TATA

VOLUME – I – TEXT

REVIEW OF MINING PLAN
&
PROGRESSIVE MINE CLOSURE PLAN

NAME OF THE MINE	BAMEBARI IRON & MN. MINE DISTRICT – KEONJHAR, STATE - ODISHA	
NAME OF OWNER / APPLICANT	MR. THACHAT VISWANATH NARENDRAN CEO & MANAGING DIRECTOR TATA STEEL LIMITED	
LEASE AREA	ORIGINAL LEASE AREA – 1150.550 ha.	INTENDED TO RETAIN AREA – 464 ha.
	Forest – 904.405 ha.	Forest – 448.395 ha.
	Non-Forest – 246.145 ha.	Non-Forest – 15.605 ha.
	Period of the Lease - 01.04.1980-31.03.2000 (2nd Renewal)	Period of the Lease - 01.04.2000-31.03.2030 (3rd Renewal)
	Expiry Date – 31.03.2000	Expiry Date – 31.03.2030
RULE UNDER WHICH THE DOCUMENT IS BEING SUBMITTED	Rule No. 17(2) of MCR 2016 & Rule No. 23, MCDR 2017	
CATEGORY OF MINE	A-FULLY MECHANISED	
PERIOD OF PROPOSALS	2020-21 TO 2024-25	
NAME OF THE QUALIFIED PERSON (QP) & QUALIFICATION	SABYASACHY MISHRA, B.E. (Mining), FCC Head (Mine & Production Planning) Ferro Alloys & Minerals Division, Tata Steel Ltd. At /P.O. : Bichhakundi, Via : Joda, Dist. : Keonjhar (Odisha), Pin – 758034 email - sabyasachy@tatasteel.com	

VOLUME - I

CONTENTS

20/12/20

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

VOLUME-II

ANNEXURES

Annexure no.	Description	Page No.	Vol Ref.
1	Copy of the resolution of Board nominating the owner	1 - 5	Part 02 of 03
2	Copy of Photo ID & Address proof of the applicant	6	
3	Certificate of change of company's name	7 - 9	
4	List of Board of Directors	10	
5	Copy of Qualified person certificate with ID and Address proof	11 - 14	
6	Copy of Surveyor Certificate	15	
7	Copy of lease deed	16 – 119	
8	Copy of Extension order	120 - 125	
9	Copy of Supplementary lease deed	126 - 145	
10	Form-I for Renewal of Mining Lease (464 ha)	146 - 154	
11	Form-D for Renewal of Mining Lease (464 ha)	155	
12	Covering letter of Form- I for Renewal of Mining Lease (686.50 ha)	156 – 158	
13	Form-D for Renewal of Mining Lease (686.50 ha)	159	
14	Copy of Authenticated Land schedule	160 – 175	
15	Joint note on Survey	176 - 178	
16	Copy of Forest clearance	179 - 180	
16A	Copy of the online Forest Clearance application for exploration (Form – C)	181 – 185	
17	Copy of NPV Demand Notice from DFO, Keonjhar (Forest Canopy)	186 – 189	
18	Copy of Environment Clearance	190 - 194	
18A	Extract of MoM of EAC of MoEF & CC on ROM of Manganese Ore	195 – 198	
19	Copy of CTE & CTO granted by SPCB Odisha	199 – 214	
20	Ambient Air Quality Report	215 – 229	
21	Water Quality Report	230 - 266	
22	Ambient Noise Level Report	267 – 276	
23	Soil Quality Report	277 – 281	
24	Copy of NABL accreditation Of Environment Laboratory	282 – 286	
25	Copies of IBM violation and reply thereof	287 – 324	
26	Copy of explosive License	325 – 347	
27	Copy of Blaster's certificate	348	
28	CMFR report	349 - 379	
29	Permission for deep hole blasting	380 - 385	
29A	Copy of permission grated by State Govt. for disposal of overburden from Jonbar Block at Bamebari Block	386	
30	Ground vibration report	387 - 395	
31	Copy of Hydrogeological Report	396 - 474	Part 02 of 03
32	Copy of Mine Plan & Scheme of Mining Approval Letter	475 - 487	
33	Copy of Approval letter of EMCP and certificates	488 - 489	

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Annexure no.	Description	Page No.	Vol. Ref.
34	Copy of FMCP Certificate	490	
35	Copy of Scale Exemption Letter	491	
36	Copy of Common Boundary Application to DGMS	492 - 493	
37	Bulk density and recovery report from NABL accredited lab	494 – 496	
37A	Time series data on Product Recovery & Extract of Form H2	497 - 517	
38	Extract of Document on Manganese Ore Vision 2020 & beyond (IBM)	518 – 522	
39	Extract of Trial Report on Recovery in Beneficiation of Low Grade Ore	523 – 531	
40	Typical Analysis of Ore and Dumps	532 – 534	
41	Photographs	535 – 546	
42	Copy of Bank Guarantees	547 - 558	
43	Details of Bore hole logs with Form I & J	559 – 808 809 - 1098	Part 02 of 03
44	3rd party Boreholes sample report & NABL Accreditation Certificate	1099 – 1112	
45	Exploration proposal collar	1113 – 1152	
46	Determination of Conversion Factor by State Govt. for Product	1153	
47	Mine Feasibility Report	1154 - 1198	

20/3/20

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

TATA

VOLUME - III

LIST OF DRAWINGS

Sl. No.	TITLE	DRAWING NO.	SCALE
1	Key Plan	DWG 01	1:50,000
2	Lease Plan - Bamebari Block	DWG 2A	1:3,960
3	Lease Plan - Joribar Block	DWG 2B	1:3,960
4	Lease Plan - Bonaikela Block	DWG 2C	1:3,960
5	Geo-referenced Cadastral Plan - Bamebari Block	DWG 3A	1:3,960
6	Geo-referenced Cadastral Plan - Joribar Block	DWG 3B	1:3,960
7	Geo-referenced Cadastral Plan - Bonaikela Block	DWG 3C	1:3,960
8	Satellite Imagery Plan - Bamebari Block	DWG 4A	1:5,000
9	Satellite Imagery Plan - Joribar Block	DWG 4B	1:5,000
10	Satellite Imagery Plan - Bonaikela Block	DWG 4C	1:5,000
11	Surface Plan - Bamebari Block	DWG 5A	1:5,000
12	Surface Plan - Joribar Block	DWG 5B	1:5,000
13	Surface Plan - Bonaikela Block	DWG 5C	1:5,000
14	Part Surface Plan - Bamebari Block	DWG 6A	1:1,000
15	Part Surface Plan - Joribar Block	DWG 6B	1:1,000
16	Part Surface Plan - Bonaikela Block	DWG 6C	1:1,000
17	Geological Plan - Bamebari Block	DWG 7A	1:5,000
18	Geological Plan - Joribar Block	DWG 7B	1:5,000
19	Geological Plan - Bonaikela Block	DWG 7C	1:5,000
20	Part Geological Plan - Bamebari Block	DWG 8A	1:1,000
21	Part Geological Plan - Joribar Block	DWG 8B	1:1,000
22	Part Geological Plan - Bonaikela Block	DWG 8C	1:1,000
23	Geological Section - Bamebari Block	DWG 9A	1:5,000
24	Geological Section - Joribar Block	DWG 9B	1:5,000
25	Geological Section - Bonaikela Block	DWG 9C	1:5,000
26	Part Geological Section - Bamebari Block	DWG 10A	1:1,000
27	Part Geological Section – Joribar Block	DWG 10B	1:1,000
28	Part Geological Section - Bonaikela Block	DWG 10C	1:1,000
29	Common Boundary Geological Section – Joribar Pit	DWG 10D	1:1,000
30	Proposed Development Plan - Bamebari Block (4 Sheets)	DWG 11A	1:1,000
31	Proposed Development Plan - Joribar Block (5 Sheets)	DWG 11B	1:1,000
32	Proposed Development Plan - Bonaikela Block (4 Sheets)	DWG 11C	1:1,000
33	Proposed Common Boundary Development Plan – Joribar Pit (3 Sheets)	DWG 11D	1:1,000
34	Proposed Development Section - Bamebari Block (2 Sheets)	DWG 12A	1:1,000

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Sl. No.	TITLE	DRAWING NO.	SCALE
35	Proposed Development Section - Joribar Block	DWG 12B	1:1,000
36	Proposed Development Section - Bonaikela Block	DWG 12C	1:1,000
37	Proposed Common Boundary Development Section – Joribar Pit (3 Sheets)	DWG 12D	1:1,000
38	Composite Development Section - Bamebari Block	DWG 13A	1:1,000
39	Composite Development Section - Joribar Block	DWG 13B	1:1,000
40	Composite Development Section - Bonaikela Block	DWG 13C	1:1,000
41	Composite Common Boundary Development Section-Joribar Pit	DWG 13D	1:1,000
42	Mineral Reject Stack & Backfilling Plan & Section Bamebari Block	DWG 14A	1:2,000
43	Waste Dump, Mineral Reject & Iron Ore Stack Plan & Section - Joribar Block	DWG 14B	1:2,000
44	Waste Dump & Mineral Reject Stack Plan & Section Bonaikela Block	DWG 14C	1:2,000
45	Environment Plan - Bamebari Block	DWG 15A	1:5,000
46	Environment Plan - Joribar Block	DWG 15B	1:5,000
47	Environment Plan - Bonaikela Block	DWG 15C	1:5,000
48	Reclamation Plan - Bamebari Block	DWG 16A	1:5,000
49	Reclamation Plan - Joribar Block	DWG 16B	1:5,000
50	Reclamation Plan - Bonaikela Block	DWG 16C	1:5,000
51	Conceptual Plan - Bamebari Block	DWG 17A	1:5,000
52	Conceptual Plan - Joribar Block	DWG 17B	1:5,000
53	Conceptual Plan - Bonaikela Block	DWG 17C	1:5,000
54	Financial Assurance Plan - Bamebari Block	DWG 18A	1:5,000
55	Financial Assurance Plan - Joribar Block	DWG 18B	1:5,000
56	Financial Assurance Plan - Bonaikela Block	DWG 18C	1:5,000

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON


भारतीय खान ब्यूरो, भुवनेश्वर
INDIAN BUREAU OF MINES, BHUBANESHWAR
भारत सरकार

VOLUME - I

INTRODUCTION

Status of Lease:

The Tata Steel Limited (earstwhileTata Iron & Steel Co. Ltd) granted with a mining lease from the then Raja of Keonjhar State with effect from 01.04.1930 for 30 years over an area of 1150.550 hectares in Palaso (Ka), Kundaposi, Jadibahal, Khandbondh & Bonaikela, villages in Keonjhar District in the state of Odisha. The lease area is consisting with three discontinuous blocks as Bamebari, Joribar and Bonaikela.

The first renewal was for a period of 20 years from 01.01.1950 to 31.03.1980 over an area of 1150.550 ha. The second renewal was for a period of 20 years from 01.04.1980 to 31.03.2000 over an area of 1150.550 ha.

The application for third renewal over a reduced area of 464.000 ha was made on 31.12.1998 in form J. From the covering letter for the above renewal application (Copy enclosed as Annexure-10), it is evident that the Steel Company had at that point of time considered applying for only those mineralized areas having maximum forestland. The mining operations are thus continuing & confined within the applied area of 464.000 ha. as per the provisions of Rule 24A (6) of MCR-1960. In the meantime, the company in view of its further expansion plans and additional requirement of ore has later in 2004 re-applied for the balance area of 686.550 ha. The Mining Lease application for the balance area of 686.550 ha has been received vide Form D no. 7627/ Mines, dated 09.12.2004. (Copy enclosed as Annexure-13)

Considering this renewal application over the reduced area of 464 ha, State Govt. has passed the express order vide letter no. 4076/SM-III(A)SM-06/2006, dated 31.05.2014 for renewal of the mining lease in favour of the company. (Copy enclosed as Annexure-8) The condition no. XV of the Express Order over the reduced area of 464 ha granted by Govt. of Odisha says, *"the grant of renewal is subject to compliance of Rule 29 and 29A of MCR 1960 regarding surrender of the area."*

Hence, under the Rule 23C of the MCDR 1988 and compliance to condition of the express order passed over an area of 464 ha by the State Govt., the Final Mine Closure Plan (FMCP) over an area of 686.550 ha out of the original lease area of 1150.550 ha was submitted and approved by Indian Bureau of Mines, Bhubaneswar Region vide letter no. FMCP/FM/01-OR/BHU/2014-15, dated 20.01.2015 (Copy enclosed as Annexure-33). Accordingly, the Certificate was also granted vide letter no. T/FMCP/C/01/BHU/2011/267, dated 31.05.2016 (Copy enclosed as Annexure-34).

In the meanwhile, subsequent to enactment of the MMDR (Amendment) Act, 2015, the lease extended till 31.03.2030 and Supplementary lease deed was executed and registered on 08.05.2015 with a notation as *".... Whereas the lessee has applied for a reduced area of 464 Hect. of the said lease."* Copy of the Supplementary Lease Deed is enclosed as Annexure-9.

APPROVED

क्षेत्रीय खान नियंत्रक
REGIONAL CONTROLLER OF MINES
भारतीय खान ब्यूरो
INDIN BUREAU OF MINES
भुवनेश्वर / BHUBANESWAR

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Status of Mining Plan:

The Scheme of Mining along with the Progressive Mine Closure Plan was submitted under the Rule 12 & 23(8) of the MCDR, 1988 for the period 2015-20 and approval obtained from IBM vide letter no. MS/OTFM/32-ORI/BHU/2014-15, dated. 26.03.2015. Further it was modified for the period 2018-20 and approval obtained from IBM vide letter no. MSM/FM/115-ORI/BHU/2018-19, Dt. 04.05.2018. Copies are being enclosed as Annexure – 32.

Status of Environment Clearance:

The mine has already obtained the Environmental Clearance (EC) in accordance to EIA Notification, 1994 from the MoEF vide letter no. J-11015/85/2003-IA II(M), Dt.17.11.2005 for production @ 0.83 LTPA of Manganese Ore. (Copy Enclosed as Annexure 18)

As per MoEF & CC Notification No. S.O. 1530(E), 6th Apr 2018, it was notified to regularise the granted EC under EIA Notification, 1994 to EIA Notification, 2006 regime. Accordingly, while processing of the mentioned EC, the Expert Appraisal Committee of MoEF & CC confirmed that, the limitation of the ROM production of Manganese Ore is 0.978 LTPA. The extract of summary record of 37th meeting held 23-24.10.2018 of the reconstituted committee of the expert appraisal committee for environmental appraisal of non-coal mining projects constituted under EIA notification, 2006 is enclosed as Annexure-18A.

Status of Forest Clearance:

The Stage – I & II Forest clearance over an area of 145.329 has been obtained from MoEF, Govt. of India vide letter no. 8-72/2004-FC, Dt.26.05.2005 & 8-72/2004-FC, Dt 25.01.2007 respectively. (Copy Enclosed as Annexure 16)

Additionally, Diversion Proposal was filed for diversion of balance forest area within Bamebari Iron & Manganese Mine i.e. over an area of 303.066 ha of balance forest land including 66.126 ha of non-forest land recorded as forest as on 25.10.1980 (Sabik Forest). The diversion proposal was submitted on-line on 13.06.2016 and the hard copy of the said proposal was submitted in the office of Addl. P.C.C.F. Odisha on 01.07.2016, the said proposal has been assigned State Serial No. OR-059/2016 and the same is under active consideration of the State Government.

Status of Consent to Operate:

The mine has also obtained the Consent to operate for production level at 0.83 LTPA of Manganese Ore under Air (Prevention and Control of Pollution) Act, 1981 & Water (Prevention and Control of Pollution) Act, 1974 from State Pollution Control Board, Odisha Wide Consent Order No.117, valid up to 31.03.2021. (Copy Enclosed as Annexure-19)

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Relaxation under Rule 106(2)(b) of the MMR, 1961:

The Director of Mines Safety, Chaibasa Region has approved vide letter no. [illegible]/1505, dated 31.5.2016 for deployment of Heavy Earth Moving Machineries with deep hole blasting within the Mining Lease. (Copy Enclosed as Annexure-29).

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

1.0 GENERAL

a) **Name of the Applicant / Lessee / Rule 45 registration no.:**

Mr. Thachat Viswanath Narendran / Tata Steel Limited / **IBM/4376/2011**

Address: AT/P.O. Jamshedpur, District : East Singhbhum, State : Jharkhand, PIN – 831001, Phone : 06572424602 FAX : 06572431818, Mobile No : NA, Email ID : jwoffice@tatasteel.com

- Copy of the Resolution by Board of Directors nominating the Owner enclosed as Annexure-1.
- Copy of Photo ID & Address proof of Applicant is enclosed as Annexure-2.

b) **Status of Applicant / Lessee:** Nominated Owner / Private Company

- Copy of Certificate on change of company's name is enclosed as Annexure-3.
- List of Board of Director of the Company is enclosed as Annexure-4

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 / lease deed:** Manganese and Iron Ore

e) **Mineral(s) which is the applicant / lessee intend to mine:** Manganese Ore.

f) **Name of Qualified Person under clause (A) of Sub Rule (1) of Rule 15 of MCR, 2016 or a person employed under clause (B) of Sub Rule (1) of Rule 55 of MCDR, 2017 (Applicable for Mine Plan) preparing:**

Name Mr. Sabyasachy Mishra (Qualified Person)
Head (Mine & Production Planning), PAMD Tata Steel Ltd., Bichakundi, Joda
Address - At/P.O.: Bichakundi, Bichakundi Village, District: Keonjhar, State: Odisha Pin Code : 758034
Phone NA,
Mobile: +91 7752004290
Email ID: sabyasachy@tatasteel.com

The copy of Photo ID & Address proof of Applicant Qualification and Experience certificate of Qualified Person as required under Rule 15 of the MCR, 2016 are enclosed as Annexure – 5.

The drawings enclosed with this document has been duly certified by Competent Surveyor and copy of the competency certificate is enclosed as Annexure – 6

2.0 LOCATION AND ACCESSIBILITY

a) Lease Details (Existing Mine):

- **Name of Mine :** Bamebari Iron & Manganese Mine
- **Latitude / Longitude of any Boundary Point:**

1. Bamebari Block : Boundary Pillar No. A –
   Latitude : 21°53'19.21724"
   Longitude : 85°25'25.3064"

   The applied area of 140 hect. lease block bounded within the extent of Latitude from 21°53'38.95" to 21°54'44.02" & Longitude from: 85°25'23.37" to 85°25'52.06"

2. Jonbar Block : Boundary Pillar No. A –
   Latitude : 21°55'13.70247"
   Longitude : 85°24'31.25737"

   The applied area of 92 hect. lease block bounded within the extent of Latitude from 21°55'41.52" to 21°56'23.84" & Longitude from 85°24'10.74" to 85°25'06.64".

3. Bonaikela Block : Boundary Pillar No. A
   Latitude : 22°03'21.47087"
   Longitude : 85°24'57.15044"

   The applied area of 232 hect. lease block bounded within the extent of Latitude from 22°02'00.42" to 22°03'21.47" & Longitude from 85°24'36.41" to 85°25'47.40".

- **Date of Grant of Lease:**

  - 1st Grant - 30 years from 1.04.1930 to 31.03.1960 over 1150.550 ha.
  - 1st Renewal - 20 years from 1.04.1960 to 16.01.1980 over 1150.550 ha.
  - 2nd Renewal - 20 years from 01.04.1980-31.03.2000 over 1150.550 ha. (Copy of the executed Lease Deed is enclosed as Annexure-7)
  - 3rd Renewal - Subsequent to enactment of the MMDR (Amendment) Act, 2015, the lease extended till 31.03.2030. The copy of the executed supplementary lease deed is enclosed as Annexure-9.

The lease area consists of three discontinuous blocks, viz. Bamebari, Jonbar & Bonaikela. The areas applied against each of these blocks are as given in Table No. 01 below.

Table No. 01

Block Name	Original lease area (Hectares)	RML Applied area, (Hectares)	Area over which MCP approved and certificate obtained (Hectares)
Bamebari	364.620	140	224.620
Jorihar	170	91	79
Boneikela	615.930	233	382.930
Total	1150.550	464.000	686.550

The application for third renewal over a reduced area of 464.000 ha. was made on 31.12.1998 in Form-J, a copy of the Form J is enclosed as Annexure-10. The renewal application of mining lease over an area of 464 ha has been received vide Form-D No. 199/Mines, dated 25.01.1999 copy of which is enclosed as Annexure-11.

In the meantime, the company in view of its further expansion programme for higher production of Steel, Ferro Alloys, Ferro Chrome and Sponge Iron etc, and additional requirement of ore later in 2004, re-applied for the fresh ML over balance area of 686.550 ha. Copy of the covering Letter of this lease application is attached as Annexure-12. The Mining Lease application for the balance area of 686.550 ha has been received vide Form D no: 7628/ Mines, dated 09.12.2004, copy of which is attached as Annexure-13.

Express Order passed by Government of Odisha vide letter no. 4075/SM-III(A)SM-06/2006, dated 31.05.2014 (Ref. Annexure-8) over 464 ha applied for renewal. In the meanwhile, subsequent to enactment of the MMDR (Amendment) Act, 2015, the lease extended till 31.03.2030 and Supplementary lease deed was executed and registered on 08.05.2015 with a notation as "... *Whereas the Lessee has applied for a reduced area of 464 Hect. of the said lease.*" Copy of the Supplementary Lease Deed is enclosed as Annexure-9.

Hence, under the Rule 33C of the MCDR, 1988 and compliance to condition of the express order passed over an area of 464 ha by the State Govt, the Final Mine Closure Plan (FMCP) over an area of 686.550 ha out of the original lease area of 1150.550 ha was submitted and approved by Indian Bureau of Mines, Bhubaneswar Region vide letter no. FMCP/FM/04 ORI/BHU/2014-15, dated 20.01.2015 (Copy enclosed as Annexure-33). Accordingly, the Certificate was also granted vide letter no. T/FMCP/C/01/BHU/2011/267, dated 31.05.2016 (Copy enclosed as Annexure-34). The survey of the surrendered area has been done by Government of Odisha through ORSAC and at present formal possession of land by Government of Odisha is awaited. The joint note on DGPS survey is enclosed as Annexure-15.

The authenticated land schedule of Bamebari Iron and Manganese mines has been enclosed as Annexure-14.

- **Period / Expiry Date** : 31.03.2030

- **Name of Lease holder** : Tata Steel Limited (Erstwhile Tata Iron & Steel Company Limited)

- **Postal Address** :
  AT/P.O. Jamshedpur, District. East Singhbhum,
  State : Jharkhand, PIN – 831001

  Telephone : 06572124602, FAX : 06572431818, Mobile No. NA
  Email ID : jwoffice@tatasteel.com

b) Details of applied / lease area with location plan:

The Tata Steel Limited (erstwhileTata Iron & Steel Co. Ltd) granted with a mining lease from the then Raja of Keonjhar State with effect from 01.04.1930 for 30 years over an area of 1150.550 hectares in Palasa (Ka), Kundaposi, Jadibahal Khandbonch & Bonaikela, villages in Keonjhar District in the state of Odisha. The lease area is consisting with three discontinuous blocks as Bamebari, Joribar and Bonaikela. The first renewal was for a period of 20 years from 01.04.1960 to 31.03.1980 over an area of 1150.550 ha. The second renewal was for a period of 20 years from 01.04.1980 to 31.03.2000 over an area of 1150.550 ha.

The application for third renewal over a reduced area of 464.000 ha. was made on 31.12.1998 in form J. From the covering letter for the above renewal application (Copy enclosed as Annexure-10), it is evident that the Steel Company had at that point of time considered applying for only those mineralized areas having maximum forestland. The mining operations are thus containing & confined within the applied area of 464.000 ha. as per the provisions of Rule 24A (6) of MCR-1960. In the meantime, the company in view of its further expansion plans and additional requirement of ore has later in 2004 re-applied for the balance area of 686.550 ha. The Mining Lease application for the balance area of 686.550 ha has been received vide Form-I no. 7627/ Mines, dated 09.12.2004. (Copy enclosed as Annexure-13). Considering this renewal application over the reduced area of 464 ha, State Govt. has passed the express order vide letter no. 4076/SM-IIf(A)SM-06/2006, dated 31.05.2014 for renewal of the mining lease in favour of the company. (Copy enclosed as Annexure-8) The condition no. XV of the Express Order over the reduced area of 464 ha granted by Govt. of Odisha says, *"the grant of renewal is subject to compliance of Rule 29 and 29A of MCR 1960 regarding surrender of the area."*

Hence, under the Rule 22C of the MCDR, 1988 and compliance to condition of the express order passed over an area of 464 ha by the State Govt., the Final Mine Closure Plan (FMCP) over an area of 686.550 ha out of the original lease area of 1150.550 ha was submitted and approved by Indian Bureau of Mines, Bhubaneswar Region vide letter no. FMCP/FM/04 ORI/BIJG/2014-15, dated 20.01.2015 (Copy enclosed as Annexure-33).

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Accordingly, the Certificate was also granted vide letter no. T/FMCP/C/01/BHU/2011/267, dated 31.05.2016 (Copy enclosed as Annexure-34).

In the meanwhile, subsequent to enactment of the MMDR (Amendment) Act, 2015, the lease extended till 31.03.2030 and Supplementary lease deed was executed and registered on 08.05.2015 with a notation as "... *Whereas the Lessee has applied for a reduced area of 464 Hect. of the said lease.*" Copy of the Supplementary Lease Deed is enclosed as Annexure-9.

This is pertinent to mention that, subsequent to joint survey of the area over 686.550 ha, and map authentication by ORSAC, surrender process is under active consideration by Govt. of Odisha. Hence, all the proposals during this planned period are only confined within the retained area of 464 ha.

The legal status of land within the original lease area of 1150.550 ha.at Bamebari Iron and Mn. Mine as on 31.03.2000, is furnished below in Table No. 02.

Table No.02

Type of Land	Bamebati	Jorbahal	Bonaikela	Total
Reserve Forest (in ha.)	0	0	402.641	402.641
Khesra Forest (in ha.)	16.381	10.785	137.192	164.358
DLC Forest (in ha.)	198.465	138.941	0	337.406
Total Forest Area (in ha.)	214.846	149.726	539.833	904.405
Non-Forest Govt. Land (in ha.)	81.420	10.111	18.593	110.124
Non-Forest Pvt. Land (in ha.)	68.354	10.163	57.504	136.021
Total	364.620	170.000	615.930	1150.550

The legal status of land within the FMCP approved area of 686.550 ha at Bamebari Iron and Mn. Mine as on 31.03.2000, is furnished below in Table No. 03

Table No. 03

Type of Land	Bamebari	Joribaha.	Bonaikela	Total
Reserve Forest (in ha.)	0	0	232.464	232.464
Khesra Forest (in ha.)	16.236	6.536	78.742	101.514
DLC Forest (in ha.)	128.265	59.873	0	188.138
Total Forest Area (in ha.)	144.501	66.409	311.226	522.136
Non-Forest Govt. Land (in ha.)	23.812	4.075	17.5	45.387
Non-Forest Pvt. Land (in ha.)	56.307	8.516	54.204	119.027
Total	224.620	79.000	382.930	686.550

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

The legal status of land intented to retain over 464 ha within Bamebari Iron and Mn. Mine, as 01.04.2020, is furnished below in Table No. 04

Table No. 04

Block	Forest Area (ha)		Non-Forest Area (ha)		Grand Total
Bamebari	Reserve Forest	0.000	Waste Land	0.607	
	Khesra Forest	0.145	Grazing Land	0.000	
	DLC Forest	79.250	Agricultural Land	8.130	
	Sabik Forest	50.015	Other Land	1.894	
	Total Forest	129.360	a) Gharabari	1.663	
			b) Road	0.231	
			c) Khan	0.000	
			d) Debastali	0.000	
			Sub Total (Other Land)	1.894	
			Total Non Forest	10.640	140
Jambar	Reserve Forest	0.000	Waste Land	0.080	
	Khesra Forest	4.349	Grazing Land	0.000	
	DLC Forest	79.068	Agricultural Land	0.477	
	Sabik Forest	6.041	Other Land	1.076	
	Total Forest	89.358	a) Gharabari	1.076	
			b) Road	0.000	
			c) Khan	0.000	
			d) Debastali	0.000	
			Sub Total (Other Land)	1.076	
			Total Non-Forest	1.642	91
Bonaikela	Reserve Forest	170.157	Waste Land	0.259	
	Khesra Forest	59.450	Grazing Land	0.000	
	DLC Forest	0.000	Agricultural Land	3.046	
	Sabik Forest	1.070	Other Land	0.019	
	Total Forest	229.677	a) Gharabari	0.018	
			b) Road	0.000	
			c) Khan	0.000	
			d) Debastali	0.000	
			Sub Total (Other Land)	0.018	
			Total Non-Forest	3.323	233
Total	Reserve Forest	170.157	Waste Land	0.955	
	Khesra Forest	63.944	Grazing Land	0.000	
	DLC Forest	149.268	Agricultural Land	11.562	
	Sabik Forest	56.126	Other Land	2.988	
	Total Forest	419.395	a) Gharabari	2.757	
			b) Road	0.231	
			c) Khan	0.000	
			d) Debastali	0.000	
			Sub Total (Other Land)	2.988	
			Total Non-Forest	15.605	464

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Forest Diversion proposals (FDP) was filed on 14.05.1982 and after several rounds of scrutiny & clarifications, Stage-II were granted over total forest land of 139.238 ha by MoEF vide letter F.No. 8-72/2004-FC, Dt.25.01.2007 from the MoEF, GoI in this regard, is enclosed as Annexure-16. The details diverted forest land is furnished below in Table No. 03. Diversion Proposal was filed for diversion of balance forest area within Bamebari Iron & Manganese Mine i.e. over an area of 308.066 ha of balance forest land including 66.126 ha of non-forest land recorded as forest as on 25.10.1980 (Sabik Forest). The diversion proposal was submitted on line on 19.06.2016 and the hard copy of the said proposal was submitted in the office of Add. P.C.C.F, Odisha on 01.07.2016, the said proposal has been assigned State Serial No. OR-059/2016 and the same is under active consideration of the State Government.

Table No.05

Block		Reserve Forest (ha.)	Khesra Forest (ha.)	DLC Forest (ha)	Sabik Forest (ha)	Total Forest (ha)
Bamebari	Within RML Area	0	0.145	70.2	59.015	129.36
	Approved FDP Area	0	0.145	47.155	0	47.3
	Applied FDP	0	0	23.045	59.015	82.06
Joribar	Within RML Area	0	4.249	79.068	6.041	89.458
	Approved FDP Area	0	4	29.374	0	33.374
	Applied FDP	0	0.249	49.694	6.041	55.984
Boneikela	Within RML Area	170.157	58.45	0	1.07	229.677
	Approved FDP Area	54.149	10.506	0	0	64.655
	Applied FDP	116.008	47.944	0	1.07	165.022
Total	Within RML Area	170.157	62.844	149.268	66.126	448.395
	Approved FDP Area	54.149	14.651	76.529	0	145.329
	Applied FDP	116.008	48.193	72.739	66.126	303.066

The Company has paid Net Present Value (NPV) of Rs. 315780000/- (Rupees Thirty-One Crores Fifty-Seven lakhs Eighty Thousand only) for the entire forest land over 448.395 ha including sabik forest of 66.126 ha within Bamebari Iron & Manganese Mine in consonance with the demands received from Divisional Forest Officer, Keonjhar Forest Division. Copy of payment details is enclosed in Annexure-17

District & State : Keonjhar & Odisha
Taluka – Champua
Village - Palsa(Ka), Kundaposi, Joribahal, Jajang, Khandbandh, Boneikela

Whether the area fall under Coastal Regulation Zone (CRZ) : No

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Existence of public road / railway line:

(a) Bamebari Block – The state express way entering to the lease line A-B while leaving the lease line I-H-I. The Railway line (Banspani - Daitary) is passing 300m East from the lease line D-E.

(b) Jarabar Block – The express way entering in to the lease line T U while leaving the lease line P-Q. The Railway line (Banspani – Daitary) is passing 260m North-East from the lease pillar 'T'.

(c) Bonaikela Block – The NH-215 entering in to the lease line N O while leaving the lease line J-K. The Railway line (Banspani – Dangoaposhi) is passing 1150m South-East from the lease pillar R.

Topo Sheet No. with latitude & longitude of all corner boundary point / pillar:

The lease area falls in villages of Palsa(Ka), Kundaposi, Jeribahal, Jajang, Khandbondh & Boreikela, Tehsil – Barbil in the Keonjhar district of Odisha. The area falls under Survey of India Topo sheet Nos. 73 G/5 & 73 F/8 (New Topo Sheet Nos. F 45N5 & F45N8). The Key Plan showing the original lease as well as area applied for renewal is being enclosed as Drawing No. DWG 01.

With compliance to the Circular No. 02/2010, Odisha Remote Sensing Application Centre (ORSAC) had carried out the DGPS survey of the lease boundary over 464 ha. (intended to retain area) corner pillars. The lease boundary superimposed over Satellite Image for Bamebari, Jorthar & Bonaikela Block are being enclosed as Drawing No. DWG 04A, DWG 04B and DWG 04C respectively.

The co-ordinates of all corner lease boundary pillars Bamebari, Jorabar & Bonaikela Blocks within 464 ha. (intended to retain) are furnished below in Table No. 6-A, 6-B & 6-C respectively.

Table No. 6 A
(BAMEBARI BLOCK)

PILLAR NO.	LONGITUDE			LATITUDE			UTM CORDINATE	
	DEGREE	MINUTE	SECOND	DEGREE	MINUTE	SECOND	EASTING	NORTHING
A	85	25	25.30640	21	53	49.21724	242226245083	337160.43424
B	85	25	33.31078	21	53	49.50984	242227177827	337390.25525
C	85	25	38.53459	21	53	38.09263	242194147843	337393.91176
D	85	25	49.02085	21	53	39.07604	242194359672	337837.87406
E	85	25	52.04508	21	54	44.02186	242394503571	337945.45608
F	85	27	27.44402	21	54	43.74369	242893577776	337938.03510
G	85	25	37.24051	21	54	32.14894	242358108347	337329.44117
H	85	25	27.37621	21	54	31.15075	242356263101	337318.20616

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

TATA

Table No. 6-B
(JORIBAR BLOCK)

PILLAR NO	LONGITUDE			LATITUDE			UTM CORDINATE	
	DEGREE	MINUTE	SECOND	DEGREE	MINUTE	SECOND	EASTING	NORTHING
A	85	24	38.999918	21	56	13.70247	2426719.68268	335877.93324
B	85	24	31.257137	21	56	13.66804	2426720.02613	335665.27662
C	85	24	31.126778	21	56	02.999088	2426365.18814	335646.97226
D	85	24	17.20303	21	56	03.04257	2426398.33514	335643.59879
E	85	24	10.75287	21	55	50.77322	2426022.92781	335059.56410
F	85	24	10.74840	21	55	44.63740	2425834.22397	335057.47103
G	85	24	10.76705	21	55	41.52503	2425738.52605	335056.72289
H	85	24	13.03205	21	55	41.52810	2425737.91383	335122.00461
I	85	24	17.05524	21	55	41.53055	2425736.27275	335254.46407
J	85	24	22.33099	21	55	42.15056	2425754.55704	335489.03887
K	85	24	33.45793	21	55	41.10580	2425712.30382	335622.85477
L	85	24	33.49499	21	55	53.53700	2426105.13681	335626.95706
M	85	24	42.66713	21	55	53.53864	2426110.75903	335976.33274
N	85	24	42.88652	21	56	02.89816	2426386.09115	335985.49488
O	85	24	49.05320	21	56	03.13534	2426391.52966	336179.71780
P	85	24	49.71465	21	56	14.32016	2426735.49436	336185.03928
Q	85	25	05.31172	21	56	14.14543	2426725.49688	336632.51266
R	85	25	05.10176	21	56	19.81435	2426899.87337	336670.58047
S	85	25	06.33924	21	56	21.31236	2426945.60721	336664.26598
T	85	25	06.64976	21	56	25.81947	2427084.12869	336676.60651
U	85	24	58.46801	21	56	25.92839	2427087.82055	336440.42960
V	85	24	51.66297	21	55	25.83472	2427059.03949	336244.60558
W	85	24	49.07706	21	55	25.84786	2427089.97518	336193.22351
X	85	24	44.88428	21	55	25.83808	2427090.23319	336050.09582
Y	85	24	38.31763	21	55	25.84139	2427091.20203	335862.44346

Table No. 6-C
(BONAIKELA BLOCK)

PILLAR NO	LONGITUDE			LATTITUDE			UTM CORDINATE	
	DEGREE	MINUTE	SECOND	DEGREE	MINUTE	SECOND	EASTING	NORTHING
A	85	24	57.15044	22	03	21.47087	2439879.04061	336534.47095
B/50	85	24	51.84629	22	03	21.31709	2439866.86804	336382.35519
C/49	85	24	44.79727	22	03	20.12892	2439831.05951	336323.23286
D/47	85	24	43.16887	22	03	12.06502	2439615.86697	336130.89907
E/46	85	24	40.77108	22	03	12.58578	2439631.85676	336062.04402
F/45	85	24	39.74990	22	03	08.01849	2439489.02145	336052.02240
G/44	85	24	37.85743	22	03	07.89367	2439458.33559	335977.00429
H/43	85	24	36.77018	22	03	02.49633	2439292.47220	335944.10323
I	85	24	36.41400	22	02	56.48520	2439107.97552	335931.06068
K	85	24	40.38543	22	02	51.23424	2438945.35725	336044.19023
L	85	24	40.39165	22	02	32.86527	2438380.78001	336036.45155
L/42	85	24	37.63504	22	03	00.42122	2439328.58176	335968.23469
M	85	24	35.55835	22	02	19.09470	2437976.44727	336465.26217
N	85	25	02.78051	22	02	19.83189	2437972.77280	336476.22112

Prepared by
SARYASACHY MISHRA
QUALIFIED PERSON

O	85	25	02.97055	22	02	40.44433	2438608.65153	336680.60903
P	85	25	16.97709	22	02	40.39422	2438600.33736	337085.23267
Q	85	25	16.82356	22	02	46.07706	2438775.76709	337087.13245
R	85	25	47.40490	22	02	46.20109	2438770.77491	337964.05535
S/68	85	25	47.11042	22	03	15.25661	2439661.21397	337961.80956
T/57	85	24	57.23660	22	03	13.92056	2439638.49358	336633.53931

c) **Attach a general location map showing area and access route:**

The lease area falls in villages of Palsa(Ka), Kundapost, Jonbahal, Jajang, Khandbondh & Boneikela, Tehsil – Barbil in the Keonjhar district of Odisha. The area falls under Survey of India Topo Sheet Nos. 73 G/5 & 73 F/8 (New Topo Sheet Nos. F 45N5 & F45N8). The Key Plan showing the original lease as well as area applied for renewal showing access route to lease area is being enclosed as Drawing No. DWG-01

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

3.0 DETAILS OF APPROVED MINING PLAN / SCHEME OF MINING :

3.1 DATE & REFERENCE OF EARLIER APPROVED MP / SOM –

The Mining Plan and subsequent Scheme of Mining was approved as per the details given below in Table No. 7.

Table No. 7

Mining Plan / Scheme of Mining	Submitted under (Rule Reference)	Approval Letter No. & Date	Period	Area (in ha)
Mining Plan	Rule 11 of MCDR, 1988	CAL/KJ/MP-248, Dt 14.06.1993	1992-93 to 1996-97	1150.550
Review & Scheme of Mining	Rule 12 of MCDR, 1988 & 24(A) of MCR,1960	314(3)/97 MCCM(C)/MI/S-7, Dt 12.06.1998	1997-98 to 2003-04	1150.550
Modification of Scheme of Mining	Rule 10 of MCDR, 1988	BBS/KJ/Mn/MS Bamebari, Dt 24.03.2005	2003-04 to 2004-05	1150.550
Scheme of Mining	Rule 12 of MCDR, 1988	MS/OTF-Mech/11-ORI/BHU 2007-08, Dt 05.12.2007	2005-06 to 2009-10	1150.550
Scheme of Mining	Rule 12 of MCDR, 1988	MS/OTF.MECH/05-ORI/BHU/2010-11, Dt 09.06.2010	2010-11 to 2014-15	1150.550
Final Mine Closure Plan	Rule 23(C) of MCDR, 1988	FMCP/FM/04-ORI/BHU/2014-15 Dated 20.01.2015 over an area of 686.550 hect		686.550
Scheme of Mining	Rule 12 of MCDR, 1988	MS/OTFM/32-ORI/BHU/2014-15 Dt. 26.03.2015	2015-16 to 2019-20	464
Modification of Review of Mining Plan	Rule 17(3) of MCR, 2016	MSM/FM/05-ORI/BHU/2018-19, Dt. 04.05.2018	2018-19 to 2019-20	464

The copies of approval letter of Mining Plan / Scheme of Mining have been enclosed as Annexure-32.

Prepared by,
SABYASACHY MISHRA
QUALIFIED PERSON

3.2 DETAILS OF LAST MODIFICATION IF ANY (FOR THE PREVIOUS APPROVED PERIOD) OF THE APPROVED MP / SOM INDICATING THE DATE OF APPROVAL, REASONS FOR MODIFICATION.

The Scheme of Mining along with the Progressive Mine Closure Plan was submitted under the Rule 12 & 23(B) of the MCDR, 1988 for the period 2015-20 and approval obtained from IBM vide letter no. MS/OTPM/32-ORI/BSU/2014-15 dated 26.03.2015. Now the modification of this Scheme of Mining is being proposed for the year 2018-19 & 2019-20 for the reasons as mentioned below;

1. With pursuance to the Circular No. F. No. 8-78/1996 FC. dated 10.03.2015, the forest area has been changed from 382.269 ha to 448.395 within the applied lease area of 464 ha (Some Non Forest land now being considered as SARK Forest)

2. Inclusion of additional resource established at Joribar Block of Bamebari Mining Lease considering the boreholes already drilled during 2015-18.

3. Due to delay in the grant of Forest Clearance, increase of production at Joribar Block from 65000 TPA to 83000 TPA during the remaining two year planned period (i.e. 2018-20) is being proposed which has no impact due to increase of forest land while curtailing from Bamebari and Bonaikela Block within the limit of quantity as approved in the Environment Clearance and Consent to Operate already granted.

4. Faster reclamation of one exhausted pit by back filling within Bamebari Block with the overburden generated in course of mine development from Joribar Block.

5. Assimilation of detailed parameters for working near common boundary at Joribar Block of Bamebari Mining Lease with Tirlagpahar (Gurtula Block) ML in the Conceptual Chapter to facilitate the necessary prior permissions from other statutory authorities involved.

The Modification of Review of Mining Plan for the period 2018-19 & 2019-20 was approved vide letter no. MSM/PM/05-ORI/BEII/2018-19, Dt. 04.05.2018

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

3.3 REVIEW OF EARLIER APPROVED PROPOSAL (IF ANY) IN RESPECT OF EXPLORATION, EXCAVATION, RECLAMATION ETC.

EXPLORATION –

Exploration proposed in the approved scheme of mining / modification of Review of Mining Plan and the actual exploration done for the total lease area is given in Table No-8 (A to C). Blockwise compliance of exploration is given in Table No 8 (D).

Table No. 8 (A) - Core Borehole

Year	Planned		Actual	
	No of Bore Holes	Meterage	No. of Bore Holes	Meterage
2015-16	45	2250	23	1159.65
2016-17	45	2250	28	1602.55
2017-18	30	1500	10	555.40
2018-19	0	0	3	141.85
2019-20	0	0	1	68.20
Total	**120**	**6000**	**65**	**3527.65**

Table No. 8 (B) DTH/RC Boreholes

Year	Planned		Actual	
	No of Bore Holes	Meterage	No.of Bore Holes	Meterage
2015-16	10	500	12	556
2016-17	10	500	17	760
2017-18	10	500	25	1059
2018-19	248	12400	49	2142
2019-20	241	12050	14	595
Total	**519**	**25950**	**117**	**5112**

Table No. 8 (C) Total (Core + RC) Boreholes

Year	Planned		Actual	
	No. of Bore Holes	Meterage	No. of Bore Holes	Meterage
2015-16	55	2750	35	1715.65
2016-17	55	2750	45	2362.55
2017-18	40	2000	35	1614.40
2018-19	248	12400	52	2283.85
2019-20	241	12050	15	663.20
Total	**639**	**31950**	**182**	**8639.65**

20/3/20

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 8 (D) – Blockwise compliance of exploration

Block wise Planned Vs Actual			Year					
			2015-16	2016-17	2017-18	2018-19	2019-20	Total
Planned	Bamebari	No of BHs	7	10	10	65	18	130
		Meterage	250	500	500	3250	2000	6500
	Jorbar	No of BHs	30	25	15	58	42	170
		Meterage	1000	1250	750	2900	2100	8000
	Bonaikela	No of BHs	30	20	15	125	159	349
		Meterage	1500	1000	750	6250	7950	17450
	Total	**No of BHs**	**55**	**55**	**40**	**248**	**241**	**639**
		Meterage	**2750**	**2750**	**2000**	**12400**	**12050**	**31950**
Actual	Bamebari	No of BHs	5	10	10	31	10	66
		Meterage	751.4	462	476.85	1350.85	421	2562.1
	Jorbar	No of BHs	30	25	15	12	5	77
		Meterage	1016.25	1391.9	705.95	568	242.2	3534.3
	Bonaikela	No of BHs	10	10	10	9	0	39
		Meterage	448	508.65	421.6	365	0	1743.25
	Total	**No of BHs**	**35**	**45**	**35**	**52**	**15**	**182**
		Meterage	**1715.7**	**2362.6**	**1614.4**	**2283.9**	**663.2**	**8639.65**

The major reasons for deviation: -

2015-16:
Number of boreholes drilled in Bamebari and Jorbar were as per plan but in Bonaikela, exploration could not be carried out as per proposal. Boreholes proposed in Bonaikela lies in forest area, for which necessary regulatory clearances could not be obtained. However, 10 boreholes were drilled in broken up area of Bonaikela

2016-17:
Number of boreholes drilled in Bamebari and Jorbar were as per plan but in Bonaikela, exploration could not be carried out as per proposal. Boreholes proposed in Bonaikela lies in forest area, for which necessary regulatory clearances could not be obtained. However, 10 boreholes were drilled in broken up area of Bonaikela

2017-18:
Number of boreholes drilled in Bamebari and Jorbar were as per plan but in Bonaikela, exploration could not be carried out as per proposal. Boreholes proposed in Bonaikela lies in forest area, for which necessary regulatory clearances could not be obtained. However, 10 boreholes were drilled in broken up area of Bonaikela

2018-19:
As mentioned in the approved modification of review of mine plan for the period 2018-19 to 2019-20, exploration proposal was made to cover the total lease area at least up to G2 level of exploration, for which exploration was proposed in forest areas and also in areas where necessary clearances were not available. Exploration in areas with

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

necessary clearance was carried out as per plan. However, in forest areas, necessary clearances could not be obtained due to which exploration could not be carried out.

2019-20:

Exploration in all the 3 blocks could not be done as per plan due to unavailability of forest clearance. However, additional boreholes were drilled in the cleared area for precise delineation of the ore body.

In addition to this, an online application, under Form-C (Proposal number: FP/OR/MRL/13/2016) has been submitted for exploration in Forest Land which is under process. Copy of the online application is being enclosed as Annexure – 16A

EXCAVATION -

Table No. 9 below gives the details of development carried out at each quarry with Overburden and ROM Production during the plan period from 2015-16 to 2019-20.

Table No. 9

Year	Blocks	Planned				Actual			
		Overburden (CuM)	Ore (Tonnes) (≥ 25% Mn)	Mineral Reject (Tonnes) (10-25% Mn)	ROM (Tonnes) (≥ 10% Mn)	Overburden (CuM)	Ore (Tonnes) (≥ 25% Mn)	Mineral Reject (Tonnes) (10-25% Mn)	ROM (Tonnes) (≥ 10% Mn)
1	2	3	4	5	6 = 4+5	7	8	9	10 = 8+9
2015-16	Banebari	51895	6000	1060	7060	54964	5211	920	6131
	Joribar	233027	77200	13625	90825	151036	61447	10843	72290
	Bonaikela	0	0	0	0	0	0	0	0
	Total	284923	83200	14685	97885	206010	66658	11764	78421
2016-17	Banebari	52746	6000	1060	7060	47370	607	122	729
	Joribar	193670	77200	13625	90825	91530	59987	10585	70572
	Bonaikela	0	0	0	0	0	0	0	0
	Total	245716	83200	14685	97885	139706	70674	12472	83146
2017-18	Banebari	56851	6000	1060	7060	23021	1757	310	2067
	Joribar	289412	65000	11470	76470	66879	54889	11451	76339
	Bonaikela	43907	17283	3153	14353	0	0	0	0
	Total	490064	83283	14683	97883	89900	66645	11761	78406
2018-19	Banebari	4975	1200	212	1412	7335	500	88	588
	Joribar	131682	81003	14294	95294	174007	67548	11294	78842
	Bonaikela	529	1000	176	1176	0	200	35	235
	Total	137240	83203	14683	97802	137240	68248	11571	79619
2019-20	Banebari	12435	1200	212	1412	0	736	84	820
	Joribar	51982	81003	14294	95294	130115	80507	10896	91403
	Bonaikela	29	1000	176	1176	0	0	0	0
	Total	64346	83203	14682	97802	130115	81243	10980	92223
Total	Banebari	178140	20400	3604	24004	132391	8991	1496	10487
	Joribar	900676	381403	67308	448708	574377	244377	56834	401211
	Bonaikela	44436	14283	2505	16705	0	200	17	217
	Total	1122252	416009	73417	489417	706968	353468	50347	411815

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

The reasons for deviation:

Year 2015-16 –

Bamebari Block - The excavation of Overburden and ROM was 106% & 87% of the plan respectively. The ROM as compared to Overburden was less for its non-availability in the development zone due to erratic pocket deposit of ore

Joribar Block - The excavation of Overburden and ROM was 45% & 30% of the plan respectively The overburden excavation was less within the development zone due to dearth of space for disposal within the diverted forest land.

Bonaikea Block – The development was not carried out due to availability of predominantly low-grade ore (<30% Mn content) with very low Mn : Fe Ratio within the development zone and less demand of low grade ore for conversion

Year 2016-17 -

Bamebari Block – The excavation of Overburden and ROM was 81% & 11% of the plan respectively The ROM as compared to Overburden was less for its non-availability in the development zone due to erratic pocket deposit of ore.

Joribar Block - The excavation of Overburden and ROM was 47% & 91% of the plan respectively The overburden excavation was less within the development zone due to dearth of space for disposal within the diverted forest land

Bonaikea Block - The development was not carried out due to availability of predominantly low-grade ore (<30% Mn content) with very low Mn : Fe Ratio within the development zone and less demand of low grade ore for conversion

Year 2017-18 –

Bamebari Block – The excavation of Overburden and ROM was 58% & 79% of the plan respectively The ROM as compared to Overburden was less for its non-availability in the development zone due to erratic pocket deposit of ore

Joribar Block - The excavation of Overburden and ROM was 23% & 100% of the plan respectively The overburden excavation was less within the development zone due to dirth of space for disposal within the diverted forest land.

Bonaikea Block The development was not carried out due to availability of predominantly low-grade ore (<30% Mn content) with very low Mn : Fe Ratio within the development zone and less demand of low grade ore for conversion.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year 2018-19 –

Bamebari Block – The excavation of Overburden and ROM was 47% & 40% of the plan respectively. The ROM as compared to Overburden was less for its non-availability in the development zone due to erratic pocket deposit of ore

Joribar Block - The excavation of Overburden and ROM was 102% & 83% of the plan respectively. The overburden excavation was as per the plan due to grant of permission for disposal at Bamebari Block for back filling of the Quarry from State Govt based on the approved proposals of Modification of Review of Mining Plan for the period 2018-20. Copy of the permission granted by State Govt. is being enclosed as Annexure – 29A.

Bonaikea Block – The development was not carried out due to availability of predominantly low-grade ore (<30% Mn content) with very low Mn : Fe Ratio within the development zone and less demand of low grade ore for conversion. However, the surfacial exposed ore was excavated on trail basis to blend with low-grade ore from other blocks at captive conversion plant site to meet the plant feed requirement.

Year 2019-20 –

Bamebari Block – The excavation of Overburden was nil whereas the ROM was 58% of the plan. Only ROM was excavated from exposed ore zone due to erratic pocketty deposit of ore to meet the requirement.

Joribar Block - The excavation of Overburden and ROM was 251% & 96% of the plan respectively. The overburden excavation was more due to development was carried out within the previous approved extent only for safe deployment and movement of HEMM. The overbuden was disposed as per the plan due to grant of permission for disposal at Bamebari Block for back filling of the Quarry from State Govt based on the approved proposals of Modification of Review of Mining Plan for the period 2018-20.

Bonaikea Block – The development was not carried out due to availability of predominantly low-grade ore (<30% Mn content) with very low Mn : Fe Ratio within the development zone and less demand of low grade ore for conversion.

RECLAMATION :

Table No. 10 below indicating the proposed and actual carried out during the period of 2015-16 to 2019-20

Table No. 10

Items	Details	Planned 2015-16	Planned 2016-17	Planned 2017-18	Planned 2018-19	Planned 2019-20	Planned Total	Actual 2015-16	Actual 2016-17	Actual 2017-18	Actual 2018-19	Actual 2019-20	Actual Total
	Area Afforestated (hect.)												
	Bamebari Block	0	0	0	1.2	1.5	2.7	1.1	1.2	1.2	0.79	0	4.29
	Jonbar Block	0	0	0	0.61	1.42	2.03	0	0	0	1.02	1.259	2.279
	Bonaikela Block	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	1.81	2.92	4.73	1.1	1.2	1.2	1.81	1.259	6.569
Sump Management	No. of Saplings Planted												
	Bamebari Block	3000	3000	3000	3000	3750	15750	14000	9759	4150	2900	2240	43729
	Jonbar Block	2000	2000	2000	1525	3550	11075	7530	7895	3850	1656	4410	25341
	Bonaikela Block	0	0	0	0	0	0	0	0	0	0	0	0
	Total	5000	5000	5000	4525	7300	26825	21530	13650	8000	4556	2150	59066
	Cumulative no. of plants												
	Bamebari Block	150773	153773	156773	159773	163523	168523	168953	177704	178458	181358	183598	184198
	Jonbar Block	76500	72600	74600	76125	79675	79675	78130	86025	89875	91531	95941	95941
	Bonaikela Block	0	0	0	0	0	0	0	0	0	0	0	0
	Total	227273	226373	231373	235098	243198	248198	247083	263733	268333	272889	280439	280439
	Cost including watch and care during the year*	125000	125000	125000	113125	182500	670625	773342	795581	679078	258189	405191	3162291
Management of worked out benches	Area available for rehabilitation (ha.)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
	Afforestation done (ha)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
	No. of saplings planted in the year	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
	Cumulative no. of plants	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
	Any other method of rehabilitation (specify)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
	Cost including watch and care during the year	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
Reclamation and Rehabilitation by Back Filling	Void available for Back filling (L x B x D) block wise												
	Bamebari Block (ha.)	1.45	0.5	0.5	0.402	0	2.852	0.93	1.6	0	0.402	0	2.932
	Jonbar Block (ha.)	0	0	0	0	0	0	0	0	0	0	0	0
	Bonaikela Block (ha.)	0	0	0	0	0	0	0	0	0	0	0	0
	Total (ha.)	1.45	0.5	0.5	0.402	0	2.852	0.93	1.6	0	0.402	0	2.932
	Void filled by waste / tailings (cum)												
	Bamebari Block	51893	52049	16031	75617	51117	246704	54564	42073	43021	137270	[illegible]	[illegible]
	Jonbar Block	0	0	0	0	0	0	0	0	0	0		
	Bonaikela Block	0	0	0	0	0	0	0	0	0	0		

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Items	Details	Planned						Actual					
		2015-16	2016-17	2017-18	2018-19	2019-20	Total	2015-16	2016-17	2017-18	2018-19	2019-20	Total
	Total	51853	52046	55031	75817	54117	288864	54964	52073	83091	137770	0	327898
Rehabilitation of waste land within lease	Afforestation on the back filled area	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Rehabilitation by making water reservoir	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Any other means (specify)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Area Available (ha)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Area Rehabilitated (ha.)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Method of Rehabilitation Returning soil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Others (specify)	Bamebari Block	0	0	0	0	0	0	426	358	0	0	0	784
	Jonbar Block	0	0	450	140	104	694	0	0	534	150	310	994
	Bonaikela Block	0	0	200	0	0	200	0	0	0	0	0	0
	Total	0	0	650	140	104	894	426	358	534	150	410	1778
	Garland Drain												
	Bamebari Block	0	0	0	0	0	0	426	358	0	0	0	784
	Jonbar Block	0	0	450	140	104	694	0	0	534	150	310	994
	Bonaikela Block	0	0	200	0	0	200	0	0	0	0	0	0
	Total	0	0	650	140	104	894	426	358	534	150	410	1778
	Check dam												
	Bamebari Block	0	0	0	1	0	1	0	0	0	1	0	1
	Jonbar Block	0	0	1	0	0	1	0	0	1	0	0	1
	Bonaikela Block	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	1	1	0	2	0	0	1	1	0	2

Prepared by:
SADYASACHY MISHRA
QUALIFIED PERSON

The reasons for deviation:

Year 2015-16 –

Bamebari Block –

a) Afforestation – Gap plantation was carried out as per the proposal. Additional plantation was carried out over the vacant area and part area of porposed area of plan period to minimise the soil erosin as well as for development of green belt.
b) Back filling – Area covered was less than plan due to retreating disposal from bottom of the quarry by compacting the disposed overburden to minimise the intercalated void.
c) Retaining Wall & Garland Drain. – Retaining wall and garland drain was further strengthened during the year.

Joribar Block -

a) Afforestation – Gap plantation was carried out as per the proposal. Additional plantation was carried out over the vacant area to minimise the soil erosin as well as for development of green belt.
b) Retaining Wall & Garland Drain – Retaining wall and garland drain was further strengthened during the year.

Bonaikea Block –

There was no proposal for afforestation and construction of retaining wall as well as garland drain during the year.

Year 2016-17–

Bamebari Block –

a) Afforestation – Gap plantation was carried out as per the proposal. Additional plantation was carried out over the vacant area and part area of porposed area of plan period to minimise the soil erosin as well as for development of green belt
b) Back filling – Area covered was more than plan due to cover up of the balance area of previous year within the approved extent. Additional overburden excavated than the plan was disposed over the approved area of succeeding year for safe movement of dumpers over the back filled area
c) Retaining Wall & Garland Drain – Retaining wall and garland drain was further strengthened during the year.

Joribar Block -

a) Afforestation – Gap plantation was carried out as per the proposal. Additional plantation was carried out over the vacant area to minimise the soil erosin as well as for development of green belt.

b) Retaining Wall & Garland Drain – Retaining wall and garland drain was further strengthened during the year.

Bonaikea Block –

There was no proposal for afforestation and construction of retaining wall as well as garland drain during the year.

Year 2017-18 –

Bamebari Block -

a) Afforestation – Gap plantation was carried out over the proposed area and and part area of plan period
b) Back filling – Area covered was nil due to continuation of overburden disposal during previous year's extended area within the approved extent.

Joribar Block -

a) Afforestation – Gap plantation was carried out as per the proposal. Additional plantation was carried out over the vacant area to minimise the soil erosin as well as for development of green belt.
b) Retaining Wall & Garland Drain – Retaining wall and garland drain was constructed as per the proposal alongwith part of next year's proposal

Bonaikea Block –

There was no proposal for afforestation and construction of retaining wall as well as garland drain during the year.

Year 2018-19 –

Bamebari Block -

a) Afforestation - Area of plantation was less due to coverage of proposed area during previous years. The balance area of the proposal was corrected durig this year.
b) Back filling – Area covered was as per the proposal and more overburden was accommodated within the approved extent by compacting the disposed overburden to minimise the intercalated void

Joribar Block -

a) Afforestation - Gap plantation was carried out as per the proposal. Additional plantation was carried out over the part of next year's proposal
b) Retaining Wall & Garland Drain – Retaining wall and garland drain was constructed as per the proposal alongwith part of next year's proposal

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Bonaikea Block –

There was no proposal for afforestation and construction of retaining wall as well as garland drain during the year.

Year 2019-20 –

Bamebari Block –

Afforestation – Area of plantation was nil due to coverage of proposed area during previous years

Joribar Block -

a) Afforestation – Area of plantation was less due to coverage of proposed area during previous year
b) Retaining Wall & Garland Drain – Retaining wall and garland drain was constructed more as compared to the proposal depending upon the surface topography.

Bonaikea Block –

There was no proposal for afforestation and construction of retaining wall as well as garland drain during the year.

Air and Water Quality & Ambient Noise levels:

Air and water quality monitored at regular interval and the data generated indicate that the pollution levels are well within the prescribed limits. The data generated are presented as Annexure-21 and Annexure-22. The major source of dust in the mines is the haul road. This is being effectively managed by regular water sprinkling during mine working hours. All precautions were taken to reduce ground vibration caused due to blasting by adoption of controlled blasting technique. The MoEF accreditation for environment monitoring lab is enclosed as Annexure-24

Prepared by,
SABYASACHY MISHRA
QUALIFIED PERSON

Land Use Pattern:

Table No. 11 below gives the land use pattern as proposed for calculation of financial assurance at the end of the modification of Review of Mining Plan and actual at end of planned period i.e 31.03.2020.

Table No. 11

Sl.No.	Type of Use	Proposed at end of Planned period (as on 31.03.2020)	Actual (As on 31.04.2020)
1	Area to be excavated	97.305	87.842
2	Storage of Top Soil	0	0
3	Waste dump	46.445	45.534
4	Mineral Storage	11.215	8.016
5	Infrastructure (Utility Corridor, Workshop, office, rest shelter etc)	4.166	4.086
6	Roads	10.420	10.420
7	Railways	0	0
8	Toring Pond	0	0
9	Effluent Treatment Plant	0	0
10	Mineral Separation Plant	0	0
11	Township Area	24.350	24.350
12	Others (Green Belt)	10.660	21.044
	Total	212.504	201.290

Remarks –

a) Area influenced by active mining and allied activities was considered as broken up area for calculation of financial assurance in earlier plan period as well as being considered in present land use pattern.

b) At Bamebari Block, 10.515 ha has been back filled (by waste over 5.998 ha & stacking of Mineral Reject [Sub Grade Ore] over 4.515 ha) at Bamebari Block. These areas have been excluded from the excavated area and accordingly included in Waste Dump & Mineral Storage Area respectively.

c) At Jorbar Block, 1.923 ha. back filled with of Mineral Reject (Sub Grade Ore) as a temporary storage has been excluded from the excavated area and accordingly included in Mineral Storage Area.

Reasons for deviation:

The actual land use pattern is well within the area considered for calculation of financial assurance. The area to be exvated and waste dump area was less than the plan as there was no operation at Bonaikela Block due to availability of predominantly low-grade ore (<30% Mn content) within the development zone and less demand of low grade ore for conversion.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

3.4 **Status of Compliance of Violations pointed out by IBM.**

The violation pointed out by IBM during inspection and the compliance submitted thereof are being enclosed as Annexure-25. Details of violation/ Show Cause and its compliance is given in Table No. 11.

Table No. 11

Sl.No.	Violation / Show Cause (Letter No. & Date)	Compliance Submitted (Letter No. & Date)	Reference
1	ORI/MN/KJR/MCDR-2/BBS/315 Dt 08.05.2015	1) MGM/P&E /408/2015 Dt 05.06.2015 2) MGM/P&E/428/2015 Dt. 10.06.2015	Annexure-25
2	ORI/MN/KJR/MCDR-2/BBS/739 Dt. 17.06.2015	1) MGM/P&E /466/2015 Dt 30.06.2015 2) MGM/P&E/481/2015 Dt 1.07.2015 3) MGM/P&E/553-A/2015 Dt. 31.07.2015	
3	ORI/MN/KJR/MCDR-2/BBS/1793 Dt. 2.09.2015	1) MGM/P&E/740/2015 Dt 10.10.2015 2) MGM/P&E/815-A/2015 Dt. 10.11.2015 3) MGM/P&E/875-A/2015 Dt. 10.12.2015 4) MGM/P&E/35-A/2015 Dt. 10.1.2016	
4	ORI/MN/KJR/MCDR 02/RBS/1941 Dt. 13.11.2018	MGM/P&E/1378/18 Dt.21.11.2018	
5	T/SDF/01/305-2018/1638 Dt. 29.10.18	MGM/P&E/1376/18 Dt.21.11.2018	

3.5 **Indicate and give details of any suspension / closure / prohibitory order issued by any Government Agency under the rule or Court of law: NONE**

3.6 **In case the MP/SoM is submitted under Rule 9 & 10 of the MCDR, 1988 or under Rule 22(6) of the MCR,1960 for approval of modification, specify reason and justification for modification under these rules: NONE**

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

PART - A

1.0 GEOLOGY AND EXPLORATION

a) Topography, Drainage Pattern, Vegetation, Climate & Rainfall:

The Bamebari Manganese Mines consisting of three detached blocks (Bamebari, Jorbar and Bonaikela), covering a total area of 1150.530 Ha (out of which 464 Ha area is intended to retain) in Champua Sub-division of Keonjhar district in the state of Orissa. A topographical plan (Drawing no DWG 01), showing position of all the blocks is enclosed.

The details of physiography for the individual blocks are as follows

Block - Bamebari - 364.620 ha (224.620 ha intended for relinquishment and 140 ha intended to retain):

The area is approachable by Pucca (Metal) road from Joda. It is about 18 km away from the nearest town of Joda.

Topography

The Bamebari block consists mainly of two hills along the same ridge, one towards north and the other towards south. The highest & lowest heights attained in the region are 624 m in north east & south-east and 546 m in north-west, respectively. The topographic expressions have been controlled by truncation of rocks of varying resistances.

Drainage Pattern

The area is intersected by several small nallahs mostly flowing towards east. These nallahs remain dry for most part of the year. The Kashi nallah, a perennial water source is situated towards the south eastern part of the lease area and flows towards south east and meets Baitarani river at a distance of 2.5 kms from the eastern boundary of the lease.

Flora and Fauna

The block is covered by moderate Sal forest on the higher slopes and shrubs/bushes on the lower level. Prominent botanical species like Shorea Robusta (Sal), Terminalia Tomentosa (Asan), Bassia Latifolia (Mahua), Betea Monosperma (Kosi), Magnifier Indicia (Mango) etc are in abundance. The animals consisting of elephants, bears, squirrels, jackals, mongoose, while among the avians are white chlorospsis, woodpecker, crows, bulbul

Climate & Rainfall

The climate is tropical with maximum temperature going up to 44-46°C in summer months and a minimum temperature going down to 5-6°C in winter months. The annual rainfall during 2018-19 is about 1409.56 mm. (Ref Table No 3.2)

Block – Joribar – 170 ha (79 ha intended for relinquishment and 91 ha intended to retain):

Joribar Block is located north of Bamebari, at a distance of 3 km & is approachable by the same Metallic Road, which runs from Joda.

Topography

The Joribar Block has an undulating terrain consisting of small hillocks towards the western and northern part with a gentle slope towards east. The highest & lowest heights attained in the region are 646 m in west & 512 m in east.

Drainage Pattern

The area is intersected by several small nallahs mostly flowing towards east and meets the Baitarani River towards east beyond the lease area.

Flora and Fauna

The block is covered by moderate Sal forest on the higher slopes and shrubs/bushes on the lower level. The plain grounds are cultivated lands. The lease area is covered by dense forests with an appreciable part covered by the open mixed jungle. Prominent botanical species like Shorea Robusta (Sal), Terminalia Tomentosa (Asan), Bassia Latifolia (Mahua), Butea Monosperma (Kosi), Magnifier Indica (Mango) etc are in abundance. The animals consisting of elephants, bears, squirrels, jackals, mungoose, while among the avians are white chlorospsis, woodpecker, crows, bulbul.

Climate & Rainfall

The climate is tropical with maximum temperature going up to 44-46°C in summer months and a minimum temperature going down to 5-6°C in winter months. The annual rainfall during 2018-19 is about 1409.56 mm. (Ref Table No 3.2)

Block – Boneikela – 615.930 ha (382.93 ha intended for relinquishment and 233 ha intended to retain):

This block is located about 3 km north of Joda and around 20 km north west of Bamebari Block & is approachable by a Metallic Road from Joda.

Topography

The area is mainly hilly terrain with prominent hills in the North Western and North-Eastern part and steeply sloping towards south. The highest & lowest heights are 717 m & 501 m in the North eastern and southern part of the block.

Drainage Pattern

The area is intersected by several small nallahs flowing towards south and meets the Suna River which flows south of the lease area.

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Flora and Fauna

The block is covered by moderate Sal forest on the higher slopes and shrubs/bushes on the lower level. The plain grounds are cultivated lands. The lease area is covered by dense forests with an appreciable part covered by the Siddhamath Reserve Forest. Prominent botanical species like Shorea Robusta (Sal), Terminalia Tomentosa (Asan), Bassia Latifolia (Mahua), Butea Monosperma (Kost), Mangifera indica (Mango) etc are in abundance. The animals consisting of elephants, bears, squirrels, jackals, mongoose, while among the avians are white chloropsis, woodpecker, crows, bulbul.

Climate & Rainfall

The climate is tropical with maximum temperature going up to 44-46°C in humid summer months and a minimum temperature going down to 5-6°C in winter months. The average annual rainfall is about 2018-19 is about 1409.56 mm. (Ref. Table No.3.2).

b) Regional Geology :

Bamebari Iron and Manganese deposit lies in the western portion of Singhbhum-Orissa craton. The Iron Ore Group (IOG) surrounds the batholithic complex and consists of low grade meta sediments, acid intermediate and mafic volcanics and sills. The IOG rocks are exposed in three major basins around the Singhbhum granite batholith (Saha et. al., 1968).

The eastern basin extends from south of Jamshedpur through Gorumahisani-Badampahar and extends southward up to near Nausahi. The southern basin lies between Daitari – Tomka, while the northern-western basin is represented by the western Singhbhum-Bonai-Keonjhargarh Iron Ore basin which extends for about 100km in length and 20 to 30km width in NNE-SSW direction from Chakradharpur to south of Keira.

The generalized chronostratigraphic succession of Singhbhum–Orissa iron ore craton after Saha et. al., 1988.

Newer Dolerite dykes & Sills	C1600 - 950 Ma
Mayurbhanj Granite	C.2000-2100 Ma
Gabbro - anorthosite -ultrabasics	
----------Un-conformity----------	
Jagannathpur Lavas	Dhanjori – Simlipal lava Dhanjori Group
Quartzite conglomerate	
----------Un-conformity----------	
Singhbhum granite	C.3100 Ma
Mafic lava, tuff, acidic volcanics,	
Tuffaceous shales, BHJ & BEQ with Iron Ores. Ferruginous chert, local Dolomite, Quartzite & Sandstone	Iron Ore Group
----------Un conformity----------	
Nilgiri Granite	

Singhbhum Granite	
Bonai Granite	
Folding and metamorphism of OMG & OMTG	C.3400 – 3500 Ma
Older metamorphic tonalite gneiss (OMTG)	C.3775 Ma
Older metamorphic group (OMG): Felsic Schist, quartzite, Para-amphibolite, Ortho-amphibolite	C.4000 Ma

The rock formations of the area belong to the Iron ore group (earlier called as series) of Upper Dharwar age. In south Singhbhum, Bonai & Keonjhar district Manganese ore deposits are associated with Shales, Laterite, Chert & Quartzite of the Iron Ore Group & are distributed within the Horse shoe shaped synclinorium, plunging towards NNE over folded towards SW. The shale formation occurs as a core of the synclinorium along Jamda-Koira valley overlying the Banded Iron Formation. The position of the Iron ore group and the rocks associated with it in the stratigraphic column is as follows:
The local stratigraphic succession of this Bonai area is given below (Sana 1990):

Upper lavas (Local)
Upper shale , Shale tuffaceous, ferruginous shale usually with fine laminations contain a few manganiferrous shale band
Banded Heamatite jasper with thin intercalations of tuffaceous shale and with supergene enrichment of iron ore bodies
Lower shale, which is tuffaceous along the eastern flank and slaty in the west
Mafic Lavas (local)

The manganese ore deposits of the area occur within the weathered shale horizon (lower shale??) of Iron ore group as tabular lenses & as irregular veins. Manganese ore also occurs in the form of Rugri & nodular masses and are formed by the process of leaching, replacement & concentration through the agencies of meteoric waters. The ore mineral are mainly oxides and generally occurs as Pyrolusite, Psilomelane & Wad.

c) Local Geology:-

The local geology of the Bamebari Manganese Blocks as observed from different boreholes more or less confirms the fact that manganese mineralization is mainly confined to the weathered shale horizon (lower shale ??) of Iron Ore group. The deposits greatly vary in size & shape & range in length from about a meter to more than 200 mts. General strike of the formations is NS to NE SW with dip varying from 10°–30° towards west. All the litho units exposed in the area are highly weathered hence; measuring the actual structural data is very difficult. Few bedding plane data from shale exposed in quarry and nalla section have been collected and shown in the surface geological plan.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

The different lithologies encountered in the area are: -

a) Soil / Alluvium with floats of iron and manganese ores
b) Laterite, manganiferous in places
c) Iron ore
d) Manganese Ore
e) Shale
f) Cherty and Jaspery quartzite

Manganese Ore: Manganese Ore occurs as lenses and pockets in association with laterite, cherty and jaspery quartzites, shale and iron ores. Thickness of ore bodies varies from 2m to 40m with an average of around 7m. Dip and strike of the ore patches are not much in evidence. The solid ore patches at times have capping of soil of varying thickness with stray pieces of manganese ores. The top layer of the ore is generally hard and massive and it passes on to spongy and porous varieties in depth.

