Lessee copy

(TEXT)

MINING PLAN

(Submitted under Rule – 16(1) of MCR, 2016)

ALONG WITH

PROGRESSIVE MINE CLOSURE PLAN

(Prepared Under Rule –23 of M.C.D.R, 2017)

In respect of

SILJORA-KALIMATI IRON & MANGANESE ORE MINES

Over an area of 713.510 hectares in village Siljora and Kalimati under Champua subdivision of Keonjhar District, Odisha.

PERIOD OF MINING PLAN PROPOSAL 2020-21 TO 2024-25

LAND DETAILS		CATEGORY OF MINE	DATE OF EXECUTION	VALIDITY
FOREST	NON-FOREST			
509.71 Ha.	203.80 Ha	'A' – FM	26.06.2020	25.06.2070 (50YEARS)

LESSEE

SRI DEBABRATA BEHERA.

At-Plot No.- 1234 (p), Gobinda Prasad,
Bomikhal, Cuttack-Puri Road, Bhubaneswar.

For Debabrata Behera

Authorised Signatory
Siljora-Kalimati Iron & Mn Ore Mines

Prepared by,

Pravata Kumar Sahoo

Msc. Geology

QUALIFIED PERSON

Mob: 9439830828

Email: pksahoo1976@gmail.com

At-Plot No.- 1234 (p), Gobinda Prasad, Bomikhal, Cuttack-Puri Road, Bhubaneswar.

Approved vide letter no:-
MS/IB/23-OAT/BHU/2020-21
Dated 11.11.2020

(TEXT)

MINING PLAN

(Submitted under Rule – 16(1) of MCR, 2016)

ALONG WITH

PROGRESSIVE MINE CLOSURE PLAN

(Prepared Under Rule –23 of M.C.D.R, 2017)

In respect of

SILJORA-KALIMATI IRON & MANGANESE ORE MINES

Over an area of 713.510 hectares in village Siljora and Kalimati under Champua subdivision of Keonjhar District, Odisha.

PERIOD OF MINING PLAN PROPOSAL 2020-21 TO 2024-25

LAND DETAILS		CATEGORY OF MINE	DATE OF EXECUTION	VALIDITY
FOREST	NON-FOREST			
509.71 Ha.	203.80 Ha	'A' – FM	26.06.2020	25.06.2070 (50YEARS)

LESSEE

SRI DEBABRATA BEHERA.

At-Plot No.- 1234 (p), Gobinda Prasad,
Bomikhal, Cuttack-Puri Road, Bhubaneswar.

Prepared by,

Pravata Kumar Sahoo

Msc. Geology

QUALIFIED PERSON

Mob: 9439830828

Email: pksahoo1976@gmail.com

At-Plot No.- 1234 (p), Gobinda Prasad, Bomikhal, Cuttack-Puri Road, Bhubaneswar.

CONTENTS

Chapter No.	Details	Page No
	Introductory note	1 – 6
1.0	General	7 – 7
2.0	Location and Accessibility	8–11
3.0	Details of approved Mining Plan / Scheme of Mining	12
	Part - A	
1	Geology and Exploration	13-42
2	Mining	43-75
3	Mine Drainage	76-83
4	Stacking of Mineral Reject /Sub Grade material and disposal of Waste	84-90
5	Use of Mineral and Mineral reject	91-93
6	Processing of ROM and Mineral Reject	94-98
7	Other	99
8	Progressive Mine Closure Plan	100-127
	Part - B	
9	Certificates / Undertakings	128
10	Plans & sections	128
11	Consent letter from the Lessee	129-130
12	Undertaking regarding CCOM Circular no. 2/2010	131
13	Certificate from Qualified Person	132

Pravata Kumar Sahoo
Qualified Person

LIST OF PLATES

SL NO	PLATE NO.	PARTICULARS	SCALE
1	PLATE NO-I	KEY PLAN	1:50,000
2	PLATE NO-II	DGPS MAP	16"=1MILE
3	PLATE NO-III	SURFACE PLAN	1:4,000
4	PLATE NO-IV	GEOLOGICAL PLAN	1:4,000
5	PLATE NO-IV(A) PLATE NO-IV(B) PLATE NO-IV(C)	GEOLOGICAL SECTIONS	1:4,000
6	PLATE NO-V(A)	DEVELOPMENT PLAN & SECTION (2020-21)FOR IRON & MN ORE (BLOCK-6)	1:2,000
6	PLATE NO-V(B)	DEVELOPMENT PLAN& SECTION (2021-22) FOR IRON & MN ORE (BLOCK-6)	1:2,000
7	PLATE NO-V(C)	DEVELOPMENT PLAN& SECTION (2022-23, 23-24, 24-25) FORMN ORE (BLOCK-1)	1:2,000
8	PLATE NO-V(D)	DEVELOPMENT PLAN& SECTION (2022-23, 23-24, 24-25) FORMN ORE (BLOCK-2)	1:2,000
9	PLATE NO-V(E)	DEVELOPMENT PLAN& SECTION (2022-23, 23-24, 24-25) FORMN ORE (BLOCK-3)	1:2,000
10	PLATE NO-V(F)	DEVELOPMENT PLAN& SECTION (2022-23, 23-24, 24-25) FORMN ORE (BLOCK-4)	1:2,000
11	PLATE NO-V(G)	DEVELOPMENT PLAN& SECTION (2022-23, 23-24, 24-25) FORMN ORE (BLOCK-5)	1:2,000
12	PLATE NO-V(H)	DEVELOPMENT PLAN& SECTION (2022-23) FOR IRON ORE (BLOCK-6)	1:2,000
13	PLATE NO-V(I)	DEVELOPMENT PLAN& SECTION (2023-24) FOR IRON ORE (BLOCK-6)	1:2,000
14	PLATE NO-V(J)	DEVELOPMENT PLAN& SECTION (2024-25) FOR IRON ORE (BLOCK-6)	1:2,000
15	PLATE NO-VI	DUMP PLAN AND SECTIONS	1 : 2000
16	PLATE NO-VI(A)	BACKFILLING PLAN	1:2,000
17	PLATE NO-VII	ENVIRONMENTAL PLAN	1:5,000
18	PLATE NO-VIII	RECLAMATION PLAN	1:4,000
19	PLATE NO-IX	CONCEPTUAL PLAN	1:4,000
20	PLATE NO-IX(A) PLATE NO-IX(B) PLATE NO-IX(C)	CONCEPTUAL SECTION	1:4,000
21	PLATE NO-X	FINANCIAL ASSURANCE PLAN	1:4,000

Pravata Ku. Sahoo
Qualified Person

LIST OF ANNEXURE

Sl. No	Description	Annexure No.	PAGE NO
1	Copy of the NIT	Annexure - 1	1 - 105
2	Copy of the preferred bidder	Annexure - 2	106
3	Copy of the Letter of Intent issued by state Government	Annexure - 3	107 – 111
4	Copy of the Successful Bidder	Annexure - 4	112-113
5	Copy of the vesting order	Annexure - 5	114-117
6	Copy of the Mine Development and Production Agreement (MDPA)	Annexure - 6	118-191
7	Copy of the lease deed	Annexure - 7	192-234
8	Copy of last approval letter of Mining Plan.	Annexure - 8	235-236
9	Copy of the forest clearance obtained by earlier lessee.	Annexure - 9	237-241
10	Copy of the Environmental Clearance granted to earlier lessee.	Annexure - 10	242-250
11	Copy of the Consent to operate order granted to earlier lessee.	Annexure - 11	251-264
12	Copy of Surface RENT.	Annexure - 12	265-268
13	The copy of the ID and address proof of the Lessee.	Annexure - 13	269
14	Self-certified copy of Qualifications and working experien of Q.P.	Annexure – 14 A	270-273
15	Copy of photo ID proof of Q.P.	Annexure -14B	274
16	Copy of Land Schedule.	Annexure -15	275-295
17	Copy of Geological Report provided by State Govt during the Auction.(SEPARATE VOLOUME)	Annexure - 16	1-1060
18	PRE Feasibility Study report as per the UNFC guide line	Annexure -17	296-325

Pravata Kumar Sahoo
Qualified Person

INTRODUCTORY NOTE

HISTORY OF THE MINING LEASE:

Siljora-Kalimati Iron & Manganese ore Mines over 715.639 hectares is located in village Siljora under Champua Sub division of Keonjhar District of Odisha. As per the MMDR (Amendment) Act, 2015 the lease period was valid upto 31.03.2020.

Present Status of the Mining Lease:

As per the section 8A(4) of MMDR (Amendment) Act 2015,on the expiry of the lease period, the lease shall be put up for auction. Accordingly, the Govt of Odisha put the Mining Lease for auction.

Pursuant to the Mines and Minerals (Development and Regulation) ACT, 1957 and The Mineral (Auction) Rules,2015,Govt of Odisha issued the Notice Inviting Tender dated 06.12.2019 for commencement of the auction process to grant the mining Lease under non-captive category in respect of Siljora-Kalimati Iron & Mn. Ore Mines over an area of 713.510Ha. (As per DGPS) in Barbil Tahasil of Keonjhar district of Odisha. **(Copy of the NIT is attached as Annexure-1).**

The e-auction process was conducted in accordance with the tender document and the mineral auction rule, 2015 for said block and Debabrata Behera has been declared as the preferred Bidder under Rule 9(4) (b) (iii) of the Rules. Copy of preferred bidder is enclosed as **Annexure No -2.**

Accordingly, the Government of Odisha has issued Letter of Intent vide Ltr.No 3028/S&M, Bhubaneswar Dated 18.03.2020 **(Copy enclosed as Annexure-3)** under Rule 10(2) of Mineral Auction Rules 2015 to Debabrata Behera for grant of Mining Lease for Siljora-KalimatiIron & Mn. Ore block over an area of 713.510 Ha (As per DGPS Survey) in Srijoda, Kalimati, Tadpani, Balda, Dubuna & Handibhanga Tahasil Barbil, Sub-division Champua, District Keonjhar, Odisha for a period of 50 years.

This letter of intent and subsequent grant of aforementioned mining lease is valid subject to the provision of the Act and the Rules made there under as amended from time to time and Debabrata Behera shall be designated as the Successful Bidder and the subsequently granted the mining lease only upon satisfactory completion of all the requirements under the Act and Rules made there under.

(A) Debabrata Behera has been considered as successful bidder:

Debabrata Behera has been declared as successful bidder vide letter no- 5271/SM, dated 24.06.2020. **(Copy enclosed videos Annexure – 4).**

Pravata Ku. Sahoo
Qualified Person

(B) Issue of Vesting Order: Pursuant to the provisions contained in rule 9A(2) of the Rules, 2016 order that all the valid rights, approvals, clearances, licenses and the like vested in the previous lessee in respect of the aforementioned mining block are deemed to have vested in favour of the holder of the letter of intent on the same terms and conditions every rights, approvals, clearances, licenses, and the like which vested with the previous lessee.

Without prejudice to the generality of the provisions of section 8B(2) of the MMDR Act, 1957, the details of the valid rights, approvals, clearances, licenses, and the like held by the previous lessee are vested in favour to Debabrata Behera by the Govt. of Odisha for a period of 2 years from the date of execution of lease deed or till the date of getting fresh approvals, clearances, licenses, permits, and the like, whichever is earlier vide order No-4274/SM, dated 30.05.2020. The copy of the vesting order is enclosed as **Annexure-5.**

(C) Signing of Mine Development and Production Agreement (MDPA)

Debabrata Behera has executed and registered the **Mine Development and Production Agreement** (MDPA) with the Government of Odisha on 26.06.2020 upon obtaining all consents, approvals, permits, NOC and the like as may be required under applicable laws for commencement of Mining operation. (Copy of the MDPA is enclosed as **Annexure-6).**

(D) Execution of the lease deed

Subsequent to signing of the **MDPA, Debabrata Behera** has made payment of the third instalment being the eighty percent of the upfront value and executed and registered the mining lease with the Government of Odisha on 27.06.2020 and the Mining Lease was granted in favour of Debabrata Behera for a period of 50 years w.e.f27.06.2020. (Copy enclosed vide **Annexure-7).**

Chronological Event upto lease deed execution

❖ 1ST [10%] Instalment of Upfront Amount

Auction Details				Details of 1ST Installment of Upfront Amount				
Date of Invitation of Bid	Forward e-Auction Held on	Accepted Highest FPO/Bid by Govt.	Date of Declaration of Preferred Bidder for Grant of ML Via- DoM's E-mail	DoM's Demand Note No.	Date	Transaction Amt. In Rs.	E-Challan No.	Dated
06.12.2019	13.02.2020	154.00%	20.02.2020	1646	22.02.2020	1.00.38,403 /-	2E9E52FB2C	24/02/2020

❖ Issue of Letter of Intent and Vesting Order

Letter of Intent [LOI]		Vesting Order [VO]	
Govt. Letter No.	Dated	VO No.	Dated
3028/S&M/IV(Misc.) SM-66/2016(Pt-II)	18.03.2020	4273/SM III(A)SM-07/2020	30.05.2020

Pravata Ku. Sahoo
Qualified Person

SILJORA-KALIMATI MANGANESE & IRON MINE
LESSEE – DEBABRATA BEHERA

2nd Instalment of Upfront Amt. and Performance Security

Details of 2nd Instalment of Upfront Amount			Performance Security in the form of BG As per Rule-12 of the Mineral [Auction] Rules, [illegible]			
Transaction Amt. in Rs.	E-Challan No.	Dated	BG No.	Dated	Amended BG Dated	Amount in Rs.*
1.00.38.403/-	2EA8DAF71F	01.04.2020	5564IPEBG2000065	11.06.2020	12.06.2020	[illegible]
					Sub-Total	[illegible]

Payment of NPV to forest department

Details of Demand Note			Details of E-Challan			Details of UTR /Transaction Details	
Div. Name	Letter No. & Dt.	NPV Amt. in Rs.	No.	Dated	NPV Amt. in Rs.	UTR No.	Dated
Keonjhar FD	2119/6F-Mining-37/ 2020 Dt. 08.04.20	35,18,31,750 /-	5830300865	16.06.2020	35,18,31,750/-	BKIDH20168665243	16.06.2020

NB: # As per information available on PARIVESH Portal of MoEF & CC.

1. **Letter No. 2898 dated 07.05.2020** from DoM to The Special Secretary, F&E Deptt., Govt of Odisha Requesting for taking necessary steps for realization of NPV from the LoI holders.
2. **Siljora:**
   i. Debabrata Behera vide its letter dated **16.06.2020** submitted details of UTR to the concerned DFOs & copy to DoM.
   ii. BOI vide its letter dated **16.06.2020** communicated about the **debit advice** to Debabrata Behera.

❖ **Representation under Rule 10(3) of the Mineral (Auction) Rule, 2015 for declaration of Successful Bidder**

Letter from DoM to S&M Dept. For declaration of Successful Bidder		Declaration of Successful Bidder by S&M Dept.		Letter from DoM to KIPL for signing of MDPA and deposition of 3rd Installment-80%	
Letter No.	Dated	Letter No.	Dated	Letter No.	Dated
4133	19.06.2020	5277	24.06.2020	4280	25.06.2020

❖ **MDPA Signing & 3RD [80%] Instalment of Upfront Amount**

Letter from DoM for signing to MDPA and deposition of 3rd Installment-80%			Details of 3RD Instalment of Upfront Amount		
DoM's Letter No.	Date	Execution of MDPA	Transaction Amt. In Rs.	E-Challan No.	Dated
4298	25.06.2020	**26.06.20**	**8.03.07.224/-**	2EB64AE7BA	26/06/2020

❖ **Grant of Lease by GOO & Demand of Stamp Duty and Registration Fees**

Lease Grant Order by S&M Dept.		Communication from DoM to Collector for Execution of Lease Deed within stipulated time period		Details of Demand @ Stamp Duty & Reg. Fees			
Memo No.	Date	Memo No.	Date	Demand Letter No.	Date	Stamp Duty in Rs.	Reg. Fees in Rs.
5506	26.06.20	5510	26.06.20	JDM, Joda 1797	27.06.20	13,88,18,371/-	5,55,27,349/-

❖ **Payment of Stamp Duty, Reg Fees and Execution & Registration of Mining Lease Deed**

Stamp Duty	Reg. Fees		Execution & Registration of ML Deed	
Date	UTR	Date	Execution Date	Registration Date
27.06.20		27.06.20	27.06.20	27.06.20

Status of Statutory Clearances:

All the statutory clearances were obtained by previous lessee and have been vested with Debabrata Behera for a period of 2 years. As per the MMDR (Amendment) Act 2020 Debabrata Behera has to obtain all the statutory clearances in its favour within a period of 2 years. The details of the Rule in which it has been mentioned that seamless mining operation can be continued are furnished below:

Pravata Ku. Sahoo
Qualified Person

Rule 9A (5) of MCR (Amendment) Rule 2020 : It shall be lawful for the new lessee to commence and continue mining operations on the land in which mining operations were being carried out by the previous lessee, after the execution of the lease deed for a period of two years as provided in section 8B of the Act

Rule 9A (7) of MCR (Amendment) Rule 2020: On submission of new mining plan, the new lessee shall switch over to the new mining plan and while undertaking mining operations as per the new mining plan, the new lessee shall conform to the approved quantity and the conceptual limit of mining plan held by previous lessee till the new lessee obtains afresh the requisite clearances, approvals, rights and the like.

