.4	Nil
12	13	1	1	SLO	1.91	8.52	59.53	3.04	Nil
13	14	1	1	SLO	1.04	12.88	57.85	1.94	Nil
14	15	1	1	SLO	0.55	25.52	50.54	0.28	Nil
15	16	1	1	SLO	0.49	29.32	47.74	0.42	0.16
16	17	1	1	SLO	0.45	20.16	53.92	0.85	Nil
17	17.5	0.5	0.5	SLO	1.07	32.2	44.93	1	Nil
17.5	18.8	1.3	1.3	BHJ	1.44	28.1	46.05	3.2	Nil

<b>B.H. No. 27</b>					<b>Date of Commencement – 2.06.16</b>				
<b>Grid Location – N400/W400</b>					<b>Date of Completion - 30.06.16</b>				
<b>R.L. of B.H. Collar – 640.92 m</b>					<b>Total Depth - 50 m</b>				
					<b>Total Core Length - 50 m</b>				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	10.7	10.7	10.7	Shale	-	-	-	-	-
10.7	11.7	1	1	SLO	2.8	7.82	58.97	3.63	Nil
11.7	12.7	1	1	SLO	2.09	2.76	64.59	1.5	Nil
12.7	13.6	0.9	0.9	SLO	3.48	4.08	59.53	5.93	Nil
13.6	14.6	1	1	SLO	5.34	9.78	48.87	12.98	Nil
14.6	15.6	1	1	Shale	12.24	10.82	32.01	24.46	Nil
15.6	17	1.4	1.4	SLO	5.23	1.88	55.04	12.55	Nil
17	17.7	0.7	0.7	Blue dust	3.27	2.58	62.34	3.51	Nil
17.7	18.7	1	1	SLO	5.98	1.32	52.23	16.32	Nil
18.7	19.7	1	1	Blue dust	2.45	0.7	63.46	4.61	Nil
19.7	20.7	1	1	Blue dust	2.23	2.12	62.34	5.01	Nil
20.7	21.7	1	1	Blue dust	1.9	0.52	65.71	2.2	Nil
21.7	22.7	1	1	Blue dust	1.46	0.58	67.4	Nil	Nil
22.7	23.7	1	1	Blue dust	0.45	0.46	69.08	Nil	Nil
23.7	24.7	1	1	Blue dust	1.01	0.62	67.96	Nil	Nil
24.7	25.7	1	1	Blue dust	0.53	0.3	68.52	Nil	Nil
25.7	26.7	1	1	Blue dust	0.43	0.32	68.52	0.09	Nil
26.7	27.7	1	1	Blue dust	1.25	0.3	67.96	0.09	Nil
27.7	28.7	1	1	Blue dust	0.61	0.14	68.44	0.1	Nil
28.7	29.7	1	1	Blue dust	0.82	0.1	68.44	Nil	Nil
29.7	30.7	1	1	Blue dust	0.87	0.4	67.96	0.19	Nil

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30.7	31.7	1	1	Blue dust	0.55	Nil	68.72	Nil	Nil
31.7	32.7	1	1	Blue dust	0.5	0.2	68.44	0.19	Nil
32.7	33.7	1	1	Blue dust	2.34	5.7	62.34	1.41	Nil
33.7	34.7	1	1	Blue dust	2.79	3.13	64.59	0.3	Nil
34.7	35.7	1	1	Blue dust	0.85	0.12	68.44	Nil	Nil
35.7	36.7	1	1	Blue dust	0.81	0.56	67.96	0.19	Nil
36.7	37.7	1	1	Blue dust	0.45	Nil	68.83	Nil	Nil
37.7	38.7	1	1	Blue dust	0.48	Nil	68.83	Nil	Nil
38.7	39.7	1	1	Blue dust	0.48	0.12	68.72	Nil	Nil
39.7	40.7	1	1	Blue dust	0.42	Nil	68.83	Nil	Nil
40.7	41.7	1	1	Blue dust	0.62	Nil	68.72	Nil	Nil
41.7	42.7	1	1	Blue dust	0.89	4.34	64.03	1.81	Nil
42.7	43.7	1	1	Blue dust	0.18	0.1	68.78	Nil	Nil
43.7	44.7	1	1	Blue dust	0.2	0.12	68.78	Nil	Nil
44.7	45.7	1	1	Blue dust	0.34	0.14	68.5	Nil	Nil
45.7	47.3	1.6	1.6	Blue dust	0.38	0.12	68.5	Nil	Nil
47.3	50	2.7	2.7	Shale	-	-	-	-	-

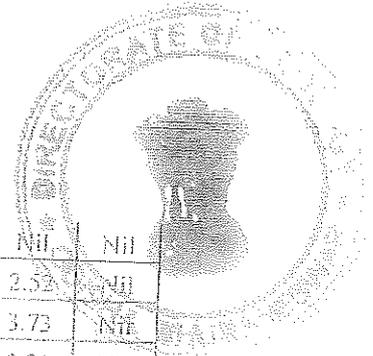
B.H. No. - 28					Date of Commencement - 19.06.16				
Grid Location - S1000/E600					Date of Completion - 14.07.16				
R.L. of B.H. Collar - 625.830 m					Total Depth - 50.4 m				
Depth of Water Table - 22.70 m					Total Core Length - 50.4 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	5.4	5.4	5.4	Laterite	-	-	-	-	-
5.4	6.4	1	1	Shale	7.96	21.54	39.87	11.78	Nil
6.4	7.4	1	1	SLO	5.64	18.46	46.61	7.65	Nil
7.4	22	14.6	14.6	Shale	12.98	40.86	12.35	20.59	Nil
22	25	3	3	Shale	10.03	23.38	33.13	17.12	Nil
25	27	2	2	Shale	8.66	20.02	37.07	14.49	Nil
27	29	2	2	Shale	7.31	17.34	44.65	9.58	Nil
29	30	1	1	Shale	7.26	18.48	41.84	12.55	Nil
30	31.5	1.5	1.5	SLO	5.53	13.7	46.89	12.15	Nil
31.5	32.5	1	1	SLO	1.91	1.82	62.62	2.05	Nil
32.5	33.5	1	1	SLO	2.32	6.06	61.27	2.66	Nil
33.5	34.5	1	1	SLO	1.93	5.04	61.5	3.56	Nil
34.5	35.5	1	1	SLO	1.43	3.94	64.03	1.65	Nil
35.5	36.5	1	1	SLO	2.44	6.34	59.53	4.63	Nil

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36.5	37.5	1	1	SLO	1.2	3.44	65.71	Nil	Nil
37.5	38.5	1	1	SLO	3.29	7.54	60.37	2.52	Nil
38.5	39.5	1	1	SLO	1.5	9.32	58.69	3.73	Nil
39.5	40.5	1	1	SLO	1.07	10.26	60.39	0.91	Nil
40.5	41.5	1	1	SLO	1.03	17.6	55.92	0.2	Nil
41.5	42.5	1	1	SLO	1.51	21.3	52	1.39	Nil
42.5	43.5	1	1	SLO	1.96	18.22	52.56	3.03	Nil
43.5	44.5	1	1	SLO	2.5	13.52	54.24	4.75	Nil
44.5	45.7	1.2	1.2	SLO	2.6	15	55.36	1.7	Nil
45.7	46.5	0.8	0.8	SLO	1.97	14.02	57.59	0.2	Nil
46.5	47.5	1	1	SLO	2.24	13	57.03	1.64	Nil
47.5	48.5	1	1	SLO	0.6	12.8	59.83	Nil	Nil
48.5	49.5	1	1	SLO	1.94	6.9	54.8	11.15	Nil
49.5	50.3	0.8	0.8	SLO	2.3	7.4	59.83	3.24	Nil
50.3	50.4	0.1	0.1	BHJ					

B.H. No. - 29					Date of Commencement - 22.06.16				
Grid Location - S1000/E400					Date of Completion - 10.07.16				
R.L. of B.H. Collar - 638.630 m					Total Depth - 21.5 m				
					Total Core Length - 21.5 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	1.85	1.85	1.85	Shale	6.44	28.6	31.45	14.98	Nil
1.85	3.1	1.25	1.25	Shale	10.59	32	21.9	18.23	Nil
3.1	4.75	1.65	1.65	Shale	11.67	30.04	22.4	19.59	Nil
4.75	8.5	3.75	3.75	Shale	12.69	30.5	19.65	21.09	Nil
8.5	10.9	2.4	2.4	Shale	11.71	8.06	47.46	8.5	Nil
10.9	15	4.1	4.1	Shale	13	40.32	6.45	30.65	Nil
15	18.5	3.5	3.5	Shale	15.53	12.58	25.83	28.15	Nil
18.5	19.5	1	1	Shale	3.24	35.88	37.63	4.71	Nil
19.5	20.6	1.1	1.1	SLO	2.65	8.38	58.69	2.98	Nil
20.6	21.4	0.8	0.8	SLO	2.49	8	58.69	3.48	Nil
21.4	21.5	0.1	0.1	BHJ	-	-	-	-	-

B.H. No. 30					Date of Commencement - 24.06.16				
Grid Location - S600/W200					Date of Completion - 19.07.16				
R.L. of B.H. Collar - 657.07 m					Total Depth - 28.60 m				
Depth of Water Table - 3.50 m					Total Core Length - 28.60 m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	0.2	0.2	0.2	Soil	6	7	8	9	10

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0.2	1.2	1	1	SLO	5.48	14.76	45.85	12.33	Nil
1.2	2.2	1	1	SLO	8.21	9.2	46.41	13.22	Nil
2.2	3.2	1	1	SLO	9.8	7.4	48.09	12.08	Nil
3.2	4.2	1	1	SLO	4.9	5.2	57.03	6.58	Nil
4.2	5.2	1	1	SLO	6	4.2	54.8	9.5	Nil
5.2	6.2	1	1	SLO	6.5	5.74	52.56	10.73	Nil
6.2	7.2	1	1	SLO	9.6	6.92	55.36	2.57	Nil
7.2	8.2	1	1	SLO	3.18	0.48	46.41	28.4	Nil
8.2	8.8	0.6	0.6	SLO	7.14	1.2	45.85	23.2	Nil
8.8	10	1.2	1.2	Shale	5.41	16.44	39.14	18.61	Nil
10	11	1	1	SLO	4.58	12.72	54.8	2.41	Nil
11	12	1	1	SLO	3.04	0.2	66.54	0.13	Nil
12	13	1	1	SLO	2.98	8.02	57.03	5.92	Nil
13	14	1	1	SLO	2.35	6.62	58.71	5.5	Nil
14	15	1	1	SLO	1.65	4.68	62.91	2.13	Nil
15	16	1	1	SLO	1.52	4.9	61.79	3.73	Nil
16	17	1	1	SLO	0.98	2.72	65.7	0.85	Nil
17	18	1	1	SLO	1.27	3.88	64.58	1.04	Nil
18	19	1	1	SLO	1.83	5.44	63.75	0.21	Nil
19	20	1	1	SLO	1.32	4.64	63.19	2.1	Nil
20	21	1	1	SLO	1.26	3.8	64.03	1.93	Nil
21	22	1	1	SLO	1.01	2.88	65.98	0.3	Nil
22	23	1	1	SLO	2.25	7.62	60.11	2.43	Nil
23	24	1	1	SLO	2.27	7.86	58.71	4.37	Nil
24	25	1	1	SLO	2.16	3.32	64.58	0.63	Nil
25	26	1	1	SLO	1.08	3.32	65.42	0.55	Nil
26	27.5	1.5	1.5	SLO	1.91	6.1	62.07	1.75	Nil
27.5	28.6	1.1	1.1	BHJ	4.79	33.12	21.8	29.5	Nil

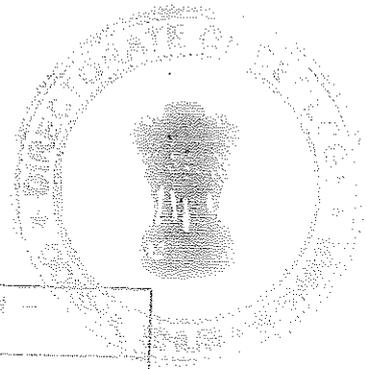
B.H. No. - 31			Date of Commencement - 05.07.16		
Grid Location - S400/W200			Date of Completion - 21.07.16		
R.L. of B.H. Collar - 663.225 m			Total Depth - 21.80 m		
			Total Core Length - 21.80 m		
Depth in m		Total in m	Core recovery in m	Lithology	Remarks
From	To				
1	2	3	4	5	6
0	21.6	21.6	21.6	Shale	
21.6	21.8	0.2	0.2	BHJ	

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B.H. No. - 32					Date of Commencement - 12.07.16				
Grid Location - 0/S1000					Date of Completion - 31.07.16				
R.L. of B.H. Collar - 638.620m					Total Depth - 49.20 m				
					Total Core Length - 49.2m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	1.2	1.2	1.2	Shale	10.54	15.66	36.34	17.64	Nil
1.2	2.3	1.1	1.1	Shale	10.37	13.1	39.69	17.01	Nil
2.3	4.2	1.9	1.9	Shale	13.19	8.8	40.11	18.19	Nil
4.2	6	1.8	1.8	Shale	14.3	3.62	44.73	14.06	Nil
6	7.25	1.25	1.25	Shale	5.76	15.24	44.73	11.36	Nil
7.25	8.25	1	1	SLO	3.51	5.88	58.15	5.74	Nil
8.25	9.25	1	1	SLO	4.04	3.6	60.39	4.34	Nil
9.25	10.25	1	1	Shale	10.45	9.36	40.09	19.38	Nil
10.25	11.25	1	1	Shale	11.13	16.5	33.65	21.53	Nil
11.25	12.25	1	1	SLO	2	0.3	67.1	0.21	Nil
12.25	13.25	1	1	SLO	1.05	0.12	68.21	0.12	Nil
13.25	14.25	1	1	SLO	2.83	2.12	59.27	5.44	Nil
14.25	15.25	1	1	SLO	4.37	10.1	51.44	8.27	Nil
15.25	16.25	1	1	SLO	1.81	0.76	67.1	0.11	Nil
16.25	17.25	1	1	SLO	1.79	1	65.98	1.4	Nil
17.25	18.25	1	1	SLO	1.67	1.48	66.54	0.18	Nil
18.25	19.25	1	1	SLO	1.61	1.34	66.54	0.3	Nil
19.25	20.25	1	1	SLO	2.28	4.62	62.07	2.84	Nil
20.25	21.25	1	1	SLO	1.85	3.12	62.07	4.59	Nil
21.25	22.25	1	1	SLO	1.39	2.72	65.98	0.12	Nil
22.25	23.25	1	1	SLO	1.03	2.02	66.54	0.31	Nil
23.25	24.25	1	1	SLO	1.56	3.02	64.03	1.85	Nil
24.25	25.25	1	1	SLO	2.27	4.62	62.07	2.81	Nil
25.25	26.25	1	1	SLO	1.9	4.84	62.63	2.14	Nil
26.25	27.25	1	1	SLO	1.58	2.42	65.98	0.12	Nil
27.25	28.25	1	1	SLO	1.29	1.02	67.38	Nil	Nil
28.25	29.25	1	1	SLO	1.61	2.82	63.75	2.6	Nil
29.25	30.25	1	1	SLO	2.9	3.02	61.51	4.51	Nil
30.25	31.25	1	1	SLO	1.57	1.18	65.42	2.1	Nil
31.25	32.25	1	1	SLO	1.9	2.9	65.15	0.61	Nil
32.25	33.25	1	1	SLO	1.86	2.8	65.71	0.21	Nil

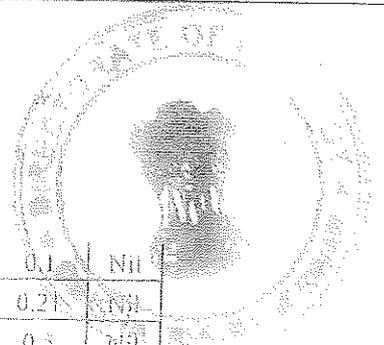
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33.25	34.25	1	1	SLO	2.1	1	66.83	0.1	Nil
34.25	35.25	1	1	SLO	1.73	2.9	65.71	0.21	Nil
35.25	36.25	1	1	SLO	1.13	1.4	66.83	0.3	Nil
36.25	37.25	1	1	SLO	1.4	1.7	66.83	Nil	Nil
37.25	38.25	1	1	SLO	2.75	1.44	64.59	1.76	Nil
38.25	39.25	1	1	SLO	1.84	0.64	67.39	Nil	Nil
39.25	40.25	1	1	SLO	1.31	1.2	67.39	Nil	Nil
40.25	41.25	1	1	SLO	1.4	1	67.39	Nil	Nil
41.25	42.25	1	1	SLO	0.15	0.07	69.08	Nil	Nil
42.25	43.25	1	1	SLO	0.29	0.3	68.8	Nil	Nil
43.25	45.2	1.95	1.95	SLO	2.47	0.7	66.27	0.71	Nil
45.2	47.2	2	2	SLO	0.14	0.06	69.08	Nil	Nil
47.2	49	1.8	1.8	SLO	1.01	0.6	67.96	Nil	Nil
49	49.2	0.2	0.2	BHJ	-	-	-	-	-