The nodules of manganese or negri ore usually occur in laterite and lateritic morrum and in places they are seen in the intervening portions of the ore lenses. The nodules are hard and do not appear to be contaminated except for a coating of clayey matter on individual nodules. The ore consists of a mixture of pyrolusite and psilomelane proportions of which vary from zone to zone.

Manganese Ore deposits are of secondary in nature and are derived from manganiferous shale of the iron ore series by the processes of leaching, concentration and replacement giving rise to manganese deposits through the agency of circulating waters of meteoric origin, perhaps aided in some cases by hydrothermal action due to the igneous intrusions. Replacement of brecciated, cherty and jaspery quartzite by manganese is clearly noticed. Here the solutions appear to have followed certain definite planes of crushing and fracture of the country rocks in the zone of oxidation.

Iron Ore: Iron ore is mostly confined to the western part of the lease area. Iron ore is mostly lateritic, friable and flaky in nature. Lateritic ores are generally found in the upper part of the iron ore horizon below the laterite zone. This type of iron ore is partly laterised. It is hard, massive or laminated, porous, unevenly fractured. It consists of haematite with goethite and limonite. Minor quantities of clay minerals are also associated with it. Friable and Flaky Ore are thinly laminated, loosely packed, breaks down into flakes with little pressure and associated with powder. Sometimes, the flaky ore are intercalated with ferruginous shale. This type occurs in shades of dark grey to greyish brown powdery portion with high proportion of flat, tabular and angular ore chips and thin hard laminated ore flakes ranging from few mm to 3-4cm. Sometimes, the laminations are so thin that it appears as biscuits. Powdery portion occurs in shades of brown to reddish brown. It contains lesser proportion of ore chips, pieces and flakes. Sometimes ochre and shale are mixed in the powdery portion. Average thickness of iron ore encountered in boreholes is around 5m.

Laterite: Extensive patches of laterite and lateritic soil are found in the area. Very often, lumps and nodules of manganese and iron ore are found to be irregularly distributed in the lateritic morrum. Also, composition of laterite varies at different places. At some places it is iron rich while at other places it is manganese rich. Average thickness of laterite encountered in boreholes is around 10m.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Quartzite: Large irregular patches of cherty and jaspery quartzite are encountered in the area while some of the biggest patches occur towards the northern portion of the property. The rock is usually bouldery, sometime massive and weathered in places. It is unbanded and no definite dip is observed. Stringers and veins of quartz, iron and manganese are at times seen to traverse the rock. Average thickness of quartzite encountered in boreholes is around 3m.

Shale: Shale found in the area are mostly lateritized; banded and unbanded varieties, which occur elsewhere in the district, are rare. Laterized shale grades from a few centimetres to several metres are encountered at places. Highly lateritized shales have also been marked on the geological map as lateritic. Average thickness of shale encountered in boreholes is around 15m.

STRUCTURE

General strike of the formations is NS to NE-SW with dip varying from 10° -30° towards west which is congruent to the regional structure of the Singhbhum Bonai Synclinorium. In some parts of the Jumbar quarry, the dip is observed to be towards north west direction while in Bamebari, it is towards west. All the litho units exposed in the area are highly weathered hence; measuring the actual structural data is very difficult.

LOCAL STRATIGRAPHIC SEQUENCE

The local litho stratigraphic succession in the area on the basis of borehole data and study of exposures is given below:-

Soil	Top soil with lateritic moorum, floats of manganese and iron ore	Younging direction ↑
Laterite	Laterite of varying thickness and composition	
Shale of varying Thickness	1)Ferruginous lateritized shale and manganiferous shale containing Mn ore bodies of varying thickness and veins of secondary silica and chert 2)Grey, pink and white unaltered shale at bottom	

d) (i) Name of prospecting /exploration agency : FAM Division

(ii) Address:

TATA STEEL LIMITED
P.O. – Bichakundi
JODA WEST
Dist. – Keonjhar
State – Odisha

(iii) E mail address : jwoffice@tatasteel.com

Phone no. : +919238120148

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

e) Details of Prospecting / Exploration already carried out :

i) Number of pits and trenches: Nil

ii) Number of boreholes drilled:

Exploration carried out in the past:

Details of exploration carried out in the past at Bamebari, Jorbar and Bonkela is given in Table 1.1 a, b & c respectively.

Table 1.1a : Past Exploration at Bamebari Block

Location	Year	No. of Bore Holes	Meterage	Borehole Type	Expenditure Incurred (Rs. Lakhs)
Bamebari Block	1962-64	23	481.60	Core	NA
	1975-77	53	1275.46	Core	NA
	1988-91	149	5573.00	Core	NA
	1998-2001	74	3372.30	Core	NA
	2003-04	25	1181.35	Core	26.06
	2006-08	13	535.55	Core	11.81
	2009-10	19	1093.80	Core	32.57
	2010-11	14	597	Core	28.14
	2011-12	10	402.70	Core	20.03
	2012-13	5	226.50	Core	11.48
	2013-14	8	415.85	Core	23.83
	2015-16	3	143.40	Core	8.22
	2016-17	1	199.00	Core	11.40
	2017-18	5	261.85	Core	15.00
	Sub-Total	**405**	**15759.36**	**Core**	**188.56**
	2009-10	45	909	DTH	12.93
	2013-14	10	439	RC	9.06
	2015-16	2	108	RC	3.24
	2016-17	6	263	RC	7.89
	2017-18	5	215	RC	6.45
	Sub-Total	**68**	**1934**	**RC/DTH**	**39.59**
	Grand Total	**473**	**17693.36**	**Core/RC/DTH**	**228.15**

Table 1.1b : Past Exploration at Jorbar Block

Location	Year	No. of Bore Holes	Meterage	Borehole Type	Expenditure Incurred (Rs. Lakhs)
Jorbar Block	1957-1969	43	1047.00	Core	NA
	2002-2008	69	3448.40	Core	76.07
	2009-10	5	393.10	Core	9.03
	2010-11	18	1119.35	Core	53.97

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

2011-12	20	1117.85	Core	55.61
2012-13	22	1153.80	Core	58.47
2013-14	10	522.60	Core	29.95
2015-16	20	1016.25	Core	58.24
2016-17	20	1183.90	Core	67.85
2017-18	2	136.95	Core	7.85
Sub Total	**229**	**11049.20**	**Core**	**415.84**
2010-11	20	361	DTH	5.14
2011-12	15	629	RC	10.51
2013-14	10	499	RC	10.32
2016-17	5	208	RC	6.24
2017-18	13	579	RC	17.37
Sub-Total	**63**	**2276**	**RC/DTH**	**49.58**
Grand Total	**292**	**13325.20**	**Core/RC/DTH**	**465.42**

Table 1.1c : Past Exploration at Boneikela Block

Location	Year	No. of Bore Holes	Meterage	Borehole Type	Expenditure Incurred (Rs. Lakhs)
Boneikela Block	1955-56	12	691.13	Core	NA
	1970-72	92	1751.02	Core	NA
	2011-12	5	215	Core	10.70
	2016-17	4	219.65	Core	12.59
	2017-18	3	156.6	Core	8.97
	Sub-Total	**116**	**3033.4**	**Core**	**32.26**
	2015-16	10	440	RC	13.44
	2016-17	6	289	RC	8.67
	2017-18	7	265	RC	7.95
	Sub-Total	**23**	**1002**	**RC/DTH**	**30.06**
	Grand Total	**139**	**4035.4**	**Core/RC/DTH**	**62.32**

Exploration data of the above borcholes has been already considered/furnished in the approved modification of mine plan for the period 2018-19 to 2019-20 and accordingly resource estimation was done.

Present Exploration:

Exploration carried out in the present modification of mine plan for the period 2018-19 to 2019-20 at Ramchani, Joribar and Boneikela is given in Table 1.1 d, e & f respectively.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Table 1.1d : Present Exploration at Bamebari Block

Location	Year	No. of BHs proposed	No. of BHs drilled	Meterage drilled	Borehole Type	Expenditure Incurred (Rs. Lakhs)
Bamebari Block	2018-19	65	3	141.85	Core	9.13
	2018-19		28	1209	RC	36.27
	2019-20	40	10	421	RC	12.63
	Total	**105**	**41**	**1771.85**	**Core/RC**	**57.03**

Exploration proposed could not completed due to un availability of forest clearance

Table 1.1e : Present Exploration at Joribar Block

Location	Year	No. of BHs proposed	No. of BHs drilled	Meterage drilled	Borehole Type	Expenditure Incurred (Rs. Lakhs)
Joribar Block	2018-19	58	12	560	RC	17.04
	2019-20	42	1	68.20	Core	3.91
	2019-20		4	174	RC	5.22
	Total	**100**	**17**	**810.20**	**Core/RC**	**26.17**

Exploration proposed could not completed due to un availability of forest clearance.

Table 1.1f : Present Exploration at Buruikela Block

Location	Year	No. of BHs proposed	No. of BHs drilled	Meterage drilled	Borehole Type	Expenditure Incurred (Rs. Lakhs)
Buruikela Block	2018-19	125	9	365	RC	10.95
	2019-20	159	0	0	-	0
	Total	**284**	**9**	**365**	**RC**	**10.95**

Exploration proposed could not completed due to un availability of forest clearance.

Cumulative exploration carried out in the 3 blocks of Bamebari lease is summarized in Table 1.1g.

Table 1.1g: Summary of Exploration in Bamebari Lease

Location	No. of Bore Holes	Meterage	Expenditure Incurred (Rs. Lakhs)
Bamebari	511	19465.21	285.18
Joribari	309	14135.40	491.59
Buruikela	148	4400.40	73.27
Total	**971**	**38001.01**	**850.04**

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

The details of already drilled boreholes have been furnished in the following table no 1.1h.

Table No. 1.1h
Details of already drilled boreholes

Bamebari Block:

Year of drilling	Borehole No	Coordinates		Borehole collar RL	Bottom lithology	Closing Depth (in meter)
		Northing	Easting			
1975-77	13/76	2325	3065	567	Chert	41.3
1975-77	14/76	2350	3065	566	Chert	22.1
1975-77	15/76	2275	3115	572	Chert	32.0
1975-77	16/76	2250	3115	571	Chert	19.7
1975-77	17/76	2232	3140	573	Chert	24.5
1975-77	18/76	2242	3301	575	Chert	3.1
1975-77	19/76	2300	3190	575	Chert	29.11
1975-77	20/76	2315	3190	575	Chert	42.5
1975-77	21/76	2250	3337	576	Chert	17.11
1975-77	22/76	2250	3315	577	Chert	9.2
1975-77	23/76	2326	3160	578	Shale	41.2
1975-77	24/76	2300	3165	578	Chert	38.9
1975-77	25/76	2275	3165	577	Shale	40.3
1975-77	26/76	2250	3165	577	Chert	27.1
1975-77	27/76	2350	3165	579	Chert	45.6
1975-77	28/76	2375	3165	579	Shale	40.8
1975-77	29/76	2375	3140	577	Shale	37.1
1975-77	30/76	2400	3165	579	Shale	30.5
1975-77	31/76	2350	3015	562	Chert	17.5
1975-77	32/76	2325	3040	564	Chert	20.0
1975-77	33/77	2275	3065	568	Laterite	11.4
1975-77	34/77	2300	3065	567	Chert	37.1
1975-77	37/77	2250	3065	567	Shale	24.8
1975-77	38/77	2250	3040	565	Shale	13.3
1975-77	39/77	2250	3015	563	Chert	13.2
1975-77	40/77	2275	3015	563	Chert	5.2
1975-77	41/77	2300	3015	563	Chert	16.3
1975-77	42/77	2224	3015	563	BIH	12.3
1975-77	43/77	2250	3190	574	Chert	14.3
1975-77	44/77	2250	3215	574	Chert	25.3
1975-77	45/77	2250	3240	574	Chert	10.4
1975-77	46/77	2250	3265	576	Shale	35.2
1975-77	47/77	2250	3291	576	Chert	10.4
1975-77	48/77	2300	3265	575	Chert	10.5
1975-77	49/77	2275	3265	576	Chert	4.5
1975-77	50/77	2290	3215	567	Chert	19.1
1975-77	51/77	2289	3241	566	Shale	16.7

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year of drilling	Borehole No	Coordinates		Borehole collar RL	Bottom lithology	Closing Depth (in meter)
		Northing	Eastng			
1975-77	52/77	2349	3242	574	Chert	10.3
1975-77	53/77	2317	3240	574	Laterite	5.4
1908-91	81/88	2999	3010	547	BHJ	10.3
1988-91	82/88	2998	3050	550	BHJ	28.7
1988-91	83/88	2996	3100	554	Shale	29.9
1988-91	84/88	2900	3000	550	DHJ	46.3
1988-91	85/88	2900	3100	555	BHJ	56.1
1988-91	86/88	2950	3050	550	BHJ	38.1
1988-91	87/88	2900	3000	568	Shale	41.5
1988-91	88/88	2992	3200	571	Manganiferous Shale	52.0
1988-91	89/88	2800	3100	561	BHJ	43.0
1988-91	810/88	2700	3100	563	BHJ	40.5
1988-91	811/88	2800	3000	553	BHJ	55.6
1988-91	812/88	2600	3100	566	BHJ	32.2
1988-91	13/88	2700	3000	553	Shale	63.0
1988-91	14/88	2500	3100	566	BHJ	20.1
1988-91	15/88	2400	3000	561	BHJ	33.6
1988-91	16/88	2600	3000	553	BHJ	47.6
1988-91	17/88	2404	3100	569	BHJ	42.4
1988-91	18/88	2500	3000	559	BHJ	28.3
1988-91	19/88	2400	3200	580	BHJ	19.8
1988-91	20/88	2407	3296	564	BHJ	29.0
1988-91	21/88	2500	3300	592	BHJ	40.5
1988-91	22/88	2500	3200	577	Laterite	31.4
1988-91	23/88	2408	3402	600	BHJ	23.5
1988 91	24/88	2600	3450	619	Chert	24.5
1988 91	25/88	2700	3400	615	Chert	30.2
1988 91	26/88	2800	3450	623	Shale	46.0
1988-91	27/88	2700	2300	595	Shale	57.0
1988-91	28/88	2800	3400	605	BHJ	45.3
1988-91	29/88	2450	3200	581	BHJ	41.0
1988-91	30/88	2450	3375	606	Laterite	22.9
1988-91	31/88	2405	3375	580	Chert	47.4
1988 91	32/88	2406	3375	605	Chert	29.0
1988-91	33/88	2408	3125	600	Chert	19.7
1988-91	34/88	2406	3225	586	Chert	46.3
1988-91	35/88	2383	3399	560	Manganese ore	21.0
1988-91	36/88	2383	3281	601	Chert	27.5
1988-91	37/88	2337	3394	600	Chert	22.1
1988-91	38/88	2325	3412	595	Shale	50.0
1988-91	39/88	2332	3393	595	Chert	16.2

Prepared by.
SABYASACHY MISHRA
QUALIFIED PERSON

Year of drilling	Borehole No	Coordinates		Borehole collar RL	Bottom lithology	Closing Depth (in meters)
		Northing	Easting			
1988-91	40/88	2425	3200	589	Chert	5.0
1988-91	41/88	2311	3439	595	Shale	30.7
1988-91	42/88	2360	3175	580	Laterite	5.0
1988-91	43/88	2298	3404	592	Chert	9.8
1988-91	44/89	2375	3197	579	Chert	13.1
1988-91	45/89	2282	3451	594	Shale	60.8
1988-91	46/89	2385	3222	583	Laterite	37.0
1988-91	47/89	2278	3448	591	Shale	60.0
1988-91	48/89	2381	3249	581	Shale	34.5
1988-91	49/89	2234	3474	592	Chert	12.5
1988-91	50/89	2381	3275	584	Chert	14.0
1988-91	51/89	2230	3499	591	Chert	18.0
1988-91	52/89	2231	3499	593	BHJ	17.4
1988-91	53/89	2356	3275	584	Chert	3.3
1988-91	54/89	2233	3474	592	BHJ	24.0
1988-91	55/89	2356	3245	574	Laterite	16.0
1988-91	56/89	2233	3451	592	Chert	62.0
1988-91	57/89	2208	3475	592	Chert	40.2
1988-91	58/89	2208	3450	593	Shale	54.0
1988-91	59/89	1760	3349	558	Shale	55.0
1988-91	60/89	2183	3450	590	Shale	67.0
1988-91	61/89	1809	3350	585	Shale	66.0
1988-91	62/89	2158	3450	588	Shale	60.0
1988-91	63/89	1809	3325	588	Shale	53.0
1988-91	64/89	2133	3450	589	Shale	50.3
1988-91	65/89	1784	3325	586	Shale	60.7
1988-91	66/89	2100	3425	592	Shale	62.0
1988-91	67/89	1761	3323	585	Shale	53.0
1988-91	68/89	2133	3425	591	Shale	44.0
1988-91	69/89	1734	3355	576	Shale	59.0
1988-91	70/89	2228	3426	593	Shale	51.0
1988-91	72/89	2208	3425	593	Shale	44.0
1988-91	73/89	3100	3397	596	Chert	21.8
1988-91	74/89	1725	3324	582	Shale	50.5
1988-91	76/89	2158	3376	593	Chert	3.5
1988-91	77/89	1825	3350	586	Shale	56.5
1988-91	78/89	2208	3376	592	Chert	16.0
1988-91	79/89	2075	3400	591	BHJ	15.4
1988-91	80/89	1825	3325	588	Shale	36.2
1988-91	81/89	2075	3348	586	Chert	40.5
1988-91	82/89	2100	3300	582	Shale	46.0
1988-91	83/89	2100	3225	575	Chert	22.3

Reported by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year of drilling	Borehole No	Coordinates		Borehole collar RL	Bottom lithology	Total Depth (in meter)
		Northing	Easting			
1988-91	84/89	3002	3273	580	Chert	18.1
1988-91	85/89	2984	3186	572	Chert	12.6
1988-91	86/89	2042	3226	576	Chert	64.0
1988-91	87/89	2047	3250	577	Chert	48.3
1988-91	88/89	2025	3225	576	Shale	56.1
1988-91	85/89	2037	3200	573	Chert	23.4
1988-91	90/89	2013	3205	574	Shale	61.2
1988-91	91/89	1700	3323	579	Shale	48.3
1988-91	92/89	2000	3225	575	Shale	60.1
1988-91	94/89	1675	3249	573	Shale	31.0
1988-91	94/89	2000	3197	573	Shale	61.3
1988-91	95/89	1675	3299	577	Shale	31.0
1988-91	96/89	1975	3199	573	Chert	14.9
1988-91	97/89	1975	3229	575	Chert	36.5
1988-91	98/89	1800	3373	578	Shale	53.0
1988-91	99/89	1950	3225	575	Shale	55.1
1988-91	100/89	1775	3274	576	Shale	55.8
1988-91	101/89	1975	3175	571	Chert	10.8
1988-91	102/89	2000	3175	571	Chert	7.3
1988-91	103/89	1675	3274	579	Shale	10.7
1988-91	104/89	2025	3274	579	Chert	14.2
1988-91	105/89	1975	3248	577	Shale	39.4
1988-91	106/89	2000	3274	579	Chert	51.9
1988-91	107/89	1700	3275	579	Shale	31.1
1988-91	108/89	2000	3299	581	Chert	40.5
1988-91	109/89	1950	3299	583	Chert	46.0
1988-91	110/89	1650	3274	579	Shale	31.8
1988-91	111/89	1625	3299	580	Shale	35.1
1988-91	112/89	1975	3274	580	Manganiferous Shale	42.3
1988-91	113/89	1575	3299	576	Shale	39.0
1988-91	114/90	1950	3274	580	Shale	44.0
1988-91	115/90	1950	3324	574	Shale	35.0
1988-91	116/90	1925	3299	572	Shale	30.5
1988-91	117/90	2021	3349	577	Shale	44.3
1988-91	118/90	1525	3340	568	Shale	32.0
1988-91	119/90	2020	3150	585	Chert	14.2
1988-91	120/90	1550	3374	568	Shale	28.0
1988-91	121/90	1992	3174	567	Chert	11.1
1988-91	122/90	1575	3400	567	Shale	32.4
1988-91	123/90	1974	3099	566	Chert	11.2
1988-91	124/90	1925	3103	565	Chert	8.5

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Year of drilling	Borehole No	Coordinates		Borehole collar RL	Bottom Lithology	Closing Depth (in meter)
		Northing	Easting			
1988-91	125/90	1600	3373	572	Shale	35.0
1988-91	126/90	1848	3176	570	Chert	19.8
1988-91	127/90	1625	3400	570	Shale	33.2
1988-91	128/90	2425	3225	589	Laterite	36.4
1988-91	129/90	1650	3423	571	Chert	38.2
1988-91	130/90	1650	3373	575	Shale	36.6
1988-91	131/90	2450	3225	585	Shale	40.0
1988-91	132/90	2450	3250	588	Shale	55.2
1988-91	133/90	2450	3275	597	Chert	25.0
1988-91	134/90	2425	3250	592	Shale	46.0
1988-91	135/90	2425	3275	593	Chert	19.5
1988-91	136/90	2406	3260	592	Shale	67.0
1988-91	137/90	2407	3270	594	Chert	41.4
1988-91	138/90	2425	3294	593	Chert	28.1
1988-91	139/90	2475	3250	587	Chert	52.6
1988-91	140/90	2500	3250	584	Shale	32.3
1988-91	141/90	2500	3275	588	Shale	40.6
1988-91	142/90	2475	3300	594	Chert	27.9
1988-91	143/90	2450	3300	595	Chert	17.0
1988-91	144/90	2450	3325	596	Chert	17.1
1988-91	145/91	2475	3325	597	Chert	25.0
1988-91	146/91	2475	3225	581	Chert	40.3
1988-91	147/91	2475	3200	578	Chert	36.6
1988-91	148/91	2500	3225	581	Shale	39.8
1988-91	149/91	2525	3225	580	Laterite	30.3
1998-2001	150/98	2348	2939	556	Shale	41.1
1998-2001	151/98	2348	2839	547	Chert	13.5
1998-2001	152/98	1065	3031	562	Chert	22.6
1998-2001	153/98	1063	3056	563	Chert	25.0
1998-2001	154/98	1641	3027	561	Chert	11.1
1998-2001	155/98	1670	3007	560	Chert	9.6
1998-2001	156/98	1090	3035	563	Chert	23.9
1998-2001	157/98	1716	3040	563	Chert	33.2
1998-2001	158/98	1687	3060	564	Chert	39.1
1998-2001	159/98	1036	3106	601	Shale	50.0
1998-2001	160/98	1045	3225	601	Shale	43.0
1998-2001	161/98	1064	3229	597	Shale	40.3
1998-2001	162/98	1078	3218	596	Shale	36.0
1998-2001	163/98	1045	3150	601	Shale	40.5
1998-2001	164/98	1069	3169	604	Shale	43.0
1998-2001	165/98	1098	3149	600	Chert	15.3
1998-2001	166/98	2388	3109	567	Laterite	42.7

Prepared by

SABYASACHY MISHRA
QUALIFIED PERSON

Year of drilling	Borehole No	Coordinates		Borehole collar RL	Bottom lithology	Closing Depth (in meter)
		Northing	Easting			
1998-2001	167/98	2394	3136	571	Shale	42.8
1998-2001	168/98	2410	3134	572	Shale	44.2
1998-2001	169/98	2424	3160	577	Chert	46.5
1998-2001	170/98	2446	3159	577	Shale	49.3
1998-2001	171/98	2467	3334	599	Chert	32.6
1998-2001	172/98	2502	3335	603	Chert	65.0
1998-2001	173/98	2466	3359	607	Chert	37.5
1998-2001	174/98	2466	3384	610	Chert	48.6
1998-2001	175/98	2491	3359	608	Laterite	65.0
1998-2001	176/99	2494	3384	612	Chert	33.1
1998-2001	177/99	2469	3409	613	Chert	49.0
1998-2001	178/99	2444	3304	609	Chert	37.7
1998-2001	179/99	2444	3409	612	Chert	33.1
1998-2001	180/99	2431	3434	612	Chert	28.4
1998-2001	181/99	2444	3447	614	Shale	60.5
1998-2001	182/99	2469	3434	614	Chert	52.3
1998-2001	183/99	2494	3434	618	Chert	58.1
1998-2001	184/99	2494	3409	611	Manganese ore	62.4
1998-2001	185/99	2469	3459	615	Chert	9.2
1998-2001	186/99	2469	3487	606	Chert	28.4
1998-2001	187/99	2441	3484	606	Chert	23.9
1998-2001	188/99	2419	3511	606	Chert	34.0
1998-2001	189/99	2491	3484	605	Chert	32.2
1998-2001	190/99	2494	3501	609	Chert	35.3
1998-2001	191/99	2463	3504	608	Laterite	23.7
1998-2001	192/99	2445	3506	609	Chert	34.5
1998-2001	193/99	2519	3502	611	Chert	44.0
1998-2001	194/99	2519	3336	612	Laterite	59.3
1998-2001	195/99	2519	3359	607	Shale	55.0
1998-2001	196/99	2519	3436	614	Chert	56.8
1998-2001	197/01	2619	3461	632	Chert	46.3
1998-2001	198/01	2569	3460	621	Chert	39.0
1998-2001	199/01	2569	3410	616	Laterite	50.2
1998-2001	200/01	2619	3411	618	Chert	51.4
1998-2001	201/01	2669	3462	624	BHJ	52.2
1998-2001	202/01	2670	3412	619	Chert	47.3
1998-2001	203/01	2620	3361	610	Chert	53.7
1998-2001	204/01	2570	3361	608	BIJ	95.0
1998-2001	205/01	2670	3313	600	Chert	39.0
1998-2001	206/01	2670	3362	611	Chert	52.9
1998-2001	207/01	2620	3312	600	Shale	58.0
1998-2001	208/01	2695	3339	605	BHJ	47.9

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year of drilling	Borehole No	Coordinates		Borehole collar RL	Bottom Lithology	Closing Depth in meter
		Northing	Easting			
1998-2001	209/01	2694	3437	623	Shale	60.6
1998-2001	210/01	2570	3311	598	Shale	75.6
1998-2001	211/01	2693	3491	626	Chert	37.0
1998-2001	212/01	2192	3309	581	Chert	53.5
1998-2001	213/01	2234	3309	576	Shale	61.0
1998-2001	214/01	2571	3339	604	Shale	71.4
1998-2001	215/01	2595	3360	609	Laterite	07.5
1998-2001	216/01	2328	3240	558	Shale	60.5
1998-2001	217/01	2570	3396	614	Shale	98.8
1998-2001	218/01	2242	3382	578	Chert	77.5
1998-2001	219/01	2274	3310	568	Shale	45.8
1998-2001	220/01	2545	3360	607	Shale	91.0
1998-2001	221/01	2277	3347	575	Shale	54.0
1998-2001	222/02	2336	3482	624	Chert	52.2
1998-2001	223/02	2385	3484	601	Chert	38.0
2003-04	1/03	2583	3167	577	Shale	50.0
2003-04	2/03	2982	3327	603	Shale	76.1
2003-04	3/03	2881	3382	608	Shale	72.0
2003-04	4/03	2573	3301	598	Shale	74.0
2003-04	5/03	2884	3282	587	Shale	74.3
2003-04	6/03	2719	3121	558	Shale	35.0
2003-04	7/03	2685	3182	577	Shale	32.5
2003-04	8/03	2983	3279	586	Shale	70.3
2003-04	9/03	2782	3181	579	Shale	33.3
2003-04	10/03	2735	3253	590	Shale	54.8
2003-04	11/03	2832	3185	569	Shale	34.4
2003-04	12/03	2934	3270	586	Shale	69.0
2003-04	13/03	2580	3240	585	Shale	17.5
2003-04	14/03	2935	3328	594	Shale	53.0
2003-04	15/03	2933	3377	604	Shale	57.3
2003-04	16/03	2644	3290	596	Shale	55.0
2003-04	17/03	2886	3330	596	Shale	37.5
2003-04	18/03	2979	3431	626	Shale	36.5
2003-04	19/03	2878	3477	626	Shale	36.9
2003-04	20/04	2836	3480	622	Shale	41.0
2003-04	21/04	2663	3307	600	Shale	33.5
2003-04	23/04	2834	3427	621	Shale	52.4
2003-04	30/04	2300	3129	545	Shale	50.2
2003-04	33/04	2293	3151	547	Shale	15.0
2003-04	35/04	2303	3177	546	Shale	9.8
2006-08	B1/07	2882	3357	585	Chert	29.6
2006-08	B2/07	2882	3387	603	Shale	43.2

Prepared By
SABYASACHY MISHRA
QUALIFIED PERSON

Year of drilling	Borehole No	Coordinates		Borehole collar RL	Bottom lithology	Closing Depth (in meter)
		Northing	Easting			
2006-08	B3/07	2007	3196	574	Shale	27.0
2006-08	B4/07	2904	3279	571	Shale	53.0
2006-08	B5/07	2908	3357	582	Shale	54.4
2006-08	B6/07	2854	3187	565	Laterite	33.0
2006-08	B7/07	2954	3380	593	Laterite	41.4
2006-08	B8/07	2883	3283	564	Shale	25.3
2006-08	B9/07	2522	3438	602	Laterite	55.5
2006-08	B10/07	2493	3398	573	Shale	23.0
2006-08	B11/07	2549	3381	601	Shale	71.2
2006-08	B12/07	2494	3458	597	Laterite	35.2
2006-08	B13/07	2525	3459	608	Manganiferous Shale	43.0
2009-10	BB01/09	1698	3222	574	Shale	67.0
2009-10	BB02/09	1518	3220	572	Shale	65.0
2009-10	BB03/09	1442	3214	572	Shale	60.7
2009-10	BB04/09	1412	3207	571	Shale	77.7
2009-10	BB05/09	1418	3101	573	Shale	61.3
2009-10	BB06/09	1357	3173	587	Shale	60.0
2009-10	BB07/09	1318	3163	586	Shale	74.2
2009-10	BB08/09	1618	3100	565	Shale	60.6
2009-10	BB09/09	1520	3306	566	Shale	57.5
2009-10	BB10/09	1154	3249	600	Shale	62.3
2009-10	BB11/09	1149	3350	543	Shale	44.0
2009-10	BB12/09	1042	3331	594	Shale	39.5
2009-10	BB13/09	1049	3386	606	Shale	44.0
2009-10	BB14/09	1101	3348	594	Shale	36.0
2009-10	BB15/09	1161	3378	599	Shale	44.3
2009-10	BB16/09	2270	3227	585	Shale	34.0
2009-10	BB17/09	2240	3105	560	Shale	52.0
2009-10	BB18/09	2189	3265	572	Chert	62.6
2009-10	BB19/09	2195	3256	564	Shale	47.6
2009-10	HPDTH01/09	2872	3318	565	Chert	15.0
2009-10	HPDTH02/09	2873	3250	564	Shale	21.0
2009-10	HPDTH03/09	2894	3294	563	Chert	24.0
2009-10	HPDTH04/09	2854	3291	566	Lateritic iron ore	15.0
2009-10	HPDTH05/09	2870	3260	566	Shale	15.0
2009-10	HPDTH06/09	2845	3267	567	Shale	15.0

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

2009-10	HPDTH07/09	2839	3309	572	Chert	40.0
2009-10	HPDTH08/09	2831	3289	571	Laterite	15.0
2009-10	HPDTH09/09	2829	3262	571	Shale	15.0
2009-10	HPDTH10/09	2897	3269	570	Shale	15.0
2009-10	HPDTH11/09	2868	3231	570	Shale	15.0
2009-10	HPDTH12/09	2843	3232	571	Chert	15.0
2009-10	HPDTH13/09	2816	3322	591	Shale	40.0
2009-10	HPDTH14/09	2854	3359	591	Shale	15.0
2009-10	HPDTH15/09	2881	3373	594	Shale	15.0
2009-10	BBDTH01/09	2357	3227	541	Chert	15.0
2009-10	BBDTH02/09	2328	3229	538	Shale	30.0
2009-10	BBDTH03/09	2297	3214	536	Shale	15.0
2009-10	BBDTH04/09	2292	3188	535	Shale	15.0
2009-10	BBDTH05/09	2296	3191	534	Shale	15.0
2009-10	BBDTH06/09	2306	3194	534	Chert	15.0
2009-10	BBDTH08/09	2385	3294	541	Chert	30.0
2009-10	BBDTH09/09	2306	3197	542	Chert	15.0
2009-10	BBDTH10/09	2360	3194	545	Shale	15.0
2009-10	BBDTH11/09	2320	3097	545	Chert	15.0
2009-10	BBDTH12/09	2290	3107	548	Shale	15.0
2009-10	BBDTH13/09	2276	3179	549	Chert	15.0
2009-10	BBDTH14/09	2268	3153	550	Shale	15.0
2009-10	BBDTH15/09	2256	3177	552	Shale	15.0
2009-10	BBDTH16/09	2292	3243	548	Shale	40.0
2009-10	BBDTH17/09	2268	3240	549	Shale	24.0

Prepared by

SABYASACHY MISHRA
QUALIFIED PERSON

2009-10	BBDCH18/09	2255	3215	549	Shale	15.0
2009-10	BBDCH19/09	2258	3260	545	Shale	15.0
2010-11	BBRC/01	2096	3096	567	Chert	40.0
2010-11	BBRC/02	2197	3116	572	Chert	40.0
2010-11	BBRC/03	2215	2997	562	Chert	40.0
2010-11	BBRC/04	2205	2899	554	Shale	50.0
2010-11	BBRC/05	1994	2982	562	Chert	40.0
2010-11	BBRC/06	2506	2800	546	Laterite	50.0
2010-11	BBRC/07	2600	2851	548	Shale	34.0
2010-11	BBRC/08	2438	2796	547	Laterite	55.0
2010-11	BBRC/09	2308	2824	549	Laterite	40.0
2010-11	BBRC/10	2156	2907	555	Chert	40.0
2010-11	BBRC/11	2101	3001	560	Laterite	45.0
2010-11	BBRC/12	2099	2940	557	Chert	43.0
2010-11	BBRC/13	2102	3147	574	Chert	40.0
2010-11	BBRC/14	2097	3144	571	Chert	40.0
2011-12	BBP/01	1906	2994	563	Chert	40.0
2011-12	BBP/02	1818	3020	562	Chert	42.0
2011-12	BBP/03	1770	3183	571	Shale	40.0
2011-12	BBP/04	1614	3440	570	Basalt	38.5
2011-12	BBP/05	1756	3399	573	Chert	40.2
2011-12	BBP/06	1788	3400	569	Basalt	40.0
2011-12	BBP/07	1900	3403	569	Basalt	42.0
2011-12	BBP/08	1876	3415	571	Chert	40.0
2011-12	BBP/09	1708	3499	582	Basalt	40.0
2011-12	BBP/10	1803	3397	576	Chert	40.0
2012-13	BBP/11	1706	3104	565	Manganiferous Shale	45.0
2012-13	BBP/12	1599	3037	562	Chert	42.0
2012-13	BBP/13	1498	3037	565	Chert	51.5
2012-13	BBP/14	1549	2972	561	Shale	42.5
2012-13	BBP/15	1552	3031	564	Chert	45.5
2013-14	BBRC/28	3396	3351	577	Shale	51.0
2013-14	BBRC/29	2600	3384	581	Laterite	56.0
2013-14	BBRC/30	2594	3335	571	Laterite	50.0
2013-14	BBRC/33	2697	3365	612	Shale	54.0
2013-14	BBRC/35	2593	3531	622	Chert	46.0
2013-14	BBRC/36	2541	3529	624	Chert	45.0
2013-14	BBRC/65	2595	3309	563	Chert	44.0
2013-14	BBRC/66	2549	3415	553	Chert	30.0
2013-14	BBRC/67	2546	3413	570	Shale	33.0
2013-14	BBRC/68	2569	3411	561	Shale	30.0
2013-14	BBP/19	1552	3088	564	Shale	55.3
2013-14	BBP/26	1608	3139	567	Shale	56.0

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

2013-14	BBP/27	1584	3139	567	Chert	48.5
2013-14	BBP/29	1633	3138	568	Shale	50.0
2013-14	BBP/30	1661	3139	567	Shale	54.5
2013-14	BBP/38	1305	3308	578	Shale	50.5
2013-14	BBP/39	1402	3305	576	Shale	50.5
2013-14	BBP/40	1397	3037	570	Chert	50.6
2015-16	BBRC/16	1552	3142	566	Chert	54.0
2015-16	BBRC/53	1559	3191	570	Manganiferous Shale	54.0
2015-16	BBP/41	1605	3192	572	Shale	49.7
2015-16	BBP/44	1575	3189	571	Manganiferous Shale	46.5
2015-16	BBP/46	1549	3196	563	Chert	47.2
2016-17	BBP/24	1601	3090	563	Shale	48.0
2016-17	BBP/28	1608	3162	569	Shale	50.0
2016-17	BBP/42	1609	3116	566	Chert	53.8
2016-17	BBP/45	1600	3216	573	Shale	47.2
2016-17	BBRC/52	1608	3240	574	Chert	48.0
2016-17	BBRC/83	2664	3334	575	Chert	45.0
2016-17	BBRC/90	2664	3309	574	Laterite	63.0
2016-17	BBRC/91	2661	3357	575	Manganiferous Shale	46.0
2016-17	BBRC/92	2572	3333	545	Laterite	30.0
2016-17	BBRC/94	2574	3361	542	Shale	31.0
2017-18	BBP/20	1573	3089	564	Chert	52.6
2017-18	BBP/21	1551	3112	565	Shale	53.9
2017-18	BBP/23	1552	3062	565	Chert	50.4
2017-18	BBP/31	1575	3113	565	Shale	47.0
2017-18	BBP/17	1498	3062	568	Chert	58.0
2017-18	BBRC/76	2642	3335	575	Chert	55.0
2017-18	BBRC/84	2642	3360	567	Shale	36.0
2017-18	BBRC/85	2615	3285	568	Shale	41.0
2017-18	BBRC/89	2694	3333	588	Chert	51.0
2017-18	BBRC/93	2614	3359	565	Chert	32.0
2018-19	BBP/43	1634	3093	564	Chert	45.4
2018-19	BBP/47	1634	3068	563	Chert	43.2
2018-19	BBP/48	1659	3092	565	Chert	43.3
2018-19	BBRC/18	1661	3240	575	Shale	46.0
2018-19	BBRC/20	1766	3240	576	Chert	43.0
2018-19	BBRC/21	1858	3247	577	Chert	42.0
2018-19	BBRC/31	2744	3442	624	Shale	42.0
2018-19	BBRC/34	2098	3528	630	Chert	48.0
2018-19	BBRC/37	1908	3284	581	Chert	40.0
2018-19	BBRC/38	1908	3242	576	Chert	42.0
2018-19	BBRC/54	1700	3140	568	Laterite	51.0

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

2018-19	BBRC/55	2657	3191	572	Shale	48.0
2018-19	BBRC/79	2541	2956	590	Shale	35.0
2018-19	BBRC/98	3546	3499	598	Chert	49.0
2018-19	BBRC/99	3597	3498	605	Chert	48.0
2018-19	BBRC/100	2763	3388	613	Chert	45.0
2018-19	BBRC/101	2047	3150	571	Chert	49.0
2018-19	BBRC/102	2044	3100	568	Chert	42.0
2018-19	BBRC/103	2097	3050	568	Chert	43.0
2018-19	BBRC/104	2071	3002	570	Chert	46.0
2018-19	BBRC/105	2493	2929	590	Ferruginous Shale	41.0
2018-19	BBRC/106	2450	2914	592	Laterite	40.0
2018-19	BBRC/107	2494	2915	593	Laterite	40.0
2018-19	BBRC/108	2447	2851	560	Shale	41.0
2018-19	BBRC/109	1753	3269	575	Shale	43.0
2018-19	BBRC/110	2398	2961	565	Shale	40.0
2018-19	BBRC/111	2037	3054	566	Chert	40.0
2018-19	BBRC/117	2307	2793	547	Laterite/Iron ore	40.0
2018-19	BBRC/118	2547	2800	546	Shale	40.0
2018-19	BBRC/119	2551	2850	549	Chert	40.0
2018-19	BBRC/120	3597	2801	546	Shale	40.0

Juribar Block:

Year of drilling	Borehole No	Coordinates		Borehole collar RL	Bottom lithology	Closing Depth (in meter)
		Northing	Easting			
1957-1969	01/68	11446	12815	561	Shale	22.67
1957-1969	02/68'	11528	12636	574	Shale	21.74
1957-1969	03/68'	11582	12818	569	Manganiferous Shale	20.30
1957-1969	04/68'	11522	12757	579	Manganiferous Shale	26.00
1957-1969	06/68'	11461	12754	567	Shale	25.00
1957-1969	13/69	11435	12633	574	WAD	25.00
1957-1969	14/69	11434	12604	571	Shale	25.00
1957-1969	15/69	11557	12605	577	Shale	25.00
1957-1969	16/69	11557	12573	579	Shale	25.00
1957-1969	17/69	11434	12694	567	Shale	25.00
1957-1969	18/69	11528	12512	597	Manganiferous Shale	25.00
1957-1969	20/69	11587	12515	592	Shale	25.00
1957-1969	21/69	11403	12602	570	Manganese ore	16.80
1957-1969	22/69	11587	12606	585	WAD	25.00
1957-1969	23/69	11493	12695	563	Shale	25.00
1957-1969	24/69	11617	12638	591	Shale	15.37
1957-1969	25/69	11494	12726	570	Shale	25.00
1957-1969	26/69	11550	12729	571	laterite	10.84

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Year of drilling	Borehole No	Coordinates		Borehole collar RL	Bottom lithology	Closing Depth (in meters)
		Northing	Easting			
1957-1969	27/69	11588	12544	585	Shale	25 00
1957-1969	28/69	11617	12515	596	Shale	25 00
1957-1969	29/69	11558	12514	594	Shale	25 00
1957-1969	30/69	11559	12484	604	Shale	25 00
2002-03	01/02	11665	12995	551	Chert	50 00
2002-03	02/02	11665	13029	550	Shale	43 70
2002-03	03/02	11714	13020	553	Shale	43 00
2002-03	04/03	11667	12946	569	Shale	58 00
2002 03	05/03'	11714	12994	565	Shale	40 35
2002 03	06/03'	11738	12995	565	Shale	38 55
2002 03	07/03'	11705	12945	570	Shale	50 20
2002 03	08/03'	11670	12922	573	Shale	65 50
2002-03	09/03'	11569	12944	566	Quartzite	61 60
2002-03	10/03'	11615	12945	565	Shale	65 20
2002-03	11/03'	11645	12922	572	Shale	47 70
2002-03	12/03'	11619	12924	571	Shale	60 00
2002-03	'13/03	11689	12948	569	Shale	51 60
2002 03	'14/03	11638	12949	567	Shale	62 00
2002 03	'15/03	11694	12921	574	Shale	55 03
2002-03	'16/03	11713	12921	574	Shale	43 50
2002-03	'17/03	11590	12944	566	Shale	67 00
2002-03	'18/03	11569	12919	569	Shale	64 20
2002-03	'19/03	11593	12921	570	Shale	69 10
2002-03	'20/03	11586	12969	563	Shale	53 45
2002-03	'21/03	11571	12969	562	Shale	43 70
2002-03	'22/03	11573	12993	559	Shale	60 50
2002-03	'23/03	11545	12947	563	Quartzite	51 40
2002-03	'24/03	11565	12893	573	Shale	67 50
2002-03	'25/03	11765	13120	559	Shale	45 00
2002-03	'26/03	11768	13070	561	Shale	45 20
2002-03	'27/03	11815	13070	565	Shale	45 00
2002-03	'28/03	11815	13120	562	Shale	50 00
2002-03	'29/03	11816	13070	567	Shale	51 00
2002-03	'31/03	11567	12576	620	Shale	54 00
2002-03	32/03	11569	12476	624	Shale	50 00
2002-03	34/03	11564	12577	614	Shale	54 30
2002-03	36/03	11518	12671	600	Shale	42 00
2002-03	37/03	11568	12626	611	Shale	52 50
2002 03	38/03	11618	12728	602	Shale	44 90
2002 03	39/03	11518	12728	602	Shale	53 50
2002 03	40/03	11571	12621	589	Shale	70 00
2002-03	41/03	11619	12673	602	Shale	55 00

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Year of drilling	Borehole No	Coordinates Northing	Coordinates Easting	Borehole collar RL	Bottom lithology	Depth (in meter)
2002-03	42/03	11714	12630	518	Shale	40.50
2002-03	43/03	11715	12671	519	Shale	56.60
2002-03	44/03	11717	12577	621	Shale	54.00
2002-03	45/03	11564	12774	587	Shale	58.50
2002-03	46/03	11667	12727	608	Shale	60.00
2002-03	47/03	11571	12677	587	Shale	50.00
2002-03	48/03	11575	12575	589	Shale	62.50
2002-03	49/03	11717	12725	608	Shale	42.50
2002-03	50/03	11529	12524	592	Shale	62.20
2002-03	51/03	11536	12475	595	Shale	50.00
2002-03	52/03	11622	12575	596	Shale	59.10
2002-03	53/03	11578	12526	591	Shale	51.50
2002-03	54/03	11583	12482	595	Shale	55.60
2002-03	55/03	11622	12583	602	Shale	46.60
2002-03	56/03	11525	12572	581	Shale	48.40
2002-03	57/03	11522	12672	571	Manganiferous Shale	35.60
2002-03	58/03	11632	12484	615	Shale	57.70
2002-03	59/03	11522	12514	578	Quartzite	30.40
2002-03	60/03	11511	12722	580	Shale	30.00
2002-03	61/03	11617	12777	599	Shale	60.10
2002-03	62/03	11617	12827	588	Shale	47.05
2002-03	63/03	11667	12826	590	Shale	50.20
2002-03	64/03	11767	12725	603	Shale	39.40
2002-03	65/03	11767	12777	594	Shale	41.55
2002-03	66/03	11717	12827	586	Shale	38.40
2002-03	67/03	11667	12777	600	Shale	54.80
2002-03	68/03	11817	12777	594	Shale	21.20
2002-03	69/03	11767	12827	584	Shale	33.50
2002-03	70/03	11817	12727	600	Shale	44.00
2002-03	71/03	11717	12777	596	Shale	25.00
2002-03	72/03	11817	12827	583	Shale	19.00
2009-10	IBVP1	11357	12581	526	laterite	15.00
2009-10	IBMP2	11352	12557	526	laterite	15.00
2009-10	IBMP3	11345	12532	527	laterite	15.00
2009-10	IBMP4	11327	12554	525	Manganese ore	15.00
2009-10	IBMP5	11325	12519	520	Shale	15.00
2009-10	IBMP6	11297	12519	531	Shale	15.00
2009-10	IBMP7	11300	12539	532	laterite	15.00
2009-10	IBMP8	11309	12562	533	Manganiferous Shale	17.00
2009-10	IBMP9	11335	12587	553	Manganese ore	15.00
2009-10	IBMP10	11349	12603	536	laterite	34.00
2009-10	IBMP11	11375	12603	536	laterite	28.00

Prepared by:
SABYASACHI MISHRA
QUALIFIED PERSON

Year of drilling	Borehole No	Coordinates		Borehole collar RL	Bottom lithology	Drilling Depth (in meter)
		Northing	Easting			
2009-10	JBMP12	11322	12599	536	laterite	15.00
2009-10	JBMP13	11291	12563	537	Manganiferous Shale	39.00
2009-10	JBMP14	11281	12541	538	laterite	15.00
2009-10	JBMP15	11274	12518	539	laterite	15.00
2009-10	JBMP16	11275	12494	539	laterite	15.00
2009-10	JBMP17	11300	12489	537	laterite	15.00
2009-10	JBMP18	11325	12490	537	laterite	15.00
2009-10	JBMP19	11373	12632	539	laterite	18.00
2009-10	JBMP20	11351	12620	538	Manganiferous Shale	15.00
2009-10	JBMP21	11379	12579	535	Manganiferous Shale	18.00
2009-10	JBMP22	11419	12634	542	laterite	15.00
2009-10	JBMP23	11415	12605	542	Manganiferous Shale	15.00
2009-10	JBMP24	11263	12541	544	laterite	27.00
2009-10	JBMP25	11272	12561	544	lateritic iron ore	25.00
2009-10	JBMP26	11285	12583	544	Manganiferous Shale	27.00
2009-10	JBMP27	11646	13045	551	Shale	9.00
2009-10	JBMP28	11645	13014	553	Shale	26.00
2009-10	JBMP29	11672	13025	554	Shale	26.00
2009-10	JBMP30	11697	13022	555	Manganiferous Shale	15.00
2009-10	JBMP31	11680	13077	554	Shale	6.00
2009-10	JB/01/09	12290	13401	551	Shale	70.00
2009-10	JB/02/09	12245	13352	553	Shale	72.30
2009-10	JB/03/09	12297	13371	570	Ochre	66.00
2009-10	JB/04/10	12304	13354	553	Chert	19.60
2009-10	JB/05/10	11495	12358	621	Shale	75.00
2010-11	JBCD/01	11346	12463	543	laterite	46.60
2010-11	JBCD/02	11396	12516	556	Shale	68.00
2010-11	JBCD/03	11452	12511	567	Chert	57.70
2010-11	JBCD/04	11346	12406	563	laterite	74.40
2010-11	JBCD/05	11403	12456	569	laterite	57.40
2010-11	JBCD/06	11399	12420	575	Shale	65.00
2010-11	JBCD/07	11450	12460	579	Shale	64.50
2010-11	JBCD/08	11500	12462	590	Shale	52.65
2010-11	JBCD/09	11400	12358	593	Shale	82.00
2010-11	JBCD/10	11502	12504	581	Manganese ore	49.30
2010-11	JBCD/11	11456	12404	600	Ochre	66.20
2010-11	JBCD/12	11504	12408	610	Chert	63.20
2010-11	JBCD/13	11450	12360	609	Manganiferous Shale	68.00
2010-11	JBCD/14	11444	12431	588	Manganiferous Shale	67.00
2010-11	JBCD/15	11399	12491	564	Manganiferous Shale	59.40
2010-11	JBCD/16	12398	12541	549	Shale	55.00
2010-11	JBCD/17	11451	12533	567	Manganese ore	70.00

Prepared By
SABYASACHY MISHRA
QUALIFIED PERSON

Year of drilling	Borehole No	Coordinates		Borehole collar RL	Bottom lithology	Closing Depth (in meter)
		Northing	Easting			
2010-11	JBCD/18	11287	12559	537	Shale	53.00
2011-12	JBCD/19	11543	12335	631	Manganiferous Shale	66.50
2011-12	JBCD/20	11505	12383	616	Manganiferous Shale	61.20
2011-12	JBCD/21	11547	12408	617	Shale	67.00
2011-12	JBCD/22	11547	12433	612	Manganiferous Shale	55.00
2011-12	JBCD/23	11507	12432	600	Chert	61.00
2011-12	JBCD/24	11600	12340	638	Shale	61.00
2011-12	JBCD/25	11510	12334	628	Manganiferous Shale	70.00
2011-12	JBCD/26	11548	12358	629	Shale	64.40
2011-12	JBCD/27	11602	12380	629	Shale	58.00
2011-12	JBCD/28	11596	12431	619	Shale	51.50
2011-12	JBCD/29	11601	12410	625	Shale	50.00
2011-12	JBCD/30	11590	12455	612	Shale	51.50
2011-12	JBCD/31	11552	12381	626	Shale	60.00
2011-12	JBCD/32	11600	12364	633	Shale	50.00
2011-12	JBCD/33	11527	12384	619	Manganese ore	45.00
2011-12	JBCD/34	11477	12361	613	Manganiferous Shale	50.00
2011-12	JBCD/35	11526	12411	611	Manganiferous Shale	45.00
2011-12	JBCD/36	11477	12380	610	laterite iron ore	40.50
2011-12	JBCD/37	11446	12342	611	Shale	50.00
2011-12	JBCD/38	11477	12336	623	Manganiferous Shale	60.25
2011-12	JBRC/01	11955	13255	545	Shale	40.00
2011-12	JBRC/02	11956	13277	544	Chert	40.00
2011-12	JBRC/03	11979	13254	544	Ochre	50.00
2011-12	JBRC/04	11930	13255	548	Chert	42.00
2011-12	JBRC/05	11931	13273	546	Chert	40.00
2011-12	JBRC/06	11997	13262	544	Chert	42.00
2011-12	JBRC/07	11931	13230	550	Manganiferous Shale	45.00
2011-12	JBRC/08	11955	13231	549	Chert	40.00
2011-12	JBRC/09	11981	13230	550	Chert	40.00
2011-12	JBRC/10	12012	13232	553	Chert	40.00
2011-12	JBRC/11	12251	13299	546	Chert	40.00
2011-12	JBRC/12	12251	13285	554	Chert	45.00
2011-12	JBRC/13	12296	13249	572	Chert	40.00
2011-12	JBRC/14	12331	13235	569	Ochre	45.00
2011-12	JBRC/15	12246	13249	564	BHJ	40.00
2012-13	JBCD/39	11620	12433	623	Shale	51.70
2012-13	JBCD/40	11425	12358	598	laterite	60.00
2012-13	JBCD/41	11480	12400	601	lateritic iron ore	48.00
2012-13	JBCD/42	11400	12332	595	Shale	70.00
2012-13	JBCD/43	11400	12383	583	Shale	60.50
2012-13	JBCD/44	11372	12405	569	Chert	60.00

Prepared by

SABYASACHY MISHRA
QUALIFIED PERSON

Year of drilling	Borehole No	Coordinates		Borehole collar RL	Bottom lithology	Closing Depth in meters
		Northing	Easting			
2012-13	JBCD/45	11368	12358	575	Shale	52.60
2012-13	JBCD/46	11421	12467	565	Shale	40.50
2012-13	JBCD/47	11524	12355	628	laterite	60.50
2012-13	JBCD/48	11574	12367	630	Shale	60.00
2012-13	JBCD/49	11580	12395	626	Manganiferous Shale	47.00
2012-13	JBCD/50	11538	12462	598	Manganiferous Shale	40.00
2012-13	JBCD/51	11515	12477	600	Manganiferous Shale	40.00
2012-13	JBCD/52	11537	12334	630	Shale	50.00
2012-13	JBCD/53	11345	12380	570	laterite	47.00
2012-13	JBCD/54	11425	12383	590	Manganiferous Shale	55.00
2012-13	JBCD/55	11482	12329	612	laterite	65.00
2012-13	JBCD/56	11460	12383	599	Shale	52.00
2012-13	JBCD/57	11425	12406	586	Manganiferous Shale	55.00
2012-13	JBCD/58	11371	12378	574	lateritic iron ore	49.10
2012-13	JBCD/59	11427	12435	578	Shale	50.00
2012-13	JBCD/60	11404	12468	551	Manganiferous Shale	40.00
2013-14	JBCD/61	11391	12520	550	Chert	60.00
2013-14	JBCD/62	11420	12516	557	Manganiferous Shale	55.10
2013-14	JBCD/63	11347	12442	549	Chert	50.00
2013-14	JBCD/64	11319	12463	543	Shale	35.00
2013-14	JBCD/65	11343	12493	529	Shale	36.00
2013-14	JBCD/66	11345	12357	577	Shale	38.00
2013-14	JBCD/67	11372	12468	549	Shale	53.50
2013-14	JBCD/68	11361	12522	530	Chert	67.00
2013-14	JBCD/69	11367	12496	544	Chert	66.00
2013-14	JBCD/70	11372	12444	556	Manganiferous Shale	67.00
2013-14	JBRC/44	11489	12728	575	Shale	62.00
2013-14	JBRC/45	11505	12722	575	Shale	51.00
2013-14	JBRC/47	11495	12698	576	Shale	57.00
2013-14	JBRC/48	11464	12697	566	Shale	58.00
2013-14	JBRC/49	11469	12727	570	Shale	52.00
2013-14	JBRC/50	11487	12751	572	Shale	52.00
2013-14	JBRC/51	11510	12738	570	Shale	30.00
2013-14	JBRC/52	11433	12605	562	Shale	53.00
2013-14	JBRC/54	11442	12752	568	Shale	57.00
2013-14	JBRC/56	11509	12697	570	Shale	35.00
2015-16	JBCD/71	11532	12516	581	Shale	35.00
2015-16	JBCD/72	11321	12444	549	alentic iron ore	48.00
2015-16	JBCD/73	11401	12637	537	Shale	37.00
2015-16	JBCD/74	11375	12335	592	Manganese ore	69.80
2015-16	JBCD/75	11322	12404	570	Chert	75.10
2015-16	JBCD/76	11295	12445	550	alentic iron ore	42.00

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year of drilling	Borehole No	Coordinates		Borehole collar RL	Bottom lithology	Closing Depth (in meter)
		Northing	Easting			
2015-16	JBCD/77	11335	12509	524	Manganese ore	45.60
2015-16	JBCD/78	11284	12464	545	Shale	42.40
2015-16	JBCD/79	11261	12468	549	aterite	55.20
2015-16	JBCD/80	11242	12483	553	aterite	77.10
2015-16	JBCD/81	11337	12527	527	Chert	42.40
2015-16	JBCD/82	11355	12648	536	Shale	35.60
2015-16	JBCD/83	11404	12599	540	Chert	39.70
2015-16	JBCD/84	11378	12659	542	Chert	50.00
2015-16	JBCD/85	11374	12557	535	lateritic iron ore	42.50
2015-16	JBCD/86	11351	12670	551	Manganiferous Shale	67.40
2015-16	JBCD/87	11434	12666	552	Chert	60.30
2015-16	JBCD/88	11455	12629	557	Chert	45.00
2015-16	JBCD/89	11410	12497	557	lateritic iron ore	55.00
2015-16	JBCD/105	11324	12422	551	Shale	58.75
2016-17	JBCD/90	11508	12306	679	Manganiferous Shale	72.50
2016-17	JBCD/91	11477	12311	624	Shale	65.90
2016-17	JBCD/92	11446	12316	617	Chert	70.00
2016-17	JBCD/93	11326	12542	540	laterite	48.80
2016-17	JBCD/94	11318	12519	522	Chert	36.00
2016-17	JBCD/95	11325	12574	525	Chert	52.20
2016-17	JBCD/96	11297	12580	536	Shale	40.60
2016-17	JBCD/97	11297	12605	545	Chert	52.75
2016-17	JBCD/98	11475	12431	590	Manganiferous Shale	85.00
2016-17	JBCD/99	11481	12455	589	laterite	41.00
2016-17	JBCD/100	11485	12530	571	Chert	67.20
2016-17	JBCD/101	11446	12491	566	Chert	62.00
2016-17	JBCD/102	11502	12484	582	Shale	65.00
2016-17	JBCD/103	11482	12479	580	Chert	65.00
2016-17	JBCD/104	11506	12527	572	Chert	52.00
2016-17	JBCD/105	11276	12430	554	Shale	67.85
2016-17	JBCD/107	11331	12360	577	Shale	67.85
2016-17	JBCD/108	11377	12686	554	Chert	75.30
2016-17	JBCD/109	11450	12695	557	Shale	71.10
2016-17	JBCD/110	11478	12710	562	Chert	77.55
2016-17	JBRC/58	11451	12558	556	Shale	28.00
2016-17	JBRC/59	11451	12583	555	Shale	40.00
2016-17	JBRC/61	11439	12540	551	Shale	42.00
2016-17	JBRC/65	11417	12494	550	Shale	48.00
2016-17	JBRC/67	11497	12574	565	Shale	50.00
2017-18	JBCD/111	11326	12667	549	Shale	75.85
2017-18	JBCD/112	11304	12637	547	Chert	61.10
2017-18	JBRC/60	11482	12504	559	Shale	37.00

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year of drilling	Borehole No	Coord nates		Borehole collar RL	Bottom litholoy	Closing Depth (in meter)
		Northing	Easting			
2017-18	JBRC/62	11427	12752	567	laterite	44.00
2017-18	JBRC/63	11498	12666	571	Shale	44.00
2017-18	JBRC/64	11437	12727	565	Shale	56.00
2017-18	JBRC/66	11494	12623	564	Shale	45.00
2017-18	JBRC/68	11623	12624	605	Shale	53.00
2017-18	JBRC/69	11659	12528	618	Shale	48.00
2017-18	JBRC/70	11550	12575	582	Shale	42.00
2017-18	JBRC/71	11459	12665	560	laterite	34.00
2017-18	JBRC/72	11467	12512	552	Shale	28.00
2017-18	JBRC/73	11467	12533	550	laterite	35.00
2017-18	JBRC/74	11347	12422	555	Manganese ore	67.00
2017-18	JBRC/75	11369	12430	557	Manganese ore	47.00
2018-19	JBRC/17	12118	13242	554	Chert	52.00
2018-19	JBRC/19	12035	13139	558	Chert	40.00
2018-19	JBRC/21	12051	13185	554	Shale	48.00
2018-19	JBRC/22	12107	13281	551	Shale	52.00
2018-19	JBRC/54	11406	12702	563	laterite	50.00
2018-19	JBRC/150	12359	13305	563	Manganiferous Shale	52.00
2018-19	JBRC/151	12100	13205	555	Shale	49.00
2018-19	JBRC/152	12126	13205	555	Shale	46.00
2018-19	JBRC/153	12346	13352	554	Manganiferous Shale	45.00
2018-19	JBRC/154	12355	13406	542	Manganiferous Shale	47.00
2018-19	JBRC/155	12398	13354	532	Shale	40.00
2018-19	JBRC/156	12383	13398	532	Ocure	47.00

Bonaikela Block:

Year of drilling	Borehole No	Coordinates		Borehole collar RL	Bottom lithology	Closing Depth (in meter)
		Northing	Easting			
1970-72	BH/1/70	4045	4960	520	Shale	10.73
1970-72	BH/10/70	4119	4881	551	Laterite	4.25
1970-72	BH/11/70	4156	4864	544	Laterite	25.00
1970-72	BH/12/70	4127	4803	552	Laterite	25.00
1970-72	BH/13/70	4095	4847	544	Shale	11.54
1970-72	BH/14/70	4199	4877	560	Shale	21.00
1970-72	BH/15/70	4212	4916	569	Shale	25.00
1970-72	BH/16/70	4270	4782	581	Shale	15.07
1970-72	BH/17/70	4266	4858	583	Shale	24.00
1970-72	BH/18/70	4331	4917	582	Shale	14.48
1970-72	BH/19/70	4315	5306	593	Shale	19.39
1970-72	BH/2/70	4059	4936	527	Shale	25.79
1970-72	BH/20/70	4295	4968	587	Shale	19.23
1970-72	BH/21/70	4264	4994	588	Shale	19.31

Prepared by.
SABYASACHY MISHRA
QUALIFIED PERSON

Year of drilling	Borehole No	Coordinates		Borehole collar RL	Rock type/Lithology	Closing Depth (in meter)
		Northing	Easting			
1970-72	BH/22/70	4368	5011	593	Shale	16.66
1970-72	BH/23/70	4357	5065	603	Laterite	14.41
1970-72	BH/24/70	4386	4933	555	Laterite	10.50
1970-72	BH/25/70	4392	4969	552	Shale	15.10
1970-72	BH/26/70	4217	5038	554	Shale	12.51
1970-72	BH/27/70	4224	5069	554	Shale	13.92
1970-72	BH/28/70	4258	5066	561	Shale	9.73
1970-72	BH/29/70	4166	5065	534	Shale	12.01
1970-72	BH/3/70	4070	4915	530	Shale	20.84
1970-72	BH/30/70	4240	5032	556	Shale	11.69
1970-72	BH/31/70	4176	5025	538	Shale	11.56
1970-72	BH/32/70	4200	4847	556	Shale	25.00
1970-72	BH/33/70	4219	4986	566	Shale	16.57
1970-72	BH/34/70	4300	4939	582	Shale	16.99
1970-72	BH/35/70	4338	4918	575	Shale	17.66
1970-72	BH/36/70	4240	4896	572	Shale	22.41
1970-72	BH/37/70	4375	4899	568	Shale	15.95
1970-72	BH/38/70	4308	4911	577	Shale	25.00
1970-72	BH/39/70	4286	4873	570	Shale	16.57
1970-72	BH/4/70	4146	4986	535	Shale	9.44
1970-72	BH/40/70	4242	4973	577	Shale	14.40
1970-72	BH/41/70	4229	4856	560	Shale	24.37
1970-72	BH/42/70	4170	4858	552	Laterite	9.82
1970-72	BH/43/70	4132	4858	551	Shale	25.00
1970-72	BH/44/70	4073	4841	552	Laterite	25.00
1970-72	BH/45/70	4378	4963	581	Manganiferous Shale	5.90
1970-72	BH/46/70	4015	4823	525	Shale	25.00
1970-72	BH/47/70	4047	4899	548	Laterite	25.00
1970-72	BH/48/70	3965	4743	515	Shale	25.00
1970-72	BH/49/70	3950	4785	505	Shale	12.71
1970-72	BH/5/70	4150	4963	537	Shale	14.00
1970-72	BH/50/70	4333	5034	509	Shale	10.35
1970-72	BH/51/70	4366	4570	559	Shale	10.00
1970-72	BH/52/70	4368	4519	554	Shale	10.71
1970-72	BH/53/70	4370	4470	553	Shale	15.66
1970-72	BH/54/70	4366	4420	565	Shale	25.00
1970-72	BH/55/70	4372	4410	556	Shale	14.35
1970-72	BH/56/70	4373	4370	554	Shale	13.50
1970-72	BH/57/70	4328	4420	549	Shale	15.56
1970-72	BH/58/70	4319	4517	548	Shale	12.70
1970-72	BH/59/70	4271	4416	540	Shale	6.70
1970-72	BH/6/70	4137	4934	539	Shale	15.47

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year of drilling	Borehole No	Coord rates		Borehole collar RL	Bottom lithology	Closing Depth (in meter)
		Northing	Easting			
1970-72	BH/60/70	4269	4515	545	Shale	25.00
1970-72	BH/61/70	4206	4419	545	Shale	30.00
1970-72	BH/62/70	4279	4381	538	Shale	30.00
1970-72	BH/63/70	4210	4512	541	Shale	35.14
1970-72	BH/64/70	4231	4379	528	Shale	30.00
1970-72	BH/65/70	4156	4509	539	Chert	35.42
1970-72	BH/66/71	4167	4567	532	Manganiferous Shale	25.00
1970-72	BH/67/71	4269	4567	548	Manganiferous Shale	25.00
1970-72	BH/68/71	4317	4567	555	Manganiferous Shale	11.09
1970-72	BH/69/71	4317	4467	545	Shale	10.00
1970-72	BH/7/70	4123	4056	531	Shale	10.16
1970-72	BH/70/71	4219	4461	537	Manganiferous Shale	13.10
1970-72	BH/71/71	4219	4412	531	Manganiferous Shale	13.49
1970-72	BH/72/71	4469	4664	583	Shale	18.52
1970-72	BH/73/71	4769	4664	624	Chert	57.10
1970-72	BH/74/71	4706	4664	601	Shale	21.48
1970-72	BH/75/71	4768	4604	607	Chert	18.42
1970-72	BH/76/71	4828	4665	644	Shale	25.00
1970-72	BH/77/72	4858	4724	665	Manganiferous Shale	25.00
1970-72	BH/78/72	4799	4725	641	Shale	25.10
1970-72	BH/79/72	4737	4726	617	Shale	17.50
1970-72	BH/8/70	4169	4935	549	Shale	15.16
1970-72	BH/80/72	4737	4634	606	Shale	11.00
1970-72	BH/81/72	4769	4514	587	Shale	20.00
1970-72	BH/82/72	4707	4602	590	Shale	17.60
1970-72	BH/83/72	4675	4571	574	Shale	23.25
1970-72	BH/84/72	4706	4544	570	Chert	30.00
1970-72	BH/85/72	4737	4514	575	Shale	25.00
1970-72	BH/86/72	4703	4482	561	Shale	24.64
1970-72	BH/87/72	3444	4414	556	Chert	27.15
1970-72	BH/88/72	3305	4413	535	Shale	25.00
1970-72	BH/89/72	3476	4443	553	Manganiferous Shale	16.00
1970-72	BH/90/70	4149	4901	535	Shale	24.71
1970-72	BH/90/72	3416	4474	542	Shale	25.20
1970-72	BH/91/72	3506	4502	539	Shale	25.00
1970-72	BH/92/72	3566	4474	550	Shale	15.20
2011-12	BORC/01	3218	4857	504	Chert	45.00
2011-12	BORC/02	3857	5512	512	Chert	45.00
2011-12	BORC/03	3847	5486	512	Chert	40.00
2011-12	BORC/04	3644	5428	508	Chert	40.00
2011-12	BORC/05	3140	4867	505	Laterite	45.00
2015-16	BORC/16	3915	4918	508	Shale	45.00

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year of drilling	Borehole No	Coordinates		Borehole collar RL	Bottom lithology	Cleaned Depth (in meter)
		Northing	Easting			
2015-16	BORC/17	3926	4872	512	Shale	40.00
2015-16	BORC/18	3960	4770	524	Shale	54.00
2015-16	BORC/19	3913	4967	514	Shale	47.42
2015-16	BORC/20	3971	4964	515	Shale	45.00
2015-16	BORC/21	4065	4972	528	Shale	40.00
2015-16	BORC/22	4015	4961	521	Shale	30.00
2015-16	BORC/23	4113	4923	552	Shale	45.00
2015-16	BORC/24	3959	4923	523	Shale	56.00
2015-16	BORC/25	4173	4932	559	Shale	30.00
2016-17	BOCD/02	3955	4824	518	Shale	63.42
2016-17	BOCD/03	3960	4796	524	Laterite	65.45
2016-17	BOCD/05	4094	4868	551	Shale	50.35
2016-17	BOCD/07	4057	4968	545	Shale	40.52
2016-17	BORC/26	3968	4924	516	Shale	50.00
2016-17	BORC/27	3960	4869	521	Shale	52.00
2016-17	BORC/29	4065	4816	546	Shale	51.00
2016-17	BORC/30	4020	4821	536	Shale	46.00
2016-17	BORC/31	4025	4873	535	Shale	47.00
2016-17	BORC/32	4019	4782	533	Shale	43.00
2017-18	BOCD/04	3961	4847	522	Shale	52.35
2017-18	BOCD/06	4076	4844	549	Shale	50.30
2017-18	BOCD/08	4079	4890	552	Shale	52.05
2017-18	BORC/33	4027	4911	535	Shale	45.00
2017-18	BORC/34	4215	5023	557	Shale	30.00
2017-18	BORC/35	4214	4974	561	Shale	30.00
2017-18	BORC/36	4109	4912	545	Shale	35.00
2017-18	BORC/37	4134	4915	548	Shale	30.00
2017-18	BORC/38	3791	4900	498	Shale	50.00
2017-18	BORC/39	3742	4952	498	Shale	45.00
2018-19	BORC/40	3715	4925	497	Ochre	43.00
2018-19	BORC/41	3741	4899	497	Shale	35.00
2018-19	BORC/42	3696	4950	496	Shale	45.00
2018-19	BORC/43	3764	4925	498	Shale	40.00
2018-19	BORC/44	4129	4970	536	Shale	40.00
2018-19	BORC/45	3916	4822	515	Laterite	60.00
2018-19	BORC/46	4104	4854	554	Shale	42.00
2018-19	BORC/47	3919	5020	516	Shale	40.00
2018-19	BORC/48	4029	5051	515	Shale	37.00

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

iii) Details of sample analysis indicating type of sample (surface / sub-surface form pits / trenches / boreholes etc)

Total number of samples collected and analysed for Bamebari, Joribar and Bonaikela blocks during 2015-16 to 2019-20 are 1578, 3002 and 1405 respectively. All the samples were analysed at our own laboratory having recognition from Directorate of Geology, Govt. of Odisha and also duly accredited by NABL. The detailed borehole logs are being enclosed as Annexure-43. Authenticated analysis report of boreholes by third paty NABL certified laboratory are being enclosed as Annexure-44.