Name of the statutory clearances	Authority	Status of statutory clearances
Approval of Mining Plan	Indian Bureau of Mines, GOI	The Modification of Review of the Mining Plan was approved vide letter No MPM/OTFM/15-ORI/BHU/2018-19, dated 25.07.2018 and is valid up to 31.03.2020. (The copy of the approval letter is enclosed as **Annexure 8**)
Forest Clearance	Ministry of Environment and Forest, GOI	The Stage-II forest clearance for the entire forest area over 451.132 hectares has been obtained from Ministry of Environment Forest, Govt. of India under Forest Conservation Act 1980. The copy of the forest clearance is enclosed as **Annexure –9**).
Environment Clearance	Ministry of Environment, Forest & Climate Change GOI	Environmental clearance has been obtained from Ministry of Environment & Forests, Govt. of India vide letter no J-11015/691/2007-IA.II(M), dated 03.02.2009 for production of iron ore to 0.136 million tons per annum and Manganese ore to 0.189 million tons. The copy of the Environmental Clearance is enclosed as **Annexure-10.**
Consent to Operate	State Pollution Control Board, Odisha	Consent to operate order has been granted by the State Pollution Control Board, Odisha vide letter No- 3226/IND-I-CON-1806 dated 23.02.2016 which is valid up to 31.03.2020. After getting approved mining plan, based on existing EC, FC and CTE order from SPCB, Fresh Consent to Operate will be obtained. The copy of the CTO is enclosed as **Annexure-11.**
Surface Right	District Collector, Keonjhar	The lessee has obtained surface right permission over an area of 652.960 hectares within the lease hold area from the Collector, Keonjhar. A copy of Surface right letter is attached as **Annexure-12.**

As part of the statutory clearance, this **Mining Plan** and **Progressive Mine Closure Plan** is prepared under Rule **16 (1) of MCR, 2016 and Rule 23 of MCDR, 2017** respectively for a period of 5 years from the date of opening of the mine for grant of Mining Lease in favour of **Debabrata Behera.**

Profile of the lessee & utilization of ore

Er. Debabrata Behera, aged about 53 years, S/o Sh. Chandra Shekhar Behera resident of Keonjhar, Odisha is a civil engineer by qualification and promoter of the Kashvi Group. Mr.Behera has rich experience of over two decades of manufacturing of sponge iron, billet, ingot, providing logistic solutions, Education, Hotel, Mining and have good exposure of steel & power industry.

Pravata Ku. Sahoo
Qualified Person

After completing B. Tech (Civil) from Hindustan College of Engineering, Chennai in 1990, Mr. Behera joined M/s Orissa Sponge Iron Ltd. in 1991 and was associated with it till 2000. He was responsible for the Operation & Maintenance of Sponge Iron, Power plant & Billet Plant. He was associated with M/s Kusum Powermet Pvt. Ltd. from 2001 till 2010 at a capacity of Director and was responsible for the erection & commissioning of 200 TPD DRI Plant, 8 MT X2 Furnaces. He had expanded another 100 TPD DRI Plant and later played key role in establishing 15 MW Captive Power Plant.

He is an active SIMA delegates in China on various occasions with the invitation from Steel & Power machine manufacturers and has good exposure of this sector. He is also an active member of OSIMA and IOEA.

Key business activities and social activities of Er.DebabrataBeheraare as under:

1. Established 200 TPD sponge iron plant during 2004 and 2010 under Kusum Power met Pvt. Ltd.
2. Established Hotel in the heart of Keonjhar during 2007 under Hotel Kashvi International and operating this hotel which is one of the best hotel of Keonjhar district.
3. Established company named Kashvi Power & Steels Pvt. Ltd. during 2010 and exporting Iron Ore Fines. This company has become the no.-1 iron ore fine exporter of India during the Financial Year 2013-14 the company has achieved a turnover of Rs. 535.00 Cores (Approx).
4. Established a shopping mall named Kashvi Taj Mall during 2013 at Keonjhar which is one of the biggest mall in Odisha.
5. Established company named Kashvi International Pvt. Ltd. a 300 TPD Sponge Iron Manufacturing plant along with 12 MW Power Plant at Keonjhar.
6. Also Established company named Kashvi Power & Steels Pvt. Ltd. as an Importer of South African Coal. This company is in process of starting Import the Steam Coal (Non-Coking) of South African Origin to Paradip Port.
7. To make education available to the surroundings of native place, promoters are managing school named St. Xavier's High school at Keonjhar form 2005 for Charity propose and now the total strength of student is around 1200.
8. Running an Orphanage in the name "ADRUTA CHILDREN HOME" at Keonjhar.
9. Provide bore well and electricity facility to the surrounding of native place.

Recognitions:

1. Mr. Debabrata Behera has been awarded "ODISHA RATNA" Award in 2013 by the Governor of ODISHA acknowledging his social activities.
2. Mr. Behera got best "ENTREPRENEUR" award from Govt of Odisha in 2012 and this award was presented by the Chief Minister of Odisha.
3. Mr. Behera was awarded as "BEST CITIZEN" by the Govt of Odisha in 2011 and this award was presented by the State Finance Minster of Odisha.

Pravata Ku. Sahoo
Qualified Person

UTILIZATION OF IRON ORE AND MANGANESE ORE

Silijoda Iron and Manganese block has been awarded to Sri Debabrata Behera, by the auction process. Sri Debabrata Behera has been declared as the successful bidder and subsequently, lease deed has been executed in favour of Sri Debabrata Behera. The block has been granted as non-captive block.

The lessee is having sponge iron ore plant outside the lease nearby Ramachandrapur, Keonjhar and there is a proposal of establishment of beneficiation & pellet plant near beneficiation and Pellet plant outside the lease area near Champadihi, Keonjhar District. Further, the lessee is in the process of acquisition of a silico-manganese plant near near Duburi, Jajpur, Odisha. The capacity of the silico-manganese plant is 4 x 9 MVA. Therefore, it is envisaged to utilise the part of the produced iron ore in the Sponge as well as pellet plant. Further, the part of the manganese ore to be produced from the lease will be utilised in the silico-manganese plant. Besides the above use, part of the iron and manganese ore will also be sold in the open market as and when required.

Pravata Ku. Sahoo
Qualified Person

1.0 General

a) Name and Address of the Lessee

Name of the Lessee: **Debabrata Behera**

Corporate office / Registered Office	Address for Communication
Registered office At-Plot No.1234(P), Govind Prasad, Bomikhal, Cuttack-Puri Road, Bhubaneswar	Registered office At-Plot No.1234(P), Govind Prasad, Bomikhal, Cuttack-Puri Road, Bhubaneswar

Rule 45 registrations No:IBM/23029/2020

b) Status of the Lessee/Applicant

Private Individual : The lessee Sri Debabrata Behera is a private individual. The lessee is having expertise in mineral trading, sponge iron production and export.

Co-operative Association : Not Applicable

Private Company : Not Applicable

Public limited Company : Not Applicable

Public Sector Undertaking : Not Applicable

Joint Sector Undertaking : Not Applicable

Other (Please specify) : Not Applicable

Mr Debabrata Behera, Lessee is the Authorised Signatory. The copy of the ID and address proof of owner/Lessee is enclosed as **Annexure-13).**

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

Manganese Ore & Iron ore

d) Mineral(s) which is / are included in the letter of intent / lease deed

Manganese ore &Iron ore is included in the lease deed

e) Mineral(s) which is the applicant /lessee intends to mine

The lessee intends to mine Manganese ore &iron ore.

f) Name and Address, Registration No. of the Recognized Person Together With Validity of Date/Person Employed Under Rule 42(1)(b) Who Has Prepared Mining Plan

As per Rule 15 of MCR 2016, the Qualified Person who has prepared the Mining Plan is furnished below:

Self-certified copy of working experience along with certificates in support of educational qualifications required as per the Rule 15 of MCR 2016 is attached as **AnnexureNo-14A.** Photo Id of Qualified person is enclosed as **Annexure No -14B.**

Pravata Kr. Sahoo
Qualified Person

2.0 LOCATION AND ACCESSIBILITY

(a)	**Lease Details**	
	Name of the Mine	Siljora - Kalimati Iron & Mn. ore block
	Latitude	21°53' 59.00750" to 21°52' 34.01443"N
	Longitude	85°21'58.88860" to 85°24'16.06824" E.
	The above co-ordinate is as per the geo-referenced map prepared by ORSAC through DGPS survey (ref: Plate-IB) and forms a part of Survey of India topo sheet No. 73G/5 (Ref: Plate-I). The co-ordinates of all the boundary pillars are furnished below:	

SURVEYED ML PILLAR CO-ORDINATES

Sl_No	Pillar_Id	Latitude	Longitude	Easting	Northing
1	MLR1	21°53'58.50113"	85°22'08.69742"	331520.5360	2422606.8710
2	MLR2	21°53'59.00705"	85°22'06.02211"	331443.9170	2422623.2460
3	MLR3	21°53'58.47465"	85°22'02.70178"	331348.4460	2422607.8850
4	MLR4	21°53'53.68675"	85°22'02.54807"	331342.4690	2422460.6810
5	MLR5	21°53'49.43513"	85°22'04.93181"	331409.4960	2422329.1960
6	MLR6	21°53'43.81814"	85°22'05.97771"	331437.6800	2422156.1280
7	MLR7	21°53'41.60850"	85°22'07.06317"	331468.1130	2422087.8400
8	MLR8	21°53'39.36887"	85°22'07.15719"	331470.0800	2422018.9320
9	MLR9	21°53'37.76507"	85°22'07.97876"	331493.1370	2421969.3570
10	MLR10	21°53'34.60021"	85°22'07.91833"	331490.3690	2421872.0410
11	MLR11	21°53'30.84984"	85°22'07.14114"	331466.8370	2421756.9360
12	MLR12	21°53'28.78382"	85°22'06.15088"	331437.7390	2421693.6980
13	MLR13	21°53'25.88274"	85°22'07.74558"	331482.5640	2421603.9900
14	MLR14	21°53'21.10170"	85°22'07.00201"	331459.6600	2421457.1770
15	MLR15	21°53'18.78747"	85°22'06.06099"	331431.8940	2421386.2900
16	MLR16	21°53'16.40006"	85°22'04.38459"	331382.9960	2421313.3770
17	MLR17	21°53'15.10250"	85°22'03.96725"	331370.5930	2421273.5980
18	MLR18	21°53'13.35593"	85°22'03.40922"	331354.0050	2421220.0530
19	MLR19	21°53'11.10267"	85°22'03.10202"	331344.4510	2421150.8480
20	MLR20	21°53'07.26341"	85°22'02.48745"	331325.5560	2421032.9600
21	MLR21	21°53'05.75930"	85°22'01.24977"	331289.5380	2420987.0790
22	MLR22	21°53'03.34716"	85°21'59.98829"	331252.5400	2420913.2790
23	MLR23	21°53'02.53058"	85°21'59.61903"	331241.6740	2420888.2780
24	MLR24	21°52'59.22831"	85°21'58.97183"	331222.0170	2420786.9150
25	MLR25	21°52'58.15132"	85°21'59.03876"	331223.5860	2420753.7720
26	MLR26	21°52'56.15497"	85°21'59.19785"	331227.5000	2420692.3260
27	MLR27	21°52'51.48125"	85°21'59.73580"	331241.4140	2420548.4230
28	MLR27A	21°52'50.32406"	85°21'59.83373"	331243.8470	2420512.8040
29	MLR28	21°52'48.44389"	85°22'00.09810"	331250.8210	2420454.8990
30	MLR28A	21°52'46.84675"	85°22'00.24096"	331254.4000	2420405.7360
31	MLR29	21°52'42.01055"	85°22'00.69918"	331265.9730	2420256.8600
32	MLR30	21°52'40.73158"	85°22'00.67894"	331264.9740	2420217.5320
33	MLR31	21°52'36.77089"	85°21'58.88860"	331212.2870	2420096.2680
34	MLR31A	21°52'36.37662"	85°21'58.33933"	331196.3910	2420084.3100
35	MLR32	21°52'35.61687"	85°21'57.13035"	331161.4380	2420061.3130
36	MLR33	21°52'34.01443"	85°21'55.82036"	331123.3100	2420012.4300
37	MLR34	21°52'34.45071"	85°21'56.89406"	331154.2740	2420025.5200
38	MLR35	21°52'32.79162"	85°21'59.87765"	331239.3780	2419973.5850
39	MLR36	21°52'29.92294"	85°22'01.04303"	331271.8940	2419885.0040
40	MLR37	21°52'29.76677"	85°22'02.72592"	331320.1520	2419879.6880
41	MLR38	21°52'32.26074"	85°22'08.02398"	331473.0520	2419954.7750
42	MLR39	21°52'29.86920"	85°22'09.68553"	331519.9680	2419880.7180
43	MLR40	21°52'28.31770"	85°22'13.88120"	331639.9030	2419831.7250
44	MLR41	21°52'26.14757"	85°22'18.03809"	331758.5240	2419763.7190
45	MLR42	21°52'24.96701"	85°22'20.63559"	331832.7040	2419726.6220
46	MLR43	21°52'23.45621"	85°22'24.41723"	331940.7690	2419679.0090