<b>B.H. No. 33</b>					<b>Date of Commencement - 13.07.16</b>				
<b>Grid Location - N200/W400</b>					<b>Date of Completion - 16.08.16</b>				
<b>R.L. of B.H. Collar - 642.39 m</b>					<b>Total Depth - 52.30 m</b>				
					<b>Total Core Length - 52.30 m</b>				
<b>Depth in m</b>		<b>Total in m</b>	<b>Core recovery in m</b>	<b>Lithology</b>	<b>Chemical assay values in Percentage</b>				
<b>From</b>	<b>To</b>				<b>L.O.I.</b>	<b>SiO<sub>2</sub></b>	<b>Fe</b>	<b>Al<sub>2</sub>O<sub>3</sub></b>	<b>Mn</b>
1	2	3	4	5	6	7	8	9	10
0	21.4	21.4	21.4	Shale	-	-	-	-	-
21.4	22.4	1	1	SLO	3.3	4.68	59.83	5	0.2
22.4	23.4	1	1	SLO	4.92	1.2	64.3	0.21	Trace
23.4	24.4	1	1	SLO	2.32	1.5	56.48	13.78	0.12
24.4	25.4	1	1	SLO	6.74	0.5	63.74	0.11	Trace
25.4	26.4	1	1	SLO	3.1	0.28	66.54	0.11	Trace
26.4	27.4	1	1	SLO	1.84	0.92	60.39	9.24	0.2
27.4	47.3	19.9	19.9	Shale	-	-	-	-	-
47.3	48.3	1	1	SLO	3.11	1.58	55.92	14.1	0.2
48.3	49.3	1	1	SLO	3.45	12	57.59	1.02	Trace
49.3	52.3	3	3	Shale	-	-	-	-	-

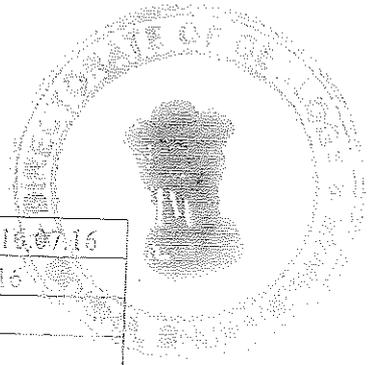
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B.H. No. - 34					Date of Commencement - 15.07.16				
Grid Location - S1000/W200					Date of Completion - 05.08.16				
R.L. of B.H. Collar - 641.34 m					Total Depth - 34.8 m				
					Total Core Length - 34.8m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	5.9	5.9	5.9	Shale	9.92	16.24	38.47	13.43	Nil
5.9	9	3.1	3.1	Shale	9.8	16.32	41.36	12.85	Nil
9	11	2	2	Shale	9.8	22.7	36.83	13.16	Nil
11	12	1	1	Shale	11.05	25.48	24.36	26.06	Nil
12	13.8	1.8	1.8	Shale	10.85	29.56	31.73	11.55	Nil
13.8	14.8	1	1	SLO	4.11	10.68	53.83	6.78	Nil
14.8	15.8	1	1	SLO	4.12	9.6	53.28	6.8	Nil
15.8	16.8	1	1	SLO	4.15	14.56	53.28	11.45	Nil
16.8	17.8	1	1	SLO	4.14	8.54	49.95	7.85	Nil
17.8	18.8	1	1	SLO	4.55	13.88	52.69	4.8	Nil
18.8	19.8	1	1	SLO	4.1	8.86	51.85	6.75	Nil
19.8	20.8	1	1	SLO	5.1	10.58	52.13	8.3	Nil
20.8	22.8	2	2	Shale	11.91	15.9	36.83	17.74	Nil
22.8	23.8	1	1	SLO	4.93	8.44	59.49	3.5	Nil
23.8	24.5	0.7	0.7	SLO	4.18	5.97	59.65	6.25	Nil
24.5	28.8	4.3	4.3	Shale	12.4	16.54	32.45	18.45	Nil
28.8	29	0.2	0.2	Shale	12.3	3.42	36.66	1.83	Nil
29	29.9	0.9	0.9	SLO	4.2	4.76	57.15	6.38	Nil
29.9	34.8	4.9	4.9	Shale	-	-	-	-	-

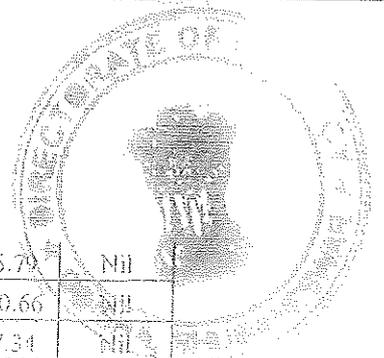
B.H. No. - 35					Date of Commencement - 01.08.16				
Grid Location - S800/W200					Date of Completion - 24.08.16				
R.L. of B.H. Collar - 649.20 m					Total Depth - 36.45 m				
Depth of Water Table - 12.8 m					Total Core Length - 36.4m				
Depth in m		Total in m	Core recovery in m	Lithology	Chemical assay values in Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	1.2	1.2	1.2	SLO	4.77	2.96	59.83	4.96	Nil
1.2	2.2	1	1	Shale	10.8	8.04	44.73	12.18	Nil
2.2	3.2	1	1	SLO	7.73	3.2	45.29	22.28	Nil
3.2	4.2	1	1	SLO	5	10.32	57.59	1	Nil
4.2	5.2	1	1	SLO	5.2	7	55.36	6.9	Nil
5.2	6.2	1	1	SLO	5.37	6.56	54.24	7.44	Nil

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6.2	7.2	1	1	SLO	4.89	9.46	53.68	6.79	Nil
7.2	8.2	1	1	Shale	6.89	18.22	43.61	10.66	Nil
8.2	9.2	1	1	SLO	6.04	8.04	53.68	7.34	Nil
9.2	10.2	1	1	SLO	5.23	13.66	48.65	8.59	Nil
10.2	11.2	1	1	SLO	5.55	11.44	49.77	9.18	Nil
11.2	12.2	1	1	SLO	4.74	8	54.8	6.59	Nil
12.2	13.2	1	1	SLO	5.61	13.84	48.65	8.82	Nil
13.2	14.2	1	1	SLO	6.25	16.7	44.13	11.26	Nil
14.2	15.2	1	1	SLO	4.88	14.78	49.21	7.87	Nil
15.2	16.2	1	1	SLO	9.46	12.92	44.73	11.64	Nil
16.2	17.2	1	1	SLO	5.49	15.76	52.56	1.89	Nil
17.2	18.2	1	1	SLO	3.7	9.78	55.92	4.43	Nil
18.2	19.2	1	1	SLO	5.83	11.7	50.32	8.43	Nil
19.2	20.2	1	1	SLO	4.53	12.46	52.56	6.02	Nil
20.2	21.2	1	1	SLO	8.48	7.46	54.24	4.19	Nil
21.2	22.2	1	1	SLO	4.88	13.21	53.35	3.84	Nil
22.2	23.2	1	1	SLO	3.32	8.8	58.97	1.97	Nil
23.2	24.2	1	1	SLO	6.26	16.55	49.72	4.75	Nil
24.2	25.2	1	1	SLO	3.35	8.83	58.41	2.67	Nil
25.2	26.2	1	1	Shale	6.41	21	44.93	6.42	Nil
26.2	27.2	1	1	SLO	6.75	18.64	46.61	5.85	Nil
27.2	28.2	1	1	SLO	6.71	18.54	46.61	6.05	Nil
28.2	29.2	1	1	SLO	7.41	17.95	46.61	5.85	Nil
29.2	31	1.8	1.8	SLO	7.48	21.83	45.49	3.55	Nil
31	33	2	2	SLO	6.97	18.29	46.05	6.75	Nil
33	35	2	2	SLO	7.08	15.25	47.74	7.5	Nil
35	36.4	1.4	1.4	SLO	5.99	14.7	49.42	6.79	Nil
36.4	36.45	0.05	0.05	BHJ	-	-	-	-	-

B.H. No. - 36			Date of Commencement - 25.07.16		
Grid Location - S600/W800			Date of Completion - 29.08.16		
R.L. of B.H. Collar - 665.55m			Total Depth - 30.45 m		
			Total Core Length - 30.45 m		
Depth in m		Total in m	Core recovery in m	Lithology	Remarks
From	To				
0	30.45	30.45	30.45	Shale	

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B.H. No. - 37		Date of Commencement - 27.07.16			
Grid Location - 0/W400		Date of Completion - 11.08.16			
R.L. of B.H. Collar - 665.36m		Total Depth - 33.10 m			
		Total Core Length - 33.10 m			
Depth in m		Total in m	Core recovery in m	Lithology	Remarks
From	To				
0	33.1	33.1	33.1	Shale	

B.H. No. - 38					Date of Commencement - 11.08.16				
Grid Location - S400/W400					Date of Completion - 30.08.16				
R.L. of B.H. Collar - 655.410m					Total Depth - 22.3 m				
					Total Core Length - 22.3m				
Depth in m		Total in m	Core recovery in m	Lithology	Percentage				
From	To				L.O.I.	SiO <sub>2</sub>	Fe	Al <sub>2</sub> O <sub>3</sub>	Mn
0	2.65	2.65	2.65	Laterite	10.24	19.2	35.13	17.88	Nil
2.65	5.15	2.5	2.5	Shale	13.82	26.12	20.96	28.45	Nil
5.15	13	7.85	7.85	Shale	16.25	35.1	13.59	26.74	Nil
13	17.5	4.5	4.5	Shale	12.8	25.64	22.66	27.02	Nil
17.5	22.3	4.8	4.8	Shale	13.37	13.98	31.16	25.71	Nil

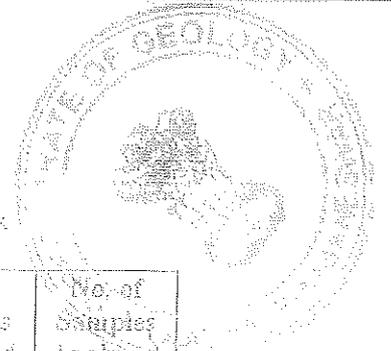
B.H. No. - 39			Date of Commencement - 14.08.16		
Grid Location - S200/W400			Date of Completion - 26.08.16		
R.L. of B.H. Collar - 661.26 m			Total Depth - 33.45 m		
Depth of Water Table - 0.85 m			Total Core Length - 33.45 m		
Depth in m		Total in m	Core recovery in m	Lithology	Remarks
From	To				
0	33.45	33.45	33.45	Shale	

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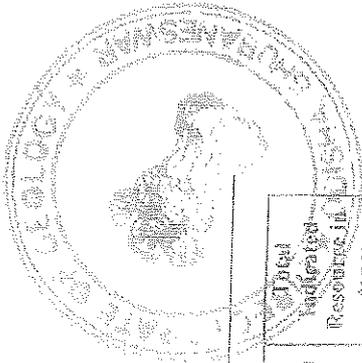
Annexure - III  
Details of Boreholes of Netrabandha Pahar Iron ore Block

B.H.No.	Grid Location	R. L. in m	Depth in m	Thickness of Ore in m	Thickness of O.R. in m	No. of Samples Collected	No. of Samples Analysed
1	O/O	674.47	36	35.9	Nil	35	35
2	O/S400	676.635	37.7	Nil	Nil	1	1
3	O/E200	655.27	27.2	23.85	0.33	27	27
4	O/S200	669.71	10	3(not accounted)	3.1	6	6
5	S200/E200	658.94	51.5	47.7	Nil	50	50
6	O/N200	641.39	46.6	39.4	Nil	46	46
7	O/E400	622.10	45.5	39.4	Nil	45	45
8	N200/E200	631.02	41.35	36.95	Nil	42	42
9	S200/E400	626.95	49.2	34.35	1.4	46	46
10	N200/W200	642.79	51	40.85	Nil	51	51
11	S400/E200	658.18	35.2	Nil	Nil	18	18
12	S600/E200	655.695	33	10.55	5.8	19	19
13	O/S600	669.71	77.5	72.00	1	78	78
14	O/W200	663.850	76.6	48.20	7.3	60	60
15	S600/E400	638.570	38	17	3	33	33
16	S400/E400	622.275	37.5	26.7	Nil	30	30
17	S800/E200	655.330	32	26.3	6.6	32	32
18	O/N400	623.29	39.1	Nil	Nil	Nil	Nil
19	S800/E400	631.94	31.5	13	11.3	24	24
20	N400/W200	627.39	38.4	29.75	5.85	32	32
21	S400/E600	616.515	26.3	18.5	5.8	19	19
22	S1000/E200	633.74	54.5	32.3	22	32	32
23	O/S800	667.770	62.8	60.2	Nil	65	65
24	S200/W200	662.06	63.2	4.8	35	17	17
25	S800/E600	625.760	19.85	2.9	14.7	8	8
26	S600/E600	634.515	18.8	17	Nil	19	19
27	N400/W400	640.92	50	35.6	10.7	36	36
28	S1000/E600	625.830	50.4	21.3	30	27	27
29	S1000/E400	638.630	21.5	1.9	19.5	10	10
30	S600/W200	657.07	28.6	26.1	0.2	28	28
31	S400/W200	663.225	21.8	Nil	Nil	Nil	0
32	O/S1000	638.620	49.2	39.75	7.25	44	44
33	N200/W400	642.39	52.3	8	21.4	8	8
34	S1000/W200	641.34	34.8	9.6	9.8	18	18
35	S800/W200	649.20	36.4	31.4	Nil	33	33
36	S600/W400	665.55	30.45	Nil	Nil	Nil	Nil
37	O/W400	665.36	33.1	Nil	Nil	Nil	Nil
38	S400/W400	655.410	22.3	Nil	Nil	5	5
39	S200/W400	661.26	33.45	Nil	Nil	Nil	Nil
Total			1544.6	851.25		1044	1044

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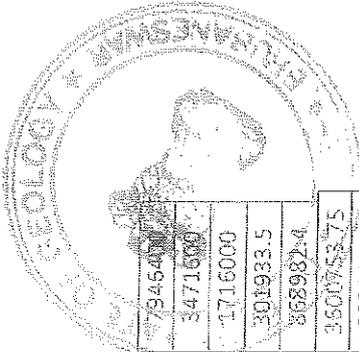
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 Odisha, Bhubaneswar



**Annexure : IV**  
**Resource and grade calculation by Bore hole influence method**

Block No	B.H. No	Panel area in m <sup>2</sup>	Bulk Density	Fe 45 to 55%				Indicated Resource in tonnes	Fe +55%				Indicated Resource in tonnes	Total Indicated Resource in tonnes
				Thickn ess in m	Fe %	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub> %		Thickn ess in m	Fe %	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub> %		
1	27	23250	3.3	2	50.55	11.1	14.65	153450	33.6	66.301	1.191	1.389	2577960	2731410
2	20	29700	3.3	2	52.095	9.38	5.46	196020	27.75	62.138	4.3	2.247	2719777.5	2915797.5
5	10	40000	3.3	4	51.566	5.28	11.85	528000	36.85	64.415	1.865	1.889	4864200	5392200
6	6	40000	3.3	3	48.89	10.713	6.14	396000	36.4	63.48	2.725	0.728	4804800	5209800
8	8	31000	3.3	1.65	52.236	4.987	8.461	168795	35.3	62.956	2.182	3.202	3611190	5779885
9	14	40000	3.3	6.2	50.16	9.3	11.53	818400	42	64.995	1.494	2.046	5544000	6362400
10	1	40000	3.3	4.5	51.99	9.1	8.72	594000	31.4	62.139	2.822	3.55	4144800	4738800
11	3	40000	3.3	9	50.502	11.833	6.299	1188000	14.85	61.979	3.541	2.456	1960200	3123200
12	7	31520	3.3	7.7	50.53	9.02	8.58	800923.2	31.7	64.12	2.869	1.56	3297307.2	4098230.4
14	24	40000	3.3	4	51.496	17.616	4.732	528000	0.8	50.992	4.48	0.088	105600	633600
16	5	40000	3.3	1	48.09	10.84	15.74	132000	46.7	63.346	1.798	1.87	6164400	6296400
17	9	38100	3.3	21.65	49.762	8.246	8.615	2722054.5	12.7	59.75	5.28	3.607	1596771	4318325.5
22	16	38950	3.3	9.8	51.08	4.28	10.874	1259643	16.9	62.14	2.909	3.92	2172241.5	3431884.5
23	21	28760	3.3	7	49.94	11.94	10.095	664356	11.5	61.192	5.74	3.384	1091442	1755798
25	30	40000	3.3	7.6	49.53	7.265	13.505	1003200	18.5	62.082	4.928	2.356	2442000	3445200
26	13	40000	3.3	11	51.216	9.066	8.484	1452000	61	63.793	2.835	2.585	8052000	9504000
27	12	40000	3.3	7.55	50.672	5.349	9.373	996600	3	57.962	5.615	1.665	396000	1392600
28	15	40000	3.3	11	50.45	16.356	3.719	1452000	6	58.84	5.795	3.781	792000	2244000
29	26	35420	3.3	12	50.185	15.78	6.458	1402632	5	58.522	8.492	4.012	584430	1987062
30	35	40000	3.3	25.2	49.17	13.78	7.717	3326400	6.2	57.749	7.787	3.697	818400	4144800

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31	23	40000	3.3	6.6	49.545	7.442	8.017	871200	53.6	63.4	2.001	1.953	7075200	79464	
32	17	40000	3.3	1	49.28	14.82	5.38	132000	25.3	58.402	3.817	1.212	3339600	3471600	
33	19	40000	3.3	13	51.8	20.077	7.7	1716000	-	-	-	-	0	1716000	
34	25	31550	3.3	2.9	51.762	12.714	6.603	301933.5	-	-	-	-	0	301933.5	
35	34	27430	3.3	7	52.43	10.957	7.53	633633	2.6	58.607	6.281	4.993	235349.4	868982.4	
36	32	27450	3.3	1	51.44	10.1	8.27	90585	38.75	65.564	1.85	1.196	3510168.8	3500958.75	
37	22	27480	3.3	0				0	32.3	65.556	1.8	1.07	2929093.2	2929093.2	
38	29	27500	3.3	0	47.46	8.06	8.5	0	1.9	58.69	8.253	3.14	172425	172425	
39	28	19860	3.3	6.5	50.85	15.22	7.1	425997	14.8	59.95	8.928	1.923	969962.4	1395959.4	
4	33	31220	3.3	0				0	8	60.598	2.832	3.683	824208	824208	
Total				195.85	1414.677	300.621	240.102	23953822	655.4	1719.658	114.41	69.202	76795526	100749348	
		Average grade		50.524		10.736		8.575							
		20% less due to mining loss, Calculation error and human error						(-) 4.791 mt						(-) 15.359 mt (-) 20.15 mt	
		Net resource						19.163 mt						61.437 mt	