Details of samples collected and analysed during the last scheme period (including 10% check samples by 3rd party NABL laboratory) is given below in Table No. 1.1 i.

Table No. 1.1i
Details of samples collected and analysed

Bamebari

Year	No. of Samples Collected	No. of Samples Analysed	No. of Check samples (3rd party)
2015-16	171	171	17
2016-17	276	276	28
2017-18	261	261	26
2018-19	546	546	55
2019-20	324	324	32
Total	**1578**	**1578**	**158**

Joribar

Year	No. of Samples Collected	No. of Samples Analysed	No. of Check samples (3rd party)
2015-16	1012	1012	100
2016-17	1168	1168	120
2017-18	526	526	50
2018-19	296	296	30
2019-20			
Total	**3002**	**3002**	**300**

Bonaikela

Year	No. of Samples Collected	No. of Samples Analysed	No. of Check samples (3rd party)
2015-16	353	353	35
2016-17	426	426	43
2017-18	261	261	26
2018-19	365	365	37
2019-20	0	0	
Total	**1405**	**1405**	**143**

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

iv) Expenditure incurred in various prospecting operations:

The details of expenditure incurred for prospecting operation has been duly furnished in Table No. 1.1 (a) to (g).

f) The surface plan of the lease area

The surface plan of Bamebari, Joribar and Bonaikela blocks have been prepared on a scale of 1: 5000 (as per permission obtained to maintain statutory plans on scales different than those specified in rule 27 (1) (d) of MCDR'88) with contour interval of 5m showing all features indicated under Rule 28(1)(a) of MCDR 1988. The same is attached as Drawing no DWG 05A, 05B & 05C respectively. Part surface plans in respect of each pit prepared on a scale of 1:1000 have been attached as Drawing no DWG 6A, 6B & 6C

g) The geological plan

The geological plan of Bamebari, Joribar and Bonaikela blocks have been prepared on a scale of 1:5000 taking the surface plan as base plan. All Litho units exposed in the lease area along with structural features, location of drilled boreholes, proposed boreholes, existing mine workings, dumps, starks, section lines contour at 5m interval and exploration limits as per UNFC guidelines have been shown in the geological plan. The same is attached as Drawing no. DWG 7A, 7B & 7C respectively. Part geological plans in respect of each pit prepared on a scale of 1:1000 have been attached as Drawing no. DWG 8A, 8B & 8C.

Copy of the Scale exemption letter is being enclosed as Annexure - 35.

h) Geological sections

Geological sections have been prepared on a scale of 1:5000 from boundary to boundary (including area intended for relinquishment). The same is attached as Drawing no DWG 9A, 9B & 9C respectively. Part geological sections corresponding to the part geological plans prepared on a scale of 1:1000 have been attached as Drawing no. DWG 10A, 10B & 10C.

i) Future Exploration programme:

Exploration proposal in Bamebari, Joribar and Bonaikela blocks (area intended to retain) has been done with the main objective of covering the total potentially mineralised area under G1 level of exploration by 2021-22 as per provision of rule 12 (4) of MCDR'2017. For this, exploration proposal has been given in the entire area (intended to retain) in G1 level except those already explored in G1 level. After completion of G2 level of exploration as per UNFC norms in grid pattern, if any area is found to be fully non-mineralised (borehole samples having Mn% and Fe% less than threshold value, i.e 10% Mn and 45% Fe), then such potentially non-mineralised area will not be proved for further G1 level of exploration. However, if the analyses of

borehole samples have Mn and Fe values above threshold value at +10% Mn and +45% Fe respectively, such area will be proved for G1 level of exploration

New boreholes have been proposed in those areas where the existing boreholes have been terminated prematurely in the ore zone (i.e., above 10% Mn and 45% Fe respectively) to intersect entire thickness of the ore body to make G1 compliance in regular grid interval. These boreholes will be closed in the waste zones.

The depth of proposed boreholes has been considered based on the occurrence of the orebody at depth both along and across the section lines. However, the actual depth may vary based on the lithologies encountered during drilling

Note: Exploration has been planned mostly in forest areas and in some areas where exploratory drilling cannot be carried out without statutory clearances. Hence, exploratory drilling in these areas will be done only after obtaining necessary clearances.

The year wise exploration plan is summarized below in Table No 1.2 and location of proposed boreholes are shown in Drawing no. DWG 7A, DWG 7B & DWG 7C. The details of proposed boreholes have been provided in tabular format in Annexure-45.

Table 1.2

Year	No. of boreholes (Core/RC/DTH)									Grid Interval	Total Nos. and meterage
	Bamebari			Joribaz			Sorchkela				
	Core	RC	Total	Core	RC	Total	Core	RC	Total		
2020-21	46	20	74	39	57	96	105	163	268	50m (G1 coverage in total lease area)	438 nos 21900m
2021-22	24	238	262	61	90	151	18	474	492		905 nos, 45430m
Total	70	266	336	100	147	247	123	637	760		**1343 nos. 67330m**

Prepared by.
SABYASACHY MISHRA
QUALIFIED PERSON

j) **Reserves and Resources as per UNFC with respect to the threshold value notified by IBM :**

A total of 67 boreholes were drilled during the period 2018 19 to 2019-20 in the 3 blocks of Bamebari lease. Resource evaluation has been carried out based on the new boreholes (except 5 boreholes drilled during the fourth quarter of 2019-20, for which analysis is still pending) drilled during the approved modification of mine plan along with all the old boreholes drilled (904 Nos.) as per UNFC norms.

Parameters for reserve/resource estimation:
Deposit evaluation was done by using mine planning software Surpac Version 6.8.

Steps followed

- Data collection from graphical borehole logs, recording and rodification.
- Data punching in to computer files and its validation.
- Creation of database in application software.
- Creation of digital database of topography, geological features (strata-contact) and surface features by digitization.
  Preparation of Digital Terrain Model (DTM) of topography using survey data and extraction of surface profiles along cross section lines
- Preparation of geological cross sections from geology and assay database of boreholes.
- Correlation of ore bodies in cross sections.
- Solid body modelling: In this method, the ore bodies are digitized across the transverse cross sections. All the ore bodies prepared from different transverse cross sections is taken in one file and longitudinal correlation is done. Then solid body modelling is done to get a 3-dimensional model of the ore body.
- Block Modelling and estimation of grade by Inverse Square Distance (ISD) method:
- The cut-off grade for manganese ore is considered to be 25% Mn and the threshold limit is considered as 10% Mn. The cut-off grade for iron ore is considered to be 58% Fe and the threshold limit is considered as 45% Fe.
- Insitu bulk density for manganese ore is considered to be 2.5 t/Cum, 2.2 t/Cum for non-saleable manganese ore, 3.0 t/Cum for iron ore Fe ≥58% and 2.75 t/Cum for non-saleable iron ore Fe ≥45 to <58%. Copy of bulk density tests carried out is enclosed as Annexure - 37.
- Resource classification has been done as per UNFC norms. Measured mineral resources (UNFC 331) for Manganese ore has been established for the areas where there is proving information with higher confidence level provided by less than 50 m x 50 m grid space drilling. Indicated mineral resource (UNFC 332 category), is categorized for the resource estimate for the areas where there is proving information with lower confidence level provided by more than 50 m x 50 m and less than 100 m x 100 m grid space drilling. Inferred mineral resource (UNFC 333 category), is categorized for resource estimated for the areas where there is proving information with lowest confidence level provided around 200 m x 200 m grid space drilling and also for exposed outcrops mapped on 1:5000 scale.

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

- Measured mineral resources (UNFC 331) for Iron ore has been established for the areas where there is proving information with higher confidence level of 100 m x 100 m grid space drilling. Indicated mineral resource (UNFC 332 category), is categorized for the resource estimated for the areas where there is proving information with lower confidence level of 200 m x 200 m. Inferred mineral resource (UNFC 333 category), is categorized for resource estimated for the areas where there is proving information with lowest confidence level provided around 400 m x 400 m grid space drilling and also for exposed outcrops mapped in 1:5000 scale.
- Following the UNFC norms for codifying reserve under Proved (111) and Probable (122) category, mine feasibility as well as economic aspects are implied on the geologically Measured (331) and Indicated (332) mineral resources. Accordingly, the ultimate pit has been designed considering the lease boundary and other statutory constraints. Common boundary operation between Guruda-A (Tiringpahar lease) and Jorbar has been considered while designing the ultimate pit. The ultimate depth in Bamebari, Jorbar and Bonaikela quarries have been proposed to be 516mRL, 486mRL and 490mRL respectively. Resources of both manganese and iron ore and mineral reject above the ultimate pit have been classified into reserves. Resources blocked below the ultimate pit and due to lease boundary constraint are classified into Pre-feasibility resources (221 & 222).
- For estimation of resources and reserves, mine face position dated 01-04-2020 has been considered.

Classification of Manganese Ore:

On the basis of Mn content, manganese ore is divided into 5 grades as given below:-

Mn (%)	Grade of Manganese Ore
> 45	Chemical & High Grade
35 – 45	Medium Grade
25 – 35	Low Grade
10 – 25	Mineral Reject
<10	Waste

Classification of Iron Ore:

On the basis of Fe content, iron ore is divided into 3 grades as given below: -

Fe (%)	Grade of Iron Ore
> 58	Ore
45 – 58	Mineral Reject
<45%	Waste

20/5/20

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Mineral Resources: Mineral Resources estimated purely based on exploration, re-estimation and re-categorization as per UNFC norms of resources, with reference to the threshold value of minerals declared by IBM are given in Table 1.3 a, b & c for manganese ore and Table 1.3 d, e & f for iron ore. Mineral resources for the area intended to relinquish have been furnished as per approved PMCP document in Table 1.3 g

Table 1.3a

Mineral Resources as on 1.04.2020: Manganese Ore

Level of Exploration	Resources in million tons				Grade
	Bamebari	Joribar	Bonaikela	Total	
G1 - Detailed exploration	0.071	1.432	0.227	1.730	Mn > 25%
G2 - General Exploration	0	0.004	0.046	0.050	
G3 – Prospecting	0	0	0	0	
G4- Reconnaissance	0	0	0	0	

Table 1.3b

Mineral Resource as on 1.04.2020: Manganese Ore (Mineral Reject)

Level of Exploration	Resources in million tons				Grade
	Bamebari	Joribar	Bonaikela	Total	
G1 - Detailed exploration	0.525	4.333	0.674	5.532	Mn 10 – 25%
G2 - General Exploration	0	0.048	0.197	0.245	
G3 – Prospecting	0	0	0	0	
G4- Reconnaissance	0	0	0	0	

Table 1.3c

Mineral Resource as on 1.04.2020: Manganese Ore (Total Manganese ore)

Level of Exploration	Resources in million tons				Grade
	Bamebari	Joribar	Bonaikela	Total	
G1 - Detailed exploration	0.596	5.765	0.901	7.262	Mn >10%
G2 - General Exploration	0	0.052	0.243	0.295	
G3 – Prospecting	0	0	0	0	
G4- Reconnaissance	0	0	0	0	

Table 1.3d

Mineral Resource as on 1.04.2020: Iron Ore

Level of Exploration	Resources in million tons				Grade
	Bamebari	Joribar	Bonaikela	Total	
G1 - Detailed exploration	0.317	0.403	0	0.720	Fe > 58%
G2 - General Exploration	0.096	0.051	0	0.147	
G3 – Prospecting	0	0	0	0	
G4- Reconnaissance	0	0	0	0	

26/11/20

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Table 1.3e

Mineral Resource as on 1.04.2020: Iron Ore (Mineral Reject)

Level of Exploration	Resources in million tons				Grade
	Ramchari	Jorthar	Bonaikela	Total	
G1 - Detailed exploration	0.504	1.109	0.085	1.698	Fe 45 - 58%
G2 - General Exploration	0.036	0.126	0	0.162	
G3 – Prospecting	0	0	0	0	
G4- Reconnaissance	0	0	0	0	

Table 1.3f

Mineral Resource as on 1.04.2020: Iron Ore (Total Iron ore)

Level of Exploration	Resources in million tons				Grade
	Ramchari	Jorthar	Bonaikela	Total	
G1 - Detailed exploration	0.821	1.512	0.083	2.416	Fe >45%
G2 - General Exploration	0.137	0.197	0	0.369	
G3 – Prospecting	0	0	0	0	
G4- Reconnaissance	0	0	0	0	

Table 1.3g

Mineral Resource as on 1.04.2020: Manganese Ore (Area intended to relinquish)

Level of Exploration	Resources in million tons				Grade
	Ramchari	Jorthar	Bonaikela	Total	
G1 - Detailed exploration	0	0	0	0	Mn >10%
G2 - General Exploration	0	0	0	0	
G3 – Prospecting	0	0.05	0.06	0.11	
G4- Reconnaissance	0.5	0.55	0.44	1.69	

Exploration carried out as per UNFC norms:

The geological boundaries of exploration limit have been marked considering an influence of 25m on one side for G1 and 50m for G2 as borehole spacing for G1 is 50m and 100m for G2 in line with the Minerals (Evidence of Mineral Contents) Rules, 2015.

Block wise exploration carried out at Ramchari Lease as per UNFC norms (As on 01-04-2020) is given below in Table No. 1.4a.

20/5/20

Prepared by

SABYASACHY MISHRA

QUALIFIED PERSON

Table 1.4a: Exploration carried out as per UNFC norms

Name of Mineral: Manganese & Iron

Sl No.	Name of the Block	Total Lease Area (in Ha)	Lease Area Explored as per UNFC Norms (in Ha) C=D+E+F+G					Remarks including reasons for not carrying out the exploration as per UNFC norms.
			G1 Level	G2 Level	G3 Level	G4 Level	Un-explored	
A	B	C	D	E	F	G	H	
1	Bamebari (intended to retain)	140	59.44	49.23	-	-	31.33	
2	Joribar (intended to retain)	91	30.14	13.72	-	-	46.84	
3	Boneikela (intended to retain)	233	18.41	23.37	-	-	191.22	
4	Bamebari (intended to relinquish)	224.62	-	-	-	-	224.62	Unavailability of forest clearance
5	Joribar (intended to relinquish)	79	1.38	0.65	-	-	77.27	
6	Boneikela (intended to relinquish)	382.93	-	-	-	-	382.93	
	Total	1150.55	109.37	86.97	-	-	954.21	

Potential mineralized area in Bamebari leasehold (area intended to retain over 464 ha) is shown below in Table 1.4b. This has been established based on the iron and manganese ore outcrops, borehole information, and geological interpretation of the lithological sections. The same will be revised with additional exploration in the future. Similarly, non-potential area has been established based on the surface outcrops like BHJ, shale, borehole information and geological interpretation based on the geological map & sections.

Table 1.4b

Potential Mineralised/Non-Potential area	Bamebari	Joribar	Boneikela	Total
Potential Mineralised area	32.01	33.02	45.05	110.08
Non-Potential area	107.99	57.98	187.95	353.92
Total	140	91	233	464

Figures are in hectares

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

d) Detailed Calculation of Reserves/Resources Section Wise:

The detailed calculation of resources for both Manganese and Iron Ore as per UNFC norms based on level of exploration at Bamebari, Jeribar and Benoikela Block (area intended to retain) is furnished below in Table No. 1.5(A), 1.5(B), 1.6(A) & 1.6(B).

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 1.5 (A)

Manganese Ore (+25% Mn) Resources & Reserves as on 01-04-2020

Resources in G1 level

Bamebari Block

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
1500	19	50	950	2.5	2375	0.002
1550	91	50	4550	2.5	11375	0.011
1600	170	50	8500	2.5	21250	0.021
1650	65	50	3250	2.5	8125	0.008
1950	4	50	200	2.5	500	0.001
2450	31	50	1550	2.5	3875	0.004
2550	105	50	5250	2.5	13125	0.013
2600	80	50	4000	2.5	10000	0.010
Total	**565**	**50**	**28250**	**2.5**	**70625**	**0.071**

Joribar Block

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
11250	185	50	9250	2.5	23125	0.023
11300	1094	50	54700	2.5	136750	0.137
11350	3810	50	190500	2.5	476250	0.476
11400	3428	50	171400	2.5	428500	0.429
11450	1878	50	93900	2.5	234750	0.235
11500	662	50	33100	2.5	82750	0.083
11550	160	50	8000	2.5	20000	0.020
11600	117	50	5850	2.5	14625	0.015
12000	103	50	5150	2.5	12875	0.013
12350	16	50	800	2.5	2000	0.002
Total	**11453**	**50**	**572650**	**2.5**	**1431625**	**1.432**

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Bonaikela Block

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
3950	15	50	750	2.5	1875	0.002
3850	332	50	16600	2.5	41500	0.042
3950	137	50	6850	2.5	17125	0.017
4000	27	50	1350	2.5	3375	0.003
4050	28	50	1400	2.5	3500	0.004
4100	147	50	7350	2.5	18375	0.018
4150	308	50	15400	2.5	38500	0.039
4200	302	50	15100	2.5	37750	0.038
4250	51	50	2550	2.5	6375	0.006
4300	220	50	11000	2.5	27500	0.028
4350	39	50	1950	2.5	4875	0.005
4650	12	50	600	2.5	1500	0.002
4700	25	50	1250	2.5	3125	0.003
4750	46	50	2300	2.5	5750	0.006
4850	128	50	6400	2.5	16000	0.016
Total	1817	50	90850	2.5	227125	0.227

Resources in G2 level

Jarthar Block

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
11300	12	50	600	2.5	1500	0.002
11350	7	50	350	2.5	875	0.001
11400	8	50	400	2.5	1000	0.001
11450	5	50	250	2.5	625	0.001
Total	32	50	1600	2.5	4000	0.004

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Resources in G2 level

Bonaikela Block

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
3400	21	50	1050	2.5	2625	0.003
3550	12	50	600	2.5	1500	0.002
4850	431	50	16550	2.5	41375	0.043
Total	**364**	**50**	**18200**	**2.5**	**45500**	**0.046**

Table No. 1.5 (B)

Mineral reject Manganese Ore (+10-25% Mn) Resources as on 01-04-2020

Resources in G1 level

Bamebari Block

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
1150	39	50	1950	2.2	1240	0.004
1250	3	50	150	2.2	330	0.000
1400	5	50	250	2.2	550	0.001
1450	17	50	850	2.2	1870	0.002
1500	48	50	2400	2.2	5280	0.005
1550	353	50	17650	2.2	38830	0.039
1600	1042	50	52100	2.2	114620	0.115
1650	425	50	21250	2.2	46750	0.047
1700	275	50	13750	2.2	30250	0.030
2000	162	50	8100	2.2	17820	0.018
2050	94	50	4700	2.2	10340	0.010
2200	50	50	2500	2.2	5500	0.006
2250	402	50	20100	2.2	44220	0.044
2550	882	50	44100	2.2	97020	0.097

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

2600	972	50	48600	2.2	106920	0.107
Total	4769	50	238450	2.2	524590	0.525

Resources in G1 level

Jorbar Block

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
11250	714	50	35700	2.2	78540	0.079
11300	2798	50	139900	2.2	307780	0.308
11350	4642	50	232100	2.2	510620	0.511
11400	7180	50	359000	2.2	789800	0.790
11450	6776	50	338800	2.2	745360	0.745
11500	4685	50	234250	2.2	515350	0.515
11550	5748	50	287400	2.2	632280	0.632
11600	2811	50	140550	2.2	309210	0.309
11650	1080	50	54000	2.2	118800	0.119
11700	67	50	3350	2.2	7370	0.007
11950	371	50	18550	2.2	40810	0.041
12000	105	50	5250	2.2	11550	0.012
12250	73	50	3650	2.2	8030	0.008
12300	509	50	25450	2.2	55990	0.056
12350	1028	50	92400	2.2	201080	0.201
Total	39387	50	1969350	2.2	4332570	4.333

Resources in G1 level

Bonaikela Block

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
3450	103	50	8150	2.2	17930	0.018
3850	573	50	28650	2.2	63030	0.063
3950	46	50	2300	2.2	5060	0.005
4000	397	50	19850	2.2	43670	0.044

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

4050	988	50	49400	2.2	100680	0.109
4100	1560	50	78000	2.2	171600	0.172
4200	809	50	40950	2.2	90090	0.090
4250	737	50	36850	2.2	81070	0.081
4300	35	50	1750	2.2	3850	0.004
4350	62	50	3100	2.2	6820	0.007
4400	29	50	1450	2.2	3190	0.003
4700	51	50	2550	2.2	5610	0.006
4750	356	50	17800	2.2	39160	0.039
4800	231	50	11550	2.2	25410	0.025
4850	21	50	1050	2.2	2310	0.002
Total	**6128**	**50**	**306400**	**2.2**	**674080**	**0.674**

Resources in G2 level

Jorbar Iron and Manganese Lease

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
11250	2	50	100	2.2	220	0.000
11350	69	50	3450	2.2	7590	0.008
11400	147	50	7350	2.2	16170	0.016
11450	7	50	350	2.2	770	0.001
11500	17	50	850	2.2	1870	0.002
11550	127	50	6350	2.2	13970	0.014
11700	6	50	300	2.2	660	0.001
12300	12	50	600	2.2	1320	0.001
14350	50	50	2500	2.2	5500	0.006
Total	**437**	**50**	**21850**	**2.2**	**48070**	**0.048**

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Resources in G2 level

Bonaikela Block

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
3150	198	50	9900	2.2	21780	0.022
3200	27	50	1350	2.2	2970	0.003
3400	377	50	18850	2.2	41470	0.041
3450	94	50	4700	2.2	10340	0.010
3500	24	50	1200	2.2	2640	0.003
4150	461	50	23050	2.2	50710	0.051
4200	511	50	25550	2.2	56210	0.056
4800	102	50	5100	2.2	11220	0.011
Total	**1794**	**50**	**89700**	2.2	**197340**	**0.197**

Table No. 1.6 (A)

Iron Ore (<58% Fe) Resources as on 01-04-2020

Resources in G1 level – Bamebari Block

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
2100	1187	50	59350	3.0	178050	0.1781
2200	42	50	2100	3.0	6300	0.0063
2250	3	50	150	3.0	450	0.0005
2400	678	50	33900	3.0	101700	0.1017
2450	84	50	4200	3.0	12600	0.0126
2500	52	50	2600	3.0	7800	0.0078
2550	69	50	3450	3.0	10350	0.0104
Total	**2115**	**50**	**105750**	**3.0**	**317250**	**0.317**

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Resources in G1 level - Joribar Block

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
11250	105	50	5250	3.0	15750	0.016
11300	63	50	3150	3.0	9450	0.009
11350	328	50	16400	3.0	49200	0.049
11400	691	50	34550	3.0	103650	0.104
11450	657	50	32850	3.0	98550	0.099
11500	263	50	13150	3.0	39450	0.039
11550	7	50	350	3.0	1050	0.001
12250	524	50	26200	3.0	78600	0.079
12300	48	50	2400	3.0	7200	0.007
Total	**2686**	**50**	**134300**	**3.0**	**402900**	**0.403**

Resources in G2 level – Bamebari Block

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
2100	457	50	22850	3.0	68550	0.069
2200	128	50	6400	3.0	19200	0.019
2400	55	50	2750	3.0	8250	0.008
Total	**640**	**50**	**32000**	**3.0**	**96000**	**0.096**

Resources in G2 level Joribar Block

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
11350	204	50	10200	3.0	30600	0.031
11350	106	50	5300	3.0	15900	0.016
12050	8	50	400	3.0	1200	0.001
12250	23	50	1150	3.0	3450	0.003
Total	**341**	**50**	**17050**	**3.0**	**51150**	**0.051**

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

TATA

Table No. 1.6 (B)

Mineral reject Iron Ore (+45-58% Fe) Resources as on 01-04-2020

Resources in G1 level

Bamebari Block

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
1150	10	50	500	2.75	1375	0.001
1450	121	50	6050	2.75	16638	0.017
2700	6	50	300	2.75	825	0.001
2950	8	50	400	2.75	1100	0.001
2000	1	50	50	2.75	138	0.000
2100	777	50	38850	2.75	106838	0.107
2200	9	50	450	2.75	1238	0.001
2250	4	50	200	2.75	550	0.001
2400	418	50	20900	2.75	57475	0.057
2450	826	50	41300	2.75	113575	0.114
2500	547	50	27350	2.75	75213	0.075
2550	168	50	8400	2.75	23100	0.023
2600	35	50	1750	2.75	4813	0.005
2700	607	50	30350	2.75	83463	0.083
2750	129	50	6450	2.75	17738	0.018
Total	**3666**	**50**	**183300**	**2.75**	**504075**	**0.504**

Resources in G1 level

Joribar Block

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
11250	1509	50	75450	2.75	207488	0.207
11300	1636	50	81800	2.75	224950	0.225
11350	1327	50	66350	2.75	182463	0.182
11400	581	50	29050	2.75	79888	0.080

Prepared by,
SABYASACHY MISHRA
QUALIFIED PERSON

11480	1166	50	58300	2.75	160325	0.160
11500	1312	50	65600	2.75	180400	0.180
11550	330	50	16500	2.75	45375	0.045
11600	140	50	7000	2.75	19250	0.019
12250	21	50	1050	2.75	2888	0.003
12300	45	50	2250	2.75	6188	0.006
Total	**8067**	**50**	**403350**	**2.75**	**1109213**	**1.109**

Resources in G1 level

Bonaikela Block

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
4100	615	50	30750	2.75	84563	0.085
Total	**615**	**50**	**30750**	**2.75**	**84563**	**0.085**

Resources in G2 level

Bamebari Block

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
2100	91	50	4550	2.75	12513	0.013
2150	44	50	2200	2.75	6050	0.006
2500	127	50	6350	2.75	17463	0.017
Total	**262**	**50**	**13100**	**2.75**	**36025**	**0.036**

Resources in G2 level

Joribar Block

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
11250	93	50	4650	2.75	12788	0.013
11300	578	50	28900	2.75	79475	0.079
11350	242	50	12100	2.75	33275	0.033
Total	**913**	**50**	**45650**	**2.75**	**125538**	**0.126**

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

The detailed calculation of reserves and resources for both Manganese and Iron Ore as per UNFC norms at Bamebari, Joribar and Bonaikela Block (area intended to retain) is furnished below in Table No. 1.7(A), 1.7(B), 1.8(A) & 1.8(B)

Table No. 1.7 (A)

Manganese Ore (+25% Mn) Reserves & Resources as on 01-04-2020

Proved Reserves (111)

Bamebari

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
1300	19	50	950	2.5	2375	0.002
1350	75	50	3750	2.5	9375	0.009
1400	138	50	6900	2.5	17250	0.017
1450	17	50	850	2.5	2125	0.002
2450	21	50	1050	2.5	2625	0.003
2550	77	50	3850	2.5	9625	0.010
2600	72	50	3600	2.5	9000	0.009
Total	**419**	**50**	**20950**	**2.5**	**52375**	**0.052**

Proved Reserves (111)

Joribar

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
11300	965	50	48250	2.5	120625	0.121
11350	3049	50	152450	2.5	381125	0.381
11400	2777	50	138850	2.5	347125	0.347
11450	1585	50	79250	2.5	198125	0.198
11500	451	50	22550	2.5	56375	0.056
11550	87	50	4350	2.5	10875	0.011
12000	103	50	5150	2.5	12875	0.013
Total	**9017**	**50**	**450850**	**2.5**	**1127125**	**1.127**

Prepared By :
SABYASACHY MISHRA
QUALIFIED PERSON

TATA

Proved Reserves (111)

Bonaikela

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
3850	301	50	15050	2.5	37625	0.038
3950	29	50	1450	2.5	3625	0.004
4100	132	50	6600	2.5	16500	0.017
4150	272	50	13600	2.5	34000	0.034
4200	278	50	13900	2.5	34750	0.035
4250	51	50	2550	2.5	6375	0.006
4300	220	50	11000	2.5	27500	0.028
4350	35	50	1750	2.5	4375	0.004
4700	25	50	1250	2.5	3125	0.003
4850	78	50	3900	2.5	9750	0.010
Total	1421	50	71050	2.5	177625	0.178

Probable Reserves (122)

Joribar

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
11300	10	50	500	2.5	1250	0.001
11350	3	50	150	2.5	375	0.000
11400	4	50	200	2.5	500	0.001
11450	2	50	100	2.5	250	0.000
Total	19	50	950	2.5	2375	0.002

Probable Reserves (122)

Bonaikela

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
3400	15	50	750	2.5	1875	0.002
3550	7	50	350	2.5	875	0.001

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

4850	243	50	12150	2.5	30375	0.030
Total	**265**	**50**	**13250**	**2.5**	**33125**	**0.033**

Pre-feasibility Resources (221)

Bamebari

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
1550	16	50	800	2.5	2000	0.002
1600	32	50	1600	2.5	4000	0.004
1650	48	50	2400	2.5	6000	0.006
1950	4	50	200	2.5	500	0.001
2450	10	50	500	2.5	1250	0.001
2550	28	50	1400	2.5	3500	0.004
2600	8	50	400	2.5	1000	0.001
Total	**146**	**50**	**7300**	**2.5**	**18250**	**0.018**

Pre-feasibility Resources (221)

Jorthar

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
11250	185	50	9250	2.5	23125	0.023
11300	129	50	6450	2.5	16125	0.016
11350	761	50	38050	2.5	95125	0.095
11400	651	50	32550	2.5	81375	0.081
11450	293	50	14650	2.5	36625	0.037
11500	211	50	10550	2.5	26375	0.026
11550	73	50	3650	2.5	9125	0.009
11600	117	50	5850	2.5	14625	0.015
12000	0	50	0	2.5	0	0.000
12350	16	50	800	2.5	2000	0.002
Total	**2436**	**50**	**121800**	**2.5**	**304500**	**0.305**

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

TATA

Pre-feasibility Resources (221)

Bonaikela

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
3450	15	50	750	2.5	1875	0.002
3850	31	50	1550	2.5	3875	0.004
3950	108	50	5400	2.5	13500	0.014
4000	27	50	1350	2.5	3375	0.003
4050	28	50	1400	2.5	3500	0.004
4100	15	50	750	2.5	1875	0.002
4150	36	50	1800	2.5	4500	0.005
4200	24	50	1200	2.5	3000	0.003
4300	4	50	200	2.5	500	0.001
4650	12	50	600	2.5	1500	0.002
4750	46	50	2300	2.5	5750	0.006
4850	50	50	2500	2.5	6250	0.006
Total	396	50	19800	2.5	49500	0.050

Pre-feasibility Resources (222)

Joribar

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
11300	2	50	100	2.5	250	0.000
11350	4	50	200	2.5	500	0.001
11400	4	50	200	2.5	500	0.001
11450	3	50	150	2.5	375	0.000
Total	13	50	650	2.5	1625	0.002

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Pre-feasibility Resources (222)

Bonaikela

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
3400	6	50	300	2.5	750	0.001
4550	5	50	250	2.5	625	0.001
4850	88	50	4400	2.5	11000	0.011
Total	**99**	**50**	**4950**	**2.5**	**12375**	**0.012**

Table No. 1.7 (B)

Mineral Reject Manganese Ore (+10-25% Mn) Reserves & Resources as on 01-04-2020

Proved Reserves (111)

Bamebari

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
1500	18	50	900	2.2	1980	0.002
1550	85	50	4250	2.2	9350	0.009
1600	38	50	1900	2.2	4180	0.004
1650	37	50	1850	2.2	4070	0.004
2550	129	50	6450	2.2	14190	0.014
2600	146	50	7300	2.2	16060	0.016
Total	**453**	**50**	**22650**	**2.2**	**49830**	**0.050**

Proved Reserves (111)

Jorabar

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
11300	1919	50	95950	2.2	211090	0.211
11350	924	50	46200	2.2	101640	0.102
11400	2052	50	102600	2.2	225720	0.226
11450	2374	50	118700	2.2	261140	0.261

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

11500	2998	50	149900	2.2	329780	0.330
11550	1335	50	66750	2.2	146850	0.147
11950	60	50	3000	2.2	6600	0.007
12000	35	50	1750	2.2	3850	0.004
Total	**11697**	**50**	**584850**	**2.2**	**1286670**	**1.287**

Proved Reserves (111)

Bunaikela

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
3050	425	50	21250	2.2	46750	0.047
4100	624	50	31200	2.2	68640	0.069
4200	527	50	26350	2.2	57970	0.058
4850	12	50	600	2.2	1320	0.001
Total	**1588**	**50**	**79400**	**2.2**	**174680**	**0.175**

Probable Reserves (122)

Joribar

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
11350	21	50	1050	2.2	2310	0.002
11400	147	50	7350	2.2	16170	0.016
11450	7	50	350	2.2	770	0.001
Total	**175**	**50**	**8750**	**2.2**	**19250**	**0.019**

Prefeasibility Resources (221)

Bamebari

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
1150	39	50	1970	2.2	4290	0.004
1250	3	50	150	2.2	330	0.000
1400	5	50	250	2.2	550	0.001
1450	17	50	850	2.2	1870	0.002

Prepared by
SABYASACHI MISHRA
QUALIFIED PERSON

1500	30	50	1500	2.2	3300	0.003
1550	258	50	13400	2.2	29480	0.029
1600	1004	50	50200	2.2	110440	0.110
1650	388	50	19400	2.2	42680	0.043
1700	275	50	13750	2.2	30250	0.030
2000	162	50	8100	2.2	17820	0.018
2050	94	50	4700	2.2	10340	0.010
2200	50	50	2500	2.2	5500	0.006
2250	402	50	20100	2.2	44220	0.044
2550	753	50	37650	2.2	82830	0.083
2600	826	50	41300	2.2	90860	0.091
Total	**4316**	**50**	**215800**	**2.2**	**474760**	**0.475**

Prefeasibility Resources (221)

Joribar

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
11250	714	50	35700	2.2	78540	0.079
11300	879	50	43950	2.2	96690	0.097
11350	3718	50	185900	2.2	409080	0.409
11400	5128	50	256400	2.2	564080	0.564
11450	4402	50	220100	2.2	484220	0.484
11500	1687	50	84350	2.2	185570	0.186
11550	4413	50	220650	2.2	485430	0.485
11600	2811	50	140550	2.2	309210	0.309
11650	1080	50	54000	2.2	118800	0.119
11700	67	50	3350	2.2	7370	0.007
11950	311	50	15550	2.2	34210	0.034
12000	70	50	3500	2.2	7700	0.008
12250	73	50	3650	2.2	8030	0.008
12300	509	50	25450	2.2	55990	0.056

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

12350	1828	50	91400	2.2	201080	0.201
Total	**27690**	**50**	**1384500**	**2.2**	**3045900**	**3.046**

Prefeasibility Resources (221)

Bonaikela

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
3450	153	50	8150	2.2	17930	0.018
3800	148	50	7400	2.2	16280	0.016
3950	46	50	2300	2.2	5060	0.005
4000	397	50	19850	2.2	43670	0.044
4050	988	50	49400	2.2	108680	0.109
4100	936	50	46800	2.2	102960	0.103
4200	352	50	17600	2.2	38720	0.039
4250	737	50	36850	2.2	81070	0.081
4300	35	50	1750	2.2	3850	0.004
4350	62	50	3100	2.2	6820	0.007
4400	29	50	1450	2.2	3190	0.003
4700	51	50	2550	2.2	5610	0.006
4750	356	50	17800	2.2	39160	0.039
4800	231	50	11550	2.2	25410	0.025
4850	9	50	450	2.2	990	0.001
Total	4540	50	227000	2.2	**499400**	**0.499**

Prefeasibility Resources (222)

Joribar

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
11250	2	50	100	2.2	220	0.000
11350	48	50	2400	2.2	5280	0.005
11600	17	50	850	2.2	1870	0.002
11650	127	50	6350	2.2	13970	0.014

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

11700	6	50	300	2.2	660	0.001
12300	12	50	600	2.2	1320	0.001
12350	50	50	2500	2.2	5500	0.006
Total	262	50	13100	2.2	28820	0.029

Prefeasibilty Resources (222)

Bonaikela

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
3150	198	50	9900	2.2	21780	0.022
3200	27	50	1350	2.2	2970	0.003
3400	377	50	18850	2.2	41470	0.041
3450	94	50	4700	2.2	10340	0.010
3500	24	50	1200	2.2	2640	0.003
4150	461	50	23050	2.2	50710	0.051
4200	511	50	25550	2.2	56210	0.056
4800	102	50	5100	2.2	11220	0.011
Total	**1794**	**50**	**89700**	**2.2**	**197340**	**0.197**

Table No. 1.0 (A)

Iron Ore (+58% Fe) Reserves & Resources as on 01-04-2020

Proved Reserves (111)

Joribar

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
11350	13	50	650	3.0	1950	0.002
11400	521	50	26050	3.0	78150	0.078
11450	656	50	32800	3.0	98400	0.098
11500	213	50	10650	3.0	31950	0.032
Total	**1403**	**50**	**70150**	**3.0**	**210450**	**0.210**

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

TATA

Prefeasibility Resources (221)

Bamebari

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
2100	1187	50	59350	3.0	178050	0.1781
2200	42	50	2100	3.0	6300	0.0063
2250	3	50	150	3.0	450	0.0005
2400	678	50	33900	3.0	101700	0.1017
2450	84	50	4200	3.0	12600	0.0126
2500	52	50	2600	3.0	7800	0.0078
2550	69	50	3450	3.0	10350	0.0104
Total	**2115**	**50**	**105750**	**3.0**	**317250**	**0.317**

Prefeasibility Resources (221)

Juribar

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
11250	105	50	5250	3.0	15750	0.016
11300	63	50	3150	3.0	9450	0.009
11350	315	50	15750	3.0	47250	0.047
11400	170	50	8500	3.0	25500	0.026
11450	1	50	50	3.0	150	0.000
11500	50	50	2500	3.0	7500	0.008
11550	7	50	350	3.0	1050	0.001
12250	524	50	26200	3.0	78600	0.079
12300	48	50	2400	3.0	7200	0.007
Total	**1283**	**50**	**64150**	**3.0**	**192450**	**0.192**

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Prefeasibility Resources (222)

Bamebari

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
2100	457	50	22850	3.0	68550	0.069
2200	128	50	6400	3.0	19200	0.019
2400	55	50	2750	3.0	8250	0.008
Total	**640**	**50**	**32000**	**3.0**	**96000**	**0.096**

Prefeasibility Resources (222)

Joribar

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
11350	204	50	10200	3.0	30600	0.031
11350	106	50	5300	3.0	15900	0.016
12050	8	50	400	3.0	1200	0.001
12250	23	50	1150	3.0	3450	0.003
Total	**341**	**50**	**17050**	**3.0**	**51150**	**0.051**

Table No. 1.8 (B)

Mineral Reject Iron Ore (+45-58% Fe) Reserves & Resources as on 01-04-2020

Proved Reserves (111)

Joribar

Section No.	Area (m²)	Influence (m)	Volume (m³)	Density (tonnes/m³)	Tonnage (tonnes)	Tonnage (mt)
11300	849	50	42450	2.75	116738	0.117
11350	510	50	25500	2.75	70125	0.070
11400	373	50	18650	2.75	51288	0.051
11450	1123	50	56150	2.75	154413	0.154
11500	655	50	32750	2.75	90063	0.090
11550	56	50	2800	2.75	7700	0.008

Prepared by,
SABYASACHY MISHRA
QUALIFIED PERSON

11600	23	50	1150	2.75	3163	0.003
Total	**3589**	**50**	**179450**	**2.75**	**493488**	**0.493**

Proved Reserves (111)

Bonaikela

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
4100	288	50	14400	2.75	39600	0.040
Total	**288**	**50**	**14400**	**2.75**	**39600**	**0.040**

Probable Reserves (122)

Jerlbar

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
11250	6	50	300	2.75	825	0.001
11300	169	50	8450	2.75	23238	0.023
Total	**175**	**50**	**8750**	**2.75**	**24063**	**0.024**

Prefeasibility Resource (221)

Bamebari

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
1150	10	50	500	2.75	1375	0.001
1450	121	50	6050	2.75	16638	0.017
1700	6	50	300	2.75	825	0.001
1950	8	50	400	2.75	1100	0.001
2000	1	50	50	2.75	138	0.000
2100	777	50	38850	2.75	106838	0.107
2200	9	50	450	2.75	1238	0.001
2250	4	50	200	2.75	550	0.001
2400	418	50	20900	2.75	57475	0.057
2450	826	50	41300	2.75	113575	0.114
2500	547	50	27350	2.75	75213	0.075

Prepared by:
SARYASACHY MISHRA
QUALIFIED PERSON

2550	168	50	8400	2.75	23100	0.023
2600	35	50	1750	2.75	4813	0.005
2700	607	50	30350	2.75	83463	0.083
2750	129	50	6450	2.75	17738	0.018
Total	**3666**	**50**	**183300**	**2.75**	**504075**	**0.504**

Prefeasibility Resource (221)

Joribar

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
11250	1509	50	75450	2.75	207488	0.207
11300	787	50	39350	2.75	108213	0.108
11350	817	50	40850	2.75	112338	0.112
11400	208	50	10400	2.75	28600	0.029
11450	43	50	2150	2.75	5913	0.006
11500	657	50	32850	2.75	90338	0.090
11550	274	50	13700	2.75	37675	0.038
11600	117	50	5850	2.75	16088	0.016
12250	21	50	1050	2.75	2888	0.003
12300	45	50	2250	2.75	6188	0.006
Total	**4478**	**50**	**223900**	**2.75**	**615725**	**0.616**

Prefeasibility Resource (221)

Bonaikela

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
4100	327	50	16350	2.75	44963	0.045
Total	**327**	**50**	**16350**	**2.75**	**44963**	**0.045**

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Prefeasibility Resource (222)

Bamebari

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
2100	91	50	4550	2.75	12513	0.013
2150	44	50	2200	2.75	6050	0.006
2800	127	50	6350	2.75	17463	0.017
Total	262	50	13100	2.75	36025	0.036

Prefeasibility Resource (222)

Joribar

Section No.	Area (m^2)	Influence (m)	Volume (m^3)	Density (tonnes/m^3)	Tonnage (tonnes)	Tonnage (mt)
11250	87	50	4350	2.75	11963	0.012
11300	409	50	20450	2.75	56238	0.056
11350	242	50	12100	2.75	33275	0.033
Total	738	50	36900	2.75	101475	0.101

20/2/20

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

The detailed calculation of reserves and resources for both Manganese and Iron Ore as per UNFC norms at Bamebari, Jorbar and Bonaikela Block (area intended to relinquish) is furnished below in Table No. 1.9(A) & 1.9(B) (as per approved FMCP document)

Table No. 1.9 (A)

Manganese Ore (+25% Mn) Reserves & Resources as on 01-04-2020

Inferred Resources (333)

Block	Mn Surface Outcrop Area (m^2)	Avg. Thickness Assumed (m)	Sp.Gr.	Tonnage (tonnes)	Tonnage Rounded (tonnes)	Tonnage (million tonnes)
Bamebari	0	0	0	0	**0**	0
Jorbar	6665	3	2.5	49988	**50000**	**0.05**
Bonaikela	8015	3	2.5	60113	**60000**	**0.06**
Total					**110000**	**0.11**

Table No. 1.9 (B)

Manganese Ore (+25% Mn) Reserves & Resources as on 01-04-2020

Reconnaissance Resource (334)

Block	Potential Mn bearing Areas (m^2)	Avg Thickness Assumed (m)	Sp.Gr.	Tonnage (tonnes)	Tonnage Rounded (tonnes)	Tonnage (million tonnes)
Bamebari	66765	3	2.5	500738	**500000**	0.50
Jorbar	73434	3	2.5	[illegible]	**550000**	0.55
Bonaikela	85350	3	2.5	640125	**640000**	0.64
Total					**1690000**	1.69

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

d) Mineral Reserves/Resources:

Following the UNFC norms for codifying reserve under Proved (111) and Probable (122) category, mine feasibility as well as economic aspects are implied on the geologically Measured (331) and Indicated (332) mineral resources. Accordingly, the ultimate pit has been designed. Resources of both manganese and iron ore and mineral reject above the ultimate pit have been classified in to reserves. Resources blocked below the ultimate pit and due to lease boundary constraint are classified into Pre-feasibility resources (221 & 222).

Justification of the reserves and resources as per UNFC norms is furnished below;

Justification of Reserves & Resources of Manganese ore (Mn >10%)
Proved Reserve UNFC 111:

GEOLOGICAL AXIS

G1(Detailed Exploration)	Work carried out
1.Geological survey: (i)Mapping-For coal, mapping 1:5000; for other minerals 1:1000 (ii)Preparation of detailed topographical-cum-geological map including all surface geological features, extent of deposit, structure, location of boreholes, assay plan & sections of exploratory mine development &borehole data; (iii)Topogrid/triangulation stations linked in the maps. **2. Geochemical survey:** Detailed grid pattern sampling and analysis **3. Geophysical survey:** Detailed and specific borehole geophysical survey. **4.Technological:** (i)Pitting - 2 to 5 per sq. km. for simple deposits; (ii)Trenching - At spacing of 200-300m; (iii)Drilling closer spaced (with definite grid pattern) than that for G2 category; iv) For opencast project grid spacing may be 100m x 50m depending on the geology, weather mantle cover, burning nature of coal seams. (iv)Exploratory mining and check drilling results if possible ; (v)Sampling- systematic pit and trench sampling, core and sludge sampling for laboratory scale and bulk sample for the pilot plant scale beneficiation studies	1) i) Geological mapping done at 1:5000 and 1:1000 scale. ii) Furnished in the surface geological plan iii) Done 2) Detailed analyses of the borehole are available 3) Not done. 4) i) Mine already exists ii) Mine already exists iii) Drilling done at 25mx25m & 50m x 50m grid interval iv) Mine already exists v) Detailed analyses of the borehole and blastholes, face samples are available 5) Petrographic and mineralogy study has been carried out. 6) Geostatistical analyses have been done.

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

5.Petrographic and mineralographic study: Refining nf data on the petrngraphic character of rocks of the deposit and its surroundings. alterations (if any), including study of grain size texture gangue and its liberation characteristics for further refining of data **6) Geostatistical analysis** of borehole data thickness of ore: waste encountered in holes, assay values of samples if considered necessary.	

FEASIBILITY AXIS

F1 (Feasibility Study)	Work carried out
1. Geology: Geology of area and project, detailed exploration, closed spaced drilling, ore body modelling, bulk samples for beneficiation, geotechnical and ground water &surface waters studies. **2. Mining:** Mining plan, mine recoveries and efficiencies, equipment selection, manpower requirement. **3.Environment:** EIA studies and EMP including socio-economic impact, rehabilitation of project affected persons, waste disposal/reclamation., detailed land use data. **4. Processing:** Pilot scale/industrial scale investigation data, list of equipment, manpower and environmental considerations like waste disposal of tailing, etc. **5. Infrastructure and services, construction activities:** Full details **6. Costing:** Detailed break-up of capital cost, operating cost, details of working capital. **7.Marketing:** Overview, specific market aspects **8. Economic viability** Cash flow forecast, inflation effects, sensitivity studies **9. Other factors:** Statutory provisions relating to labour, land, mining, taxation etc.	1) Detailed geological study, exploration, ore body modeling beneficiation studies has been done. There is no problem for gentechnical and ground water problem. 2) Enclosed in Mining Plan. 3) EIA studies and EMP has been done 4) Processing details enclosed in Mine Plan 5) Enclosed in Mining Plan. 6) Costs details have provided in annual returns 7) Captive Mine. 8) Economic viability is being calculated on the basis of our captive requirement. This is being constantly monitored by Company's accounts department. 9) Complied.

20/2/20

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

ECOMOMIC AXIS

F1(Economic)	Work carried out
1. Detailed exploration. 2. Mining report /mining plan / working mines. 3. Specific end-use grades of reserves (above economic cut-off grade). 4. Specific knowledge of forest/non-forest and other land use data.	1) Has been carried out 2) Mine plan submitted. 3) Mentioned in Mine Plan 4) Non forest area and details land use data mentioned in Mine Plan.

Probable Reserve UNFC 121&122:

GEOLOGICAL AXIS

G2(General Exploration)	Work carried out
1.Geological survey : (i)Mapping on 1:25,000 to 1:5,000 or larger scale with triangulation points, benchmarks, if any shown. For coal, mapping on 1:10,000 scale (ii) Linking of maps so prepared with topogrid. (iii)Assessment of lithology, structure, surface mineralisation, analysis of old history of mining.	1) i) Geological mapping done at 1:5000 scale ii) Furnished in the surface geological plan iii) Done 2) i) Detailed analyses of the borehole and are available ii) Recording of deleterious elements like alumina and phosphorous has been done.
2. Geochemical survey: (i)Detailed litho-geochemical channel sampling from fresh rock exposures, trenches, pits; (ii)Recording of deleterious elements, likely by-product elements (e.g. Ga in bauxite, Ni, PGE etc. in chromite, Au in Fe ore, etc. (Ni for coal/lignite exploration),	3) Not done.
3.Geophysical survey: (i)Borehole geophysical survey; (ii)Special geophysical traverses for problem solving, if required.	4) Drilling done at 50m & 100m interval
4.Technological: (a)Pitting/trenching:systematic pitting/trenching for deciphering extent of mineralisation at surface. (b)Drilling: grid reduction needed: sparing (i) for coal, gypsum near surface potash and salt beds-400 to 1000m.	Detailed core sampling and analyses of the borehole are available.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

(ii) Iron and manganese ore-100 to 200m. (iii) limestone and dolomite and barytes- 200 to 400m up to a depth of at least 30 m. (c) Sampling: (i) Systematic pit and trench sampling, deep pitting if necessary; (ii) Core sampling: lithology and strength of mineralisation wise (check sampling -10%). (d) Laboratory scale scanning/chemical analysis. (e) Bulk sampling if necessary for testing processing technology. (f) Collection of abiotic geo-environmental parameters. **5.Petrographic:**Study of petrographic character of rocks including grain size, texture etc.	5) Petrographic and mineralogy study has been carried out

FEASIBILITY AXIS

F2 (Pre-feasibility Study)	Work carried out
1. Geology: Local geology, mineralogy, identification of ore types and geometry. **2. Mining:** Methods, pre-production plan, development plan, manpower (rough estimate). **3. Environment:** Base line data on environment **4. Processing:** Proven laboratory scale/pilot scale beneficiation, investigation data, likely establishment, **5.Infrastructure and services, construction activities:** Brief details **6. Costing:** Capital and operating cost - rough estimates based on comparable mining operations. **7.Marketing:** Overview like industrial structure, demand supply relation, pricing, etc. **8. Economic viability:** Preliminary study of cash flow forecasts. **9. Other factors:** Statutory provisions relating to labour, land, mining, taxation., etc.	1) Geological study and exploration have been done 2) Enclosed in Mining Plan. 3) EIA studies and EMP has been done 4)) Processing details enclosed in Mine Plan. 5) Enclosed in Mining Plan. 6) Costs details have provided in annual returns 7) Captive Mine. 8) Economic viability is being calculated on the basis of our captive requirement. 9) Forest clearance will be obtained shortly.

Prepared by.
SABYASACHY MISHRA
QUALIFIED PERSON

ECONOMIC AXIS

E1(Economic)	Work carried out
1.Detailed exploration. 2.Mining report /mining plan / working mines. 3.Specific end-use grades of reserves (above economic cut-off grade). 4. Specific knowledge of forest/non-forest and other land use data.	1) Has been carried out 2) Mine plan submitted. 3) Mentioned in Mine Plan 4) Forest clearances will be obtained shortly.

Pre-feasibility Resource UNFC 221 & 222:

GEOLOGICAL AXIS

G1(Detailed Exploration)	Work carried out
1.Geological survey: (i)Mapping For coal, mapping 1 5000;for other minerals 1:1000 (ii)Preparation of detailed topographical-cum geological map including all surface geological features, extent of deposit, structure, location of boreholes, assay plan & sections of exploratory mine development &borehole data: (iii)Topogrid/triangulation stations linked in the maps.	i) i) Geological mapping done at 1: 5000 and 1:1000 scale. ii) Furnished in the surface geological plan. iii) Done 2) Detailed analyses of the borehole are available 3) Not done. 4)
2. Geochemical survey: Detailed grid pattern sampling and analysis.	i) Mine already exists
3. Geophysical survey: Detailed and specific borehole geophysical survey.	ii) Mine already exists
4.Technological: (i)Pitting - 2 to 5 per sq km. for simple deposits; (ii)Trenching At spacing of 200-300m, (iii)Drilling- closer spaced (with definite grid pattern) than that for G2 category; ii) For opencast project grid spacing may be 100m x 50m depending on the geology, weather mantle cover, bunching nature of coal seams. (iv)Exploratory mining and check drilling results if possible ; (v)Sampling: systematic pit and trench sampling, core and sludge sampling for laboratory scale and bulk sample for the pilot plant scale beneficiation studies.	iii) Drilling done at 50m & 100m grid interval iv) Mine already exists v) Detailed analyses of the borehole and blastholes, face samples are available 5) Petrographic and mineralogy study has been carried out. 6) Geostatistical analyses have been done.

Prepared by:
SABYASACHY NISHRA
QUALIFIED PERSON

5.Petrographic and mineralographic study: Refining of data on the petrographic character of rocks of the deposit and its surroundings, alterations (if any), including study of grain size texture gangue and its liberation characteristics for further refining of data **6) Geostatistical analysis** of borehole data thickness of ore : waste encountered in holes, assay values of samples if considered necessary.	

FEASIBILITY AXIS

F2 (Pre-feasibility Study)	**Work carried out**
1. Geology: Local geology, mineralogy, identification of ore types and geometry. **2. Mining:** Methods, pre-production plan, development plan, manpower (rough estimate). **3. Environment:** Base line data on environment. **4. Processing:** Proven laboratory scale/pilot scale beneficiation, investigation data, likely establishment, **5.Infrastructure and services, construction activities.** Brief details **6. Costing:** Capital and operating cost : rough estimates based on comparable mining operations. **7.Marketing:** Overview like industrial structure, demand supply relation, pricing, etc. **8. Economic viability:** Preliminary study of cash flow forecasts. **9. Other factors:** Statutory provisions relating to labour, land, mining, taxation, etc.	1) Geological study and exploration have been done. 2) Enclosed in Mining Plan 3) EIA studies and EMP has been done 4)) Processing details enclosed in Mine Plan. 5) Enclosed in Mining Plan 6) Costs details have provided in annual returns 7) Captive Mine. 8) Economic viability is being calculated on the basis of our captive requirement. 9) Forest clearance will be obtained shortly and details land use data mentioned in Mine Plan

ECONOMIC AXIS

E2 (Potentially Economic)	**Work carried out**
1.General and detailed exploration 2 Specific end use grades of reserves (above /marginally below economic cut-off grade). 3. General knowledge of forest/non-forest and other land use data.	1) General exploration has been carried out 2) Captive consumption 3) Locked up under ultimate pit and lease boundary

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Justification of Resources of Iron ore (Fe ≥45%)

Proved Reserve [UNFC 111:

GEOLOGICAL AXIS

G1(Detailed Exploration)	Work carried out
1.Geological survey: (i)Mapping-For coal, mapping 1:5000;for other minerals 1:1000 (ii)Preparation of detailed topographical-cum-geological map including all surface geological features, extent of deposit, structure, location of boreholes, assay plan & sections of exploratory mine development &borehole data; (iii)Topogrid/triangulation stations linked in the maps **2. Geochemical survey:** Detailed grid pattern sampling and analysis **3. Geophysical survey:** Detailed and specific borehole geophysical survey. **4.Technological:** (i)Pitting - 2 to 5 per sq. km. for simple deposits; (ii)Trenching - At spacing of 200-300m; (iii)Drilling- closer spaced (with definite grid pattern) than that for G2 category. ii) For opencast project grid spacing may be 100m x 50m depending on the geology, weather mantle cover burning nature of coal seams. (iv)Exploratory mining and check drilling results if possible. (v)Sampling- systematic pit and trench sampling, core and sludge sampling for laboratory scale and bulk sample for the pilot plant scale beneficiation studies. **5.Petrographic and mineralographic study:** Refining of data on the petrographic character of rocks of the deposit and its surroundings, alterations (if any), including study of grain size texture, gangue and its liberation characteristics for further refining of data **6) Geostatistical analysis** of borehole data thickness of ore; waste encountered in holes, assay values of samples if considered necessary	1) i) Geological mapping done at 1:5000 and 1:1000 scale. ii) Furnished in the surface geological plan iii) Done 2) Detailed analyses of the borehole are available 3) Not done. 4) i) Mine already exists ii) Mine already exists iii) Drilling done at 50m. & 100m grid interval iv) Mine already exists v) Detailed analyses of the borehole and blastholes, face samples are available 5) Petrographic and mineralogy study has been carried out. 6) Geostatistical analyses have been done.

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

FEASIBILITY AXIS

F1 (Feasibility Study)	Work carried out
1. Geology: Geology of area and project, detailed exploration, closed spaced drilling, ore body modelling, bulk samples for beneficiation, geotechnical and ground water &surface waters studies.	1) Detailed geological study, exploration, ore body modeling, beneficiation studies has been done
2. Mining: Mining plan, mine recoveries and efficiencies, equipment selection, manpower requirement	2) The iron ore is associated with manganese ore which occurs in lenses and pockets. It will be mined along with manganese ore.
3.Environment: EIA studies and EMP including socio-economic impact, rehabilitation of project affected persons, waste disposal/reclamation., detailed land use data.	3) EIA studies and EMP has been done
4. Processing. Pilot scale/industrial scale investigation data, list of equipment, manpower and environmental considerations like waste disposal of tailing, etc.	4) to be stacked for future use 5) Enclosed in Mining Plan. 6) The operating and capital costs are taken together with manganese ore. 7) not established 8) to be stacked for future use. 9) Complied.
5. Infrastructure and services, construction activities: Full details	
6. Costing: Detailed break up of capital cost, operating cost, details of working capital.	
7.Marketing: Overview, specific market aspects.	
8. Economic viability: Cash flow forecast, inflation effects, sensitivity studies.	
9. Other factors: Statutory provisions relating to labour, land, mining, taxation etc	

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

ECOMOMIC AXIS

E1(Economic)	Work carried out
1. Detailed exploration. 2 Mining report /mining plan / working mines. 3. Specific end-use grades of reserves (above economic cut-off grade). 4. Specific knowledge of forest/non-forest and other land use data.	1) Has been carried out 2) Mine plan submitted 3) Mentioned in Mine Plan 4) Non forest area and details land use data mentioned in Mine Plan.

Probable Reserve UNFC 121&122-

GEOLOGICAL AXIS

G2(General Exploration)	Work carried out
1.Geological survey : (i)Mapping on 1:25,000 to 1:5,000 or larger scale with triangulation points, benchmarks, if any shown For coal, mapping on 1:10,000 scale	1) i) Geological mapping done at 1:5000 scale ii) Furnished in the surface geological plan
(ii) Linking of maps so prepared with topogrid:	iii) Done
(iii)Assessment of lithology, structure, surface mineralisation, analysis of old history of mining	2) i) Detailed analyses of the borehole and are available.
2. Geochemical survey: (i)Detailed litho-geochemical channel sampling from fresh rock exposures, trenches, pits:	ii) Recording of deleterious elements like alumina and phosphorous has been done
(ii)Recording of deleterious elements, likely by-product elements (e.g. Ga in bauxite, Ni, PGE etc. in chromite, Au in Fe ore, etc. (Nil for coal/lignite exploration)	3) Not done.
3.Geophysical survey: (i)Borehole geophysical survey: (ii)Special geophysical traverses for problem solving, if required.	4) Drilling done at 100m & 200m interval
4.Technological: (a)Pitting/trenching,systematic pitting/trenching for deciphering extent of mineralisation at surface (b)Drilling, grid reduction needed. spacing (i) for coal, gypsum near surface potash and salt beds-400 to 1000m;	Detailed core sampling and analyses of the borehole are available.

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

(ii) Iron and manganese ore-100 to 200m. (iii) limestone and dolomite and barytes- 200 to 400m up to a depth of at least 30 m; (c) Sampling (i) Systematic pit and trench sampling, deep pitting if necessary; (ii) Core sampling: lithology and strength of mineralisation wise (check sampling - 10%). (d) Laboratory scale scanning/chemical analysis, (e) Bulk sampling if necessary for testing processing technology. (f) Collection of abiotic geo-environmental parameters. 5.**Petrographic:**Study of petrographic character of rocks including grain size, texture etc	5) Petrographic and mineralogy study has been carried out.

FEASIBILITY AXIS

F2 (Pre-feasibility Study)	Work carried out
1. Geology: Local geology, mineralogy, identification of ore types and geometry. **2. Mining:** Methods, pre-production plan, development plan, manpower (rough estimate). **3. Environment:** Base line data on environment. **4. Processing:** Proven laboratory scale/pilot scale beneficiation, investigation data, likely establishment, **5.Infrastructure and services, construction activities** Brief details **6. Costing:** Capital and operating cost - rough estimates based on comparable mining operations **7.Marketing:** Overview like industrial structure, demand supply relation, pricing, etc. **8. Economic viability:** Preliminary study of cash flow forecasts **9. Other factors** Statutory provisions relating to labour, land, mining, taxation, etc	1) Geological study and expluration have been done. 2) The iron ore is associated with manganese ore which occurs in lenses and pockets. It will be mined along with manganese ore. 3) EIA studies and EMP has been done 4)) to be stacked for future use. 5) Enclosed in Mining Plan. 6) The operating and capital costs are taken together with manganese ore 7) to be stacked for future use. 8) Economic viability is being calculated on the basis of our captive requirement 9) Forest clearance will be obtained shortly.

Prepared by,
SABYASACHY MISHRA
QUALIFIED PERSON

ECONOMIC AXIS

E1(Economic)	Work carried out
1.Detailed exploration. 2.Mining report /mining plan / working mines. 3.Specific end-use grades of reserves (above economic cut-off grade). 4. Specific knowledge of forest/non-forest and other land use data.	1) Has been carried out 2) Mine plan submitted. 3) Mentioned in Mine Plan 4) Forest clearances will be obtained shortly.

Pre-feasibility Resource UNFC 221 & 222:

GEOLOGICAL AXIS

G1(Detailed Exploration)	Work carried out
1.**Geological survey:** (i)Mapping-For coal, mapping 1:5000:for other minerals 1:1000 (ii)Preparation of detailed topographical-cum-geological map including all surface geological features, extent of deposit, structure, location of boreholes, assay plan & sections of exploratory mine development &borehole data; (iii)Topogrid/triangulation stations linked in the maps. 2. **Geochemical survey:** Detailed grid pattern sampling and analysis. 3. **Geophysical survey:** Detailed and specific borehole geophysical survey. **4.Technological:** (i)Pitting - 2 to 5 per sq km for simple deposits (ii)Trenching At spacing of 200-300m, (iii)Drilling- closer spaced (with definite grid pattern) than that for G2 category; ii) For opencast project grid spacing may be 100m x 50m depending on the geology, weather mantle cover, burring nature of coal seams. (iv)Exploratory mining and check drilling results if possible ; (v)Sampling- systematic pit and trench sampling, core and sludge sampling for laboratory scale and bulk sample for the pilot plant scale beneficiation studies.	1) i) Geological mapping done at 1: 5000 and 1:1000 scale. ii) Furnished in the surface geological plan iii) Done 2) Detailed analyses of the borehole are available 3) Not done. 4) i) Mine already exists ii) Mine already exists iii) Drilling done at 100m & 200m grid interval iv) Mine already exists v) Detailed analyses of the borehole and blastholes face samples are available 5) Petrographic and mineralogy study has been carried out. 6) Geostatistical analyses have been done.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

5.Petrographic and mineralographic study: Refining of data on the petrographic character of rocks of the deposit and its surroundings, alterations (if any), including study of grain size texture gangue and its liberation characteristics for further refining of data **6) Geostatistical analysis** of borehole data thickness of ore : waste encountered in holes, assay values of samples if considered necessary	

FEASIBILITY AXIS

F2 (Pre-feasibility Study)	**Work carried out**
1. Geology: Local geology, mineralogy, identification of ore types and geometry. **2. Mining:** Methods, pre-production plan, development plan, manpower (rough estimate). **3. Environment:** Base line data on environment. **4. Processing:** Proven laboratory scale/pilot scale beneficiation, investigation data, likely establishment, **5.Infrastructure and services, construction activities:** Brief details **6. Costing:** Capital and operating cost - rough estimates based on comparable mining operations. **7.Marketing.** Overview like industrial structure, demand supply scenario, pricing, etc. **8. Economic viability:** Preliminary study of cash flow forecasts. **9. Other factors:** Statutory provisions relating to labour, land, mining, taxation, etc	1) Geological study and exploration have been done 2) Enclosed in Mining Plan. 3) EIA studies and EMP has been done 4)) to be stacked for future use. 5) Enclosed in Mining Plan. 6) not estimated 7) not done 8) not done 9) Forest clearance will be obtained shortly and details land use data mentioned in Mine Plan

ECONOMIC AXIS

E2 (Potentially Economic)	**Work carried out**
1.General and detailed exploration 2 .Specific end-use grades of reserves (above /marginally below economic cut-off grade). 3. General knowledge of forest/non-forest and other land use data	1) General exploration has been carrind out 2) Captive consumption 3) Locked up under ultimate pit and lease boundary

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Category-Wise Reserves Indicated in The Approved Scheme of Mining:

Mineral Resource & Reserve of Manganese ore as on 01.04.2018 mentioned in approved modification of review of mine plan for the period 2018-19 to 2019-20 is given in the Table No. 1.10 below:

Table No. 1.10 a (Manganese ore)

Classification	UNFC Code	Quantity (in Million Tonnes)				Grade
		Bamebari	Joribar	Bonaikela	Total	
A. Mineral Reserve						
(1) Proved Mineral Reserve	111	0.045	1.056	0.264	1.365	Mn > 25%
(2) Probable Mineral Reserve	121 and 122	0	0.018	0	0.018	
Total Reserves		**0.045**	**1.074**	**0.264**	**1.383**	
B1. Remaining Ore Mineral Resources						
(1) Feasibility Mineral Resource	211	0	0	0	0	
(2) Pre-feasibility Mineral Resource	221 and 222	0.030	0.285	0	0.314	
(3) Measured Mineral Resource	331	0.384	4.525	0.617	5.525	Mn >10%
(4) Indicated Mineral Resource	332	0	0.042	0.207	0.249	
(5) Inferred Mineral Resource	333	0	0	0.726	0.726	
Total Ore Mineral Resources		**0.414**	**4.852**	**1.55**	**6.814**	

Table No. 1.10 b (Iron ore)

Classification	UNFC Code	Quantity (in Million Tonnes)				Grade
		Bamebari	Joribar	Bonaikela	Total	
A. Mineral Reserve						
(1) Proved Mineral Reserve	111	0	0	0	0	Fe > 50%
(2) Probable Mineral Reserve	121 and 122	0	0	0	0	
Total Reserves		**0**	**0**	**0**	**0**	
B1. Remaining Ore Mineral Resources						
(1) Feasibility Mineral Resource	211	0	0	0	0	
(2) Pre-feasibility Mineral Resource	221 and 222	0	0	0	0	
(3) Measured Mineral Resource	331	0.294	1.750	0.056	2.100	Fe > 45%
(4) Indicated Mineral Resource	332	0.482	0.266	0	0.749	
(5) Inferred Mineral Resource	333	0.363	0.006	0.096	0.303	
Total Ore Mineral Resources		**1.139**	**2.022**	**0.100**	**3.251**	

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Depletion of Reserves:

The year wise ROM production of manganese ore for the period 01.04.2018 to 31.12.2019 is given in Table No. 1.10c below.

Manganese Ore (Mn>25%):

Table 1.10c: Depletion of Reserves (in million tonnes)

Year	Bamebari	Joribar	Banaikela	Total
2018-19	0.001	0.071	0	**0.072**
2019-20	0	0.084	0	**0.084**
Total	**0.001**	**0.155**	**0**	**0.156**

Iron Ore (Fe>58%): There was no production of iron ore during the period.

Additional Reserves Established:

A total of 67 boreholes were drilled during the period 2018-19 to 2019-20 in the 3 blocks of Bamebari lease. Resource evaluation has been carried out based on the new boreholes (except 5 boreholes drilled during the fourth quarter of 2019-20, for which analysis is still pending) drilled during the approved modification of mine plan along with all the old boreholes drilled (904 Nos.) as per UNFC norms. Resource estimation has been carried out using ore body modelling and block modelling technique. The updated reserves/resources were estimated as per the details given under the Para "Category wise updated Reserves". Working back from the updated reserves, the net addition/depletion of resources is given in Table No. 1.11.

Table No. 1.11 a (Manganese ore)

Classification	UNFC Code	Quantity (in Million Tonnes) Bamebari	Jonbir	Benoko'a	Total	Grade
A. Mineral Reserve						
(1) Proved Mineral Reserve	111	0.009	0.226	-0.086	0.148	
(2) Probable Mineral Reserve	122		-0.316	0.033	0.017	
Total Reserves Addition		0.009	0.210	-0.053	0.165	
B. Remaining Ore Mineral Resources						
(1) Pre-feasibility Mineral Resource	221	-0.012	0.020	0.050	0.059	Mn > 25%
(2) Pre-feasibility Mineral Resource	222		0.002	0.012	0.014	
(3) Measured Mineral Resource	331					
(4) Indicated Mineral Resource	332			-0.162	-0.162	
(5) Inferred Mineral Resource	334			-0.500	-0.500	
Total Ore Mineral Resources Addition		-0.012	0.022	-0.600	-0.589	
B2. Remaining Mineral Reject Reserve & Resources						
(1) Proved Mineral Reserve	111	0.950	1.287	0.175	1.512	
(2) Probable Mineral Reserve	122		0.019		0.019	
(3) Pre-feasibility Mineral Resource	221	0.475	3.046	0.499	4.020	Mn >10 - 25%
(4) Pre-feasibility Mineral Resource	222		0.029	0.197	0.226	
(5) Measured Mineral Resource	331	-0.384	-1.505	0.017	-5.505	
(6) Indicated Mineral Resource	332		-0.042	-0.045	-0.087	
(7) Inferred Mineral Resource	334			-0.226	-0.226	
Total Mineral Reject Resources Addition		0.141	-0.166	-0.017	-0.041	
Total Reserve + Resources Addition		0.137	0.066	0.670	0.466	Mn > 10%

Difference in resources is mainly due to the fact that Inferred resources estimated earlier has not been considered during the present estimation.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 1.11 b (Iron ore)

Classification	UNFC Code	Quantity (in Million Tonnes)				Grade
		Bamebari	Joribar	Bamebera	Total	
A. Mineral Reserve						
(1) Proved Mineral Reserve	111		0.210		0.210	
(2) Probable Mineral Reserve	122				0	
Total Reserves Addition			0.210		0.210	
B. Remaining Ore Mineral Resources						
(1) Pre-feasibility Mineral Resource	221	0.307	0.192		0.500	Fe > 58%
(2) Pre-feasibility Mineral Resource	222	0.096	0.051		0.147	
(3) Measured Mineral Resource	331	-0.010	0.393		-0.393	
(4) Indicated Mineral Resource	332	-0.285	-0.030		-0.315	
(5) Inferred Mineral Resource	333	-0.054	0.000		-0.054	
Total Ore Mineral Resources Addition		**0.064**	**-0.174**		**-0.110**	
B2. Remaining Mineral Reject Reserve & Resources						
(1) Proved Mineral Reserve	111		0.493	0.040	0.533	
(2) Probable Mineral Reserve	122		0.024		0.024	
(3) Pre-feasibility Mineral Resource	221	0.504	0.616	0.045	1.165	Fe +45 - 58%
(4) Pre-feasibility Mineral Resource	222	0.036	0.101		0.137	
(5) Measured Mineral Resource	331	-0.274	-1.367	0.075	1.715	
(6) Indicated Mineral Resource	332	0.197	-0.232		-0.435	
(7) Inferred Mineral Resource	333	-0.308	-0.005	-0.025	-0.339	
Total Mineral Reject Resources Addition		**-0.240**	**-0.371**	**-0.015**	**0.626**	
Total Reserve + Resources Addition		**-0.175**	**-0.334**	**-0.015**	**-0.525**	Fe > 45%

Difference in resources is mainly due to the fact that Inferred resources estimated earlier has not been considered during the present estimation.