Qualified Person

SURVEYED ML PILLAR CO-ORDINATES					
Sl_No	Pillar_Id	Latitude	Longitude	Easting	Northing
47	MLR44	21°52'22.24830"	85°22'25.92247"	331983.5860	2419648.9080
48	MLR45	21°52'18.82165"	85°22'30.11300"	332102.7670	2419537.7460
49	MLR46	21°52'16.51075"	85°22'30.70280"	332118.9470	2419463.2960
50	MLR47	21°52'15.34593"	85°22'33.34258"	332194.3480	2419426.8720
51	MLR48	21°52'12.66153"	85°22'34.28685"	332220.5830	2419344.6280
52	MLR49	21°52'09.44571"	85°22'37.21252"	332303.5260	2419244.2400
53	MLR50	21°52'07.62958"	85°22'38.50204"	332339.9550	2419187.9950
54	MLR51	21°52'06.27570"	85°22'44.92995"	332524.0430	2419144.4110
55	MLR52	21°52'03.58806"	85°22'48.54938"	332627.0760	2419060.6590
56	MLR53	21°52'03.46347"	85°22'52.44450"	332738.8540	2419055.6500
57	MLR54	21°52'04.08952"	85°22'56.79752"	332864.0200	2419073.5890
58	MLR55	21°52'04.28155"	85°23'00.75933"	332977.8150	2419078.2990
59	MLR56	21°52'05.72690"	85°23'03.61659"	333060.3060	2419121.8880
60	MLR57	21°52'04.98319"	85°23'08.37568"	333196.6860	2419097.5810
61	MLR58	21°52'03.22442"	85°23'11.02082"	333272.0530	2419042.6940
62	MLR59	21°52'02.24587"	85°23'12.43195"	333312.2470	2419012.1740
63	MLR60	21°52'01.05955"	85°23'15.28985"	333393.9070	2418974.8290
64	MLR61	21°52'02.76093"	85°23'26.12851"	333705.6040	2419023.8950
65	MLR62	21°52'03.24150"	85°23'30.04314"	333818.1370	2419037.4990
66	MLR63	21°51'55.26127"	85°23'36.13791"	333990.5370	2418790.2430
67	MLR64	21°51'53.83413"	85°23'42.34709"	334168.3300	2418744.4910
68	MLR65	21°51'51.83425"	85°23'45.90684"	334269.8810	2418681.9200
69	MLR66	21°51'52.00399"	85°23'47.63866"	334319.6520	2418686.6220
70	MLR67	21°51'52.46953"	85°23'50.26637"	334395.2370	2418700.1530
71	MLR68	21°51'53.85667"	85°23'55.26515"	334539.1850	2418741.3190
72	MLR69	21°51'56.46057"	85°24'01.77366"	334726.8620	2418819.4560
73	MLR70	21°51'50.89705"	85°24'06.41359"	334858.2850	2418646.9690
74	MLR71	21°51'50.14946"	85°24'07.19641"	334880.5190	2418623.7440
75	MLR72	21°51'49.10028"	85°24'09.18938"	334937.3980	2418590.8830
76	MLR73	21°51'49.68595"	85°24'12.40244"	335029.8250	2418607.9370
77	MLR74	21°51'50.37125"	85°24'16.06824"	335135.2810	2418627.9210
78	MLR75	21°51'50.59447"	85°24'20.15636"	335252.7130	2418633.5690
79	MLR76	21°51'50.87369"	85°24'22.39551"	335317.0830	2418641.4900
80	MLR77	21°51'48.88051"	85°24'29.48737"	335520.0400	2418578.0830
81	MLR78	21°51'57.42223"	85°24'20.52164"	335265.3760	2418843.4430
82	MLR79	21°52'03.46905"	85°24'14.97775"	335108.1550	2419031.0590
83	MLR80	21°52'06.39680"	85°24'12.17528"	335028.6390	2419121.9350
84	MLR81	21°52'11.92185"	85°24'06.97808"	334881.2090	2419293.4040
85	MLR82	21°52'19.91501"	85°23'59.30459"	334663.4870	2419541.5190
86	MLR83	21°52'24.53257"	85°23'54.96570"	334540.4130	2419684.8260
87	MLR84	21°52'28.99693"	85°23'50.74884"	334420.7950	2419823.3860
88	MLR85	21°52'37.58783"	85°23'42.55313"	334188.2890	2420090.0480
89	MLR86	21°52'44.60734"	85°23'35.04016"	333974.8840	2420308.1820
90	MLR87	21°52'52.16887"	85°23'27.16805"	333751.3500	2420543.0970
91	MLR88	21°52'57.20398"	85°23'21.45540"	333588.9940	2420699.6670
92	MLR89	21°53'01.51647"	85°23'17.02685"	333463.2670	2420833.6280

Pravata Ku. Sahoo
Qualified Person

SURVEYED ML PILLAR CO-ORDINATES					
Sl_No	Pillar_Id	Latitude	Longitude	Eastings	Northings
93	MLR90	21°53'06.14499"	85°23'12.27591"	333328.3900	2421977.4870
94	MLR91	21°53'08.83063"	85°23'09.04039"	333236.3960	2422060.9780
95	MLR92	21°53'11.60331"	85°23'05.46094"	333134.5350	2422147.4300
96	MLR93	21°53'14.89156"	85°23'01.58414"	333024.3250	2422249.8290
97	MLR94	21°53'19.65939"	85°22'55.71639"	332857.4450	2421398.0340
98	MLR95	21°53'23.31108"	85°22'51.21637"	332729.4640	2421511.7010
99	MLR96	21°53'25.68109"	85°22'48.23829"	332644.7530	2421585.4910
100	MLR97	21°53'34.05741"	85°22'37.85172"	332349.3510	2421846.2480
101	MLR98	21°53'41.87016"	85°22'27.84394"	332064.6470	2422089.5640
102	MLR99	21°53'46.19863"	85°22'22.41388"	331910.2040	2422224.3350
103	MLR100	21°53'49.62492"	85°22'18.47690"	331798.3230	2422330.9070

	Date of Grant of Lease	The Government of Odisha has issued Letter of Intent vide Lr.No. 3028/S&M, Bhubaneswar Dated 18.03.2020.The lease has been executed on 27.06.2020. As per Mines & Minerals Development & Regulation (Amendment) Act, 2015, and as per terms of lease deed, the date of expiry of the lease is 50 years from the date of execution; 26.06.2070.
	Period/Expiry date	As per Mines & Minerals Development & Regulation (Amendment) Act, 2015, and as per terms of LOI, the date of expiry of the lease is 50 years from the date of execution of the same.
	Name of the Lease holder Postal Address Telephone Fax Email id Mobile No	Debabrata Behera (Lessee) **Corporate office / Registered Office**: Registered office At-Plot No.1234(P), Govind Prasad, Bomikhal, Cuttack-Puri Road, Bhubaneswar-751010 **Address for Communication**: Registered office At-Plot No.1234(P), Govind Prasad, Bomikhal, Cuttack-Puri Road, Bhubaneswar-751010
(b)	Details of Applied Lease area with location map (fresh area/mine)	M.L area over 713.510 Ha (as per DGPS Survey) falls in Srijoda, Kalimati, Tadpani, Balda, Dubuna&Handibhanga, Tehsil-Barbil, Sub-division Champua, District Keonjhar, Odisha. Khesra/Khata No/ Plot No. has been given in the land schedule vide **Annexure –15**

Pravata Ku. Sahoo
Qualified Person

As per the land schedule, the pre-operational land use pattern is given as follows:

Village	Govt . Land (in Ha.)	Private Land (in Ha.)	Forest Land (in Ha.)		ST Land (in Ha.)	Sub Total Area (in Ha.)
			DLC	Sabik		
Bada Kalimati	15.739	2.723	153.255	33.084	14.667	219.468
Balda	0	0	8.997	0	0	8.997
Dubuna	0.126	0.059	0	1.470	0	1.655
Handibhanga	4.656	0.398	0.184	4.836	9.357	19.431
Srijoda	132.315	2.100	141.053	142.284	21.660	439.412
Tadapani	0	0	24.547	0	0	24.547
Total	**152.836**	**5.280**	**328.036**	**181.674**	**45.684**	**713.510**

District & State :		Keonjhar & Odisha
Taluka :		Barbil
Village:		Srijoda, Kalimati, Tadpani, Balda, Dubuna & Handibhanga
Whether the area falls under Coastal Regulation Zone (CRZ)		No
If yes, details thereof :		Not Applicable
	Existence of public road/railway line, if any nearby and approximate distance	The leasehold of Siljora-Kalimati Iron & Mn. Ore block over 713.510 Ha(as per DGPS) and 712.993 Ha(As per ROR) is well connected with Road and Railways.The communication with the lease is as follows: a) **Road link** The State Highway connecting Joda –Dubunavia Bamebari, Keonjhar passing through the ML area. b) **Rail link** Nayagarh Railway station is located at a distance of 12 km and Banspani Railway station (BIL) is 25 km away from the lease area. c) **Air link** Bhubaneswar airport (270 km away) is the nearest airport from the area. There is an airstrip/helipad near Bhadrasai, Barbil which is around 45 km from the lease area.
	Toposheet No. with latitude & longitude of all corner boundary point/pillar	Ref: Para-(a) of this chapter as indicated above.
c)	Attach a general location map showing area and access routes.	The area has been earmarked on a survey of India topographical map as well as cadastral map. **Ref Plate No-I and II**

Pravata Ku. Sahoo
Qualified Person

3.0 DETAILS OF APPROVED MINING PLAN/SCHEME OF MINING.

3.1 Date and reference of earlier approved Mining Plan/Scheme of Mining

The Mining plan being submitted is a fresh Mining plan after auction. Hence review of the details of earlier approved Mining plan and review of Mining plan is not applicable in this case.

3.2 Details of last modifications if any (for the previous approval period) of approved MP/SOM, indicating date of approval, reason for modification

Not applicable as it is the 1st Mining Plan being submitted afresh in favour of Debabrata Behera

3.3 Review of earlier approved proposal in respect of exploration, excavation, reclamation etc.

Not applicable as it is the 1st Mining Plan being submitted by the lessee. Hence, review in respect of exploration, excavation, reclamation etc. is not applicable.

3.4 Give Status of Compliance of violations pointed out by IBM

Not Applicable

3.5 Details of any suspension/closure/prohibitory order issued by any Government agency under any Rule or court of Law.

Not Applicable

3.3 In case the MP/SOM is submitted under Rule 9 and 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 Rule.

Not Applicable

Pravata Ku. Sahoo
Qualified Person

CHAPTER-1

1.0 GEOLOGY AND EXPLORATION

a) **Briefly describe the topography, drainage pattern, vegetation, climate, rainfall data of the area applied/mining lease area:**

Topography:

The mine is divided into two sections namely Siljora and Kalimati. Kalimati section is covered by eastern part of the lease hold area. The Siljora section lies at a higher elevation than the Kalimati section. The general elevation of Siljora section varies from 560m to 776m, while it is 524m to 740m in the Kalimati section. The Siljora Section is separated from the Kalimati section by a N-S running valley having steep slopes on either side. The Siljora section represents a sub-plateau in the middle, surrounded by steep slope in the western side and very steep slope surface in the southern and south-eastern side which are traversed by numerous streams and streamlets. The direction of stream flows from east to west in the western side and north to south as well as north west to south east in other areas. All these streams and streamlets are seasonal being rain fed only.

At the extreme southern end stands a highly steep-slope-hill having the maximum contour of 730m. In between this hill and the Siljora sub-plateau, lies an east-west trending valley. The nearby Guruda sub-plateau encroaches the Kalimati section in its north-west flank in a NNW-SSE trend. This sub-plateau in its eastern part is bifurcated by a long stretching, east-west trending valley. The sub-plateau is sub-rounded in south-eastern and south western sides by steep slope faces.

The eastern boundary of the lease hold area provides a contrasting topography in the form of plain land.

A perennial stream flows along the western boundary and is roughly taken as the boundary line. Another stream flows beside the boundary lines in the eastern flank. It is also a perennial one.

Drainage pattern:

Due to sloped surfaces and prevailing of several streams and streamlets the area is well drained and there is no chance of any flood in this area. A perennial stream flows along the western boundary and is roughly taken as the boundary line. Another stream flows beside the boundary lines in the eastern flank. It is also a perennial one.

Vegetation: A major part of the lease area is covered with green shrubs and trees. But the density of vegetation varies from place to place. In the eastern and western boundary area, the vegetation is thin, only a few trees and small bushes are found scattered here and there. On the other hand, the central zone of Siljora section as well as the Kalimati section, the density of shrubs and trees is more. The common trees of the area are Mahua, Sal,Kusum,Jhala,Bahada,Karanj, Ashan etc. Some forest fruit bearing trees like Chaar,Amla,Kendu,Kathal,Mango are also seen.

Climate: The area falls under tropical climate. The Climatological data of the area has analysed. The rainfall belt 1950-2250mm and temperature of the area varies from 4.8^{0}C to 47^{0}C.

Pravata Ku. Sahoo
Qualified Person

Rainfall data: The average annual rainfall in the past one decade was 748.6mm with the highest precipitation in august when about 80% of the rainfall was received in the area during the SW Monsoon(June to September) every year.

b) Brief descriptions of Regional Geology with reference to location of lease/applied area:

Regional Geology:

The Siljora - Kalimati manganese and Iron ore deposit forms a part of pre-cambrian sedimentary formation known as the Iron-ore series developed in Singhbhum-Keonjhar-Bonai area. The general strike of the formation in Northern Singhbhum is NNE-SSW, but gradually changing over to NW-SE in the eastern part and in the adjoining area of Mayurbhanj. This part of Singhbhum is marked by a shear zone along which rocks have been thrust towards the south and metamorphosed. The shear zone is marked with intrusions of soda-granophyre with in which deposits of copper, apatite and magnetite are associated. Towards north of the shear zone the rocks consist of phyllites and tuffs with basic intrusive at the bottom which are overlain by ferruginous quartzite's and phyllites. Above them appear a series of lava flows called the Dalma volcanic which occupy a fairly broad belt of country.

The iron-ore series consist mainly of banded hematite quartzites and shales with intercalations of lava flows and tuffs. There are views that large part of the shales may really consist of tuffaceous material. Dunn (1942) believes that certain phyllites and shales in Eastern and Southern Singhbhum were originally volcanic tuffs and that they have been either silicified or replaced by Iron to come extend, the later when in contact with banded ferruginous rocks. In some places the phyllites are manganiferous and have been partly replaced by manganese ores. Such manganese ore bodies are of small dimensions and are observed in several places of Keonjhar and Bonai.

Their formation has largely been determined by local topography and drainage in ancient times as they extend only to shallow depths and are mainly composed of pyrolusite, psilomelane and wad. The iron ore series is overlain by the Kolhan series of presumably Cuddapah age (Algonkian) and consists of basalt conglomerates and sandstones which are overlain by limestones and shales.The general stratigraphical succession of this area is as under:

- Kolhan series (basal conglomerate and sandstone)
- Unconformity
- Phyllites and tuffs with manganese and dolomite.
- Banded hematite quartzite.
- Phyllites and tuffs conglomerate and basic igneous rocks.

The rocks of the Iron ore series in West Singhbhum, Keonjhar and Bonai give rise to a rugged topography. The beds of banded hematite-jasper form prominent ridges rising to about 2500 to 3000 ft. in altitude. The lower ground is occupied by lavas, phyllites and shales. The whole succession of rocks is folded into a series of asymmetrical or slightly over tuned anticlines and synclines. The rocks have a NNE-SSW strike with a general westerly dip. The structure may, in general, be

Pravata Ku. Sahoo
Qualified Person

considered as a syncline pitching towards northern with an over folded western limb in which occurs the most important Iron ore deposits.

The banded hematite jaspers consist of alternating bands of jasper or chalcedony and hematite containing varying proportions of iron oxide and silica. Owing to their greater hardness they stand up as prominent ridges and cliffs. On weathered surfaces, the hematite band often stand up while the jasper bands from depressions due to high leaching action.

The colour of jasper bands varies from grey or white lavender, red and brown to black. The maximum thickness of hematite-jasper formation as stated by Jones (1934) is about 3000 ft. in Bonai and 1000 ft. in the main iron-ore range on the border of Keonjhar, and Singhbhum.

Iron ore from the banded hematite-jasper is or different physical types, viz., massive, laminated, shally, powdery, etc. Massive ore is encountered at the surface of many deposits. It is massive, dark brown to steel-grey in colour and Fe content about 60 to 65 percent. This type forms the float ore.

In laminated ore bedding planes are will seen where open spaces between the lamina may be observe. The open spaces are occasionally filled with powdery ore or shally substance. The ore is mainly porous, but compact variety is also observed in abundance. The laminated ore is supposed to be formed by leaching out of Silica from banded hematite-Jasper and subsequent filling by iron.

shally ore has a shally structure with iron content of about 50 percent. This might have been formed by enrichment of shale of iron ore series by infiltrating solutions containing Iron.

Powdery ore occurs as fairly large pockets and lenses. The material turns to powder if disturbed even slightly when in situ, the ore show bedding and may contain lumps of laminated ore with it. It is dark blue-grey to black in color and consists mainly of hematite with some quantity of martite. It is generally rich in Iron ore containing 60 to 69 percent of iron.

Bore holes drilled by different Agencies show that the hard massive ore is largely confined to the surface but they may extend to a depth of 50 to 100 ft. compact and laminated ores may extend to various depths from the surface. They often contain intercalations and masses or un-replaced hematite-Jasper and powdery ores. This may indicate that, while the ore near the surface has been completely leached of its silica and alumina with the consequent filling of all the pore spaces by ore, there are still unfilled spaces left between the layers at depth.

The banded iron ore formation developed in the Upper Pre-Cambrian period is very common in different parts of the world. Similar formations have not been found to any applicable extent in Cambrian and later period. They are generally considered as marine deposits formed by rhythmic precipitation of alternating layers of colloidal silica and ferric hydroxide. High content of carbon-dioxide, high humidity and temperature prevailing in Pre-Cambrian atmosphere must have helped in leaching away of silica and iron form the rocks exposed at that time. Silica and iron from submarine volcanism also contributed to this process. Experiment of Moore and Maynard (1929) show the possibility of the colloidal materials having been transported in solution under the stabilizing

Pravata Ku. Sahoo
Qualified Person

influence of some organic acids. The iron oxide bands are practically pure while the silica bands are more or less mixed with some iron oxide, thus having the composition and appearance of jasper.

c) Detailed description of geology of the lease area such as shape and size of the mineral/ore deposit, disposition various litho-units indicating structural features if any etc.