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 Director of Geology  
 Government of Karnataka

Annexure: V

Resource & Grade calculation by Cross Sectional area method  
High grade (at 55 % cut off Fe other than HLO & Blue dust)

Section line/Bore hole No.	Cross - sectional area in sq m	Strike influence (m)	Volume in cu m	Bulk density	Tonnage in tonnes	Avg. Grade for each line (Fe%)	Avg. Grade for each line (SiO <sub>2</sub> %)	Avg. Grade for each line (Al <sub>2</sub> O <sub>3</sub> %)
AA'	6176	150	926400	3.3	3057120	63.784	4.4505	5.172
BB'	18701	200	3740200	3.3	12342660	62.4485	2.5325	2.66425
CC'	10625	200	2125000	3.3	7012500	60.704	3.72925	3.57725
DD'	11403	200	2280600	3.3	7525980	57.62033	4.043333	2.1
EE'	3276	200	655200	3.3	2162160	61.191	5.739	3.588
FF'	10697	200	2139400	3.3	7060020	59.6584	5.5288	3.3282
GG'	12309	200	2461800	3.3	8123940	59.93625	7.22975	3.731
HH'	25246	150	3786900	3.3	12496770	60.906	6.9988	3.44
<b>Total</b>					59781150			
- 20% towards accuracy in sampling and other variables					59.781 mt			
Net resource					(-) 11.956 mt	60.781	5.031	3.424
Net resource					47.825 mt			

HLO (Lumpy ore) (at 55 % cut off Fe)

Section line/Bore hole No.	Cross - sectional area in sq m	Strike influence (m)	Volume in cu m	Bulk density	Tonnage in tonnes	Avg. Grade for each line (Fe%)	Avg. Grade for each line (SiO <sub>2</sub> %)	Avg. Grade for each line (Al <sub>2</sub> O <sub>3</sub> %)
BB'	568	200	113600	3.3	374880	63.618	1.7699	2.035
GG'	1265	200	253000	3.3	834900	63.52	1.677	2.344
<b>Total</b>					1209780			
- 20% towards accuracy in sampling and other variables					1.210mt			
Net resource					(-) 0.242mt	63.569	1.723	3.409
Net resource					0.968 mt			



Blue dust

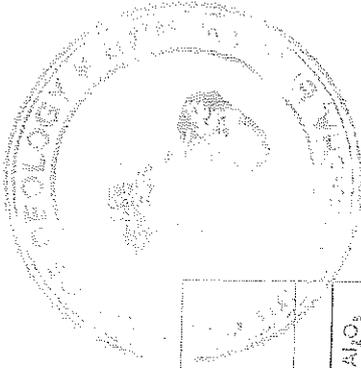
Section line/Bore hole No	Cross-sectional area in sq m	Strike influence (m)	Volume in cu m	Bulk density	Tonnage in tonnes	Avg. Grade for each line (Fe%)	Avg. Grade for each line (SiO <sub>2</sub> %)	Avg. Grade for each line (Al <sub>2</sub> O <sub>3</sub> %)
AA'	4109	150	616350	3.3	2033955	68.05	0.964	1.165
BB'	3176	200	635200	3.3	2096160	66.260	1.420	1.118
CC'	10,014	200	2002800	3.3	6609240	65.651	1.519	1.503
EE'	2154	200	430800	3.3	1421640	62.326	2.742	3.890
FF'	5602	200	1120400	3.3	3697320	65.785	2.850	1.056
GG'	2226	200	445200	3.3	1469160	65.809	1.067	1.373
Total					17327475	65.647	1.76	1.584
-20% towards accuracy in sampling and other variables					17,327 mt			
					(-) 3,465 mt			
					13,862 mt			

Sub grade (at +45 to <55 % cut off Fe)

Section line/Bore hole No	Cross-sectional area in sq m	Strike influence (m)	Volume in cu m	Bulk density	Tonnage in tonnes	Avg. Grade for each line (Fe%)	Avg. Grade for each line (SiO <sub>2</sub> %)	Avg. Grade for each line (Al <sub>2</sub> O <sub>3</sub> %)
AA'	192	150	28800	3.3	95040	51.3225	10.24	10.955
BB'	387	200	77400	3.3	255420	50.89733	6.9933	8.817
CC'	3925	200	785000	3.3	2590500	50.7955	9.8133	8.78225
DD'	5237	200	1047400	3.3	3456420	49.78267	12.234	9.69567

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**Annexure : VI**  
**Calculation of average grade by cross sectional method**

Sl No	Section	B.H.	Fe 45 to 55%			Average %			Fe +55%			Average %		
			Fe %	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub>	Fe %	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub>	Fe %	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub>	Fe %	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub>
1	AA'	18	0	0	0	51.3225	10.24	10.055	0	0	0	61.665	5.02	2.8155
		20	52.095	9.38	5.46				62.138	4.3	2.247			
		27	50.55	11.1	14.65				61.192	5.74	3.384			
2	BB'	6	48.89	10.713	6.14	50.89733	6.9933	8.817	63.48	2.725	0.728	62.862	2.401	2.3755
		8	52.236	4.987	8.461				62.956	2.182	3.202			
		10	51.566	5.28	11.85				64.415	1.865	1.889			
		33	0	0	0				60.598	2.832	3.683			
3	CC'	1	51.99	9.1	8.72	50.7955	9.8133	8.78225	62.139	2.822	3.55	63.308	2.682	2.402
		3	50.502	11.833	6.299				61.979	3.541	2.456			
		7	50.53	9.02	8.58				64.12	2.869	1.56			
		14	50.16	9.3	11.53				64.995	1.494	2.046			
		37	0	0	0				0	0	0			
4	DD'	4	0	0	0	49.78267	12.234	9.69567	0	0	0	58.029	3.853	1.855
		5	48.09	10.84	15.74				63.346	1.798	1.87			
		9	49.762	8.246	8.615				59.75	5.28	3.607			
		24	51.496	17.616	4.732				50.992	4.48	0.088			
		39	0	0	0				0	0	0			
		2	0	0	0	50.51	8.11	10.4845	0	0	0	61.666	4.325	3.652
5	EE'	11	0	0	0				0	0	0			
		16	51.08	4.28	10.874				62.14	2.909	3.92			
		21	49.94	11.94	10.095				61.192	5.74	3.384			
		31	0	0	0				0	0	0			
		38	0	0	0				0	0	0			
		12	50.672	5.349	9.373	50.4106	10.763	8.3078	57.962	5.615	1.665	60.24	5.533	2.8798
6	FF'	13	51.216	9.066	8.484				63.793	2.835	2.585			
		15	50.45	16.356	3.719				58.84	5.795	3.781			

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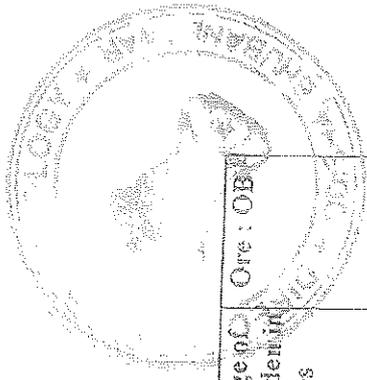
7	GG'	26	50.185	15.78	6.458	50.3114	13.767	7.0834	58.522	8.492	4.012	59.123	6.951	1.055
		30	49.53	7.265	13.505				62.082	4.928	2.356			
		36	0	0	0				0	0	0			
		17	49.28	14.82	5.38				58.402	3.817	1.212			
8	HH'	19	51.8	20.077	7.7	50.545	11.084	7.85	56.94	14.2	Nil	61.673	5.422	2.4544
		23	49.545	7.442	8.017				63.4	2.001	1.953			
		25	51.762	12.714	6.603				0	0	0			
		35	49.17	13.78	7.717				57.749	7.787	3.697			
		22	0	0	0				65.556	1.8	1.07			
		28	50.85	15.22	7.1				59.95	8.928	1.923			
		29	47.46	8.06	8.5				58.69	8.253	3.14			
		32	51.44	10.1	8.27				65.564	1.85	1.196			
34	52.43	10.957	7.53	58.607	6.281	4.993								
Block average					50.572	10.376	8.88445	61.071	4.523	2.43753				

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University of Madras



**Annexure : VII**  
**Calculation of Ore : Overburden**

Section	Sectional area in m <sup>2</sup>	Strike Influence in m	Volume of Ore in m <sup>3</sup>	Bulk density of Ore	Tonnage of Ore in tones	Tonnage of ore in tones (80% recovery)	Over burden Sectional area in m <sup>2</sup>	Volume of over burden in m <sup>3</sup>	Bulk density of over burden	Tonnage of Over burden in tonnes	Ore : OB
AA'	10477	150	1571550	3.3	5186115	4148892	5361	804150	2.7	2171205	
BB'	22832	200	4566400	3.3	15069120	12055296	4558	911600	2.7	2461520	
CC'	24564	200	4912800	3.3	16212240	12969792	2234	446800	2.7	1206360	
DD'	16640	200	3328000	3.3	10982400	8785920	6122	1224400	2.7	3305880	
EE'	7902	200	1580400	3.3	5215320	4172256	2220	444000	2.7	1198800	
FF'	27435	200	5487000	3.3	18107100	14485680	4371	874200	2.7	2360340	
GG'	27672	200	5534400	3.3	18263520	14610816	4480	896000	2.7	2419200	
HH'	27134	150	4070100	3.3	13431330	10745064	4481	672150	2.7	1814805	
<b>Total</b>											
						<b>81973716</b>				<b>16937910</b>	<b>01:0.21</b>

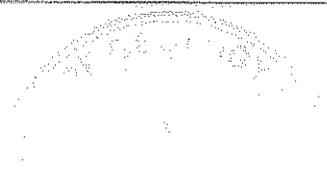
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*KR*

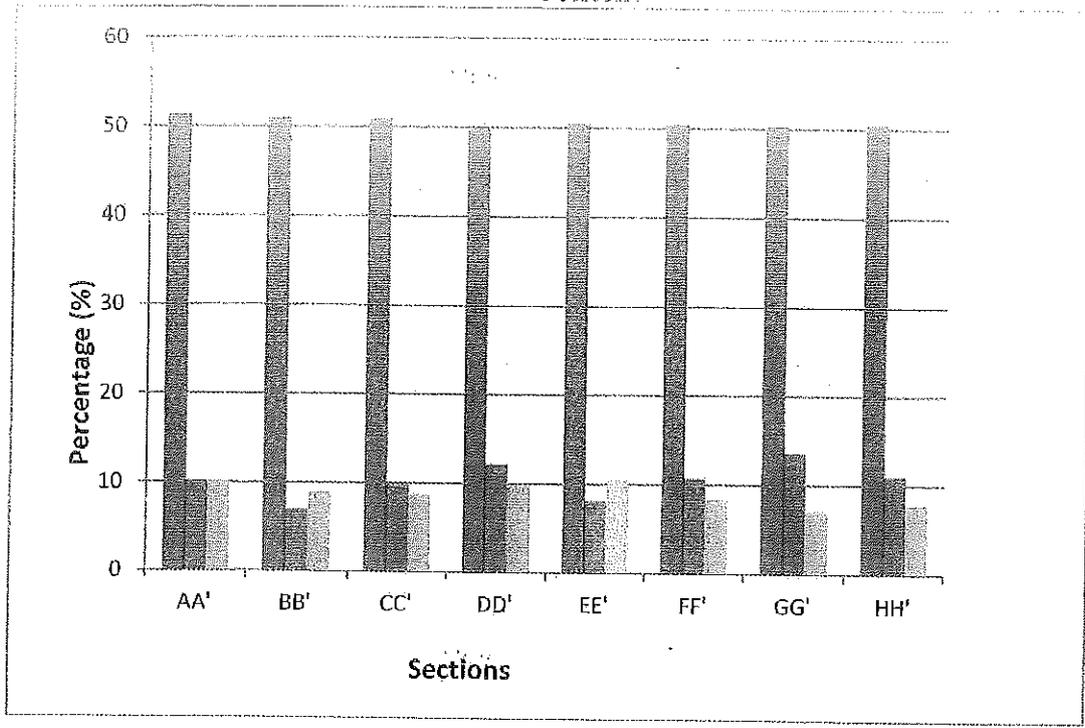
*KR*

Note: Bulk density of ore & over burden has been taken as 3.3 (determined) and 2.7 (assumed) respectively.

*M. S. Srinivasan*  
Director of Geology  
Bangalore



**Annexure: VIII**  
**Graphical representation of section wise variation in average Fe, SiO<sub>2</sub> & Al<sub>2</sub>O<sub>3</sub> Content**



**Figure 1**

Fe 45% to 55 %

Section	Fe %	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub> %
AA'	51.32	10.24	10.055
BB'	50.9	6.9933	8.817
CC'	50.8	9.8133	8.7823
DD'	49.78	12.234	9.6957
EE'	50.51	8.11	10.485
FF'	50.41	10.763	8.3078
GG'	50.31	13.67	7.083
HH'	50.55	11.084	7.85

*Kaha*  
*KM*  
 71 *KNaik*  
*ADP*  
 Director of Geology  
 04148, Bhubaneswar

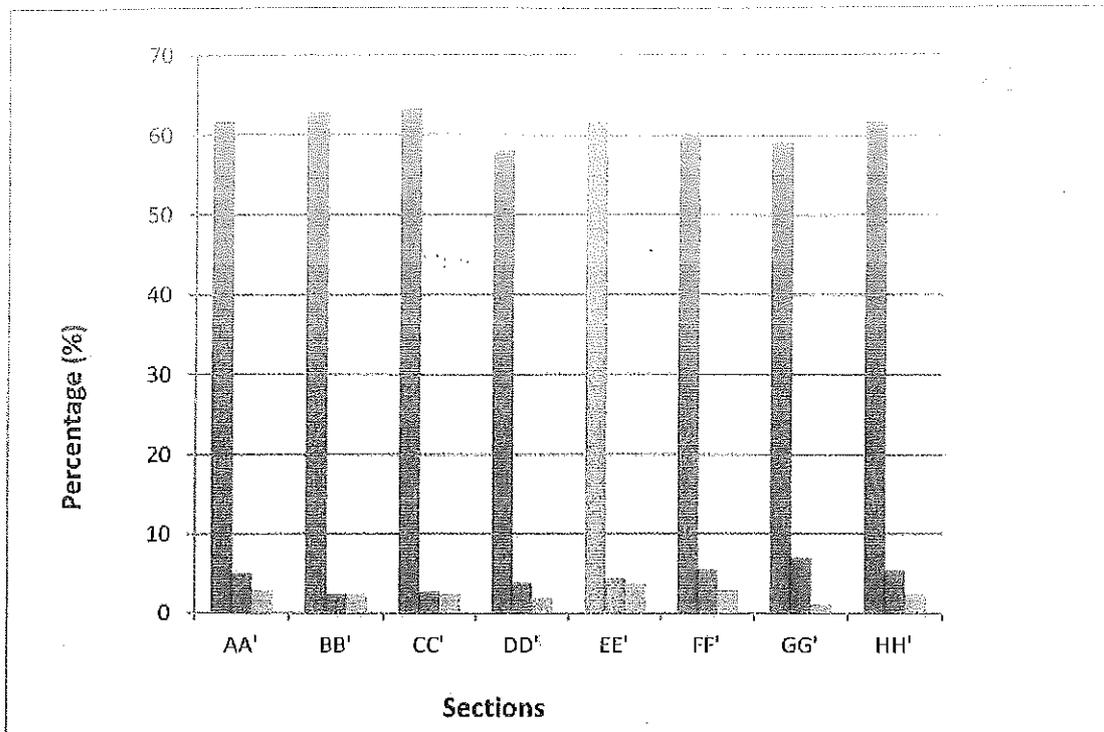


Figure 2

Fe +55% grade

Section	Fe %	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub> %
AA'	61.67	5.02	2.8155
BB'	62.86	2.401	2.3755
CC'	63.31	2.6815	2.403
DD'	58.03	3.8527	1.855
EE'	61.67	4.3245	3.652
FF'	60.24	5.533	2.88
GG'	59.12	6.951	1.055
HH'	61.67	5.4224	2.4644