No additional reserves were established for the area intended to relinquish.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Category wise updated Resources/Reserves as on 01.04.2020

The category-wise resources & reserves of Bamebari lease within the area intended to retain (464.00 ha) are given in Table 1.12 a & b.

Table No. 1.12 a (Manganese ore)

Classification	UNFC Code	Quantity (in Million Tonnes)				Grade
		Bamebari	Jeribar	Boneikela	Total	
A. Mineral Reserve						
(1) Proved Mineral Reserve	111	0.052	1.127	0.178	1.357	
(2) Probable Mineral Reserve	122		0.002	0.033	0.035	
Total Ore Reserves		**0.052**	**1.129**	**0.211**	1.392	
B. Remaining Ore Mineral Resources						
(1) Pre-feasibility Mineral Resource	221	0.018	0.305	0.05	0.373	Mn > 25%
(2) Pre-feasibility Mineral Resource	222		0.002	0.012	0.014	
(3) Measured Mineral Resource	331					
(4) Indicated Mineral Resource	332					
(5) Inferred Mineral Resource	333					
Total Ore Mineral Resources		**0.018**	**0.307**	0.062	0.387	
B2. Remaining Mineral Reject Reserve & Resources						
(1) Proved Mineral Reserve	111	0.05	1.287	0.175	1.512	
(2) Probable Mineral Reserve	122		0.019		0.019	
(3) Pre-feasibility Mineral Resource	221	0.475	3.046	0.499	4.02	Mn -10 25%
(4) Pre-feasibility Mineral Resource	222		0.029	0.197	0.226	
(5) Measured Mineral Resource	331					
(6) Indicated Mineral Resource	332					
(7) Inferred Mineral Resource	333					
Total Mineral Reject Resources		0.525	4.381	0.871	5.777	
Total Reserve + Resources		0.595	5.817	1.144	7.556	Mn > 10%

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 1.12 b (Iron ore)

Classification	UNFC Code	Quantity (in Million Tonnes) Bamebari	Jenbar	Barsuan	Total	Grade
A. Mineral Reserve						
(1) Proved Mineral Reserve	111		0.210		0.210	
(2) Probable Mineral Reserve	122				0	
Total Ore Reserves		0	0.210	0	0.210	
B. Remaining Ore Mineral Resources						
(1) Pre-feasibility Mineral Resource	221	0.317	0.192		0.509	Fe > 58%
(2) Pre-feasibility Mineral Resource	222	0.096	0.051		0.147	
(3) Measured Mineral Resource	331				0	
(4) Indicated Mineral Resource	332				0	
(5) Inferred Mineral Resource	333				0	
Total Ore Mineral Resources		0.413	0.243	0	0.656	
B2. Remaining Mineral Reject Reserve & resources						
(1) Proved Mineral Reserve	111		0.493	0.04	0.533	
(2) Probable Mineral Reserve	122		0.024		0.024	
(3) Pre-feasibility Mineral Resource	221	0.504	0.616	0.045	1.165	Fe -45 - 58%
(4) Pre-feasibility Mineral Resource	222	0.036	0.101		0.137	
(5) Measured Mineral Resource	331				0	
(6) Indicated Mineral Resource	332				0	
(7) Inferred Mineral Resource	333				0	
Total Mineral Reject Resources		0.54	1.234	0.085	1.859	
Total Reserve + Resources		0.953	1.687	0.085	2.725	Fe > 45%

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

The category-wise resources & reserves of Bamebari lease within the area intended to relinquish (685.350 ha) are given in Table 1.12 c.

Table No. 1.12 c (Manganese ore)

Classification	UNFC Code	Quantity (in Million Tonnes)				Grade
		Bamebari	Jorbar	Bonaikela	Total	
A. Mineral Reserve						
(1) Proved Mineral Reserve	111				0	
(2) Probable Mineral Reserve	122				0	
Total Ore Reserves		0	0	0	0	
B. Remaining Ore Mineral Resources						
(1) Pre-feasibility Mineral Resource	221				0	Mn > 25%
(2) Pre-feasibility Mineral Resource	222				0	
(3) Measured Mineral Resource	331				0	
(4) Indicated Mineral Resource	332				0	
(5) Inferred Mineral Resource	333	0	0.05	0.06	0.11	
(6) Reconnaissance Mineral Resource	334	0.5	0.55	0.64	1.69	
Total Ore Mineral Resources		0.50	0.60	0.70	1.80	
B2. Remaining Mineral Reject Reserve & Resources						
(1) Proved Mineral Reserve	111				0	
(2) Probable Mineral Reserve	122				0	
(3) Pre-feasibility Mineral Resource	221				0	Mn +10 25%
(4) Pre-feasibility Mineral Resource	222				0	
(5) Measured Mineral Resource	331				0	
(6) Indicated Mineral Resource	332				0	
(7) Inferred Mineral Resource	333				0	
Total Mineral Reject Resources		0	0	0	0	
Total Reserve + Resources		0.50	0.60	0.70	1.80	Mn > 10%

No iron ore resources were established in the area intended to relinquish.

20/5/20

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

The category-wise resources & reserves of Total Ramchari lease (Total lease area of 1150.550 Ha) are given in Table 1.12 d & e.

Table No. 1.12 d (Manganese ore)

Classification	UNFC Code	Quantity (in Million Tonnes)				Grade
		Ramchari	Jorbar	Bamebeda	Total	
A. Mineral Reserve						
(1) Proved Mineral Reserve	111	0.052	1.127	0.178	1.357	
(2) Probable Mineral Reserve	122		0.002	0.033	0.035	
Total Ore Reserves		**0.052**	**1.129**	**0.211**	1.392	
B. Remaining Ore Mineral Resources						
(1) Pre-feasibility Mineral Resource	221	0.018	0.305	0.05	0.373	Mn > 25%
(2) Pre-feasibility Mineral Resource	222		0.002	0.012	**0.014**	
(3) Measured Mineral Resource	331				0	
(4) Indicated Mineral Resource	332				0	
(5) Inferred Mineral Resource	333	0	0.05	0.06	0.11	
(6) Reconnaissance Mineral Resource	334	0.5	0.55	0.64	1.69	
Total Ore Mineral Resources		**0.518**	**0.907**	**0.762**	2.187	
B2. Remaining Mineral Reject Reserve & Resources						
(1) Proved Mineral Reserve	111	0.05	1.287	0.175	1.512	
(2) Probable Mineral Reserve	122		0.019		0.019	
(3) Pre-feasibility Mineral Resource	221	0.475	3.046	0.490	4.02	Mn 10 - 25%
(4) Pre-feasibility Mineral Resource	222		0.029	0.197	0.226	
(5) Measured Mineral Resource	331				0	
(6) Indicated Mineral Resource	332				0	
(7) Inferred Mineral Resource	333				0	
Total Mineral Reject Resources		**0.525**	**4.381**	**0.871**	5.777	
Total Reserve + Resources		**1.095**	**6.417**	**1.844**	9.356	Mn > 10%

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 1.12 e (Iron ore)

Classification	UNFC Code	Quantity (in Million Tonnes)				Grade
		Bamebari	Jenbar	Boneikela	Total	
A. Mineral Reserve						
(1) Proved Mineral Reserve	111		0.210		0.210	
(2) Probable Mineral Reserve	122				0	
Total Ore Reserves		0	0.210	0	0.210	
B. Remaining Ore Mineral Resources						
(1) Pre-feasibility Mineral Resource	221	0.317	0.192		0.509	Fe > 55%
(2) Pre feasibility Mineral Resource	222	0.096	0.051		0.147	
(3) Measured Mineral Resource	331				0	
(4) Indicated Mineral Resource	332				0	
(5) Inferred Mineral Resource	333				0	
Total Ore Mineral Resources		0.413	0.243	0	0.656	
B2. Remaining Mineral Reject Reserve & Resources						
(1) Proved Mineral Reserve	111		0.494	0.04	0.533	
(2) Probable Mineral Reserve	122		0.024		0.024	
(3) Pre-feasibility Mineral Resource	221	0.504	0.616	0.045	1.165	Fe 45 - 55%
(4) Pre feasibility Mineral Resource	222	0.036	0.101		0.137	
(5) Measured Mineral Resource	331				0	
(6) Indicated Mineral Resource	332				0	
(7) Inferred Mineral Resource	333				0	
Total Mineral Reject Resources		0.54	1.234	0.085	1.859	
Total Reserve + Resources		0.953	1.687	0.085	2.725	Fe > 45%

Note: It may not be possible to quantify grade wise reserves, as normally there is considerable variation in size and grade distribution within the ore zone, which results variable recovery factor and bulk density. Thus, tonnages arrived are tentative

All resources above the ultimate pit have been classified as reserves.

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

2.0 MINING

A. OPENCAST MINING:

a) BRIEFLY DESCRIBE THE EXISTING AS WELL AS PROPOSED METHOD FOR EXCAVATION WITH ALL DESIGN PARAMETERS INDICATING ON PLANS / SECTIONS:

EXISTING METHOD FOR EXCAVATION WITH DESIGN PARAMETERS:

Manganese mine operations are spread at Bamebari, Joribar and Bonajkela Blocks of Bamebari Manganese Mine lease. The manganese ore deposits occur as small lenses and irregular veins.

In order to facilitate the deep hole blasting and safe movement of existing HEMM fleet, the bench angle normally maintained at 85° and overall pit slope maintained at 35° max. Overburden and ROM are being removed by using shovel-dumper combination. The benches are being maintained with 6 - 9 m high with width of 8 – 10m. The haul road having width of 10 – 12m with gradient of 1:16 has been assumed for designing of pits. Haul roads are maintained with 3 to 4 times the width of the largest haulage unit with extra width employed on the curves for safe movement of the dumpers. Horizontal curves are maintained to ensure the driver of the haul truck to negotiate the curve safely at given speed. Blast holes for both overburden and ore are drilled by 100mm diameter crawler drills.

Similarly, the blasted run-off mine ore is being hauled to sorting places located at the top of the quarry. The ROM is then dressed, sorted, sized and graded manually at sorting place. The piece-rated (Mazdoor/Reja) are deployed at different sorting places considering the average output per man shift of 1-1.2 ton (Avg.) viewing the finished ore production required from the particular quarry / pit. For annual production of 83200 MT max. (present capacity) of manganese ore in 300 working days, about 235 piece-rated workers will be deployed for production of 277 MT/day and accordingly will be increased upon the proposed production in subsequent years.

The different quality of finished ore is then loaded manually to the dumpers and transported to stacking ground for stacking the ore in regular geometrical shapes and samples are collected and analysed at our laboratory. Then removal permission is obtained from Mining & Geology Department of State Government after stock verification.

Thereafter, the stocks are dispatched to designated place as mentioned in the ore removal permission obtained.
Miscellaneous operations in the mine includes levelling of dumping yard, preparation and maintenance of haul roads, dozing of boulders from the mine face, loading of trucks at stock yard etc.

Currently mining operation is restricted to day time (General shift) only. Necessary permission under MMR 106(2)(b), 1961 from the Directorate General of Mines Safety (DGMS) has been obtained vide letter No. 380070/1595, Dt. 31.05.2016 (Annexure-29).

The present dimension of major quarries and Dump as on 01.04.2020 are furnished in table no. 2.1 and table no. 2.2 respectively.

Table No. 2.1
The present dimensions of the major quarries

Name of the pits	Location	Length (m)	Breadth (m)	Depth (m)	Pit Slope (Degree)	No. of benches in Ore	No. of benches in OB	Total No. of benches	Area Required (ha)
Bamebari Pit	2142N - 2971N & 3044 E - 3569E	830	512	86	20	3	8	11	10.515 (a)
Ichhar Pit	11235 N -11612N & 12319E -12740E	449	366	116	25	6	5	10	1.923 (b)
Banelkela Pit	4042N - 4237N & 4648 E - 5066 E	172	67	38	31	1	1	2	0

(a) 5.998 ha. out of 20.502 ha has been back filled with waste
(b) 1.923 ha. of quarry area has been used for temporary stocking of Mineral Reject (Sub Grade Ore)

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 2.2 : The present dimensions of the Dumps

Block	Dump Type	Location	Length (m)	Breadth (m)	Area (ha.)	Height (m)	Area Reclaimed/Plated by plantation (in Ha)	Present Capacity (LCuM)	Overall Dump Slope	Present Status of the Dump
Bamebari	OB(D#1)	2230 N-2967 N 2459 E-2534 E	750	250	14.53	52	11.247 Ha	55.1	28	Dead
Bamebari	OB(D#2)	1643 N-2196 N 3231 E- 3545 E	596	133	5.38	8	2.56 Ha	15.8	28	Dead
Bamebari	OB(D#3)	1241 N-1377 N 3072 E-3218 E	175	115	1.35	8	0.85 Ha	1.2	26	Dead
Bamebari	IRON ORE Stock (M#1)	2759 N-2966 N 3162 E-3407 E	285	231	3.85	5	0	3.48	28	Active
Bamebari	MR(M#2)	2739N - 2862N 3039E - 3152E	117	103	0.86	5	0	0.8	26	Dead
Samebari	MR(M#3)	2557N - 2653N 3141E - 3248E	115	83	0.66	6	0	0.8	28	Active
Jaribar	OB(D#1)	12285 N-12618N 13154E-13514 E	375	84	2.88	60	0.9 Ha	25.16	28	Active
Jaribar	OB(D#2)	11477 N- 12016N 12806 E- 13146E	407	158	4.93	16	5.43 ha	27.86	28	Dead
Jaribar	MR(M#1)	11620 N-11735N 12549E-12763 E	216	60	1.18	15	0	0.46	28	Active
Jaribar	MR(M#2)	11502 N- 11582N 12588 E-12792E	212	66	1.03	12	0	0.24	28	Active
Bonaisola	OB(D#1)	4238N-4449 N 4249 E-4351 E	208	91	1.69	10	0	1.5	28	Dead
Bonaisola	OB(D#2)	4080 N-4329 N 4381 E-4670 E	280	246	3.53	12	0	3.8	28	Dead

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

PROPOSED METHOD FOR EXCAVATION WITH DESIGN PARAMETERS:

No change in method of excavation and design parameters as being proposed in this plan period. The manganese ore deposits occur as small lenses and irregular veins. In spite of lot of geological exploration already done the occurrence of manganese ore and its continuity is still very unpredictable. This plan has been prepared with a view to mine in areas having the highest potential of proved and probable mineral reserve and having relatively large ore zones. This is done with a view to have concentrated workings in order to economize on the other resource requirements. However, there are many other small pockets of ore, where such detailed exploratory drilling may not have been viable and are therefore often ignored at the planning stage.

Considering the high demand of high grade manganese ore it will be necessary to open up many more production faces simultaneously. It is often very difficult to meet the production demand as per plan due to the sudden disappearance of the ore body in contradiction with the geological predictions. The availability of sufficient high grade ore also varies with the geological predictions. Under the circumstances, it is sometimes necessary to resort to exploratory mining in new areas based on surface exposures or even where sufficient geological information is yet to be collected. Often such areas are worked for a very short span of time because of very low reserves at Bamebari & Bonaikela Block. Thus, while the development plans for major pits have been covered, the smaller ore zones that may be mined mostly as a contingency measure.

Currently mining operation is restricted to day time (General shift) only. Necessary permission under MMR 106(2)(b), 1961 from the Directorate General of Mines Safety (DGMS) has been obtained vide letter No. 380070/1595, Dt. 31.05.2016 (Annexure-29). However, to meet the excavation target of overburden from the mine and mechanised screening of Mn Ore ROM, provision will be kept open for mining operation beyond daylight hours from 2023-24 onward for which permission shall be sought from DGMS to work beyond day light hours. The 2nd shift operation will start upon getting the permission. The operation will be restricted to overburden benches beyond day light with a view of achieving the proposed stripping ratio in the proposed planned period.

Top soil is generally found in the top most layer of the virgin earth crust within the ML area which also contains the float ore at most of the places. As we proceed towards any virgin land during the plan period, top soil will be encountered. A layer of ~15 cm of maximum thickness has been envisaged as the top soil. Due to presence of float ore, section-wise calculation of top soil is not conceivable, hence indicated in the corresponding section where virgin area to be encountered during development. It has been proposed to deal with carefully and stack separately at the plantation site after sorting of any float ore so that it could be used for succeeding plantation activities. Efforts shall be taken for its usage within 3 months to obtain the maximum nutritional value.

This is pertinent to mention that; manual processing of ore will be upgraded with mechanisation as described in subsequent chapter in this document.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

b) **INDICATE YEAR-WISE TENTATIVE EXCAVATION IN CUBIC METERS INDICATING DEVELOPMENT, ROM PIT WISE AS IN TABLE BELOW.**

I. INSITU TENTATIVE EXCAVATION:

The development of the respective quarries has been proposed starting from the pit bottom to the top in accordance to the geological sections. Overburden and ROM are being removed by using shovel dumper combination. The benches are being planned with 6 – 9 m high with width of 8 – 10m. The haul road having width of 10 – 12m wit gradient of 1:16 has been assumed for designing of pits. Haul roads are designed to be 3 to 4 times the width of the largest haulage unit (for 2 way traffic) with extra width employed on the curves. Horizontal curves are designed to ensure the driver of the haul truck can negotiate the curve safely at given speed. The layout of the haul road has been shown in the DWG 10A, 10B and 10C. The overburden quantities that has to be removed in the respective quarries have been arrived at based on the stripping ratios. The quantities of overburden proposed to be removed year wise have been mentioned below. The manner in which the overburden will be generated during the next 5 years from the individual lease blocks is proposed to be dumped have also been furnished below.

The yearly proposed development plans for the next 5 years for Bamebari, Joribar & Bonaikala quarries are shown in drawing no. DWG 11A, DWG 11B and DWG 11C respectively. The relevant sections are shown in drawing no. DWG 12A, DWG 12B and DWG 12C respectively.

The ROM shown in cum will be converted to tonnage by multiplying with average bulk density of 2.5 in case of ore > 25% Mn. content & 2.2 in case of mineral reject 10-25% Mn content. The product will be considered as 100% (recovery) of the ROM ore as indicated in Figure 1 (Typical Material Balance of Mn. Ore ROM). The product recovery has been ascertained based on the time series data for last 5 years. Copy of the same is enclosed as Annexure – 37A. Further to increase the productivity of 1.44 t/manshift to 2.50 t/manshift, physical separation of ROM with double deck mobile screening has been installed. The grade-wise conversion factor for the product is being determined with the consonance of Directorate of Mining & Geology, Govt. of Odisha. Copy of the same is being enclosed as Annexure – 4o. The 10-25% Mn Ore includes some manually unprocessed ore and processed fines during manual dressing and sizing, the conversion factor is being considered as 2.2 as ascertained by 3rd Party NABL accredited laboratory as insitu density for Mn Ore <25% Mn (i.e Mineral reject) (Annexure – 37).

Mineral Reject: The Mn. content >10% & <25% of ROM and fines generated during manual processing (dressing and sizing) of ROM (Size. < 6 mm) is considered as Mineral Reject. The mineral fines do not have a regular demand throughout the year. It has got limited use and occasionally consumed by Ferro alloys making plants.

Yearly development program during the plan period of 2020-21 to 2014-25 is furnished in table no. 2.3.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 2.3 : YEAR WISE DEVELOPMENT PLAN

Year	Pit	Total Tentative Excavation (CuM)	Top Soil (CuM)	OB/SB/NI (CuM)	ROM - Mn.Ore			ROM (CuM) - Iron Ore (Mineral Reject)	ROM (Mn. + Iron) / Waste (OB) Ratio	Location of Development (Extent) and Drawing Reference	Proposed Bench level (mRL - from - to)
					Ore (CuM)	Mineral Reject (CuM)	Total (CuM)				
2020-21		68250	0	63522	460	110	570	4158	1 : 13.45	2516N - 2716N & 3408E - 3536E (Drawing No. 11A-Sheet 01)	548 to 628 mRL with 6m bench height
2021-22		74150	0	70378	1465	1534	2999	773	1 : 18.47	2513N - 2716N & 3297E - 3530E (Drawing No. 11A-Sheet 02)	540 to 596 mRL with 8m bench height
2022-23	Bamebari Block	413950	0	372745	10001	15017	25018	16087	1 : 9.04	2450N - 2731N & 3262E - 3545E (Drawing No. 11A-Sheet 03)	524 to 628 mRL with 8m bench height
2023-24		0	0	0	0	0	0	0	0	-	-
2024-25		1020750	8220	966980	13595	35355	45950	0	1 : 21.03	1438N - 1717N & 2985E - 3354E (Drawing No. 11A-Sheet 04)	516 to 588 mRL with 6m bench height
Total		1577100	8220	1473225	22541	51996	74537	21118	1 : 19.76		
2020-21		360500	0	219613	32381	5545	37925	102962	1 : 1.55	12528-11608N & 12322E-12677E (Drawing No. 11B-Sheet 01)	596 to 636 mRL with 8m bench height
2021-22	Joribar Block	344750	0	156310	67190	31251	98441	89996	1 : 0.83	11252N-11495N & 12312E-12736E (Drawing No. 11B-Sheet 02)	509 to 628 mRL with 8m bench height

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Total Tentative Excavation (CuM)	Top Soil (CuM)	OB/SB/IB (CuM)	ROM - Kn Ore			ROM (CuM) - Iron Ore (Mineral Reject)	ROM (Mn +Iron) / Waste (OB) Ratio	Location of Development (Extent) and Drawing Reference	Proposed Bench level (mRL - from - to)
					Ore (CuM)	Mineral Reject (CuM)	Total (CuM)				
2022-23		471100	0	224894	76444	68154	144598	31608	1 : 1.27	11298N-11572N & 12312E-12777E (Drawing No. 11B-Sheet 03)	508 to 428 mRL with 8m bench height
2023-24		631750	0	431666	92309	97603	190412	9672	1 : 2.15	11238N-11630N & 12312E-12790E (Drawing No. 11B-Sheet 04)	492 to 636 mRL with 8m bench height
2024-25		1447250	2614	1242564	89405	112645	202050	0	1 : 6.14	11270N-11635N & 12498E-12871E (Drawing No. 11B-Sheet 05)	492 to 612 mRL with 8m bench height
Total		3185350	2614	2275069	358228	315201	673429	234238	1:2.50		
2020-21		21500	0	13744	440	345	785	1971	1 : 6.80	4091N-4167N & 4822E-4922E (Drawing No. 11C-Sheet 01)	540 to 558 mRL with 6m bench height
2021-22	Barsekela Block	41350	0	28273	11325	1632	12957	149	1 : 2.15	4077N-4189N & 4617E-4935E (Drawing No. 11C-Sheet 02)	528 to 568 mRL with 4m Bench height
2022-23		81450	0	49315	13575	820	14384	6751	1 : 2.85	4175E-4281N & 4825E-4950E (Drawing No. 11C-Sheet 03)	550 to 582 mRL with 8m bench height

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Total Tentative Excavation (CuM)	Top Soil (CuM)	OB/SB/IB (CuM)	ROM - Mn Ore			ROM (CuM) - Iron ore (Mineral Reject)	ROM (Mn. +Iron) / Waste (OB) Ratio	Location of Development (Extent) and Drawing Reference	Proposed Bench level (mRL - from -- to--)
					Ore (CuM)	Mineral Reject (CuM)	Total (CuM)				
2023-24		211250	0	201562	7191	2397	9588	0	1:21.03	4244N-4394N & 4861E-5037E (Drawing No. 11C-Sheet 24)	560 to 600 mRL with 8m bench height
2024-25		0	0	0	0		0	0	0		
Total		355550	0	308974	32511	5203	37714	8862	1:8.19		
2020-21	Total	450750	0	301873	33280	6000	39280	109091	1:2.03		
2021-22		460250	0	254941	80000	34400	114400	90909	1:1.24		
2022-23		806500	0	657954	100000	64000	164000	54546	1:2.76		
2023-24		843000	0	633328	100000	100000	200000	9672	1:3.02		
2024-25		2468000	10834	2209166	100000	149000	249000	0	1:8.90		
Grand Total		5118000	10834	4057268	413280	372400	785680	264218	1:3.86		

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Yearly development program for the development plan in term of tonnage is furnished in table no. 2.4.

Table No. 2.4 : YEAR WISE DEVELOPMENT PLAN

Year	Pit	Total Tentative Excavation (Tonnes)	Top Soil (Tonnes)	OB/SB/IB (Tonnes)	ROM - Min.Ore			ROM (Tonnes) - Iron Ore (Mineral Reject)	ROM (Million) / Waste (OB) Ratio
					Ore (Tonnes)	Mineral Reject (Tonnes)	Total (Tonnes)		
2020-21	Bamebari Block	128436	0	127344	1150	242	1392	11435	1:0.90
2021-22		149749	0	140756	3712	3391	7043	2126	1:15.35
2022-23		693520	0	745490	25002	33037	58039	44514	1:7.77
2023-24		0	0	0	0	0	0	0	0
2024-25		2037429	12330	1933160	26489	77781	104269	0	1:8.54
Total		**3117193**	**12330**	**2946450**	**56352**	**114391**	**170743**	**58075**	**1:12.04**
2020-21	Jenbai Block	532375	0	439226	80951	17199	98149	283146	1:1.17
2021-22		569354	0	512428	167075	68759	235834	247487	1:0.64
2022-23		710637	0	569798	191118	149630	340748	46922	1:1.09
2023-24		1310081	0	863392	232022	214927	446949	26508	1:1.82
2024-25		2056599	3921	2605172	224512	247819	472331	0	1:3.47
Total		**6139149**	**3921**	**4550038**	**895569**	**698442**	**1589011**	**604155**	**1:2.03**
2020-21	Bonai kota Block	39347	0	37448	1100	799	1899	5430	1:5.15
2021-22		88405	0	56596	28813	3560	31303	385	1:1.75
2022-23		156342	0	29639	33698	1824	35712	18565	1:4.22
2023-24		426575	0	403324	17978	5273	23251	0	1:17.34
2024-25		0	0	0	0	0	0	0	0
Total		**710674**	**0**	**617948**	**81279**	**11447**	**92726**	**24371**	**1:6.27**
2020-21	Total	700358	0	603758	83200	13200	96400	300000	1:1.52
2021-22		807562	0	709892	223000	75688	298688	250000	1:2.97
2022-23		1750708	0	1319928	259000	104800	434000	150000	1:2.25
2023-24		1736656	0	1266659	230000	240300	470600	26508	1:2.69
2024-25		4993932	16251	4116342	250000	325500	575500	0	1:7.67
Grand Total		**9967016**	**16251**	**8114536**	**1033200**	**819260**	**1852480**	**726600**	**1:3.11**

a) The present approved RC quantity for Bamebari Iron and Manganese mines is 83200 Ton on production of Manganese ore on the basis of EIA notification of 1994. As per MoEF & CC Notification No. S.O. 1530(E), 6th Apr 2018, it was notified to regularise the granted EC under EIA Notification, 1994 to EIA Notification 2006 regime. Accordingly, while processing of the mentioned EC, the Expert Appraisal Committee of MoEF & CC confirmed that, the limitation of the ROM production of Manganese Ore is 0.970 LTPA. The extract of summary record of 37th meeting dtd. 23-24.10.2018 of the reconstituted committee of the expert appraisal committee for environmental appraisal of non-coal mining projects constituted under EIA notification, 2006 is enclosed as Annexure-18A.

In the plan period, the proposed maximum ROM has been planned for 575,600 tonnes / annum (max). Necessary approvals shall be sought from the MoEF & CC and SPCB before such enhancement in production.

b) The (<58% Fe Content) iron ore will be incidentally generated as mineral reject during development of benches from the zones overlying over manganese ore. However, it will be stacked separately till viability of any future usage.

Prepared by
SABYASACHY NISHRA
QUALIFIED PERSON

c) The stacked mineral reject of Iron Ore will be further processed for sizing by mobile crushing and screening unit subsequent to necessary approvals from MoEF & CC and State Pollution Control Board as per the captive demand.

d) The bench wise generation has been indicated in Table No. 2.8 (A to E) below. While summarising the above Table No. 2.3 & 2.4, the ROM production of Manganese Ore from different lease blocks are furnished in Table No. 2.5 as given below.

Table No. 2.5 : Details of ROM

Year	Pit	ROM (CuM) - Mn Ore			ROM (Tonnes) - Mn Ore		
		Ore	Mineral Rejects	Total	Ore	Mineral Rejects	Total
2020-21	Bamebari Block	460	110	570	1150	242	1392
2021-22		1485	1514	2999	3713	3330.8	7043
2022-23		10001	15017	25018	25003	330374	58040
2023-24		0	0	0	0	0	0
2024-25		10595	35355	45950	26488	77781	104269
Total		22541	51996	74537	56353	114391	170744
2020-21	Joribar Block	32380	5545	37925	80950	12199	93149
2021-22		67190	31254	98444	167975	68758.8	236734
2022-23		76444	68154	144598	191113	1499388	341049
2023-24		92609	97603	190412	232023	2147266	446744
2024-25		89405	112645	202050	223513	2478.19	421332
Total		358228	315201	673429	895570	693442	1589012
2020-21	Barsakela Block	440	345	785	1100	759	1859
2021-22		11325	1632	12957	28313	3590.4	31903
2022-23		13755	629	14384	33889	1384.38	35711
2023-24		7151	2397	9548	17978	5274.4	23251
2024-25		0	0	0	0	0	0
Total		32511	5203	37714	81278	11447	92724
2020-21	Tora	33280	6000	39280	83200	13200	96400
2021-22		80000	34400	114400	200000	75680	275680
2022-23		100000	84000	184000	250000	184800	434800
2023-24		100000	120000	220000	250000	264000	514000
2024-25		100000	148000	248000	250000	325600	575600
Grand Total		413280	372400	785680	1033200	819280	1852480

The grade wise proposal for production from different blocks is given below in Table No. 2.6. This is pertinent to mention that; the figures are average with respect to bore holes analysis results and may vary on actual basis due to the erratic nature of Manganese ore deposit.

As the mine will be developed from bottom to top, main sump area will be at bottom of the quarry to accommodate the rain water for which 6-8m max. depth in addition to annual limit as well as UPL has been considered in calculation of excavation of overburden and ore.

APPROVED

REGIONAL CONTROLLER OF MINES
INDIN BUREAU OF MINES

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Table No 2.6

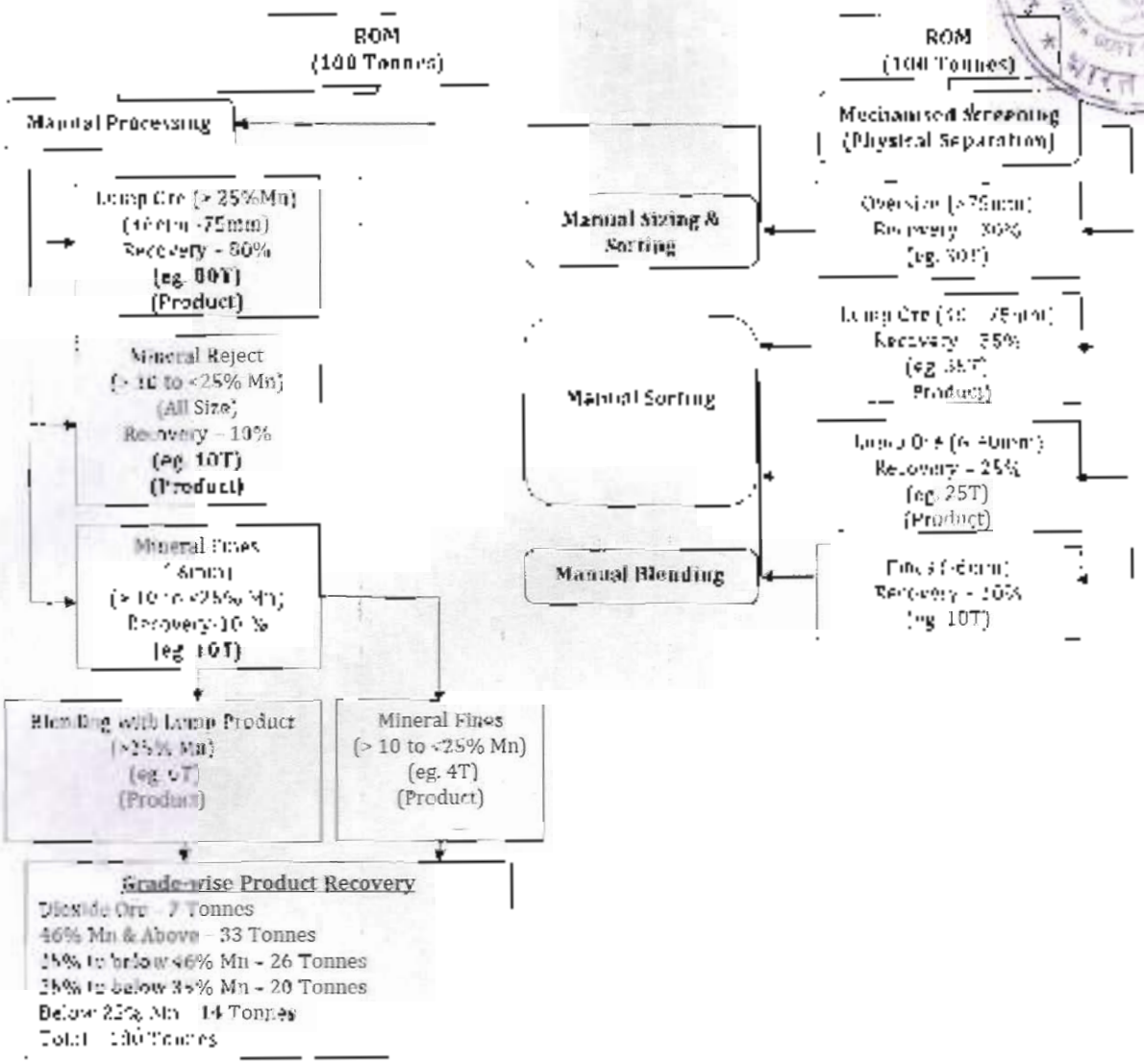
Year	Avg. Grade - Mn Ore								Avg. Grade - Mn Ore (Mineral Reject)							
	Banebari Block		Joribar Block		Bonaikela Block		All Blocks (Wt. Avg.)		Ramghari Block		Joribar Block		Bonaikela Block		All Blocks (Wt. Avg.)	
	Mn %	Fe %	Mn %	Fe %	Mn %	Fe %	Mn %	Fe %	Mn %	Fe %	Mn %	Fe %	Mn %	Fe %	Mn %	Fe %
2020-21	34.05	16.19	35.35	20.65	30.45	23.9	35.27	20.74	15.06	20.51	16.25	31.83	19.05	34.64	16.39	31.78
2021-22	37.76	15.72	34.8	19.54	28.50	27.87	33.33	20.05	12.11	16.44	16.21	32.65	17.34	34.83	16.08	32.04
2022-23	32.74	21.19	37.19	13.28	30.75	21.92	35.47	15.24	17.17	27.07	15.75	29.32	18.54	33.61	16.10	29.12
2023-24	0	0	36.83	16.32	27.32	21.97	36.12	16.73	0	0	17.03	27.61	20.08	26.67	17.09	27.54
2024-25	35.23	11.24	33.84	19.55	0	0	33.78	18.67	16.57	23.57	16.13	30.73	0	0	17.77	28.54
Wt. Avg	33.33	16.09	35.65	17.47	28.97	24.11	34.99	17.92	16.73	23.27	17.06	29.67	18.91	30.86	17.04	28.79

Year	Avg. Grade - Mn Ore ROM (Ore + Mineral Reject)								Avg. Grade - Iron Ore (Mineral Reject)							
	Banebari Block		Joribar Block		Bonaikela Block		All Blocks (Wt. Avg.)		Banebari Block		Joribar Block		Bonaikela Block		All Blocks (Wt. Avg.)	
	Mn %	Fe %	Mn %	Fe %	Mn %	Fe %	Mn %	Fe %	Fe %	Mn %	Fe %	Mn %	Fe %	Mn %	Fe %	Mn %
2020-21	30.75	18.59	32.65	22.11	25.80	31.78	32.68	22.25	49.87	0.54	54.09	1.62	56	2.1	53.96	1.59
2021-22	25.63	16.00	29.48	23.35	25.80	28.65	29.00	23.78	49.90	0.35	54.79	1	50.92	7.15	54.74	1.00
2022-23	24.10	25.05	27.76	20.63	30.14	22.52	27.47	21.14	50.32	0.64	54.35	1.44	49.63	4.96	52.57	1.70
2023-24	0	0	27.31	21.75	25.65	23.04	27.22	21.81	0	0	55.04	2.01	0	0	55.04	2.01
2024-25	20.60	16.95	23.59	25.43	0	0	24.72	24.25	0	0	0	0	0	0	0	0
Wt. Avg	23.21	20.90	27.53	22.60	27.73	24.94	27.35	22.73	50.22	0.76	54.43	1.37	51.07	4.36	53.98	1.42

- In-situ Bulk Density (Mn. Ore ROM > 25% Mn Content) = 2.5 T/CuM (Avg.)
- In-situ Bulk Density (Mn. Ore ROM < 25% Mn Content) = 2.2 T/CuM (Avg.)
- In-Situ Bulk Density (Iron Ore ROM > 58% Fe Content) = 3.0 T/CuM (Avg.)
- In-Situ Bulk Density (Iron Ore ROM < 58% Fe Content) = 2.75 T/CuM (Avg.)
- In-situ Bulk Density of Waste = 2.00 T/CuM (Avg.)

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

The typical material balance of ROM by manual processing of Manganese Ore is furnished below in Figure – 1.



(Figure – 1 Typical Material Balance for Mn Ore ROM)

The report on size recovery test by 3rd party NABL accredited laboratory is enclosed as Annexure – 37. The product recovery has been indicated based on time series data for last 5 years and the data supported with extract of Annual Return (Form – IB2) are being enclosed as Annexure – 37A. Further to increase the productivity of 1.44 t/manshift to 2.50 t/manshift physical separation of ROM with double deck mobile screening has been installed.

This is pertinent to mention that, the entire ROM (> 10% Mn. content) is being considered for consumption since 2018-19, hence the recovery of the grade wise product at present is 100%. The mineral fines do not have a regular demand throughout the year and being occasionally consumed by Ferro alloys making plants. Hence, the unblended fines will be stored for usage as when required.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

c) Enclose individual year wise development plans and sections showing pit layouts, dumps, stocks of mineral reject, if any

In the plan period, the proposed maximum ROM has been planned for 575.603 tonnes / annum (max). Necessary approvals shall be sought from the MoEF&CC and SEIAA before such enhancement in production.

During this plan period of 2020-25, aspects with respect to development proposals in each block are enumerated below as

Bamebari Block –

During 2020-21, proposed development will be carried out towards north-east within the extent of 2516N - 2716N & 3308E - 3536E from 626 mRL to 548 mRL. (Ref. Drawing No. 11A Sheet 01). There will be no further land degradation during the year due to mining.

During 2021-22, proposed development will be carried out towards north-east within the extent of 2514N - 2716N & 3292E - 3530E from 596 mRL to 540 mRL. (Ref. Drawing No. 11A Sheet 02). There will be no further land degradation during the year due to mining.

During 2022-23, proposed development will be carried out towards north-east within the extent of 2450N - 2730N & 3262E - 3545E from 628 mRL to 524 mRL. (Ref. Drawing No. 11A Sheet 03). There will be no further land degradation during the year due to mining.

This is also reported that, beyond 532 mRL, no more Manganese Ore will be available to mined out economically due to presence of variegated shale. However, 15 nos. of bore holes has been proposed to be drilled during 2023-24 to confirm the lean stones. Considering the past experience from exploration activities, manganese ore may not be available below of such scales for which back filling from bottom to top of the pit has been proposed from 2023-24 onwards. (Ref. Drawing No. 14A)

During 2023-24 no development will have to be carried out at Bamebari Block due to availability of more ore from Joribar Block and Bonaikela Block which will fulfil the requirement of ore.

During 2024-25, proposed development will be carried out as upon a new quarry within the extent of 2438N - 2717N & 2985E - 3354E from 588 mRL to 516 mRL. (Ref. Drawing No. 11A Sheet 04). There will be additional land degradation due to mining over an area of 5.930 ha.

Considering the above yearly proposals, the net area to be degraded for development of pit will be 5.93 ha.

The summary of the development proposals of Bamebari Block during the period of 2020-25 is furnished below in Table No. 2.7.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Table No 2.7A

Particular for the year (Pumchara Block)	2020-21	2021-22	2022-23	2023-24	2024-25
Reference Drawing Number	DWG -11A (Sheet.01)	DWG -11A (Sheet 02)	DWG -11A (Sheet.03)	-	DWG -11A (Sheet.04)
Bench Geometry					
Height (in m)	6	8	8	No development is being proposed during the year	8
Width (in m)	8	8	8		8
Ramp width (m)	10	10	10		10
Ramp Gradient	1 in 16	1 in 16	1 in 16		1 in 16
Individual bench slope angle (degree)	70	70	70		70
Quarry Development					
Location (Quarry name)	Bamebari Pit (Prop.Qry.1)	Bamebari Pit (Prop.Qry.1)	Bamebari Pit (Prop.Qry.1)		Bamebari New Pit (Prop.Qry.2)
Extent of development (Coordinate)	2516N - 2716N & 3310E - 3536E	2513N - 2716N & 3297E - 3550E	2450N - 2731N & 3262E - 3545E		1438N - 1737N & 2985E - 3354E
Representative Sections Value considered for development with maximum RL within the extent of 25m both side (N & S)	2500N - 563 to 596 mRL 2550N - 568 to 626 mRL 2600N - 548 to 620 mRL 2650N - 554 to 620 mRL 2700N - 578 to 614 mRL	2500N - 548 to 588 mRL 2550N - 540 to 572 mRL 2600N - 540 to 596 mRL 2650N - 548 to 580 mRL 2700N -572 to 596 mRL	2400N - 564 to 612 mRL 2450N - 564 to 620 mRL 2500N - 532 to 628 mRL 2550N - 524 to 628 mRL 2600N - 524 to 628 mRL 2650N - 540 to 628 mRL 2700N - 564 to 628 mRL 2750N - 604 to 628 mRL		1450N - 548 to 580 mRL 1512N - 524 to 580 mRL 1550N - 516 to 580 mRL 1600N - 524 to 568 mRL 1650N - 532 to 586 mRL 1700N - 540 to 580 mRL
Benches considered for development with RL	13 Nos 564 to 626 mRL	7 Nos 540 to 596 mRL	13 Nos 524 to 628 mRL		9 Nos 516 to 580 mRL
Top RL	626	596	628		588
Bottom RL	548	540	524		516
Direction of advancement	Lateral expansion towards North east upto bottom level within the existing pit	Lateral expansion towards North East upto bottom level within the existing pit	Lateral expansion in all direction upto bottom level within the existing pit.		New pit to be developed in all direction upto bottom level.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Particular for the year (Bamebari Block)	2020-21	2021-22	2022-23	2023-24	2024-25
Dimension of the quarry at the end of the year including existing benches (Max. Length & Breadth)	830 X 512	830 X 512	830 X 512		365 X 140
Area occupied (in sq.m)	242100	242100	242100		59300
Overall quarry slope angle	35 (Max)	35 (Max)	35 (Max)		30 (Max)
Production of Mn Ore (in MT)	1150	3712	25002		26658
Generation of Mineral reject (Mn Ore) from the quarry (in MT)	275	3785	17542		88388
Production of ROM-MN Ore (Ore+ Mineral reject) in MT	1425	7497	42544		114870
ROM of Iron Ore (Mineral Reject) to be excavated in MT	11435	2126	44514		0
Total Generation of Waste (in c.um)	63522	70378	372945		963560

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Joribar Block –

This is pertinent to mention that; the Lease Line E-F of Joribar Block coincides with the Lease Line H-I of Taringpahar Mn. Mine (Guruda Block) which is under same management control. The common area of 158m also been proposed from 2021-22 for exploitation after due clearance from Forest Department & DGMS for working in safety zone of both the mine. The copy of the application made to DGMS is being enclosed as Annexure- 36. The corresponding plans and sections showing the common boundary working pertaining to this application has been enclosed as Drawing No. DWG 11B (Sheet 1 to 3) & DWG 12D respectively.

The modalities to be followed while working over the common boundary as,

(a) The method of mining will be mechanized, near the common boundary
(b) Common boundary line will be marked in the field by permanent pillars after joint survey and demarcation.
(c) Common boundary line at each bench level shall be marked with pegs. Another line with lime shall be marked at 30 cm away from the actual boundary line inside the lease of other lessee for continuous reference while working close to the common boundary line.
(d) Detailed report of deployment of man & machinery while working within 7.5 meters of the common boundary shall be signed by authorized/competent person
(e) A joint inspection report by authorized/competent person shall be maintained and signed in a bound paged book in every shift while working in the common boundary.
(f) The excavation will be done as per the sequence of operation as given in the plan & section.
(g) After completion of each bench excavation, boundary markings will be done with proper peg marks and joint survey plan is to be updated and signed by both the surveyors and Managers
(h) Existing common code of practice for blasting is to be followed.
(i) All safety precautions are to be observed as per the conditions to be imposed by the DGMS.
(j) Necessary records as specified by the DGMS are to be maintained.
(k) Workings in common boundary shall be carried out in daylight only.
(l) The Managers of both the mines shall settle any dispute arising out of the workings at the site.
(m) As the both the leases are under same management, exclusive fleet will be deployed for common boundary working. Though it is common boundary this exclusive fleet movement will be in both lease the to make the operation safe and cost effective.
(n) Lease wise of record of overburden, subgrade and ore generation will maintained in bound paged book

While working out over the common boundary, the waste and ore has been calculated as given below in Table No. 2.7B which is already been included in Table No. 2.5A for yearly calculations.

Prepared by.
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 2.7 B

Year	Pit	Total Tentative Excavation (CuM)	Top Soil (CuM)	OB/SB/IB (CuM)	ROM - Mn.Ore (CuM)		ROM (CuM) - Mn Ore (Mineral Reject)	ROM (Met) / Waste (Top Soil + OB+Mn Ore ROM) Ratio
					Ore (CuM)	Mineral Reject (Incl. Fines) (CuM)		
2020-21	Jorihar Block	0	0	0	0	0	0	0
2021-22		115000	150	77850	11950	1950	24000	1 : 7.85
2022-23		54000	0	27700	12495	2295	11600	1 : 3.67
2023-24		35000	0	17500	9350	1650	6500	1 : 2.18
2024-25		0	0	0	0	0	0	0
Total		204000	150	123050	32895	5895	42100	1 : 3.18

During 2020-21, proposed development will be carried out within the existing quarry within the extent of 11252N-11608N & 12322E-12677E from 636 mRL to 508 mRL (Ref. Drawing No. 11B Sheet 01). There will be land degradation over 0.152 ha due to mining.

During 2021-22, proposed development will be carried out within the existing quarry within the extent of 11252N-11495N & 12312E-12736E from 628 mRL to 508 mRL. (Ref. Drawing No. 11B Sheet 02). There will be land degradation over 0.203 ha due to mining.

During 2022-23, proposed development will be carried out within the existing quarry within the extent of 11298N-11572N & 12312E-12777E from 628 mRL to 508 mRL. (Ref. Drawing No. 11B Sheet 03). There will be land degradation over 0.540 ha due to mining.

During 2023-24, proposed development will be carried out within the existing quarry with lateral movement of the six benches towards eastern side over the virgin area within the extent of 11288N-11630N & 12312E-12790E from 636 mRL to 492 mRL. (Ref. Drawing No. 11B Sheet 04). There will be land degradation over 0.633 ha due to mining.

During 2024-25, proposed development will be carried out within the existing quarry with lateral movement of the eleven benches towards north, east & south side over the virgin area within the extent of 11270N-11635N & 12490E-12871E from 612 mRL to 492 mRL. (Ref. Drawing No. 11B Sheet 05). There will be land degradation over 2.510 ha due to mining.

Considering the above yearly proposals, the net area to be degraded for development of pit will be 4.038 ha.

The summary of the development proposals at Jorihar Block during the period of 2020-25 is furnished below in Table No. 2.7C.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

TATA

Table No. 2.7C

Particular for the year (Jorbar Block)	2020-21	2021-22	2022-23	2023-24	2024-25
Reference Drawing Number	DWG -11B (Sheet 01)	DWG -11B (Sheet 02)	DWG -11B (Sheet 03)	DWG - 11B (Sheet 04)	DWG -11B (Sheet 05)
Bench Geometry					
Height (in m)	8	8	8	8	8
Width (in m)	8 to 10	8 to 10	8 to 10	8 to 10	8 to 10
Ramp width (in)	12	12	12	12	12
Ramp Gradient	1 in 16	1 in 16	1 in 16	1 in 16	1 in 16
Individual bench slope angle (degree)	70	70	70	70	70
Quarry Development					
Location (Quarry name)	Jorjear Pit	Jorbar Pit	Jorbar Pit	Jorbar Pit	Jorbar Pit
Extent of development (Coordinate)	11252N-11605N & 12322E-12677E	11252N-11495N & 12312E-12736E	11298N-11572N & 12312E-12777E	11268N-11630N & 12312E-12790E	11273N-11635N & 12490E-12871E
Representative Sections Value considered for development with maximum RL within the extent of 25m both side (N & S)	11250N - 540 to 580 mRL 11300N - 516 to 588 mRL 11350N - 508 to 580 mRL 11400N - 516 to 612 mRL 11450N - 532 to 628 mRL 11500N - 540 to 636 mRL 11550N - 564 to 636 mRL 11600N - 572 to 628 mRL	11250N - 540 to 580 mRL 11300N - 508 to 596 mRL 11350N - 508 to 604 mRL 11400N - 508 to 620 mRL 11450N - 524 to 628 mRL 11500N - 548 to 628 mRL	11300N - 508 to 588 mRL 11350N - 508 to 596 mRL 11400N - 508 to 612 mRL 11450N - 508 to 604 mRL 11500N - 540 to 628 mRL 11550N - 556 to 612 mRL	11300N - 508 to 564 mRL 11350N -492 to 604 mRL 11400N - 492 to 596 mRL 11450N - 508 to 596 mRL 11500N - 524 to 636 mRL 11550N - 548 to 628 mRL 11600N - 572 to 628 mRL 11650N - 596 to 620 mRL	11300N - 516 to 564 mRL 11350N - 492 to 572 mRL 11400N - 492 to 572 mRL 11450N - 508 to 580 mRL 11500N - 516 to 588 mRL 11550N - 532 to 596 mRL 11600N - 556 to 604 mRL 11650N - 596 to 612 mRL
Benches considered for development with RL	16 Nos. 508 to 636 mRL	15 Nos. 508 to 628 mRL	15 Nos. 508 to 628 mRL	19 Nos. 492 to 636 mRL	15 Nos. 492 to 612 mRL
Top RL	636	628	628	636	612
Bottom RL	508	508	508	492	492

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Particular for the year (Joribar Block)	2020-21	2021-22	2022-23	2023-24	2024-25
Direction of advancement	Lateral expansion in all direction upto bottom level within the existing pit	Lateral expansion towards East and West upto bottom level within the existing pit.	Lateral expansion towards North, East and West upto bottom level within the existing pit.	Lateral expansion in all direction upto bottom level within the existing pit.	Lateral expansion towards North, East and South upto bottom level within the existing pit.
Dimension of the quarry at the end of the year including existing benches (Max. Length & Breadth)	460 X 370	462 X 420	462 X 410	462 X 450	560 X 470
Area excepted (in sq.m)	135000	137200	142500	147600	172500
Overall quarry slope angle	35 (Max)	35 (Max)	35 (Max)	35 (Max)	35 (Max)
Production of Mn. Ore (in MT)	130950	167975	191110	232022	223512
Generation of Mineral reject (Mn. Ore) from the quarry (in MT)	13862	78145	170386	244008	281612
Production of ROM MN.Ore (Ore+ Mineral reject) in MT	94812	246110	361496	476030	505124
ROM of Iron Ore (Mineral reject) to be excavated in MT	283146	247489	85922	26590	0
Total Generation of Waste (in cum)	219107	156985	224894	431666	1242584

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Bonaikela Block –

During 2020-21, proposed development will be carried out within the existing quarry with lateral extension towards north, south and west within the extent of 4091N-4167N & 4822E-4922E from 558 mRL to 540 mRL. (Ref. Drawing No. 11C Sheet 01). There will be land degradation over 0.313 ha due to mining.

During 2021-22, proposed development will be carried out within the existing quarry with lateral extension towards all direction within the extent of 4077N-4189N & 4817E-4935E from 568 mRL to 528 mRL. (Ref. Drawing No. 11C Sheet 02). There will be land degradation over 0.193 ha due to mining.

During 2022-23, proposed development will be carried out within the existing quarry with lateral extension towards north and east within the extent of 4175N-4261N & 4825E-4956E from 582 mRL to 550 mRL. (Ref. Drawing No. 11C Sheet 03). There will be land degradation over 0.923 ha due to mining.

During 2023-24, proposed development will be carried out over virgin area towards north and east side of existing pit within the extent of 4244N-4394N & 4861E-5037E from 600 mRL to 560 mRL. (Ref. Drawing No. 11C Sheet 04). There will be land degradation over 1.901 ha due to mining.

During 2024-25, no development will have to be carried out at Bonaikela Block due to availability of more ore from Bamebari Block and Jarihar Block which will match the requirement of ore.

Considering the above yearly proposals, the net area to be degraded for development of pit will be 3.330 ha.

The summary of the development proposals at Bonaikela Block during the period of 2020-25 is furnished below in Table No. 2.7D.

The detailed layout of the waste dump and stacking of mineral rejects has been described in Chapter 4.0 of this document.

Year Wise Development Plans and Sections - The year-wise developmental showing section-wise and bench-wise development at Bamebari Block, Jarihar Block & Bonaikela Block are given in Table 2.8 A, 2.8 B, 2.8 C, 2.8 D & 2.8 E respectively.

TATA

Table No 2.7D

Particular for the year (Bonaikela Block)	2020-21	2021-22	2022-23	2023-24	2024-25
Reference Drawing Number	DWG -11C (Sheet-02)	DWG -11C (Sheet-02)	DWG -11C (Sheet-03)	DWG -11C (Sheet-04)	-
Bench Geometry					
Height (in m)	8	8	8	8	No development has been proposed during the year
Width (in m)	8	8 to 10	8 to 10	8 to 10	
Ramp width (in)	10	10	10	10	
Ramp Gradient	1 in 16	1 in 16	1 in 16	1 in 16	
Individual bench slope angle (degree)	70	70	70	70	
Quarry Development					
Location (Quarry name)	Bonaikela Pit	Bonaikela Pit	Bonaikela Pit	Bonaikela Pit	
Extent of development (Coordinate)	4091E-4167N & 4822E-4972E	4077N-4199N & 4817E-4935E	4175N-4281N & 4825E-4958E	4244N-4314N & 4861E-5037E	
Representative Sections Value considered for development with maximum RL within the extent of 25m both side (N & S)	4100N - 540 to 552 mRL 4150N - 540 to 556 mRL	4100N - 528 to 552 mRL 4150N - 528 to 568 mRL 4200N - 544 to 568 mRL	4200N - 550 to 571 mRL 4250N - 550 to 582 mRL 4300N - 566 to 582 mRL	4250N - 560 to 584 mRL 4300N - 560 to 592 mRL 4350N - 560 to 600 mRL 4400N - 576 to 592 mRL	
Benches considered for development with RL	3 Nos 540 to 556 mRL	5 Nos. 528 to 568 mRL	4 Nos. 550 to 582 mRL	5 Nos 560 to 600 mRL	
Top RL	556	568	582	600	
Bottom RL	540	528	550	560	
Direction of advancement	Lateral expansion towards North, South and West upto bottom level within the existing pit	Lateral expansion on overall direction upto bottom level within the existing pit	Lateral expansion towards North East of the existing pit.	Lateral expansion towards North East of the existing pit.	
Dimension of the quarry at the end of the year including existing benches (Max. Length & Breadth)	266 X 90	272 X 110	272 X 125	356 X 250	
Area occupied (in sq.m)	112000	114000	123200	142200	
Overall quarry slope angle	35 (Max)	35 (May)	35 (Max)	35 (Max)	
Production of Mn Ore (in MT)	1120	26313	33868	17973	

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Particular for the year (Sonakela Block)	2020-21	2021-22	2022-23	2023-24	2024-25
Generation of Mineral reject (Mn Ore) from the quarry (in MT)	963	4080	2072	5492	
Production of ROM MN Ore (Ore+ Mineral reject) in MT	1963	32393	15960	23970	
ROM of Iron Ore (Mineral Reject) to be excavated in MT	5420	385	16563	0	
Total Generation of Waste (in cum)	18744	24253	60315	201662	

Prepared by
BABYASACHY MISHRA
QUALIFIED PERSON

Table No. 2.8 A (Year - 2020-21)

Year	Pit	Representative Section Line	Zone Considered for calculation	Level (mRL) From	Level (mRL) To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sq.m)	Overburden Length of Influence	Overburden Volume (CuM)	ROM (Mn Ore) [Mn≥25%] (Ore) Cross Section Area (Sq.m)	ROM Length of Influence	ROM Volume (CuM)
2020-21	Banebari	2500 N	2475 N - 2525 N	560	566	G1 & G2	12		0.24	50	12			
				566	572		25		0.5	50	25			
				572	578		94		1.88	50	94			
				578	584		127		2.54	50	127			
				584	590		20		0.4	50	20			
				590	596		16		0.32	50	16			
Sub Total							294	0	5.88		294	0		0
		2550 N	2525 N - 2575 N	548	554	G1 & G2	525		10.2	50	510			
				554	560		459		9.06	50	453			
				560	566		815		16.22	50	811			
				566	572		1118		22.36	50	1118			
				572	578		1059		21.18	50	1059			
				578	584		866		17.32	50	866			
				584	590		1454		29.08	50	1454			
				590	596		1765		35.3	50	1765			
				596	602		1617		32.34	50	1617			
				602	608		1684		33.68	50	1684			
				608	614		955		19.1	50	955			
				614	620		681		13.62	50	681			
				620	626		220		4.4	50	220			
Sub Total							13210	0	263.86		13193	0		0
		2600 N	2575 N - 2625 N	548	554	G1 & G2	1825		[illegible]	50	[illegible]	8.95	50	448
				554	560		[illegible]		[illegible]	50	[illegible]	0.24	50	12
				560	566		2195		43.9	50	2195			
				566	572		1911		[illegible]	50	1911			
				572	578		1447		28.94	50	1447			
				578	584		1959		[illegible]	50	1959			
				584	590		2643		52.86	50	2643			
				590	596		2896		57.92	50	2896			
				596	602		2172		43.44	50	2172			
				602	608		2524		50.48	50	2524			

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Year	PL	Representative Section Line	Zone Considered for Calculation	Level (mRL) From	Level (mRL) To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Over-burden Cross Section Area (Sq.m)	Over-burden Length of Influence	Over-burden Volume (CuM)	ROM (Mn.Ore) [Mn≥25%] (Ore) Cross Section Area (Sq.m)	ROM Length of Influence	ROM Volume (CuM)
				608	614		1661		33.22	50	1661			
				614	620		824		16.48	50	824			
		Sub Total					23176	0	498.62		24931	9.2		460
		2650 N	2625 N - 2675 N	554	560	G1 & G2	1195		23.9	50	1195			
				560	566		1726		34.52	50	1726			
				566	572		1670		34.02	50	1661			
				572	578		2370		43.4	50	2170			
				578	584		2421		46.28	50	2314			
				584	590		3303		69.32	50	3466			
				590	596		2595		51.74	50	2587			
				596	602		1190		27.4	50	1370			
				602	608		1543		30.86	50	1543			
				608	614		680		13.6	50	680			
				614	620		387		7.74	50	387			
		Sub Total					19406	0	381.98		19099	0		0
		2700 N	2675 N - 2725 N	578	584	G1 & G2	566		7.94	50	397			
				584	590		1021		13.24	50	912			
				590	596		2410		33.54	50	1677			
				596	602		2250		37.54	50	1877			
				602	608		1500		19.84	50	992			
				608	614		1087		3	50	150			
		Sub Total					9776	0	120.1		6005	0		0
		Total (Bamebari Block)					60250	0	1270.4		63522	9.2		460
	Dubna	11250 N	11225 N - 11275 N	542	548	G1 & G2	322		6.34	50	317			
				548	556		935		17.6	50	880			
				556	564		1108		22.16	50	1108			
				564	572		717		14.34	50	717			
				572	580		138		2.76	50	138			
		Sub Total					3220	0	62.8		3140	0		0
		11300 N	11275 N - 11325 N	516	524	G1 & G2	3147		[illegible]	50	2515	4.4	50	220
				524	532		6529		103.1	50	5155	0.24	50	12
				532	540		5258		[illegible]	50	[illegible]	25.42	50	1271
				540	548		10104		[illegible]	50	[illegible]	1.3	50	65

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

TATA

Year	Pit	Representative Section Value	Zone Considered for calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sqm)	Overburden Length of Influence	Overburden Volume (CuM)	ROM (Mn Ore) [Mn>25%] (Ore) Cross Section Area (Sqm)	ROM Length of Influence	ROM Volume (CuM)
				548	556		6698		110.9	50	5545			
				556	564		7157		119.24	50	5962			
				564	572		4569		65.52	50	3276			
				572	580		2063		[illegible]	50	2066			
				580	588		87		1.74	50	87			
				Sub Total			40451	0	562.38		20119	31.36		1568
		11350 N	11325 N - 11375 N	508	516	G1 & G2	720		0	50		14.08	50	704
				516	524		7928		45.54	50	2277	93.08	50	4654
				524	532		10359		159.56	50	7978	8.86	50	443
				532	540		6748		33.84	50	1692	35.06	50	1753
				540	548		4300		47.76	50	2388	16.3	50	817
				548	556		4195		32.2	50	1610	8.08	50	404
				556	564		2007		7.62	50	381	[illegible]	50	[illegible]
				564	572		872		5.18	50	259	3.4	50	170
				572	580		106		1.46	50	73			
				Sub Total			35394	0	333.36		16668	182.64		9132
		11400 N	11375 N - 11425 N	516	524	G1 & G2	144		0	50		2.88	50	144
				524	532		5522		17.4	50	870	79.64	50	3982
				532	540		9394		70.58	50	3529	102.16	50	5108
				540	548		8955		104.84	50	5242	44	50	2200
				548	556		10503		84.96	50	4248	9.88	50	494
				556	564		6926		78.64	50	3932	2.48	50	124
				564	572		7027		96.98	50	4849	6.38	50	319
				572	580		4896		30.36	50	1518	5.16	50	258
				580	588		6373		24.48	50	1224	0.72	50	36
				588	596		4405		13.52	50	676			
				596	604		2407		9.1	50	455			
				604	612		720		10.44	50	522			
				Sub Total			66370	0	546.3		27315	253.18		12659
		11450 N	11425 N - 11475 N	532	540	G1 & G2	192		3.32	50	166			
				540	548		15602		125.20	50	6260	52.04	50	2602
				548	556		18950		252.58	50	12629	10.56	50	528
				556	564		6639		100.6	50	5030	6.7	50	335

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

TATA

Year	Pit	Representative Section Value	Cross Section considered for calculation	Level (mRL) From	Level (mRL) To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden: Cross Section Area (Sq.m)	Overburden: Length of Influence	Overburden: Volume (CuM)	BGM (Mn. Ore) [Mn≥25%] (Ore): Cross Section Area (Sq.m)	BGM: Length of Influence	BGM: Volume (CuM)
				564	572		[illegible]		112.74	50	5637	0.88	50	44
				572	580		[illegible]		[illegible]	50	1966	11.78	50	589
				580	588		[illegible]		26.15	50	1308	0.9	50	45
				588	596		9038		0.94	50	47			
				596	604		7151		4.88	50	244			
				604	612		[illegible]		69.5	50	3475			
				612	620		[illegible]		57.76	50	2888			
				620	628		291		5.82	50	291			
Sub Total							90267	0	958.6		47930	83.66		4183
		11550 N	11475 N - 11525 N	540	548	G1 & G2	441		7.1	50	355	1.26	50	63
				548	556		[illegible]		103.16	50	5158	15.24	50	762
				556	564		[illegible]		62.72	50	3136	8.86	50	443
				564	572		7146		136.78	50	6839	1.82	50	91
				572	580		[illegible]		73.48	50	3674	17.44	50	872
				580	588		1160		55.54	50	2777	19.54	50	977
				588	596		4173		3.6	50	180	4.8	50	240
				596	604		[illegible]		2.44	50	122	3.62	50	181
				604	612		4477		33.44	50	1672	4.2	50	210
				612	620		4729		32.[illegible]	50	1608			
				620	628		2874		45.14	50	2257			
				628	636		[illegible]		[illegible]	50	[illegible]			
Sub Total							45824	0	547.22		47361	75.78		3789
		11550 N	11525 N - 11575 N	564	572	G1 & G2	[illegible]		[illegible]	50	[illegible]			
				572	580		[illegible]		[illegible]	50	10455	8.94	50	447
				580	588		[illegible]		[illegible]	50	[illegible]	8.46	50	423
				588	596		4014		[illegible]	50	4101	2.90	50	145
				596	604		4302		[illegible]	50	4106			
				604	612		[illegible]		[illegible]	50	5068			
				612	620		5699		101.48	50	5074			
				620	628		3079		61.58	50	3079			
				628	636		365		7.3	50	365			
Sub Total							50162	0	953.36		47668	20.36		1018
				572	580		167		3.34	50	167			

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Representative Section Value	Zone Considered for Calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sq.m)	Overburden Length of Influence	Overburden Volume (CuM)	ROM (Min.Ore) [Min≥25%] (Ore) Cross Section Area (Sq.m)	ROM Length of Influence	ROM Volume (CuM)
		1100 N	1157.5 N - 1162.5 N	580	586	G1 & G2	5403		106.86	50	5403			
				586	596		9396		197.86	50	9892			
				596	604		1285		25.7	50	1285			
				604	612		1411		28.22	50	1411			
				612	620		2065		40.56	50	2028			
				620	628		327		6.52	50	326			
		Sub Total					20934	0	408.24		20412	0		0
		Total (Joribar Block)					360500	0	4392.3		219610	642.6		32,500
	Bonaikela	1100 N	1075 N	540	546	G1 & G2	5285		103.80	50	5190	1.06	50	53
			4125 N	546	552		[illegible]		62.5	50	[illegible]			
		Sub Total					8594	0	165.88		8294	1.06		53
		1150 N	4125 N - 4175 N	540	546	G1 & G2	3301		49.52	50	2476	7.74	50	387
				546	552		7004		125.7	50	6285			
				552	558		1099		21.98	50	1099			
		Sub Total					12906	0	209.2		10460	7.74		387
		Total (Bonaikela Block)					21500	0	374.88		18744	8.8		440
		Grand Total (2020-21)					450250	0	5017.6		301879	665.6		33280

Table Cont'd

Year	Pit	Representative Section Value	Zone Considered for Calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	ROM (Min Ore) [Min≥10% <25%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)	Total ROM (Min.Ore) [Min ≥10%]	Iron Ore ROM [Min≥45%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)
2020-21	Banaikela	2500 N	2475 N - 2525 N	560	566	G1 & G2				0			
				566	572					0			
				572	578					0			
				578	584					0			
				584	590					0			
				590	596					0			

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Representative Section Line	Zone Considered for calculation	Level (mRL) From	Level (mRL) To	Level of Exploration	ROM [Mn Ore] [Mn≥10% <25%] (Mineral Reject) Cross Section Area (Sq.m)	ROM [Mn Ore] [Mn≥10% <25%] (Mineral Reject) Length of Influence	ROM [Mn Ore] [Mn≥10% <25%] (Mineral Reject) Volume (CuM)	Total ROM [Mn Ore] [Mn≥10%]	Iron Ore ROM [Mn≥45%] (Mineral Reject) Cross Section Area (Sq.m)	Iron Ore ROM [Mn≥45%] (Mineral Reject) Length of Influence	Iron Ore ROM [Mn≥45%] (Mineral Reject) Volume (CuM)
		Sub Total					0		0	0	0		0
		2550 N	2525 N - 2575 N	548	554	G1 & G2	0.3	50	15	15			
				554	560		0.12	50	6	6			
				560	566		0.08	50	4	4			
				566	572					0			
				572	578					0			
				578	584					0			
				584	590					0			
				590	596					0			
				596	602					0			
				602	608					0			
				608	614					0			
				614	620					0			
				620	626					0			
		Sub Total					0.50		25	25	0		0
		2600 N	2575 N - 2625 N	548	554	G1 & G2	1.58	50	79	[illegible]			
				554	560		0.12	50	6	18			
				560	566					0			
				566	572					0			
				572	578					0			
				578	584					0			
				584	590					0			
				590	596					0			
				596	602					0			
				602	608					0			
				608	614					0			
				614	620					0			
		Sub Total					1.7		85	[illegible]	0		0
		[illegible] N	2625 N - 2675 N	[illegible]	[illegible]	G1 & G2				0			
				[illegible]	[illegible]					0			
				[illegible]	[illegible]					0	0.3	50	15
				[illegible]	578					0	4	50	200
				578	584					0	2.14	50	107

TATA STEEL LIMITED, FERRO ALLOYS & MINERALS DIVISION
BAMEBARI IRON & MANGANESE MINE, AT/P.O.: BAMEBARI, VIA: JODA, DIST: KEONJHAR (ODISHA)

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

TATA

Year	Pit	Representative Survey No.	Area Considered for calculation	Level (mRL) From	Level (mRL) To	Level of Exploration	ROM (Min.Grade) (Max.10%-<25%) (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)	Total ROM (Min.Grade) (Max-10%)	Iron Ore ROM (Min-45%) (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)
				584	590					0	0.74	50	37
				590	596					0	0.16	50	8
				596	602					0	0.4	50	20
				602	608					0			
				608	614					0			
				614	620					0			
			Sub Total				0		0	0	7.74		387
	2390 N	2675 N	570	584	61 & 62					0	3.82	50	191
		2345 N	584	590						0	18.22	50	911
			590	596						0	14.66	50	733
			596	602						0	7.46	50	373
			602	608						0	11.32	50	566
			608	614						0	17.94	50	897
			Sub Total				0		0	0	73.42		3771
			Total (Bamebari Block)				2.2		110	570	105.16		4158
	Indian	11250 N	11427 N	540	548	61 & 62				0	0.1	50	5
			11278 N	548	556					0	1.5	50	75
				556	564					0			
				564	572					0			
				572	580					0			
			Sub Total				0		0	0	16		80
	11600 N	11275 N	516	526	61 & 62	0.7	50	35	255	7.54	50	377
		11325 N	526	532		1.28	50	64	76	25.88	50	1294
			532	540		2.58	50	129	1400	63.78	50	3189
			540	548		0.26	50	13	78	3.98	50	199
			548	556					0	62.86	50	3143
			556	564					0	23.94	50	1197
			564	572					0	25.06	50	1253
			572	580					0	0.16	50	8
			580	588					0			
			Sub Total			4.82		241	2809	349.92		17496
	11650 N	11325 N	506	516	61 & 62	0.12	50	6	320			
			516	524		3.48	50	174	4567	16.48	50	824