Siljjora–KalimatiManganese deposit forms a part of Bonai-Keonjhar iron manganese belt which is 60 km long & 25 km wide synclinorium. The banded iron formations; which broadly define the outline of the synclinorium, are almost continuously exposed along the margin, while manganese ore bearing shales occur within the core region of the fold. The entire region displays the effect of superposed folding on two near perpendicular axes, the generalised trends being NNE-SSW & WNW-ESE to NW-SE.

The Iron Ore Group of rocks comprises slightly metamorphosed banded iron formation (BIF), basic to intermediate volcanic rocks, black and banded silty shales, variegated clayey shale, ferruginous shale, dolomite and chert. While rocks are extensively lateritised to various depths, the Mn ore bodies with different grades are confined as pockets and lensoids to the upper portion till a depth of 70 metres in some places but overall are restricted to approximately 50 m to 55 m. zone. The mixed fades formation is about 40-120 m. thick. Below this the BIF members like quartzite, chert, jasper and unaltered hard manganiferous gray shale appear repeatedly. Based upon the subsurface studies at different locations a local litho stratigraphic succession of Siljora - Kalimati Mn & Iron block can be established as:- Weathered Laterite

- Lateritic Iron & Mn Ore
- Mn Ore embedded within Lateritic Shale
- Mn Ore restricted as pockets within Manganiferous Shale
- Variegated Shale
- Unaltered hard grey shale with quartzite, Chert & Jasper

The chief structural elements preserved in the rocks of the area are bedding, banding and lamination, cleavage in the banded shale and micro fold.

Manganese ore in the Siljora area occurs as thin bands, lenses, stringers and as box works of various shapes in three distinct lithological associations' viz. with laterite at surface levels, with manganiferrous shale and with clayey shale successively one below the other. Often it is noticed that one mode of occurrence grades imperceptibly into the other. One interesting feature noticed in the ore associated with ferruginous shale is the presence of carbonate minerals (mainly calcite) with partly altered and lateritised shale. Pyrolusite, psilomelane, cryptomelane and wad are the chief ore components. Colloform textures with simultaneous formation of pyrolusite and cryptomelane is a common feature, banded and brecciated textures are also noted.Structural control of manganese deposits is rarely observed. Theremobilised ore occurs preferentially in the zones of anticlines (eg.Kocha quarry) in shales, though it is difficult to locate in the upper portion owing to the thick laterite cover.

Pravata Ku. Sahoo
Qualified Person

The structure may, in general, be considered as a syncline pitching towards northern with an overfolded western limb in which occurs the most important Mn ore deposits. Manganese is also mobilised and re-deposited along several fracture and fault planes.

Based on the available field evidences and geochemical criteria of ore and wad, it is suggested that the manganese deposits of the Bonai-Keonjhar belt were the result of a complex history of evolution involving syngenetic deposition under volcano-sedimentary environment in shallow marginal marine basin surrounded by a land characterized by peneplaned relief, diagenetic differentiation, intense deformation and supergene alteration under lateritic conditions. They may, therefore, be classed as volcanogenic-sedimentary-diagentic type deposits.

ROCK TYPES AVAILABLE: The Iron Ore Group of rocks comprises slightly metamorphosed banded iron formation (BIF), basic to intermediate volcanic rocks, black and banded silty shales, variegated clayey shale, ferruginous shale, dolomite and chert. While rocks are extensively lateritised to various depths, the ore bodies are defined to approximately 50 m to 55 m. zone. The mixed fades formation is about 40-60 m. thick.

STRUCTURAL FEATURES: The general trend of the litho unit encountered within the lease area is NNE-SSW, but gradually changing over to NW-SE. with varying amount of dip towards east. Dip varies in between 20^0 to 30^0.

The rocks of the belt are folded into a major, low, NNE-plunging synclinorium slightly overturned to the east. The BIF forms a spectacular U-shaped closure in the southern part of the belt in Bonai with the two limbs of the synclinorium opening to the north. The overturned western limb, dipping steeply to the west forms narrow, almost rectilinear outcrops while the gently dipping (also westerly) eastern limb of the synclinorium is characterized by wide outcrops and is less well-defined. The outer rim of the synclinorium is underlain by the older rocks of the Volcanic and Basal Formations while the core is made up of the rocks of the Mixed Facies Formation and Banded Shale Formation.

The major synclinorium is superposed upon by another set of folds developed about ENE-WSW trending and northwesterly inclined (steeply) axial planes.

The superposed deformations about axes almost at right angles to each other resulted in a characteristic interference pattern leading to the formation of structural domes and basins on macroscopic as well as mesoscopic scale.

The chief structural elements preserved in the rocks of the area are bedding, banding and lamination (S_1), cleavage in the banded shale (S_2) and mesoscopic fold axis.

MODE OF OCCURRENCE: Manganese ore in the Siljora area, occurs as thin bands, lenses, stringers & as box works of various shapes in three distinct lithological associations viz. with

Pravata Ku. Sahoo
Qualified Person

laterite at surface levels, with ferruginous shale and with clayey shale successively one below the other. Often it is noticed that one mode of occurrence grades imperceptibly into the other. One interesting feature noticed in the ore associated with ferruginous shale is the presence of carbonate minerals (mainly calcite) with partly altered and lateritised shale. Pyrolusite, psilomelane, cryptomelane and wad are the chief ore components. Colloform textures with simultaneous formation of pyrolusite and cryptomelane is a common feature, banded and brecciated textures are also noted. Structural control of manganese deposits is rarely observed. There mobilised ore occurs preferentially in the zones of anticlines (eg.Kocha quarry) in shales, though it is difficult to locate such upwards owing to the thick laterite cover. Manganese is also mobilised and re-deposited along several fracture and fault planes.

(d)Name of the prospecting/exploration agency:

As per the Geological Report, the prospecting/exploration agency who were engaged for drilling by the old lessee are furnished below:

Name of Prospecting/ exploration agency	Address	Email Address	Phone no.
M/s. V.K.S. Mining Services	C/o- Lal Mohan Mohanty, Near TV centre, Joda, Keonjhar, Odisha-758034	vks.joda@gmail.com	06767272215
M/s. Geotech Exploration	51, Panchdeep Nagar, Wardha Road NA, Maharastra-440025	rajeshasthankar@geotechindia.co.in	09422113345
M/s. SPS Geomining Solution Pvt. Ltd	**Address:** K no. 128/ 197, Serenda, P.O. Bhadrasahi, Barbil, Dist: Keonjhar, 758035, Odisha	**E mail address:** spsgeomining@gmail.com	**Phone no.** 9437610190, 8017176910, 9830353767

e) **Details of prospecting/exploration already carried out:**

i) **Number of pits and trenches indicating dimensions, spacing etc along and across the strike/ foliation with reference to geological plan:**

There are six excavated blocks having following dimensions which give good exploratory data and trend of ore body.

Name of Block	Existing Dimension (m^2)
Block-1	1400x800
Block-2	1000x1000
Block-3	500 x 586
Block-4	500 x 400
Block-5	340x280
Block-6 (**Mn.**)	650x500
Block-6 (**Iron**)	340x300

ii) **Number of boreholes indicating type (Core/RC/DTH), diameter, spacing, inclination, Collar level, depth etc with standard borehole logs duly marking on geological plan/sections:**

Siljora-Kalimati Manganese & Iron mine is an operational mine for more than 70 years. The exploration was carried out since 2000 through core & non - core drilling. Till date 225 nos. of coring (9259.00m) and 3108 nos. of non-coring (141891.00m) holes, a total of 3333 nos. of exploratory holes were completed in the entire leasehold area. Total depth covered by these exploratory holes is 151150.00m. The total leasehold area of 715.639 Ha is covered by boreholes with a grid interval of 10m to 50m and 50m to 100m depending upon the disposition of the ore zone and is under detailed exploration (G1) for 391.160 Ha and General Exploration (G2) for 324.479Ha of UNFC

Pravata Ku. Sahoo
Qualified Person

Classification. All the bore holes are shown in the Geological plan in 1:4000 scale attached to this report. Details of the borehole logs in the area are enclosed in this report as annexture.

Details of Year wise boreholes drilled is given below:

Year	No. of Coring holes	Depth of Core Drilling (m)	No. of Non-Coring holes	Depth of Non-Core Drilling (m)	No. of Exploratory Boreholes	Total Depth of Exploratory Boreholes
UP to 2000	65	2925	11	497	76	3422
2003-04	-	-	149	3318	149	3318
2004-05	-	-	150	3000	150	3000
2005-06	-	-	-	-	-	-
2006-07	-	-	-	-	-	-
2007-08	-	-	166	2905	166	2905
2008-09	-	-	75	1500	75	1500
2009-10	-	-	75	2553	75	2553
2010-11	-	-	254	3628	254	3628
2011-12	-	-	-	-	-	-
2012-13	-	-	-	-	-	-
2013-14	-	-	250	16456	250	16456
2014-15	-	-	900	50747	900	50747
2015-16	10	432	590	33061	600	33493
2016-17	45	1531	55	3016	100	4547
2017-18	40	1276	240	11458	280	12734
2018-19	65	3095	193	9752	258	12847
Total	**225**	**9259**	**3108**	**141891**	**3333**	**151150**

The distribution of lease area as per exploration category

The data spacing and distribution is based on part I and II of the schedule and is sufficient to establish the degree of geological and grade continuity appropriate for the Mineral resource estimation.

The distribution of lease area as per exploration category:(As per the Geological Report)

Total Lease area: 715.639 Ha						
Item of Information	Lease area explored as per UNFC norms (in Ha) till date.					Remarks/ comments including reasons for not carrying out the exploration as per UNFC norms.
	Total Lease area= A+B+C+E					
	G1 Level	G2 Level	G3 Level	Explored and found non-mineralised with level of exploration (Remarks)	Unexplored lease area	
	A	B	C	D	E	
Area as per level of exploration	391.160 Ha (out of which 353.17Ha is mineralised)	324.479 ha (10.22 Ha mineralised)	Nil	352.249 Ha (37.99 Ha in G1 area+314.259 Ha in G2 area)	Nil	The area has been explored under G1 and G2 level by previous lessee. During plan period of 5 years, it has been proposed to drill ..... nos of bore holes to cover entire area under G1 level.
No. Of BH Drilled	3109 nos (out of which 2249 nos. are mineralised)	224 nos (out of which 18 nos. are mineralised)	Nil	1066nos (860 nos in G1+206nos in G2	-	
No. Of BH considered for Resource Estimation	Within 3333 holes 2388 no. Of holes are used	Nil	-	-	-	
Meterage Drilled	140408m	10742m	-	27198m (16456m in G1+10742m in G2)	-	
Grid Interval	10m to 50m	100m to 200m	200m to 400m	20m to 50m	-	
Scale of Mapping	1:4000	1:4000	-	1:4000	1:4000	
Total Resource (Mn) after above exploration as on dated:01.01.2019					Manganese ore =4022521MT	
Total Resource (Fe) after above exploration as on dated:01.01.2019					Iron ore =718741 MT	

Pravata Kr. Sahoo
Qualified Person

(iii Details of sample analysis indicating type of sample (surface, sub-surface from pits/ trenches/bore holes etc.) complete chemical analysis for entire strata for all radicals may be undertaken for selected samples from a NABL accredited Lab or Government Laboratory or equivalent.

All the borehole samples has been analysed from M/s. Mitra S.K. (P) Ltd. and M/s B.V. Briggs & Co. Pvt. Ltd. both of which are NABL accredited laboratories. NABL accreditation certificates of both the laboratories are attached with this report as annexure.

Samples collected in both coring and non-coring drilling are subjected to coning & quartering method to get the proper representation. The portion of the sample retained after the coning and quartering process is then crushed and grinded to get the powdered sample for chemical analysis. After analysis the grade of the ore is determined.

In sampling of mineral cores, the core is split in to two halves. One half is prepared for sampling and other half is preserved for future reference. Length of the sample depends upon the change in the lithology or maximum upto 1 metre.

iv) **Expenditure incurred in various prospecting operations:**

Exploration has been carried out by old lessee. The expenditure of exploration work is not available in Geological Report.

f) The surface plan of the lease area may be prepared on a scale of 1: 1000 or 1: 2000 with contour interval of maximum of 10 m depending upon the topography and size of the area duly marked by grid lines showing all features indicated under Rule 32(a) of MCDR 2017.

A surface plan in 1:4000 scale with 10 m contour interval and 100m grid interval is prepared as per rule 32(a) of MCDR, 2017.

g) For preparation of geological plan, surface plan prepared on a scale of 1: 1000 or 1: 2000 scale specified under para 1.0 (f) of Part A of the format may be taken as the base plan. The details of exploration already carried out along with supporting data for existence of mineral, locations proposed exploration, various lithounits along with structural features, mineralized/ore zone with grade variation if any may be marked on the geological plan along with other features indicated under Rule 32(b) of MCDR 2017:

A geological plan in 1:4000 scale with 10m contour interval and 100m grid interval along with the details of exploration already done and proposed, the exposure of mineral zone & other litho units, the structural features is prepared as per rule 32(b) of MCDR,2017.

h) Geological sections may be prepared on natural scale of geological plan at suitable interval across the lease area from boundary to boundary:

Geological sections in 1:4000 scales is prepared at an interval 100m, across the lease area from boundary to boundary.

i) Broadly indicate the future programme of exploration with due justification (duly marking on Geological plan year wise location in different colours) taking into consideration the future tentative excavation programme planned in next five years as in table below:

The entire area has been explored under G1 and G2 category through core/DTH drilling. It has been envisaged to explore the entire under G1 category. The details of proposed bore hole will be undertaken during 2020-21 to 2023-24. Total 450 nos of bore holes have been proposed to be drilled during plan period. Bore holes proposed within the potential mineralised zone will be of core type/RC type and that proposed within the non-potential mineralised zone will be of DTH type. The average

Pravata Ku. Sahoo
Qualified Person

depth of core type bore holes will be 70m or up to end of the mineralised zone. The details of bore hole with location, type, etc. are furnished below:

YEAR	No. of Boreholes (Core/RC/DTH)	Grid Interval	Total Meterage	No. of Pits, dimension, volume	No. of Trench, Dimension & Volume
2020-21	78nos(Core/RC)	50m x 50m	5460m	—	—
2021-22	163 nos (Core/RC)	50m x 50m	11410m	—	—
2022-23	90 nos(Core/RC	50m x 50m	6300m	—	—
2023-24	119 nos(Core/RC	50m x 50m	8330m	—	—
Total	450 nos		9700m		

The location and other details of bore holes will be as follows:

Year	Name of the BH	Easting	Northing	Meterage	Nos of Bore Holes	Type of Bore Hole	Details of analysis
2020-21	PBH - 1	331288	2420928	70m or upto bottom of mineralisation whichever is more	70 nos	Core /RC/DTH	The analysis will be done at every one meter interval. Further, if there is any change in lithology within the sample interval of , then based on lithology additional sampling will be carried out. The analysis will be carried out adhering to Mineral Evidence Rule, 2016
	PBH - 2	331288	2420878			Core /RC/DTH	
	PBH - 3	331288	2420828			Core /RC/DTH	
	PBH - 4	331288	2420728			Core /RC/DTH	
	PBH - 5	331288	2420678			Core /RC/DTH	
	PBH - 6	331288	2420628			Core /RC/DTH	
	PBH - 7	331288	2420578			Core /RC/DTH	
	PBH - 8	331288	2420478			Core /RC/DTH	
	PBH - 9	331288	2420428			Core /RC/DTH	
	PBH - 10	331288	2420328			Core /RC/DTH	
	PBH - 11	331388	2420878			Core /RC/DTH	
	PBH - 12	331388	2420828			Core /RC/DTH	
	PBH - 13	331388	2420728			Core /RC/DTH	
	PBH - 14	331388	2420628			Core /RC/DTH	
	PBH - 15	331388	2420578			Core /RC/DTH	
	PBH - 16	331388	2420528			Core /RC/DTH	
	PBH - 17	331388	2420428			Core /RC/DTH	
	PBH - 18	331388	2420328			Core /RC/DTH	
	PBH - 19	331388	2420278			Core /RC/DTH	
	PBH - 20	331488	2420928			Core /RC/DTH	
	PBH - 21	331488	2420878			Core /RC/DTH	
	PBH - 22	331488	2420828			Core /RC/DTH	
	PBH - 23	331488	2420778			Core /RC/DTH	
	PBH - 24	331488	2420728			Core /RC/DTH	
	PBH - 25	331488	2420678			Core /RC/DTH	
	PBH - 26	331488	2420628			Core /RC/DTH	
	PBH - 27	331488	2420528			Core /RC/DTH	
	PBH - 28	331488	2420478			Core /RC/DTH	
	PBH - 29	331488	2420428			Core /RC/DTH	
	PBH - 30	331488	2420378			Core /RC/DTH	
	PBH - 31	331488	2420328			Core /RC/DTH	
	PBH - 32	331488	2420278			Core /RC/DTH	
	PBH - 33	331588	2420928			Core /RC/DTH	
	PBH - 34	331588	2420878			Core /RC/DTH	
	PBH - 35	331588	2420828			Core /RC/DTH	
	PBH - 36	331588	2420728			Core /RC/DTH	
	PBH - 37	331588	2420628			Core /RC/DTH	
	PBH - 38	331588	2420528			Core /RC/DTH	
	PBH - 39	331588	2420478			Core /RC/DTH	
	PBH - 40	331588	2420428			Core /RC/DTH	
	PBH - 41	331588	2420378			Core /RC/DTH	
	PBH - 42	331588	2420328			Core /RC/DTH	
	PBH - 43	331588	2420278			Core /RC/DTH	
	PBH - 44	331688	2420778			Core /RC/DTH	
	PBH - 45	331688	2420728			Core /RC/DTH	
	PBH - 46	331688	2420628			Core /RC/DTH	
	PBH - 47	331688	2420528			Core /RC/DTH	
	PBH - 48	331688	2420428			Core /RC/DTH	
	PBH - 49	331688	2420378			Core /RC/DTH	
	PBH - 50	331688	2420328			Core /RC/DTH	
	PBH - 51	331788	2420678			Core /RC/DTH	
	PBH - 52	331788	2420628			Core /RC/DTH	
	PBH - 53	331788	2420578			Core /RC/DTH	

Pravata Ku. Sahoo
Qualified Person

	PBH - 54	331788	2420528			Core /RC/DTH	
	PBH - 55	331788	2420478			Core /RC/DTH	
	PBH - 56	331788	2420428			Core /RC/DTH	
	PBH - 57	331788	2420328			Core /RC/DTH	
	PBH - 58	331788	2420278			Core /RC/DTH	
	PBH - 59	331888	2420478			Core /RC/DTH	
	PBH - 60	331888	2420428			Core /RC/DTH	
	PBH - 61	331888	2420378			Core /RC/DTH	
	PBH - 62	331888	2420328			Core /RC/DTH	
	PBH - 63	331988	2420478			Core /RC/DTH	
	PBH - 64	331988	2420428			Core /RC/DTH	
	PBH - 65	331988	2420378			Core /RC/DTH	
	PBH - 66	331988	2420328			Core /RC/DTH	
	PBH - 67	332088	2420478			Core /RC/DTH	
	PBH - 68	332088	2420428			Core /RC/DTH	
	PBH - 69	332088	2420378			Core /RC/DTH	
	PBH - 70	332088	2420328			Core /RC/DTH	
	PCD – 1	331788	2421277		8 NOS	CHECK DRILL	
	PCD – 2	331788	2421177				
	PCD – 3	331788	2421077				
	PCD – 4	331788	2420977				
	PCD – 5	332088	2421277				
	PCD – 6	332088	2421177				
	PCD – 7	332088	2421077				
	PCD – 8	332088	2420977				
Sub-total					78 nos		
2021-22	PBH - 71	331288	2420228	70m or upto bottom of mineralisation whichever is more		Core /RC/DTH	The analysis will be done at every one meter interval. Further, if there is any change in lithology within the sample interval of , then based on lithology additional sampling will be carried out. The analysis will be carried out adhering to Mineral Evidence Rule, 2016
	PBH - 72	331288	2420178			Core /RC/DTH	
	PBH - 73	331288	2420128			Core /RC/DTH	
	PBH - 74	331288	2420078			Core /RC/DTH	
	PBH - 75	331290	2420028			Core /RC/DTH	
	PBH - 76	331290	2419929			Core /RC/DTH	
	PBH - 77	331388	2420228			Core /RC/DTH	
	PBH - 78	331388	2420178			Core /RC/DTH	
	PBH - 79	331388	2420128			Core /RC/DTH	
	PBH - 80	331388	2420078			Core /RC/DTH	
	PBH - 81	331388	2420028			Core /RC/DTH	
	PBH - 82	331388	2419978			Core /RC/DTH	
	PBH - 83	331490	2420228			Core /RC/DTH	
	PBH - 84	331488	2420128			Core /RC/DTH	
	PBH - 85	331488	2420078			Core /RC/DTH	
	PBH - 86	331488	2420028			Core /RC/DTH	
	PBH - 87	331588	2420229			Core /RC/DTH	
	PBH - 88	331588	2420179			Core /RC/DTH	
	PBH - 89	331588	2420128			Core /RC/DTH	
	PBH - 90	331588	2420078			Core /RC/DTH	
	PBH - 91	331588	2420028			Core /RC/DTH	
	PBH - 92	331588	2419978			Core /RC/DTH	
	PBH - 93	331588	2419927			Core /RC/DTH	
	PBH - 94	331588	2419877			Core /RC/DTH	
	PBH - 95	331688	2420228			Core /RC/DTH	
	PBH - 96	331688	2420078			Core /RC/DTH	
	PBH - 97	331690	2420028			Core /RC/DTH	
	PBH - 98	331688	2419928			Core /RC/DTH	
	PBH - 99	331688	2419878			Core /RC/DTH	
	PBH - 100	331788	2420228			Core /RC/DTH	
	PBH - 101	331788	2420178			Core /RC/DTH	
	PBH - 102	331788	2420128			Core /RC/DTH	
	PBH - 103	331788	2420078			Core /RC/DTH	
	PBH - 104	331788	2420028			Core /RC/DTH	
	PBH - 105	331788	2419978			Core /RC/DTH	
	PBH - 106	331790	2419928			Core /RC/DTH	
	PBH - 107	331788	2419828			Core /RC/DTH	
	PBH - 108	331888	2420228			Core /RC/DTH	
	PBH - 109	331888	2420178			Core /RC/DTH	
	PBH - 110	331888	2420128			Core /RC/DTH	
	PBH - 111	331888	2420078			Core /RC/DTH	
	PBH - 112	331888	2420028			Core /RC/DTH	

Pravata Ku. Sahoo
Qualified Person

	PBH - 113	331888	2419978			Core /RC/DTH	
	PBH - 114	331888	2419928			Core /RC/DTH	
	PBH - 115	331888	2419878			Core /RC/DTH	
	PBH - 116	331888	2419828			Core /RC/DTH	
	PBH - 117	331888	2419778			Core /RC/DTH	
	PBH - 118	331988	2420228			Core /RC/DTH	
	PBH - 119	331988	2420178	70m or upto bottom of mineralisation whichever is more	157nos	Core /RC/DTH	The analysis will be contagent every one meter interval. Further, if there is any change in lithology within the sample interval of , then based on lithology additional sampling will be carried out. The analysis will be carried out adhering to Mineral Evidence Rule, 2016
	PBH – 120	331988	2420128			Core /RC/DTH	
	PBH – 121	331988	2420028			Core /RC/DTH	
	PBH – 122	332388	2420078			Core /RC/DTH	
	PBH – 123	331988	2419978			Core /RC/DTH	
	PBH – 124	331990	2419928			Core /RC/DTH	
	PBH – 125	331988	2419828			Core /RC/DTH	
	PBH – 126	331988	2419778			Core /RC/DTH	
	PBH – 127	331988	2419728			Core /RC/DTH	
	PBH – 128	331988	2419678			Core /RC/DTH	
	PBH – 129	332088	2420228			Core /RC/DTH	
	PBH – 130	332088	2420178			Core /RC/DTH	
	PBH – 131	332088	2420128			Core /RC/DTH	
	PBH – 132	332088	2420078			Core /RC/DTH	
	PBH – 133	332088	2420028			Core /RC/DTH	
	PBH – 134	332088	2419978			Core /RC/DTH	
	PBH – 135	332088	2419928			Core /RC/DTH	
	PBH – 136	332088	2419878			Core /RC/DTH	
	PBH – 137	332088	2419828			Core /RC/DTH	
	PBH – 138	332088	2419728			Core /RC/DTH	
	PBH – 139	332088	2419628			Core /RC/DTH	
	PBH – 140	332188	2420278			Core /RC/DTH	
	PBH – 141	332190	2420228			Core /RC/DTH	
	PBH – 142	332188	2420128			Core /RC/DTH	
	PBH – 143	332188	2420078			Core /RC/DTH	
	PBH – 144	332190	2420028			Core /RC/DTH	
	PBH – 145	332188	2419928			Core /RC/DTH	
	PBH – 146	332188	2419878			Core /RC/DTH	
	PBH – 147	332188	2419828			Core /RC/DTH	
	PBH – 148	332188	2419778			Core /RC/DTH	
	PBH – 149	332188	2419728			Core /RC/DTH	
	PBH – 150	332188	2419628			Core /RC/DTH	
	PBH – 151	332188	2419578			Core /RC/DTH	
	PBH – 152	332188	2419528			Core /RC/DTH	
	PBH – 153	332188	2419478			Core /RC/DTH	
	PBH – 154	332290	2420228			Core /RC/DTH	
	PBH – 155	332288	2420178			Core /RC/DTH	
	PBH – 156	332288	2420128			Core /RC/DTH	
	PBH – 157	332288	2420078			Core /RC/DTH	
	PBH – 158	332290	2420028			Core /RC/DTH	
	PBH – 159	332288	2419928			Core /RC/DTH	
	PBH – 160	332288	2419878			Core /RC/DTH	
	PBH – 161	332288	2419828			Core /RC/DTH	
	PBH – 162	332288	2419728			Core /RC/DTH	
	PBH – 163	332288	2419678			Core /RC/DTH	
	PBH – 164	332288	2419628			Core /RC/DTH	
	PBH – 165	332288	2419578			Core /RC/DTH	
	PBH – 166	332288	2419528			Core /RC/DTH	
	PBH – 167	332288	2419428			Core /RC/DTH	
	PBH – 168	332288	2419378			Core /RC/DTH	
	PBH – 169	332388	2419978			Core /RC/DTH	
	PBH – 170	332388	2419928			Core /RC/DTH	
	PBH – 171	332388	2419828			Core /RC/DTH	
	PBH – 172	332388	2419778			Core /RC/DTH	
	PBH – 173	332388	2419728			Core /RC/DTH	
	PBH – 174	332388	2419678			Core /RC/DTH	
	PBH – 175	332388	2419628			Core /RC/DTH	
	PBH – 176	332388	2419528			Core /RC/DTH	
	PBH – 177	332388	2419478			Core /RC/DTH	
	PBH – 178	332388	2419428			Core /RC/DTH	
	PBH – 179	332388	2419378			Core /RC/DTH	
	PBH – 180	332488	2419828			Core /RC/DTH	
	PBH – 181	332488	2419728			Core /RC/DTH	

Pravata Ku. Sahoo
Qualified Person

	PBH – 182	332488	2419628			Core /RC/DTH	The analysis will be done at every 10 meter interval. Further, if there is any change in lithology within the sample interval of , then based on lithology additional sampling will be carried out. The analysis will be carried out adhering to Mineral Evidence Rule, 2016
	PBH – 183	332488	2419578			Core /RC/DTH	
	PBH – 184	332488	2419528			Core /RC/DTH	
	PBH – 185	332488	2419478			Core /RC/DTH	
	PBH – 186	332488	2419428			Core /RC/DTH	
	PBH – 187	332488	2419378			Core /RC/DTH	
	PBH – 188	332588	2419728			Core /RC/DTH	
	PBH – 189	332588	2419678			Core /RC/DTH	
	PBH – 190	332588	2419628			Core /RC/DTH	
	PBH – 191	332588	2419578			Core /RC/DTH	
	PBH – 192	332588	2419528			Core /RC/DTH	
	PBH – 193	332588	2419428			Core /RC/DTH	
	PBH – 194	332588	2419378			Core /RC/DTH	
	PBH – 195	332688	2419728			Core /RC/DTH	
	PBH – 196	332688	2419678			Core /RC/DTH	
	PBH – 197	332688	2419578			Core /RC/DTH	
	PBH – 198	332688	2419528			Core /RC/DTH	
	PBH – 199	332688	2419478			Core /RC/DTH	
	PBH – 200	332688	2419428			Core /RC/DTH	
	PBH – 201	332688	2419378			Core /RC/DTH	
	PBH – 202	332788	2419728			Core /RC/DTH	
	PBH – 203	332788	2419678			Core /RC/DTH	
	PBH – 204	332788	2419628			Core /RC/DTH	
	PBH – 205	332788	2419578			Core /RC/DTH	
	PBH – 206	332788	2419528			Core /RC/DTH	
	PBH – 207	332788	2419428			Core /RC/DTH	
	PBH – 208	332788	2419378			Core /RC/DTH	
	PBH – 209	332888	2419728			Core /RC/DTH	
	PBH – 210	332888	2419678			Core /RC/DTH	
	PBH – 211	332888	2419628			Core /RC/DTH	
	PBH – 212	332888	2419578			Core /RC/DTH	
	PBH – 213	332888	2419528			Core /RC/DTH	
	PBH – 214	332888	2419478			Core /RC/DTH	
	PBH – 215	332888	2419428			Core /RC/DTH	
	PBH – 216	332988	2419728			Core /RC/DTH	
	PBH – 217	332988	2419678			Core /RC/DTH	
	PBH – 218	332988	2419628			Core /RC/DTH	
	PBH – 219	332988	2419578			Core /RC/DTH	
	PBH – 220	332988	2419528			Core /RC/DTH	
	PBH – 221	332988	2419478			Core /RC/DTH	
	PBH – 222	332988	2419428			Core /RC/DTH	
	PBH – 223	332988	2419378			Core /RC/DTH	
	PBH – 224	333088	2419828			Core /RC/DTH	
	PBH – 225	333088	2419728			Core /RC/DTH	
	PBH – 226	333188	2419828			Core /RC/DTH	
	PBH – 227	333188	2419728			Core /RC/DTH	
	PCD – 1	332088	242087	PROPOSECD CHECK DRILL	8 NOS	Core /RC/DTH	
	PCD – 2	332088	2420777			Core /RC/DTH	
	PCD – 3	332088	2420677			Core /RC/DTH	
	PCD – 4	332288	2420677			Core /RC/DTH	
	PCD – 5	332288	2420577			Core /RC/DTH	
	PCD – 6	332288	2420477			Core /RC/DTH	
	SUB TOTAL				163 NOS		
Sub-total				63 nos			

2022-23	PBH - 228	332388	2419328	70m or upto bottom of mineralisation whichever is more	82 NOS	Core /RC/DTH	
	PBH - 229	332388	2419278			Core /RC/DTH	
	PBH - 230	332488	2419328			Core /RC/DTH	
	PBH - 231	332488	2419278			Core /RC/DTH	
	PBH - 232	332488	2419228			Core /RC/DTH	
	PBH - 233	332488	2419178			Core /RC/DTH	
	PBH - 234	332588	2419328			Core /RC/DTH	
	PBH - 235	332588	2419228			Core /RC/DTH	
	PBH - 236	332588	2419177			Core /RC/DTH	
	PBH - 237	332688	2419328			Core /RC/DTH	
	PBH - 238	332688	2419278			Core /RC/DTH	
	PBH - 239	332688	2419228			Core /RC/DTH	
	PBH - 240	332688	2419178			Core /RC/DTH	