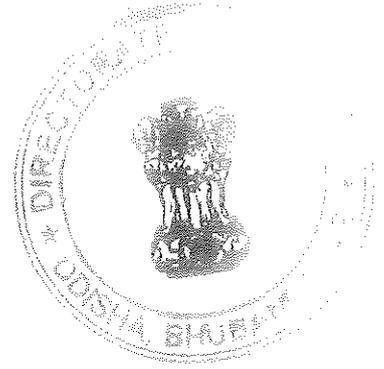
*Kaha*

*ART*

72

*ISNAIK*

*AD-10*  
Director of Geology  
Odisha, Bhubaneswar



GOVERNMENT OF ODISHA  
DEPARTMENT OF STEEL AND MINES  
DIRECTORATE OF GEOLOGY

**REPORT ON  
INVESTIGATION OF IRON ORE AROUND  
NETRABANDHA PAHAR, SUNDARGARH  
DISTRICT, ODISHA**

**F. S.: 2012-13  
2015-17**

**VOLUME - II  
(PLATES)**

*Kaba*

*AS 5/10*

*KNaik*

*AS 5/17*  
Director of Geology  
Odisha, Bhubaneswar



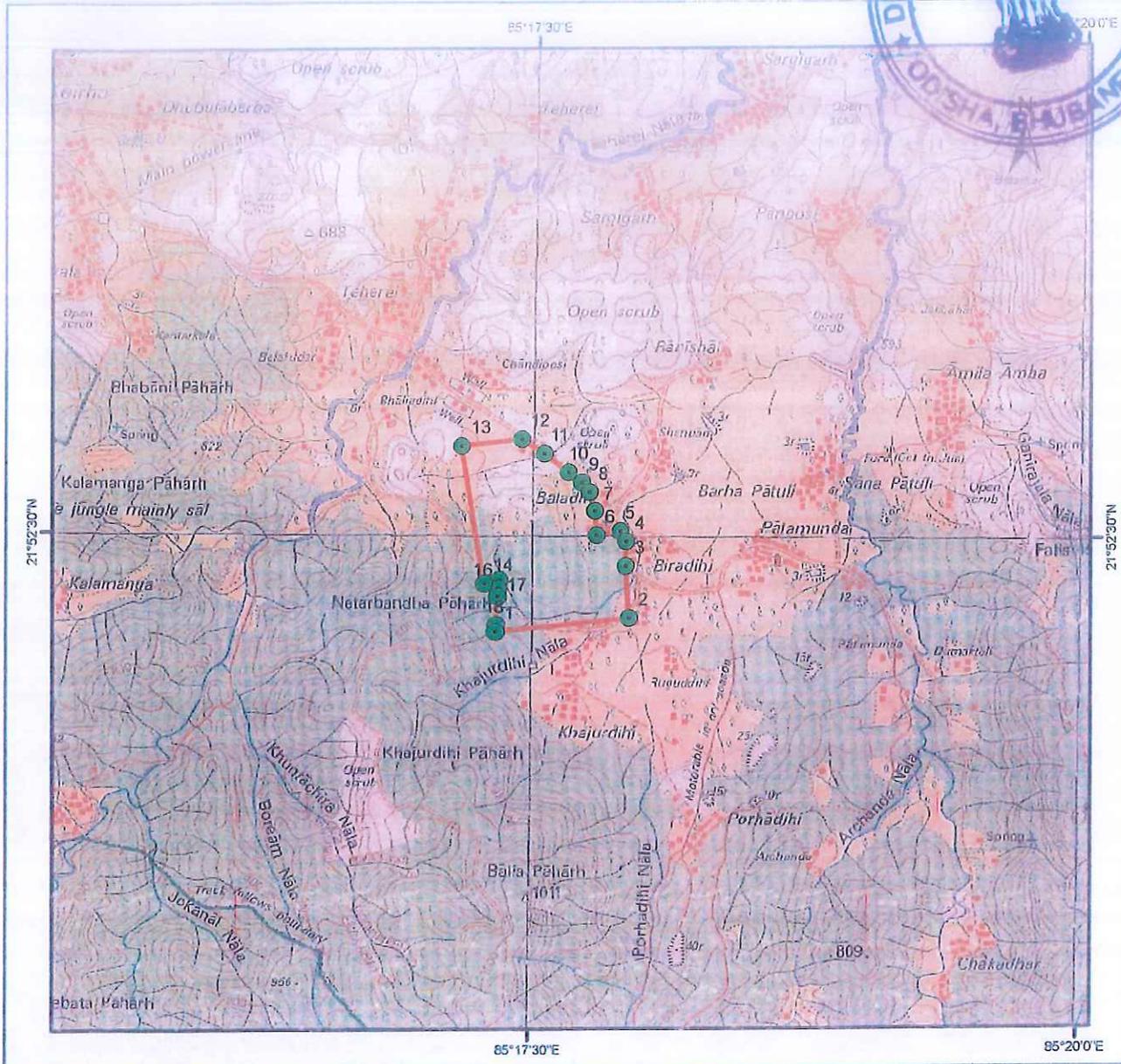
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Plate-II	Map showing Netrabandha Pahar Iron ore Block in Bonai-Keonjhar Horse-Shoe Belt.
Plate-III	Geological Map around Netrabandha Pahar Iron ore Block (1: 2,000).
Plate-IV	Bore hole plan and Contour plan of Netrabandha Pahar Iron ore Block (1: 2,000).
Plate V (A-D)	Graphical Litho log of Boreholes B.H. 1 to 39.
Plate-VI	Borehole influence Block map of Netrabandha Pahar Iron ore Block (1:2,000).
Plate-VII (A-F)	Geological sections along A-A', B-B', C-C', D-D', E-E', F-F', G-G' and H-H' Horizontal – 1:2,000, Vertical – 1:500.
Plate-VIII	Map showing the DGPS block boundary of Netrabandha Pahar Iron ore block, Sundargarh district (Scale – 1:2,000).

*Kaha* *KR* *KMAIK*

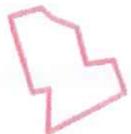
*Abhishek*  
Director of Geology  
Odisha, Bhubaneswar

INDEX MAP OF NETRABANDHA PAHAR IRON ORE BLOCK, SUNDARGARH DISTRICT

T. S. N. F45N5 Plate - I



Pillar ID	Latitude	Longitude
1	21°52'05.24244"	85°17'20.07528"
2	21° 52' 8.908" N	85° 17' 56.810" E
3	21° 52' 22.320" N	85° 17' 55.650" E
4	21° 52' 28.665" N	85° 17' 55.717" E
5	21° 52' 31.206" N	85° 17' 54.139" E
6	21° 52' 30.236" N	85° 17' 47.457" E
7	21° 52' 36.366" N	85° 17' 47.026" E
8	21° 52' 41.204" N	85° 17' 45.466" E
9	21° 52' 43.649" N	85° 17' 43.360" E
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11	21° 52' 50.932" N	85° 17' 32.999" E
12	21° 52' 54.542" N	85° 17' 26.720" E
13	21° 52' 52.774" N	85° 17' 10.449" E
14	21°52'17.67504"	85°17'16.93824"
15	21°52'18.52788"	85°17'20.99112"
16	21°52'16.36896"	85°17'20.75100"
17	21°52'14.42280"	85°17'20.63184"
18	21°52'06.87936"	85°17'20.15772"



DGPS Boundary of Netrabandha Pahar Iron Ore Block



Pillar Point

*Atomi*  
 Director of Geology  
 Odisha, Bhubaneswar

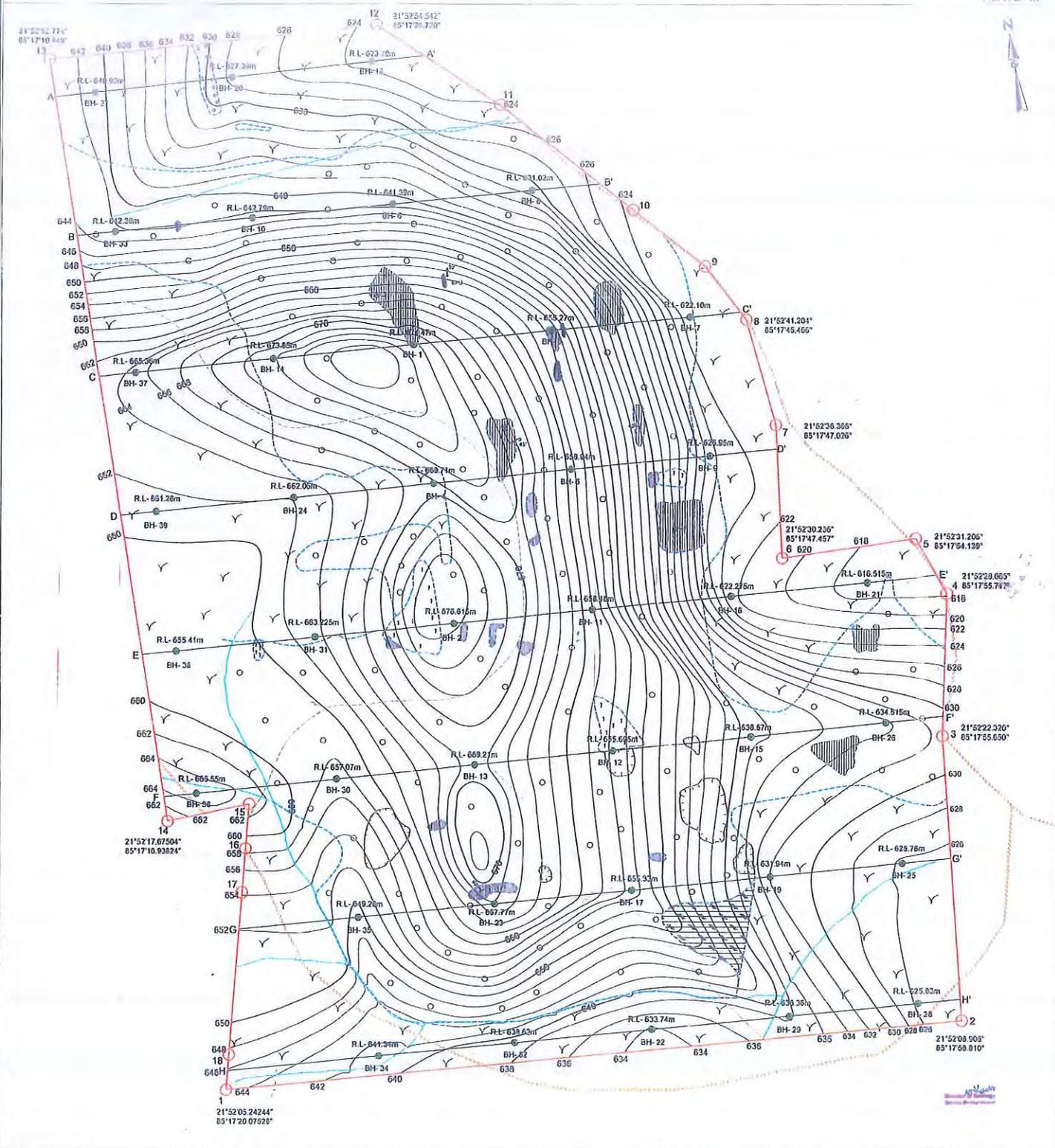
*Kabe* *Atomi* *KMaiti*





# GEOLOGICAL PLAN AND BORE HOLE PLAN OF NETRABANDHA PAHAR IRON ORE BLOCK, SUNDARGARH DISTRICT.

PLATE-III



## LEGENDS

- |          |               |                      |           |                |                  |
|----------|---------------|----------------------|-----------|----------------|------------------|
| Soil     | Iron(Fe +55%) | Old Quarry           | Road      | Dip-Strike     | PILLAR ID (1-18) |
| Floats   | BHJ           | Contour              | Bore hole | Plunge of Fold |                  |
| Laterite | Litho limit   | Non Mineralised Zone | Nala      | Joint          |                  |

0 0.25 0.50/100

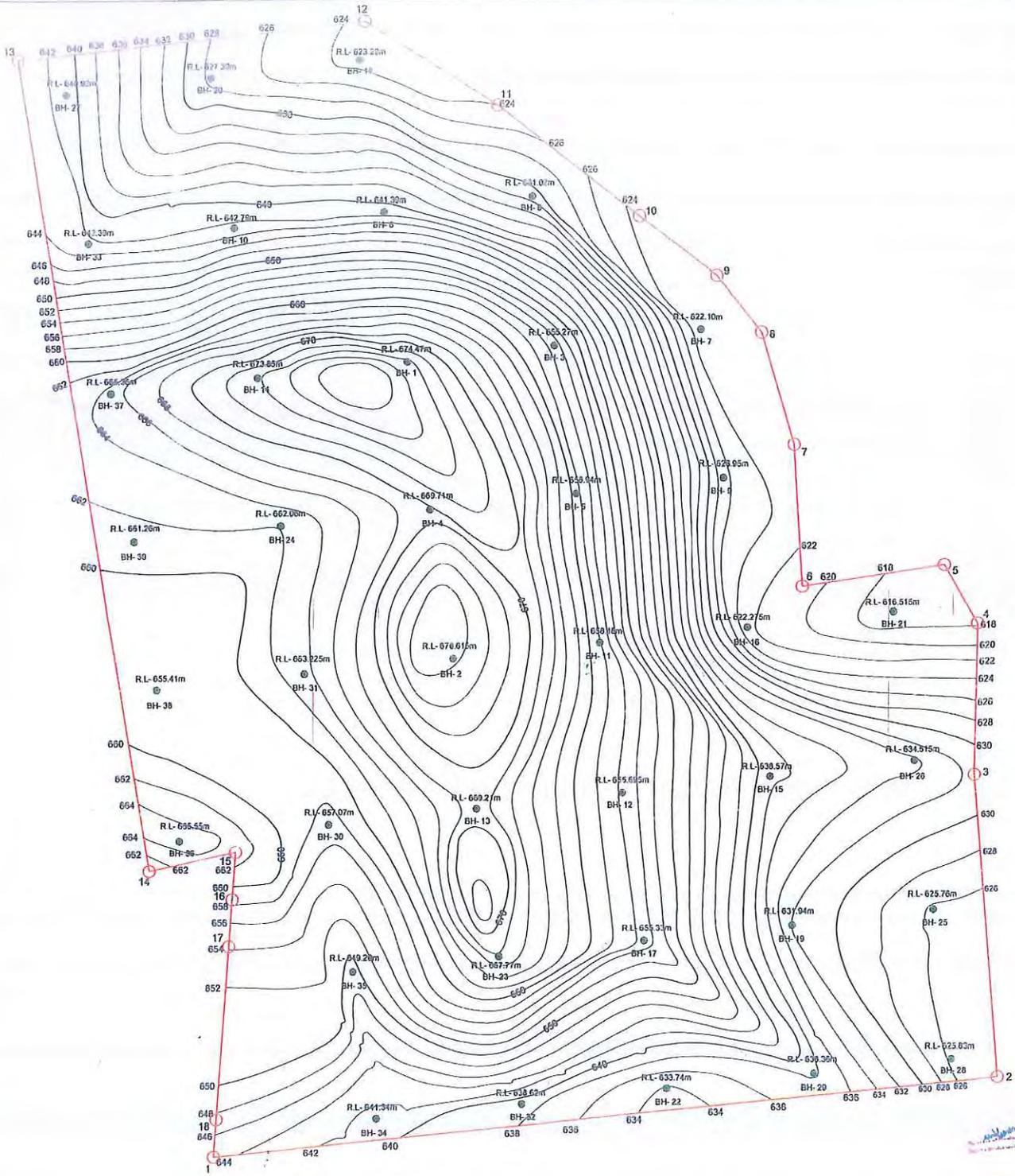
SCALE- 1:2000

*Raha* *ATM* *KNSIK*



# BORE HOLE PLAN AND CONTOUR PLAN OF NETRABANDHA PAHAR IRON ORE BLOCK, SUNDARGARH DISTRICT.

PLATE-IV



**LEGENDS**

-  Contour
-  Bore hole
-  PILLAR ID (1-18)



SCALE- 1:2000

*Raha*



**GRAPHICAL LITHOLOG OF BORE HOLES WITH ASSAY VALUE,  
NETRABANDHA PAHAR IRON ORE BLOCK, SUNDARGARH DISTRICT**

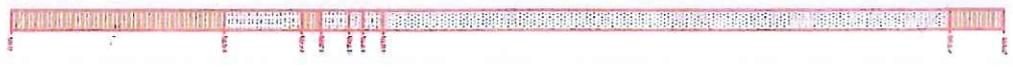
Ref. Toposheet No. -73-G/5

SCALE - 1:100

**SECTION ALONG A-N**

**BH - 27**

Date of Commencement-02.08.15  
Date of Completion-20.08.15  
Location-N 480/W 400  
R. L. -482.20m.



**BH - 20**

Date of Commencement-05.05.15  
Date of Completion-20.05.15  
Location-N 480/W 200  
R. L. -482.20m.



**BH - 18**

Date of Commencement-20.04.15  
Date of Completion-04.05.15  
Location-N 480/W 400  
R. L. -482.20m.



**BH - 33**

Date of Commencement-15.07.15  
Date of Completion-20.08.15  
Location-N 200/W 400  
R. L. -482.50m.



**BH - 10**

Date of Commencement-20.02.15  
Date of Completion-02.03.15  
Location-N 100/W 200  
R. L. -482.75m.



**BH - 6**

Date of Commencement-20.03.15  
Date of Completion-25.05.15  
Location-N 0/W 200  
R. L. -482.20m.  
Water Table-5.7m.



**BH - 06**

Date of Commencement-13.12.15  
Date of Completion-14.02.16  
Location-N 200/W 200  
R. L. -482.05m.  
Water Table-35.0m.