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Representative Section Value	Zone Considered for calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	ROM (Mn Ore) (Mn 10% < 25%) (Mineral Reject) Cross Section Area (Sq.m)	ROM Length of Influence	ROM Volume (CuM)	Total ROM (Mn Ore) (Mn > 25%)	Iron Ore ROM (Mn < 1%) (Mineral Reject) Cross Section Area (Sq.m)	Iron Ore Length of Influence	Iron Ore Volume (CuM)
			11375 N	524	532		3.74	50	187	637	31.52	50	[illegible]
				532	540		3.86	50	193	1946	22.2	50	1110
				540	548		1.6	50	[illegible]	955	21.94	50	1097
				548	556		0.46	50	24	429	43.14	50	2157
				556	564		0.24	50	12	196	30	50	1500
				564	572					170	8.64	50	112
				572	580					0	0.55	50	13
			Sub Total				13.7		685	9817	170.18		8909
		11400 N	11375 N - 11425 N	516	524	G1 & G2				144			
				524	532		4.62	50	231	4718	2.58	50	129
				532	540		4.4	50	220	5078	0.74	50	37
				540	548		3.38	50	169	2069	20.88	50	1044
				548	556		1.7	50	85	539	113.52	50	5676
				556	564		1.54	50	77	201	55.86	50	2793
				564	572		0.5	50	25	345	36.66	50	1834
				572	580		0.06	50	3	206	55.84	50	2792
				580	588					36	100.26	50	5013
				588	596					0	76.39	50	3819
				596	604					0	23.04	50	1152
				604	612					0	1.12	50	56
			Sub Total				32.2		1610	14300	493.1		24655
		11150 N	11125 N - 11475 N	532	540	G1 & G2	0.32	50	16	16			
				540	548		13.26	50	663	3306	38.61	50	1933
				548	556		6.18	50	309	837	5.76	50	289
				556	564		4.58	50	229	364	14.86	50	744
				564	572		[illegible]	50	145	106	49.86	50	2492
				572	580		1.92	50	96	585	39.1	50	1955
				580	588		0.84	50	42	87	120.06	50	6003
				588	596					0	179.82	50	8991
				596	604					0	138.34	50	6917
				604	612					0	80.24	50	4011
				612	620					0	14.5	50	727
				620	628					0			

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Representative Section	Zone Considered for calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	ROM (Mn Ore) [Mn ≥10% ≤25%] (Mineral Reject) Cross Section Area (Sq m)	ROM Length of Influence	ROM Volume (Cum)	Total ROM (Mn Ore) [Mn ≥10%]	Iron Ore ROM [Mn≤45%] (Mineral Reject) Cross section Area (Sq m)	Iron Ore Length of Influence	Iron Ore Volume (Cum)
		Sub Total					38.62		1501	5684	731.96		36653
		11500 N	11475 N - 11525 N	540	544	G1 & G2	6.96	50	21	86			
				548	556		4.30	50	201	966			
				556	564		4.86	50	243	647			
				564	572		4.52	50	226	807			
				572	580		3.06	50	153	1000			
				580	588		1.92	50	96	1062	12.3	50	615
				588	596		1.52	50	76	316	72.54	50	3627
				596	604		0.16	50	8	109	50.39	50	2519
				604	612					210	60.9	50	3045
				612	620					0	22.42	50	1121
				620	628					0	17.74	50	887
				628	636					0			
		Sub Total					21.3		1063	4554	272.29		13614
		11550 N	11525 N - 11575 N	564	572	G1 & G2				0			
				572	580		1.86	50	93	540			
				580	588		1.74	50	87	570			
				588	596		2.68	50	134	232	8.59	50	429
				596	604		1.56	50	78	78	0.88	50	44
				604	612		0.26	50	13	13	0.04	50	2
				612	620		0.08	50	4	4	11.74	50	587
				620	628					0			
				628	636					0			
		Sub Total					8.78		439	1437	20.74		1037
		11600 N	11575 N - 11625 N	572	580	G1 & G2				0			
				580	588					0			
				588	596		0.08	50	4	4			
				596	604					0			
				604	612					0			
				612	620					0	2.74	50	137
				620	628					0	7.62	50	381
		Sub Total					0.08		4	4	10.36		518
		Total (Gambar Block)					110.9		5545	27925	2059.24		102962

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Representative Section Value	Zone Considered for calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	ROM (Mn.Ore) (Mn>10% <25%) (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)	Total ROM (Mn.Ore) (Mn>10%)	Iron Ore ROM (Mn≤35%) (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)
	Bond sala	4100 W	4025 W - 4125 W	545	548	G1 & G2	1.52	50	76	129	0.04	50	2
				548	552		0.56	50	28	26	4.02	50	151
		Sub Total					2.08		104	157	3.06		153
		4150 N	4125 N - 4175 N	540	546	G1 & G2	2.82	50	141	520	5.99	50	297
				546	552		2	50	100	108	30.42	50	1521
				552	558								
		Sub Total					4.82		241	628	36.36		1818
		Total (Bonaikela Block)					6.9		345	785	39.42		1971
		Grand Total (2020-21)					120		6000	39200	2181.82		109091

Table No. 2.8 B (Year - 2021-22)

Year	Pit	Representative Section Value	Zone Considered for calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sq.m)	Overburden Length of Influence	Overburden Volume (CuM)	ROM (Mn.Ore) (Mn≥25%) (Ore) Cross Section Area (Sq.m)	ROM Length of Influence	ROM Volume (CuM)
2021-22	[illegible]	2600 N	2575 N - 2625 N	548	556	G1 & G2	156		3.12	50	156			
				556	564		176		2.82	50	141	0.62	50	31
				564	572		81		1.2	50	60	0.10	50	5
				572	580		65		1.34	50	67			
				580	588		14		0.28	50	14			
		Sub Total					514	0	9.06		453	0.68		34
		2550 N	2525 N - 2575 N	540	548	G1 & G2	541		5.78	50	289	2.36	50	118
				548	556		3342		63.04	50	3152	0.1	50	5
				556	564		4946		97.28	50	4864			
				564	572		3472		69.36	50	3468			
		Sub Total					12301	0	235.46		11773	2.46		123
		2500 N	2475 N - 2525 N	540	548	G1 & G2	1945		9.76	50	488	18.66	50	933
				548	556		11626		214.22	50	10711	7.58	50	379

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Reference Section Line	Zone Considered for Calculation	Level (m RL) From	Level (m RL) To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sq m)	Overburden Length of Influence	Overburden Volume (CuM)	ROM (Mn Ore) [Mn≥25%] (Ore) Cross Section Area (Sq m)	ROM Length of Influence	ROM Volume (CuM)
			2625 N	556	564		8792		175.84	50	8792			
				564	572		5255		105.1	50	5255			
				572	580		4705		94.1	50	4705			
				580	588		3760		75.2	50	3760			
				588	596		240		4.8	50	240			
		Sub Total					15113	0	659.22		32963	26.24		1312
		2650 N	2625 N - 2675 N	548	556	G1 & G2	2315		44.98	50	2249	0.12	50	6
				556	564		7621		152.42	50	7621			
				564	572		6653		133.06	50	6653			
				572	580		5997		119.94	50	5997			
				580	588		1821		36.42	50	1821			
		Sub Total					25139	0	487.62		24381	0.12		6
		2700 N	2675 N - 2725 N	572	580	G1 & G2	502		10.54	50	527			
				580	588		272		5.08	50	254			
				588	596		29		0.58	50	29			
		Sub Total					883	0	16.2	50	810	0		0
		Total (Bottachori Block)					74150	0	1407.56		70378	49.7		1405
	[illegible]	11250 N	11225 N - 11275 N	540	548	G1 & G2	19		0.08	50	4			
				548	556		201		4.82	50	241			
				556	564		412		8.24	50	412			
				564	572		279		5.58	50	279			
				572	580		21		0.42	50	21			
		Sub Total					1012	0	19.14		957	0		0
		11300 N	11275 N - 11325 N	508	516	G1 & G2	984		8.72	50	415	0.44	50	22
				516	524		1757		61.64	50	3082	12.44	50	672
				524	532		2404		35.84	50	1792	6.54	50	329
				532	540		2192		25.51	50	1277	2.56	50	128
				540	548		4109		67.44	50	3372			
				548	556		2450		44.62	50	2231			
				556	564		1629		26.16	50	1308			
				564	572		889		9.36	50	468			
				572	580		808		15.68	50	784			
				580	588		1641		32.82	50	1641			

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	[illegible]	[illegible]	Level (mRL) From	Level (mRL) To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sq.m)	Overburden Length of Influence	Overburden Volume (CuM)	ROM (Mn Ore) (Mn>25%) (Ore) Cross Section Area (Sq.m)	ROM Length of Influence	ROM Volume (CuM)
				588	596		592		11.84	50	592			
		Sub Total					22952	0	339.61		16983	27.82		1158
		11550 N	11425 N - 11175 N	508	516	G1 & G2	17917		15.22	50	761	277.4	50	13870
				516	524		15203		69.79	50	3489	164.36	50	8218
				524	532		4560		11.4	50	565	46.1	50	2405
				532	540		6632		41.78	50	2109	74.81	50	3741
				540	548		10166		180.08	50	9004	9.12	50	456
				548	556		13278		194.6	50	9730	2.32	50	116
				556	564		8285		127.4	50	6470	10.12	50	506
				564	572		4730		62.56	50	3128	5.52	50	276
				572	580		1345		12.14	50	607			
				580	588		576		11.3	50	565			
				588	596		622		10.09	50	504			
				596	604		705		3.64	50	182			
		Sub Total					102096	0	740.80		37044	592.04		29602
		11500 N	11375 N - 11125 N	508	516	G1 & G2	1150		0	50		22.96	50	1148
				516	524		13434		27.26	50	1363	247.98	50	12399
				524	532		19940		47.60	50	2484	195.24	50	9762
				532	540		15967		113.30	50	5669	83.9	50	4195
				540	548		14376		236.45	50	11823	12.2	50	610
				548	556		13254		275.34	50	13767	3.46	50	173
				556	564		12567		223.3	50	11165	6.98	50	349
				564	572		3471		50.44	50	2522	14.8	50	740
				572	580		6195		46.9	50	2345	58.2	50	2910
				580	588		9562		46.2	50	2310	11.4	50	570
				588	596		11127		31.56	50	1578			
				596	604		7126		92.42	50	4621			
				604	612		2594		49.18	50	2459			
				612	620		182		3.61	50	181			
		Sub Total					134829	0	1236.04		61802	657.28		32864
		11450 N	11425 N -	524	532	G1 & G2	1178		13.46	50	673			
				532	540		6739		77.82	50	3891	3	50	150
				540	548		10281		174.54	50	8727	0.4	50	20

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Representative Section Value	Zone Considered for calculation	Level (in RL) From	Level (in RL) To	Level of exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sqm)	Overburden Length of Influence	Overburden Volume (CuM)	ROM (Mn Ore) (Mn≥25%) (Ore) Cross Section Area (Sqm)	ROM Length of Influence	ROM Volume (CuM)
			11477 N	548	556		10114		182.92	50	9146	10.09	50	504
				556	564		8526		140.52	50	7026	23.58	50	1179
				564	572		672		10.08	50	504	0.24	50	12
				572	580		3239		21.1	50	1055	21.62	50	1081
				580	588		12713		36.5	50	1825	7.94	50	397
				588	596		14182		0.88	50	44	0.6	50	30
				596	604		13625		42.04	50	2102			
				604	612		9267		33.86	50	1693			
				612	620		2974		38.52	50	1926			
				620	628		431		0.52	50	126			
		Sub Total					90953	0	780.58		35029	67.45		4371
		13300 N	11175 N - 11525 N	540	550	61 & 62	13		0.22	50	11			
				556	564		66		0.96	50	48			
				564	572		436		9.72	50	486			
				596	604		13		0	50				
				604	612		1672		0	50				
				612	620		2205		0	50				
				620	628		523		0	50				
		Sub Total					4928	0	9.9		495	0		0
		Total (Jornbar Block)					344750	0	3126.2		156310	1343.8		67190
	Bamebari	4100 N	4077 N - 4123 N	528	536	61 & 62	1849		33.76	50	1696	42.84	50	2142
				536	544		9300		148.62	50	7431	36.7	50	1823
				544	552		2197		43.8	50	2190			
		Sub Total					15248	0	226.18		11309	79.54		3977
		4150 N	4125 N - 4175 N	528	536	61 & 62	6130		44.88	50	2244	76.88	50	3844
				536	544		8918		90.76	50	4538	66.30	50	3315
				544	552		7016		129.18	50	6459			
				552	560		1942		38.84	50	1942			
				560	568		242		4.84	50	242			
		Sub Total					24248	0	308.5	50	15425	143.26		7159
		4200 N	4175 N -	544	552	61 & 62	79		1.59	50	79			
				552	560		879		17.80	50	890	4.7	50	235
				560	568		546		10.92	50	546			

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Representative Section Value	Area Considered for calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sqm)	Overburden Length of Influence	Overburden Volume (CuM)	ROM (Mn Ore) [Mn≥25%] (Ore) Cross Section Area (Sqm)	ROM Length of Influence	ROM Volume (CuM)
			4225 N											
Sub Total							1704	0	30.30		1519	3.7		185
Total (Bagiaburu Block)							41350	0	565.06		28253	226.5		11325
Grand Total (2021-22)							400250	0	5098.02		254941	1639		80050

Table Cont'd

Year	Pit	Representative Section Value	Area Considered for calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	ROM (Mn Ore) [Mn>10% <25%] (Mineral Reject) Cross Section Area (Sqm)	Length of Influence	Volume (CuM)	Total ROM (Mn Ore) [Mn>10%]	Iron Ore ROM [Mn≥45%] (Mineral Reject) Cross Section Area (Sqm)	Length of Influence	Volume (CuM)
2021-22	Ramesu	2500 N	2475 N - 2525 N	548	556	G1 & G2				0			
				556	564		0.04	50	2	33	0.08	50	4
				564	572		0.35	50	18	21			
				572	580		0.06	50	3	3			
				580	588					0			
Sub Total							0.46		23	57	0.08		4
		2550 N	2525 N - 2575 N	540	548	G1 & G2	2.48	50	124	252			
				548	556		3.7	50	185	190			
				556	564		1.16	50	58	58	0.48	50	24
				564	572		0.08	50	4	4			
Sub Total							7.42		371	504	0.48		24
		2600 N	2575 N - 2625 N	540	548	G1 & G2	10.08	50	504	1477			
				548	556		10.72	50	536	615			
				556	564					0			
				564	572					0			
				572	580					0			
				580	588					0			
				588	596					0			
Sub Total							20.8		1040	2092	0		0
				548	556		1.6	50	80	[illegible]			

Prepared by:
SABYASACHI MISHRA
QUALIFIED PERSON

TATA

Year	Pit	Representative Section Value	Co-ordinates of Exploration	From (mSL)	To	Level of Exploration	ROM (Min Ore) [Mn≥10% <25%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)	Total ROM (Mn Ore) [Mn>10%]	Iron Ore ROM [Mn≥45%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)
			2625 E	556	564					0			
		6550 N	2675 E	564	572	G1 & G2				0	1.5	50	75
				572	580					0	8.8	50	410
			N	580	586					0	3.14	50	157
		Sub Total					1.6		80	86	13.44		672
		6500 N	2675 E	572	580	G1 & G2				0	1.1	50	55
				580	588					0	0.36	50	18
			2725 N	586	596					0			
		Sub Total					0		0	0	1.46		73
		Total (Ramchari Block)					30.28		1514	2999	134.6		773
	Jorthar	11550 S	11225 E	540	548	G1 & G2				0	0.3	50	15
			N	548	556					0	0.2	50	10
			11275 E	556	564					0			
				564	572					0			
				572	580					0			
		Sub Total					0		0		1.1		55
		11600 K	11275 E	508	516	G1 & G2	6.52	50	326	440			
			N	516	524		10.8	50	540	1412	5.26	50	263
			11325 E	524	532		5.48	50	274	705	0.18	50	9
				532	540		4	50	200	936	17.71	50	887
				540	548					0	20.72	50	1036
				548	556					0	4.38	50	219
				556	564					0	6.42	50	321
				564	572					0	8.42	50	421
				572	580					0	0.64	50	32
				580	588					0			
				588	596					0			
		Sub Total					28.8		1440	2791	63.56		3178
		11450 K	11475 E	508	516	G1 & G2	59.24	50	2962	3e832	6.48	50	324
			N	516	524		45.56	50	2278	10695	25.98	50	1299
			11525 E	524	532		21.2	50	1060	3460	10.1	50	505
				532	540		16	50	780	4442	0.12	50	6
				540	548		6.32	50	316	752	6.2	50	310

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Representative Section Value	Zone Considered for Calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	ROM (Mn Ore) [Mn≥10% <25%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)	Total ROM (Mn Ore) [Mn≥10%]	Iron Ore ROM [Mn≥45%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)
				548	556		2.44	50	122	[illegible]	38.2	50	1910
				556	564		0.72	50	36	545	27.42	50	1371
				564	572		0.18	50	9	285	26.54	50	1327
				572	580					0	10.60	50	530
				580	588					0	0.22	50	11
				588	596					0	2.36	50	118
				596	604					0	2.09	50	104
Sub Total							150.54		7527	37129	159.46		7923
		11400 N	11375 N - 11425 N	508	516	G1 & G2	0.04	50	2	1150			
				516	524		[illegible]	50	1692	14591			
				524	532		133.44	50	6672	16654	8.44	50	422
				532	540		110.58	50	5529	9724	11.48	50	574
				540	548		26.86	50	1343	1955	[illegible]	50	663
				548	556		7.96	50	398	571	28.4	50	1420
				556	564		4.96	50	248	597	17.7	50	885
				564	572		2.26	50	113	[illegible]	1.76	50	88
				572	580		10.18	50	509	3410	[illegible]	50	531
				580	588		1.68	50	84	654	110.06	50	5503
				588	596					0	190.38	50	9519
				596	604					0	49.9	50	2495
				604	612					0	2.7	50	135
				612	620					0			
Sub Total							335.8		16790	49654	967.46		48373
		11450 N	11425 N - 11475 N	524	532	G1 & G2	9.08	50	454	154			
				532	540		51.24	50	2562	2712	3.52	50	176
				540	548		30.72	50	1536	1556			
				548	556		9.28	50	464	950			
				556	564		2.42	50	121	[illegible]			
				564	572		0.44	50	22	34	2.68	50	134
				572	580		[illegible]	50	255	[illegible]	119.96	50	5998
				580	588		0.26	50	13	[illegible]	209.56	50	10478
				588	596					40	282.36	50	[illegible]
				596	604					6	230.46	50	[illegible]

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Representative Section Name	Zone Considered in Calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	ROM (Mn Ore) [Mn≥10% ≤25%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)	Total ROM (Mn Ore) [Mn>10%]	Iron Ore Rejects [Mn≥45%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)
				604	612					0	151.60	50	7584
				612	620					0	20.96	50	1048
				620	628					0	0.1	50	5
		Sub Total					109.54		5477	8850	1021.08		51054
		11500 N	11475 N 11525 N	548	556	G1 & G2	0.04	50	2	2			
				556	564		0.16	50	16	10			
				564	572					0			
				596	604					0	0.26	50	13
				604	612					0	33.94	50	1692
				612	620					0	44.1	50	2205
				622	628					0	10.16	50	521
		Sub Total					0.4		20	20	88.26		4413
		Total (Joribar Block)					625.08		31254	98444	1799.92		89496
	Bonaikela	4100 N	4075 N 4125 N	528	536	G1 & G2	0.38	50	19	2161			
				536	544		0.52	50	26	1861	0.2	50	10
				544	552					0	0.14	50	7
		Sub Total					0.9		45	4022	0.34		17
		4150 N	4125 N 4175 N	528	536	G1 & G2	1.24	50	62	3906			
				536	544		19.4	50	970	4289	2.42	50	121
				544	552		11.1	50	555	555	0.04	50	2
				552	560					0			
				560	568					0			
		Sub Total					31.74		1587	8750	2.46		123
		4200 N	4175 N 4225 N	544	552	G1 & G2				0			
				552	560					165			
				560	568					0			
		Sub Total					0		0	165	0		0
		Total (Bonaikela Block)					32.64		1632	12937	2.8		140
		Grand Total (2021-22)					688		34400	114400	1018.58		90909

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 2.0 C (Year - 2022-23)

Year	Pit	Representative Section Value	Zone considered for calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sqm)	Overburden Length of Influence	Overburden Volume (CuM)	ROM (Mn Ore) (Mn>25%) (Ore) Cross Section Area (Sqm)	ROM Length of Influence	ROM Volume (CuM)
2022-23	Barsu Ban	2400 N	2375 N - 2425 N	564	572	G1 & G2	5		0.10	50	5			
				572	580		110		2.20	50	110			
				580	588		137		2.74	50	137			
				588	596		486		9.72	50	486			
				596	604		540		10.46	50	520			
				604	612		33		0.54	50	27			
		Sub Total					1311	0	25.70		1285	0		0
		2450 N	2425 N - 2475 N	548	556	G1 & G2	2316		46.32	50	2316			
				556	564		6598		131.96	50	6598			
				564	572		3780		75.60	50	3780			
				572	580		2467		48.66	50	2433			
				580	588		1597		[illegible]	50	1579			
				588	596		1555		29.90	50	1495	1.20	50	60
				596	604		1771		35.42	50	1771			
				604	612		837		16.74	50	837			
				612	620		5		0.10	50	5			
		Sub Total					20944	0	414.7		20735	1.2		60
		2500 N	2475 N - 2525 N	532	540	G1 & G2	95		1.90	50	95			
				540	548		2980		59.60	50	2980			
				548	556		7750		154.68	50	7734	0.24	50	12
				556	564		9083		151.00	50	7550	19.36	50	968
				564	572		6652		104.04	50	5202	9.38	50	469
				572	580		4025		60.90	50	3045	0.08	50	4
				580	588		3226		62.14	50	3107	0.10	50	5
				588	596		4781		79.98	50	3999	0.36	50	18
				596	604		3744		74.76	50	3738			
				604	612		2613		52.26	50	2613			
				612	620		1562		31.24	50	1562			
				620	628		255		5.10	50	255			
		Sub Total					40064	0	837.6		41880	29.6		2480
		2550 N	2525 N - ...	524	532	G1 & G2	3536		40.46	50	2023	12.92	50	646
				532	540		12734		1016.7	50	9081	27.44	50	1372

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Representative Section	Zone Considered for Calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sq m)	Overburden Length of influence	Overburden Volume (CuM)	ROM (Mn Ore+) [Mn≥25%] (Ore) Cross Section Area (Sq m)	ROM Length of influence	ROM Volume (CuM)
			2575 N	540	548		22529		381.04	50	19052	46.04	50	2302
				548	556		10970		216.80	50	10844			
				556	564		9696		172.19	50	8606	7.34	50	367
				564	572		8305		163.38	50	8169			
				572	580		7229		139.04	50	6952			
				580	588		6415		127.90	50	6395			
				588	596		6405		128.10	50	6405			
				596	604		6263		125.26	50	6264			
				604	612		4809		96.16	50	4808			
				612	620		4632		92.64	50	4632			
				620	628		1386		27.72	50	1386			
		Sub Total					105198	0	1894.9		94745	93.74		4687
		1600 N	2575 N - 2625 N	524	532	G1 & G2	1106		2.90	50	145	1.86	50	93
				532	540		7663		82.16	50	4108	16.46	50	823
				540	548		16882		239.40	50	11970	57.16	50	2850
				548	556		12327		225.76	50	11300			
				556	564		11597		231.91	50	11597			
				564	572		10431		208.66	50	10433			
				572	580		7699		153.98	50	7699			
				580	588		6584		131.60	50	6580			
				588	596		6169		121.30	50	6059			
				596	604		5916		110.72	50	5536			
				604	612		5613		112.26	50	5613			
				612	620		4744		84.88	50	4244			
				620	628		517		10.34	50	517			
		Sub Total					125560	0	1723.56		86178	75.48		3774
		2650 N	2625 N - 2575 N	540	548	G1 & G2	44		0.80	50	40			
				548	556		8052		160.12	50	8006			
				556	564		12924		238.68	50	11934			
				564	572		16148		324.60	50	16230			
				572	580		16068		314.96	50	15748			
				580	588		11778		235.20	50	11760			
				588	596		10551		210.26	50	10513			

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Representative Section Value	Zone Considered for calculation	Level (mRL) From	Level (mRL) To	Level of Hydrology [illegible]	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sq.m)	Overburden Length of Influence	Overburden Volume (CuM)	ROM (Mn.Ore) [Mn>25%] (Ore) Cross Section Area (Sq.m)	ROM Length of Influence	ROM Volume (CuM)
				596	604		9575		193.62	50	9161			
				604	612		7347		146.86	50	7343			
				612	620		5283		104.04	50	5202			
				620	628		876		17.56	50	878			
				Sub Total			97062	0	1938.5		96925	0		0
		2700 N	2675 N - 2725 N	564	572	GL & 62	9		0.18	50	9			
				572	580		1939		30.72	50	1536			
				580	588		3201		90.64	50	4532			
				588	596		8571		140.90	50	7195			
				596	604		7309		148.86	50	7119			
				604	612		10308		112.16	50	5608			
				612	620		6186		42.00	50	2100			
				620	628		1672		36.20	50	1810			
				Sub Total			45147	0	609.60		30484	0		0
		2750 N	2725 N - 2775 N	604	612	GL & 62	69		1.16	50	58			
				612	620		694		7.20	50	360			
				620	628		95		1.90	50	95			
				Sub Total			858	0	10.26		513	0		0
				Total (Bamebari Block)			413950	0	7454.9		372745	200.02		10001
	Int'...	11400 N	11475 N - 11425 N	509	516	GL & 62	799		0.82	50	41	1.14	50	72
				516	524		116		1.64	50	82	0.10	50	5
				524	532		130		6.90	50	345	0.94	50	47
				532	540		1381		18.54	50	927			
				540	548		4924		99.64	50	4982			
				548	556		8563		171.26	50	8563			
				556	564		3136		66.72	50	3136			
				564	572		4							
				572	580		107							
				580	590		0							
				Sub Total			18920	0	365.52		18276	2.48		124
		11450 N	11425 N -	509	516	GL & 62	3133		4.00	50	200	14.92	50	746
				516	524		1578		0.76	50	38	15.12	50	2756
				524	532		37475		5.16	50	250	13.38	50	16669

Prepared by:
SABYASACHI MISHRA
QUALIFIED PERSON

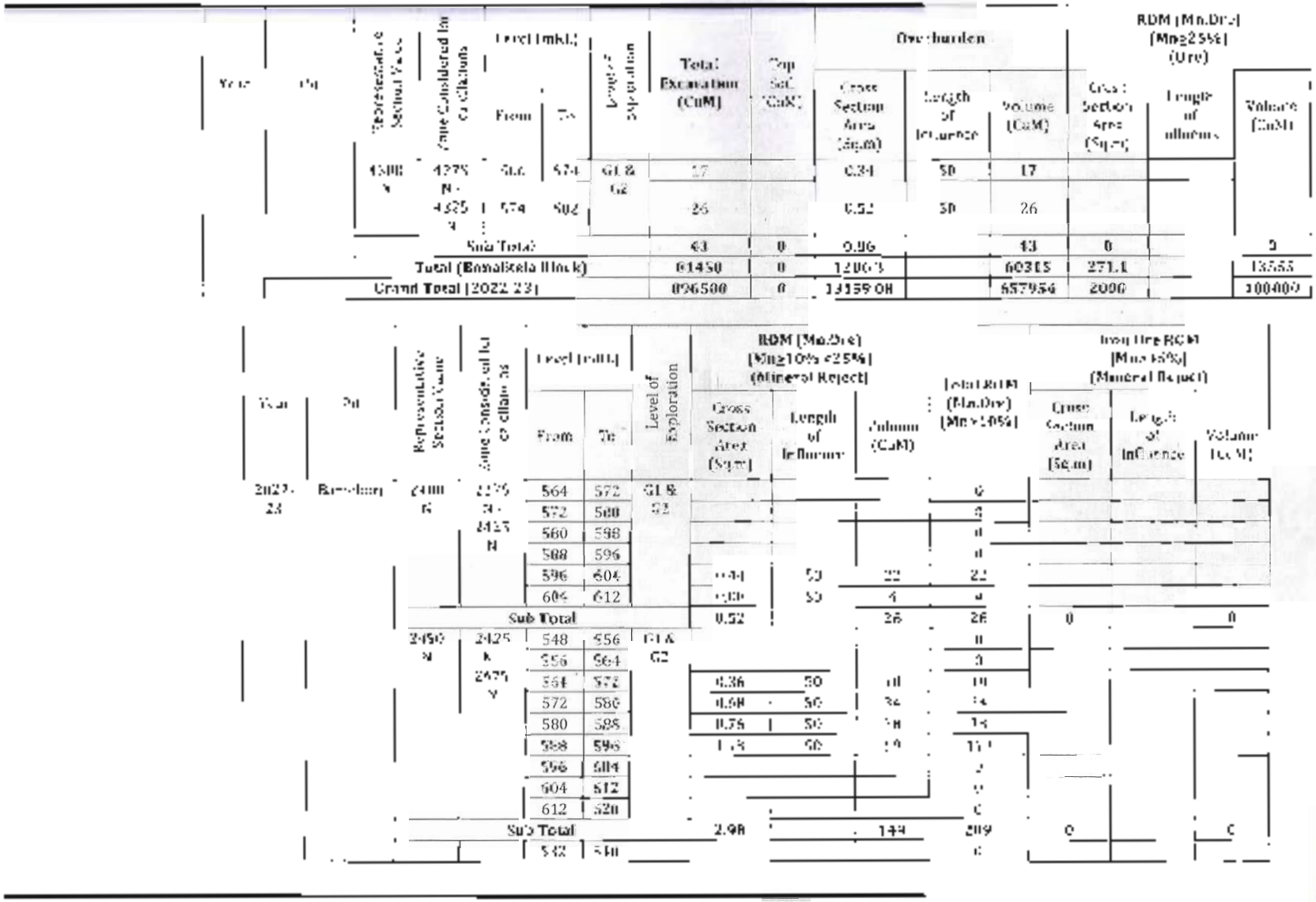
TATA

Year	Pit	Representative Section Value	Zone Considered for calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sq m)	Overburden Length of Influence	Overburden Volume (CuM)	ROM (Mn Ore) [Mn>25%] (Ore) Cross Section Area (Sq m)	ROM Length of Influence	ROM Volume (CuM)
			11375 N	532	540		19527		71.90	50	3595	300.00	50	17300
				540	548		19329		349.82	50	17491	31.72	50	15806
				548	556		18607		371.90	50	18598	0.14	50	[illegible]
				556	564		17635		352.70	50	17635			
				564	572		5604		113.04	50	5604			
				572	580		5		0.15	50	5			
				580	588		63		1.25	50	63			
				588	596		342		6.84	50	342			
		Sub Total					106178	0	1298.18		64900	705.20		35264
		11400 N	11375 N 11425 N	508	516	G1 & G2	9516		14.84	50	742	100.02	50	6931
				516	524		16253		181.76	50	9088	44.92	50	2246
				524	532		16204		100.96	50	5048	139.92	50	6996
				532	540		6063		78.88	50	3944	37.52	50	1876
				540	548		5051		85.70	50	4285	5.22	50	261
				548	556		5629		109.80	50	5490	0.78	50	39
				556	564		7313		137.82	50	6891	1.48	50	69
				564	572		9492		83.02	50	4151	77.54	50	3877
				572	580		3961		71.74	50	1054	62.62	50	3131
				580	588		1800		70.50	50	1005	1.68	50	214
				588	596		852		15.24	50	763			
				596	604		283		5.66	50	283			
				604	612		373		7.40	50	373			
		Sub Total					85519	0	852.22		43111	513.6		23680
		11450 N	11425 N - 11475 N	508	516	G1 & G2	12		0.90	50				
				516	524		2017		29.50	50	1870			
				524	532		8296		139.20	50	4064	[illegible]	50	131
				532	540		15513		165.76	50	8230	23.10	50	1155
				540	548		14103		209.50	50	10329	1.52	50	26
				548	556		5726		75.00	50	1750	3.41	50	172
				556	564		5142		109.98	50	5492	15.00	50	750
				564	572		12500		167.06	50	8153	20.46	50	1023
				572	580		9287		51.02	50	2071	106.54	50	5327
				580	588		7695		50.68	50	2534	9.42	50	47

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Representative Section Value	Area Considered for Calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sq m)	Overburden Length of Influence	Overburden Volume (CuM)	ROM (Mn Ore) [Mn≥25%] (Ore) Cross Section Area (Sq m)	ROM Length of Influence	ROM Volume (CuM)
				580	596		4293		1.05	50	52	19.56	50	979
				596	709		767							
		Sub Total					89989	0	1007.78		58389	199.48		9974
		11560 N	11475 N-11525 N	540	548	G1 & G2	2547		102.09	50	5104	0.80	50	40
				548	556		12456		109.82	50	5451	5.72	50	286
				556	564		18377		194.40	50	9720	3.32	50	166
				564	572		[illegible]		210.96	50	10548	65.04	50	3252
				572	580		5411		40.66	50	2033	4.65	50	233
				580	588		5951		31.30	50	1569	4.12	50	206
				588	596		2600		2.12	50	106	1.90	50	95
				596	604		4231		1.26	50	63			
				604	612		3539		1.46	50	73			
				612	620		5489		14.74	50	737			
				620	628		120		1.68	50	84			
		Sub Total					81326	0	709.56		35470	85.56		4278
		11550 N	11525 N-11575 N	556	564	G1 & G2	273		1.52	50	76			
				564	572		1049		65.48	50	3274			
				572	580		6456		181.84	50	9092	1.60	50	80
				580	588		2281		11.76	50	588	0.88	50	44
				588	596		1807		11.26	50	563			
				596	604		2391		35.08	50	1754			
				604	612		1605		19.68	50	984			
		Sub Total					19560	0	254.62		12731	2.48		124
		Total (Jurdhar Block)					401100	0	4497.80		224804	1530.80		76444
	Sunaketi	4200 N	4175 N-4225 N	550	558	G1 & G2	27481		350.46	50	17523	168.28	50	8414
				558	566		12707		162.94	50	8147	81.06	50	4053
				566	574		2999		37.48	50	1874			
		Sub Total					43091	0	570.88		28544	249.40		12467
		4250 N	4225 N-4275 N	550	558	G1 & G2	8062		105.86	50	5293	7.46	50	373
				558	566		12487		253.50	50	12675	1.08	50	54
				566	574		12896		195.78	50	9789	5.32	50	266
				574	582		4381		59.42	50	2971	7.90	50	395
		Sub Total					38316	0	614.56		30728	21.76		1088

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON



Year	Pit	Representative Section Name	Range Considered for Calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sq.m)	Overburden Length of Influence	Overburden Volume (CuM)	RDM (Mn.Ore) (Mn≥25%) (Ore) Cross Section Area (Sq.m)	RDM (Mn.Ore) (Mn≥25%) (Ore) Length of Influence	RDM (Mn.Ore) (Mn≥25%) (Ore) Volume (CuM)
		4300 N	4275 N - 4425 N	516	574	G1 & G2	17		0.34	50	17			
				574	502		26		0.52	50	26			
		Sub Total					43	0	0.86		43	0		0
		Total (Banalikela Block)					61450	0	12063		60315	271.1		13565
		Grand Total (2022-23)					896500	0	13159.08		657956	2000		100400

Table Cont'd

Year	Pit	Representative Section Name	Range Considered for Calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	RDM (Mn.Ore) (Mn≥10% <25%) (Mineral Reject) Gross Section Area (Sq.m)	RDM (Mn.Ore) (Mn≥10% <25%) (Mineral Reject) Length of Influence	RDM (Mn.Ore) (Mn≥10% <25%) (Mineral Reject) Volume (CuM)	Total RDM (Mn.Ore) (Mn≥10%)	Iron Ore RDM (Mn≥6%) (Mineral Reject) Cross Section Area (Sq.m)	Iron Ore RDM (Mn≥6%) (Mineral Reject) Length of Influence	Iron Ore RDM (Mn≥6%) (Mineral Reject) Volume (CuM)
2022-23	Banalikela	4400 N	2275 N - 2425 N	564	572	G1 & G2				0			
				572	580					0			
				560	588					0			
				588	596					0			
				596	604		0.44	50	22	22			
				604	612		0.08	50	4	4			
		Sub Total					0.52		26	26	0		0
		2450 N	2425 E - 2675 W	548	556	G1 & G2				0			
				556	564					0			
				564	572		0.36	50	18	18			
				572	580		0.68	50	34	34			
				580	588		0.76	50	38	38			
				588	596		1.18	50	59	59			
				596	604					0			
				604	612					0			
				612	620					0			
		Sub Total					2.98		149	209	0		0
				542	540					0			

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Sl.	Representative Section Value	Zone Considered for calculation	Level (mRL) From	Level (mRL) To	Level of exploration	ROM (Mn Ore) [Mn≥10% <25%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)	Total ROM (Mn Ore) [Mn>10%]	Iron Ore ROM [Fe≥45%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)
		2500 N	2475 N-2525 N	540	548	G1 & G2				0			
				548	556		0.08	50	4	16			
				556	564		10.47	50	524	1471	0.80	50	40
				564	572		19.62	50	981	1450			
				572	580		19.52	50	976	950			
				580	588		14.20	50	710	714			
				588	596		5.14	50	254	272			
				596	604		0.12	50	6	6			
				604	612					0			
				612	620					0			
				620	628					0			
		Sub Total					69.28		3464	4944	0.8		40
		2550 N	2525 N-2575 N	524	532	G1 & G2	17.14	50	857	1583			
				532	540		41.62	50	2081	1553			
				540	548		23.50	50	1175	3177			
				548	556		1.68	50	84	84	0.84	50	42
				556	564		12.48	50	624	591	2.00	50	100
				564	572		11.22	50	561	551	1.50	50	75
				572	580		4.94	50	247	247			
				580	588		0.40	50	20	20			
				588	596					0			
				596	604					0			
				604	612					0			
				612	620					0			
				620	628					0			
		Sub Total					114.98		5749	10436	4.34		217
		2600 N	2575 N-2625 N	524	532	G1 & G2	17.40	50	870	963			
				532	540		54.64	50	2732	3555			
				540	548		39.46	50	1973	4031			
				548	556		0.78	50	39	39			
				556	564					0			
				564	572					0			
				572	580					0			

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	[illegible]	Zone Considered for Calculations	Level (mRL) From	Level (mRL) To	[illegible]	ROM (Mn.Ore) [Mn>10% <23%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (Cum)	Total ROM (Mn Ore) [Mn>10%]	Iron Ore ROM [Fe<45%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (Cum)
				[illegible]	588					0			
				[illegible]	596					0			
				596	604					[illegible]			
				604	612					0			
				612	620					0			
				620	628					0			
		Sub Total					112.28		5614	[illegible]	0		0
		2650 N	2625 N 2675 N	540	548	G1 & G2	0.18	50	5	0			
				548	556		0.12	50	6	0			
				556	564					0			
				564	572					0	[illegible]	50	119
				572	580					0	6.40	50	320
				580	588					0	[illegible]	50	[illegible]
				588	596					0	0.82	50	41
				596	604					0	7.90	50	395
				604	612					0			
				612	620					0			
				620	628					0			
		Sub Total					0.3		15	15	18.44		922
		2700 N	2675 N - 2725 N	564	572	G1 & G2				0			
				572	580					0	[illegible]	50	[illegible]
				580	588					0	13.78	50	689
				588	596					0	[illegible]	50	926
				596	604					0	[illegible]	50	[illegible]
				604	612					0	93.04	50	4652
				612	620					0	121.72	50	6086
				620	628					0	4.24	50	212
		Sub Total					0		0	0	293.26		14663
		2750 N	2725 N 2775 N	604	612	G1 & G2				0	0.22	50	11
				612	[illegible]					0	0.68	50	34
				620	628					0			
		Sub Total					0		0	0	0.9		345
		Total (Bamebari Block)					100.34		15017	25018	751.74		16187

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	RL	Representative Section Value	Zone Considered for calculation	Level (in RL) From	Level (in RL) To	Level of Exploration	ROM (Mn.Ore) [Mn≥10% <25%] (Mineral Reject) Cross Section Area (Sq.m.)	ROM Length of Influence	ROM Volume (CuM)	Total ROM (Mn.Ore) [Mn≥10%]	Iron Ore ROM [Fe≥45%] (Mineral Reject) Cross Section Area (Sq.m)	Iron Ore Length of Influence	Iron Ore Volume (CuM)
	Jun'50	11[illegible] N	11275 N - 11325 N	508	516	G1 & G2	4.72	50	100	250			
				516	524		0.50	50	29	34			
				524	532		0.92	50	16	93			
				532	540		3.00	50	154	154			
				540	548		0.04	50	2	2			
				548	556					0			
				556	564					0			
				564	572					0	[illegible]	50	4
				572	580					0	2.14	50	107
				580	588					0			
			Sub Total				8.34		447	541	2.22		111
		11350 N	11325 N - 11375 N	508	516	G1 & G2	13.74	50	2187	2941			
				516	524		31.68	50	1584	3360			
				524	532		30.96	50	548	17217			
				532	540		18.64	50	932	15902			
				540	548		5.04	50	252	1030			
				548	556		0.04	50	2	0			
				556	564					0			
				564	572					0			
				572	580					0			
				580	588					0			
				588	596					0			
			Sub Total				100.1		5005	41260	0		0
		11400 N	11375 N - 11425 N	508	516	G1 & G2	26.86	50	1343	8774			
				516	524		40.58	50	4529	7122			
				524	532		81.60	50	4080	11085	1.40	50	70
				532	540		17.76	50	888	2764	2.00	50	100
				540	548		8.32	50	416	571	1.90	50	95
				548	556		0.72	50	36	75	1.20	50	61
				556	564		6.00	50	300	569	1.06	50	53
				564	572		26.06	50	1303	5200	2.82	50	141
				572	580		3.94	50	197	1729	31.58	50	1579
				580	588		1.34	50	67	171	9.08	50	454

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

TATA

Year	Pit	Representative Section No.	Zone Considered for sections	Level (mRL) From	Level (mRL) To	Level of Exploration	ROM (Mineral Reject) [Mn≥10% - <25%] Cross Section Area (Sq m)	ROM Length of Influence	ROM Volume (Cu m)	Total ROM (Mn Ore) [Mn≥10%]	Iron Ore ROM (Mineral Reject) [Fe≥45%] Cross Section Area (Sq m)	Iron Ore Length of Influence	Iron Ore Volume (Cu m)
				588	596					0	1.38	50	69
				597	604					2			
				604	612					0			
			Sub Total				281.26		14063	39743	53.3		2665
		11150 N	11425 N – 11475 N	500	516	G1.5 G2				0			
				516	524		2.94	50	147	147			
				524	532		23.80	50	1190	1321	0.28	50	14
				532	540		101.88	50	5094	6219	20.50	50	1025
				540	548		71.32	50	3566	3392	1.40	50	70
				548	556		32.44	50	1622	1794	[illegible]	50	[illegible]
				556	564		41.96	50	2098	2688	15.10	50	755
				564	572		45.54	50	2277	3300	18.92	50	946
				572	580		18.62	50	931	4256	17.62	50	881
				580	588		4.64	50	242	513	90.96	50	4540
				588	596		0.96	50	48	1427	64.28	50	3214
				596	604					0	15.34	50	767
			Sub Total				344.3		17215	27109	248.22		12411
		11500 N	11475 N – 11525 N	540	548	G1.8 G2	47.96	50	2398	2405			
				548	556		133.58	50	6679	6963			
				556	564		169.82	50	8491	9617			
				564	572		102.28	50	5114	8466	16.46	50	823
				572	580		33.88	50	1694	1927	23.44	50	1172
				580	588		12.96	50	648	854	67.44	50	3372
				588	596		3.18	50	159	359	44.80	50	2240
				596	604		0.20	50	10	10	83.16	50	4158
				604	612					0	62.72	50	3136
				612	620					0	23.04	50	1152
				620	620					0	0.72	50	36
			Sub Total				503.86		25193	29671	327.54		16377
		11750 N	11525 N – 11575 N	556	564	G1.5 G2	3.94	50	197	197			
				564	572		33.42	50	1671	1671			
				572	580		25.72	50	1286	1555			
				580	588		24.38	50	1219	1293			

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

TATA

Year	Pit	Representative Section Value	Zone Considered for calculation	Level (mRL) From	Level (mRL) To	Level of Exploration	ROM (Min.Ore) [Min≥10% <25%] (Mineral Reject) Cross Section Area (Sq.m)	Length of influence	Volume (CuM)	Total ROM (Min.Ore) [Min>10%]	Iron Ore ROM [Min≤45%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)
				580	596		24.04	50	1202	1202	0.84	50	42
				596	604		12.70	50	635	635	0.04	50	2
				604	612		0.42	50	21	2[illegible]			
		Sub Total					125.22		6261	5585	0.88		44
		Total (Inflow Block)					1363.08		68154	144[illegible]40	632.16		31609
	Bamebari	4250 N	4175 N - 4225 N	550	558	G1 & G2	0.02	50	1	8425	28.90	50	1445
				550	566		10.18	50	509	4562			
				566	574		2.50	50	125	125			
		Sub Total					12.7		635	13104	28.9		1445
		4250 N	4225 N - 4275 N	550	558	G1 & G2				573	47.92	50	2396
				558	566		0.06	50	3	52	5.[illegible]	50	235
				566	574		3.78	50	189	455	52.26	50	2613
				574	582		0.04	50	2	397	0.26	50	13
		Sub Total					3.88		194	1282	106.12		5306
		4300 N	4275 N - 4325 N	566	574	G1 & G2				0			
				574	582					0			
		Sub Total					0		0	0	0		0
	Total (Bamebari Block)						16.50		829	14384	135.02		6751
	Grand Total (2022-23)						1680		84000	184000	1090.92		54546

Table No. 2.8 D (Year - 2023-24)

Year	Pit	Representative Section Value	Zone Considered for calculation	Level (mRL) From	Level (mRL) To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sq.m)	Overburden Length of influence	Overburden Volume (CuM)	ROM (Min.Ore) [Min≥25%] (Ore) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)
							No development has been proposed							
2023-24	Bamebari	11,000 N	11275 N	508	516	G1 & G2	54					0.76	50	38
				516	524		480		9.42	50	471	7.16	50	358

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON
RQP 2[illegible]/269

Year	Pit	Representative Section Line	Zone Considered for calculations	Zone (mRL) From	Zone (mRL) To	Level & Explanation	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sq.m)	Overburden Length of Influence	Overburden Volume (CuM)	ROM (Mn Ore) [Mn≥25%] (Ore) Cross Section Area (Sq.m)	ROM Length of influence	ROM Volume (CuM)
			11325 N	524	532		2788		37.68	50	1894	2.9	50	145
				532	540		5693		113.88	50	5694	11.5	50	575
				540	548		5664		113.28	50	5664			
				540	556		4037		80.74	50	4037			
				556	564		313		6.26	50	313			
		Sub Total					19919	0	355.46		17773	20.44		1022
		11350 N	11325 N 11127 N	492	500	G1 & G2	3973		69.56	50	3479	99.1	50	4570
				500	508		13558		73.50	50	3594	131.24	50	6562
				508	516		9014		37.6	50	1880	49.96	50	2498
				516	524		19794		51.86	50	2593	258.87	50	12944
				524	532		7199		43.08	50	2154	88.58	50	4429
				532	540		6459		103.74	50	5187	19.08	50	954
				540	548		5802		116.04	50	5802			
				548	556		5285		105.7	50	5285			
				556	564		3674		73.48	50	3674			
				564	572		875		17.5	50	875			
				580	588		262		5.24	50	262			
				596	[illegible]		88		1.76	50	88			
		Sub Total					77018	0	699.46		34973	647.00		32394
		11460 N	11427 N - 11427 N	492	500	G1 & G2	1250		54.9	50	2745	9.66	50	483
				500	508		15977		216.12	50	10806	95.58	50	4779
				508	516		22011		318.7	50	15935	40.5	50	2025
				516	524		25173		235.58	50	11779	212.7	50	10635
				524	532		14260		185.72	50	9286	94.6	50	4730
				532	540		10296		235.28	50	11764	38.06	50	1903
				540	548		11910		134.94	50	6747	41.76	50	2088
				540	556		10379		162.56	50	8128	25.02	50	1251
				556	564		16352		280.16	50	14008	44.34	50	2217
				564	572		6017		93.70	50	4685	27.28	50	1364
				572	580		2270		3.48	50	174	36.79	50	1839
				580	588		2021		28.12	50	1406			
				588	596		347		5.49	50	274			
		Sub Total					154462	0	1954.02		97741	606.38		30334

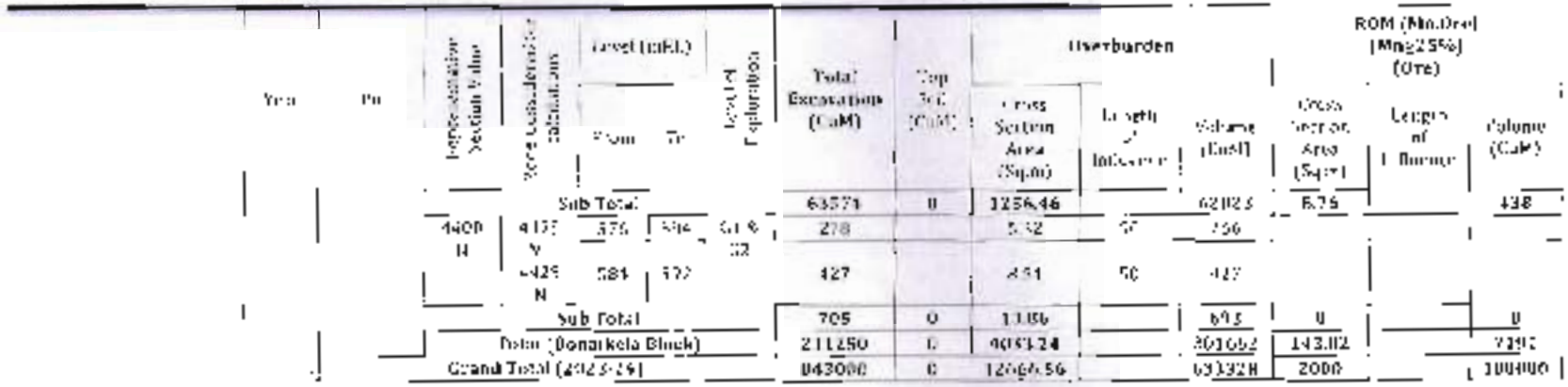
Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Nearest Plane Section Line	Zone Considered for Calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sq.m)	Overburden Length of Influence	Overburden Volume (CuM)	ROM (Mn.Ore) (Mn≥25%) (Ore) Cross Section Area (Sq.m)	ROM Length of Influence	ROM Volume (CuM)
		11450 N	11425 N - 11475 N	508	516	G1 & G2	2500		49.86	50	2493			
				516	524		24440		485.86	50	24293			
				524	532		39339		720.46	50	36023	10.72	50	536
				532	540		25521		440.48	50	22024	27.58	50	1379
				540	548		24697		340.90	50	17045	69.14	50	3457
				548	556		19470		189.02	50	9451	82.62	50	4131
				556	564		24420		220.02	50	11001	191.82	50	9591
				564	572		16869		306.96	50	15348	3.26	50	163
				572	580		1742		[illegible]	50	[illegible]	0.86	50	143
				580	588		251		4.12	50	[illegible]	5.02	50	251
				588	596		150		0	50		3	50	150
		Sub Total					185466	0	2777.74		138687	401.42		20071
		11500 N	11475 N - 11525 N	524	532	G1 & G2	5		0.06	50	3			
				532	540		5380		75.66	50	3783	22.92	50	1151
				540	548		15362		256.18	50	12809			
				548	556		13309		216.18	50	10809			
				556	564		20256		352.7	50	17635	10.56	50	528
				564	572		24045		412.48	50	20624	35.3	50	1765
				572	580		2288		23.04	50	1152	0.16	50	8
				580	588		1564		7.44	50	372	0.19	50	9
				588	596		1757		2.68	50	134	8.24	50	412
				596	604		1496							
				604	612		1275		0.14	50	7	0.04	50	2
				612	620		1501		14.14	50	707			
				620	628		774		14.4	50	720			
				628	636		84		1.82	50	91			
		Sub Total					92007	0	1357.26		67664	76.9		3945
		11550 N	11525 N - 11575 N	548	556	G1 & G2	6355		103.06	50	5153	0.88	50	44
				556	564		13101		159.04	50	7952	0.34	50	17
				564	572		16421		164.42	50	8221	7.52	50	376
				572	580		17624		211.12	50	10556	33.74	50	1687
				580	588		2117		23.2	50	1160			
				588	596		2312		14.4	50	720			

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Representative Section/Plan	Zone Considered in Calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sq.m)	Overburden Length of Influence	Overburden Volume (CuM)	ROM (Mn Ore) (Mn≥35%) (Ore) Cross Section Area (Sq.m)	ROM Length of Influence	ROM Volume (CuM)
				596	604		2005		30.9	50	1545			
				604	612		3095		61.02	50	3051			
				612	620		571		11.12	50	556			
				620	628		43		0.46	50	23			
		Sub Total					60024	0	840.74		42037	42.68		2134
		11600 N	11575 N - 11625 N	572	580	G1 & G2	739		12.76	50	638			
				580	588		6044		101.62	50	5081			
				588	596		4205		63.82	50	3191	0.18	50	9
				596	604		6279		117.9	50	5895			
				604	612		10545		210.72	50	10536			
				612	620		6762		134.68	50	6734			
				620	628		224		4.48	50	224			
		Sub Total					34812	0	645.98		32299	0.18		9
		11650 N	11625 N - 11675 N	596	604	G1 & G2	28		0.56	50	28			
				604	612		262		5.24	50	262			
				612	620		2		0.04	50	2			
		Sub Total					292	0	5.84		292	0		0
		Total (Joribar Block)					651750	0	8634.12		431666	1836.18		92009
	Bonaikela	4750 N	4725 N - 4775 N	560	568	G1 & G2	5047		113.24	50	5662			
				568	576		13548		262.38	50	13119			
				576	584		7756		142.14	50	7107	12.98	50	649
		Sub Total					27153	0	517.76		25888	12.98		649
		4300 N	4275 N - 4325 N	560	568	G1 & G2	36472		688.16	50	34408	54.8	50	2040
				568	576		50061		933.2	50	46660	62.62	50	3131
				576	584		27416		542.42	50	27121	2.66	50	133
				584	592		4069		81.38	50	4069			
		Sub Total					119826	0	2245.16		112258	122.08		6104
		4350 N	4325 N - 4375 N	550	560	G1 & G2	8664		169.94	50	8497	1.5	50	75
				568	576		25083		493.5	50	24675	2.34	50	117
				576	584		21327		426.02	50	21301			
				584	592		8197		163.74	50	8187			
				592	600		163		3.26	50	163			

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON



Year	Pit	Representative Section Value	Zone Considered for calculation	Level (mRL) From	To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)	ROM (Mn.Ore) [Mn≥25%] (Ore) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)
			Sub Total				63571	0	1256.46		62825	8.75		438
		4400 N	4137 W	576	594	G1 & G2	278		5.32	97	756			
			4429 N	584	622		427		8.51	50	427			
			Sub Total				705	0	13.86		693	0		0
			Total (Donarkela Block)				211250	0	4015.24		201062	143.02		7291
			Grand Total (2023-24)				843000	0	12066.56		693328	2000		100400

Table Cont'd

Year	Pit	Representative Section Value	Zone Considered for calculation	Level (mRL) From	To	Level of Exploration	ROM (Mn.Ore) [Mn≥10% <25%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)	Total ROM (Mn.Ore) [Mn≥10%]	Iron Ore ROM [Mn>45%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)
2023-24	Remaining Indian	11300 N	11275 N - 11323 N	508	516	G1 & G2	No development has been proposed			54			
				516	524		4.82	50	241	509			
				524	532		14.90	50	745	804			
				532	540		2.68	50	134	707			
				540	548					0			
				548	556					0			
			Sub Total				22.48		1124	2166	0		0
		11450 N	11425 N - 11375 N	492	500	G1 & G2	10.46	50	524	5430			
				500	508		66.04	50	3302	9750			
				508	516		52.72	50	2636	4131			
				516	524		64.39	50	3219	16260	0.92	50	16
				524	532		12.28	50	614	5041	6.04	50	2
				532	540		0.24	50	12	1000	5.92	50	296
				540	548					0			
				548	556					0			

20/12/24

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Reference Section Value	Zone Considered for calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	ROM (Mn Ore) (Mn≥10% <25%) (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)	Total ROM (Mn.Ore) (Mn>10%)	Iron Ore ROM (Mn≤45%) (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)
				556	564					0			
				564	572					0			
				580	588					0			
				596	604					0			
				Sub Total			186.14		9307	41701	6.88		344
		11400 N	11375 N - 11425 N	492	500	G1 & G2	0.44	50	22	305			
				500	508		67.44	50	3372	8171			
				508	516		80.90	50	4045	6071	0.16	50	8
				516	524		51.18	50	2559	13674			
				524	532		14	50	700	5346	1.04	50	52
				532	540		51.96	50	2598	4501	0.62	50	31
				540	548		61.5	50	3075	5163			
				548	556		49.82	50	2491	1742			
				556	564		40.76	50	2038	4255	1.78	50	89
				564	572		16.19	50	809	2174	0.38	50	19
				572	580		2.28	50	114	1951	2.86	50	143
				580	588		1.6	50	80	80	10.7	50	535
				588	596		0.54	50	27	27	0.92	50	46
				Sub Total			448.68		22434	55768	19.06		953
		11450 N	11425 N - 11475 N	508	516	G1 & G2	0.14	50	7	7			
				516	524		2.94	50	147	147			
				524	532		56.6	50	2830	3076			
				532	540		129.76	50	6488	7062	0.6	50	30
				540	548		83.82	50	4191	4640			
				548	556		118.36	50	5918	10019			
				556	564		76.4	50	3820	11111	0.32	50	16
				564	572		27.14	50	1357	1520			
				572	580		9.82	50	491	931	0.38	50	19
				580	588		1.88	50	94	345	[illegible]	50	200
				588	596					150			
				Sub Total			506.06		25303	45411	[illegible]		405
		11500 N	11475 N - [illegible]	524	532	G1 & G2	0.12	50	6	6			
				532	540		9.92	50	496	1537			

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	FY	Representative Section Value	Zone Considered for Calculation	Level (mRL) From	Level (mRL) To	Level of Exploration	ROM (Mn.Ore) [Mn≥10% <25%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)	Total ROM (Mn.Ore) [Mn>10%]	Iron Ore ROM [Mn≥45%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)
			11525 N	540	548		50.88	50	2544	2543			
				548	556		89.8	50	4490	4490			
				556	564		61.86	50	3093	3621			
				564	572		25.2	50	1260	3045	7.52	50	376
				572	580		4.44	50	222	230	28.08	50	1404
				580	588		1.78	50	89	99	29.82	50	1491
				588	596		0.64	50	32	444	23.48	50	1174
				596	604					0	29.96	50	1498
				604	612					2	24.52	50	1226
				612	620					0	17.88	50	894
				620	628					0	0.08	50	4
				628	636					0			0
		Sub Total					244.64		12231	16076	161.34		8067
		11550 N	11525 N - 11575 N	548	556	G1 & G2	23.16	50	1158	[illegible]			
				556	564		102.64	50	5132	5149			
				564	572		155.6	50	7780	8156			
				572	580		105.42	50	5271	6968			
				580	588		[illegible]	50	[illegible]	3257			
				588	596		31.84	50	1592	1592			
				596	604		9.28	50	464	464			
				604	612		0.68	50	34	34			
				612	620					0	0.3	50	15
				620	628					0			
		Sub Total					493.76		24688	[illegible]	0.3		15
		11600 N	11575 N - 11625 N	572	580	G1 & G2	[illegible]	50	160	160			
				580	588		[illegible]	50	924	[illegible]			
				588	596		20.1	50	1005	1014			
				596	604		[illegible]	50	394	394			
				604	612		0.08	50	4	4			
				612	620		[illegible]	50		0	0.56	50	28
				620	628					0			
		Sub Total					49.52		2476	2485	0.56		28
				595	604					0			

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Representative Section	Zone Considered for calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	ROM [Mn Ore] [Mn≥10% <25%] [Mineral Reject] Cross Section Area (Sqm)	Length of Influence	Volume (CuM)	Total ROY (Mn Ore) [Mn<10%]	Iron Ore ROM [Mn≥45%] [Mineral Reject] Cross Section Area (Sqm)	Length of Influence	Volume (CuM)
		11650 N	11575 N - 11625 N	404	412	G1 & G2				0			
				412	620					0			
		Sub Total					0		0	0	0		0
		Total (Joribar Block)					1952.96		97603	190412	193.44		9672
	[illegible]	4250 N	4175 N - 4225 N	560	568	G1 & G2	3.7	50	185	285			
				568	576		6.50	50	129	129			
				576	584					849			
		Sub Total					12.26		614	1240	0		0
		4300 N	4275 N - 4325 N	560	568	G1 & G2	22.40	50	1124	3564			
				568	576		5.44	50	272	3403			
				576	584		1.24	50	62	595			
				584	592					0			
		Sub Total					29.16		1458	7562	0		0
		4150 N	4125 N - 4175 N	560	568	G1 & G2	4.74	50	213	307			
				568	576		0.9	50	45	408			
				576	584		0.52	50	26	26			
				584	592		0.2	50	10	10			
				592	600					0			
		Sub Total					8.26		413	751	0		0
		4400 N	4375 N - 4425 N	576	584	G1 & G2	0.24	50	12	12			
				584	592					0			
		Sub Total					0.24		12	12	0		0
		Total (Hanakela Block)					47.94		2397	9588	0		0
		Grand Total (2023-24)					2000		100000	200000	193.44		9672

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

TATA

Table No. 2.8 E (Year - 2024-25)

Year	Pit	Representative Section Value	Zone Considered in Calculations	Level (mRL) From	Level (mRL) To	Zone/ Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sq.m)	Overburden Length of Influence	Overburden Volume (CuM)	ROM (Mn Ore) [Mn≥25%] (Ore) Cross Section Area (Sq.m)	ROM Length of Influence	ROM Volume (CuM)
2024-25	Barraian	1450 N	1425 N - 1475 N	548	556	G1 & G2	320		6.40	50	320			
				556	564		8738		174.76	50	8738			
				564	572		14290		285.80	50	14290			
				572	580		901	310	11.82	50	591			
				Sub Total			24249	310	478.78		23939	0		0
		1500 N	1475 N - 1525 N	524	532	G1 & G2	1788		35.75	50	1788			
				532	540		7638		152.76	50	7638			
				540	548		16671		333.42	50	16671			
				548	556		34335		686.70	50	34335			
				556	564		56124		1122.48	50	56124			
				564	572		29396		587.92	50	29396			
				572	580		2362	1870	9.84	50	492			
				Sub Total			148314	1870	2927.30		146369	0		0
		1550 N	1525 N - 1575 N	516	524	G1 & G2	3282		28.56	50	1428	40.14	50	2007
				524	532		16244		323.12	50	16156	1.76	50	88
				532	540		34886		685.52	50	34276	2.48	50	124
				540	548		50580		960.08	50	48004	43.42	50	2171
				548	556		66399		1327.98	50	66399			
				556	564		77234		1544.68	50	77234			
				564	572		35156		703.12	50	35156			
				572	580		16263	1870	287.86	50	14393			
				Sub Total			304316	1870	5857.2		292860	87.8		4390
		1600 N	1575 N - 1625 N	524	532	G1 & G2	12858		85.46	50	4273	77.90	50	3895
				532	540		36633		723.40	50	36170	2.70	50	135
				540	548		51604		816.52	50	40826	43.44	50	2177
				548	556		64031		1290.36	50	64518			
				556	564		73641		1464.02	50	73201			
				564	572		44813		895.26	50	44763			
				572	580		27803		556.06	50	27803			
				580	588		3179	1920	25.10	50	1255			
				Sub Total			335184	1920	5756.12		288256	124.1		6205

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

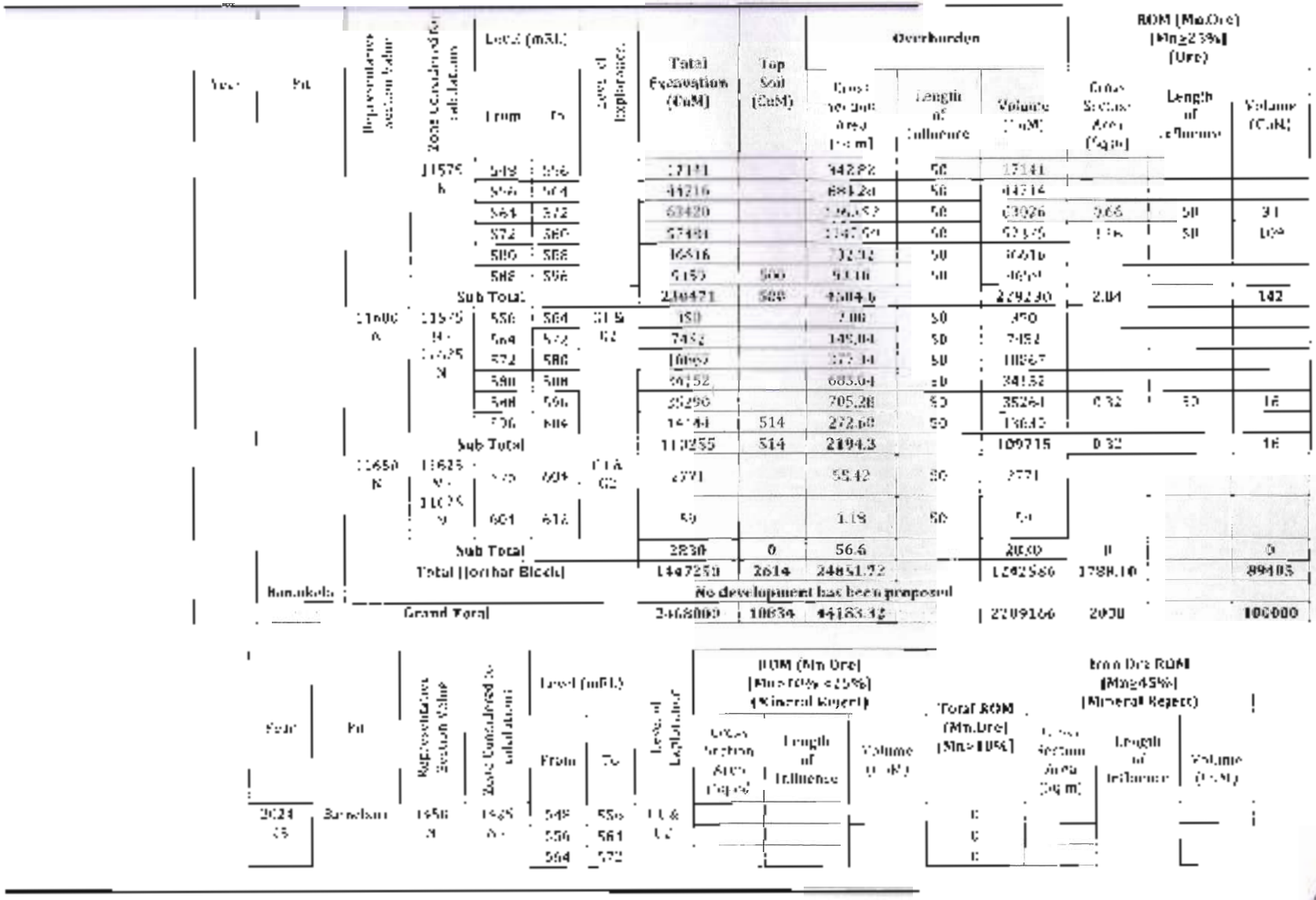
TATA

Year	Pit	[illegible]	[illegible]	Level (mRL) From	Level (mRL) To	[illegible]	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross Section Area (Sqm)	Overburden Length of Influence	Overburden Volume (CuM)	ROM (Min.Ore) [Mn≥25%] (Ore) Cross Section Area (Sqm)	ROM Length of Influence	ROM Volume (CuM)
		1650 N	1625 N - 1675 N	532	540	G1 & G2	13763		222.84	50	11142			
				540	548		24680		509.96	50	23498			
				548	556		48275		953.90	50	47695			
				556	564		58846		1176.92	50	58846			
				564	572		31113		622.25	50	31113			
				572	580		5094		101.89	50	5094			
				580	588		2631	1950	13.62	50	681			
		Sub Total					194360	1950	1701.30		185069	0		0
		1700 N	1675 N - 1725 N	540	548	G1 & G2	69		1.38	50	69			
				548	556		4915		98.32	50	4916			
				556	564		14066		281.32	50	14066			
				564	572		10655		213.10	50	10655			
				572	580		681	300	7.62	50	381			
		Sub Total					30087	300	601.74		30087	0		0
		Total (Bamebari Block)					1020750	8220	19331.6		966580	211.9		10555
	[illegible]	11400 N	11375 N - 11425 N	516	524	G1 & G2	2		0.00	50		0.04	50	2
				524	532		108		0.78	50	69	0.79	50	39
				532	540		5291		99.54	50	4977	2.28	50	114
				540	548		9550		192.60	50	9630			
				548	556		7109		142.18	50	7109			
				556	564		30		0.60	50	30			
		Sub Total					22130	0	435.5		21775	3.1		155
		11350 N	11325 N - 11375 N	492	500	G1 & G2	10658		69.04	50	3452	138.60	50	7206
				500	508		7769		62.60	50	3130	92.46	50	4623
				508	516		24737		315.70	50	15785	108.30	50	5415
				516	524		25571		352.62	50	17631	100.56	50	5028
				524	532		21004		378.04	50	18902	47.80	50	2094
				532	540		20474		409.42	50	20471			
				540	548		20563		411.26	50	20563			
				548	556		20205		404.10	50	20205			
				556	564		1454		29.08	50	1454			
				564	572		1409		28.18	50	1409			
		Sub Total					167079	0	2740.1		137005	457.0		22890

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Representative Section Value	Zone considered for calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden: Cross Section Area (Sq.m)	Overburden: Length of Influence	Overburden: Volume (CuM)	ROM (Mn Ore) (Mn≥25%) (Ore): Cross Section Area (Sq.m)	ROM: Length of Influence	ROM: Volume (CuM)
		11400 S	11375 N - 11425 N	492	500	G1 & G2	7646		97.32	50	4866	52.52	50	2626
				500	508		27479		341.94	50	17097	173.42	50	8671
				508	516		52619		745.72	50	37286	105.86	50	5293
				516	524		50399		756.76	50	37838	177.96	50	8898
				524	532		31554		527.84	50	26392			
				532	540		19916		373.80	50	18690	33.16	50	1658
				540	548		20126		489.34	50	24467	36.38	50	1819
				548	556		23941		459.00	50	22950	0.86	50	43
				556	564		25191		502.60	50	25130			
				564	572		16398	550	454.24	50	[illegible]			
		Sub Total					277152	550	4329.54		216477	580.46		29023
		11450 S	11425 N - 11475 N	500	516	G1 & G2	5671		103.60	50	5180	6.02	50	301
				516	524		39781		767.40	50	38375	227.40	50	11370
				524	532		37633		708.60	50	35430	67.56	50	3379
				532	540		35271		550.96	50	27641	82.40	50	4124
				540	548		21929		389.02	50	19451	135.30	50	6765
				548	556		26057		521.56	50	26078	10.56	50	528
				556	564		17503		349.89	50	17494	0.18	50	9
				564	572		11012		220.24	50	11012			
				572	580		1752	550	20.01	50	1002			
		Sub Total					283915	550	4234.36		211718	529.50		26478
		11500 S	11475 N - 11525 N	516	524	G1 & G2	621		12.42	50	621			
				524	532		20748		324.30	50	16215	63.68	50	3181
				532	540		54704		983.06	50	49153	49.72	50	2446
				540	548		56306		1091.78	50	54589	0.72	50	36
				548	556		64362		1189.54	50	59477	44.46	50	2224
				556	564		63345		1186.54	50	59327	49.02	50	2451
				564	572		45067		880.06	50	44003	10.82	50	541
				572	580		23567		471.34	50	23567			
				580	588		7293	500	143.86	50	7193			
		Sub Total					352415	500	6274.02		313841	214.02		10708
		11550 S	11525 N	532	540	G1 & G2	57		1.14	50	57			
				540	548		6378		122.84	50	6142			