Pravata Ku. Sahoo
Qualified Person

	PBH - 241	332788	2419328	70m or upto bottom of mineralisation whichever is more		Core /RC/DTH	The analysis will be done at every one metre interval. Further, where any change in lithology within the sample interval of , then based on lithology additional sampling will be carried out. The analysis will be carried out adhering to Mineral Evidence Rule, 2016
	PBH - 242	332788	2419278			Core /RC/DTH	
	PBH - 243	332788	2419228			Core /RC/DTH	
	PBH - 244	332788	2419177			Core /RC/DTH	
	PBH - 245	332888	2419328			Core /RC/DTH	
	PBH - 246	332888	2419278			Core /RC/DTH	
	PBH - 247	332888	2419228			Core /RC/DTH	
	PBH - 248	332988	2419328			Core /RC/DTH	
	PBH - 249	332988	2419278			Core /RC/DTH	
	PBH - 250	333088	2419628			Core /RC/DTH	
	PBH - 251	333088	2419578			Core /RC/DTH	
	PBH - 252	333088	2419528			Core /RC/DTH	
	PBH - 253	333088	2419478			Core /RC/DTH	
	PBH - 254	333088	2419428			Core /RC/DTH	
	PBH - 255	333088	2419328			Core /RC/DTH	
	PBH - 256	333088	2419278			Core /RC/DTH	
	PBH - 257	333188	2419628			Core /RC/DTH	
	PBH - 258	333188	2419528			Core /RC/DTH	
	PBH - 259	333188	2419478			Core /RC/DTH	
	PBH - 260	333188	2419428			Core /RC/DTH	
	PBH - 261	333188	2419328			Core /RC/DTH	
	PBH - 262	333188	2419278			Core /RC/DTH	
	PBH - 263	333288	2419928			Core /RC/DTH	
	PBH - 264	333288	2419728			Core /RC/DTH	
	PBH - 265	333288	2419628			Core /RC/DTH	
	PBH - 266	333288	2419528			Core /RC/DTH	
	PBH - 267	333288	2419478			Core /RC/DTH	
	PBH - 268	333288	2419428			Core /RC/DTH	
	PBH - 269	333288	2419378			Core /RC/DTH	
	PBH - 270	333288	2419328			Core /RC/DTH	
	PBH - 271	333288	2419278			Core /RC/DTH	
	PBH - 272	333388	2420878			Core /RC/DTH	
	PBH - 273	333288	2420628			Core /RC/DTH	
	PBH - 274	333288	2420578			Core /RC/DTH	
	PBH - 275	333288	2420478			Core /RC/DTH	
	PBH - 276	333288	2420428			Core /RC/DTH	
	PBH - 277	333388	2420828			Core /RC/DTH	
	PBH - 278	333388	2420728			Core /RC/DTH	
	PBH - 279	333388	2420628			Core /RC/DTH	
	PBH - 280	333388	2420528			Core /RC/DTH	
	PBH - 281	333387	2420428			Core /RC/DTH	
	PBH - 282	333388	2419928			Core /RC/DTH	
	PBH - 283	333388	2419828			Core /RC/DTH	
	PBH - 284	333388	2419728			Core /RC/DTH	
	PBH - 285	333388	2419628			Core /RC/DTH	
	PBH - 286	333388	2419528			Core /RC/DTH	
	PBH - 287	333388	2419428			Core /RC/DTH	
	PBH - 288	333388	2419328			Core /RC/DTH	
	PBH - 289	333388	2419278			Core /RC/DTH	
	PBH - 290	333488	2420628			Core /RC/DTH	
	PBH - 291	333488	2420528			Core /RC/DTH	
	PBH - 292	333488	2420428			Core /RC/DTH	
	PBH - 293	333488	2420328			Core /RC/DTH	
	PBH - 294	333488	2419928			Core /RC/DTH	
	PBH - 295	333488	2419828			Core /RC/DTH	
	PBH - 296	333488	2419728			Core /RC/DTH	
	PBH - 297	333488	2419628			Core /RC/DTH	
	PBH - 298	333488	2419528			Core /RC/DTH	
	PBH - 299	333488	2419428			Core /RC/DTH	
	PBH - 300	333488	2419378			Core /RC/DTH	
	PBH - 301	333488	2419328			Core /RC/DTH	
	PBH - 302	333488	2419278			Core /RC/DTH	
	PBH - 303	333588	2420528			Core /RC/DTH	
	PBH - 304	333588	2420428			Core /RC/DTH	
	PBH - 305	333588	2419378			Core /RC/DTH	
	PBH - 306	333588	2419328			Core /RC/DTH	
	PBH - 307	333688	2419328			Core /RC/DTH	
	PBH - 308	333788	2419328			Core /RC/DTH	
	PBH - 309	333688	2419278			Core /RC/DTH	

Pravata Ku. Sahoo
Qualified Person

	PCD - 1	332488	2420478		8 NOS	Core /RC/DTH	
	PCD – 2	332488	2420378			Core /RC/DTH	
	PCD – 3	332488	2420278			Core /RC/DTH	
	PCD – 4	332488	2420178			Core /RC/DTH	
	PCD – 5	332688	2420378			Core /RC/DTH	
	PCD – 6	332688	2420278			Core /RC/DTH	
	PCD – 7	332688	2420178			Core /RC/DTH	
	PCD – 8	332688	2420078			Core /RC/DTH	
	SUB TOTAL				90 NOS		
2023-24	PBH - 310	332688	2419127	70m or upto bottom of mineralisation whichever is more	111 NOS	Core /RC/DTH	The analysis will be done at every one meter interval. Further, if there is any change in lithology within the sample interval of , then based on lithology additional sampling will be carried out. The analysis will be carried out adhering to Mineral Evidence Rule, 2016
	PBH - 311	332688	2419077			Core /RC/DTH	
	PBH - 312	332788	2419127			Core /RC/DTH	
	PBH - 313	332788	2419077			Core /RC/DTH	
	PBH - 314	332888	2419127			Core /RC/DTH	
	PBH - 315	332988	2419228			Core /RC/DTH	
	PBH - 316	332988	2419177			Core /RC/DTH	
	PBH - 317	332988	2419127			Core /RC/DTH	
	PBH - 318	333088	2419228			Core /RC/DTH	
	PBH - 319	333088	2419177			Core /RC/DTH	
	PBH - 320	333188	2419228	70m or upto bottom of mineralisation whichever is more		Core /RC/DTH	
	PBH - 321	333188	2419127			Core /RC/DTH	
	PBH - 322	333288	2419228			Core /RC/DTH	
	PBH - 323	333288	2419178			Core /RC/DTH	
	PBH - 324	333288	2419127			Core /RC/DTH	
	PBH - 325	333288	2419076			Core /RC/DTH	
	PBH - 326	333388	2419228			Core /RC/DTH	
	PBH - 327	333388	2419127			Core /RC/DTH	
	PBH - 328	333388	2419076			Core /RC/DTH	
	PBH - 329	333388	2419027			Core /RC/DTH	
	PBH - 330	333488	2419228			Core /RC/DTH	
	PBH - 331	333488	2419178			Core /RC/DTH	
	PBH - 332	333488	2419127			Core /RC/DTH	
	PBH - 333	333486	2419027			Core /RC/DTH	
	PBH - 334	333588	2419228			Core /RC/DTH	
	PBH - 335	333588	2419177			Core /RC/DTH	
	PBH - 336	333588	2419127			Core /RC/DTH	
	PBH - 337	333588	2419076			Core /RC/DTH	
	PBH - 338	333688	2419228			Core /RC/DTH	
	PBH - 339	333688	2419177			Core /RC/DTH	
	PBH - 340	333688	2419127			Core /RC/DTH	
	PBH - 341	333788	2419228			Core /RC/DTH	
	PBH - 342	333788	2419177			Core /RC/DTH	
	PBH - 343	333788	2419127			Core /RC/DTH	
	PBH - 344	333788	2419076			Core /RC/DTH	
	PBH - 345	333888	2419228			Core /RC/DTH	
	PBH - 346	333888	2419177			Core /RC/DTH	
	PBH - 347	333888	2419127			Core /RC/DTH	
	PBH - 348	333988	2419177			Core /RC/DTH	
	PBH - 349	333988	2419127			Core /RC/DTH	
	PBH - 350	333988	2419076			Core /RC/DTH	
	PBH - 351	333988	2419026			Core /RC/DTH	
	PBH - 352	333988	2418975			Core /RC/DTH	
	PBH - 353	333988	2418930			Core /RC/DTH	
	PBH - 354	333988	2418878			Core /RC/DTH	
	PBH - 355	333988	2418830			Core /RC/DTH	
	PBH - 356	334088	2419130			Core /RC/DTH	
	PBH - 357	334088	2419030			Core /RC/DTH	
	PBH - 358	334088	2418927			Core /RC/DTH	
	PBH - 359	334088	2418876			Core /RC/DTH	
	PBH - 360	334088	2418830			Core /RC/DTH	
	PBH - 361	334188	2419130			Core /RC/DTH	
	PBH - 362	334188	2419030			Core /RC/DTH	
	PBH - 363	334188	2418927			Core /RC/DTH	
	PBH - 364	334188	2418876			Core /RC/DTH	
	PBH - 365	334188	2418826			Core /RC/DTH	
	PBH - 366	334188	2418778			Core /RC/DTH	
	PBH - 367	334288	2419130			Core /RC/DTH	
	PBH - 368	334288	2419030			Core /RC/DTH	
	PBH - 369	334288	2418929			Core /RC/DTH	
	PBH - 370	334288	2418878			Core /RC/DTH	
	PBH - 371	334288	2418826			Core /RC/DTH	
	PBH - 372	334288	2418727			Core /RC/DTH	

Pravata Ku. Sahoo
Qualified Person

	PBH - 373	334388	2419030			Core /RC/DTH	
	PBH - 374	334388	2418927			Core /RC/DTH	
	PBH - 375	334388	2418876			Core /RC/DTH	
	PBH - 376	334388	2418827			Core /RC/DTH	
	PBH - 377	334488	2418878			Core /RC/DTH	
	PBH - 378	334488	2418827			Core /RC/DTH	
	PBH - 379	334488	2418776			Core /RC/DTH	
	PBH - 380	334588	2418827			Core /RC/DTH	
	PBH - 381	334688	2418826			Core /RC/DTH	
	PBH - 382	334788	2418826			Core /RC/DTH	
	PBH - 383	334788	2418778	70m or upto bottom of mineralisation whichever is more		Core /RC/DTH	The analysis will be done at every one Quarter interval. Further, if there is any change in lithology within the sample interval of , then based on lithology additional sampling will be carried out. The analysis will be carried out adhering to Mineral Evidence Rule, 2016
	PBH - 384	334888	2418976			Core /RC/DTH	
	PBH - 385	334888	2418927			Core /RC/DTH	
	PBH - 386	334888	2418876			Core /RC/DTH	
	PBH - 387	334888	2418778			Core /RC/DTH	
	PBH - 388	334888	2418678			Core /RC/DTH	
	PBH - 389	334988	2418978			Core /RC/DTH	
	PBH - 390	334988	2418927			Core /RC/DTH	
	PBH - 391	334988	2418876			Core /RC/DTH	
	PBH - 392	334988	2418678			Core /RC/DTH	
	PBH - 393	335088	2418978			Core /RC/DTH	
	PBH - 394	335088	2418927			Core /RC/DTH	
	PBH - 395	335088	2418876			Core /RC/DTH	
	PBH - 396	335088	2418827			Core /RC/DTH	
	PBH - 397	335088	2418778			Core /RC/DTH	
	PBH - 398	335088	2418727			Core /RC/DTH	
	PBH - 399	335088	2418678			Core /RC/DTH	
	PBH - 400	335188	2418878			Core /RC/DTH	
	PBH - 401	335188	2418827			Core /RC/DTH	
	PBH - 402	335188	2418723			Core /RC/DTH	
	PBH - 403	335188	2418678			Core /RC/DTH	
	PBH - 404	335288	2418778			Core /RC/DTH	
	PBH - 405	335288	2418723			Core /RC/DTH	
	PBH - 406	335288	2418678			Core /RC/DTH	
	PBH - 407	335388	2418678			Core /RC/DTH	
	PBH - 408	331388	2421229			Core /RC/DTH	
	PBH - 409	331489	2421429			Core /RC/DTH	
	PBH - 410	331488	2421527			Core /RC/DTH	
	PBH - 411	331488	2421729			Core /RC/DTH	
	PBH - 412	331588	2422329			Core /RC/DTH	
	PBH - 413	331588	2422229			Core /RC/DTH	
	PBH - 414	331588	2422029			Core /RC/DTH	
	PBH - 415	331588	2422478			Core /RC/DTH	
	PBH - 416	331688	2422329			Core /RC/DTH	
	PBH - 417	331888	2422229			Core /RC/DTH	
	PBH - 418	331586	2421629			Core /RC/DTH	
	PBH-419	331588	2422478			Core /RC/DTH	
	PBH-420	331688	2422329			Core /RC/DTH	
	PCD – 1	334088	2419578		8 NOS	Core /RC/DTH	
	PCD-2	334088	2419478			Core /RC/DTH	
	PCD – 3	334088	2419378			Core /RC/DTH	
	PCD- 4	334088	2419278			Core /RC/DTH	
	PCD – 5	334288	2419578			Core /RC/DTH	
	PCD – 6	334288	2419478			Core /RC/DTH	
	PCD – 7	334288	2419378			Core /RC/DTH	
	PCD - 8	334288	2419278			Core /RC/DTH	
	SUB TOTAL				119 NOS		
Total	**450 nos**		31500 m (Approx.)				

j) Reserves and Resources as per UNFC with respect to the threshold value notified by IBM may be furnished in a tabular form as given below: (Area explored under different level of exploration may be marked on the geological plan and UNFC code for area considered for different categories of reserve/resources estimation may also be marked on geological cross sections). Submit a feasibility/pre-feasibility study report along with financial analysis for economic viability of the deposit as specified under the UNFC field guidelines may be incorporated.

Parameters considered during estimation of the reserve/resource .

As per the Geological Report, on the basis of the exploration done, total resource of the area was calculated as Measured mineral resources under G1, and Indicated mineral resources under G2.

Pravata Ku. Sahoo
Qualified Person

Estimation of Measured Mineral Resources: Measured mineral resource is estimated from detailed explored area of 391.160 Ha which qualifies for G_1 level of exploration. Within this 391.160 Ha area 3109 nos. of boreholes were drilled and are used for estimation of resources. The recovery of ROM manganese ore from these measured manganese ore pockets is taken as 85% with Bulk Density of 1.68 for the manganese ore grade varying from 10%Mn. & above. The recovery factor of Iron ore is taken as 25% and Bulk density as 2.50 T/m^3 for the ore grade varying from 45% Fe & above.

Estimation of Indicated Mineral Resources: Indicated mineral resource is estimated from General explored area of 324.479 Ha which qualifies for G_2 level of exploration. The area is demarcated in Geological plan considering 224nos of boreholes drilled at an interval of 100m as well as 50m extrapolated area outside the G1 area. Estimation of Indicated mineral resources is based on the manganese ore zones encountered in boreholes. As the boreholes are distantly spaced and the lateral extension is also very much restricted the recovery of Manganese ore from these scattered manganese ore pockets is taken as 5% with Bulk Density of 1.68 for the manganese ore grade varying from 10%Mn. & above. The recovery factor of Iron ore is taken as 25% and Bulk density as 2.50 T/m^3 for the ore grade varying from 45% Fe & above.

Category wise reserve/resource estimated in the earlier Review of the Mining Plan with grade (as on 1.01.2019)

The category wise reserve and resources estimated in the Geological Report is given below:

Summarized Statement of Resource

Manganese ore

Category of Resource	Saleable ore (MT) (+25%Mn)	Mineral Rejects (MT) (10-25%Mn)	Total ROM (MT)
Measured (331)	293464	3713825	4007289
Indicated (332)	406	14826	15232
Total	**293870**	**3728651**	**4022521**

Iron ore

Category of Resource	Saleable ore (MT) (+55%Mn)	Mineral Rejects (MT) (45-55%Mn)	Total ROM (MT)
Measured (331)	117452	464188	581640
Indicated (332)	15933	121168	137101
Total	**133385**	**585356**	**718741**

Depletion of Reserves:

Year	Production of Mn ore in MT	Production of Mn ore in MT
2018-2019 (1.01.2019-31.03.2019)	40334.627	Nil
2019-20	122912.749	Nil
Total	**163247.376**	

Residual Reserve/Resources: (as on 01.04. 2020)

Manganese ore

Category of Resource	Saleable ore (MT) (+25%Mn)	Mineral Rejects (MT) (10-25%Mn)	Total ROM (MT)
Measured (331)	293464	3550578	3844042
Indicated (332)	406	14826	15232
Total	**293870**	**3565404**	**3859274**

Pravata Ku. Sahoo
Qualified Person

Iron ore

Category of Resource	Saleable ore (MT) (+55%Mn)	Mineral Rejects (MT) (45-55%Mn)	Total ROM (MT)
Measured (331)	117452	464188	581640
Indicated (332)	15933	121168	137101
Total	**133385**	**585356**	**718741**

Updated reserves established category-wise (with basis of parameters)

A detail geological report has been prepared and scrutinized by the committee constituted by state govt. Based on the geological report the resource of iron and Manganese ore has been categorised as follows:

Parameters considered for Resource Estimation

- As per guidelines of IBM threshold value of iron ore is considered as 45% Fe and calculation of resource is done under different range of Fe% i.e. 45 to 55% Fe and 55 % Fe above. Similarly, for manganese ore the threshold value has been considered as +10%Mn. For calculation of resource of Manganese ore different range of Mn% i.e 10-25%Mn and +25%Mn have been taken into consideration.
- Considering the above factors the grade – wise calculation of updated iron ore and manganese ore resources, in the ML area in all the deposits are done.
- Cross-sectional method of reserve estimation has been adopted and 42 cross sections at 100m interval has been prepared but influence of the ore pockets of a particular section has been taken as 20m. Along with two longitudinal sections there are altogether 44 cross sections. Cross-sectional area of the ore zones (marked through analysis results) are been calculated in a particular section and then multiplied with the influence of the ore body to get the volume of ore. Tonnage is calculated after multiplying the volume with the average bulk density. Cross sectional area was estimated with the help of Auto CAD.
- Position of holes are well shown on the cross sections and the lithology as encountered in each of the bore holes were plotted indicating the run wise grade of ore encountered in the hole. The ore zones are plotted in each of the bore holes of respective cross sections and are connected to arriving sectional area of different grade of the ore zone for that section.