INDEX	
SOIL	1-10
LUTEITE	11-15
LIMONITE	16-20
SOFT LAMINATED ORE	21-25
HARD LAMINATED ORE	26-30
EMERY ORE	31-35
BLUE SLIST	36-40
SAND	41-45
S.S.S.	46-50

**ABDUL KHALIQ**  
Director of Geology  
Odisha, Bhubaneswar

*Kaha*

*AK*

*KNOIS*







**GRAPHICAL LITHOLOG OF BORE HOLES WITH ASSAY VALUE,  
METTABANDHA PAHAR IRON ORE BLOCK, SUNDARIBATHI DISTRICT  
Ref. Toposheet No-73-G/5  
SCALE - 1:100**

**SECTION ALONG S-S'**

**B 11 - 25**  
 Zone of quartzite with iron ore  
 Zone of quartzite with iron ore  
 Location: S. 11 - 25  
 Map No. 73-G/5



**B 11 - 23**  
 Zone of quartzite with iron ore  
 Zone of quartzite with iron ore  
 Location: S. 11 - 23  
 Map No. 73-G/5



**B 11 - 17**  
 Zone of quartzite with iron ore  
 Zone of quartzite with iron ore  
 Location: S. 11 - 17  
 Map No. 73-G/5



**B 11 - 19**  
 Zone of quartzite with iron ore  
 Zone of quartzite with iron ore  
 Location: S. 11 - 19  
 Map No. 73-G/5



**B 11 - 22**  
 Zone of quartzite with iron ore  
 Zone of quartzite with iron ore  
 Location: S. 11 - 22  
 Map No. 73-G/5



**B 11 - 24**  
 Zone of quartzite with iron ore  
 Zone of quartzite with iron ore  
 Location: S. 11 - 24  
 Map No. 73-G/5



**B 11 - 26**  
 Zone of quartzite with iron ore  
 Zone of quartzite with iron ore  
 Location: S. 11 - 26  
 Map No. 73-G/5



**B 11 - 20**  
 Zone of quartzite with iron ore  
 Zone of quartzite with iron ore  
 Location: S. 11 - 20  
 Map No. 73-G/5



**B 11 - 28**  
 Zone of quartzite with iron ore  
 Zone of quartzite with iron ore  
 Location: S. 11 - 28  
 Map No. 73-G/5



INDEX	
1	Zone of quartzite with iron ore
2	Zone of quartzite with iron ore
3	Zone of quartzite with iron ore
4	Zone of quartzite with iron ore
5	Zone of quartzite with iron ore
6	Zone of quartzite with iron ore
7	Zone of quartzite with iron ore
8	Zone of quartzite with iron ore
9	Zone of quartzite with iron ore
10	Zone of quartzite with iron ore

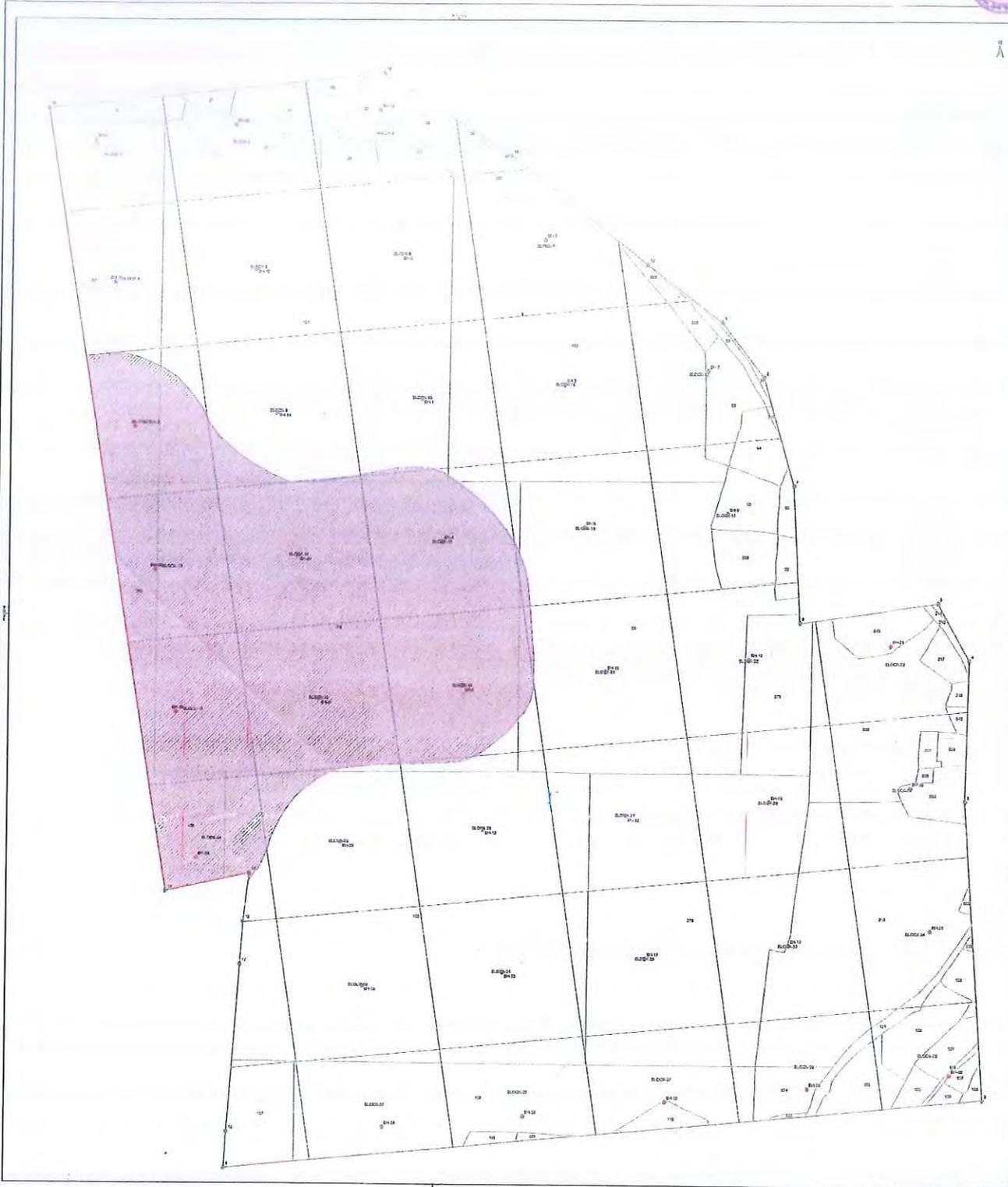
*Abhishek*  
 Director of Geology  
 Government of Karnataka

*Kabe*

*AK*

*KNAIS*

BOREHOLE INFLUENCE BLOCK MAP OF NETRABANDHA PAHAR IRON ORE BLOCK, SUNDARGARH DISTRICT



Pillar ID	Latitude	Longitude
1	21°52'05.24244" N	85°17'20.07528" E
2	21°52'08.908" N	85°17'56.810" E
3	21°52'22.320" N	85°17'55.650" E
4	21°52'28.665" N	85°17'55.717" E
5	21°52'31.206" N	85°17'54.139" E
6	21°52'30.236" N	85°17'47.457" E
7	21°52'36.366" N	85°17'47.026" E
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12	21°52'54.542" N	85°17'26.720" E
13	21°52'52.774" N	85°17'10.449" E
14	21°52'17.67504" N	85°17'16.93824" E
15	21°52'18.52780" N	85°17'20.99112" E
16	21°52'16.36896" N	85°17'20.75100" E
17	21°52'14.42280" N	85°17'20.63184" E
18	21°52'06.87936" N	85°17'20.15772" E



**Legend**

- DGPS Boundary of Netrabandha Pahar Iron Ore Block
- Pillar Point
- Plot Boundary
- Non Mineralised Area
- Mineralised Area
- Borehole Point
- Borehole Influence Block

*Kaba*      *AN*      *KNOIK*

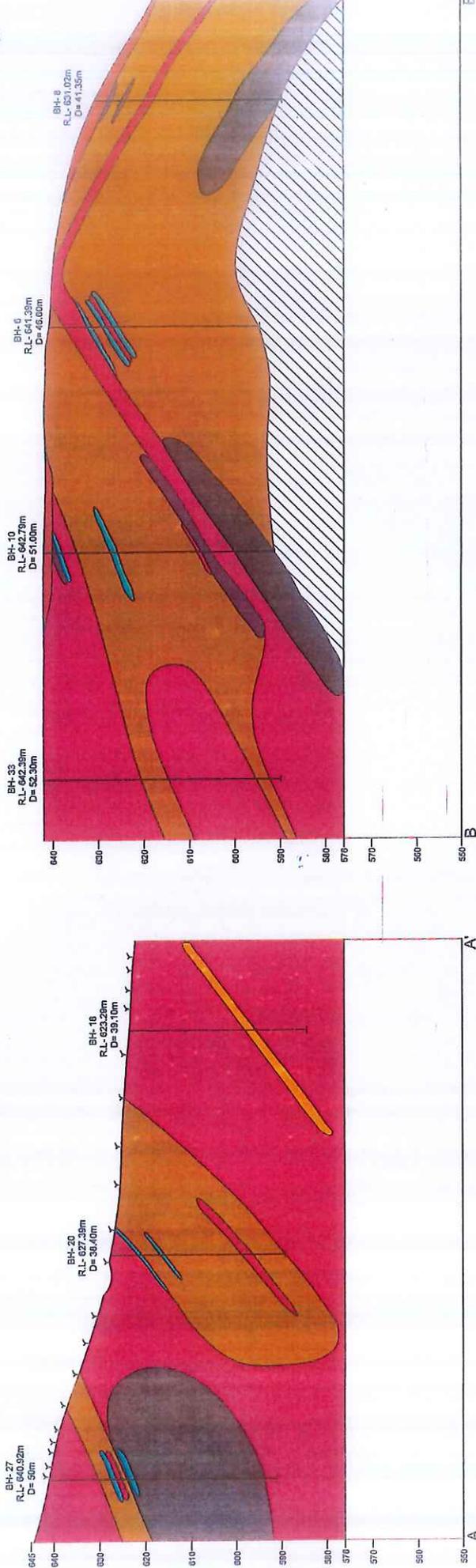


PLATE- VII(A)

# SECTION PLAN OF NETRABANDHA PAHAR IRON ORE BLOCK

## Section along A-A' and B-B'

SCALE  
Horizontal- 1:2000  
Vertical-1:500



### INDEX

- |  |          |  |                 |  |               |
|--|----------|--|-----------------|--|---------------|
|  | Soil     |  | Shale           |  | Iron(Fe +55%) |
|  | Laterite |  | Iron(Fe +5-55%) |  | Blue Duct     |
|  | Limonite |  | HLO             |  | BHJ           |

*Kabo*

*1/15/20*

*K Naik*

*115*

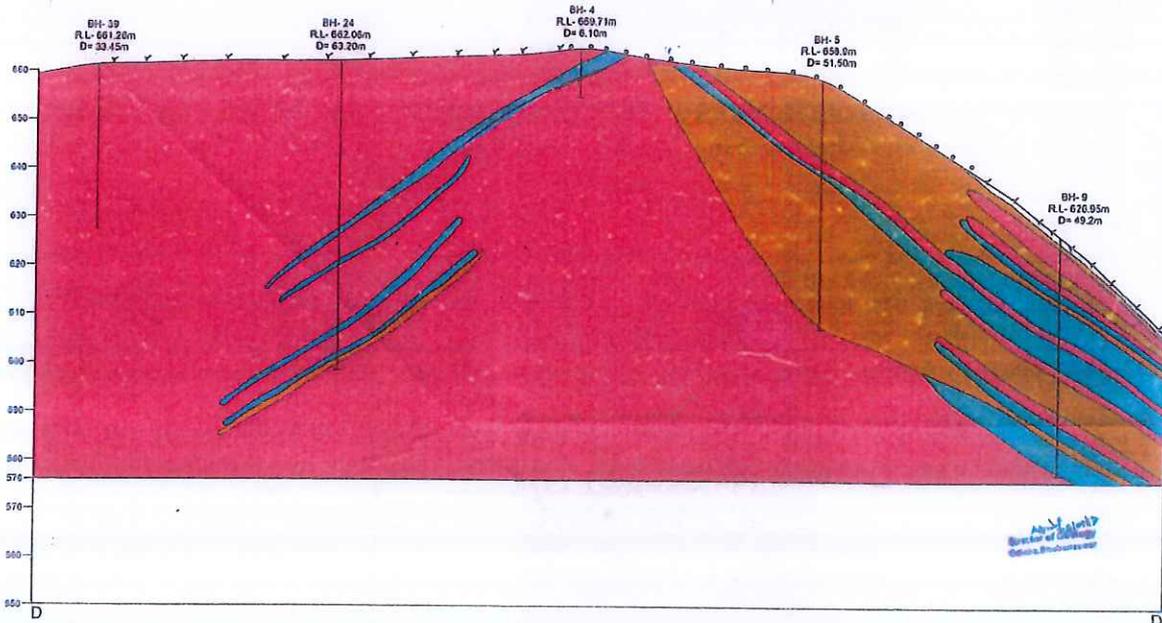
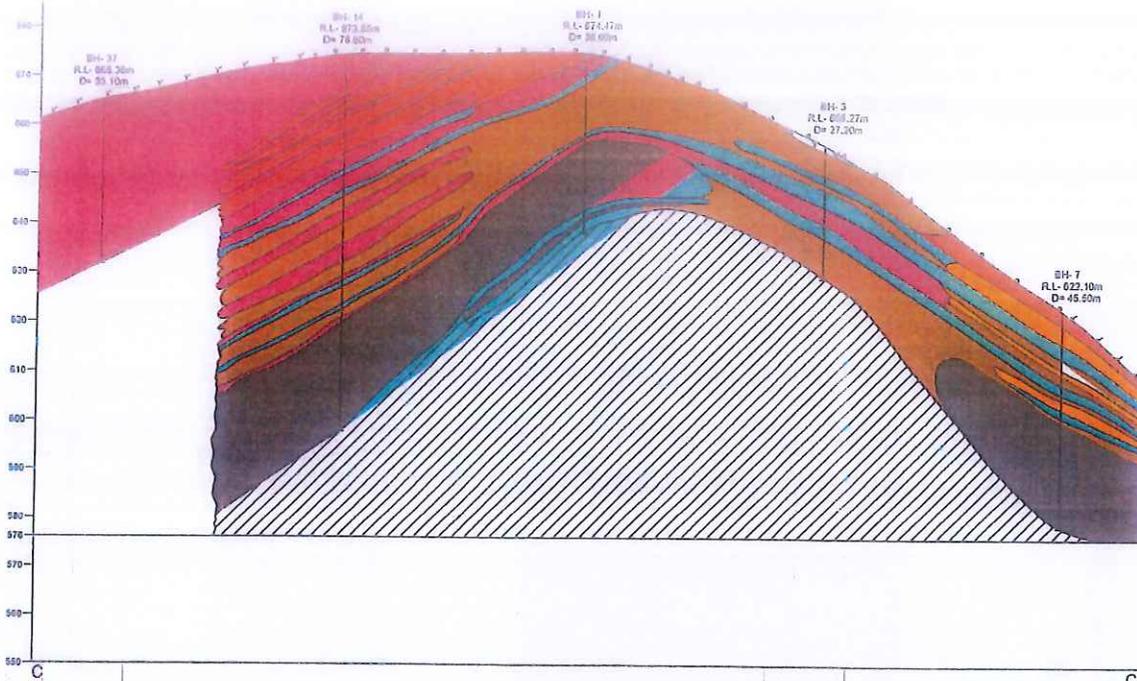
# SECTION PLAN OF NETRABANDHA PAHAR IRON ORE BLOCK

Section along C- C' and D- D'

SCALE

Horizontal 1:2000  
Vertical 1:200

PLATE



INDEX					
	Soil		Limonite		Iron(Fe +55%)
	Boulder		Shale		Blue Dust
	Laterite		Iron(Fe 45-55%)		BHJ