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

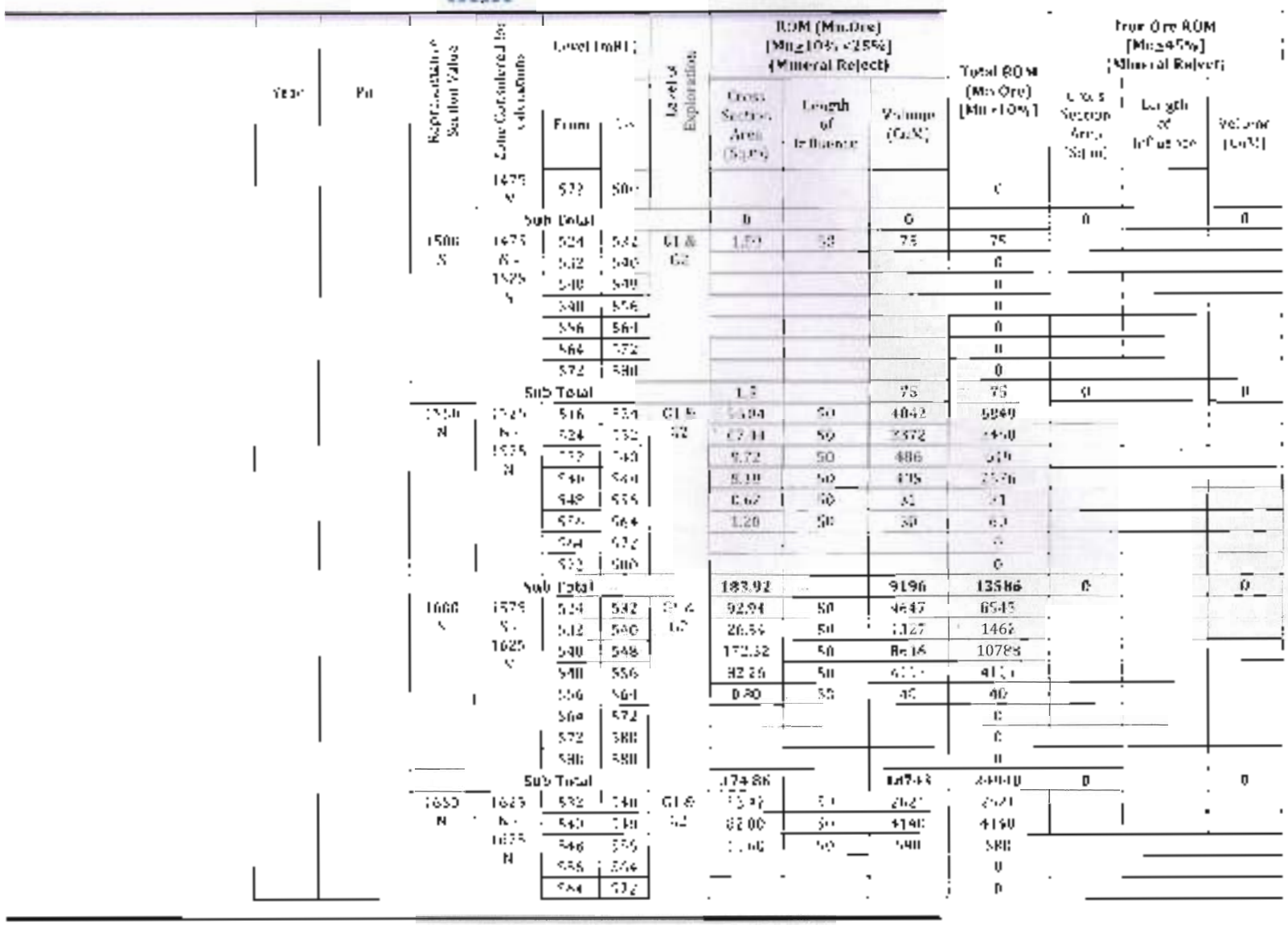


Year	Pit	Representative section taken	Zone Considered for calculation	Level (mRL) From	To	Level of Exploration	Total Excavation (CuM)	Top Soil (CuM)	Overburden Cross section area (Sq m)	Length of Influence	Volume (CuM)	ROM (Mn.Ore) (Min≥53%) (Ore) Cross Section Area (Sq m)	Length of Influence	Volume (CuM)
		11575 N	11625 N	548	556		17111		342.22	50	17111			
				556	564		44216		884.32	50	44216			
				564	572		63420		1268.52	50	63026	0.66	50	31
				572	580		57481		1147.60	50	57325	1.16	50	109
				580	588		16516		330.32	50	16516			
				588	596		9153	500	93.18	50	4659			
		Sub Total					230471	500	4584.6		229230	2.04		142
		11600 N	11575 N - 11625 N	556	564	31 & 32	150		3.00	50	450			
				564	572		7383		148.04	50	7452			
				572	580		16867		337.34	50	16867			
				580	588		34152		683.04	50	34152			
				588	596		35290		705.28	50	35261	0.32	50	16
				596	604		14144	514	272.68	50	13643			
		Sub Total					113255	514	2194.3		109715	0.32		16
		11650 N	11625 N - 11675 N	596	604	31 & 32	2771		55.42	50	2771			
				601	612		59		1.18	50	59			
		Sub Total					2830	0	56.6		2830	0		0
		Total Jorthar Block					1447250	2614	24851.72		1242586	1788.10		89405
	Banakola						No development has been proposed							
		Grand Total					2468800	10834	44163.43		2209166	2030		100000

Table Cont'd

Year	Pit	Representative Section Taken	Zone Considered for calculation	Level (mRL) From	To	Level of Exploration	ROM (Mn Ore) (Min 50% e 53%) (Mineral Report) Cross Section Area (Sq m)	Length of Influence	Volume (CuM)	Total ROM (Mn.Ore) (Min≥ 53%)	Iron Ore ROM (Mn≥45%) (Mineral Report) Cross Section Area (Sq m)	Length of Influence	Volume (CuM)
2024 - 25	Bamebari	11650 N	11675 N - 11725 N	548	556	31 & 32				0			
				556	564					0			
				564	572					0			

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON



Year	Pit	Representative Section Value	Zone Considered for calculations	Level (mRL) From	Level (mRL) To	Level of Exploration	ROM (Min Ore) [Min ≥10% <25%] (Mineral Reject) Cross Section Area (Sqm)	Length of Influence	Volume (Cu.M)	Total ROM (Min Ore) [Min >10%]	True Ore ROM [Min ≥25%] (Mineral Reject) Cross Section Area (Sqm)	Length of Influence	Volume (Cu.M)
			1475 N	572	580					0			
		Sub Total					0		0	0	0		0
		1500 N	1475 N - 1525 N	524	532	G1 & G2	1.50	50	75	75			
				532	540					0			
				540	548					0			
				548	556					0			
				556	564					0			
				564	572					0			
				572	580					0			
		Sub Total					1.5		75	75	0		0
		1550 N	1525 N - 1575 N	516	524	G1 & G2	5.04	50	4842	5040			
				524	532		47.44	50	3672	4410			
				532	540		9.72	50	486	810			
				540	548		8.10	50	405	2376			
				548	556		0.62	50	31	31			
				556	564		1.20	50	30	60			
				564	572					0			
				572	580					0			
		Sub Total					183.92		9196	13586	0		0
		1600 N	1575 N - 1625 N	524	532	G1 & G2	92.94	50	4647	6543			
				532	540		26.54	50	1327	1462			
				540	548		172.32	50	8616	10785			
				548	556		82.26	50	4113	4113			
				556	564		0.80	50	40	40			
				564	572					0			
				572	580					0			
				580	588					0			
		Sub Total					374.86		18743	23043	0		0
		1650 N	1625 N - 1675 N	532	540	G1 & G2	53.47	50	2647	2921			
				540	548		82.00	50	4100	4160			
				548	556		11.66	50	580	580			
				556	564					0			
				564	572					0			

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Representative Section Value	Zone Considered for Calculation	Level (mRL) From	Level (mRL) To	Level of Exploration	ROM (Min Ore) [Mn>10%<25%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)	Total ROM (Min Ore) [Mn>10%]	Interim ROM [Mn>=25%] (Mineral Reject) Cross Section Area (Sq.m)	Length of Influence	Volume (CuM)
				372	380					0			
				380	388					0			
		Sub Total					146.82		7341	7341	0		0
		1170? N	11675 N - 11725 N	540	548	G1 & G2				0			
				548	556					0			
				556	564					0			
				564	572					0			
				572	580					0			
		Sub Total					0		0	0	0		0
		Total (Bamebari Block)					707.1		35355	45930	0		0
	[illegible]	11300 N	11275 N - 11325 N	516	524	G1 & G2				2			
				524	532		6.12	50	306	445			
				532	540					114			
				540	548					0			
				548	556					0			
				556	564					0			
		Sub Total					6.12		306	561	0		0
		11350 N	11325 N - 11375 N	492	500	G1 & G2	25.12	50	1256	7169			
				500	508		0.32	50	16	4639			
				508	516		71.04	50	3552	8907			
				516	524		58.24	50	2912	5940			
				524	532		4.56	50	228	3192			
				532	540					1			
				540	548					1			
				548	556					2			
				556	564					0			
				564	572					0			
		Sub Total					159.58		7964	30874	0		0
		11400 N	11375 N - 11425 N	492	500	G1 & G2	3.08	50	154	2780			
				500	508		34.27	50	1712	13862			
				508	516		200.62	50	10031	15324			
				516	524		71.26	50	3563	12561			
				524	532		103.24	50	5162	5162			

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Pit	Representative Section Value	Zone Considered for calculations	Level (mRL) From	Level (mRL) To	Levels of Exploration	ROM [Min Ore] [Min 10% <23%] [Mineral Reject] Cross Section Area (Sq m)	ROM [Min Ore] Length of Influence	ROM [Min Ore] Volume (CuM)	Total ROM (Min Ore) [Mn>10%]	Iron Ore ROM [Mn<45%] [Mineral Reject] Cross Section Area (Sq m)	Iron Ore ROM Length of Influence	Iron Ore ROM Volume (CuM)
				532	540		91.34	50	4552	5225			
				540	548		75.92	50	3848	5659			
				548	556		33.96	50	1968	1991			
				556	564		0.82	50	41	41			
				564	572					0			
		Sub Total					622.04		31102	60123	0		0
		11450 N	11425 N - 11475 N	508	516	G1 & G2	3.86	50	198	191			
				516	524		80.76	50	4038	15111			
				524	532		387.58	50	19379	27403			
				532	540		269.08	50	13454	17570			
				540	548		114.26	50	5712	12478			
				548	556		53.02	50	2651	3174			
				556	564					0			
				564	572					0			
				572	580					0			
		Sub Total					903.42		45171	71649	0		0
		11500 N	11475 N - 11525 N	516	524	G1 & G2				0			
				524	532		26.93	50	1349	4539			
				532	540		63.96	50	3196	5634			
				540	548		234.28	50	11714	11756			
				548	556		173.24	50	8662	10885			
				556	564		36.54	50	1827	4300			
				564	572		12.46	50	623	1264			
				572	580					0			
				580	[illegible]					0			
		Sub Total					547.46		27373	58074	0		0
		11550 N	11525 N - 11575 N	532	540	G1 & G2				0			
				540	548		4.72	50	236	236			
				548	556					0			
				556	564		0.14	50	7	[illegible]			
				564	572		7.22	50	361	194			
				572	580					109			
				580	588					0			

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON
20/3/20

Year	Pit	Representative Section Value	Section Lines under Consideration	Level (mRL) From	Level (mRL) To	Level of Exploration	ROM (Mn Ore) [Mn≥10%, <25%] (Mineral Reject) Cross Section Area (Sqm)	Length of Influence	Volume (CuM)	Total ROM (Mn Ore) [Mn≥10%]	Iron Ore ROM [Mn>45%] (Mineral Reject) Cross Section Area (Sqm)	Length of Influence	Volume (CuM)
				588	596					0			
		Sub Total					11.90		599	741	0		0
		11600 N	11575 N - 11625 N	556	564	G1 & G2				0			
				564	572					0			
				572	580					0			
				580	588					0			
				588	596		0.20	50	10	26			
				596	604					0			
		Sub Total					0.2		10	26	0		0
		11550 N	11525 N - 11575 N	596	604	G1 & G2				0			
				604	612					0			
		Sub Total					0		0	0	0		0
		Total (Jamhar Block2)					2252.9		112645	202050	0		0
	Sonakela	No development has been proposed.											
		Grand Total					2960		148000	246000	0		0

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

EXISTING BLASTING METHOD:

The purpose of the blasting is to induce a heaving effect so that, excavator can load the blasted material easily into dumpers. The requirement of blasting is mainly to break the hard in-situ patches which otherwise cannot be removed. The blasting is carried out with large diameter (83mm) slurry explosive cartridges. Cap-sensitive slurry explosive cartridges are being used as base charge and non-cap sensitive are used as column charge. The blasting is therefore being conducted in a scattered manner in the quarry.

The details of burden, spacing and explosive consumption pattern in both overburden and ROM are mentioned below.

Depth of the hole	= 6m (bench height) + 10% as sub grade drilling)
	= 6.6 m (max)
Spacing	= 3m
Burden	=2.5m
Volume/ hole (in-situ)	= 45 CuM
Specific Gravity	= 2.5
Tonnage/ Hole	= 112.5 Tonnes
Powder factor	= 5.0 Kg/Tonne
So, Quantity of explosive/hole	= 22.5 Kg.

After charging with 250ms delay DTH & stemming of holes, connection is done with detonating fuse. Cord relay of 25 ms / 50 ms are used for delay in case of normal blasting (i.e. if there is no permanent structure within danger zone not belonging to owner or danger zone is free from intersection of public road etc). Cord Relay of 25 ms / 50 ms is fixed between holes along the spacing as well as between rows. There after shot is fired electrically after taking clearance from guards posted to prevent un-authorized entry to mine.

In case of controlled blasting (i.e in close proximity to roads, buildings etc) bottom initiation pattern by using 250 ms delay Down To Hole (DTH) followed by connection of hole to hole with 17ms Trunk Line Delay (TLD). In case of multi row holes, 42 ms, 65 ms, 100 ms TLD are used for subsequent rows respectively.

The charge per delay in all cases is maintained within 66 Kg to minimize the ground vibration and noise caused due to blasting operation.

The explosives are brought from Joda West magazine which is centrally located and caters to all mines under same management control of the company as when required for blasting for mining operation. The explosives are brought in the working hours and blasting carried out. Blasting operation is / and to be carried out in different blocks at scattered day and time, so that same blasting crew can carry out operations in all the blocks. The copy of explosive magazine and explosive vans licenses in favour of Joda West Iron and Manganese Mines, Tata Steel Limited with validity till 31.03.2024 has been enclosed as Annexure-26. The copy of the certificate issued by competent authority for carrying out blasting operation is enclosed as Annexure-27.

Prepared by,
SABYASACHY MISHRA
QUALIFIED PERSON

Rock breaker is also being operated alternatively for breaking of boulders based on the requirement.

The details of explosives presently used are furnished below in the Table No. 2.3.

TABLE NO. 2.3: DETAILS OF EXPLOSIVES PRESENTLY USED		
Class 2	Aquadyne 83mm	M/s. IDL Chemicals Ltd., Rourkela
	Emulboost 25mm	M/s. IDL Chemicals Ltd., Rourkela
	Energel 83mm	M/s. IDL Chemicals Ltd., Rourkela
	Superdyne 25mm	M/s. IDL Chemicals Ltd., Rourkela
	Supergel 83mm	M/s. IDL Chemicals Ltd., Rourkela
	Tuebiast 83mm	M/s. IDL Chemicals Ltd, Rourkela
Class 6	D Cord 1l	M/s. IDL Chemicals Ltd., Rourkela
	Detonating Fuse	M/s. IDL Chemicals Ltd., Rourkela
	Electric Detonator	M/s. IDL Chemicals Ltd, Rourkela
	Raydet (None)	M/s. IDL Chemicals Ltd., Rourkela

PROPOSED BLASTING METHOD:

The site mixed emulsion (SME) will be used by replacing the usage of explosive with cartridge form after grant of permission and license as applicable. The blasting parameters for proposed SME usage commensuration the present parameters are given below in Table No. 2.4

TABLE NO. 2.4: COMPARISION OF BLASTING PARAMETERS		
Blasting Parameters (Overburden & ROM)	Existing (Cartridge form)	Proposed (SME)
Drill hole diameter[mm]	100	100
Bench height [m]	6-8	6-8
Burden [m]	2.75-3.0	2.75-3.0
Spacing[m]	2.75-3.0	2.75-3.0
Stemming[m]	3.0	3.0
Sub grade drilling[m]	0.4-0.6	0.4-0.6
Charge per hole[kg]	30-33	30-35
Booster gm]	0	100

Further to the mentioned parameters, there may be scope to change the parameters considering the strata and field conditions.

As the development of the mine has been proposed to carry out in 2 shift operation from 2023-24, only drilling activities will be carried out in 2 shift whereas the blasting operation shall be carried out during day light time.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

DEPLOYMENT OF MACHINERIES: -

Considering the yearly excavation during next 5 years for Mn ore Mining as mentioned above in Table No. 2.5 A for manganese, the required fleet size has been calculated for Shovel, Dumper and Drill and ancillary equipment are given in the Table No. 2.9 A, 2.9 B, 2.9 C and 2.9 D respectively for Mn ore mining. Additionally,

In accordance to the Table No. 2.5A, there will be variation of quantity to be handled during each year in an incremental manner. Hence the deployment of Shovels, Dumpers and Drills has been calculated for each year. Due to enhancement of production, maximum development has been proposed during 2024-25 with introduction of 2 shift mining operation. Accordingly, the deployment of machineries has been calculated.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 2.9A

SHOVEL

a	Type of Excavator	Back Hoe	Back Hoe	Basis of Calculation
b	Bucket cap. Cum	2.1	2.1	
c	Working Area	Jamebari, Jothar & Bonaikela (OE + OC)		
d	Fill factor (Shovel)	0.96	0.96	
e	Swell factor	1.1	1.1	
f	Cycle time, sec	32	32	
g	Dumper type	Rear End	Rear End	
h	Dumper cap (loose) Cum	9	9	
h1	Fill factor (Dumper)	0.9	0.9	
h2	Swell factor	1.1	1.1	
i	Spotting time & Idle Time of Dumper, sec.	60	60	
j	Loading time, min.	3.14	3.14	[(b*h1*h2)/(h*d*e)]*[(f+i)/60]
k	Capacity, cum/hr.	171.8	171.8	(60/j)*b
l	No. of day/annum	300	300	
m	No of shifts/day	1	1	
n	hrs/shift	5	6	13 hrs in case of 2 shift Operation
o	Capacity/shovel/annum, cum	309273	309273	k*l*m*n
p1	**Yearly Excavation, CuM (Year - 2020-21)**	360500	89750	
q1	Working fleet required	2.06	0.29	p1/o
r1	Recommended working fleet	1	1	Rounded
s1	Availability (%)	85	85	
t1	Fleet required	2.4	0.3	(q1/s1) * 100
u1	Recommended fleet	3	1	Rounded
p2	**Yearly Excavation, CuM (Year - 2021-22)**	344750	115500	
q2	Working fleet required	1.11	3.19	p2/o
r2	Recommended working fleet	1	1	Rounded
s2	Availability (%)	85	85	
t2	Fleet required	1.3	0.2	(q2/s2) * 100
u2	Recommended fleet	2	1	Rounded
p3	**Yearly Excavation, CuM (Year - 2022-23)**	401110	495390	

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

q3	Working fleet required	1.30	1.60	p3/r
r3	Recommended working fleet	1	2	Rounded
s3	Availability (%)	85	85	
t3	Fleet required	1.5	1.9	(q3/s3) * 100
u3	Recommended fleet	1	2	Rounded
p4	**YearlyExcavation, CuM (Year - 2023-24)**	631750	211250	
q4	Working fleet required	2.04	0.68	p4/o
r4	Recommended working fleet	2	1	Rounded
s4	Availability (%)	85	85	
t4	Fleet required	2.4	0.8	(q4/s4) * 100
u4	Recommended fleet	3	1	Rounded
p5	**Yearly Excavation, CuM (Year - 2024-25)**	1447250	1020750	
q5	Working fleet required	2.34	1.65	p5/o /2 (2 Shift Operation)
r5	Recommended working fleet	3	2	Rounded
s5	Availability (%)	85	85	
t5	Fleet required	2.8	1.9	(q5/s5) * 100
u5	Recommended fleet	3	2	Rounded

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 2.9 B

		DUMPER		
a	Type	Rear End	Rear End	Basis of Calculation
b	Working Area	Bamebari, Joribar & Bonaikela (OB + Ore)		
c	Bumper cap (ins.tn), cum.	9	9	
c1	Fill factor	0.9	0.9	
c2	Swell factor	1.1	1.1	
d	Loading time, min.	3.14	3.14	4 of Shovel
e	Avg. Lead distance, km.	2	2	
f	Speed, km/hr.	20	20	
g	Travel time, min	12.00	12.00	e * 2/f * 60
h	Unloading time, min	2	2	
i	Total cycle time, min	17.14	17.14	d+g+h
j	Bumper cap.(ins.tn), cum/hr	31.49	31.49	60/i*(c*c1*c2)
k	No. of day/annum	300	329	
l	No. of shifts/day	1	1	no of Shovel
m	hrs/shift	6	6	r of Shovel (13 hrs in case of 2 Shift Operation)
n	Capacity/dumper/annum, cum	56133	56133	j * k * l * m
o1	**Yearly Excavation, CuM (Year - 2020-21)**	**360500**	**89750**	
p1	Working fleet required	6.42	1.60	o1 / n
q1	Recommended working fleet	7	2	Rounded
r1	Availability	75	75	
s1	Fleet required	8.56	2.13	p1/r1 * 100
t1	Recommended fleet	9	3	Rounded
o2	**Yearly Excavation, CuM (Year - 2021-22)**	**344750**	**115500**	
p2	Working fleet required	6.14	1.03	o2 / n /
q2	Recommended working fleet	7	1	Rounded
r2	Availability	75	75	
s2	Fleet required	8.19	1.37	p2/r2 * 100
t2	Recommended fleet	9	2	Rounded

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

o1	**Yearly Excavation, CuM (Year - 2022-23)**	**401110**	**495390**	
p3	Working fleet required	7.15	8.83	o3 / n
q3	Recommended working fleet	8	9	Rounded
r3	Availability	75	75	
s3	Fleet required	9.53	11.77	p3/r3 * 100
t3	Recommended fleet	**10**	**12**	Rounded
o4	**YearlyExcavation, CuM (Year - 2023-24)**	**631750**	**211250**	
p4	Working fleet required	11.25	3.76	o4 / n
q4	Recommended working fleet	12	4	Rounded
r4	Availability	75	75	
s4	Fleet required	15	5.02	p4/r4 * 100
t4	Recommended fleet	15	6	Rounded
o5	**Yearly Excavation, CuM (Year - 2024-25)**	**1447250**	**1020750**	
p5	Working fleet required	12.89	9.09	o5 / n / 2 (2 Shift Operation)
q5	Recommended working fleet	13	9	Rounded
r5	Availability	75	75	
s5	Fleet required	17	12.12	p5/r5 * 100
t5	Recommended fleet	18	12	Rounded

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON
191

TATA

Table No. 2.9 C

	DRILL					
	Year >	2020-21	2021-22	2022-23	2023-24	2024-25	Basis of Calculation
a	Yearly Excavation (in-situ), CuM	450250	460250	896500	843000	2468000	
b	Formation	OB+Ore	OB+Ore	OB+Ore	OB+Ore	OB+Ore	
c	Drilling requirement, CuM	435225	414225	806850	758700	2221200	~ 90% of In-situ Excavation
d	Drill hole diameter, mm	100	100	100	100	102	
e	Yield cum/m	7.5	7.5	7.5	7.5	7.5	Spacing 3m & Burden 2.5m
f	Drilling reqd. m	54030	55230	107580	101160	296160	c / e
g	Drilling rate, m/hr.	25	25	25	25	25	
h	Drill Hours required	2161	2209	4303	4046	11846	f / g
i	No. of day/annum	300	300	300	300	300	
j	No. of shifts/day	1	1	1	1	1	
k	hrs/shift	6.5	6.5	6.5	6.5	13	2 Shift during 2024-25
l	Working fleet	1.11	1.13	2.21	2.08	1.52	h/(i*j*k)
m	Availability (%)	75	75	75	75	75	
n	Required fleet size	1.48	1.51	2.94	2.77	2.03	l/m%
o	Recommended fleet size	2	2	3	3	3	

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 2.9 D
(Ancillary Equipment)

Equipment	Capacity	Fleet Size (Nos.)
Front End Loader	2.00 Cu.m	2
Jack Hammer drill	32-37 mm	1
Compressor	365 cfm	2
Placer Dumper	3.00 Cum	2
Dozer	120 HP	3
Water Sprinkler	9000 litres	5
Explosive Van	10 tonnes	2
Jeeps		5
Flat Body Truck		2
Ambulance		2
Crane	3 tonnes	2
Rock Breaker		2
Screen (75 Tph)		1
Feeding Shovel (PC 200)	0.9 Cum	1

The machineries including ancillary equipment deployed as on 01.04.2020 and proposed to be deployed during the plan period is furnished below in Table No 2.9E

Table No. 2.9E

Equipment	Capacity	Existing Deployment As on 01.04.2020	Proposed Deployment of Machineries during plan period (Max. Nos.)
Shovel (Back Hoe)	1.8 CuM	2	0
Shovel (Back Hoe)	0.8 CuM	1	0
Shovel (Back Hoe)	2.1 CuM	2	3
Dumpers	25 T	20	30
Dumpers	16 T	1	1
Dumpers	13 T	2	2
Drills	110 mm	1	3
Front End Loader	2.00 Cum	1	2
Road Grader	200 HP	0	1
Jack Hammer drill	32-37 mm	9	1
Compressor	365 cfm	0	2
Placer Dumper	3.00 Cum	0	2
Dozer	180 HP	1	3
Water Sprinkler	9000 litres	1	2
Water Sprinkler	15000 litres	1	3
Explosive Van	10 tonnes	1	2
Jeeps		3	5
Flat Body Truck		1	3
Ambulance		1	2
Crane	5 tonnes	1	2
Rock Breaker		0	2
Screen (75 Tph)		0	1
Feeding Shovel (PC 200)	0.9 Cum	0	1

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

d) DESCRIBE BRIEFLY GIVING SALIENT FEATURES OF THE PROPOSED METHOD OF WORKING INDICATING CATEGORY OF THE MINE.

Proposed Method of Working

Manganese mine operations are spread at Bamebari, Joribar and Bonaikela Blocks of Bamebari Manganese Mine lease

The manganese ore deposits occur as small lenses and irregular veins. In spite of lot of geological exploration already done the occurrence of manganese ore and its continuity is still very unpredictable. This plan has been prepared with a view to mine in areas having the highest potential of proved and probable mineral reserve and having relatively large ore zones. This is done with a view to have concentrated workings in order to economize on the other resource requirements. However, there are many other small pockets of ore, where such detailed exploratory drilling may not have been viable and are therefore often ignored at the planning stage.

Considering the high demand of high-grade manganese ore, it will be necessary to open up many more production faces simultaneously. It is often very difficult to meet the production demand as per plan due to the sudden disappearance of the ore body in contradiction with the geological predictions. The availability of sufficient high-grade ore also varies with the geological predictions. Under the circumstances, it is sometimes necessary to resort to exploratory mining in new areas based on surface exposures or even where sufficient geological information is yet to be collected. Often such areas are worked for a very short span of time because of very low reserves at Bamebari & Bonaikela Block. Thus, while the development plans for major pits have been covered, the smaller ore zones that may be mined mostly as a contingency measure.

In order to facilitate the deep hole blasting and safe movement of existing HEMM fleet, the bench angle will be maintained at 85° and overall pit slope at 35° max. Overburden and ROM will be removed by using shovel-dumper combination. The benches will be maintained with 6 – 8 m high with width of 8 – 10m. The haul road having width of 10 – 12m w.r gradient of 1:16 has been assumed for designing of pits. Haul roads are to be maintained with 3 to 4 times the width of the largest haulage unit with extra width employed on the curves for safe movement of the dumpers. Horizontal curves will also be maintained to ensure the driver of the haul truck to negotiate the curve safely at given speed.

Blast holes for both overburden and ore will be drilled by 100mm diameter crawler drills.

Similarly, the blasted run-off mine ore will be hauled to sorting places located at the top of the quarry. The ROM will be then dressed, sorted, sized and graded manually at sorting place. The different quality of finished ore will be loaded manually to the dumpers and transported to stacking ground for stacking the ore in regular geometrical shapes and samples are collected and analysed at our laboratory. Then removal permission is to be obtained from Mining & Geology Department.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Government after stack verification. Further to increase the productivity of 1.44 t/manshift to 2.50 t/manshift, physical separation of ROM with double deck mobile screening unit will be carried out during 2020-21.

Thereafter, the stocks will be d spatched to designated place as mentioned in the ore removal permission obtained

Miscellaneous operations in the mine will include levelling of dumping yard, preparation and maintenance of haul roads, dozing of boulders from the mine face, loading of trucks at stack yard etc.

Cartently mining operation is restricted to day time (General shift) only. Necessary permission under MMR 106(2)(b), 1961 from the Directorate General of Mines Safety (DGMS) has been obtained vide letter No. 360070/1.95. Dt. 31.05.2016 (Annexure 29). However, to meet the excavation target of overburden of the mine, provision will be kept open for mining operation beyond daylight hours from 2024-25 onward for which permission shall be sought from DGMS to work beyond day light hours. The 2nd shift operation will start upon getting the permission. The operation will be restricted to overburden benches beyond day light with a view of achieving the proposed stripping ratio in the proposed planned period.

CATERGORY OF THE MINE –

As the Mine is operated with the deployment of heavy machineries for deep hole drilling, excavation, loading and transport and average employment exceeding one hundred and fifty, the mine is being categorised as "A" Catergory" in accordance to the Rule 55 (2) (a) of MCDR, 2017.

e) **DESCRIBE BRIEFLY THE LAYOUT OF THE MINE WORKING, PIT ROAD LAYOUT, THE LAYOUT OF THE FACES AND SITES FOR DISPOSAL OF OVERBURDEN / WASTE ALONG WITH GROUND PREPARATION PRIOR TO DISPOSAL OF WASTE, REJECT ETC.**

Mine Working, Pit Road Layout & layout of the faces –

The pit benches are being planned with 6 – 8 m high with width of 8 – 10m as concurrent to the existing parameters. The haul road having width of 10 – 12m with gradient of 1:16 has been assumed for designing of pits. Haul roads are designed to be 3 to 4 times the width of the largest haulage unit (for 2 way traffic) with extra width employed on the curves. Horizontal curves are designed to ensure the driver of the haul truck can negotiate the curve safely at given speed. The layout of the haul road has been shown in the DWG 10A, 10B and 10C. The overburden quantities that has to be removed in the respective quarries have been arrived at based on the stripping ratios.

Sites for Disposal of Overburden / Waste –

The following points are taken into consideration for selecting site for the disposal of waste.

(i) Area of disposal should be barren.
(ii) Area should be in proximity to the places of work to avoid long hauls/ lead.
(iii) The area so selected should not be over land earmarked for township/ other ancillary facilities connected with the mining or proposed to come up in near future.

While selecting the dumping space for waste disposal all the above points had been considered.

Ground Preparation for disposal of Waste –

Prior to disposal of waste over any virgin land / existing dump requiring the further extension, efforts shall be taken prepare a road up to maximum proposed extent. The trees if any to be cleared as directed by State Forest Department while granting of tree felling permissions. After such tree clearance, protective measures like retaining wall, garland drain and check dams as proposed will be constructed. The disposal of waste will be carried out in a retreating manner with 10m max terrace height and width. While moving back in a retreating manner of disposal, efforts to be taken to rehabilitate the matured slopes of the dump by conventional plantation / vetiver grass to minimise the soil erosion.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Disposal of Overburden / Waste -

The existing waste dump at Bamebari pit is restricted for further enhancement due to no space at northern and western side due to presence of safety zone near lease boundary and presence of mine entrance at southern side. Only the space available at eastern side will subsequently converged with ensuing back filling. As proposed in the proceeding approved Scheme of Mining, all the over burden material excavated during mining will be backfilled in the quarry only. Further the overburden generated in Bamebari pit shall be completely backfilled in the old Bamebari Quarry.

This is pertinent to mention that, as per earlier approved proposal, Overburden from Jothbar Quarry is being disposed off at Bamebari Block for quarry back filling. This was due to lack space for OB disposal on account of delay in grant of forest clearance. In this same manner, OB from Jothbar will be continued to dispose off till end of 2022-23 and we expect to obtain the forest clearance. Accordingly, the OB will be disposed off over the existing Waste Dump JB (D#1) by lateral extension from 2023-24 subsequent to proving of non-mineralisation.

The overburden generated in Boneikela block will be nominal as the ore deposit that is proposed to be mined out is present as an outcrop. The overburden generated will be disposed over new area within the extent of 4395N - 4606N & 4890E - 5180E having non-mineralised zone based on the surface exposures. However, bore holes will be drilled to confirm the non mineralisation of the area before commencement of disposal of overburden.

The proposed waste dump plans and sections for Bamebari, Jothbar and Boneikela and back filling of old pit in Bamebari Quarry are shown in drawing no. DWG 14A, DWG 14B and DWG 14C respectively.

f) Conceptual Mine Planning up to 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 relevant sections.

Excavation -

As mentioned earlier in this mining plan the production demand of high grade and medium grade ore will continue to be higher and will demand opening of more number of production faces in order to meet the production, particularly for high-grade manganese ore. Once a patch or small pocket of ore is completely exploited, the production from that quarry drops drastically till another pocket of ore is exposed for exploitation.

Since such pockets within a quarry are usually quite far apart both laterally as well as depth, exposure of new pocket of ore takes substancial time. It is therefore necessary to develop another location in advance and keep the ore exposed to take care of such exigencies in order to maintain the production level at a steady state. With the depleting reserve base and increased production demand it shall no longer be possible

Prepared by,
SABYASACHY MISHRA
QUALIFIED PERSON

to meet the entire production from the present major working pits of Joribar of Bamebari Manganese Mines for the next five years. It shall therefore be necessary to exploit the other small occurrences at the Bamebari, Joribar, Bmnaike'a Quarry.

In view of the mineral conservation and proper utilization of low grade manganese ore produced from the mine which amounts to around 35% of total production, Research and development initiatives have been taken up by R & D wing of Tata Steel to come up with a breakthrough beneficiation technique for enriching the low-grade manganese ore. The progress in this direction is quite satisfactory and the results are very much promising. We hope to commission a common beneficiation plant within Joda West Mining Lease in near future which will be a first of its kind in India for beneficiation of low grade unusable ore being produced from our mines. In addition to this, we are also exploring the possibilities of beneficiation of low grade ore with local parties on conversion basis.

The deposits of manganese ore in the entire lease follows no regular pattern and the mine operation staff relies heavily on the experienced mining personnel who are able to often provide worthwhile additional clues to the patchy and tricky occurrences. Thus, exploration activities are planned and carried out based on these field observations, yet it is extremely difficult to predict the evolving shape of the pits and to estimate the ore reserves for an accurate prediction of the life of the pits.

An effort has been made to conceptualize the mining operation under such conditions for exploitation of the ore bodies.

This is also pertinent to mention that, the present method of winning of ore by opencast mining method will also to be continued till end of lease period i.e. of 31.03.2020 within the applied area over 464 ha

The overall stripping ratio (OB in CuM / ROM in MT) is 4.5 with waste of total 52.62 Lakh CuM which is to be handled during this plan period. This stripping ratio may shift up to 5.40 during next plan period from 2025-26 to end lease period i.e. 31.03.2030 while working at greater depth. Considering the present proposed level of production of Mn. Ore @ 2.33 LMT, waste of total 63 Lakh Cum will be excavated during next plan period of 2025-30. To accomodate these excaved waste, scope of back filling shall be worked out to minimise the requirement pof additional land for waste disposal.

Recovery from ROM

This is pertinent to mention that, the entire ROM (> 10% Mn. content) is being considered for consumption since 2019-19, hence the recovery of the grade wise product at present is 100%. The mineral fines do not have a regular demand throughout the year and being occasionally consumed by Ferro alloys making plants. Hence, the unblended fines will be stored for usage as when required.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Disposal of Waste –

As mentioned above, ~120Lakh CuM of waste to be generated during this plan period and next plan perid from 2025-26 to end lease period i.e. 31.03.2030. To accomodate these excavetd waste, scope of back filling shall be worked out at first instant to minimise the requirement pof additional land for waste disposal. If such back filling scope not arise, then plan for disposal over non mineralised area can be envisaged.

Backfilling of Voids

After the pits have been exhausted of minerals, the backfilling will commence. A part of Bamebari pit has already been backfilled in accordance to the approved proposals. In the plan period, it is proposed to backfill the Bamebari pit from the overburden generated in Jeribar block. After the Bamebari pit is devoid of mineral, backfilling will have continued to be done from overburden generated from the Jeribar block until the pit is fully reclaimed. After the pits are reclaimed it will be rehabilitated by plantation. In the event backfilling material is not available rehabilitation will be done by water harvesting in lower benches.

Reclamation & Rehabilitation – The reclaimation of the mining pits by back filling will be carried out once exhausted. The old exposed benches have been conceputaulised to be rehabilitated by plantation. The waste dumps will be afforestated when they are permanently abandoned/ matured. The afforestation of the dumps and mining benches will be done by following methods.

a) Method of pitting and planting –

i. The worked-out mining benches will be reclaimed by making pits 0.3 m X0.3 m X0.3 m size 2m apart. The pits will then be filled with sweet earth, sand and cow-dung.
ii. Neem cake powder will be applied in the pit to protect the plants from white ants.
iii. Such ground preparation will be done before monsoon after which appropriate varieties of saplings will be planted during monsoon.

b) Method of planting by contour trenching -

This method is proposed for slopes wherein contour trenches are dug at 3m interval along the contour. The excavated earth is stacked on the edge of the trench on the lower slope side to arrest the water flow that comes due to rains and accumulates on the trenches and gradually seeps through the strata enabling the planted saplings to get water and nutrients regularly for healthy growth.

Life of Mine –

At the proposed average rate of ROM excavation during the plan period 2020-21 to 2024-25 (i.e. ~0.370 mtpa), the anticipated life of mine is about 8 years by considering the reserves and resources available as on 01.04.2020.

Manganese Ore Beneficiation –

At present, the manganese ore is being dressed, sorted, sized and graded manually at sorting yard. The process of mineral beneficiation of the low-grade manganese ore is known since long. A beneficiation process flow sheet is in process to explore to upgrade these ores using high intensity magnetic separators and reduction roasting followed by low intensity magnetic separation. Beneficiation and agglomeration test is being carried out to demonstrate the beneficiation process flow sheet at R & D, Tata Steel, IIMT- Bhubaneswar and Mintek Laboratory of South Africa. High Intensity magnetic separation can upgrade the Mn ore up to usable for Silico Manganese Production and detail test work on reduction roasting process is in progress to upgrade this resource, which can be used for Ferro manganese making. The progress in this direction is quite satisfactory and the results are very much promising. We hope to commission a common beneficiation plant within Joda West Mining Lease in near future which will be a first of its kind in India for beneficiation of low grade unusable ore being produced from our mines. In addition to this, we are also exploring the possibilities of beneficiation of low-grade ore with local parties on conversion basis.

However, the economic viability of the process is under study in view of the high energy cost. Our company's R&D proposed to take up pilot plant studies for assessing the feasibility of beneficiation of the low grade manganese ores and fines.

Further, the (<58% Fe Content) iron ore will be incidentally generated as mineral reject during development of benches from the zones overlying over manganese ore. However, it will be stacked separately till viability of any future usage. The economic viability for up-gradation by means of beneficiation of this ore will be studied based the on the available reserves and resources for its effective usage at our steel plants located at Jamshedpur and Kalinga Nagar.

Further, a beneficiation process flow sheet is in process to explore to upgrade these ores using high intensity magnetic separators and reduction roasting followed by low intensity magnetic separation. Beneficiation and agglomeration test is being carried out to demonstrate the beneficiation process flow sheet at R & D, Tata Steel, IIMT-Bhubaneswar and Mintek Laboratory of South Africa.

High Intensity magnetic separation can upgrade the Mn ore up to usable for Silico Manganese Production and detail test work on reduction roasting process is in progress to upgrade this resource, which can be used for Ferro manganese making.

In view of mineral conservation and proper utilization of low grade manganese ore produced from Bamebari Iron and Manganese Mines and other surrounding manganese mines of Tata Steel Ltd. We propose to commission a beneficiation plant during the mining plan period which will be for beneficiation of low grade unusable ore being produced from our mines.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

The details of study for beneficiation of Low/ Sub Grade Manganese Ore and Fines carried out so far:-

Reduction roasting has been explored to convert the feebly magnetic hematite to magnetite using coal but techno economics is challenging issue. The high intensity magnetic separator can recover the feebly magnetic particles but particle size as well as liberation characteristics play a crucial role in this process. Reduction roasting studies were carried out for temperature range 500°C to 1000°C using various types of reductant. These studies were carried out and major findings are.

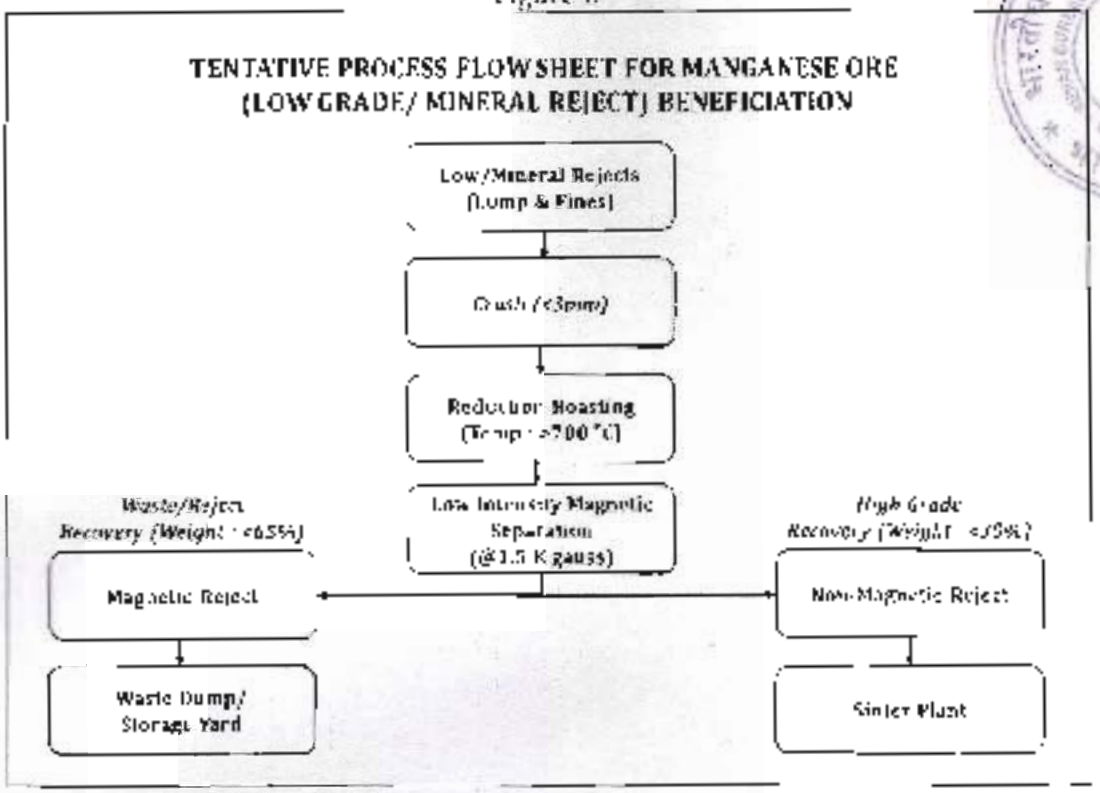
1. Roasting in coarser sizes (+6mm) is not successful and <3mm is most suitable size
2. FeMn grade product (Mn >46%, Mn/Fe >7%) can be achieved at yield depends on roasting temperature (700-1000°C) and time. Weight Recovery was 37-45%, and test work in progress to optimize that.
3. R&D Tata Steel and MINTEK, South Africa is doing detailed test work (prompt. 800, 900,1000°C, Time. 2,4 and 6 hours. Ore types : 5 to produce high grade Mn ore concentrate using low grade ore fines.
4. Yield and product grade is sensitive to sources of low grade at different mines sites and composition (Fe & SiO_2).

Sintering Process also carried out for agglomerate the Mn ore fines and found to be commercially viable to utilize the ore fines. So, the area of work to commercialize this project are as follow:

1. Techno-economic studies of different process flow sheets (Fig. 2)
2. Material balance for beneficiation plant inputs and output disposal plans
3. Detailed Project Report for Sinter plant and beneficiation plant
4. Statutory requirements for beneficiation and sinter plant.

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Figure 2



With the completion of feasibility study, it is proposed to use the low-grade ore from the mines and beneficiate centrally ores from all the manganese leases of Tata Steel and elsewhere.

The report for one of the trail conducted so far as to establish the feasibility of the beneficiation process with optimum weight recovery (Trial recovery ~50%) is being enclosed as Annexure – 39.

Process for utilization of low grade and mineral reject of manganese ores

Utilization of low and subgrade manganese ores and fines (Mn <30%) in pyro-metallurgical extraction process of high carbon ferromanganese production is limited due to stringent ore requirements of submerged arc furnace process and the ferruginous nature of ore. Therefore, hydro and electrolytic processing of captive low grade manganese ores for production of valuable market saleable products like manganese sulphate ($MnSO_4$) crystals, manganese carbonate ($MnCO_3$) powder and electrolytic manganese metal (EMM) and manganese dioxide (MnO_2) is carried out. Process development includes various unit operations such as reductive leaching, precipitation, sulphide precipitation followed by evaporation to produce crystals, electrolysis of leach solution and furnace melting (induction). Bench scale leaching tests were carried out with three sets of reductants which includes charcoal, starch and sulphur dioxide. Process parameters (optimum pulp density, reductant dosage; pH; oxidation-reduction potential; temperature and time) are established at laboratory scale. At these optimum process conditions, tests were carried out at 5 litres reactor to

evaluate the techno commercial aspects of the process. Tata Steel have plans to conduct the large-scale testing with continuous operation at pilot plant for production of above products and eventually establish the market acceptability of the Mn bearing products. The pilot plant having capacity to treat 200-250 kg/h of lean grade manganese ore is planned for generating the products and process scale up information in order to establish the process at large scale and market acceptability of the new products.

Land Use Pattern :-

The detailed land use pattern at Bamebari lease over an area of 464 ha. at present and at the end of lease period as conceptualised is furnished below. The break up of the land use pattern within the retained lease area of 464.000 ha.) has been furnished in the same table. (Table No. 2.10).

The balance area of 686.55 ha. which is under surrender process, shall be remain untouched during this plan period. The Final Mine Closure Plan (FMCP) over an area of 686.550 ha out of the original lease area of 1150.550 ha was submitted and approved by Indian Bureau of Mines, Bhubaneswar Region vide letter no. FMCP/FM/04-ORI/RHQ/2014-15, dated 20.01.2015 (Copy enclosed as Annexure-33). Accordingly, the Certificate was also granted vide letter no. T/FMCP/C/01/BHQ/2011/267, dated 31.05.2016.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 2.10

S. No	Type of Use	As at Present as on 01.04.2020 (ha.)				As at end of lease period (as on 31.03.2030) (ha.)			
		Bamebari	Joribar	Bonaikela	Total	Bamebari	Joribar	Bonaikela	Total
1	Area Excavated	25.747	16.173	45.920	87.840	39.65	36.760	58.680	135.090
2	Storage of Top Soil	0	0	0	0	0	0	0	0
3	Waste Dump	21.712	12.812	11.010	45.534	30.812	27.200	26.120	84.132
4	Mineral Storage	1.823	2.193	4.000	8.016	3.14	8.330	4.500	15.970
5	Infrastructure (Workshop Magazine etc)	2.000	1.256	0.830	4.086	1.25	4.475	0.830	6.555
6	Roads	3.100	3.58	3.740	10.420	6.78	3.380	8.300	18.360
7	Railways	0	0	0	0	0	0	0	0
8	Tailing Pond	0	0	0	0	0	0	0	0
9	Effluent Treatment Plant	0	0	0	0	0	0	0	0
10	Mineral Separation Plant	0	0	0	0	0	0	0	0
11	Township Area	17.346	7.004	0	24.350	18.682	6.540	0	25.222
12	Others - Green Belt	11.460	9.594	0	21.054	4.11	4.115	5.470	13.695
	Area remain Un touched	56.822	38.383	167.500	262.710	35.576	0.000	128.90	164.476
	Total	140.000	91.000	233.000	464.000	140.000	91.000	233.000	464.000

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

II. `DUMP REHANDLING (FOR THE PRUPOSE OF RECOVERY OF MINERAL):

No dump working for recovery of ore is envisaged during this plan period.

B. UNDERGROUND MINING:

None

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON
TATA STEEL LIMITED FERRO ALLOYS & MINERALS DIVISION
BAMEBARI IRON & MANGANESE MINE, AT/P.O - BAMEBARI, VIA JODA, DIST: KEONJHAR (ODISHA)

3.0 MINE DRAINAGE

a) Minimum and Maximum depth of water table based on observation from nearby wells and water bodies-

While carrying out the hydro-geological studies it was reported that a test hole was drilled near the mine working down to at least 10% more than the ultimate pit depth. Top most RL of bore well was 545 m amsl. Water table was encountered 36.05 m RL i.e at 508.95 m during post monsoon season and in pre-monsoon season it was at 38.66 m. (i.e at 506.3 m amsl) which is below 537 m RL. The Bamebari block consists mainly of two hills along the same ridge, one towards north and the other towards south. The highest & lowest heights attained in the region are 624 m in north-east & south-east and 546 m in north west, respectively. Copy of the Hydro Geological Study Report is being enclosed as Annexure – 31

Bamebari Block: The mining operation at Bamebari Quarry consist of two parts, the southern part of the quarry is exhausted and northern part of the quarry is active and under operation. The overburden of northern part is being used to back fill the southern part as per the approved Scheme of Mining. The maximum depth of the southern part is 73.6m with top and bottom levels are 596 mRL and 522.4 mRL respectively. Similarly, the maximum depth will be up to 546 mRL at end of the plan period (i.e 31st Mar'2020) i.e. no further extension beyond existing ultimate pit depth.

Joribar Block: The Joribar Block has an undulating terrain consisting of small hillocks towards the western and northern part with a gentle slope towards east. The highest & lowest heights attained in the region are 646 m in west & 514 m in east.

During study, it was observed that water table lies approximately 492 m AMSL during pre-monsoon and 496m AMSL during post-monsoon period. In both season (Pre-monsoon and Post-monsoon) water table remains below the ultimate pit depth of 496m. Hence, the Mine workings will not intersect groundwater table in the lease area and no requirement of pumping to evacuate water except accumulated surface run off caused due to heavy rain fall

Bonaikela Block: In Bonaikela the area is mainly hilly terrain with prominent hills in the North-Western and North-Eastern part and steeply sloping towards south. The highest & lowest heights are 717 m & 501 m in the North-eastern and southern part of the block. The table lies approximately 512.4 m AMSL during pre-monsoon and 514.2m AMSL during post-monsoon period. The pit bottom will be 580 mRL at the end of plan period which is well above the ground water level

b) Indicate maximum and minimum depth of working-

The block wise proposed maximum working mRL during the plan period, minimum and maximum water table (in mRL) during post-monsoon and pre-monsoon have been shown in the table 3.1.

Table No. 3.1

Block	At the start of the plan period(mRL) (as on 31.04.2023)		At the end of the plan period(mRL) (as on 31.03.2025)		Water table (Post Monsoon) (mRL)	Water table (Pre Monsoon) (mRL)
	Top	Bottom	Top	Bottom		
Bamebari	625	548	588	516	509	506
Joribar	636	508	613	492	495	492
Bonaikela	536	540	600	528	514	512

As the mine will be developed from bottom to top, main sump area will be at bottom of the quarry to accommodate the rain water for which 6-8m max. depth in addition to annual limit as well as OPL has been considered in calculation of excavation of overburden and ore.

It is evident from the above table that, the proposed depth of mining will not intersect ground water table in the current plan period at Bamebari & Bonaikela Block. At Joribar Block, the ground water table will be intersected for which the abstraction permission will be sought from Central Ground Water Borad in due course of time.

c) Quantity & Quality of water likely to be encountered, the primping arrangements and places where the mine water finally proposed to be discharged-

As mentioned in the Table No. 3.1, no ground water will be encountered during planned period at Bamebari & Bonaikeal Block. The puniping arrangements will be made at Joribar Block at pit bottom and the pumped water will be discharged to out side lease boundary in accordance to the conditions likely to be endorsed by Central Ground Water Borad in the approval of abstraction.

d) Describe regional and local drainage pattern

Regional Drainage: The natural drainage system is distinct due to hilly topography in most part of the study circle. Baitarani river flowing at a minimum distance of 4.6 km on SE, 2.3 km on NE and 2 km on E from Bonaikela, Joribar and Bamebari blocks respectively forms the major drainage system of the area. Kundra nala or Suna nadi originating little distance beyond the study area flows from SW towards NE and joins Baitarani river on NE part. Kundra nala passes closure to the Bonaikela block (minimum distance, 0.27 km on South). Distance of Kundra nala from Joribar and Bamebari blocks are 3.8 km on NW and

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

on NW respectively. Major part of the area has dendritic drainage pattern. The hill ranges are drained by seasonal nallahs in all directions. A few seasonal streams flow through the lease. High flood level of Baitarani river and Kundra Nala is much below the mining lease.

Local Drainage: Core zone is mainly hilly area. The area is under hard rock formations. The rocks do not have primary porosity; only structural weaknesses like joints, fractures, folds, faults and weathering process provide secondary porosity for storing and transmitting water. The buffer zone is by and large occupied by iron ore series. The extent of weathering varies from a few centimetres in upland areas to several meters in villages. The structural weakness also persists for couple of 100 meters locally along deep seated lineaments. The ground water occurs under unconfined to semi confined conditions. The area receives recharge mainly from precipitation and surface sources. Study area's subsurface and surface drainage is controlled by Baitarani and Kundra nala. The area in the vicinity of core zone of Roneikela block is drained mainly by Kundra nala whereas the area near to Jeribar and Bamebari blocks are drained by Baitarani river.

Rainfall: The highest annual rainfall in the region was 1165 mm in the last three years. The monsoon season is between June- September. The peak monsoon period is July- September. The month wise rainfall for the last five years is furnished in Table no. 3.2.

Table No. 3.2

Months	2015-16		2016-17		2017-18		2018-19		2019-20	
	Rainfall	Rainy Days	Rainfall	Rainy Days	Rainfall	Rainy Days	Rainfall	Rainy Days	Rainfall	Rainy Days
Apr	0	0	0	0	0	0	128.9	16	49	2
May	61.2	7	130.1	12	68.2	8	56.8	10	121.9	5
Jun	191.2	14	135.5	13	68.4	10	49.5	13	46	9
Jul	388	26	294.4	23	233	21	489.3	21	130.2	19
Aug	220.5	16	259.6	20	218.2	20	218.13	26	261.0	22
Sep	214.5	12	213.6	10	156	13	136.7	16	276.6	20
Oct	3	0	37.1	5	34.8	4	59.4	6	139.6	9
Nov	3	0	0	0	49.7	4	1.8	1	0	0
Dec	56	8	0	0	0	0	218.43	26	77	3
Jan	7	0	0	0	0	0	22.1	9	38.2	4
Feb	110	6	0	0	0	0	28	14	21.6	6
Mar	110.25	4	26.7	5	0	0	4.1	5	73.6	9
Total	1166.65	93	1300	88	850.3	76	1109.56	162	1194.8	107

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Data & Methodology Used for Surface Runoff Calculation

The surface runoff and infiltration in any location can be estimated through the following equation:

Surface Runoff = Rainfall – Initial abstraction – Infiltration

The NRCS curve number method is an empirical description of infiltration. It combines infiltration with initial losses (interception and detention storage) to estimate the rainfall excess, which would appear as runoff. This model is relatively simple requiring few input parameters and has been widely applied in the fields of soil physics and hydrology (US EPA, 1998a). The method is an empirically based one, and is applicable to the situation in which amounts of rainfall, runoff, and infiltration are of interest (US EPA, 1998b) The USDA NRCS curve method predicts direct surface runoff using the following equation.

$$Q = \frac{(P-Ia)^2}{(P-Ia)+S}$$

In which, Q = Total rainfall excess (runoff) for storm event (mm or inches), P = Total rainfall for storm event (mm or inches), Ia = Total, initial loss or "initial abstraction" (inches), S = Potential maximum retention capacity of soil at beginning of storm or maximum amount of water that will be absorbed after runoff begins (inches).

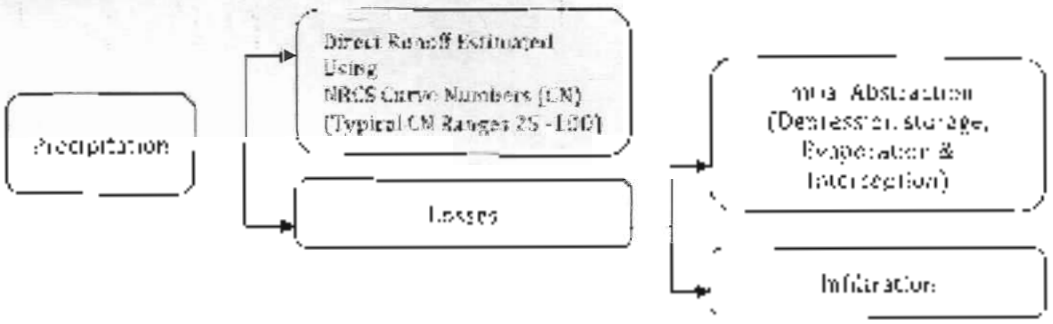


Figure 3 : Conceptual components of rainfall in SCS Curve Method.

The retention parameter is a statistically derived parameter related to the initial soil moisture content or soil moisture deficit (US EPA, 1998a). The value of S is determined based on the type of soil and the amount and kind of plants covering the ground (cover types) This is derived through as relationship to the value of the NRCS runoff curve number (CN). A curve number is a numerical description

of the permeability of the land in a watershed. This number varies from 0 (100 % rainfall infiltration) to 100 (0 % infiltration – e.g., road/concrete)

The following relation relates the value of S to the 'curve number':

CN = runoff curve number (0-100), based on the soil and land use information. CN is determined through several factors. The most important are the hydrologic soil group (HSG), the ground cover type, treatment, hydrologic condition, the antecedent runoff condition (ARC), and whether impervious areas are connected directly to drainage systems, or whether they first discharge to a pervious area before entering the drainage system. Soils are extremely important in determining the runoff curve number. Soils are generally classified into four HSG's (hydrological soil groups: A, B, C, and D) according to how well the soil absorbs water after a period of prolonged wetting.

The terms 'initial abstraction or initial surface loss' incorporates rainfall loss due to interception, evaporation from surface during rainfall events, depression and detention storages. The value of Ia depends greatly on the cover types (the kind of plants covering the soil or land use), the kind of soil (hydrologic soil groups, its treatment, and hydrologic condition) and antecedent soil moisture of the area being studied. For a given drainage basin, the values of Ia are highly variable, but generally are correlated with soil and cover parameters.

A major limitation for applying the SCS model lies in that the values of the parameter Ia must be evaluated with field data for each specific site. The runoff and infiltration estimation using the NRCS Curve Number method requires the following inputs of land use / land cover, soil type/hydrologic soil groups, rainfall distribution and values of initial abstraction or initial losses for each type of land use / land cover.

Existing Drainage System:

As there are hilly terrains in each block, to drain out the surface run-off water, a small sump is maintained at the lowest level of the quarry. Because the quantity is very small, the water gets automatically soaked into the ground. The spoil banks are in stages which helps to restrict the solids flowing thru' the water during rainy season. This prevents wash offs of solid along the slope. The run-offs water passing through the drain does not get contaminated by any dirt or soil except turbidity in rainy season. The water ultimately gets discharged into small seasonal nallahs passing through the lease area.

Considering the highest rain fall and rainy days as mentioned in Table No. 3.1 and area to be degraded at end of this plan period, the surface run off has been calculated for the entire lease over an area of 464 ha. and furnished in Table No. 3.3 below

Table 3.3

(A) Mining Catchment Area (Sqm)=A			101138 0	Sqm	(Includes the area influenced due to active mining)					
Year	Rain Fall (mm) (P)	Rain Fall (m3) (R)	Standard Curve Number (CN)	Retention Parameter (S=(1000/CN)-10)	Initial Abstraction (Ia (mm))	Total Surface Run off (mm) Q = (P-Ia)2/(P+Ia)+S)	Total Surface Run off (m3) (Q = Q*A)	Infiltration (m3) (X)= 8.15%	Initial Loss (m3) (Y = P*Ia)	Total Runoff (m3) (Z = Q - X-Y)
2018-19	1408.56	1445601	78	1.76	4.5	1402	1417097	214948	6343	1195806
								Total Days of Rainfall		163
								(A) Average Surface Runoff from Other Area (KLD)		7348

(D) Dump Catchment Area (Sqm)=A			593460	Sqm	(Includes all OB & Mineral Reject dumps)					
Year	Rain Fall (mm) (P)	Rain Fall (m3) (R)	Run off Curve Number (CN)	Retention Parameter (S=(1000/CN)-10)	Initial Abstraction (Ia (mm))	Total Surface Run off (mm) Q = (P-Ia)2/(P+4Ia)3	Total Surface Run off (m3) (Q = Q*A)	Infiltration (m3) (X)= 8.15%	Initial Loss (m3) (Y = P*Ia)	Total Runoff (m3) (Z = Q - X-Y)
2018-19	1408.56	832986	51	9.61	4.5	1396	828787	123460	6043	699284
								Total Days of Rainfall		163
								(B) Average Surface Runoff from Dump Area (KLD)		4292
								(A+B) Total Average Surface Runoff (KLD)		11640

Drainage Capacity

A total of 9 garland drain with a collective length 2774 m is provided along with 4 settling pits to arrest the surface runoff. Moreover, a cemented garland drain is provided along the dump adjacent to lease boundary to arrest the surface runoff. The concrete patch path ensures less soil erosion and flow of water from designated path

Garland Drain:

- Length: 3376 m
- Width: 1.5 m
- Height: 1.5m
- Holding capacity of garland drain = 7596 m^3

The garland drains and settling pits are being cleaned before the onset of rainy season for efficient and better management of surface run off in the lease area. The mine drainage with existing protective measures has been shown in Drawing no. DWG 15A DWG 15B and DWG 15C.

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON
TATA STEEL LIMITED FERRO ALLOYS & MINERALS DIVISION
BAMEBARI IRON & MANGANESE MINE, At/P.O.: BAMUPANI, VIA: JODA, DIST: KEONJHAR (ODISHA)

In the plan period, the following measures are to be taken to arrest the surface run offs given in Table 3.3:

Table No. 3.3

Year		2020-21	2021-22	2022-23	2023-24	2024-25
Bamebari Block	Toe Wall (m)	0	0	0	0	0
	Garland Drain (m)	0	0	0	0	0
	Check dams (nos)	0	0	0	0	0
	Settling pits (nos)	0	0	0	0	0
Jambar Block	Toe Wall (m)	0	0	270	302	0
	Garland Drain (m)	0	0	0	302	0
	Check dams (nos)	0	0	0	0	0
	Settling pits (nos)	0	0	0	1	0
Boneikela Block	Toe Wall (m)	300	0	0	208	0
	Garland Drain (m)	300	0	0	208	0
	Check dams (nos)	0	0	0	0	0
	Settling pits (nos)	1	0	0	0	0
Total	Toe Wall (m)	300	0	270	510	0
	Garland Drain (m)	300	0	0	510	0
	Check dams (nos)	0	0	0	0	0
	Settling pits (nos)	1	0	0	1	0

Surface Runoff Management-

Garland Drain - Garland drains with total of 9 garland drain with a collective length 2774 m is provided along with 4 settling pits for silt collection of 1.5 m -2 m width and 1m-1.5m deep have been constructed on the toe of all the OB dumps to collect the surface run-off during rainy season. Each dump is provided with garland drain and water from upper level flow to next level via concrete patch path (channel) provided for same purpose at areas were feasible. The concrete patch path ensures less soil erosion and flow of water from designated path. The garland drains and settling pits are being cleaned before the onset of rainy season for efficient and better management of surface run off in the lease area

Toe wall - Toe wall along with garland drain is constructed all around dump. Toewall had been made from stone and concrete and has dimension of 1.5m× 1.0 m. The toe walls provide safety to dump as well as it also arrests erosion

Coir Matting on dump slope - Coir mat will be used to cover dump slope for soil erosion control in critical areas. Coir mats are made from a natural and biodegradable coconut fibre and it is meant to slow down the speed at which water moves across the surface and obstructions for the water to slow down on. This effectively decreases erosion and allowing vegetation to effectively take root.

Plantation on Dumps – The overburden is systematically and scientifically dumped on a geologically barren area and properly supported with hard

material and the same is being reclaimed through plantation in time bound phased manner after being declared inactive.

Water management for domestic & Industrial use

Source of water Supply –

The mining requires supply of water for various purposes during mining. Water is drawn from Tindharia point in River Baitarni. Vegetation etc apart from drinking water supply. The water requirement of mine will be 175 m^3/day during lean season and 140 m^3/day during the monsoon season. The major portion of water drawl fulfils the domestic requirement 100 m^3/day. The dust suppression at mine will be 50 m^3/day in lean season and 25 m^3/day in monsoon season. For plantation and gardening activities 25 m^3/day and 15 m^3/day will be required during lean and monsoon season.

Domestic Supply – Water is supplied for domestic purpose in Banebari colony and nearby villages. The water requirement of 100 m^3/day is met from Tindhatia point in River Baitarni. The domestic effluents in Banebari colony is treated in the STP having 100 KLD capacity and the waste water so generated is recycled for gardening purpose.

Industrial purpose – The existing manganese ore processing is manual in nature and thus no water is required in the beneficiation process. The major portion of industrial requirement of water is for the purpose of suppressing dust. In the lean season, it is envisaged that more dust will be generated than in monsoon season therefore the requirement of water for dust suppression is more. Water is also provided for drinking purpose in offices and to mine workers.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON
TATA STEEL LIMITED, FERRO ALLOYS & MINERALS DIVISION
BANEBARI IRON & MANGANESE MINE, AT/P.O. BANEBARI, VIA JODA, DIST. KEONJHAR (ODISHA)

4.0 STACKING OF MINERAL REJECT / SUB-GRADE MATERIAL AND DISPOSAL OF WASTE

a) Indicate briefly the nature and quantity of Top Soil, Overburden / Waste and Mineral Reject to be disposed off.

Nature of Top Soil -

Top Soil is the outermost layer of the earth's crust. Soil is made of mineral matter, organic matter, water, and air. Living organisms are also present in soil. Mineral matter began as rock, and soil generally has mineral particles of different sizes. Organic matter is partially decomposed plant and animal matter. Pore spaces are the gaps between solid soil particles. They are occupied by water and air. Earthworms, insects, bacteria, fungi, and other organisms inhabit soil. Most land plants depend on soil to provide four basic needs; anchorage, water, air, and nutrients.

To assess the quality of soil in and around the mining area, soil samples were collected once for physico-chemical analysis from different types of land i.e. fallow land, Agricultural land and Scrubby land. The typical analysis is furnished below in Table No. 4.1.

Table No. 4.1

Sl No.	Parameters	Analysis Results		
		Bamebari Block	Joribar Block	Banaikela Block
1	pH	6.3	6.4	6.7
2	Texture	Loamy Sand	Loamy Sand	Loamy Sand
3	Temparature (0C)	18.7	25.9	17.8
4	Organic Matter (%)	1.3	1.3	1.24
5	Phosphate	<40	<40	<40
6	Potash	<250	<250	<250
7	Electrical Conductivity (µs/cm)	362	370	365
8	Porosity (%)	27	28.1	31.2
9	Nitrogen (%)	0.002	0.013	0.01

Top soil is generally found in the top most layer of the virgin earth crust within the ML area which also contains the float ore at most of the places. As we proceed towards any virgin land during the plan period top soil will be encountered. A layer of ~15 cm of maximum thickness has been envisaged as the top soil. Due to presence of float ore, section-wise calculation of top soil is not conceivable, hence included in the over burden. As proposed in the current mining plan period, there will be some generation of top soil while working over virgin area. It has been proposed to deal with carefully and stock separately at the plantation site after sorting of any float ore so that it could be used for succeeding plantation activities. Efforts shall be taken for its use.

within 3 months to obtain the maximum nutritional value of the top soil so generated.

Quantity & Storage of Top Soil –

The yearly generation of top soil as envisaged during the plan period is furnished below in Table No. 4.2

Table No. 4.2

Year	Generation of Top Soil (CuM)			
	Bamebari	Joribar	Ponakela	Total
2020-21	0	0	0	0
2021-22	0	0	0	0
2022-23	0	0	0	0
2023-24	0	0	0	0
2024-25	8220	2614	0	10834
Total	8220	2614	0	10834
Storage Location	2434N - 2506N & 3123E - 3167E	11670N - 11709N & 12427E - 12482E	3630N - 3690N & 4821E - 4867E	
Storage Area (ha.)	0.15	0.15	0.15	0.45

Nature of Overburden / Waste –

Bamebari Block –

Overburden in Bamebari block mostly consists of lateritic soil / morrum, laterite, chert and shale. Very often, lumps and nodules of manganese and iron ore are found to be irregularly distributed in the lateritic morrum. Also, composition of laterite varies at different places. Shale found in the area are mostly lateritized, banded and unbanded varieties. Lateritized shale grades from a few centimetres to several metres are encountered at places. Chert is usually bouldery, sometime massive and weathered in places. It is unbanded and no definite dip is observed. Stringers and veins of quartz, iron and manganese are at times seen to traverse the rock.

Joribar Block –

Overburden in Joribar block mostly consists of lateritic soil / morrum, laterite and shale. Extensive patches of laterite and lateritic soil are found in the area. Very often, lumps and nodules of manganese and iron ore are found to be irregularly distributed in the lateritic morrum. Also, composition of laterite varies at different places. Shale found in the area are mostly lateritized, banded and unbanded varieties. Lateritized shale grades from a few centimetres to several metres are encountered at places.

Bonaisola Block –

Overburden in Bonaisola blocks mostly consists of lateritic soil / morrum, laterite and shale. Extensive patches of laterite and lateritic soil are found in the area. Very often, lumps and nodules of manganese and iron ore are found to be irregularly distributed in the lateritic morrum. Also, composition of laterite varies at different places. Shale found in the area are mostly lateritized; banded and unbanded varieties. Lateritized shale grades from a few centimetres to several metres are encountered at places.

Quantity & Disposal of Overburden / Waste –

The yearly generation of overburden from the respective quarries has been based on the pit designs corresponding to the yearly planned production given under Table No. 2.5 a & 2.5 b, is given in Table No. 4.3 below with location for disposal and proposed area at end of plan period.