Bulk density and Recovery factor of Iron and Manganese ore

Recovery factor of Manganese ore is taken as 65% based on the figure/ data mentioned in the modification of mining plan approved by Indian Bureau of Mines. The recovery of Mn ore from ore zone pockets is determined as 65%by NABL accredited laboratory M/s. Mitra S. K. Pvt. Ltd. as the Mn ore occurs as small and large pockets in Manganiferrous laterite, Manganiferrous shale, Manganiferrous chert and Manganiferrous quartzite. The report of Recovery factor has been attached as annexure.

The Bulk Density of 1.68 T/m3 has been determined by NABL accredited laboratory M/s. Mitra S. K. Pvt. Ltd for the ore, the grade of which varies from 10% Mn and above. report of Bulk Density has been attached as annexure.

The threshold value of ROM Manganese ore is taken as 10% Mn.The cut-off grade of ROM Manganese orehas been taken as25% Mn.Resources have been calculated separately on the basis of threshold value of 10% Mn to the cut-off grade of 25% Mn and then 25% Mn and above. The Mn ore above 25% Mn will be directly saleable after necessary sorting and sizing. The Mn ore from 10%

Pravata Ku. Sahoo
Qualified Person

to 25% Mn will be stacked separately and dispatched as per buyers demand. The recovery of ROM Mn ore during excavation will be 65% with 35% waste generation only. Within the total excavation of ROM Mn ore, 90% of total ROM Mn ore will be of grade above 25%Mn, 10% of total ROM Mn ore will be of grade 10-25%Mn.

Recovery factor of Iron ore is taken as 25% based on the figure/ data mentioned in the modification of mining plan approved by Indian Bureau of Mines. Recovery percentage from the total Iron ore zone excavation has been calculated as 25% by NABL accredited laboratory M/s. Mitra S. K. Pvt. Ltd. and has been considered for resource estimation. As the Iron ore zones are scattered and occurs mainly as floats without any lateral continuity, it generates considerable amount of waste lowering the recovery factor. The report of Recovery factor has been attached as annexure.

The Bulk Density of Iron ore has been determined by NABL accredited laboratory M/s. Mitra S. K. Pvt. Ltd as 2.50 T/m3, the grade of which varies from 45% Fe and above. The report is attached as an annexure.

Resources have been calculated separately on the basis of threshold value of 45% Fe to the cut-off grade of 55% Fe and then 55% Fe and above.

The boreholes are done with a grid interval of 10m to 50m and 50m to 100m depending upon the disposition of the ore zone provides sufficient information for resource estimation.

k) Detail calculation of reserves/resources section wise

Cross Section wise Measured Mineral Resources of Manganese Ore (**Grade 10% Mn to 25% Mn**):

Cross section considered	Area of x section (m^2)	Length of influence (m)	Volume of excavation (m^3)	Recovery factor (%)	Volume of Iron Ore (m^3)	Bulk density (T/m^3)	Resource of Mn Ore (tonnes)
331288	7.99	20	159.8	65%	103.87	1.68	174.5
331388	475.24	20	9504.8	65%	6178.12	1.68	10379.24
331488	629.32	20	12586.4	65%	8181.16	1.68	13744.35
331588	1257.23	20	25144.6	65%	16343.99	1.68	27457.9032
331688	5615.96	20	121099.2	65%	78714.48	1.68	122652.566
331788	4193.52	20	92650.4	65%	60222.76	1.68	91586.4768
331888	4604.44	20	102328.8	65%	66513.72	1.68	100560.97
331988	8017.52	20	169130,40	65%	109934.76	1.68	175102.637
332088	7635.37	20	161187.4	65%	104771.81	1.68	166756.481
332188	7813.69	20	165053.8	65%	10728497	1.68	170650.99
3322?8	9095.44	20	194588.8	65%	12648272	1.68	198644.41
3323 8	6849.87	20	145777.4	65%	94755.31	1.68	149601.161
332- 8	9102.56	20	190831.2	65%	124040.28	1.68	198799.91
33 8	4965.54	20	108090.8	65%	70259.02	1.68	108447.394
8	7453.95	20	1598190	65%	103882,35	1.68	162794.268
8	1855.09	20	45881.8	65%	29823.17	1.68	40515.1656
8	2779.47	20	64369.4	65%	41840.11	1.68	60703.6248
3	6912.39	20	149027.8	65%	96868.07	1.68	150966.598
3	5843.5	20	125650	65%	81672.5	1.68	127622.04
8	2432.67	20	57433.4	65%	37331.71	1.68	53129.5128
4	0	20	0	65%	0	1.68	0
3	364.62	20	7292.4	65%	4740.06	1.68	7963.3
1	1902.15	20	38043	65%	24727.95	1.68	41542.96
4	11650.59	20	233011,80	65%	151457,67	1.68	254448.89
1	10210.78	20	204215.6	65%	132740.14	1.68	223003.44
1	5861.09	20	117221,80	65%	76194.17	1.68	128006.21
8	6419.1	20	128382	65%	83448.3	1.68	140193.14
8	4410.33	20	88206.6	65%	57334.29	1.68	96321.61
8	9738.94	20	194778.8	65%	126606.22	1.68	212698.45
9	7365.33	20	147306.6	65%	95749.29	1.68	160858.81
4	3664.4	20	73288	65%	47637.2	1.68	80030.5
8	1606.65	20	32133	65%	20886.45	1.68	35089.24
8	0	20	0	65%	0	1.68	0
1	0	20	0	65%	0	1.68	0
1	1837.2	20	36744	65%	23883.6	1.68	40124.45
1	0	20	0	65%	0	1.68	0
1	0	20	0	65%	0	1.68	0
	162571.94		3251438.8		2113435.22		3580571.17

Pravata Kr. Sahoo
Qualified Person

ction wise Measured Mineral Resources of Manganese Ore (Above 25% Mn):

	Area of x section (m²)	Length of influence (m)	Volume of excavation (m³)	Recovery factor (%)	Volume of Iron Ore (m³)	Bulk density (T/m³)	Resource of Mn Ore (tonnes)
	4.36	20	87.20	65%	56.68	1.68	95.22
	144.01	20	2880.20	65%	1872.13	1.68	3145.88
	35.79	20	715.88	65%	465.32	1.68	781.74
	67.33	20	1346.60	65%	875.29	1.68	1470.49
	254.64	20	5092.80	65%	3310.32	1.68	5561.34
	349.44	20	6988.80	65%	4542.72	1.68	7631.77
	724.98	20	14499.60	65%	9424.74	1.68	15833.56
	1549.67	20	30993.40	65%	20145.71	1.68	33844.79
	733.75	20	14675.00	65%	9538.75	1.68	16025.10
	318.87	20	6377.40	65%	4145.31	1.68	6964.12
	1066.05	20	21321.00	65%	13858.65	1.68	23282.53
	233.14	20	4662.80	65%	3030.82	1.68	5091.78
	175.48	20	3509.60	65%	2281.24	1.68	3832.48
	120.23	20	2404.60	65%	1562.99	1.68	2625.82
	138.08	20	2761.60	65%	1795.04	1.68	3015.67
	63.00	20	1260.00	65%	819.00	1.68	1375.92
	464.83	20	9296.60	65%	6042.79	1.68	10151.89
	628.72	20	12574.40	65%	8173.36	1.68	13731.24
	307.21	20	6144.20	65%	3993.73	1.68	6709.47
	419.98	20	8399.60	65%	5459.74	1.68	9172.36
	0.00	20	0.00	65%	0.00	1.68	0.00
	0.00	20	0.00	65%	0.00	1.68	0.00
	0.00	20	0.00	65%	0.00	1.68	0.00
	1275.05	20	25501.00	65%	16575.65	1.68	27847.09
	1704.26	20	34085.20	65%	22155.38	1.68	37221.04
	754.02	20	15080.40	65%	9802.26	1.68	16467.80
	524.33	20	10486.60	65%	6816.29	1.68	11451.37
	374.50	20	7490.00	65%	4868.50	1.68	8179.08
	243.75	20	4875.00	65%	3168.75	1.68	5323.50
	473.57	20	9471.40	65%	6156.41	1.68	10342.77
	93.75	20	1875.00	65%	1218.75	1.68	2047.50
	6.13	20	122.60	65%	79.69	1.68	133.88
	0.00	20	0.00	65%	0.00	1.68	0.00
	0.00	20	0.00	65%	0.00	1.68	0.00
	188.06	20	3761.20	65%	2444.78	1.68	4107.23
	0.00	20	0.00	65%	0.00	1.68	0.00
	0.00	20	0.00	65%	0.00	1.68	0.00
	13437		268740		174681		**293464**

tion wise Indicated Mineral Resources of Manganese Ore(Grade 10% to 25% Mn):

Area of x section (m²)	Length of influence (m)	Volume of excavation (m³)	Recovery factor (%)	Volume of Iron Ore (m³)	Bulk density (T/m³)	Resource of Mn Ore (tonnes)
48.44	20	968.80	5%	48.44	1.68	81.38
993.00	20	19860.00	5%	993.00	1.68	1668.24
1528.33	20	30566.60	5%	1528.33	1.68	2567.59
559.91	20	11198.20	5%	559.91	1.68	940.65
398.07	20	7961.40	5%	398.07	1.68	668.76
593.06	20	11861.20	5%	593.06	1.68	996.34
96.76	20	1935.20	5%	96.76	1.68	162.56
227.19	20	4543.80	5%	227.19	1.68	381.68
957.26	20	19145.20	5%	957.26	1.68	1608.20
156.47	20	3129.40	5%	156.47	1.68	262.87
586.64	20	11732.80	5%	586.64	1.68	985.56
1629.27	20	32585.40	5%	1629.27	1.68	2737.17
214.62	20	4292.40	5%	214.62	1.68	360.56
147.04	20	2940.80	5%	147.04	1.68	247.03
380.83	20	7616.60	5%	380.83	1.68	639.79
307.97	20	6159.40	5%	307.97	1.68	517.39
8825		**176497**		**8825**		**14826**

Pravata Ku. Sahoo
Qualified Person

Cross Section wise Indicated Mineral Resources of Manganese Ore (Grade 25% Mn & above):

Cross section considered	Area of x section (m^2)	Length of Influence (m)	Volume of excavation (m^3)	Recovery factor (%)	Volume of Iron Ore (m^3)	Bulk density (T/m^3)	Resource of Mn Ore Tons
331288	24.22	20	484.40	5%	24.22	1.68	40.69
331388	1.00	20	20.00	5%	1.00	1.68	1.68
331488	169.55	20	3391.06	5%	169.553	1.68	284.85
332388	24.12	20	482.40	5%	24.12	1.68	40.52
332488	13.99	20	279.80	5%	13.99	1.68	23.50
334788	8.95	20	179.00	5%	8.95	1.68	15.04
Total	242		4837		242		406

Summarized Statement of Resource

Category of Resource	Saleable ore (MT) (+25%Mn)	Mineral Rejects (MT) (10-25%Mn)	Total ROM (MT)
Measured (331)	293464	3550571.2	3844035
Indicated (332)	406	14826	15232
Total	**293870**	**3565397**	3859267

Iron Ore

Cross Section wise Measured Mineral Resources of Iron Ore (Grade 45% to 55% Fe):

Cross section considered	Area of x section (m^2)	Length of Influence (m)	Volume of excavation (m^3)	Recovery factor (%)	Volume of Iron Ore (m^3)	Bulk density (T/m^3)	Resource of Iron Ore (tonnes)
333688	3776.61	20	75532.20	25%	18883.05	2.5	47207.63
333788	4610.31	20	92206.20	25%	23051.55	2.5	57628.88
333888	2780.57	20	55611.40	25%	13902.85	2.5	34757.13
333988	6843.31	20	136866.20	25%	34216.55	2.5	85541.38
334088	8638.95	20	172779.00	25%	43194.75	2.5	107986.88
334188	4344.16	20	86883.20	25%	21720.80	2.5	54302.00
334288	3687.97	20	73759.40	25%	18439.85	2.5	46099.63
334688	2453.16	20	49063.20	25%	12265.80	2.5	30664.50
	37135		742701		185675		464188

Cross Section wise Measured Mineral Resources of Iron Ore (Grade 55% Fe & above):

Cross section considered	Area of x section (m^2)	Length of Influence (m)	Volume of excavation (m^3)	Recovery factor (%)	Volume of Iron Ore (m^3)	Bulk density (T/m^3)	Resource of Iron Ore (tonnes)
333688	532.24	20	10644.8	25%	2661.2	2.5	6653
333788	385.52	20	7710.4	25%	1927.6	2.5	4819
333888	820.07	20	16401.4	25%	4100.35	2.5	10250.88
33398	2535.40	20	50708	25%	12677	2.5	31692.5
3340	2261.98	20	45239.6	25%	11309.9	2.5	28274.75
3341	1606.95	20	32139	25%	8034.75	2.5	20086.88
3342	859.59	20	17191.8	25%	4297.95	2.5	10744.88
3346	394.42	20	7888.4	25%	1972.1	2.5	4930.25
To	9396		187923		46981		117452

Cross Section wise Indicated Mineral Resources of Iron Ore (Grade 45% to 55% Fe):

Cross section considered	Area of x section (m^2)	Length of Influence (m)	Volume of excavation (m^3)	Recovery factor (%)	Volume of Iron Ore (m^3)	Bulk density (T/m^3)	Resource of Iron Ore (tonnes)
333988	1135.68	20	22713.60	25%	5678.40	2.5	14196.00
334088	1635.86	20	32717.20	25%	8179.30	2.5	20448.25
334188	1469.58	20	29391.60	25%	7347.90	2.5	18369.75
334788	2629.96	20	52599.20	25%	13149.80	2.5	32874.50
334888	2822.33	20	56446.60	25%	14111.65	2.5	35279.13
	9693		193868		48467		121168

Pravata Ku. Sahoo
Qualified Person

ction wise Indicated Mineral Resources of Iron Ore (Grade 55% Fe & above):

d	Area of x section (m^2)	Length of Influence (m)	Volume of excavation (m^3)	Recovery factor (%)	Volume of Iron Ore (m^3)	Bulk density (T/m^3)	Resource of Iron Ore (tonnes)
	1274.65	20	25493	25%	6373.25	2.5	15933.13
	1274.65		25493		6373.25		15933

zed Statement of Resource

ry of Resource	Saleable ore (MT) (+55%Fe)	Mineral Rejects (MT) (45-55%Fe)	Total ROM (MT)
resource(331)	117452	464188	581640
(332)	15933	121168	137101
	133385	**585356**	**718741**