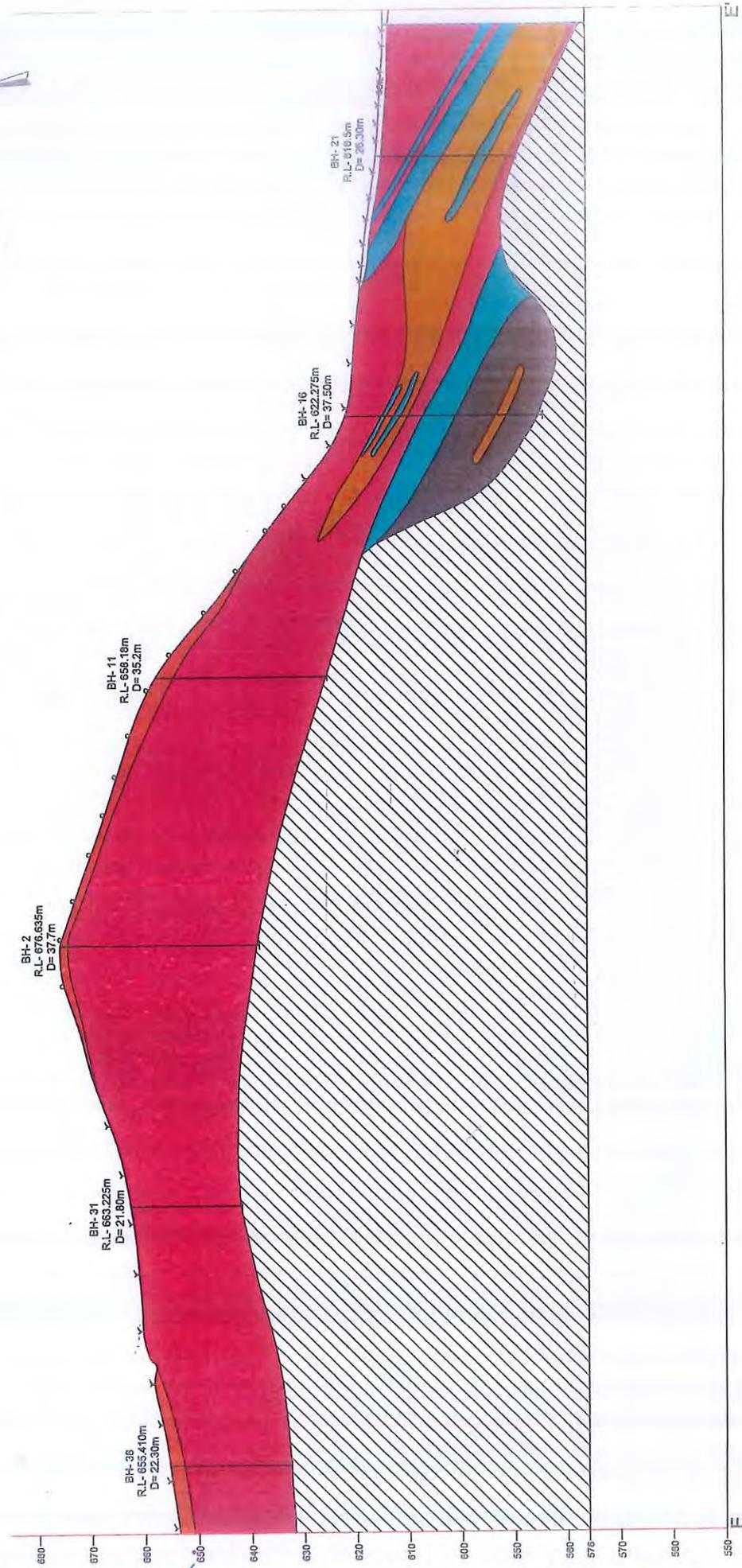
*Kaba* *Atini*

KNais



# SECTION PLAN OF NETRABANDHA PAHAR IRON ORE BLOCK Section along E-E'

SCALE  
Horizontal- 1:2000  
Vertical-1:500



**INDEX**

	Soil		Shale		Iron(Fe) ~55%
	Laterite		Iron(Fe) 45-55%		Blue Dust
	BHU				

*Handwritten signatures and initials:* Raha, KN, KNAR's, HP

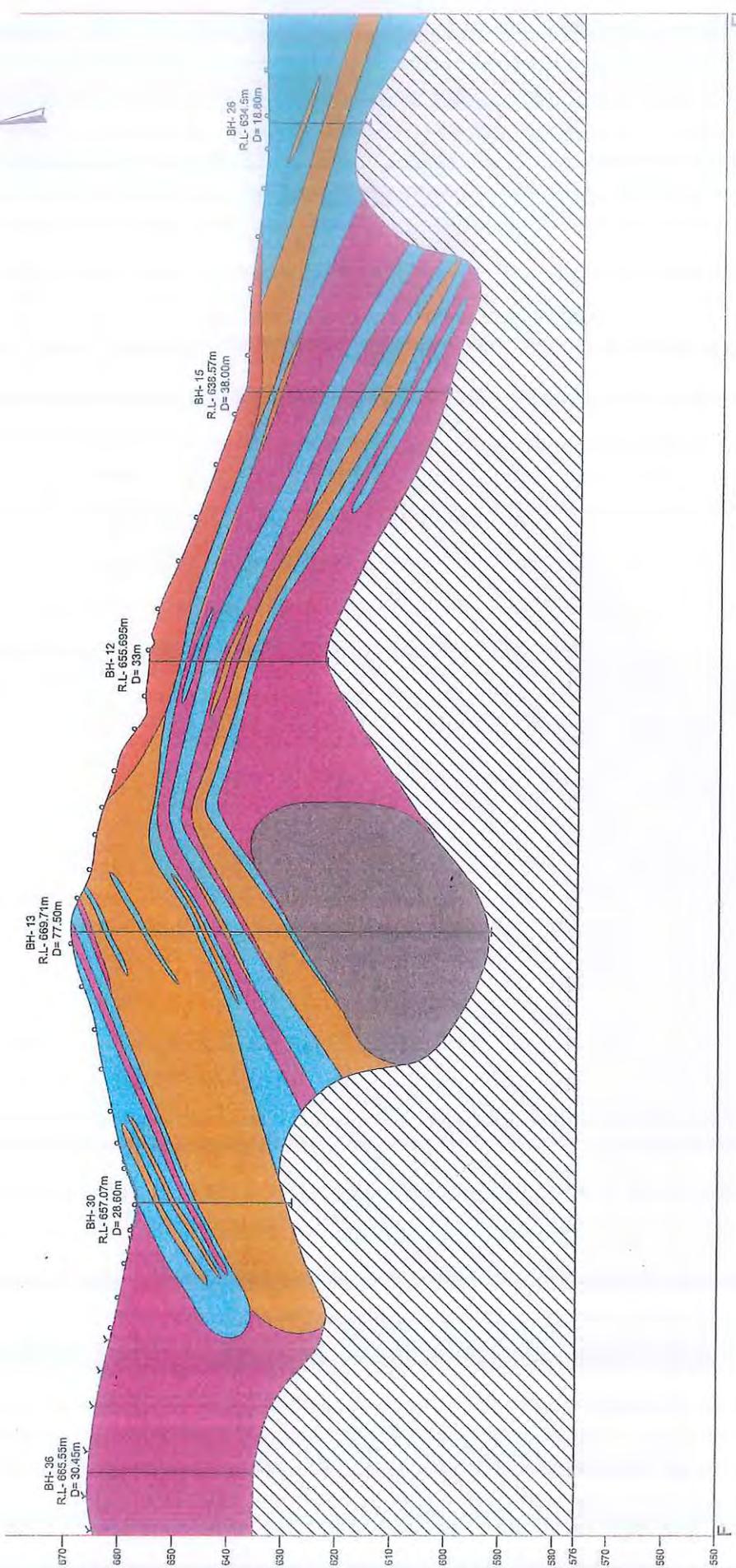


PLATE- VIII(D)

# SECTION PLAN OF NETRABANDHA PAHAR IRON ORE BLOCK Section along F- F'

SCALE

Horizontal- 1:2000  
Vertical- 1:500



### INDEX

- Soil
- Boulder
- Latelite
- Shale
- Iron(Fe 45-55%)
- Iron(Fe +55%)
- Blue Dust
- BHJ

UNIVERSITY OF BORNEO  
FACULTY OF GEOLOGY  
Geological Engineering

*Raha* *ATI* *KNAIK*

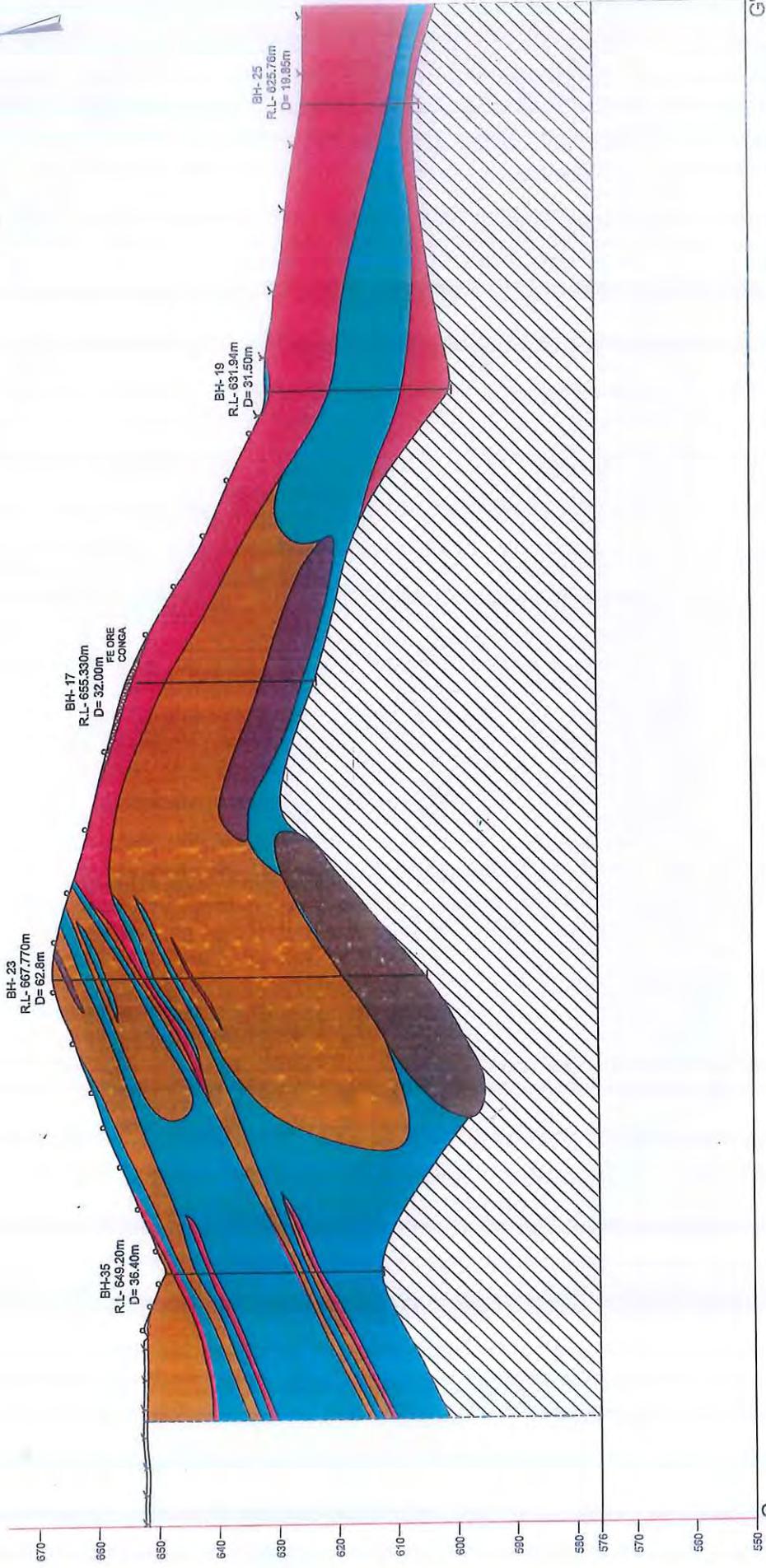


# SECTION PLAN OF NETRABANDHA PAHAR IRON ORE BLOCK

## Section along G-G'

SCALE

Horizontal- 1:2000  
Vertical-1:500



### INDEX

	Soil		Shale		HLO
	Boulder		Iron(Fe 45-55%)		Blue Dust
	Conga Ore		Iron(Fe +55%)		BHJ

Director of Geology  
Odisha, Bhubaneswar

*Handwritten signatures and initials: Kaha, KISHU, KNAIK*

# SECTION PLAN OF NETRABANDHA PAHAR IRON ORE BLOCK

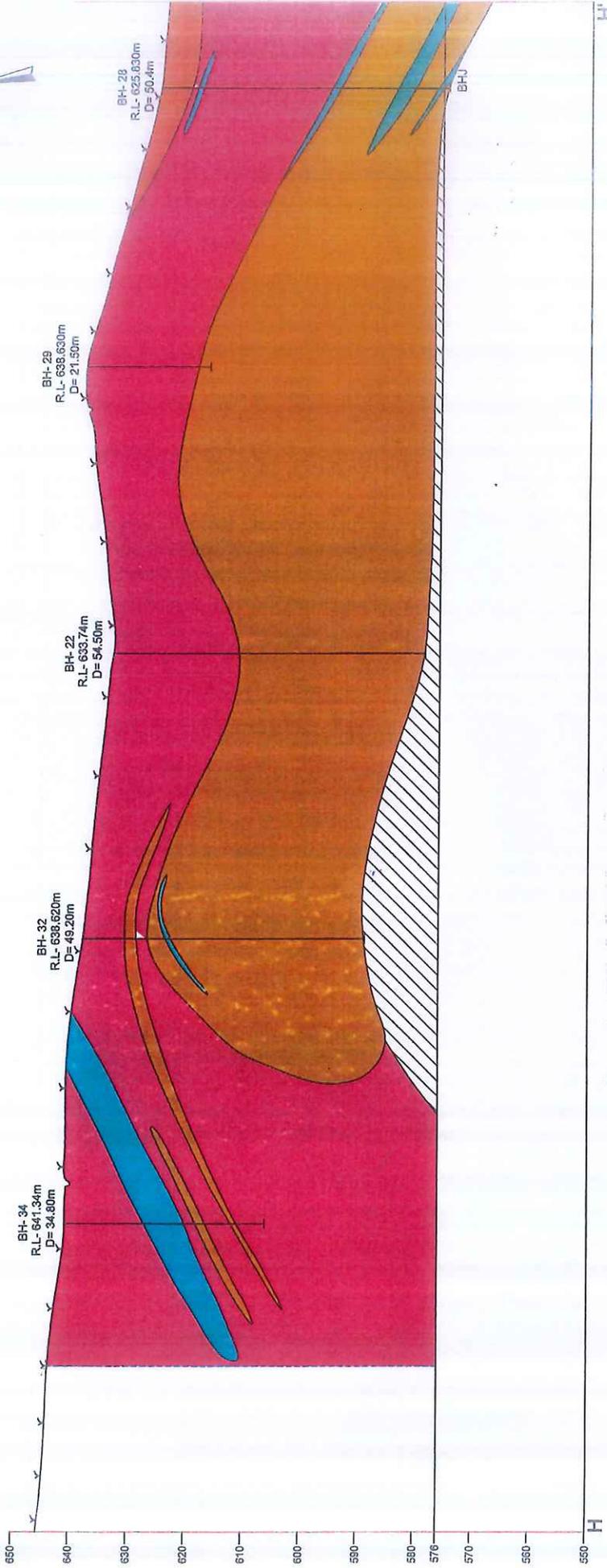
## Section along H-H'

PLATE- VII(F)



SCALE

Horizontal- 1:2000  
Vertical-1:500



### INDEX

- Soil
- Laterite
- Shale
- Iron(Fe 45-55%)
- Iron(Fe +55%)
- BHJ

Dr. Anil Kumar  
Director of Geology  
G.O. No. 108/2014-15

*Kaha* *AK* *KNAIK*

DGPS MAP OF NETRABANDHA PAHAR IRON ORE BLOCK, SUNDARGARH DISTRICT



Pillar ID	Latitude	Longitude
1	21°52'05.24244" N	85°17'20.07528" E
2	21°52' 8.908" N	85°17' 56.810" E
3	21°52' 22.320" N	85°17' 55.650" E
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17	21°52'14.42280" N	85°17'20.63184" E
18	21°52'06.87936" N	85°17'20.15772" E



**Legend**

- DGPS Boundary of Netrabandha Pahar Iron Ore Block
- Plot Boundary
- Pillar Point

*Kare* *K.N.*

*K.Naik*



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

MINING PLAN OF NETRABANDH PAHAR  
IRON ORE BLOCK OVER 139.223 Ha IN  
SUNDERGARH Dist, ODISHA

**PRE-FEASIBILITY REPORT**  
**OF**  
**NETRABANDH PAHAR IRON ORE BLOCK**  
**AT**  
**BALADIHI VILLAGE**  
**IN KOIRA TEHSIL**  
**(in Sundergarh Dist. of Odisha )**

MINING BLOCK AREA	- 139.223 Ha.
LoI for grant of ML issued on	- 24.06.2017
CATEGORY OF MINES	- 'A' Mechanised.
TYPE OF LAND	- Forest : 112.621 Ha Non Forest : 26.602 Ha
SUBMITTED UNDER	- Rule 13 ( 1 ) of MCR, 2016

**-- APPLICANT --**

**BHUSHAN POWER & STEEL LIMITED**  
**F. Block, 1<sup>st</sup> Floor,**  
**International Trade Tower, Nehru Place,**  
**New Delhi – 110 019**

**PREPARED BY :**

**S. RAHA, K C JYOTISHI & K NAIK**  
**Qualified Person**  
**( Under Rule 15 of MCR, 2016 )**  
**SPS GEOMINING SOLUTION PRIVATE LIMITED**  
**F. N. – 401, Star Plaza,**  
**43/3 Feeder Road, Belghoria,**  
**Kolkata – 700 056.**

e-Mail : [spsgeomining@gmail.com](mailto:spsgeomining@gmail.com) / [info@spsgeomining.com](mailto:info@spsgeomining.com)  
9830353767 / 9937010455 / 9437243582

*Raha*  
*KNaik*



SPS GeoMining Solution Private Limited

S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

**PRE-FEASIBILITY REPORT OF THE  
NETRABANDH PAHAR IRON ORE BLOCK  
OVER 139.223 Ha IN SUNDERGARH Dist.  
ODISHA**

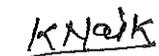
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**BHUSHAN POWER & STEEL LIMITED**

  
S RAHA  
Qualified Person

  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



SPS GeoMining Solution Private Limited

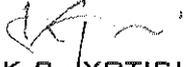
S. Raha, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

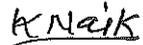
**PRE-FEASIBILITY REPORT OF THE  
NETRABANDH PAHAR IRON ORE BLOCK  
OVER 139.223 Ha IN SUNDERGARH Dist.  
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**S RAHA**  
Qualified Person

**BHUSHAN POWER & STEEL LIMITED**

  
**K C JYOTISHI**  
Qualified Person

  
**K NAIK**  
Qualified Person



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**PRE-FEASIBILITY REPORT OF THE  
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OVER 139.223 Ha IN SUNDERGARH Dist.  
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LIST OF ANNEXURE

1. Certificate from CA regarding Capital Investment

I

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Qualified Person

K NAIK  
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NETRABANDH PAHAR IRON ORE BLOCK  
OVER 139.223 Ha IN SUNDERGARH Dist.  
ODISHA**

**PRE-FEASIBILITY STUDY REPORT**

**0.0.0 INTRODUCTION:**

M/s Bhushan Power & Steel Limited ( henceforth be known as BPSL ) is a leading manufacturer of flat and long products and have state-of-the-art plants at Chandigarh, Derabassi, Kolkata and Odisha in India. These plants manufacture value added products covering entire steel value chain right from Coal Mining to manufacturing Pig Iron, DRI, Billets, HR Coils, CR Coils, GP/GC Sheets, Precision Tubes, Black Pipe/GI Pipe, Cable Tapes, Tor Steel, Carbon and Special Alloy Steel Wire Rods and Rounds conforming to IS and international standards. Present turn over of the company is above Rs 8700 Crores with large volume of exports.