Table 4.3

Year	Generation of Overburden (OB)			
	Bamebari Block	Joribar Block	Bonaikela Block	Total
2020-21	63522	219613	18744	301879
2021-22	70678	156310	28273	254941
2022-23	372715	224994	60315	657951
2023-24	0	431666	231662	663328
2024-25	966580	1242586	0	2209166
Total	1473225	2275069	338994	4087268
Disposal Location	Back filling Area (2182N - 2730N & 3047E - 3543E)	12180N - 12538N & 13154E – 13629E	4395 – 4608N & 4890E - 5180E	
Area Covered (ha)	17.041	10.100	4.400	32.544

Nature of Mineral Reject –

Mineral reject of manganese ore consists of laterite (manganiferous) and manganiferous shale. Manganese composition in laterites varies at different places resulting in variation in colour from brownish to blackish brown. It generally occurs above the main ore bearing zone. Manganiferous shale is blackish in colour and grades from a few centimetres to several metres at places. It generally occurs below the main ore bearing zone.

The Mn content >10% & <25% of ROM and fines generated during manual processing (dressing and sizing) of ROM (Size < 6 mm) is considered as Mineral Reject.

Mineral reject of iron ore consists of laterite (iron rich). It is brownish in colour, hard massive and generally occur at the surface level. The (<58% Fe content) iron ore will be incidentally generated as mineral reject during development.

of benches from the zones overlying over manganese ore. However, it will be stacked separately till viability of any future usage.

The average grade of mineral reject of Mn. Ore & Iron Ore as expected during the plan period is furnished below in Table No. 4.4

Table No. 4.4

Avg. Grade - Mn Ore (Mineral Reject)

Year	Bamebari Block		Joribar Block		Banaikela Block		All Blocks (Wt. Avg.)	
	Mn %	Fe %	Mn %	Fe %	Mn %	Fe %	Mn %	Fe %
2020-21	15.06	20.51	16.25	31.83	19.05	34.64	16.39	31.79
2021-22	12.11	16.44	16.21	32.69	17.34	34.83	16.08	32.06
2022-23	17.57	29.97	15.75	29.32	18.54	32.61	16.10	29.12
2023-24	0	0	17.02	27.61	20.08	36.67	17.09	27.59
2024-25	16.57	21.57	18.15	30.73	0	0	17.77	28.54
Wt. Avg.	16.73	23.27	17.06	29.67	18.91	30.86	17.04	28.79

Avg. Grade - Iron Ore (Mineral Reject)

Year	Bamebari Block		Joribar Block		Banaikela Block		All Blocks (Wt. Avg.)	
	Fe %	Mn %	Fe %	Mn %	Fe %	Mn %	Fe %	Mn %
2020-21	49.87	0.54	54.09	1.62	56	2.1	53.96	1.39
2021-22	49.90	0.35	54.79	1	50.92	7.15	54.74	1.00
2022-23	50.12	0.84	54.35	1.44	49.63	6.96	52.57	1.70
2023-24	0	0	55.04	2.01	0	0	55.04	2.01
2024-25	0	0	0	0	0	0	0	0
Wt. Avg.	50.22	0.76	54.43	1.37	51.07	4.96	53.98	1.42

Quantity & Disposal of Mineral Reject –

During manual sorting at ROM, generation of mineral reject is visualized. Maximum 6% of mineral reject (fines) is blended with lump ore stacks and treated as undersize of the stack and balance is stored over the sorting yard for its future usage. Similarly, the reject generated from the manganese ore sorting yard as well as Iron Ore from the mine as in-situ excavation are also stacked at identified place for its future usage.

The yearly generation of mineral reject of Manogese & Iron Ore from the respective quarries has been based on the pit designs corresponding to the yearly planned production given under Table No. 2.5 a & 2.5 b, is given in Table No. 4.5 below with location for disposal and proposed area at end of plan period.

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 4.5

Year	Pit	Generation of Mineral Reject (CuM)			Stacking Location		
		Mn Ore (Included in ROM - Product)	Mn Ore (Fines)	Iron Ore (ROM)	Mn Ore	Iron Ore	Stack Area
2020-21	Bamebari	113	46	4158	2503N – 2702N & 3141E – 3250E (Back Filling site)	2759N – 2966N & 3742E – 3406E (Back Filling site)	Mn Ore 1.684 Iron Ore 3.85
2021-22		1514	148	773			
2022-23		15017	1099	16187			
2023-24		0	0	0			
2024-25		35355	1060	0			
Sub Total		51996	2254	21118			
2020-21	Joribor	5545	3238.0	102967	11620N – 11870N & 12456E – 12807E	a) 11600N - 11697N & 12800E - 13038E b) 11907N - 12055N & 13321E - 13291E	Mn Ore 6.50 Iron Ore 0.45 0.12
2021-22		37254	6719.0	80996			
2022-23		68134	7644.0	31608			
2023-24		97603	9282.0	9672			
2024-25		102645	8041.0	0			
Sub Total		315201	35823.0	234238			
2020-21	Ronabeda	345	44	1971	4034N – 4293N & 4980E – 5088E	3942N - 3954N & 5054E - 5122E (Temporary Stacking at Ore Stockyard)	Mn Ore 1.22 Iron Ore 0.50
2021-22		1432	1132.0	140			
2022-23		821	1356.0	6751			
2023-24		2397	719.0	0			
2024-25		0	0.0	0			
Sub Total		5203	3251.0	8862			
2020-21	Total	6000	3328	109091			Mn Ore 9.404 Iron Ore 4.83 Total 14.334
2021-22		34400	7999	90909			
2022-23		84000	10000	54546			
2023-24		100000	10000	9672			
2024-25		148000	10001	0			
Total		372400	41328	264218			

The summary of Top Soil, Mineral Reject and Waste is furnished below in Table No. 4.6.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 4.6

Year	Pit	Top Soil (CuM) Re-use / Spreading	Top Soil (CuM) Storage	Back Filling Iron Ore	Storage Iron Ore	Mineral Reject (CuM) Storage (Mn Ore ROM)	Mineral Reject (CuM) Beneficiation (Mn Ore ROM)	Mineral Reject (CuM) Blending (Mn Ore ROM)	Mineral Reject (CuM) Storage Mn Ore Fines (40% of Generation)	Mineral Reject (CuM) Blending Mn Ore Fines (60% of Generation)	Waste (CuM) Back Filling	Waste (CuM) Storage
2020-21	Bamebari	0	0	4158	0	110	0	0	19	29	63522	0
2021-22		0	0	773	0	620	0	894	59	89	70378	0
2022-23		0	0	16187	0	6556	0	8461	400	600	472745	0
2023-24		0	0	0	0	0	0	0	0	0	0	0
2024-25		8220	0	0	0	7671	0	20204	424	636	965580	0
Sub Total		8220	0	21118	0	14409	0	37597	901	1352	1572225	0
2020-21	Joda	0	0	102962	0	5545	0	0	1295	1943	219613	0
2021-22		0	0	89996	0	12706	0	19460	2680	4031	154210	0
2022-23		0	0	31008	0	29757	0	30397	3058	4536	224814	0
2023-24		0	0	9672	0	36438	0	61165	3712	5569	0	431666
2024-25		2614	0	0	0	22529	0	90116	3576	5365	0	1242566
Sub Total		2614	0	234238	0	104599	0	219602	14329	21444	608817	1674232
2020-21	[illegible]	0	0	0	1971	345	0	0	18	26	0	18744
2021-22		0	0	0	140	668	0	964	453	679	0	28253
2022-23		0	0	0	6751	362	0	467	542	814	0	60315
2023-24		0	0	0	0	895	0	1502	309	431	0	201662
2024-25		0	0	0	0	0	0	0	0	0	0	0
Sub Total		0	0	0	8852	2096	0	3165	1330	1951	0	308974
2020-21	Total	0	0	107120	1971	6000	0	0	1331	1997	283135	18744
2021-22		0	0	90769	140	14073	0	20127	3190	4799	226588	28253
2022-23		0	0	47795	6751	36676	0	47324	4000	6000	597639	60315
2023-24		0	0	9672	0	37333	0	62667	4000	6000	0	633328
2024-25		10834	0	0	0	29600	0	114400	4001	6000	965580	1242386
Total		10834	0	255356	8862	221453	0	250907	16031	24797	2074042	1983226

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

b) The proposed dumping ground within the lease area to 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 mineralisation area with technical constraint & justification.

Sites for Disposal -

The following points are taken into consideration for selecting site for the disposal of waste

i) Area of disposal should be barren.

ii) Area should be in proximity to the places of work to avoid long hauls/ lead.

iii) The area so selected should not be over land earmarked for township/ other ancillary facilities connected with the mining or proposed to come up in near future while considering the ultimate pit limits.

While selecting the dumping space for waste disposal all the above points had been considered.

Ground Preparation –

Prior to disposal of waste over any virgin land / existing dump requiring the further extension, efforts shall be taken prepare a road up to maximum proposed extent. The trees if any to be cleared as directed by State Forest Department while granting of tree felling permissions. After such tree clearance, protective measures like retaining wall, garland drain and check dams as proposed will be constructed. The disposal of waste will be carried out in a retreating manner with 10m max terrace height and width. While moving back in a retreating manner of disposal, efforts to be taken to rehabilitate the matured slopes of the dump by conventional plantation / vetiver grass to minimise the soil erosion.

The above parameters have been followed at Bamebari, Joribar & Bonaikela Block.

Disposal of Overburden / Waste –

Bamebari Block

The existing waste dump at Bamebari pit is restricted for further enhancement due to no space at northern and western side due to presence of safety zone near lease boundary and presence of mine entrance at southern side. Only the space available at eastern side will subsequently converged with ensuing back filling. As proposed in the preceding approved Scheme of Mining, all the over burden material excavated during mining will be backfilled in the quarry only. Further the overburden generated in Bamebari pit shall be completely backfilled in the old Bamebari Quarry.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Joribar Block –

This is pertinent to mention that, as per earlier approved proposal, Overburden from Joribar Quarry is being disposed off at Bamebari Block for quarry back filling. This was due to lack space for OB disposal on account of delay in grant of forest clearance. In this same manner, OB from Joribar will be continued to dispose off till end of 2022-23 and we expect to obtain the forest clearance. Accordingly, the OB will be disposed off over the existing Waste Dump IB (D#2) by lateral extension from 2023-24 subsequent to proving of non-mineralisation.

Bonaikela Block

The overburden generated in Bonaikela block will be nominal as the ore deposit that is proposed to be mined out is present as an outcrop. The overburden generated will be disposed over new area within the extent of 4395N – 4606N & 4890E - 5180E having non-mineralised zone based on the surface exposures. However, boreholes will be drilled to confirm the non mineralisation of the area before commencement of disposal of overburden.

The proposed waste dump plans and sections for Bamebari, Joribar and Bonaikela and back filling of old pit in Bamebari Quarry are shown in drawing no. DWG 14A, DWG 14B and DWG 14C respectively.

The details with respect to present location, yearly build up and position at end of plan period are being furnished in next para (c)

Further, the mineral reject of Manganese ore generated at Joribar will be stored in the north-eastern part of the joribar quarry within the extent of 11502N- 11583N & 12588E – 12795E due to unavailability of area due to want of forest clearance. The mineral reject has been stored here temporarily in accordance to the modification of Scheme of Mining for the period 2018-20. After obtaining the required forest clearance, the mineral reject stored temporarily will be shifted to the existing Joribar mineral reject dump (M#1) extending the dump laterally. During re-handling, the mineral reject will be shifted to 11630 N 11748N and 12539E-12757E and disposed by reclaiming method of dumping. The existing mineral reject dump will be extended laterally with an increase in area of 1.81 ha.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 4.7 - The present dimensions of the Dumps

Block	Dump Type	Location	Length (m)	Breadth (m)	Area (ha.)	Height (m)	Area Reqd/ Reqd raised by plantation (in Ha	Present Capacity (L.Cu.M)	Overall Dump Slope	Present Status of the Dump
Bamebari	OB(DM1)	2711 N-2967 N & 2459 E-2534 E	250	250	14.53	52	11.247 Ha	55 1	28	Dead
Bamebari	OB(DM2)	1643 N-2195 N & 2241 E-2545 E	596	133	6.36	8	2.56 Ha	17.0	28	Dead
Bamebari	OB(DM3)	1241 N-1377 N & 3072 E-3216 E	175	115	1.35	8	0.85 Ha	1.2	28	Dead
Bamebari	ROM ORE Stock (MM1)	2754 N-2966 N & 3162 E-3407 E	285	231	3.85	8	0	0.49	28	Active
Bamebari	MR(MM2)	2239 N - 2362 N & 3039E - 3152E	217	103	0.86	6	0	0.8	28	Dead
Bamebari	MR(MM3)	2557 N - 2659 N & 3116 E - 3248E	215	85	0.66	6	0	0.4	28	Active
Joribar	OB(DM1)	12765 N-12418N & 131545 - 13514 E	375	84	2.98	60	0.5 Ha	25.16	28	Active
Joribar	OB(DM2)	11672 N-12016N & 12886 E-13249E	107	198	9.03	46	6.54 Ha	22.86	28	Dead
Joribar	MR(MM1)	11620 N-12750N & 12549E - 13763 E	216	69	1.38	15	0	0.46	28	Active
Joribar	MR(MM3)	12582 N-12592N & 12588 E-12792E	212	66	1.03	12	0	0.24	28	Active
Bonaikela	OB(DM1)	4229N-4449 E & 4249 E-4351 E	220	91	1.69	10	0	1.5	28	Dead
Bonaikela	OB(DM2)	4080 N-4429 N & 4092 E-4670 E	280	246	2.52	12	0	3.8	28	Dead

The typical analysis of all dumps as mentioned above is given in Annexure – 40.

The mineral reject generation at Bamebari and Bonaikela block will be very nominal due to less production of ROM as compared to Joribar Block. The details of their disposal with location is being furnished in next para.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

c) **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.**

Disposal of Waste –

The existing waste dump at Bamebari pit is restricted for further enhancement due to no space at northern and western side due to presence of safety zone near lease boundary and presence of mine entrance at southern side. Only the space available at eastern side will subsequently converged with ensuing back filling. As proposed in the preceding approved Scheme of Mining, all the over burden material excavated during mining will be backfilled in the quarry only. Further the overburden generated in Bamebari pit shall be completely backfilled in the old Bamebari Quarry.

This is pertinent to mention that, as per earlier approved proposal, Overburden from Jonbar Quarry is being disposed off at Bamebari Block for quarry back filling. This was due to lack space for OB disposal on account of delay in grant of forest clearance. In this same manner, OB from Jonbar will be continued to dispose off till end of 2022-23 and we expect to obtain the forest clearance. Accordingly, the OB will be disposed off over the existing Waste Dump IB (D#1) by latera. extension from 2023-24

The overburden generated in Bonaikela block will be nominal as the ore deposit that is proposed to be mined out is present as an outcrop. The overburden generated will be dumped in the existing dump

The proposed waste dump plans and sections for Bamebari, Jonbar and Bonaikela and back filling of old pit in Bamebari Quarry are shown in drawing no. DWG 14A, DWG 14B and DWG 14C respectively. The position of existing dumps and position at end of planned period is given in the Table No. 4.8(A), 4.8(B) & 4.8(C) below.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON
TATA STEEL LIMITED FERRO ALLOYS & MINERALS DIVISION
BAMEBARI IRON & MANGANESE MINE, AT/P.O.: BAMEBARI, VIA : JODA, DIST: KEONJHAR (ODISHA)

Table No. 4.8(A) - (Bamebari Block)

Status of the Waste Dump		Dump (D#1)	Backfilling of OB Quarry
Existing	Location	2230N – 2967N & 2553E – 2534E	2102N – 2402N & 3047E – 3436E
	Length	750 mtr	290 mtr
	Breadth	230 mtr	220 mtr
	Top Level	592 mRL	568 mRL
	Bottom Level	540 mRL	558 mRL
	Height	52 mtr	10 mtr
	Terraces	4 Lifts	1
	Area	14.53 Ha	5.99 Ha
	Capacity	56.1 Lakh Cum	16 Lakh Cum
Yearly Build up	At end of 2020-21	There is no proposal for further build up as this is being rehabilitated by plantation (Area rehabilitated till 01.09.2019 is 11.247ha)	2.83 Lakh CuM from 554 to 580 mRL with 2 lift
	At end of 2021-22		2.26 Lakh CuM from 580 to 590 mRL with 1 lift
	At end of 2022-23		5.97 Lakh CuM from 590 to 620 mRL with 1 lift.
	At end of 2023-24		--
	At end of 2024-25		9.66 Lakh CuM from 590 to 620 mRL with 3 lift above the ground within the extent of 2320N – 2730N & 3267E – 3543E
At end of 5 years planned period	Location		2182N – 2730N & 3047E – 3543E
	Length		625 mtr
	Breadth		260 mtr
	Proposed Top Level		630 mRL
	Proposed Bottom Level		568 mRL
	Height		70 mtr
	Terraces		7 Lifts
	Max. Lift Height		10 mtr
	Method of Dumping		Retreating
	Area		17.044
	Additional Capacity		20.72 Lakh CuM
	Tota. Capacity		35.72 lakh Cum
	Terrace Slope		37 Deg
	Overall Slope		35 Deg

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 4.8(B) - (Joribar Block)

Status of the Waste Dump		Existing Dump IB (Dn I)
Existing	Location	12285N-12410N & 13154E - 13549E
	Length	375 mtr
	Breadth	83 mtr
	Top Level	576 mRL
	Bottom Level	516 mRL
	Height	60 mtr
	Terraces	6
	Area	2.98 Ha
	Capacity	25.16 lakh cum
Yearly Building	At end of 2020-21	No disposal of waste due to non availability of additional area for want of Forest clearance
	At end of 2021-22	
	At end of 2022-23	
	At end of 2023-24	4.32 LCuM from 516 to 545 mRL with 3 lifts
	At end of 2024-25	12.42 LCuM from 545 to 580 mRL with 3 lifts
At end of 5 years planned period	Location	12180N - 12538N & 13154E - 13678E
	Length	511 mtr
	Breadth	365 mtr
	Proposed Top Level	580 mRL
	Proposed Bottom Level	516 mRL
	Height	64 mtr
	Terraces	6 lifts
	Max. lift Height	10 mtr
	Method of Dumping	Retreating
	Area	16.100 ha
	Additional Capacity	16.79 Lakh CuM
	Total Capacity	41.90 lakh Cum
	Terrace Slope	37 Deg
	Overall Slope	35 Deg

Table No. 4.8(C) - (Bonaikela Block)

Status of the Waste Dump		Bonaikela Block
Existing	Length	New Waste dump will be developed from 2020-21 within the extent of 4393N – 4606N & 4990E - 5180E
	Breadth	
	Top Level	
	Bottom Level	
	Height	
	Terraces	
	Area	
	Capacity	

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Yearly Build up	At end of 2020-21	18741 CuM from 556 to 560 mRL in 1 Lift
	At end of 2021-22	28254 CuM from 560 to 570 mRL in 1 Lift
	At end of 2022-23	60315 CuM from 570 to 580 mRL in 1 Lift
	At end of 2023-24	201662 CuM from 580 to 600 mRL in 2 Lift
	At end of 2024-25	Nil
At end of 5 years planned period	Location	4395 – 4606N & 4890E - 5180E
	Length	320 m
	Breadth	215 m
	Proposed Top Level	600 mRL
	Proposed Bottom Level	556 mRL
	Height	44 m
	Terraces	5
	Max. Lift Height	10 m
	Method of Dumping	Retreating
	Area (ha.)	4.4
	Additional Capacity	3.09 LCuM
	Total Capacity	3.09 LCuM
	Terrace Slope	37 Deg
	Overall Slope	38 Deg

For faster reclamation, it is proposed to backfill the old Bamebari quarry from overburden generated in the Jurihar quarry. The following environment preventive measures will be undertaken to alleviate the adverse impact on the forest & Environment:

- No further diversion/widening shall be caused to any existing public road.
- Extensive water sprinkling shall be carried out to control the fugitive dust emission.
- The trucks loaded with overburden shall be covered with tarpaulin to prevent the air borne dust.
- Wheel washing facility will be provided at exit points.
- The overloading of truck will not be done.
- Vehicular emissions shall be kept under control and regularly monitored

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Stacking of Mineral Reject –

The threshold value is kept at 10% Mn as recommended by IBM. The mineral rejects produced shall be stacked separately from the overburden and waste dumps for their future usage.

The details of studies carried out so far for further beneficiation to enrich Fe quality has been discussed in Chapter 6 of this document.

Bamebari Block - The mineral reject generated at Bamebari Block will be stacked over the existing MR stack – BM(M#3). The yearly disposal is furnished below in Table No. 4.9 (A) and Drawing No. 14A.

Table No. 4.9A (Bamebari Block)

Storage of the Mineral Reject		Existing BM(M#3)
Existing	Location	2557N – 2652N & 3111E – 3248E
	Length	115 mtr
	Breadth	83 mtr
	Top Level	570 mRL
	Bottom Level	564 mRL
	Height	8 mtr
	Terraces	1
	Area	0.66 ha. (±)
	Capacity	0.86 Lakh Cum
Yearly Build up	At end of 2020-21	139 CuM from 570 to 572 mRL
	At end of 2021-22	1964 CuM from 572 to 574 mRL
	At end of 2022-23	16268 CuM from 574 to 577 mRL
	At end of 2023-24	0
	At end of 2024-25	37455 CuM from 577 to 580 mRL with 1 HL
At end of 5 years planned period	Location	2563N – 2702N & 3141E – 3250E
	Length	219 mtr
	Breadth	85 mtr.
	Proposed Top Level	580 mRL
	Proposed Bottom Level	570 MRL
	Height	18 mtr
	Terraces	2
	Max. Lift Height	10
	Method of Dumping	Retreating
	Area	10.100 ha
	Additional Capacity	0.56 Lakh CuM
	Total Capacity	1.36 Lakh CuM
	Terrace Slope	37 Deg.
	Overall Slope	35 Deg.

Joribar Block – The mineral reject of Manganese ore generated in Joribar will be stored in the north eastern part of the joribar quarry due to unavailability of area due to want of forest clearance. The mineral reject is stored here temporarily. After obtaining the required forest clearance the mineral reject stored temporarily will be shifted to the existing Joribar mineral reject dump extending the dump laterally. After re-handling, the subgrade mineral stored temporarily will be shifted to 11620N – 11870N & 12456E -12807E by retreating method of dumping. The existing mineral reject dump will be extended laterally with an increase in area of 6.50 ha. Status of mineral reject stack of Joribar is furnished in table no. 4.9 B and Drawing No. 14B.

Table no. 4.9B

Status of the Mineral Reject Stack		Joribar	
		Existing	Proposed
Existing	Location	11470N – 11645N & 12587E – 11547E (Within the P.L)	11620N - 11731N & 12562E - 12764E
	Length	212 m (max)	Expected to start during 2022-23 after grant of PL & subsequent working permission.
	Breadth	66 m (max)	
	Top Level	586 mRL	
	Bottom Level	569 mRL	
	Height	27 m	
	Terraces	2 Nos.	
	Area (Ha)	1.035	The mineral reject of 1.88 LCuM to be re-handled from reject dump will also be accommodated over the valley area
	Capacity	1.45 Lakh CuM	
Yearly Build up	At end of 2020-21	7441 CuM from 572 mRL to 592 mRL with 2 lift	
	At end of 2021-22	56176 CuM 592 to 606 mRL with 2 lift	
	At end of 2022-23		77384 CuM from 586 to 620 mRL with 3 lift
	At end of 2023-24	Will be under re handling to proposed location	107124 CuM from 620 to 640 with 2 lift
	At end of 2024-25		122748 CuM from 640 to 660 mRL with 2 lift
At end of 5 years planned period	Location	11470N - 11645N & 12585E - 11547E	11620N – 11870N & 12456E - 12807E
	Length	250 (max)	611 (max)
	Breadth	109 (max	203 (max)
	Proposed Top Level	633 mRL	660 mRL
	Proposed Bottom Level	569 mRL	586 mRL
	Height	33 m	74 m (Covering of the valley)
	Terraces	4	7
	Max. Lift Height	10 m	10 m
	Method of Dumping	Retreating	Retreating

Prepared by.
SABYASACHY MISHRA
QUALIFIED PERSON

Area (ha)	2.186	6.5
Additional Capacity	36799 CuM	4.967 CuM
Total Capacity	1.88 LCuM	4.96 LCuM
Terrace Slope	37.5 Deg.	37.5 Deg.
Overall Slope	35 Deg.	35 Deg.

Bonaikela Block - The mineral reject generated at Bonaikela will be stacked at new location within the extent of 4033N-4193N & 4980E-5090E. The Status of new mineral reject stack of Bonaikela is furnished in table no. 4.9 C and Drawing No. 14C.

Table No. 4.9C

Status of the Mineral Reject Stack		Bonaikela Block
Existing	Length	New Mineral Reject stack will be developed from 2020-21 within the extent of 4033N-4193N & 4980E-5090E
	Breadth	
	Top Level	
	Bottom Level	
	Height	
	Terraces	
	Area	
	Capacity	
Yearly Build up	At end of 2020-21	384 CuM from 510 mRL to 512 mRL
	At end of 2021-22	2280 CuM from 512 to 517 mRL with 1 no
	At end of 2022-23	1548 CuM from 517 to 523 mRL with 1 no
	At end of 2023-24	2876 CuM from 523 to 528 mRL with 1 no
	At end of 2024-25	0
At end of 5 years planned period	Location	4033N-4193N & 4980E-5090E
	Length	175 m.
	Breadth	80 m
	Proposed Top Level	528 mRL
	Proposed Bottom Level	510 mRL
	Height	20 m
	Terraces	3
	Max. Lift Height	10 m
	Method of Dumping	Retreating
	Area (ha.)	1.32
	Additional Capacity	0.97 LCuM
	Total Capacity	0.97 LCuM
	Terrace Slope	37 Deg
	Overall Slope	38 Deg

The mineral rejects produced shall be stacked separately from the overburden and waste dumps as shown Drawing no. DWG 14A, DWG 14B and DWG 14C.

Prepared by,
SABYASACHY MISHRA
QUALIFIED PERSON

Stacking of Iron Ore ROM –

The generation of Iron Ore ROM (Mineral Reject) is inevitable while development for Manganese Ore from the pits at Bamebari, Joribar & Bonaikela Block. These Iron Ore ROM will be stacked temporarily at designated place at each block. The details of generation and stacking place of the same is furnished below in Table No. 4.10

Table No. 4.10

Year	Pit	ROM (Iron Ore) (cuM)	Place of Temporary Stacking	Remarks
2020-21		4158		
2021-22		[illegible]		
2022-23	Bamebari	16187	2759N - 2966N & 3162E - 3406E (Back filling site)	The iron ore will stack up to 625 mRL within the existing stack.
2023-24		0		
2024-25		0		
Sub Tota		21118		
2020-21		102962		a. Iron Ore excavated during 2020-21 & 2021-22 will be stacked up to 575 mRL. b. Iron Ore excavated during 2022-23 & 2023-24 will stacked up to 550 mRL.
2021-22		99996	a) 11600N - 11697N & 12800E - 13034E b) 11907N - 12055N & 13021E - 13291E	
2022-23	Joribari	31603		
2023-24		9672		
2024-25		0		
Sub Tota.		234238		
2020-21		1971		
2021-22		140		
2022-23	Bonaikela	6751	3842N - 3854N & 5054E - 5122E	The iron ore excavated will be stacked at Ore Stock area
2023-24		0		
2024-25		0		
Sub Tota		8862		
2020-21		109091		
2021-22		100909		
2022-23	Total	54546		
2023-24		9672		
2024-25		0		
Total		264218		

As had been proposed in the earlier approved mining plan and schemes, the following precautions will be undertaken as;

a) Retaining Wall (stonewalls) of 1-1.2 m w dth, 1 m height and garland drains of 1m. width, 1m depth shall be provided around downhill of the dumps to arrest and guide any wash offs of the material dumped.
b) The edges of each terrace shall be inward slope to guide the rain water while preventing the formation of gullies.
c) The slope angle of the dumps shall be maintained by dozing and levelling at suitable intervals

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Concurrent reclamation of dumps will be done by plantation over the inactive slopes. The amount of area likely to be degraded by way of dumping and proposed reclaiming method is given in Table No.4.11.

Table No. 4.11

Year	Nature of Dump	Area at beginning of the year (ha)	Additional area degraded during the year (ha)	Area to be rehabilitated during the year (ha)	Balance area at the end of year (ha)
2020-21	Overburden dumping	45.534	0.500	0	46.034
2021-22		46.034	1.302	0	47.336
2022-23		47.336	2.730	1.000	49.066
2023-24		49.066	8.320	1.000	56.386
2024-25		56.386	0.000	0	56.386
Total			12.852	2.000	

Remarks : The proposed area of rehabilitation over an area of 2 ha has not been considered as green belt at the end of this plan period. hence, balance area of 58.386 ha has been considered for calculation of financial assurance.

The Proposed yearly plantation programme (Table No. 4.12) and Toe wall-garland drain construction programme (Table No. 4.13) for next five years period is given below:

Table 4.12

Yearly Plantation programme

Year	Bamebari Block			Joribar Block			Bonaikela Block			Total	
	No. of Sapling	Area (in ha.)	Location	No. of Sapling	Area (in ha.)	Location	No. of Sapling	Area (in ha.)	Location	No. of Sapling	Area (in ha.)
2020-21	2500	1.00	2832N-2930N & 3013E-3170E	0	0.00	-	0	0.00		2500	1
2021-22	2500	1.00	2190N-2355N & 3046E-3291E	0	0.00	-	2500	1.00	4430N-4601N & 4888E-5159E	5000	2
2022-23	2500	1.00	2145N-2255N & 3082E-3337E	0	0.00	-	2000	0.80	4478N-4593N & 4905E-5178E	4500	1.8
2023-24	5875	2.35	2154N-2345N & 3156E-3430E	2500	1.00	12422N-12498N & 12529E	0	0.00	-	8375	3.35

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Year	Bamebari Block			Joribar Block			Bonaikela Block			Total	
	No. of Sapling	Area (in ha.)	Location	No. of Sapling	Area (in ha.)	Location	No. of Sapling	Area (in ha.)	Location	No. of Sapling	Area (in ha.)
						13631E					
2024-25	3500	1.40	2213N-2165N & 3162E 3426E	2500	1.00	12360N - 12512N & 13674E -13590E	0	0.00	-	6000	2.4
Total	26875	6.75		5003	2.00	0	4500	1.80	0	36375	10.55

As mentioned earlier in Table No. 2.5 (A), pit development at Bonaikela Block will be gradually go up and according the waste dump will be developed. Such waste dump will also remain active during the plan period and will be further extend after grant of forest clearance to accommodate waste generated from the pit. Therefore, no plantation programme has been proposed.

Table No.4.13

Construction of Toe Wall and Garland Drain

Year	Bamebari Block		Joribar Block		Bonaikela Block		Total	
	Toe wall (m)	Garland Drain (m)	Toe wall (m)	Garland Drain (m)	Toe wall (m)	Garland Drain (m)	Toe wall (m)	Garland Drain (m)
2020-21	0	0	0	0	0	0	0	0
2021-22	0	0	0	0	508	508	508	508
2022-23	0	0	270	270	0	0	270	270
2023-24	0	0	302	302	0	0	302	302
2024-25	0	0	0	0	0	0	0	0
Total	0	0	572	572	508	508	1080	1080

While providing the garland drain, four no. setting pit having dimension of 3m Length x 3m Breadth x 1m Depth with check dam of 6m Length x 2m Width x 1m height will be provided to settle and arrest the suspended solids from the waste dump caused due to rain.

As on 01.08.2019, at Bamebari Block, 1523m of retaining wall & 1220m of garland drain has been provided. Similarly, 1260m retaining wall & 537m of garland drain has been provided at Joribar Block.

The year-wise area proposed to be taken up for afforestation and construction of protective measures has been duly shown in the environment management plan enclosed as drawing no. DWG 16A, DWG 16B and DWG 16C.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

5.0 USE OF MINERAL AND MINERAL REJECT

a) Requirement of end-use industry specifically in terms of physical and chemical composition:

The Manganese ore is mostly being mined out to cater to the requirements of our Ferro Alloys Plant at Joda and Steel Plants at Jamshedpur & Kalinga Nagar. With the proposed acquisition of some other steel plants and upcoming silico-manganese plant, the captive requirement of manganese ore will be increased in near future.

Similar requirement of other captive plants will call for production of manganese ore of different physical and chemical composition. In the course of producing higher grade manganese ore, additional quantity of medium and low-grade manganese ore shall also be produced.

Physical and chemical composition of ore required for captive consumption:

There is no change in the specifications of the manganese ore to be produced from the mine.

The specifications of ore required for ferro manganese alloy production is as follows:

Mn.	Fe.	SiO2	Al2O3	P	Mn/Fe
44 -48%	10-12%	4.5-5%(Min)	4%(Max)	0.15%(Max)	3.8– 4.8

The specifications of ore required for silico manganese alloy production is as follows:

Mn.	Fe.	SiO2	Al2O3	P	Mn/Fe
35-42%	18-22%	10-15%(Min)	7%(Max)	0.15%(Max)	1.6–2.4

The ore requirement by Indian FerroManganese & SilicoManganese alloys producres has been summarised by Indian Bureau of Mines in Manganese Ore Vision 2020 and beyond. The extract of the document is being enclosed as Annexure – 38.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Specification of ore produced at mine:

Table 5.1

Grade Type	Chemical Specification	Physical Specification
Chemical Grade / Dioxide	Mn > 48 % & Fe < 4 %	+10 -75 mm, 6-25mm
High Grade	Mn > 46 %	+10 -75 mm, 6-25mm
Medium Grade	Mn > 35 % & Fe < 20 %	+10 -75 mm + 6 -25 mm
Low Grade	Mn > 25 % & Fe < 35 %	+10 -75 mm + 6-25mm
Mineral Reject	Mn >10% & <25%	-10mm & All Size.

The different grades of ore from all the quarries/mines of the Company are ultimately blended in the plant to meet the desired specification as mentioned above for production of Ferro manganese / other alloys. The typical chemical analysis of the above ore types analysed at Company's Geological Laboratory is given in Table No. 5.2. This laboratory at Joda is recognized by the Directorate of Geology, Govt. of Odisha as well as NABL.

Table No. 5.2
(Typical Chemical analysis)

Grade	Chemical Analysis					Ratio	O/s%	U/s%
	Mn%	Fe%	SiO_2%	Al_2O_3%	P%os%	Mn:Fe		
High	47.63	9.52	1.64	4.09	0.11	5.00	2.05	4.91
Medium	37.46	18.18	3.06	5.02	0.08	2.06	1.05	4.97
Low	31.50	22.27	6.14	4.74	0.09	1.41	1.05	4.76

The specification of the Ferromanganese and Silicomanganese alloys as required by the end use industry is mentioned below:

Table 5.3

Products	Chemical composition					Size
	Mn%	Si%	C%	P%	S%	
50/12 SiMn	50	12.5	2.5	0.3	0.03	+10 -60
60/15 SiMn	60	15	2	0.3	0.05	+10 -60
Low Carbon SiMn	55	20	0.5	0.75	0.02	+10 -60
Medium Carbon FeMn	70	1.5	6	0.3	0.05	+10 60
High Carbon FeMn	70	1.5	6	0.3	0.05	+10 -60

The specification mentioned above is based on the current trends, it may vary in future based on value in use for the end user

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

b) Requirement of intermediate industries involved in upgradation of mineral before its end use.

To make use of low grade manganese ore for the production of Mn. alloys, it is envisaged to evaluate various available technologies and its techno economic viability for beneficiation. It is proposed to set up beneficiation plant low-grade manganese ores outside lease area.

c) Requirements for other industries, captive consumption, export, associated industrial use etc.

Tata Steel intends to enhance High Carbon Ferro Manganese (HC Fe-Mn) production capacity from 0.0504 MTPA to 0.06 MTPA by design modifications in the existing 1x9 MVA furnace and with addition of 0.06 MTPA Si-Mn plant and 0.05 MTPA sinter plant at Joda, Keonjhar district, Odisha.

The pre-requisite of EIA-EMP, Public Hearing for captive ferro plant has been completed successfully on 12.11.2014 and the EIA-EMP approval along with Consent to Establish (CTE) has been obtained. Apart from this, company also proposes to acquire a Silico-Manganese plant of 0.050 MTPA capacity. This would help to utilise the medium grade, low grade and manganese ore fines generate during the mining operation.

The fines generated during the manual sorting process of different grade type having physical and chemical specification shall be utilized in the upcoming sinter and briquette plant followed by consuming it in the above-mentioned plants.

With the enhanced production of manganese ore as envisaged in this mining plan period, it is hoped that the purchase of manganese ore by our captive plant shall be substantially reduced. In the plan period, it is proposed to produce all the grades of manganese ore to meet the captive requirement for which ROM required to be mined out from all the captive mines held by Company is furnished below in Table No. 5.4

Table No. 5.4

Captive Requirement of Manganese Ore

(Ore in Tonnes - >25% Mn.)

Year	Joda West	Bamebari	Tiringpahar	Khandbund	Total
2020-21	180000	83200	65000	80000	428200
2021-22	250000	200000	100000	200000	750000
2022-23	400000	250000	130000	245000	1025000
2023-24	400000	250000	130000	245000	1025000
2024-25	400000	250000	230000	245000	1125000
Total	1630000	1033200	695000	1015000	4373200

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

d) Indicate precise physical and chemical specification stipulated by buyers.

There is no change in the specifications of the manganese ore to be produced from the mine.

Mn	Fe	SiO2	Al2O3	P	Mn/Fe
44-48%	10-12%	4.5-5%(Min.)	4%(Max.)	0.15%(Max.)	3.8-4.6

The specifications of ore required for Silico manganese alloy production is as follows.

Mn	Fe	SiO2	Al2O3	P	Mn/Fe
35-42%	18-22%	10-15%(Min.)	2%(Max.)	0.15%(Max.)	1.6-2.4

The ore requirement by Indian FerroManganese & SilicoManganese alloys producers has been summarised by Indian Bureau of Mines in Manganese Ore Vision 2030 and beyond. The extract of the document is enclosed as Annexure – 30

e) Details of processes adopted to upgrade the ROM to suit the user requirement.

The low-grade manganese ore beneficiation plant is proposed to be installed outside the lease to cater the all Manganese leases of the Company based on the requirement of ore during 2020-21 to make it operational from 2021-22 subsequent to grant of statutory clearances from different authorities. The details are enumerated in Chapter – 6

Efforts made for utilization of mineral reject (having 10% to 25% Mn content) including fines.

The ROM of Manganese Ore is being manually processed and approximately 10% is being separated by eye estimation from the ROM having >25% Mn content. Further the in-situ ROM having 10-25% is also being excavated while development of the pits. Both the segregated and in-situ rejects are being considered as Mineral Reject.

The 60% of fines >25% Mn content generated during the manual sorting process is being blended with lump stacks and consumed by plants in accordance to their requirement. The balance 40% is being stacked for future usage and sintering of the same will be further to be explored in accordance to the requirement

The year-wise generation of such mineral reject and subsequent blending for its usage has been furnished in Table No. 5.5. Efforts will be undertaken for blending of Mn Ore with >15% Mn content in accordance to the plant requirement from 2021-22.

TATA

Table No. 5.5

Year	Pit	Generation of Iron Ore Mineral Reject (Fe Content 45-58%)			Generation of Mn Ore Mineral Reject (Mn Content 10-25%)					Generation of Mn Ore Mineral Reject (Fines)		
		Back Filling	Storage	Total	Storage	Beneficiation	Blending	Total	% of Blending	Storage (40% of Generation)	Blending (60% of Generation)	Total
2020-21		4156	0	4156	130	0	0	130	0%	18	28	46
2021-22		773	0	773	820	0	894	1714	52%	59	89	148
2022-23	Bamebari	10187	0	10187	6556	0	8461	15017	56%	400	600	1000
2023-24		0	0	0	0	0	0	0	0%	0	0	0
2024-25		0	0	0	7071	0	28284	35355	80%	424	636	1060
Sub Total		21118	0	21118	14577	0	37587	51996	72%	901	1353	2254
2020-21		102962	0	102962	5545	0	0	5545	0%	1295	1943	3238
2021-22		89996	0	89996	12786	0	18468	31254	59%	3688	4031	6719
2022-23	Jenhar	31608	0	31608	20757	0	30397	51154	59%	3058	4586	7644
2023-24		9672	0	9672	36138	0	61165	97303	63%	3712	5569	9281
2024-25		0	0	0	22529	0	90116	112645	80%	3376	5065	8441
Sub Total		234238	0	234238	104599	0	210632	315201	67%	14329	21494	35823
2020-21		0	1971	1971	345	0	0	345	0%	18	26	44
2021-22		0	140	140	668	0	964	1632	59%	453	679	1132
2022-23	Roomkela	0	6751	6751	362	0	467	829	56%	542	814	1356
2023-24		0	0	0	895	0	1502	2397	63%	288	431	719
2024-25		0	0	0	0	0	0	0	0%	0	0	0
Sub Total		0	8862	8862	2098	0	3105	5203	60%	1300	1951	3251
2020-21		107120	1971	109091	6000	0	0	6000	0%	1331	1997	3328
2021-22		90769	140	90909	14073	0	20331	34403	59%	3200	4799	7999
2022-23	Total	41795	6751	54546	36676	0	47324	84002	56%	4030	6000	10030
2023-24		9672	0	9672	37233	0	63667	100900	63%	4000	6000	10000
2024-25		0	0	0	29600	0	118400	148000	80%	4000	6000	10001
Total		255356	8862	264218	121493	0	250907	372400	67%	16531	24797	41328

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

6.0 Processing of ROM and Mineral Rejects

a) Present method of manual processing of Manganese Ore :-

The ROM excavated from quarry is shifted to sorting yard by dumpers. Dressing, sorting and sizing of ROM is carried out at sorting yard by manual means under the supervision Mining Supervisors. After dressing and sorting, different grade ores are kept separately at sorting yard to prevent contamination. Different grades are assessed by visualizing the streak colour by experienced face workers and samplers from our Geological Dept.

Mineral Rejects generated during dressing and sorting are transported to separate place for its storage for future use. Mineral fines generated during dressing and sorting are kept at sorting yard and dispatched to different parties when there is a market demand.

Lump ore is then shifted manually to stacking yard from sorting yard by dumpers. During shifting of ore, the supervisors ascertain the eye estimated grade and allow for shifting of same to the specific yard as per grade. If any mixed up ore found, he will not allow shifting until the spurious material get segregated.

Stacking of Lump ore is done as per the grade in different area. Ore Stack is kept within (100 -500) tonnes, depending upon the availability of that grade ore and space at stack yard. The face workers are deployed for making the stack in a geometrical shape. Then samples are drawn by Samplers and prepare the pulp. The pulps are analyzed at our own laboratory to ascertain the grade is finalized after sampling.

The face workers deployed at sorting yard are provided with all safety appliances (i.e. he met, safety shoe, goggles, knee guard, hand gloves etc) and the supervisors are responsible for implementation of all safety procedures at work place.

As proposed in the last scheme of mining of Bamebari Iron & Mn Mines, has gone one step towards mechanized screening to increase the productivity of 1.44 t/manshift to 2.50 t/manshift, physical separation of ROM with double deck mobile screening has been installed. We have already obtained Consent to Establish (CTE) & Consent to Operate (CTO) from the state pollution control board, Odisha for installation & Operation of a mobile crushing & screening plant upto 75 TPH. In 1st phase a 75 TPH Screening plant has been installed. Copy of CTE & CTO attached in Annexure - 19. The lump recovery by virtue of crushing of manganese ore is yet to be established and expected to be completed by 2022-23 to start during 2023-24.

The typical material balance has been indicated in Figure - 1. The report on size recovery test by 3rd party NABL accredited laboratory is enclosed as Annexure-37. The product recovery has been indicated based on time series data for last 5 years and the data supported with extract of Annual Return (Form – H2) are being enclosed as Annexure – 37A.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Future proposal for mechanized processing of Manganese Ore :-

As a part towards mechanization, crushing, screening and mechanical sorting (based on Radiometric X-Ray technology) unit is proposed to be commissioned during the mining plan period for mechanizing the subsequent processing of the ROM. The plant shall have a capacity up to 75 TPH to crush the ROM to -75mm size. The screening shall be done at 10 mm size.

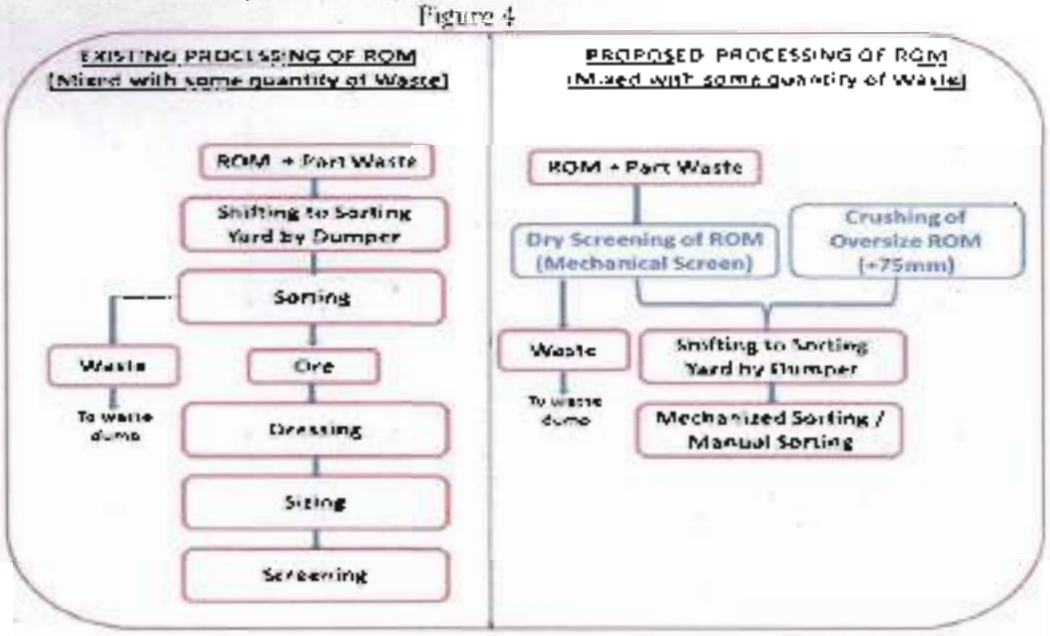
The products of -75 +10mm shall be shifted to stack yard for preparation of stacks in geometrical shape. The fines (-10mm) shall be shifted to the mineral reject stacking area by using loader and dumpers. The waste generated if any shall be shifted to waste dumps.

The above unit shall be of dry process and the following environment protection measures shall be taken to control the air pollution.

- Enclosures shall be provided to trap the dust while crushing, screening and conveying.
- Water spray shall be provided at all transfer points.

As the detailed feasibility report is yet to established by several trials for different types of grades to extricate the recovery of saleable ore with material balance. However, the schematic comparison of existing and proposed process is furnished below in Figure 4.

Figure 4



Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Further, a beneficiation process flow sheet is in process to explore to upgrade these ores using high intensity magnetic separators and reduction roasting followed by low intensity magnetic separation. Beneficiation and agglomeration test is being carried out to demonstrate the beneficiation process flow sheet at R & D, Tata Steel, IIMT-Bhubaneswar and Mintek Laboratory of South Africa.

High Intensity magnetic separation can upgrade the Mn ore up to usable for Silico Manganese Production and detail test work on reduction roasting process is in progress to upgrade this resource, which can be used for Ferro manganese making.

In view of mineral conservation and proper utilization of low grade manganese ore produced from Bamebari Iron and Manganese Mines and other surrounding manganese mines of Tata Steel Ltd. We propose to commission a beneficiation plant during the mining plan period which will be for beneficiation of low grade unusable ore being produced from our mines.

The details of study for beneficiation of Low/ Sub Grade Manganese Ore and Fines carried out so far:-

Reduction roasting has been explored to convert the feebly magnetic hematite to magnetite using coal but techno economics is challenging issue. The high intensity magnetic separator can recover the feebly magnetic particles but particle size as well as liberation characteristics play a crucial role in this process. Reduction roasting studies were carried out for temperature range 500°C to 1000°C using various types of reductant. These studies were carried out and major findings are:

1. Roasting in coarser sizes (>6mm) is not successful and <3mm is most suitable size.
2. FeMn grade product (Mn >46%, Mn/Fe >7%) can be achieved at yield depends on roasting temperature (700-1000°C) and time. Weight Recovery was 37-45%, and test work in progress to optimize that.
3. R&D Tata Steel and MINTEK, South Africa is doing detailed test work (tempt: 800, 900,1000°C, Time: 2,4 and 6 hours, Ore types : 5 to produce high grade Mn ore concentrate using Low grade ore fines.
4. Yield and product grade is sensitive to sources of low grade at different mines sites and composition (Fe & SiO_2)

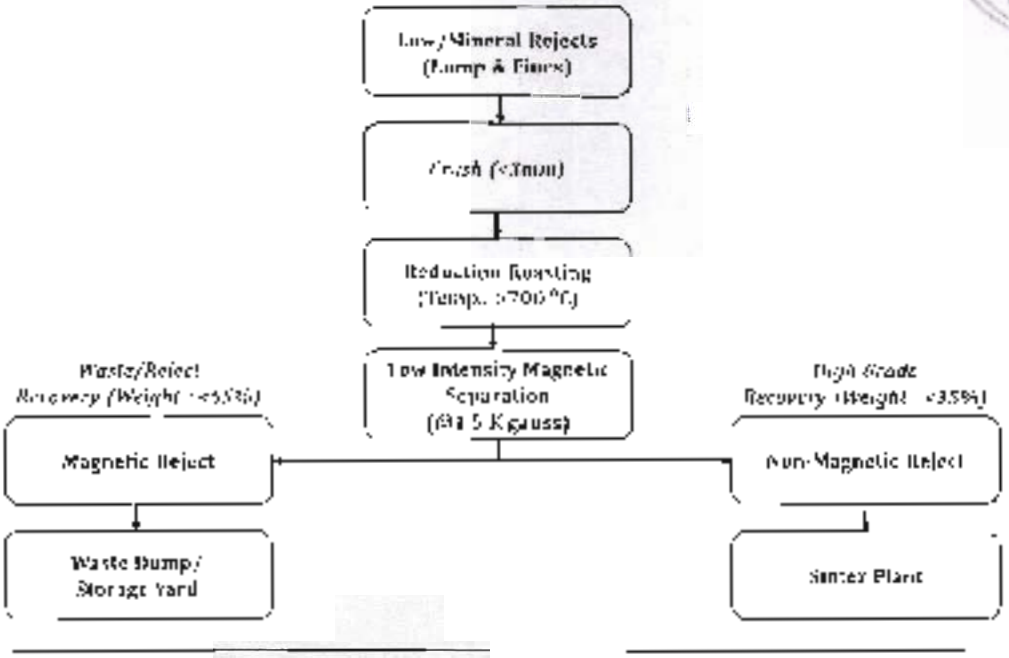
Sintering Process also carried out for agglomerate the Mn ore fines and found to be commercially viable to utilize the ore fines. So, the area of work to commercialize this project are as follow.

1 Techno-economic studies of different process flow sheets (Fig 2)
2 Material balance for beneficiation plant inputs and output disposal plans
3 Detailed Project Report for Sinter plant and beneficiation plant
4 Statutory requirements for beneficiation and sinter plant.

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Figure 5

TENTATIVE PROCESS FLOWSHEET FOR MANGANESE ORE
(LOW GRADE/ MINERAL REJECT) BENEFICIATION



With the completion of feasibility study, it is proposed to use the low grade ore from the mines and beneficiate centrally ores from all the manganese leases of Tata Steel and elsewhere.

The report for one of the trial conducted so far as to establish the feasibility of the beneficiation process with optimum weight recovery (Trial recovery ~50%) is being enclosed as Annexure – 39.

The typical material balance for 100 tonnes of low-grade manganese ore is furnished below in Table No. 6.1.

Table No. 6.1

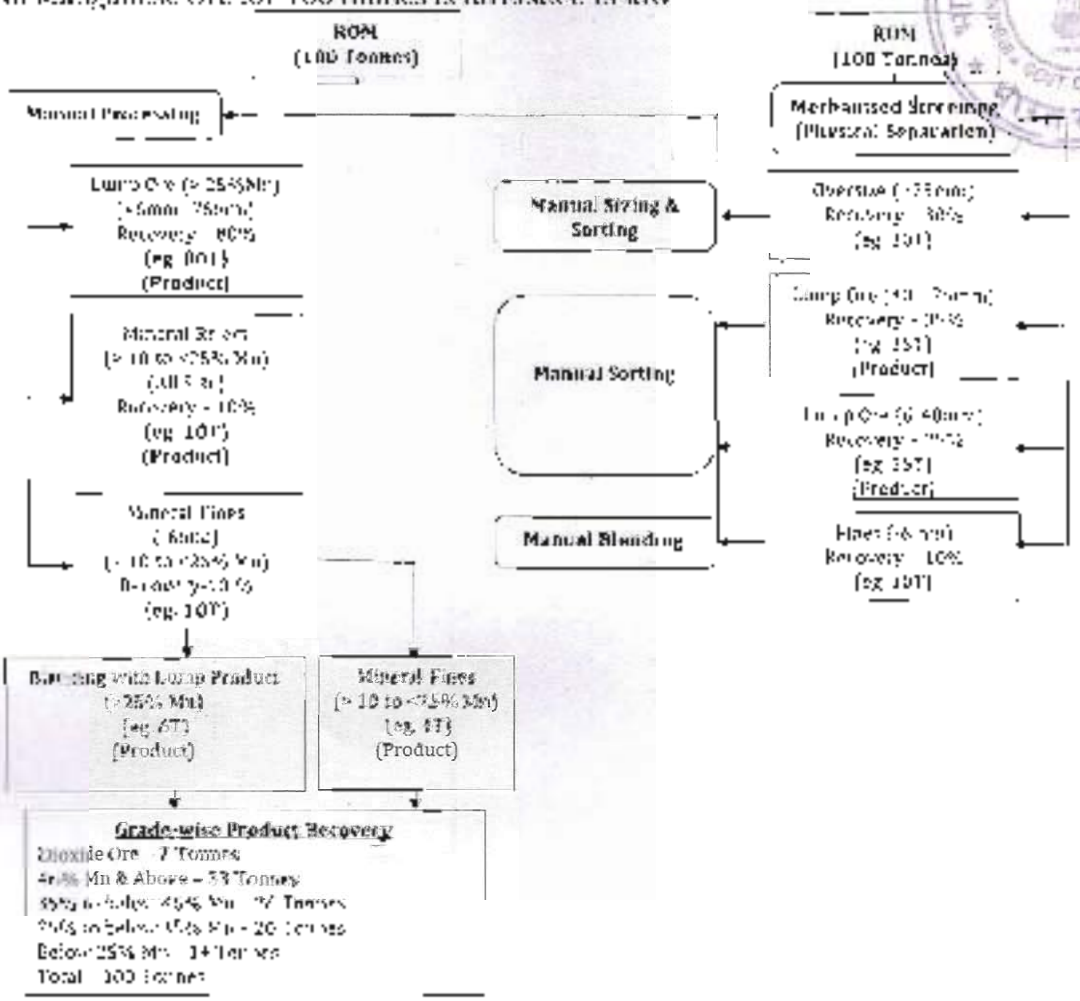
Feed Quantity	Feed Grade (Mn %)	Recovery					
		Mn Ore		Iron Ore		Waste	
		Quantity	Grade	Quantity	Grade	Quantity	Grade
100	25 - 35	50	>42%Mn	25	>60% Fe	25	Mn <10 Fe : 35-45%
Recovery (%)		50		25		25	

This low-grade manganese ore beneficiation plant is proposed to be installed outside the lease to cater the all Manganese Leases of the Company based on the requirement of ore during 2020-21 to make it operational from 2021-22 subsequent to grant of statutory clearances from different authorities.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

b) Material Balance Chart –

The typical material balance of ROM by manual processing and mechanised screening of Manganese Ore for 100 tonnes is furnished below



The report on size recovery test by 3rd party NABL accredited laboratory is enclosed as Annexure-37. The product recovery has been indicated based on time series data for last 5 years and the data supported with extract of Annual Return (Form - H2) are being enclosed as Annexure – 37A

Based on the above-mentioned time series data, the material balance of ROM by manual processing and mechanised screening of Manganese Ore during plan period is furnished below in Table No 6.2.

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Table No 6.2

Year	Pit	ROM (Tonnes) - Mn Ore			Grade-wise Recovery of Product						
		Ore	Mineral Rejects	Total	Lumpy Ore	46% Mn & Above	35% to below 46% Mn	25% to below 35% Mn	Below 25% Mn	Below 25% Mn (Fines)	Total
1	2	3	4	5 = 3+4	6 = 3*7%	7= 3*33%	8=3*26%	9=3*20%	10=(3*10%)+4	11=3*4%	12 = Sum(6-11)
2020-21	Bamebari Block	1153	242	1392	81	380	299	230	357	46	1392
2021-22		3713	3331	7044	260	1225	965	743	3702	149	7044
2022-23		25903	33037	58940	1750	8551	6301	5031	35538	1000	58940
2023-24		0	0	0	0	0	0	0	0	0	0
2024-25		26486	77781	104265	1854	8741	6887	5298	80430	1060	104269
Total		56354	114391	170745	3945	18597	14652	11271	120027	2254	170745
2020-21	Jajang Block	80950	12199	93149	5667	26714	21047	16190	20294	3238	93149
2021-22		167975	68759	236734	11758	55432	43674	33595	85556	6719	236734
2022-23		191110	149939	341049	13378	63066	49689	38222	169050	7644	341049
2023-24		232023	214727	446750	16242	76568	60326	46405	237929	9281	446750
2024-25		223513	247839	471352	15646	73759	58113	44703	270190	8941	471352
Total		895571	693442	1589013	62690	295538	232848	179114	782999	35823	1589013
2020-21	Bonaikela Block	1100	759	1859	77	363	286	220	869	44	1859
2021-22		28413	3590	31903	1982	9343	7361	5663	6423	1130	31923
2022-23		33888	1824	35712	2372	11183	8611	6779	5213	1356	35712
2023-24		17978	5273	23251	1258	5933	4674	3596	7071	719	23251
2024-25		0	0	0	0	0	0	0	0	0	0
Total		81279	11447	92726	5690	26822	21133	16256	19575	3251	92726
2020-21	Total	83200	13200	96400	5824	27455	21632	16640	21320	3328	96400
2021-22		200000	75600	275600	14000	66000	52000	40000	95600	8000	275600
2022-23		250000	184300	434300	17500	82500	65000	50000	209300	10000	434300
2023-24		250000	220000	470000	17500	82500	65000	50000	245000	10000	470000
2024-25		250000	325600	575600	17500	82500	65000	50000	350600	10000	575600
Grand Total		1033200	819280	1852480	72324	340956	268632	206640	922600	41328	1852480

20/7/20
Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Further grade wise break up of Mn Ore below 25% Mn content is furnished below in Table No. 6.3. Efforts will be undertaken for blending of Mn Ore with >15% Mn content in accordance to the plant requirement from 2021-22

Table No. 6.3

Year	Pit	ROM (Mn - 10-25%) (Tonnes)	Grade wise Break up: (Tonnes)			
			10-15% Mn	15-20% Mn	20-25% Mn	Total
2020-21	Bamebari	357	144	165	48	357
2021-22		3702	1515	1627	560	3702
2022-23		35528	13016	16107	4805	35528
2023-24		0	0	0	0	0
2024-25		80430	16086	39596	24748	80430
Sub Total		120017	33261	57495	29361	120017
2020-21	Joribar	20294	8167	9405	2722	20294
2021-22		85556	35000	37593	12963	85556
2022-23		169050	73810	76192	19048	169050
2023-24		237929	88823	92000	57103	237930
2024-25		278169	54034	133007	91128	278169
Sub Total		792999	259838	348197	174964	782999
2020-21	Kenaikela	869	349	402	118	869
2021-22		6422	2628	2821	973	6422
2022-23		5213	2276	2250	687	5213
2023-24		7071	2640	2784	1692	7071
2024-25		0	0	0	0	0
Sub Total		19575	7893	8307	3375	19575
2020-21	Total	21520	8660	9972	2888	21520
2021-22		95680	39143	42041	14496	95680
2022-23		209790	91602	94550	23640	209790
2023-24		245000	91467	94733	58800	245000
2024-25		350629	70120	172604	107876	350600
Total		922619	300992	413908	207700	922600

c) Disposal method for tailings or reject from the processing plant

There is no disposal of tailings from the current method of processing as it is manual in nature. The fines generated during manual processing (dressing and sizing) of ROM (Size: < 6 mm) is considered as Mineral Fines. The mineral Fines do not have a regular market throughout the year. It has got limited use and occasionally consumed by Ferro alloys making plants. The mineral fines generated during the processing is stacked separately mineral reject dumps.

d) Quantity and Quality of Tailing/Reject:

As mentioned above no tailings will be generated during manual processing of Manganese Ore. However, generation of mineral reject is envisaged to be generated during the manual processing. The mineral reject generated will be stacked separately in mineral reject dump. The quantum of mineral reject generated and pattern of usage is given below in Table No. 6.4

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 6.4

Year	Pr	Generation of Iron Ore Mineral Reject (Fe Content 45-55%)			Generation of Mn Ore Mineral Reject (Mn Content 10-25%)					Generation of Mn Ore Mineral Reject (2 nos)		
		Back Filling	Storage	Total	Storage	Beneficiation	Blending	Total	% of Blending	Storage (40% of Generation)	Blending (60% of Generation)	Total
2020-21		4158	0	4158	110	0	0	110	0%	10	28	46
2021-22		773	0	773	620	0	894	1514	59%	59	89	148
2022-23	Bamebar.	16187	0	16187	6556	0	8461	15017	56%	400	600	1000
2023-24		0	0	0	0	0	0	0	0%	0	0	0
2024-25		0	0	0	7071	0	28284	35355	80%	424	636	1060
Sub Total		21118	0	21118	14409	0	37587	51996	72%	901	1352	2254
2020-21		102962	0	102962	5545	0	0	5545	0%	1795	1947	3235
2021-22		89996	0	89996	12798	0	18456	31254	59%	2688	4031	6719
2022-23	Jaribar	31608	0	31608	29757	0	38397	68154	56%	3050	4575	7649
2023-24		9672	0	9672	36438	0	61165	97603	63%	3712	5569	9281
2024-25		0	0	0	22529	0	90116	112645	80%	3576	5365	8941
Sub Total		234238	0	234238	104599	0	213602	315201	67%	14329	21494	35823
2020-21		0	1971	1971	345	0	0	345	0%	18	26	44
2021-22		0	140	140	668	0	964	1632	59%	453	679	1132
2022-23	Bonaikela	0	6751	6751	362	0	467	829	56%	542	814	1356
2023-24		0	0	0	895	0	1502	2397	63%	288	431	719
2024-25		0	0	0	0	0	0	0	0%	0	0	0
Sub Total		0	8862	8862	2098	0	3165	5233	60%	1300	1951	3251
2020-21		107120	1971	109091	6000	0	0	6000	0%	1331	1997	3328
2021-22		90769	140	90909	14073	0	28327	34400	59%	3200	4799	7999
2022-23	Total	47795	6751	54546	36676	0	47224	84001	56%	4000	6000	10000
2023-24		9672	0	9672	37333	0	62667	100000	63%	4000	6000	10000
2024-25		0	0	0	29600	0	118400	148000	80%	4000	6000	10001
Total		255356	8862	264218	122493	0	230907	372400	67%	16531	24797	41328

Prepared By:
SABYASACHY MISHRA
QUALIFIED PERSON

e) Quantity and type of chemicals to be used in processing plant:

No chemicals have been envisaged for usage for processing of Manganese Ore.

f) Quantity and type of chemicals to be stored on site/plant:

As the processing of Manganese Ore will not be involved with any chemicals, storage of the same does not required.

g) Water required for mining and processing and source of supply of water:

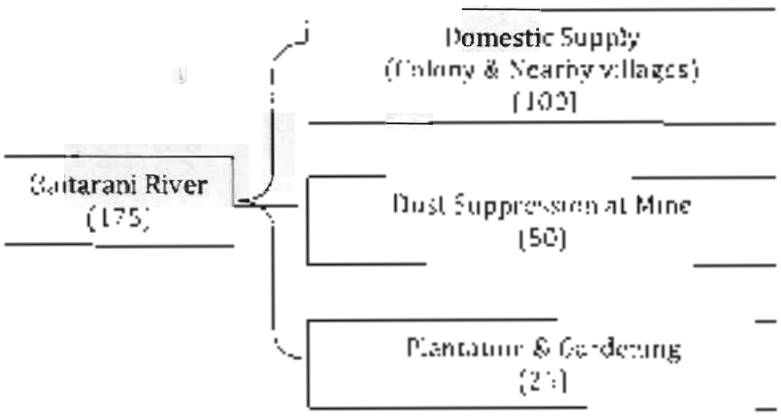
The existing manganese ore processing is manual in nature and thus no water is required in the beneficiation process. The major portion of industrial requirement of water is for the purpose of suppressing dust. In the lean season, it is envisaged that more dust will be generated than in monsoon season therefore the requirement of water for dust suppression is more. Water is also provided for drinking purpose in offices and to mine workers.

The water used at the mine is being drawn from Baitarani River at Tindharia village and supplied thru' 5.3 km pipe line network to Bamebari Block.

The dust suppression at mine will be 50 m³/day in lean season and 25 m³/day in monsoon season. For plantation and gardening activities 25 m³/day and 15 m³/day will be required during lean and monsoon season.

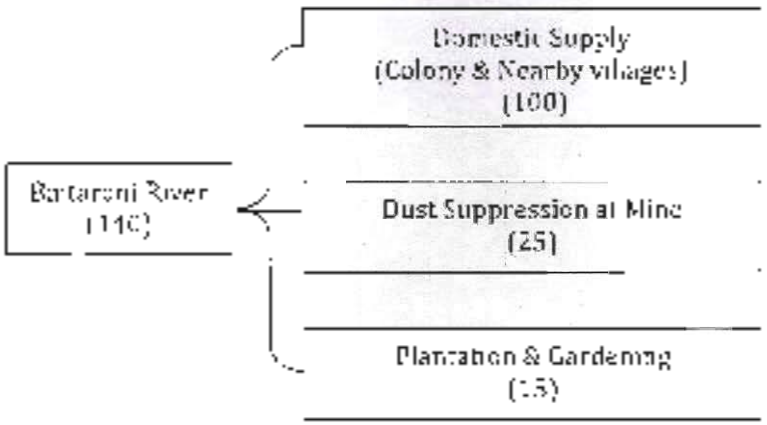
Present water balance chart is furnished below in Table No. 6.5 (A) & (B)

Table No. 6.5 (A)
WATER BALANCE CHART DURING LEAN SEASON
(Avg. m³/day)



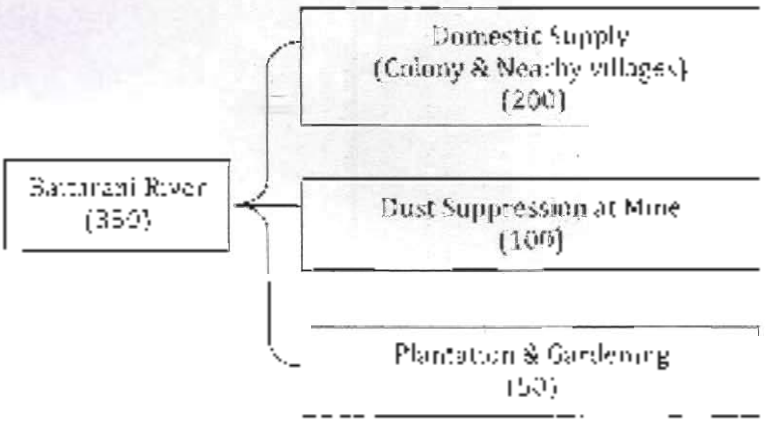
Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 6.5 (B)
WATER BALANCE CHART DURING MONSOON SEASON
(Avg. m³/day)



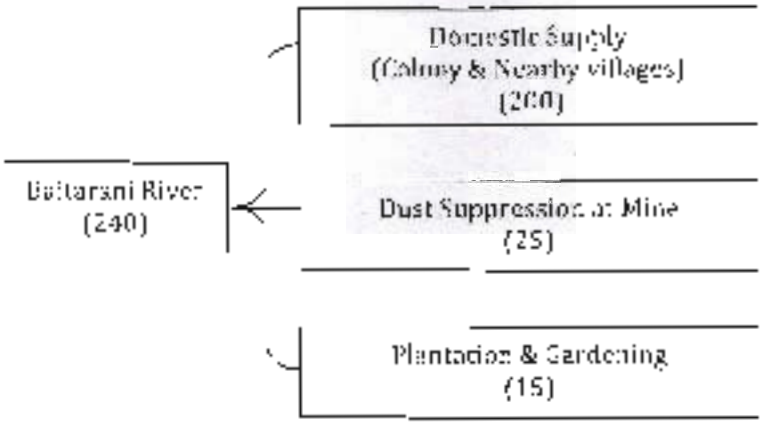
The future requirement of water during lean and monsoon seasons while enhancing the production of Manganese Ore is furnished below in Table No 6.6 (A) & (B).

Table No. 6.6 (A)
WATER BALANCE CHART DURING LEAN SEASON
(Avg. m³/day)



Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 6.6 (B)
WATER BALANCE CHART DURING MONSOON SEASON
(Avg. m³/day)



Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

7.0 OTHERS

a) SITE SERVICES

- The lease hold area does not fall within or near to any National Parks and Sanctuaries.

- Rights and Ownership – M/s Tata Steel Ltd. has hold the ownership of lease area and obtained the surface right over an area of 303.141 ha

- Socio economic Study – The Public hearing has been concurted by State Pollution Control Board during processing of Environmental Clearance for approval in favour of the mine

  With the increase of mining the following socio-economic changes are expected to take place especially within 4 – 5 km from the project area.

  a) The project will improve the overall quality of life of the community and society at large.

  b) The project is not going to cause any damage to existing agricultural situation which is scanty, characteristically low yield and seasonal in this area. Rather the project will help the farmers by improving agriculture. Supplementary income shall in turn increase investment in agriculture and consequently agricultural production.

  c) The project is going to have positive employment and income effects, on account of indirect employment associated with allied activities.

  d) The project is going to have positive impact on consumption behavior by way of raising average consumption and income through multiplier effect.

  e) The project is likely to accelerate the need and importance of education among the local people and increase the literary rate.

  f) The project is going to push up the demand for water for drinking and other purposes in the region

- Roads: Well developed roads within and to the lease hold already exist. Other mining roads shall be developed in due course, for which adequate and suitable mining equipment (viz. dozer, grader etc.) are already there

  Power Source: The manganese ore occurs as small lenses and pockets in the area in a scattered manner. Small diesel operated hydraulic excavators with medium size dumpers are therefore being presently used to provide mobility. It is also not advisable to carry out the excavation of ore beyond day light hours as it shall increase the dilution. Further the low grade ore are also being consumed for Silico manganese alloy production. Thus the existing infrastructure for power for taking care of the lighting load in the colony etc. is sufficient to cater to the needs for the near future.

Prepared by,
SABYASACHY MISHRA
QUALIFIED PERSON

- Labour supply and skill: No increase in production and change in technology is proposed during the current planned period. Hence, the existing human resource is sufficient. However, the skill of the work force shall be further enhanced by providing further training. The infrastructure for training is already in place and adequate to take care of the same.

b) EMPLOYMENT POTENTIAL

The proposed requirement of manpower considering the proposed production as well as mine development as mentioned in Section 3.9 is given in Table No. 7.1 below. The organisational chart is given in figure 6.

Table No. 7.1

Sl No	Category		No	Remarks
1	Manager	:	1	
2	Mining Engineer	:	1	Qualification & Experience: Whole time Mining Engineer shall have Degree in Mining Engg from any recognized College / University with minimum five years of professional experience of working in a supervisory capacity in the field of mining.
3	Geologist	:	1	Qualification & Experience : Whole time Geologist shall have post graduate Degree in Geology from any recognized College / University with minimum five years of professional experience of working in a supervisory capacity in the field of mining
4	Asst. Manager (Mines)	:	2	For Mining, Drilling & Blasting
5	Asst. Manager (Mechanical)	:	1	
6	Asst.Manager (Electrical)	:	1	
7	Surveyor		1	
8	Environment Officer	:	1	
9	Sr. Mines Foreman	:	4	For Mining Operation
10	Mines Foreman / Mining Mate	:	6	For Mining Operation & Stack Yard
11	Blaster	:	2	
12	Blaster Helper	:	6	
13	Survey Helpers	:	4	
14	Shovel Operator & Helpers	:	10	
15	Dumper Operator	:	30	
16	Drill Operator & Helper		10	
17	Loader Operator	:	1	
18	Placer Dumper Driver	:	1	

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

19	Dozer Operator	:	2
20	Water Sprinkler Driver	:	3
21	Explosive van Driver	:	1
22	Light Vehicle Driver	:	3
23	Truck Driver	:	1
24	Ambulance Driver	:	1
25	Crane Operator	:	1
26	Mechanic / Fitter	:	10
27	Electrician	:	3
28	Maintenance Helper	:	7
29	Clerk	:	4
30	Sampler	:	2
31	Sampling Helper	:	4
32	Piece Rated (Mazdoor/Roja)	:	235
	Total		362

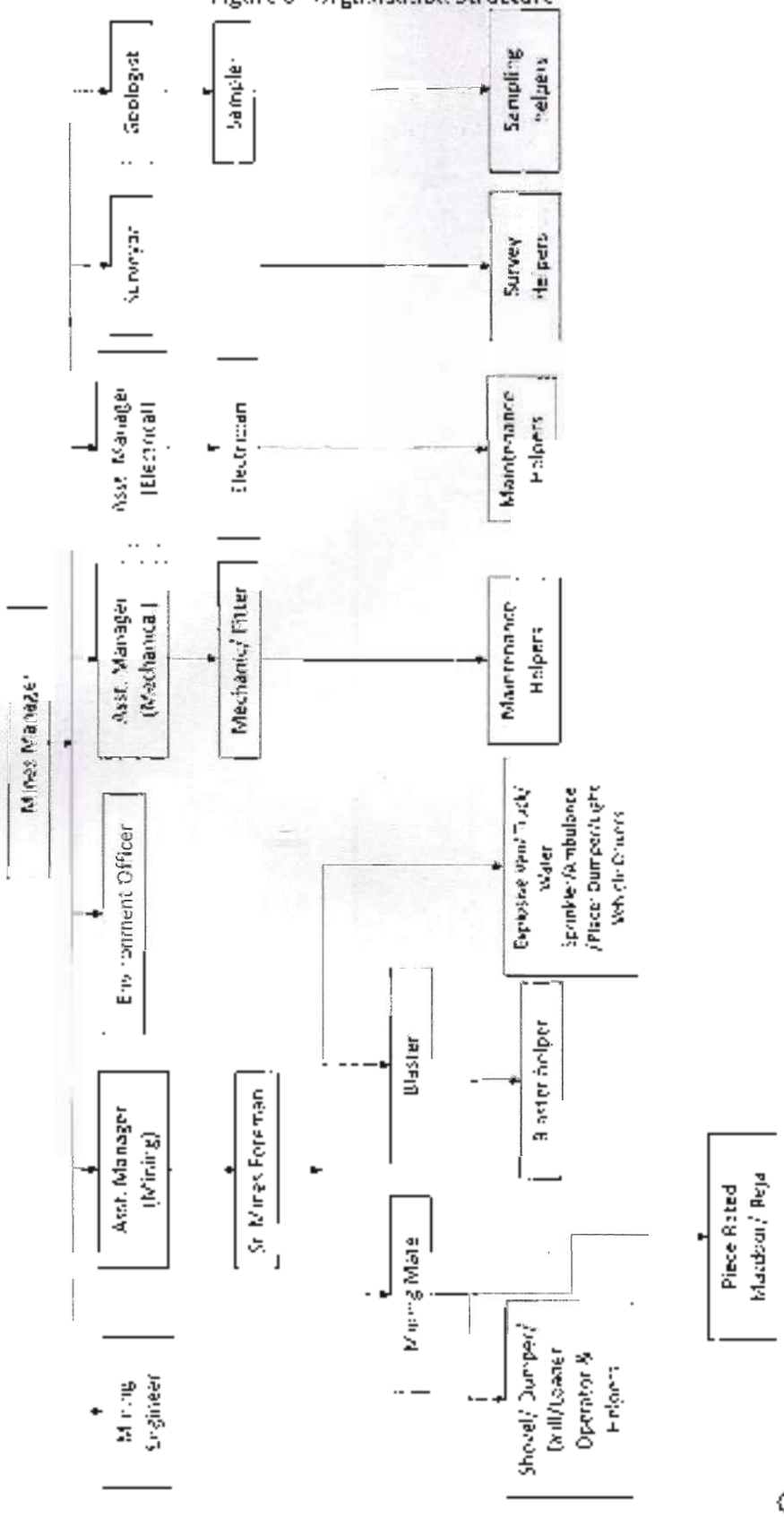
While summing of the above table, the category of employment is mentioned in Table No. 7.2 as given below.

Table No. 7.2

Category	Present			Future		
	Departmental	Contractual	Total	Departmental	Contractual	Total
Highly Skilled	12	0	12	15	0	15
Skilled	12	45	57	17	52	69
Semi-Skilled	8	28	36	11	32	43
Un-Skilled	0	207	207	0	235	235
Total	32	280	312	43	319	362

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Figure 6 Organisation Structure



Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

8.0 PROGRESSIVE MINE CLOSURE PLAN UNDER RULE 23 OF MCDR, 1988

8.1 ENVIRONMENT BASE LINE INFORMATION:

Physiography:

The area under study consists of a part of Odisha's plateau region (Keonjhar plateau) and a strip of Orissa's mountain region. The area under study is situated in Singhbhum Dottar synclinorium which is characterized by gentle to moderately steep or steep slopes. Substantial part of the study area is covered by reserved forests on hills.

Upper part of the study area (with Boneikela at it's center) has Thakurani reserved forest on the north, Sidhamath reserved forest on NW – SW sector, Baitarani reserved forest on S through E sector and Chamakpur reserved forest on SE. Average ground level in Boneikela block is 500 mRL. Highest elevation at hilly regions at Thakurani, Sidamath, Baitarani and Chamakpur reserved forests are 841 mRL, 808 mRL, 616 mRL and 572 mRL respectively. Lower half of the study area (with Jorbar and Bamebari blocks at center) has Chamakpur reserved forest occupying almost 80% of the eastern part and Baitarani reserved forest on north.

Mixed forests are sparsed mostly beneath the hilly reserved forests on moderate slopes. Villages are located mostly with a number of small quarries in the lower part of the study area in central and southern part through SW sector on plain (or gently sloping) land. Boneikela block in the upper part and Jorbar and Bamebari blocks in the lower part of the study area are in gentle slope. Highest elevation (700 mRL) within the Boneilela block is the top of a hillock on north eastern side from where ground level slopes in all directions in varying degree. After a brief valley like terrain in central part of the block ground level again rises and peaks near SW at 600 mRL. At the central valley like part ground level of 500 mRL occurs. In Bamebari block the highest elevation occurs at the central part at 620 mRL from where ground level descends in eastern, western and southern sides. Jorbar block is characterized by a depression in the central part forming a small valley like terrain with gradual rising slope on both eastern and southern sides. Maximum ground level is 600 mRL near the western boundary whereas minimum level at valley is 500 mRL.

There is no national park, biosphere reserve, sanctuary, habitat for migratory birds, archaeological site, defence installation, airports within 10 km of the periphery of core/ buffer zone. As explained earlier, the 10 km radius study area all around the three discrete blocks (Bamebari, Jorbar and Boneikela) has mostly hilly forests and villages and scrubby land.

Prepared by,
SABYASACHY MISHRA
QUALIFIED PERSON

Land Use Pattern:

The detailed land use pattern of Bamebari lease over an area of 464 ha. at present, at the end of the five years planned period and at the conceptual end of life is furnished in table No. 2.9 The break-up of the land use pattern within the applied RML area of 464.000 ha) has already been furnished in the Table No 2.10. The balance area of 686.55 ha. will be remain untouched as conceptualized The Final Mine Closure Plan (FMCP) over an area of 686.550 ha out of the original lease area of 1150.550 ha was submitted and approved by Indian Bureau of Mines, Bhubaneswar Region vide letter no FMCP/FM/04-ORI/BHU/2014-15, dated 20.01.2015 (Copy enclosed as Annexure-33). Accordingly, the Certificate was also granted vide letter no. T/FMCP/C/01/BHU/2011/267, dated 31.05.2016

Water Regime:

The natural drainage system is distinct due to hilly topography in most part of the study circle Baitarani river flowing at a minimum distance of 4.6 km on SE, 2.3 km on NE and 2 km on E from Bonoikela, Joribar and Bamebari blocks respectively forms the major drainage system of the area. Kundra nala or Suna nadi originating little distance beyond the study area flows from SW towards NE and joins Baitarani river on NE part. Kundra nala passes closure to the Bonoikela Block (minimum distance 0.27 km on South). Distance of Kundra nala from Joribar and Bamebari blocks are 3.8 km on NW and 6.5 km on NW respectively. Major part of the area has dendritic drainage pattern. The hill ranges are drained by seasonal nallahs in all directions. A few seasonal streams flow through the lease, High flood level of Baitarani river and Kundra Nala is much below the mining lease.

Core zone is mainly hilly area. The area is under hard rock formations. The rocks do not have primary porosity; only structural weaknesses like joints, fractures, folds, faults and weathering process provide secondary porosity for storing and transmitting water. The buffer zone is by and large occupied by iron ore series. The extent of weathering varies from a few centimeters in upland areas to several meters in valleys. The structural weakness also persists for couple of 100 meters locally along deep-seated lineaments. The ground water occurs under unconfined to semi-confined conditions. The area receives recharge mainly from precipitation and surface sources. Study area's subsurface and surface drainage is controlled by Baitarani and Kundra nala. The area in the vicinity of core zone of Bonoikela Block is drained mainly by Kundra nala whereas the area near to Joribar and Bamebari blocks are drained by Baitarani river.

The surface water quality is being analyzed fortnightly and analysis report is being enclosed as Annexure - 21.

Prepared by,
SABYASACHY MISHRA
QUALIFIED PERSON

Location of Water Quality monitoring stations are tabulated below:

Water Quality Monitoring station	
Block	**Existing**
Bamebari	3297 E, 2039 N
Joribar	13867 E, 12200 N

Quality of Air & Ambient Noise level:

Quality of Air:

The baseline status of the ambient air quality has been established through a scientifically designed ambient air quality monitoring network and was based on following considerations:

- Meteorological condition on synoptic scale.
- Topography of the study area
- Representatives of regional background air quality for obtaining baseline status
- Location of residential areas representing different activities in absence of any stack, the ambient air quality is expected to be affected in and around the mining areas up to a limited distance (within 5 km). Keeping this in view, air quality of core and nearby buffer zone mainly has been monitored.

To assess the ambient air quality level, monitoring stations were set up in the core zone and neighbouring buffer zone up to 5 km distance.

Existing Air Quality Status:

During the operational stage the air quality monitoring is being done at different work zone locations like in the open pit faces, waste and reject dumps, dressing and sorting yard for three dry seasons, as per IBM/ MoEF norms, to draw on climatic data coupled with emission data. The pollutants to be monitored are respirable particulate matter & suspended particulate matter containing significant silica/ silicates, trace & heavy metals, toxic elements and other gases like CO, SO_x & NO_x. Location of Air Quality monitoring stations are tabulated below:

	AAQ Monitoring stations	
Block	**Existing**	**Proposed**
Bamebari	2318N & 3011E	2318N & 3011E
	2201N & 2005E	2201N & 2685E
	1988N & 3058E	1988N & 3058E
Joribar	11452N & 12833E	11452N & 12833E
	11719N & 13195E	11719N & 13195E
Bonaikela	4317N & 4982E	4345N & 5078E
		4086N & 4798E

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

To monitor the effectiveness of dust prevention and control actions, it is necessary to compare background levels of airborne dust with conditions down wind, and back this up with adequate meteorological equipments. Dust samplers complete with particle size partitioning and independent power generators provide sufficient data. The equipment selected is capable of collection of Sulphur dioxide and Nitrogen oxides samples.

The method of deployment of respirable dust samples is down wind condition at the mine site where there is chance of dust nuisance. Air quality analysis is carried out by engaging competent and approved agency by Odisha Pollution Control Board twice in a week all around the year. Air Quality Data reveals no adverse impact on the air quality due to the mining activity.

The results of Ambient Air Quality are enclosed as Annexure 21.

Ambient Noise Level:

In order to have an idea about the existing noise levels of the study area, noise monitoring has been carried out. At each noise monitoring station, Leq. noise level has been recorded at hourly intervals for 8 hours continuously by operating the noise recording instrument for fifteen (15) minutes during each hour. Location of noise monitoring station are as tabulated below:

	Noise Monitoring station	
Block	Existing	Proposed
Bamebari	20?9N & 3253E	1825N & 3049E 2097N & 3253E
Joribar	13425N & 12773E	13425N & 12773E
Bonaikela	4097N & 4827E	4000N & 4798E

The results of Ambient Noise level are enclosed as Annexure-22.

Flora & Fauna:

The entire forest land of 448.395 ha within the lease falls under the Class-I of Eco value class and 0.2 canopy density as assessed by the Divisional Forest Officer, Keonjhar, Govt. of while demanding the NPV. The copy of the letter is enclosed as Annexure-17.

The lease area doesn't form part of any National Park, Wild Life Sanctuary Elephant Reserve, Biosphere Reserve or any critical wildlife habitat. There are no endangered or endemic wildlife species in the area. Some of the common species of flora and fauna available in the area are as follows.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Sl no	Local name	Species	Family
		TREE SPECIES	
1	Amla	Emblica officinalis	Euphorbiaceae
2	Amba	Mangifera indica	Anacardiaceae
3	Asan	Terminalia tomentosa	Combretaceae
4	Bahada	Terminalia belerica	Combretaceae
5	Balhan	Duggina dogginensis	Papilionaceae
6	Bara	Ficus bengalensis	Moraceae
7	Bela	Aegel marmelos	Rutaceae
8	Chara	Buchnania lanzan	Anacardiaceae
9	Bada Chakunda	Cassia siamea	Ceasalpiniaceae
10	Dhaura	Anogeisus latifola	Combretaceae
11	Gambhari	Gmelina arborea	Verbenaceae
12	Harida	Terminalia chebula	Combretaceae
13	Jamun	Syzygium cumini	Myrtaceae
14	Karanja	Pongamia pinnata/glabra	Papilionaceae
15	Kasi	Bridelia retusa	Euphorbiaceae
16	Kendu	Diospyrus melanoxylon	Ebenaceae
17	Karam/Kurum	Adina cordifolia	Rutaceae
18	Kumbhi	Careya arborea	Myrtaceae
19	Kusum	Schleichera oleosa	Sapindaceae
20	Mahula	Madhuca indica/ Bassia latifolia	Sapotaceae
21	Moi/Zia (Daka)	Lannea coromandelica	Anacardiaceae
22	Munduli	Mitragyna parviflora	Rubiaceae
23	Neem	Azadirachta indica	Meliaceae
24	Patuli/Padal	Stereospermum suaveolens	Bignoniaceae
25	Sidha	Lagerstroemia parviflora	Lythraceae
26	Simuli	Bombax ceiba	Bombacaceae
27	Sirsa	Albizzia lebbeck	Mimosaceae
28	Sal	Shorea robusta	Dipterocarpaceae
29	Sisseo	Dalbergia sissoo	Papilionaceae
30	Sunari	Cassia fistula	Ceasalpiniaceae
		SHRUBS / HERBS	
1	Apamarga	Achyanthes aspera	Amaranthacea
2	Bajramuh/Bisinpi	Sida spp	Malvaceae
3	Dhatki	Woodfordia fruticosa	Lythraceae
4	Kasunda/ Ghoda chakunda	Cassia sophera	Ceasalpiniaceae
5	Khajuri	Phoenix sp.	Palmae
6	Kurei/Kerua	Holarchera antidysenterica	Apocynaceae
7	Kurudo	Gardenia spp	Rubiaceae
8	Nagaain	Lantana camara	Verbenaceae
9	Panwar/chakunda	Cassia tora	Ceasalpiniaceae
10	Pokasunga	Ageratum conyzoides	Asteraceae
		GRASSES	
1	Khadika grass	Aristida setacea	Gramineae
2	Kasatandi/Payal	Saccharum spontaneum	Graminae (Poaceae)
3	Ghasa	Panicum spp.	Graminae (Poaceae)

Prepared By
SABYASACHY MISHRA
QUALIFIED PERSON

Sl no	Local name	Species	Family
4	Guguchia	Chrysopogon aciculatus	Gramineae (Poaceae)
5	Dabs	Cynodom dactylon	Gramineae (Poacean)
6	Dinanath ghas	Pennisetum pedicillatum	Gramineae (Poaceae)
7	Kahr ghas	Imperata cylindrical	Gramineae (Poaceae)
8	Sinkola	Heteropogon contortus	Gramineae (Poaceae)
		CLIMBERS	
1	Atunda	Combretum decandrum	Combretaceae
2	Anantamula/ Suganchi	Hemidesmus indicus	Asclepiadaceae
3	Raidanka	Mucuna pruriens	Papilionaceae
4	Satabari	Asparagus racemosus	Liliaceae

S.No	Scientific Name	Common Name	Schedule
	Amphibians		
1	Rana tigrina	Indian Bull Frog	IV
2	Rana hexdactyla	Frog	IV
3	Rana cyanophyctis	Water skiaper	IV
	Reptiles		
4	Varanus salvator	Monitor Lizard	I
5	Naja tripudians	Common Cobra	IV
6	Bangarus coerulens	Common Krait	IV
7	Bangares fasciatus	Banded Krait	IV
8	Chameleon spp	Balu Supt	II
9	Python molurus	Python	I
	Birds		
10	Columba livia	Pegon	
11	Coturnix coturnax	Common crow	
12	Milvus migrans	Common kite	
13	Pavo cristatus	Common peafowl	I
14	Passer domesticus	Common sparrow	
15	Psittacula columboides	Parrot	
16	Gallus gallus	Owl	
17	Streptopelia sp	Dove	
18	Milvus migrans	Common parish kite	
19	Brachypternus bengalensis	Wood pecker	II
20	Ploceus philhapinus	Baya weaver Bird	
21	Cuculus microptens	Cuckoo	IV
22	Gyps bengalensis	Vulture	IV
23	Bulbulcus ibis	Cattle egret	IV
24	Ardea alba	Large Egret	IV
25	Acridotheres tristus	Myna	IV
26	Molpastes cafer	Bulbul	
	Mammals		
27	Pteropus medius	Bat	
28	Rattus rattus	Maya	

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Sl.No	Scientific Name	Common Name	Schedule
29	Macaca mullata	Monkey	II
30	Orytolagus cuniculus	Rabbit	-
31	Funambulus pennati	Squirrel	IV
32	Herpestis edwardsi	Mongoose	IV
33	Canis aureus	Jackal	II
34	Muntiacus muntjack	Sutra	III
35	Sus scrofa	Wild pig	III
36	Felis chaus	Jungle cat	IV
37	Melursus ursinus	Bhalu	II
38	Hyaena hyaena	Hela bagh	III
39	Hystrix indica	Percupine	-
40	Elephas maximus	Elephant	I

Climate & Meteorology:

The area lies in tropical region where climate is characterized by very hot summers and moderate winters. However, the winter temperatures of the study area indicate that it is in the sub-tropical region. Summer is typically from March to mid-June when temperature ranges from a maximum of 44°C during daytime to a minimum of 23°C at night. Winter is from December to February when the maximum temperature during day goes up to 29°C and minimum temperature at night becomes as low as 4°C.

The annual rain fall recorded at the mine site is furnished in Table No. 3.1.

Human Settlements:

The impact area comprises of 43 villages. The population structures of these villages are furnished below.

Sl. No.	Name of Villages	Total number of households	Population		
			Total	Male	Female
1	Burkala	17	80	40	40
2	Kotrudapur	171	913	466	447
3	Daduan	194	879	429	450
4	Jada	50	433	228	205
5	Ranapal	325	1589	766	823
6	Harihanpur	56	288	144	144
7	Dhobakuchuda	239	1106	524	582
8	Dholabeda	395	1967	979	988
9	Jalahari	746	3021	1576	1445
10	Langalakanti	108	563	277	285
11	Haridajodi	80	336	166	170
12	Jajanga	1418	5799	3111	2688
13	Bandhuabeda	96	476	235	241
14	Kamalpur	165	706	362	344
15	Bhandardihi	305	1291	652	639
16	Tamunapasi	258	1271	630	641

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Sl. No	Name of Villages	Total number of households	Population		
			Total	Male	Female
17	Belda	73	332	170	162
18	Jagannathapur	85	409	218	191
19	Dichabali	190	948	458	490
20	Kalimati	195	783	389	394
21	Balada	311	1243	613	630
22	Kanapasi	125	566	276	290
23	Palasa	96	508	247	261
24	Gurudacamp	58	249	138	111
25	Gurada	249	1108	603	505
26	Malada	186	743	411	382
27	Khadabandha	266	1163	595	568
28	Chormalda	99	445	225	220
29	Kundurupaci	80	349	170	179
30	Rugudi	176	695	356	339
31	Kamargoda	250	1142	570	571
32	Banaikala	56	253	134	119
33	Gamulai	52	218	106	112
34	Tanto	115	535	276	259
35	Badagaon	156	770	393	377
36	Bhusugaon	337	1487	797	690
37	Bhadrasahi	174	779	427	352
38	Lahanda	209	1049	565	485
39	Bhagalapur	118	595	294	301
40	Ralkala	305	1379	708	671
41	Balita	162	766	377	389
42	Deejhar	172	813	395	418
43	Serenda	345	1468	793	675
	Total	9336	41557	21284	20273

Category of Population-

Sl. No	Name of the Villages	Schedule Cast		Schedule Tribe	
		Male	Female	Male	Female
1	Birikala	0	0	40	40
2	Gobindapur	3	1	427	403
3	Daduan	57	63	214	229
4	Joda	1	0	156	156
5	Baruga	61	68	649	702
6	Kariharpur	0	0	0	0
7	Dhobakochuda	46	69	421	449
8	Baolabeda	72	75	775	774
9	Jalabari	355	363	799	781
10	Langalakunu	3	3	187	186
11	Nandapdi	0	0	159	163
12	Taianga	350	346	1963	1735
13	Randhabeda	0	0	235	241
14	Kamalpur	24	28	172	149
15	Khandaridiha	75	66	9	

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Sl. No	Name of the Villages	Schedule Cast		Schedule Tribe	
		Male	Female	Male	Female
16	Jamunapasi	54	76	391	378
17	Belda	0	1	130	118
18	Jagannathapur	0	0	210	185
19	Unchabal	4	6	316	332
20	Kalimati	33	31	329	245
21	Kusda	34	29	499	555
22	Kanaposi	14	10	126	140
23	Palasa	0	0	247	251
24	Gurudacamp	33	30	40	23
25	Guruda	14	10	462	424
26	Malada	1	2	192	198
27	Khadabandha	64	61	410	418
28	Chormalda	28	26	100	177
29	Kundurupani	23	26	114	120
30	Rugadi	47	41	143	145
31	Kamarguda	0	0	561	566
32	Banelkala	23	19	28	71
33	Gamalai	0	0	107	107
34	Tanto	9	9	232	229
35	Jhadagaon	65	64	269	256
36	Bhusugaon	83	71	170	157
37	Bhadrasahi	56	41	189	181
38	Lehanda	37	29	419	371
39	Bhagalapur	7	5	247	248
40	Kuxala	15	16	348	311
41	Balita	11	11	351	350
42	Deojhar	7	10	318	343
43	Serenda	86	63	480	447
	Total	1829	1802	13577	13258

Total population of the impact area villages is 41,557, with average household size being 4 - 5 members. Average sex ratio in the study area village is 952 females per 1000 males. Majority of the villages were tribal dominated with percentage of ST and SC population is 64.57 and 8.74 respectively.

Literacy :

The average literacy rate of the buffer area villages as per Census 2001 is 38.44% and average male and female literacy rate is 25.48% and 12.96% respectively.

Occupational profile.

As per the 2001 Census, total workers comprise of about 16,981 (40.86%). The total number of male workers & female workers are 9842 & 3180 and their percentages are 46% and 16% respectively.

Prepared by,
SABYASACHY MISHRA
QUALIFIED PERSON

There are no protected monuments and historical monuments inside the core and buffer zone. Only one temple is located near the colony at an aerial distance of 800 m from the active mining area.

The occupational profile of the villages within the impact area is described as follows:

S.N	Village	Main Worker		Marginal Worker		Non Worker	
		Male	Female	Male	Female	Male	Female
1	Barisola	16	11	10	11	34	15
2	Gobindapur	218	61	22	130	226	247
3	Dadsai	239	79	8	71	182	340
4	Jada	43	3	78	124	107	39
5	Bansaal	345	10	79	222	343	571
6	Hambarpur	70	3	13	5	61	136
7	Dhobakudiada	240	77	24	50	260	455
8	Bhuiabeda	478	94	84	212	465	602
9	Jalahari	732	364	67	72	727	1059
10	Lamgalakanti	170	34	5	9	102	247
11	Haradajodi	16	3	77	70	93	97
12	Jajanga	1737	693	46	107	2331	1986
13	Bandhabeda	90	2	16	0	129	230
14	Kamalpur	166	34	24	84	172	226
15	Bhandardihi	300	16	32	10	330	613
16	Jamunajoda	290	76	55	259	285	315
17	Belda	79	38	10	52	81	72
18	JagannathPur	101	25	7	55	110	111
19	Unchahati	213	99	32	123	213	268
20	Kalatati	190	6	61	219	138	178
21	Balada	386	268	17	49	210	314
22	Kanaposi	127	109	16	37	133	144
23	Palasa	112	117	24	29	111	115
24	Guradacamp	67	13	9	0	62	98
25	Gurada	351	153	6	4	246	348
26	Malada	84	6	110	48	217	328
27	Khadabanicha	307	116	4	1	284	452
28	Chormalda	94	8	13	9	118	207
29	Kandurupani	54	35	21	15	95	129
30	Rugudi	155	39	23	41	176	268
31	Kanungoda	286	103	30	108	254	360
32	Baneikala	70	13	1	13	61	94
33	Gamutai	3	0	58	59	45	53
34	Tanto	139	12	14	13	146	225
35	Dudagaon	183	65	3	2	267	330
36	Bhusugaon	340	46	28	21	399	623
37	Bhadrasahi	225	34	9	2	198	316
38	Lahanda	202	137	61	23	297	325
39	Bhagalapur	89	55	32	24	173	218
40	Rankela	332	96	77	46	329	609
41	Rahta	175	40	28	95	174	254
42	Deuthar	189	40	9	44	197	334
43	Sorendo	214	35	133	28	446	512
	Total	9842	3388	1471	2480	9971	14605
	Percentage	41.35		9.51		59.14	

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

8.2 ENVIRONMENT IMAPCT ASSESSMENT:

The environmental impacts due to mining and its allied activities largely depend upon the size of operation; stripping ratio and extent of mechanization. The matrix for impact identification is shown in Table No. 8.1

Table No. 8.1

Environmental Impact Identification Matrix

Aspects → / Impacted Attributes ↓	Mining & Allied Activities									Post Operational Phase		
	Site Preparation	Opencast Excavation	Dumping of Overburden	Stacking of Ore & Transportation	Water Consumption	Water Discharge	Maintenance of Equipment	Power Generation by DG Sets	Development of Green belt	Employment	Reclamation (Buffer Zone)	Transportation	Industrialisation
Land													
Air Quality													
Water Quality													
Noise Levels													
Vibration Levels													
Water Regime													
Acid Mine Drainage													
Surface Subsidence													
Socio-economics													
Historical Monument													

Adverse Impact
Beneficial Impact

Prepared by,
SABYASACHY MISHRA
QUALIFIED PERSON

The environmental attributes that are subjected to test for having impact on their by varying degree include ambient air quality, water resources & quality, noise levels, flora and fauna (ecology), soil and land use, socio-economic environment and infrastructural development, health etc. Various activities causing impacts to have been considered under various stages viz. siting, operation of opencast mines and secondary activities and also at post operational phase.

The activities have been arranged in columns and environmental attributes in rows in the matrix. A preliminary scrutiny has been made and the cells which fall at the junction of "activity" and "attribute", that have possible interaction with each other, have been crossed.

The matrix thus, identifies the environmental attributes likely to be affected and the activities responsible for this. The impacts may be beneficial or adverse.

Future Land Use Pattern:

Considering the existing Manganese Ore production, the land use has been planned for next five years till 31.03.2025. The detail break-up of land use pattern for the individual lease blocks are furnished below in Table No. 8.2.

It shall be noted that the provisions of the Odisha Scheduled Areas Transfer of Immovable property (by Scheduled Tribes) Regulation, 1956 (Odisha Regulation 2 of 1956) and the Forest (Conservation) Act, 1980 will be followed and for the time being the area concerned has been identified under the category of area to remain untouched. However, specific permission shall be obtained from appropriate authority for doing mining in future.

The mineral storage area includes the finished ore stacking area, sorting yard and mineral fines stacks.

TATA

Table No. 8.2

Sl No	Type of Use	As at Present as on 01.04.2020 (ha.)				Addn/ (-)n. Requirement during five (5) yrs plan period				As at end of plan period i.e. 31.03.2025			
		Bamebari	Jonbar	Banaikela	Total	Bamebari	Jonbar	Banaikela	Total	Bamebari	Jonbar	Banaikela	Total
1	Area Excavated	45.947	16.179	45.920	87.843	5.930	6.630	8.330	13.296	31.677	26.211	49.250	101.138
2	Storage of Top Soil	0	0	0	0	0.150	0.150	0.150	0.450	0.150	0.150	0.150	0.450
3	Waste dump	20.712	12.812	11.01	45.534	0	7.227	5.925	13.152	21.712	20.039	16.635	58.386
4	Mineral Storage	1.823	2.193	4	8.016	1.650	6.472	0	5.472	2.823	6.665	4.000	13.488
5	Infrastructure (Workshop Magazine etc)	2.080	1.256	0.870	4.206	0	0.730	0.665	1.395	2.080	1.986	1.535	5.601
6	Roads	3.130	3.580	3.740	10.420	1.000	0	0	1.000	4.107	3.580	3.740	11.420
7	Railways	0	0	0	0	0	0	0	0	0	0	0	0
8	Parking Point	0	0	0	0	0	0	0	0	0	0	0	0
9	Effluent Treatment Plant	0	0	0	0	0	0	0	0	0	0	0	0
10	Mineral Separation Plant	0	0	0	0	0	0	0	0	0	0	0	0
11	Township Area	17.350	7.004	0	24.350	0	0	0	0	17.546	7.004	0	24.350
12	Others - Green Belt	11.350	9.594	0	21.044	-3.894	0	0	-3.894	7.556	9.594	0	17.150
Area remain Untouched		77.827	38.396	167.508	282.710	-	-	-		52.646	23.802	157.73	234.167
	Total	140.037	91	233	464	4.186	16.582	9.770	30.543	140	91	233	464

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

ii) Air Quality:

In mechanized opencast mine, mining operations such as mining extraction, loading and unloading, movement of dumpers on haul roads and external dumping and sizing of ore etc are expected to generate airborne fugitive dusts. Comparatively higher level of SPM and RPM are expected due to fine particles which becomes easily airborne after blasting and in haul roads. Due to high specific gravity of the ore raising of dusts shall be not much. But excavated wastes shall raise the airborne dust level to some extent. The detail analysis of ambient air quality is enclosed as Annexure-20

The region is full of mining and allied industry. The existing background level of ambient air quality also includes the effect of neighbouring mines. The estimated dust level rise, may not cause any appreciable impact in core zone and neighboring environment

Mitigation measure -

The fugitive pollution is localized and there is no stack pollution from mining area caused to the villages. Maximum concentration predicted at express way is close to active work zone. Dust generated in excavation area shall be screened by artificially generated forests which have not been taken into account when predicting the ground level concentration.

While transporting manganese ore from mine to Joda Ferro Alloys plant as manganese ore is hard lumpy in nature, substantial raising of dust during transportation is not expected. As a precautionary measure, the loaded trucks will be covered with tarpaulin sheets.

While transporting overburden from one mining block to the other the following environment preventive measures will be undertaken to alleviate the adverse impact on the forest & Environment.

- No further diversion/widening shall be caused to the existing road
- Extensive water sprinkling shall be carried out to control the fugitive dust emission.
- The trucks loaded with overburden shall be covered with tarpaulin to prevent the air borne dust.
- Wheel washing facility will be provided at exit points.
- The overloading of truck will not be done
- Vehicular emissions shall be kept under control and regularly monitored.

There is no potential source of NOx generation at the core zone other than blasting. Thus, SO2 and NOx levels shall remain very less throughout the life of the mine and hence have not been considered for predictive modelling.

iii) Water Quality:

The main minerals in the country rock are goethite, limonite, clay, pyrolusite, psilomelane and bauxite. These minerals are non-toxic in nature even when exposed to superficial weathering under tropical humid conditions. However, higher number of suspended particles are released into surface water during rainy seasons. The stream water during the summers are remarkable clear. The surface water quality analysis report is enclosed as Annexure-21.

The Water balance chart for Bamebari Lease is given in Table No. 8.2 (a) & 8.2(b)

Table No. 8.2 (a)
WATER BALANCE CHART DURING LEAN SEASON
(Avg. m³/day)

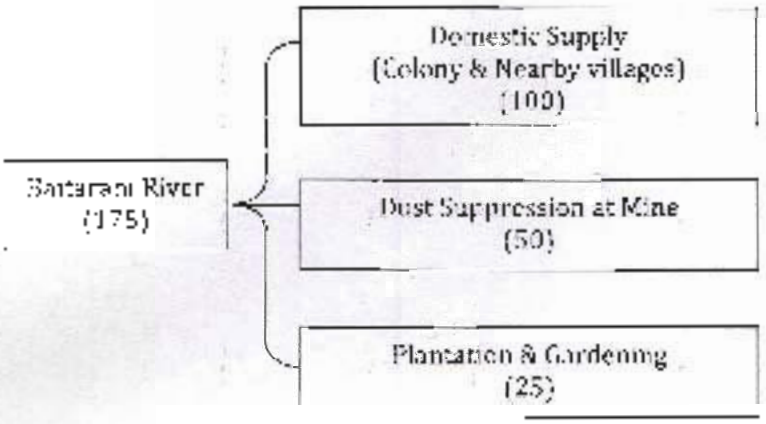
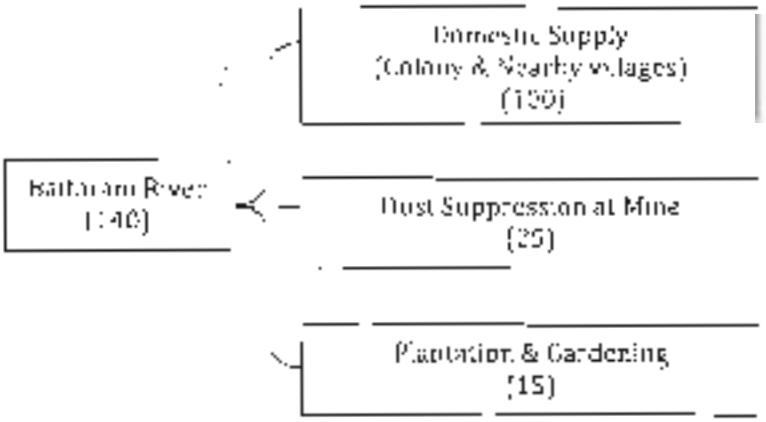


Table No. 8.2 (b)
WATER BALANCE CHART DURING MONSOON SEASON
(Avg. m³/day)



Mitigation measures –

Sanitary sewage generated from staff quarters, offices & mine area will continued to be discharged to septic tank/ soak pit.

Effluents from gatage and workshop are carried to oil separation system and the oil free water is recycled. Canteen waste water is being discharged to the soak pits. Thus, there is no regular effluent discharge from this mine going outside the lease area. Surface run off shall generate only during heavy monsoon for which drainage in the core zone has been planned to be regulated in a manner so that impact on surface water bodies is minimised and yet the drainage pattern of the area is not affected.

Water management (including storm water drainage) by a network of garland drains/ diversion ditches / settling pits has been planned. The salient features are as follows:

- Garland drains shall be made around the dumps. While constructing drains, routing and terracing shall be done by maintaining the overall slope in the direction of flow direction so that run off distribution is not affected.
- First one or where possible two rows of parallel or near parallel diversion ditches shall be constructed preferably in non-ore bearing area. The connecting drains between them shall carry water down to the bottom sump.
- Retaining wall shall be made on all sides of the dumps. Retaining walls will have weep holes to allow water to flow down to garland drains.
- Two stages catch pits of adequate size shall be constructed at suitable places depending upon contour by which storm water will get collected at the catch pits through a network of garland drains
- Small grasses / bushes in drains hold back solid particles from draining away.
- Small stone barriers across the drain will check water current and arrest solids
- Stone pitching will be made at suitable places to regulate water flow.
- Some of the drains which will serve for a long time shall be made with concrete.
- Settling pits and drains shall be cleaned periodically.

iv) Noise Level :

In order to have an idea about the existing noise levels of the study area, noise monitoring has been carried out at all vulnerable locations. Measurements have been carried out at all the monitoring stations. At each noise monitoring station, Leq noise level has been recorded at hourly intervals for 8 hours continuously by operating the noise recording instrument for fifteen (15) minutes during each hour.

The results of Ambient Noise Level are enclosed as Annexure -22.

Mitigation measures –

Noise level shall be maintained below 90 dB (A) in work zone (for 8 hours exposure). Noise levels are expected to increase (wrt present low level) at surface work zone with increase of mining and allied activities.

The following measures will be taken to reduce noise levels.

- Diesel powered machineries which are major source of noise in open cast environment will be properly maintained as per maintenance schedule to prevent undesirable noise.
- Static diesel engines shall be housed as far as possible (not made of sheet metals or surrounded by baffles)
- Surface drilling and blasting operations will not be carried out at night
- Drill machine operators and dumper drivers will be provided with ear protective appliances.
- Plantation will be developed around office building and mine to reduce noise exposure level

v) Vibration Level :

The purpose of the blasting is to induce a heaving effect so that, excavator can load the blasted material easily into dumpers. The requirement of blasting is mainly to break the hard in-situ patches which otherwise cannot be removed. The blasting is carried out with large diameter (165mm) slurry explosive cartridges. Cap-sensitive slurry explosive cartridges are being used as base charge and non cap sensitive are used as column charge.

The blasting will therefore be scattered in the quarry. The details of burden, spacing and explosive consumption pattern are mentioned below,

Depth of the hole	= 6m (bench height) + 10% as sub grade drilling)
	= 6.6 m (max)
Spacing	= 3m
Burden	=2.5m
Volume/ hole (in-situ)	= 45 CuM
Specific Gravity	= 2.5
Tonnage/ Hole	= 112.5 Tonnes
Powder factor	= 3.0 Kg/Tonne
Sc. Quantity of explosive/hole	= 22.5 Kg.

After charging with 250ms delay DTH & stemming of holes, connection is done with detonating fuse. Cord relay of 25 ms / 50 ms are used for delay in case of normal blasting (i.e. if there is no permanent structure within danger zone not belonging to owner or danger zone is free from intersection of public road etc.). Cord Relay of 25 ms / 50 ms is fixed between holes along the spacing as well as between rows. There after shot is fired electrically after taking clearance from guards posted to prevent un authorized entry to mine.

In case of controlled blasting (i.e in close proximity to roads, batments etc) bottom initiation pattern by using 250 ms delay Down To Hole (DTH) followed by connection of hole to hole with 17ms Trunk Line Delay (TLD). In case of multi row holes, 42 ms, 65 ms, 100 ms TLD are used for subsequent rows respectively.

Mitigation Measures –

- Blasting shall be carried out only during day time as per the scheduled timing.
- Maximum permissible charge per delay would depend on the distance of structure to be protected from the blasting based on CIMFR Study Report. Suggested number of rows in a blast should not be more than four to reduce fly rock and ground vibrations.
- Detonation cords should be used for connections and for initiation of detonation in holes.
- Detonation cord relays should be used for providing delay timings between rows (75 ms to 50 ms) and within rows or between holes (15,17 or 25 ms duration)
- Length of blast will depend on the total number of holes which can be blasted in a round while observing the above guidelines/ restrictions. However, it should be as large as design would permit. Attempts should be made to have one large blast with less frequency than to have several small blasts.
- Initiation sequence Diagonal or extended V pattern or Bottom Initiation
- Drill cuttings may be used as stemming material.
- Whenever required, covering of holes including the entire area to be blasted, particularly for small dia holes by old belt conveyors over the wire nets is much more effective. Gunny bags filled with sand free of pebbles, weighing at least 30-40 kg. may be placed over the old belt conveyors/wire nets at an interval of 2m between and within the rows

vi) Water Regime:

Core zone is mainly hilly area. The area is under hard rock formations. The rocks do not have primary porosity; only structural weaknesses like joints, fractures, folds, faults and weathering process provide secondary porosity for storing and transmitting water. The buffer zone is by and large occupied by iron ore series. The extent of weathering varies from a few centimeters in upland areas to several meters in villages. The structural weakness also persists for couple of 100 meters locally along deep seated lineaments. The ground water occurs under unconfined to semi-confined conditions. The area receives recharge mainly from precipitation and surface sources. Study area's subsurface and surface drainage is controlled by Baitarani and Kundra nala. The area in the vicinity of core zone of Bonaisola block is drained mainly by Kundra nala whereas the area near to Jonbar and Bamebari blocks are drained by Baitarani river

As there are hilly terrains in each block, to drain out the surface run-off water, a small sump is maintained at the lowest level of the quarry. Because the quantity is very small, the water gets automatically soaked into the ground. The spoil banks are in stages which helps to restrict the solids flowing through the water during rainy season. This prevents wash offs of solid along the slope. The run offs water passing through the drain does not get contaminated by any dirt or soil except turbidity in rainy season. The water ultimately get discharged into small seasonal nallahs passing through the lease area.

The surface water quality analysis report is enclosed as Annexure 21

vii) Acid Mine Drainage:

The main minerals in the country rock are goethite, limonite, clay, pyrolusite, psilomilane and bauxite. These minerals are non-toxic in nature in nature even when exposed to superficial weathering under tropical humid conditions. However, only higher number of suspended particles are released into surface water during rainy seasons. The stream water during the summers are remarkable clear. Since there is no washing / beneficiation of ore except for manual breaking and dry screening, treatment / disposal of water from processing operations are not required. As mining operations are on hill slopes, there is no possibility of ground water getting intercepted in future also.

Also viewing the regional as well as local geology, there is no surficial exposure of iron sulphide which can form chemical reaction with the surface run offs to make it acidic. Hence, acid mine drainage is not envisaged.

viii) Surface Subsidence:

Although there is change in elevations caused due to opencast mining, neither the ground water intersected nor the workings are over the ground water table which may cause the land weaker than the original mass. Hence, surface subsidence is not envisaged.

ix) Socio-Economics:

With the increase of mining the following socio-economic changes are expected to take place especially within 4 – 5 km from the project area.

a) The project will improve the overall quality of life of the community and society at large

b) The project is not going to cause any damage to existing agricultural situation which is scanty, characteristically low yield and seasonal in this area. Rather the project will help the farmers by improving agriculture. Supplementary income shall in turn increase investment in agriculture and consequently agricultural production

c) The project is going to have positive employment and income effects, on account of indirect employment associated with allied activities

d) The project is going to have positive impact on consumption behavior by way of raising average consumption and income through multiplier effect

e) The project is likely to accelerate the need and importance of education among the local people and increase the literacy rate.

f) The project is going to push up the demand for water for drinking and other purposes in the region

Prepared by,
SABYASACHY MISHRA
QUALIFIED PERSON

x) **Historical Monuments:** There are no historical monuments, national parks, biosphere reserve, sanctuary, habitat for migratory birds, archaeological site, defence installation, airports within 10 km of the periphery of core/ buffer zone.

Environment Clearance:

The mine has already obtained the Environmental Clearance from the MoEF vide letter no.J-11015/85/2003-IA.II(M), Dt.17.11.2005 for production @ 0.932 LTPA of Manganese Ore, copy of which is enclosed as Annexure-18

The mine has also obtained the Consent to operate for production level at 0.83 LTPA of Manganese Ore under Air (Prevention and Control of Pollution) Act, 1981 & Water (Prevention and Control of Pollution) Act, 1974 from State Pollution Contro. Board, Odisha. Wide Consent Order No.117, valid up to 31.03.2021, copy of which is enclosed as Annexure-19

8.3 PROGRESSIVE RECLAMATION PLAN:

8.3.1 MINED OUT LAND

The land use patterns within the Gamebahri mining lease area of 464 ha. with respect to present as on 31.7.2019, at the end of this plan period (i.e 31.03.2025) and Conceptual period (i.e. end of lease period as on 31.03.2030) is furnished in Table no. 8.3 as follows:

Table No. 8.3

S.No	Type of Use	As on 01.04.2020 (ha)	As on 31.03.2025 (ha)	As on 31.03.2030 (ha)
1	Area Excavated	87.840	101.138	135.090
2	Storage of Top Soil	0	0.450	0
3	Waste Dump	45.534	58.386	84.132
4	Mineral Storage	8.016	13.188	15.970
5	Infrastructure (Workshop, Magazine etc)	4.086	5.451	6.555
6	Roads	10.420	12.420	16.860
7	Railways	0	0.000	0
8	Tailing Pond	0	0.000	0
9	Effluent Treatment Plant	0	0.000	0
10	Mineral Separation Plant	0	0.000	0
11	Township Area	24.350	24.350	25.222
12	Others - Green Belt	21.044	17.150	13.695
13	Area remain Un touched	262.710	232.167	164.176
	Total	464	464	464

The year-wise land degradation by virtue of development and their concurrent reclamation by back filling during this planned period of 2020-21 TO 2014-25 is given in Table No.8.4 below

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Table No 0.4

Year	Nature	Area at beginning of the year (ha)	Additional area degraded during the year (ha)				Area to be reclaimed by back filling during the year (ha)				Balance area at the end of year (ha)
			Bamebari	Joribar	Bonaikela	Total	Bamebari	Joribar	Bonaikela	Total	
2020-21	Development of quarries	87.840	0	0.152	0.313	0.465	2.565	0	0	2.565	88.305
2021-22		90.305	0	0.203	0.193	0.396	1.580	0	0	1.580	89.701
2022-23		89.701	0	0.54	0.923	1.463	4.300	0	0	4.300	90.164
2023-24		90.164	0	0.633	1.901	2.534	0	0	0	0	92.698
2024-25		92.698	5.930	2.510	0	8.440	4,000	0	0	4,000	101.138
Total		-	5.930	4.038	3.330	13.298	12.445	0	0	12.445	-

Remarks- The year-wise area to be reclamation by back filling has not been deducted from the quarry area due to its continuation during the plan period.

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Bamebari Block –

As proposed in the preceding approved Scheme of Mining, all the over burden material excavated during mining will be backfilled in the quarry only. Further the overburden generated in Bamebari pit shall be completely backfilled in the old Bamebari Quarry.

This is pertinent to mention that, as per earlier approved proposal, Overburden from Joribar Quarry is being disposed off at Bamebari Block within the extent of 2182N – 2482N & 3047E – 3438E for quarry back filling. This was due to lack space for OB disposal on account of delay in grant of forest clearance. In this same manner, disposal of waste will be continued till 2022-23.

The quarry will be developed towards north east side of the old quarry within the extent of 2320N - 2730N & 3267E – 3543E. till 2022-23 at 532 mRL. This is also expected that, beyond 532 mRL, no more Manganese Ore will be available to mined out economically due to presence of variegated shale. However, 25 no. of bore holes has been proposed to be drilled during 2022-23 to confirm the bottomness. Considering the past experience from exploration activities, manganese ore may not be available below of such shales for which back filling from bottom to top of the pit has been proposed from 2023-24 onwards. (Ref. Drawing No. 14A).

Joribar Block -

No exhausted pit will be available during this plan period of 2020-21 to 2024-25 for reclamation by back filling with waste.

Bonaiketa Block –

No exhausted pit will be available during this plan period of 2020-21 to 2024-25 for reclamation by back filling with waste.

It is further proposed that the slopes of all the overburden dumps shall be afforested by planting different local / forestry species for rehabilitation, varieties of grass and bushy plants along these slopes to further arrest the solids from wind erosion. The Concurrent rehabilitation of dumps will be done as per the practice. The amount of area likely to be degraded by way of dumping and proposed retreating method is given in Table No. 8.5

Prepared by,
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 6.5

Year	Nature of Dump	Area at beginning of the year (ha)	Additional area degraded during the year (ha)	Area to be rehabilitated during the year (ha)	Balance area at the end of year (ha)
2020-21		45.534	0.500	0	46.034
2021-22		46.034	1.302	0	47.336
2022-23	Overburden	47.336	2.730	1.000	49.066
2023-24		49.066	8.320	1.000	56.386
2024-25		56.386	0	0	56.386
Total			12.852	2.000	

Remarks : The proposed area of rehabilitation over an area of 2 ha has not been considered as green belt at the end of this plan period, hence, balance area of 58.306 ha has been considered for calculation of financial assurance

The proposal of mining operation and dumping of overburden are shown in the drawing no. DWG 11A, DWG 11B, DWG 11C & DWG 14A, DWG 14B, DWG 14C.

The details of toe wall construction and rehabilitation of overburden dumps has been described in table 4.9 and depicted in the plan no. DWG 16A ,DWG 16B and DWG 16C. The year-wise reclamation and rehabilitation measures to be undertaken during plan period is shown in plan no. DWG 16A, DWG 16B and DWG 16C.

8.3.2 TOP SOIL MANAGEMENT:

As mentioned earlier, top soil as envisaged to be generated during the course of mining. However, care shall be taken to excavate the top soil during end of summer season for its immediate usage for plantation during monsoon. Efforts shall be taken for not storing the top soil for more than three months to prevent the loss of its nutrients caused due to seasonal effects.

8.3.3 TAILING DAM MANAGEMENT:

Presently no mineral beneficiation is being done for low grade manganese ore. Hence the generation of tailing from the mineral beneficiation process is not envisaged within the scope of present Progressive Mine Closure Plan.

8.3.5 SURFACE SUBSIDENCE:

Although there is change in elevations caused due to opencast mining, the ground water did not intersect nor the workings are over the ground water table which may cause the land weaker than the original mass. Hence, surface subsidence is not envisaged.

INFORMATION ON PROTECTIVE MEASURES FOR RECLAMATION AND REHABILITATION:

Similarly, information on protective measures for reclamation and rehabilitation works to be carried out during ensuing mining plan period (i.e 2020-21 to 2024-25) is furnished below in Table No. 8.6.

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 8.6

Items	Details	Proposal during the Plan Period (2020-21 to 2024-25)					
		2020-21	2021-22	2022-23	2023-24	2024-25	Total
Dumps Management	Area Afforestated (hect.)						
	Bamebari Block	1.00	1.60	1.00	2.35	1.40	6.75
	Joribar Block	0	0	0	1.00	1.00	4.00
	Bonaikela Block	0	1	0.8	0	0	1.8
	Total	1	2	1.8	3.35	2.4	10.55
	No. of Saplings Planted						
	Bamebari Block	2500	2500	2500	5875	3500	16875
	Joribar Block	0	0	0	2500	2500	5000
	Bonaikela Block	0	2500	2000	0	0	4500
	Total	2500	5000	4500	8375	6000	26375
	Cumulative no. of plants						
	Bamebari Block	186998	189498	191998	197873	201373	201373
	Joribar Block	95941	95941	95941	98441	100941	100941
	Bonaikela Block	0	2500	4500	4500	4500	4500
	Total	282939	287939	292439	300814	306814	306814
	Cost including watch and care during the year*	157500	315000	283500	527625	377000	1660625
Management of waste dump benches	Area available for rehabilitation (ha.)	Nil	Nil.	Nil.	Nil.	Nil.	Nil.
	Afforestation done (ha)	Nil	Nil.	Nil.	Nil.	Nil.	Nil.
	No. of saplings planted in the year	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.
	Cumulative no. of plants	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.
	Any other method of rehabilitation (specify)	Nil.	Nil.	Nil.	Nil	Nil.	Nil.
	Cost including watch and care during the year	Nil.	Nil.	Nil.	Nil	Nil.	Nil.
Reclamation and Rehabilitation by Back Filling	Void available for Back Filling (L x B x D) pitwise						
	Bamebari Block (ha.)	2.565	1.580	4.300	0	4.000	12.445
	Joribar Block (ha.)	0	0	0	0	0	0
	Bonaikela Block (ha.)	0	0	0	0	0	0
	Total (ha.)	2.565	1.580	4.300	0	4.000	12.445
	Void filled by waste / rock (cu.m)						

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Items	Details	Proposal during the Plan Period (2020-21 to 2024-25)					
		2020-21	2021-22	2022-23	2023-24	2024-25	Total
	Bamebari Block	288135	226688	507630	0	966580	2074042
	Jardiba Block	0	0	0	0	0	0
	Bonaikela Block	0	0	0	0	0	0
	Total	288135	226688	507630	0	966580	2074042
	Afforestation on the back filled area	Nil	Nil	Nil	Nil	Nil	Nil
	Rehabilitation by making water reservoir	Nil	Nil	Nil	Nil	Nil	Nil
	Any other means (specify)	Nil	Nil	Nil	Nil	Nil	Nil
Rehabilitation of waste land within lease	Area Available (ha)	Nil	Nil	Nil	Nil	Nil	Nil
	Area Rehabilitated (ha)	Nil	Nil	Nil	Nil	Nil	Nil
	Method of Rehabilitation	Nil	Nil	Nil	Nil	Nil	Nil
	Retaining wall						
	Bamebari Block	0	0	0	0	0	0
	Jardiba Block	0	0	270	302	0	572
	Bonaikela Block	0	508	0	0	0	508
	Total	0	508	270	302	0	1080
	Garland Drain						
	Bamebari Block	0	0	0	0	0	0
Others (specify)	Jardiba Block	0	0	270	302	0	572
	Bonaikela Block	0	508	0	0	0	508
	Total	0	508	270	302	0	1080
	Check dam with retaining Pit						
	Bamebari Block	0	0	0	0	0	0
	Jardiba Block	0	0	0	0	0	1
	Bonaikela Block	0	1	0	0	0	1
	Total	0	1	0	1	0	2

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

8.4 DISASTER MANAGEMENT AND RISK ASSESSMENT:

Potential risks which may cause severe environmental degradation with or without the damage to properties, loss of life or serious bodily injuries are assessed based on the identified environmental imparts of all operations carried out in the mine. The potential emergency situations at Bamebari Mn. Mine may arise from the following causes:

(i) Damage to lubricant and HSD storage chambers / tankers
(ii) Failure of check dams
(iii) Explosions (in magazine, HSD tankers / storage chambers, LPG storage)
(iv) Fire

Action plan to deal with the above emergency situations are as follows in Table No. 8.7

Table No.8.7

No	Emergency Situation	Steps to deal with the emergency
(i)	Damage to lubricant and HSD storage chambers / tankers	(a) Shift injured personnel, if any, to hospital (b) Cordon of the area (c) Plug the leakages, as far as possible (d) Stop the spillages spreading to larger areas (e) Arrange to collect the spilled material, as far as possible (f) Arrange to scrap the contaminated ground, if possible and dispose of the same as oily waste (g) Assess the impact and restore the normal situation
(ii)	Failure of check dams	(a) Arrange medical assistance, in case of injury (b) Block and plug the leakages with cement / sand bags (c) Intimate the people downstream or those likely to be affected by Public Address System (d) Assess the water quality leaving the lease area and environmental impacts
(iii)	Explosions / Fire	(a) Cordon of the area (b) Shift injured personnel, if any, to hospital (c) Arrange water tanker / fire brigade to deal with the fire (d) Roll call to search for missing person (e) Assess the impact and restore the normal situation (f) Investigate reasons for failure and take necessary corrective action for future

The following personnel with their responsibility shall be contacted in case of any disasters occurred within the Bamebari Lease in Table No. 8.8.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 8.8

Designation	Contact No.	Responsibility
Mr. PK Mohanta Designation: Manager At/PO: Bamebari, Via : Joda Dist. Keonjhar PIN - 758034 (ODISHA)	09438887802	➢ Identify and allocate the resources as required to alleviate the circumstances. ➢ Communicate the fact associated with disaster to all concerned for provision of resources, legal authorities as applicable and stake holders. ➢ Understand and implement at all levels including roles, responsibilities, authorities, initial & periodic training and continuous monitoring of activities and results to demonstrate the effectiveness of systems implemented to meet the company's policy and legal requirements.
Mr Amulya Kumar Panda Designation: Safety Officer At/PO: Bichhakundi, Via : Joda Dist. Keonjhar PIN - 758034 (ODISHA)	09263635343	➢ Identify the safety aspects and impacts of the conditions and suggest immediate measures. ➢ Organize the resources as required to alleviate the circumstances. ➢ When determining controls, or considering changes to existing controls, consideration shall be given to reducing the risks according to the following hierarchy: a) Elimination; b) Substitution; c) Engineering controls; d) Signage/warnings and/or administrative controls; e) Personal protective equipment
Mr. Birindra Kumar Jena Designation: Environment Officer At/PO. Bichhakundi, Via . Joda Dist. Keonjhar PIN - 758034 (ODISHA)	08114395177	➢ Identify the environmental aspects and impacts of the conditions and suggest immediate measure. ➢ When determining controls, or considering changes to existing controls, consideration shall be given to reducing the risks according to the following hierarchy: a) Elimination; b) Substitution; c) Engineering controls; d) Signage/warnings and/or administrative controls;
Mr. Manu Mishra Designation: Sr.Manager (Security), At/PO: Bichhakundi, Via : Joda Dist. Keonjhar PIN - 758034 (ODISHA)	09438887779	➢ Assist Safety Officer & Environment Officer Organize the resources as required to alleviate the circumstances. ➢ Assist Manager Communicate the fact associated with disaster to all concerned for provision of resources, legal authorities as applicable and stake holders.

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

8.5 CARE AND MAINTENANCE DURING TEMPORARY DISCONTINUATION:

During temporary discontinuance, the following shall be complied.

(i) All access roads to the mine site are proposed to be stopped by a temporary drop gate.
(ii) Display boards are proposed in the access roads indicating "Mine Closed Temporarily – No Trespassers Allowed".
(iii) The top of every mine working is proposed to be adequately fenced so as to prevent any inadvertent fall within the pit.
(iv) Toe-wall with adequate height is proposed around every dump to prevent rolling of boulders and avoid any person from approaching the tip of the dump inadvertently.

The abandoned area shall be inspected at a regular interval by security personnel to determine any incident of illegal activity and once in a week by the Mining Engineer / Manager of the mine to determine any unsafe condition that may have developed during the period.

In the event of any temporary discontinuance of mining activity either due to any court order or statutory requirements or other unforeseen circumstances all efforts shall be made to ensure the following minimum services:

1 Uninterrupted power supply.
2 Uninterrupted drinking water supply and operation of drinking water treatment facilities,
3 Uninterrupted medical and ambulance services,
4 Uninterrupted security & firefighting services.
5 Environmental Monitoring as per the schedule,
6 Laboratory services for checking the quality of drinking water and water that is discharged after treatment,

Necessary staff for ensuring the operation and maintenance of the above services shall continue to remain on duty. The entire mine premises shall be regularly inspected in order to ensure that the workings are safe.

In case any unsafe or hazardous conditions are noticed, actions as enumerated above under the emergency plan shall be taken.

8.6 FINANCIAL ASSURANCE:

The amount of financial assurance to be deposited has been calculated based on the area proposed to be used for mining and allied activities at the rate of Rs. 3,00,000 / hectare. The area to be utilized has been evaluated on the basis of the land use pattern at the end of five year planned period, which is enclosed as drawing no. DWG 18A, DWG 18B and DWG 18C.

For this, the areas put to use for mining and allied activities and the area to be considered for financial assurance has been calculated for Bamebari, Jomabar & Bonaikela Block in the Table No. 8.9 to 8.11 respectively. The summary of calculation for all the blocks has been furnished in Table No. 8.12.

Table No. 8.9
Break up of Land Use Pattern at Bamebari Block of Bamebari Iron & Mn. Mine within intended to be retained area of 140.000 ha for Calculation of Financial Assurance

Sl No	Type of Use	As at Present as on 01.04.2020 (ha.)	Additional requirement during plan period (ha.)	As at end of plan period (ha.)	Area considered as fully reclaimed (ha.)	Net area considered for Calculation (ha.)
		A	B	C = A+B	D	E = C – D
1	Area Excavated	25.747	5.930	31.677	0	31.677
2	Storage of Top Soil	0.000	0.150	0.150	0	0.150
3	Waste Dump	21.712	0	21.712	0	21.712
4	Mineral Storage	1.823	1.000	2.823	0	2.823
5	Infrastructure(Workshop, Magazine etc)	2.000	0	2.000	0	2.000
6	Roads	3.100	1.000	4.100	0	4.100
7	Railways	0.000	0	0	0	0.000
8	Tailing Pond	0.000	0	0	0	0.000
9	Effluent Treatment Plant	0.000	0	0	0	0.000
10	Mineral Separation Plant	0.000	0	0	0	0.000
11	Township Area	17.346	0	17.346	0	17.346
12	Others - Green Belt	11.450	-3.894	7.556	0	7.556
	Total Area considered for financial assurance	**83.178**	**4.186**	**87.364**	**0**	**87.364**

Prepared by:
SABYASACHY NISHRA
QUALIFIED PERSON

Table No 8.10

Break up of Land Use Pattern at Joribar Block of Bamebari Iron & Mn Mine within intended to be retained area of 91.0011 ha for Calculation of Financial Assurance

Sl No	Type of Use	As at Present as on 01.04.2020 (ha.)	Additional requirement during plan period (ha.)	As at end of plan period (ha)	Area considered as fully reclaimed (ha.)	Net area considered for Calculation (ha.)
		A	B	C = A+B	D	E = C – D
1	Area Excavated	16.173	4.038	20.211	0	20.211
2	Storage of Top Soil	0	0.150	0.150	0	0.150
3	Waste Dump	12.812	7.227	20.039	0	20.039
4	Mineral Storage	2.193	4.472	6.665	0	6.665
5	Infrastructure(Workshop, Magazine etc)	1.256	0.700	1.956	0	1.956
6	Roads	3.580	0	3.580	0	3.580
7	Railways	0	0	0	0	0
8	Tailing Pond	0	0	0	0	0
9	Effluent Treatment Plant	0	0	0	0	0
10	Mineral Separation Plant	0	0	0	0	0
11	Township Area	7.004	0	7.004	0	7.004
12	Others - Green Belt	9.594	0	9.594	0	9.594
	Total Area considered for financial assurance	**52.612**	**16.587**	**69.199**	**0**	**69.199**

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Table No 6.11

Break up of Land Use Pattern at Bonaikela Block of Bamebari Iron & Mn. Mine within intended to be retained area of 233.000 ha for Calculation of Financial Assurance

Sl No	Type of Use	As at Present as on 01.04.2020 (ha.)	Additional requirement during plan period (ha.)	As at end of plan period (ha)	Area considered as fully rehabilitated (ha.)	Net area considered for Calculation (ha.)
		A	B	C = A+B	D	E = C – D
1	Area Excavated	45.920	3.330	49.250	0	49.250
2	Storage of Top Soil	0	0.150	0.150	0	0.150
3	Waste Dump	11.010	4.405	15.415	0	15.415
4	Mineral Storage	4.000	1.220	5.220	0	5.220
5	Infrastructure(Workshop, Magazine etc)	0.830	0.665	1.495	0	1.495
6	Roads	3.740	0	3.740	0	3.740
7	Railways	0	0	0	0	0
8	Tailing Pond	0	0	0	0	0
9	Effluent Treatment Plant	0	0	0	0	0
10	Mineral Separation Plant	0	0	0	0	0
11	Township Area	0	0	0	0	0
12	Others - Green Belt	0	0	0	0	0
Total Area considered for financial assurance		**65.500**	**9.770**	**75.270**		**75.270**

25/3/20

Prepared by
SABYASACHY MISHRA
QUALIFIED PERSON

Table No. 8.12

Break up of Land Use Pattern at Bamebari Iron & Mn Mine within intended to be retained area of 464.000 ha for Calculation of Financial Assurance

Sl.No	Type of Use	As at Present as on 01.04.2023 (ha.)	Additional requirement during plan period (ha.)	As at end of plan period (ha)	Area considered as fully reclaimed (ha.)	Net area considered for Calculation (ha.)
		A	B	C = A+B	D	E = C – D
1	Area Excavated	87.840	13.298	101.138	0	101.138
2	Storage of Top Soil	0.000	0.450	0.450	0	0.450
3	Waste Dump	45.534	11.632	57.166	0	57.166
4	Mineral Storage	8.016	6.692	14.708	0	14.708
5	Infrastructure(Workshop, Magazine etc)	4.086	1.365	5.451	0	5.451
6	Roads	10.420	1.000	11.420	0	11.420
7	Railways	0.000	0	0	0	0.000
8	Tailing Pond	0.000	0	0	0	0.000
9	Effluent Treatment Plant	0.000	0	0	0	0.000
10	Mineral Separation Plant	0.000	0	0	0	0.000
11	Township Area	24.350	0	24.350	0	24.350
12	Others - Green Belt	21.044	-3.894	17.150	0	17.150
Total Area considered for financial assurance		**201.290**	**30.543**	**231.833**	**0**	**231.833**

The area to be considered for financial assurance is calculated to be 231.833 ha. The Financial Assurance for this area has been calculated to be Rs. 6, 95,49,900/- (Rupees Six crores ninty-five lakhs forty-nine thousand nine hundred only).

This is pertinent to mention that, One Bank Guarantee No. 0393BGR0144020 from ICICI Bank in favor of the Regional Controller of Mines, Bhubaneswar for an amount of Rs. 6, 42, 69, 900/- (Rupees Six crores forty-two lakhs sixty-nine thousand nine hundred only) has been submitted over an area of 214.233 ha. Further, due increase of total area at 17.600 ha (Top Soil – 0.450 ha + Green Belt – 17.150 ha.), an additional bank guarantee (No. 0393BGR0241520, Dtd. 16.03.2020 for an amount of Rs. 52,80,000/- (Rs. Fifty-two lakhs eighty thousand only) (i.e. 17.600 ha/ X Rs.3 Lakhs) in favor of the Regional Controller of Mines, Bhubaneswar is being submitted. Copies of the same are being enclosed along with Annexure – 42.

The summary of the bank guarantees submitted (Annexure – 42) to Indian Bureau of Mines for the ensuing plan period is furnished below in Table No. 8.13.

Table No. 8.13

Sl. No	Bank Guarantee No	Issuing Bank	Bank Guarantee Amount (Rs.)	Validity of Bank Guarantee
1	0393BGR0144020	ICICI Bank	6, 42, 69, 900	31.03.2025
2	0393BGR0241520	ICICI Bank	52,80,000	31.03.2025
	Total		6,95,49,900	

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON

Additional Information:-

1. All the applicable statutory drawings as listed in Page No. 4 of this document has been prepared digitally and being submitted in Volume – III. The part plans have been prepared in the Scale of 1:1000. In case of depiction of lease boundary, the drawings have been prepared in the Scale of 1:5000.

   Further, it may please be noted that, permission for preparation of plans and sections on a scale other than prescribed scale under Rule 27(1)(D) of the MCDR, 1988 has been obtained from Indian Bureau of Mines, Nagpur vide letter no. X-11013/61/MP/89-CCOM/356, dated 23.02.96. Copy of the same is enclosed as Annexure – 35.

2. Few Photographs showing the Lease boundary pillars, Quarry under operation, Quarry Reclamation by back filling and environmental protection measures has been furnished in Annexure – 41.

3. The Environment Management Cell is in place and the Head of the department is reporting to General Manager of the division. The Air & Water samples are being collected and analysed by M/s. Visiontek Consultancy Pvt. Ltd., Bhubaneswar [Recognized as "A" category consultant as by State Pollution Control Board, Orissa]. This laboratory has also been accredited by NABL & recognised by MoEF. The Copy of the Environment Laboratory Recognition Letter has been enclosed as Annexure – 24.

(Thachat Viswanath Narendran)
CEO & Managing Director,
Tata Steel Ltd.

TATA

CONSENT LETTER / UNDERTAKING / CERTIFICATE FROM THE APPLICANT

01. The Review of Mining Plan in respect of Barnebari Iron & Manganese Mine over an area of 1150.550 hect. (Area intended to retain 464 hect. + FMCP Approved Area applied for surrender – 686.550 hect.) in villages Palasa (Ka), Kundaposi, Jadibahal, Lajang, Khandbondh, Bonaikela, District: Keonjhar, State: Odisha bearing Supplementary Mining Lease Deed Document No. 1103150024S, dated 08.05.2015 submitted under Rule-17(2) of the Minerals (Other than Atomic and Hydro Carbons Energy Minerals) Concession Rules, 2016 has been prepared by Qualified Person (QP) Sri Sabyasachy Mishra.

This is to request the Regional Controller of Mines, Indian Bureau of Mines, Bhubaneshwar, to make any further correspondence regarding any correction of the Review of Mining Plan with the said qualified person at his address below -

Sri Sabyasachy Mishra
Head (Mine & Production Planning)
Ferro Alloys & Minerals Division, Tata Steel Ltd
At./P.O.. Bichhakundi
Dist. Keonjhar (Odisha)
PIN – 758034
email sabyasachy@tatasteel.com

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

02. It is certified that the CCOM Circular No-2/2010 will be implemented and complied within 6 months of authorization of agency by the state government or within 6 months of lease execution (whichever is earlier)

03. It is certified that the Progressive Mine Closure Plan 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 permission is required the lessee will approach the concerned authorities.

04. The provisions of Mines Act, Rules and Regulations made there under have been observed in the Review of Mining Plan over an area of 1150.550 hect. (Area intended to retain 464 hect. + FMCP Approved Area applied for surrender 686.550 hect.) in Keonjhar District in Odisha State belonging to Bamebari Iron & Manganese Mine 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.

05. The information furnished in the Review of Mining Plan and Progressive Mine Closure Plan is true and correct to the best of our knowledge and records.

06. It is to undertake that all the measures proposed in this Progressive Mine Closure Plan will be implemented in a time bound manner as proposed.

Signature of Applicant (Nominated Owner)

Place : Jamshedpur

Date :

Name of Nominated Owner: **Thachat Viswanath Narendran**
Designation: **CEO & Managing Director**
Name of Company: **Tata Steel Limited**
Address:-
At. / P.O. – Jamshedpur
Dist – East Singhbhum
State: Jharkhand
PIN: 831001

TATA STEEL LIMITED
Office of CEO & Managing Director Jamshedpur 831 001 India
Tel 91 657 2404900 Fax 91 657 2431018 e-mail mdoffice@tatasteel.com
Registered Office: Bombay House, 24, Homi Mody Street, Fort, Mumbai 400 001
Tel 91 22 6665 8282 Fax 91 22 6665 7724
Corporate Identity Number (CIN): L27100MH1907PLC000260 Website: www.tatasteel.com

CERTIFICATE FROM QUALIFIED PERSONNEL

The provisions of the Mineral Conservation and Development Rules 2017 have been observed in the preparation of the Review of Mining Plan for Bamebari Mining Lease of Tata Steel Limited 1150.550 hect (Retained Area – 464 hect. + FMCP Approved Area applied for surrender – 686.550 hect.) in villages Palasa (Ka), Kundaposi, Jadchahal, Jajang, Khandbandh, Bonaikela, District. Keonjhar, State: Odisha and wherever specific permissions are required, the applicant will approach the concerned authorities of Indian Bureau of Mines.

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

Name : Sabyasachy Mishra
Designation : Qualified Person &
Head (Mine & Production Planning)
TATA STEEL LTD.
Ferro Alloys and Minerals Division

Place : Bichitrapur
Date : 28/2/20

28/2/20

Prepared by:
SABYASACHY MISHRA
QUALIFIED PERSON