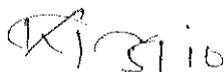
The Company has successfully implemented and commissioned a green field integrated steel plant with the present capacity of 2.3 Mln Tonnes which is being enhanced to 3.4 Million Tonnes of Steel and captive Power Plant in Odisha with HR Coil making facility - First in Private Sector in the State of Odisha. For this plant, technology and equipments were sourced from leading world-renowned companies viz., Lurgi, ABB Ltd., SMS Siemag, SMS Meer Danieli, LOI Tenova, Kocks etc. BPSL has a wide marketing network both in India (comprising 35 sales offices) and abroad for selling its value added products.

The rock-solid foundation combined with continuous upgradation and innovation has enabled the Company to surpass its goals constantly. BPSL's end-to-end portfolio has enabled it to offer a wide spectrum of products at superior quality consistently exceeding customers' specifications. In addition to the export thrust, BPSL cater to the domestic steel requirements of fast-growing sectors like automotive, white goods, construction / infrastructure, furniture, fasteners, telecommunication, power etc.

With a view to make its presence in a big way in Special Alloy Steel Long Product business, BPSL has commissioned a most modern state of the art Wire Rod-cum-

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**PRE-FEASIBILITY REPORT OF THE  
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Bar Mill and is commissioning a host of down stream finishing facilities viz., Heat Treatment facilities, Bright Bar manufacture etc.

The Company is certified to ISO 9001:2008 & TS-16949 Quality Standards and ISO 14001:2004 Environment Management Standards.

**0.0.1.PRE-FEASIBILITY STUDY :**

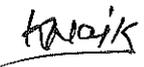
Pre-feasibility study has been made with a view to providing the technical and financial information of the target area which is a prospective mining project. In this feasibility study, following parameters pertaining to the future mining project have been studied in details.

- GENERAL DESCRIPTION OF THE TARGET AREA.
- EXPLORATION
- RESERVE ASSESSMENT.
- PROPOSED MINING METHOD.
- PROPOSED MINERAL PROCESSING.
- PROJECTED MARKETING SCENARIO.
- INFRASTRUCTURAL REQUIREMENT.
- ENVIRONMENTAL CONSIDERATION.
- OTHERS.
- ECONOMIC ANALYSIS.

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## 1.0.0. GENERAL DESCRIPTION OF THE TARGET AREA :

### 1.1.0. Topographical and Land use Details :

The Netrabandh Pahar block, granted to BPSL under auction covers 139.223 ha of land falling within Koira Tehsil of Sundergarh dist., Odisha. Majority of land comprises of forest land with some tenanted land, objectionable land like debasthali, smasan, nala etc. but with no residential area. The tenanted land is barren and uncultivated land. No known agricultural product grows within the block area. The Netrabandh Pahar block represents an undulating to plain topography. At places flat topped low mounds are noticed with general gradient to NE and SE. The highest contour in this area is at 678 m ( north-central & south-central part of the block ) & lowest contour is at 618 m at the northeast part of the block. The relief of the area is more than 60mt.

The top of the area is covered with hard boulder iron ore floats, general iron ore floats mixed with lateritic soil, alluvial soil and in some places BHJ. Underneath these covers lie iron ore beds, shale & BHJ formation.

### 1.2.0. Existing Land – Use :

The target area is a virgin land; except exploration through core drilling, no other exploration / mining activities were ever undertaken.

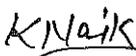
### 1.3.0. Dimension of the Deposit :

The target area having 139.223 ha of land forms a part of the Bonai - Keonjhar belt of the famous "Horse Shoe Synclinorium" falling in Sundargarh and Keonjhar districts. The feebly metamorphosed Precambrian volcano-sedimentary rocks exposed in this belt between the Singhbhum granite on the east and Bonai granite on the west are classified as 'Iron Ore Group' (Sarkar & Saha, 1962) or 'Koira Group' (Murty and Acharya, 1975). These rocks are disposed in form of a low northerly plunging 'Horse-Shoe' shaped synclinorium (Jones, 1934).

  
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The entire target area, barring a small part in the west-central part is mineralized containing the iron ore bed in the Upper Shale formation underlain by the BIF formation. The area has been explored through 39 number of drill holes ( 1494.6 mt ) at a spacing of 200 X 200 mt. The exploration conforms to G-2 category under UNFC guidelines.

## 2.0.0. EXPLORATION :

Prior to auction, the State Directorate had taken up a detailed, thorough and exhaustive geological study of this block giving due importance to the mining prospective. The scheme involved topographic survey, field mapping, demarcation of ore deposits, sub-surface exploration through core drilling, logging of drilled cores, sampling of drilled cores and chemical analysis of the samples. The different aspects of the study were :

### 2.1.0. Topographic Survey :

The area has been topographically surveyed by the survey team of Directorate of Geology in a scale of 1 :2,000.

The topographical features as well as ore geometry was taken into consideration while fixing the base line. The survey work was carried out with the help of Theodolite, Dumpy level and Prismatic compass. The Base Line (0-0) was fixed parallel to the trend of the ore body i.e. N100W-S100E and the offset grid lines parallel to Base line, at an interval of 50 m towards north and named as N-1, N-2, N-3 etc and similarly towards south named as S-1, S-2, S-3 etc. The section lines were laid at 50 m interval perpendicular to the base line. These are named as E-1, E-2, E-3 etc towards east of the 0/0 location on the map, and similarly W-1, W-2, W-3 etc towards west. The R.L. of base and section lines was connected from the nearest culvert located near road junction close to Baladihi village by dumpy level and calibrated with the GPS data. Contouring was carried out at 2m interval.

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Geocadastral map, prepared by Odisha Space Application Centre using DGPS has also been provided by State Directorate of Geology as a part of Tender Documents for the Auction of the Block.

### 2.2.0. Geological Mapping :

Detailed geological mapping on 1:2000 scale was carried out and the litho units exposed in the mapped area comprises iron ore bodies mostly lateritised on the surface, ferruginous shale and soil cover. Iron ore in this area occur as isolated bodies associated with buff coloured variegated shale and ferruginous shale. The iron ore is capped by ferrugenous laterite. Litho-structural details are depicted in the geological plan.

### 2.3.0. Exploration Carried :

Detailed exploration involved ;

1. Core drilling in a 200 X 200 mt grid
2. Total number of holes : 39 nos
3. Total meterage drilled : 1494.60 mt
4. Number of holes confirming barren zone : 6 nos ( 191.00 mt )
5. Number of holes in ore zone ( +45% Fe ) : 33 nos ( 1303.60 mt )
6. Maximum depth of drilling in any hole : 77.50 mt ( BH 13 )
7. Bore holes with more than 50 mt depth : 9 nos
8. Sampling scheme adopted : 1 mt in general
9. Total number of samples drawn and analysed : 1044 nos.
10. Samples analysed at : Laboratory of Directorate of Mines
11. Quality of Ore :Qualitywise the deposit exhibits a good trend. Out of 33 holes ( 1303.60 mt ) drilled through ore zone ( +45% Fe ) :
  - a. 24 boreholes with 496.80 mt contains +60% Fe
  - b. Out of 24 boreholes ( 496.80 mt ) 19 boreholes with 276.25 mt contains +65% Fe

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#### 2.4.0. Exploration Proposed :

Since the entire block area has been explored by core drilling in a 200 X 200 mt grid conforming to G2 category under UNFC guidelines, a detailed exploration in 100 X 100 mt grid, conforming to G1 category under UNFC guidelines to be undertaken during first 5 years of mining lease period as per statute. The details of locations of the proposed boreholes has been shown in the geological plan. All these boreholes will be drilled upto the end of the ore zone. However in case ore zone is not touched by 40 mt from the ground level in any borehole hole will be closed at 40 mt depth as the maximum OB found in the present exploration is 35 mt.

The geological resource of iron ore with + 55% Fe which is marketable / consumable by BPSL and is entrapped within the target area is about 81.976 Mln Tonnes. The mineable reserve has been arrived at 64.577 Mln Tonnes considering loss during mining which includes loss due to mining operation and loss due to entrapped ore outside the ultimate pit limit based on safety zones as well as floor space availability for ease of vehicular movement. This reserve is more than sufficient to sustain the production demand for the first 5 year period of mining operation.

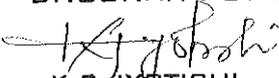
#### 3.0.0. PARAMETERS CONSIDERED FOR RESERVE ASSESSMENT :

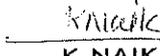
The iron ore deposit lying within the target area have been explored systematically through core drilling, geological mapping in detail, sampling of drilled cores and analysis of all samples.

So a very clear understanding of the deposits could be made.

The different parameters considered for reserve assessment are :

  
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Cut-Off Grade	Specific Gravity		Recovery% of Ore in respective Ore Zone	
55 % Fe	FLOATS	3.3	FLOATS	80%
55 % Fe	HLO	3.3	HLO	80%
55 % Fe	SLO	3.3	SLO	80%
55 % Fe	BD	3.3	BD	80%
+45 – 55% Fe	SG	3.3	SG	80%

Parameters are similar to those accepted by Director of Geology, Govt of Odisha.

#### 4.0.0. PRODUCTION SCHEDULE :

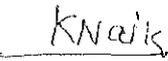
Considering the ore body configuration, ore reserve, physical as well as chemical quality, the scope of marketability, demand of own plant, logistics and also the capability of the applicant, it may be easily construed that a production target of 2 Mln Tonnes per annum is a very justified estimation.

The rated capacity of the mine in the target area will be 2 Mln Tonne of iron ore with +55% Fe grade ore. However in the initial period of first 2 years it would be from 0.75 to 1.25MlnTonnes due to more emphasis on infrastructure development, bench / haul road development, exploration for more systematic delineation of different ore bodies, waste/subgrade zones. The production programme will be as follows :

Year	Production Schedule	Actual Production Planning
	( MlnTonnes )	
1 <sup>st</sup> Year	0.750	0.751
2 <sup>nd</sup> Year	1.250	1.252
3 <sup>rd</sup> Year	2.000	2.001
4 <sup>th</sup> Year	2.000	2.000
5 <sup>th</sup> Year	2.000	2.001
Onwards	2.000	2.000

  
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The waste materials that will be generated during mining will consist of i) Overburden – alluvial soil, lateritic soil, and ii) Intercalated waste – lateritic soil in float ore zone, shaly formation. Dumping of waste / stacking of sub grade ore will be done as per schedule provided in the mining plan.

#### 4.1.0. PROPOSED MINING METHOD :

##### 4.1.1. Bench dimensions :

Now a days the mining fraternity in this sector has adopted the mechanized open cast mining method of operation. BPSL will be no exception in carrying out mining in the same fashion in this target area.

Wagon drills, Air Compressor, hydraulic Excavators, Rock breakers, dozer, Dumpers etc. will be used as mining machinery. For mechanical processing / segregation of ROM into saleable product, mobile crushing & screening plants will be deployed.

The basic system of mining will be :

The overburden consists of loose alluvial soil, laterite, shale. The alluvial soil, where its thickness is more than 1mt will be ripped through backhoe shovel and loaded into tippers for stacking at the selected area; however such zone is unlikely to be cut in the first 5 year plan period. The overburden will be broken by deep hole drilling & controlled blasting. Similarly part of the ore zone also consists of hard formation and requires drilling & blasting. In general about 60% of the ore zone will require drilling & blasting. The bench height will be kept at 6 mt with bench width of 10 mt. Separate bench for overburden will be maintained. Drilling pattern will be 6.5 m X 3 m X 2.5 m. Drilling depth inclusive of subgrade drilling of 0.5 mt to avoid toe in the bench. For blasting large diameter Power Gel cartridge and cordex fuse in combination will be used. The feed size for crushing plant will be – 500 mm. So the over sized blasted boulders will be broken into smaller size befitting with crushing plant's requirement. Secondary blasting will be avoided by using rock breaker. Bench slope will be maintained at 45°.

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Ramps at a gradient varying from 1:16 to 1: 20, having width more than three times the width of tippers / dumpers will be provided for connecting different benches at locations favourable for optimizing haul length and maximizing mineral extraction.

The blasted overburden material will be loaded into tippers / dumpers using excavators and will be taken into preselected waste dump site. The run-off-mine ore will be hauled to crushing plant for sizing / screening plant for segregation into different sizes.

The haul road would be developed simultaneously to facilitate the movement of HEMM and dumpers.

#### 5.0.0. PROPOSED MINERAL PROCESSING :

Based on the drilled data, geological mapping of the block carried out by the qualified persons, experience of mining activities in this zone, it is presumed that about 60% of the ore zone will require drilling & blasting. The float ore / blasted hard ore will be fed to the mobile crushing unit through a grizzly. The crushed ore will be screened in the mobile screening plant. Rest of the ROM containing mainly SLO & BD will be directly fed to mobile screening plants through grizzly.

#### 6.0.0. PROPOSED MARKETING SCENARIO :

A part of the production will be consumed in the own plant of the applicant. Balance production will be sold in the open market.

#### 6.1.0. Present sale price:

Average sale value of iron ore of different quality ( grade & physical properties ) as published by IBM for the month of May 2017 is shown below :

  
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Physical Quality	Grade	Rs per Tonne
IRON ORE LUMPS	-55% Fe	486
	55% to below 58% Fe	1569
	58% to below 60% Fe	1709
	60% to below 62% Fe	2299
	62% to below 65% Fe	2710
	65% Fe and above	2710
IRON ORE FINES	-55% Fe	397
	55% to below 58% Fe	703
	58% to below 60% Fe	703
	60% to below 62% Fe	895
	62% to below 65% Fe	1285
	65% Fe and above	1300

The above sale price is exclusive of Royalty, Reserve Price, DMF & NMEF

**7.0.0. INFRASTRUCTURES :**

**7.1.0. Road :**

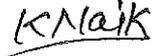
**7.1.1. Metal road:**

A panchayat road ( metal road ) running from Koira to Patmunda / Khajurdih runs along the eastern boundary of the block; sometime through the lease area, sometime out side the lease area. This panchayat road joins NH 215 at a distance of about 7 KM from the lease area. SH 10(A) runs at a distance of about 8 KM from the lease area. Both the NH & SH joins the lease area to Rourkela via Tensa & Kalta, respectively. Rourkela is about 110 KM from the lease area.

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#### 7.1.2. Haul road:

For haulage of waste / ROM / sub grade material within the block area morrum roads, though very short in length, will be developed. This road will be maintained regularly using dozer / excavator. The width will be maintained at 10-12 mt and road gradient will not be more than 1 : 16 to 1 : 20.

#### 7.2.0 Statutory Obligation :

##### 7.2.1. First Aid Station / Room:

A dispensary with a doctor and associated staff with basic necessary facilities will be developed within the block area. First aid boxes will be kept at the pit head during mining operation. An ambulance is proposed to be kept at the dispensary.

A fully equipped hospital is available at the nearest township at Koira which is about 8 km from the block.

##### 7.2.2. Vocational training center:

A well-equipped Vocational Training Centre will be developed within the block area for the staff. Major training courses will also be conducted.

##### 7.2.3. Rest Shelter:

Well maintained rest shelter with proper sitting arrangement, drinking water arrangement, sanitation etc. will be provided near the pit heads.

##### 7.2.4. Canteen:

A staff canteen will be developed within the block area which will cater to the staffs. However there will be inevitably local tea stall / other hotels near the block area once mining starts.

##### 7.2.5. Urinals and Latrines:

Surface latrine and urinals will be provided at appropriate locations at the mine site for use of mining personnel / staff.

##### 7.2.6. Adequate Lighting Arrangement:

Adequate lighting arrangement will be made at quarry, quarry faces and haulage roads, workshop etc. as per the statutory requirement. The lighting towers will be erected at appropriate places inside mine.

  
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#### 7.2.7. Drinking Water:

Drinking water will be provided at rest shelters, office and canteen. The quality of water will be regularly tested for its suitability for human consumption.

#### 7.3.0. Maintenance Facilities :

##### 7.3.1. Workshop:

A well equipped workshop will be developed within the block area. Since all the equipment will be on hire basis, this work shop will also be maintained by the contractor.

##### 7.3.2. Store:

A small store building will be developed in the block area which will be handed to the contractor for maintaining as its store. All the required spares will be stored in this store room.

##### 7.3.3. Oil Room:

For storage of various types of oils and lubricants, a well-maintained room will be developed which will be used for the machinery to be deployed in the mine.

#### 7.4.0. Other Facilities :

##### 7.4.1. Mines Office:

A well maintained mine office will be provided. A patch of land under non forest / non objectionable land is available in the northern side of the block area. This area will also caters to other infrastructures like dispensary, VT room, store, laboratory etc. The office will be equipped with all infrastructure facilities and communication arrangements through Telephone, E-mail, Internet and local area net working etc.

##### 7.4.2. Power Supply:

Electricity will be provided at mines office, mine lighting areas etc.

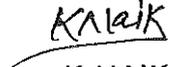
##### 7.4.3.Colony :

A well developed campus will be erected in between block area and Koira to cater the residential purpose of the staffs. It will have the major facility that a residential complex is generally equipped with.

  
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#### 8.0.0. MECHINERY :

All the equipment will be acquired on hire basis as per the present trend in the market.

#### 9.0.0. ENVIRONMENTAL REQUIREMENT :

##### 9.1.0. EIA& EMP :

As per statutory requirement the Environmental Impact Assessment & Environmental Management Plan ( EIA / EMP ) shall be prepared and get approved by the Ministry of Environment & Forest, through a consultant recognized by National Accreditation Board for Laboratory (NABL).Regular monitoring of different environmental parameters will be carried through local analytical parties.

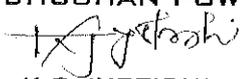
##### 9.2.0. Mine closure plan and reclamation plan :

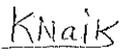
The mineable reserve of iron ore within the target area has been estimated at about 64,577 MlnTonnes. Considering the maximum annual production level of 2 Mln Tonnes from 3<sup>rd</sup> year onwards, the life of the mine to be developed over the block area is 33 years. So closure of the mine is expected only after 33 years from the day of opening of the mine.

Initially the waste / sub grade materials will be dumped / stacked separately in external dumps / stack yards following proper precautionary measures to avoid erosion, pollution / contamination. Back filling of these materials into the pits, excavated and exhausted of ore willbe made in the conceptual period.

The details will be incorporated in the conceptual plan to be annexed to the mining plan to be prepared as per the statute.

  
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#### 10.0.0. ECONOMIC ANALYSIS :

##### 10.1.0. Costing :

The costing is broadly divided into capital cost and operating cost. Since the mining lease is not yet granted, the calculations are made based on the present mining scenario.

##### 10.1.1. Capital Cost :

The general capital investment involved in this mining venture will include invest in :

1. Investment against clearances of statutory requirements like preparation and getting approval of Mining Plan, Environment Clearance & Forest clearance from MOEF&CC, clearances from State Pollution Control Board which involves Public Hearing,
2. Investment on 90% of the upfront price
3. Investment on account of Bank Guarantee against performance security
4. Investment on acquisition of land as it involved private land,
5. Investment on conversion of Reserved land ( Gochar, Rakhit for basti )
6. Investment on development of infrastructure in / around the mine,
7. Investment on mining equipment,
8. Investment on crushing plant / screening plant,
9. Investment on development of mine to bring it to production stage,

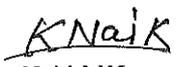
Contrary to this general norms, BPSL will enjoys the benefit of a slight low capital investment because of :

1. Well developed approach road to the block is there.
2. There will be a meager investment towards mining equipment. This is because of easy availability of all the equipment including mobile crushing / screening plants on hire basis in the local area. Due to closure of many mines in the locality, a number of such equipment are found standing idle in the locality.

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3. No beneficiation plant is required to be set up as the BPSL is having a beneficiation plant in its Steel plant near Jharsuguda where a substantial amount of the product from this block will be despatched.
4. Since overburden is very less / nil, topography is very gentle, there will be minimum investment for pre production developmental work.
5. Investment on Upfront Price as well as on Bank Guarantee is not considered while calculating the cost of production as upfront price will be adjusted against royalty and performance guarantee will not be discounted at any stage.

To understand the requirement of capital investment, it is essential to know the land type and area involved in this project and the actual utilization of area.

LAND DETAILS OF THE BLOCK

SI No.	KISAM	Ha	REMARKS
1	Forest	112.621	Includes forest under Rakhit ( 28.456 Ha )
2	Rakhit	11.910	Gochar, road
3	Community	1.465	Debasthali, Smasan
4	Govt.	0.440	Nala
5	Private	12.787	
6	<b>TOTAL</b>	<b>139.223</b>	

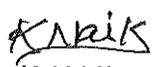
LAND DETAILS OF THE BLOCK TO BE UTILISED

SI No.	KISAM	Ha	REMARKS
1	Forest	112.621	Includes forest under Rakhit ( 28.456 Ha )
2	Rakhit	11.910	Gochar, road
3	Community	0.000	Will not be disturbed / utilized
4	Govt.	0.000	Will not be disturbed / utilized
5	Private	10.820	1.967 ha of land will not be disturbed
6	<b>TOTAL</b>	<b>135.351</b>	

  
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ENVISAGED CAPITAL INVESTMENT

SI No.	HEAD	RATE per Ha ( In Lakh Rs )	TOTAL AMOUNT ( In Lakh Rs )
1a.	Forest land diversion plan	Lumpsum	100.00
1b.	NPV	9.5	1069.90
1c.	Compensatory Afforestation Land	12 approx	1351.45
1d.	Compensatory Afforestation Cost	2 approx	225.24
1e.	Wildlife Management Plan	0.43	48.43
1f.	C.A. Cost for Safety Zone (1.641 x1.5= 2.461Ha)	2 approx	4.92
2	Felling, logging and Transportation cost of trees	Lumpsum	80.00
3	Mining Plan	Lumpsum	20.00
4	EIA / EMP / Hydrogeological Study etc.	Lumpsum	35.00
5	Conversion of Reserved Land	20 approx	238.20
6	Acquisition of private land	20 approx	216.40
7	Infrastructure	Lumpsum	1500.00
8	Vehicles	Lumpsum	100.00
<b>TOTAL</b>			4989.54 Or Say 50 Crore

- Effect of Capital investment at different years of discountment may be summarised as :

Investment_Lakh	Rate / Annum	Years	Int_Lakh	Total_Lakh	Production_Lakh Tonne	Rate / Tonne_Rs
5000	12%	7	2414.14	7414.14	120	61.78

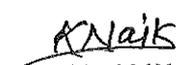
10.1.2. Operating Cost :

The operating cost involves cost towards extraction of iron ore through drilling, blasting, rock breaking using wagon drills, rock breaker, explosives; removal of over burden / waste, sub grade material, rejects to preselected sites using shovels,

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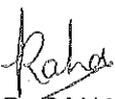
dumpers, shifting ROM to crushing plant / screening plant using shovels, dumpers, feeding to grizzlies / dumpers / tippers at chcrushing plant / screening plants using shovels, loaders, dozing at dump sites, removal of soft OB by using dozer. Other costs include cost towards employment of mining personnel, government taxes, expenses towards social corporate responsibility etc. To derive the operating cost following factors are to be kept under calculation :

**Mining Equipment / Vehicles / Ambulance etc:**

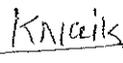
SI No.	Equipment	Number of equipment	Status of procurement
1	Shovel	5	To be hired
2	Loaders	3	To be hired
3	Wagon Drill	4	To be hired
4	Dumper	17	To be hired
5	Rock Breakers	1	To be hired
6	Dozer	1	To be hired
7	Mobile crushing plant	2	To be hired
8	Mobile Screening Plant	4	To be hired
9	Water Tanker	5	To be hired
10	Passenger Vehicles	5	To be owned
11	Utility vehicle	3	To be owned
12	Ambulance	1	To be owned

**Man power requirement :****i) Management & Supervisory Personnel:**

<u>Designation</u>	<u>Qualification</u>	<u>Nos.</u>
Mines Manager	First class Manager's certificate	1
Mining Engineers	Second Class Manager's certificate	4
HR	M.A. in Sociology, Labour Welfare	1
Geologist	M.Sc. in Geology	3
Environmental Engg.	M.Sc. in Environment Science	1
Surveyor	Certificate of Competency from DGMS	2
Mining Foreman	Certificate of Competency from DGMS	4
Mining Mate	Certificate of Competency from DGMS	8
Mechanical Engg.	Degree in Mechanical Engg.	1
Mechanical Foreman	Diploma in Mechanical Engg.	2
Electrical Engg.	Degree in Electrical Engg.	1
Electrical Foreman	Diploma in Electrical Engg.	2
Blaster	Certificate of Competency from DGMS	1
Accountant		1

  
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Accountant / Clerical /  
Weighbridge Clerk

25

TOTAL 57

**ii) Skilled / Semi-skilled Workers' Requirement :**

Since all the equipment will be on hire basis, man power will be provided by the contractor.

**In addition to the above, there will be sufficient number of security personnel.**

The cost of production per T of Iron ore considering @ 2 MlnTonne per annum.

**A. OPERATIONAL COST :**

SI No.	ITEM	RATE PER TONNE ( In Rupees )
1	Mining	160.00
2	Exploration	2.50
3	Salary / Wages	19.00
4	Overhead	10.00
5	Environmental	2.50
6	Peripheral / Social	5.00
7	Security	2.00
8	Miscellaneous	5.00
	<b>TOTAL</b>	<b>206.00</b>

**B. TAXES / ROYALTY :**

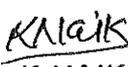
Average sale value of Iron ore in Odisha for the month of May 2017 was :

SI No.	SIZE	GRADE ( Fe% )	RATE in Rs
1	LUMPS	60 – 62	2290
2		62 – 65	2710
3		+ 65	2710
4	FINES	60 – 62	895

  
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5		62 – 65	1285
6		+ 65	1300

**CASE 1 :**

Considering all the product under the highest grade division of IBM i.e. + 65% Fe and 40% of production as lumps, the average ROYALTY ( based on the average sale value published by IBM for the month of May 2017 ( latest ) comes to :

Types	Grade	Avg sale price	Avg quantity per Annum	Total Price
Fines	+ 65%	1300	1.2 Mln T	156.0 Cr
Lumps	+ 65%	2710	0.8 Mln T	216.8 Cr
			TOTAL	372.8 Cr
			i.e. Rs 1864 /- per Tonne	

**STATUTORY TAXES**

SI No.	ITEM	RATE PER TONNE ( In Rupees )
1	Royalty @ 15% of sale value	279.60
2	Payment under Rule 8 of Mineral (Auction) Rules 2015 (@ 87.15% of sale value )	1624.48
3	DMF @ 10% of Royalty	27.96
4	NMET @ 2% of Royalty	5.59
5	Central Cess	1.00
	<b>TOTAL</b>	<b>1938.63</b> Or say Rs 1939 /-

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K C JYOTISHI  
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SPS GeoMining Solution Private Limited

S. Raia, K C Jyotishi, K Naik  
Qualified Persons  
( under Rule 15 of MCR, 2016 )

**PRE-FEASIBILITY REPORT OF THE  
NETRABANDH PAHAR IRON ORE BLOCK  
OVER 139.223 Ha IN SUNDERGARH Dist.  
ODISHA**

**CASE 2 :**

ROM – 2 Mln Tonne		TOTAL SALE VALUE
<b>LUMPS ( 40% of ROM ) i.e. 0.8 Mln T</b>		
a.	70% - 60-62% Fe i.e. 0.56 Mln T	128.74 Cr
b.	30% - 62-65% Fe i.e. 0.24 Mln T	65.04 Cr
<b>FINES ( 60% of ROM ) i.e. 1.2 Mln T</b>		
a.	40% - 60-62% Fe i.e. 0.48 Mln T	42.96 Cr
b.	60% - 62-65% Fe i.e. 0.72 Mln T	92.52 Cr
<b>TOTAL</b>		<b>329.26 Cr</b>
		Or Rs 1646.30 per Tonne Or say <b>Rs 1646 /-</b>

**STATUTORY TAXES**

Sl No.	ITEM	RATE PER TONNE ( In Rupees )
1	Royalty @ 15% of sale value	246.90
2	Payment under Rule 8 of Mineral (Auction) Rules 2015 (@ 87.15% of sale value )	1434.49
3	DMF @ 10% of Royalty	24.69
4	NMET @ 2% of Royalty	4.94
5	Central Cess	1.00
<b>TOTAL</b>		<b>1712.02</b> Or say <b>Rs 1712 /-</b>

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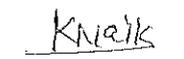
10.2.0 Economic Viability :

10.2.1. MINERAL RESOURCES / RESERVES AS PER UNFC :

Total Resources = Reserve + remaining resource			Quantity Million Tons	Details break up constrain wise							
Reserves	Proved	(111)	-	-	forest land						
				-	Non forest land						
	Probable	(121)	-	-	Diverted forest land						
				-	Non forest land						
		(122)	64.577	57.638	forest land						
			6.939	Non forest land							
<b>B. Remaining Mineral Resources</b>	Feasibility Mineral Resources	<b>(211)</b>			Ultimate pit limit						
					Lease barrier/ safety barrier						
					Non-diverted forest land						
					Permanent infrastructure like Road, power lines, habitation						
					Lowgrade part						
					Non beneficiable part						
					Others( to specify						
	Pre-feasibility Mineral Resources	<b>(222)</b>	17.399	3.147		Ultimate pit limit					
						Lease barrier/ safety barrier					
						Non-diverted forest land					
						Permanent infrastructure like Road, power lines, habitation					
					14.172	Lowgrade part					
						Non beneficiable part					
	Measured Mineral Resources	<b>(331)</b>				Specify /outline					
Indicated Mineral Resources					<b>(332)</b>						
								Inferred Mineral Resources	<b>(333)</b>		
<b>SUBTOTAL</b>	<b>RESERVES(a)</b>		<b>64.577</b>	<b>57.638</b>	Forest land						

  
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Qualified Person

  
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				6.939	Non forest land
	Remaining resources(b)		17.399		
All Total	Resources (a+b)		81.976		Specify forest land in brief

**10.3.0. COST BENEFIT ANALYSIS:**

The cost benefit analysis for this mining project can be arrived at based on :

- Considering Capital Investment to be discounted at the end of 7<sup>th</sup> year of production,
- Considering Production of mines to be 12.0 Mln T for the first 7<sup>th</sup> years,

Investment_Lakh	Rate / Annum	Years	Int_Lakh	Total_Lakh	Production_Lakh Tonne	Rate / Tonne_Rs
5000	12%	7	2414.14	7414.14	120	61.78

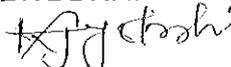
So the actual cost per tonne of iron ore production is :

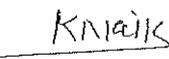
SI No	Type of Cost	Amount in Rs	
		First 7 years	After 7 <sup>th</sup> year
1	Direct cost against production	206.00	206.00
2	Effect on cost due to investment	61.78	0.00
3	TOTAL COST	267.78	206.00

**10.3.1. COST BENEFIT ANALYSIS FOR THE LIFE OF MINE :****BASED ON VALUE OF PRODUCT :****First 7 years**

Cost of Production_Rs	CASE 1		CASE 2	
	Avg Sale Price_Rs	Cost : Sale	Avg Sale Price_Rs	Cost : Sale
267.78	1864.00	1 : 6.96	1646.00	1 : 6.15

  
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After 7<sup>th</sup> years

Cost of Production_Rs	CASE 1		CASE 2	
	Avg Sale Price_Rs	Cost : Sale	Avg Sale Price_Rs	Cost : Sale
206.00	1864.00	1 : 9.05	1646.00	1 : 7.99

**BASED ON BENEFIT TO NATIONAL ECONOMY****BENEFIT TO SOCIETY :**

Considering total production to be about 64.577 Mln Tonne and keeping salary / wages fixed at the present rate the benefit ratio during the life of the mine comes to :

	CASE 1	CASE 2
Value of Product	12037.15	10629.37
Benefit to Economy (Royalty, DMF, Other Taxes, NMET & Payment under Auction Rule 2015)	12362.98	10915.64
Employment Benefit *	121.14	121.14
<b>Total Benefit to Society</b>	<b>24521.28</b>	<b>21666.16</b>

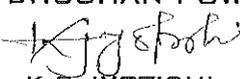
\* Without considering employment of about 150 persons through contractor & about 30 Security Personnel

**LOSS TO ENVIRONMENT :**

As per the guidelines prescribed in Forest Conservation Act, 1980 ( Rules & Guidelines as amended upto 14.09.2001 ), the environmental value of one hectare of fully stocked forest ( density 1.0 ) would be taken as Rs 181 Lakhs to accrue over a period of 50 years.

- i. In the present case the average forest density is 0.30; therefore, environmental loss due to loss of forest over 112.621 Ha to accrue loss over a period of 50 years will be  $181 \times 100.332 \times 0.30 = \text{Rs } 6115.32 \text{ Lakhs}$

  
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- ii. Considering an increase in the bank rate, the present rate for environmental losses is likely to be increased by about 35 %. Thus the environmental loss at additional increase of 35 % will be Rs 8255.68 Lakh for 50 years equaling Rs 5448.75 Lakh for 33 years i.e life of the mine

	CASE 1	CASE 2
Total Loss to Environment	5448.75	5448.75

Therefore the loss to benefit ratio comes to :

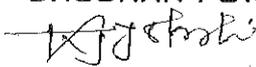
	CASE 1	CASE 2
Total Benefit to Society	24521.28	21666.16
Total Loss to Environment	5448.75	5448.75
Loss : Benefit	1 : 4.50	1 : 3.98

#### 11.0.0. CONCLUSION :

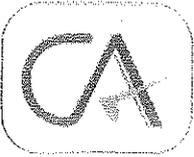
The Pre-feasibility study as detailed above indicates that the mining project, once the mining lease is granted, will be a feasible one. However before start of mining operation a detailed feasibility study will be carried regarding actual expenses towards hire charges of equipment prevailing that time, the capital investment and its discounted method, the salary / wages component of plant division versus mining division.

The present pre-feasibility report has been prepared in a very conservative way so that in no case the project becomes unviable in a later stage.

  
S RAHA  
Qualified Person

BHUSHAN POWER & STEEL LIMITED  
  
K C JYOTISHI  
Qualified Person

  
K NAIK  
Qualified Person



# NARESH VERMA AND COMPANY

Chartered Accountants

2745/23 11th Floor, Beadon Pura, Karol Bagh, New Delhi-110 005  
91-9968251001, Off: 011-22575345

## TO WHOM SO EVER IT MAY CONCERN

Based upon the information and documents provided by M/s Bhushan Power & Steel Ltd having its registered office at 1<sup>st</sup> Floor, F Block, International Trade Tower Nehru Place, New Delhi-110019, it is certified that Bhushan Power & Steel Ltd has been granted Netrabandha Pahar Iron Ore Block in Baladihi Village, Koira Taluka, of Sundargarh District & based on the calculation & estimates provided by the company to us, the expenditure for development of the mine is estimated to appx. Rs 50.00 Crs (Rs. Fifty Crores Only).

The source for incurring the expenditure on the mine will be internal accrual of the company or loan to be availed for appx. 7 years and will be discounted at the rate of 12.00% p.a..

For Naresh Verma & Company  
Chartered Accountants



(CA: Naresh Verma)  
Membership No.519300  
Date: 04/09/2017  
Place: New Delhi



*Naresh Verma* *CA 5110* *ANALIS*