Reserve

reserve has been estimated under proved (121) and probable (122) category. The details of
n of Mineable Reserve are furnished below:

ese ore

ction wise Proved Mineral Reserve (121) of Manganese Ore (**Grade 10% to 25% Mn**):

n d	Area of x section (m^2)	Length of Influence (m)	Volume of excavation (m^3)	Recovery factor (%)	Volume of Iron Ore (m^3)	Bulk density (T/m^3)	Resource of Mn Ore (tonnes)
88	0	20	0	65%	0	1.68	0
88	471.82	20	9436.4	65%	6133.66	1.68	10304.5488
88	629.32	20	12586.4	65%	8181.16	1.68	13744.3488
88	1257.23	20	25144.6	65%	16343.99	1.68	27457.9032
88	5615.96	20	112319.2	65%	73007.48	1.68	122652.566
88	4193.52	20	83870.4	65%	54515.76	1.68	91586.4768
88	4604.44	20	92088.8	65%	59857.72	1.68	100560.97
88	8008.655	20	160173.1	65%	104112.515	1.68	174909.025
88	7560.292	20	151205.84	65%	98283.796	1.68	165116.777
88	7813.69	20	156273.8	65%	101577.97	1.68	170650.99
88	9076.54	20	181530.8	65%	117995.02	1.68	198231.634
88	6713.07	20	134261.4	65%	87269.91	1.68	146613.449
88	9102.56	20	182051.2	65%	118333.28	1.68	198799.91
88	4862.04	20	97240.8	65%	63206.52	1.68	106186.954
88	7397.25	20	147945	65%	96164.25	1.68	161555.94
88	1816.39	20	36327.8	65%	23613.07	1.68	39669.9576
88	2683.17	20	53663.4	65%	34881.21	1.68	58600.4328
88	6618.99	20	132379.8	65%	86046.87	1.68	144558.742
88	5843.5	20	116870	65%	75965.5	1.68	127622.04
88	2205.87	20	44117.4	65%	28676.31	1.68	48176.2008
88	0	20	0	65%	0	1.68	0
88	364.62	20	7292.4	65%	4740.06	1.68	7963.3008
88	1902.15	20	38043	65%	24727.95	1.68	41542.956
88	11650.59	20	233011.8	65%	151457.67	1.68	254448.886
88	10210.78	20	204215.6	65%	132740.14	1.68	223003.435
88	5457.89	20	109157.8	65%	70952.57	1.68	119200.318
88	4893.6	20	97872	65%	63616.8	1.68	106876.224
88	4332.03	20	86640.6	65%	56316.39	1.68	94611.5352
88	9738.94	20	194778.8	65%	126606.22	1.68	212698.45
88	7339.23	20	146784.6	65%	95409.99	1.68	160288.783
88	3647.3	20	72946	65%	47414.9	1.68	79657.032
88	1606.65	20	32133	65%	20886.45	1.68	35089.236
88	0	20	0	65%	0	1.68	0
88	0	20	0	65%	0	1.68	0
88	1837.2	20	36744	65%	23883.6	1.68	40124.448
88	0	20	0	65%	0	1.68	0
88	0	20	0	65%	0	1.68	0
	159455.287		**3189105.74**		**2072918.73**		**3482503.47**

Pravata Ku. Sahoo
Qualified Person

ction wise Proved Mineral Reserve (121) of Manganese Ore (Above 25% Mn):

Area of x section (m^2)	Length of Influence (m)	Volume of excavation (m^3)	Recovery factor (%)	Volume of Iron Ore (m^3)	Bulk density (T/m^3)	Resource of Mn Ore (tonnes)
4.36	20	87.2	65%	56.68	1.68	95.2224
143.63	20	2872.6	65%	1867.19	1.68	3136.8792
35.79	20	715.8	65%	465.27	1.68	781.6536
67.33	20	1346.6	65%	875.29	1.68	1470.4872
254.64	20	5092.8	65%	3310.32	1.68	5561.3376
349.44	20	6988.8	65%	4542.72	1.68	7631.7696
724.98	20	14499.6	65%	9424.74	1.68	15833.5632
1548.685	20	30973.7	65%	20132.905	1.68	33823.2804
725.408	20	14508.16	65%	9430.304	1.68	15842.9107
318.87	20	6377.4	65%	4145.31	1.68	6964.1208
1063.95	20	21279	65%	13831.35	1.68	23236.668
217.94	20	4358.8	65%	2833.22	1.68	4759.8096
175.48	20	3509.6	65%	2281.24	1.68	3832.4832
108.73	20	2174.6	65%	1413.49	1.68	2374.6632
131.78	20	2635.6	65%	1713.14	1.68	2878.0752
58.7	20	1174	65%	763.1	1.68	1282.008
454.13	20	9082.6	65%	5903.69	1.68	9918.1992
596.12	20	11922.4	65%	7749.56	1.68	13019.2608
307.21	20	6144.2	65%	3993.73	1.68	6709.4664
394.78	20	7895.6	65%	5132.14	1.68	8621.9952
0	20	0	65%	0	1.68	0
0	20	0	65%	0	1.68	0
0	20	0	65%	0	1.68	0
1275.05	20	25501	65%	16575.65	1.68	27847.092
1704.26	20	34085.2	65%	22155.38	1.68	37221.0384
709.22	20	14184.4	65%	9219.86	1.68	15489.3648
354.83	20	7096.6	65%	4612.79	1.68	7749.4872
365.8	20	7316	65%	4755.4	1.68	7989.072
243.75	20	4875	65%	3168.75	1.68	5323.5
470.67	20	9413.4	65%	6118.71	1.68	10279.4328
91.85	20	1837	65%	1194.05	1.68	2006.004
6.13	20	122.6	65%	79.69	1.68	133.8792
0	20	0	65%	0	1.68	0
0	20	0	65%	0	1.68	0
188.06	20	3761.2	65%	2444.78	1.68	4107.2304
0	20	0	65%	0	1.68	0
0	20	0	65%	0	1.68	0
13091.573		261831.46		170190.449		**285919.954**

ction wise Probable Mineral Reserve (122) of Manganese Ore (Grade 10% to 25% Mn):

Area of x section (m^2)	Length of Influence (m)	Volume of excavation (m^3)	Recovery factor (%)	Volume of Iron Ore (m^3)	Bulk density (T/m^3)	Resource of Mn Ore (tonnes)
48.44	20	968.80	5%	48.44	1.68	81.38
993.00	20	19860.00	5%	993.00	1.68	1668.24
1528.33	20	30566.60	5%	1528.33	1.68	2567.59
559.91	20	11198.20	5%	559.91	1.68	940.65
398.07	20	7961.40	5%	398.07	1.68	668.76
593.06	20	11861.20	5%	593.06	1.68	996.34
96.76	20	1935.20	5%	96.76	1.68	162.56
227.19	20	4543.80	5%	227.19	1.68	381.68
957.26	20	19145.20	5%	957.26	1.68	1608.20
156.47	20	3129.40	5%	156.47	1.68	262.87
586.64	20	11732.80	5%	586.64	1.68	985.56
1629.27	20	32585.40	5%	1629.27	1.68	2737.17
214.62	20	4292.40	5%	214.62	1.68	360.56
147.04	20	2940.80	5%	147.04	1.68	247.03
380.83	20	7616.60	5%	380.83	1.68	639.79
307.97	20	6159.40	5%	307.97	1.68	517.39
8825		**176497**		**8825**		**14826**

Pravata Ku. Sahoo
Qualified Person

tion wise Probable Mineral Reserve (122) of Manganese Ore (Grade 25% Mn & above):

	Area of x section (m^2)	Length of Influence (m)	Volume of excavation (m^3)	Recovery factor (%)	Volume of Iron Ore (m^3)	Bulk density (T/m^3)	Resource of Iron Ore (tonnes)
8	24.22	20	484.40	5%	24.22	1.68	40.6
8	1.00	20	20.00	5%	1.00	1.68	0.58
8	169.55	20	3391.06	5%	169.553	1.68	284.85
8	24.12	20	482.40	5%	24.12	1.68	40.52
8	13.99	20	279.80	5%	13.99	1.68	23.50
8	8.95	20	179.00	5%	8.95	1.68	15.04
	242		4837		242		**406**

ed Statement of Mineable Reserve

y of Resource	Saleable ore (MT) (+25%Mn)	Mineral Rejects (MT) (10-25%Mn)	Total ROM (MT)
serve (121)	285919.954	3482503.47	3768423
Reserve (122)	406	14826	15232
	286326	3497329	3783655

tion wise **Proved Mineral Reserve (121)** of Iron Ore (Grade 45% to 55% Fe):

	Area of x section (m^2)	Length of Influence (m)	Volume of excavation (m^3)	Recovery factor (%)	Volume of Iron Ore (m^3)	Bulk density (T/m^3)	Resource of Iron Ore (tonnes)
8	3776.61	20	75532.2	25%	18883.05	2.5	47207.625
8	4394	20	87880	25%	21970	2.5	54925
8	2780.57	20	55611.4	25%	13902.85	2.5	34757.125
8	6721	20	134420	25%	33605	2.5	84012.5
8	7865	20	157300	25%	39325	2.5	98312.5
8	4344.16	20	86883.2	25%	21720.8	2.5	54302
8	3687.97	20	73759.4	25%	18439.85	2.5	46099.625
8	2453.16	20	49063.2	25%	12265.8	2.5	30664.5
	36022.47		720449.4		180112.35		**450280.875**

ction wise Proved Mineral Reserve(121) of Iron Ore (Grade 55% Fe & above):

on d	Area of x section (m^2)	Length of Influence (m)	Volume of excavation (m^3)	Recovery factor (%)	Volume of Iron Ore (m^3)	Bulk density (T/m^3)	Resource of Iron Ore (tonnes)
	532.24	20	10644.8	25%	2661.2	2.5	6653
	385.52	20	7710.4	25%	1927.6	2.5	4819
	820.07	20	16401.4	25%	4100.35	2.5	10250.88
	2535.40	20	50708	25%	12677	2.5	31692.5
	2261.98	20	45239.6	25%	11309.9	2.5	28274.75
	1606.95	20	32139	25%	8034.75	2.5	20086.88
	859.59	20	17191.8	25%	4297.95	2.5	10744.88
	394.42	20	7888.4	25%	1972.1	2.5	4930.25
	9395		187923		46981		**117452**

ction wise Probable Mineral Reserve(122) of Iron Ore (Grade 45% to 55% Fe):

	Area of x section (m^2)	Length of Influence (m)	Volume of excavation (m^3)	Recovery factor (%)	Volume of Iron Ore (m^3)	Bulk density (T/m^3)	Resource of Iron Ore (tonnes)
8	1135.68	20	22713.60	25%	5678.40	2.5	14196.00
8	1635.86	20	32717.20	25%	8179.30	2.5	20448.25
8	1469.58	20	29391.60	25%	7347.90	2.5	18369.75
8	2629.96	20	52599.20	25%	13149.80	2.5	32874.50
8	2822.33	20	56446.60	25%	14111.65	2.5	35279.13
	9693		193868		48467		**121168**

Pravata Ku. Sahoo
Qualified Person

Cross Section wise Probable Mineral Reserve (122) of Iron Ore (Grade 55% Fe & above):

Cross section considered	Area of x section (m^2)	Length of influence (m)	Volume of excavation (m^3)	Recovery factor (%)	Volume of Iron Ore (m^3)	Bulk density (T/m^3)	Resource of Iron Ore (tonnes)
334788	1274.65	20	25493	25%	6373.25	2.5	15933.13
	1274.65		25493		6373.25		15933

Summarized Statement of Mineable Reserve

Category of Resource	Saleable ore (MT) (+55%Fe)	Mineral Rejects (MT) (45-55%Fe)	Total ROM (MT)
Measured resource(121)	**117452**	**450280.875**	567732.9
Indicated (122)	15933	121168	137101
Total	133385	571448.9	704833.9

NON-MINEABLE RESOURCE

Manganese ore

Cross Section wise Pre-Feasibility Mineral Resource **(221)** of Manganese Ore (Grade 10% to 25% Mn):

Cross section considered	Area of x section (m^2)	Length of influence (m)	Volume of excavation (m^3)	Recovery factor (%)	Volume of Iron Ore (m^3)	Bulk density (T/m^3)	Resource of Mn Ore (tonnes)
331388	3.42	20	68.4	65%	44.46	1.68	74.6928
331988	8.865	20	177.3	65%	115.245	1.68	193.6116
332088	75.078	20	1501.56	65%	976.014	1.68	1639.70352
332288	18.9	20	378	65%	245.7	1.68	412.776
332388	136.8	20	2736	65%	1778.4	1.68	2987.712
332588	103.5	20	2070	65%	1345.5	1.68	2260.44
332688	59.05	20	1181	65%	767.65	1.68	1289.652
332788	38.7	20	774	65%	503.1	1.68	845.208
332888	102	20	2040	65%	1326	1.68	2227.68
332988	293.4	20	5868	65%	3814.2	1.68	6407.856
333188	226.8	20	4536	65%	2948.4	1.68	4953.312
333788	403.2	20	8064	65%	5241.6	1.68	8805.888
333888	1525.5	20	30510	65%	19831.5	1.68	33316.92
333988	78.3	20	1566	65%	1017.9	1.68	1710.072
334188	26.1	20	522	65%	339.3	1.68	570.024
334288	17.1	20	342	65%	222.3	1.68	373.464
	3116.713		**62334.26**		**40517.269**		**68069.01**

Pravata Ku. Sahoo
Qualified Person

Cross Section wise pre-Feasibility Mineral Resource (221) of Manganese Ore (above 25%Mn):

Cross section considered	Area of x section (m^2)	Length of influence (m)	Volume of excavation (m^3)	Recovery factor (%)	Volume of Iron Ore (m^3)	Bulk density (T/m^3)	Resource of Mn Ore (tonnes)
331388	0.38	20	7.6	65%	4.94	1.68	8.2992
331988	0.985	20	19.7	65%	12.805	1.68	21.5124
332088	8.342	20	166.84	65%	108.446	1.68	182.18928
332288	2.1	20	42	65%	27.3	1.68	45.864
332388	15.2	20	304	65%	197.6	1.68	331.968
332588	11.5	20	230	65%	149.5	1.68	251.16
332688	6.3	20	126	65%	81.9	1.68	137.592
332788	4.3	20	86	65%	55.9	1.68	93.912
332888	10.7	20	214	65%	139.1	1.68	233.688
332988	32.5	20	650	65%	422.5	1.68	709.8
333188	25.2	20	504	65%	327.6	1.68	550.368
333788	43.5	20	870	65%	565.5	1.68	950.04
333888	169.5	20	3390	65%	2203.5	1.68	3701.88
333988	8.7	20	174	65%	113.1	1.68	190.008
334188	2.82	20	56.4	65%	36.66	1.68	61.5888
334288	2	20	40	65%	26	1.68	43.68
334488	0	20	0	65%	0	1.68	0
334888	0	20	0	65%	0	1.68	0
	344.027		**6880.54**		**4472.351**		**7543.55**

Summarized Statement of Non-Mineable Resource

Category of Resource	Saleable ore (MT) (+25%Mn)	Mineral Rejects (MT) (10-25%Mn)	Total ROM (MT)
Feasibility Resource (221)	**7513.55**	**68069.01**	75582.56

Iron ore

Feasibility Mineral Resource (221)

Cross section considered	Area of x section (m^2)	Length of influence (m)	Volume of excavation (m^3)	Recovery factor (%)	Volume of Iron Ore (m^3)	Bulk density (T/m^3)	Resource of Iron Ore (tonnes)
333688	0	20	0	25%	0	2.5	0
333788	216	20	4320	25%	1080	2.5	2700
333888	0	20	0	25%	0	2.5	0
333988	123.62	20	2472.4	25%	618.1	2.5	1545.25
334088	773	20	15460	25%	3865	2.5	9662.5
334188	0	20	0	25%	0	2.5	0
334288	0	20	0	25%	0	2.5	0
334688	0	20	0	25%	0	2.5	0
	1112.62		22252.4		5563.1		**13907.75**

Summarized Statement of Non-Mineable Resource

Category of Resource	Saleable ore (MT) (+55%Fe)	Mineral Rejects (MT) (45-55%Fe)	Total ROM (MT)
Pre-Feasibility Resource (221)	0	13907.75	13907.75

Pravata Ku. Sahoo
Qualified Person

(k) Mineral Reserves/ Resources:

Mineral Resources: (Mineral resources has been estimated purely based on level of exploration with reference to the threshold value of minerals declared by IBM)

Level of Exploration	Resources of Mn ore in tonne	Grade	Resources of Iron ore in tonne	Grade
G1-Detail Exploration	3844035	+10%Mn	567732.9	+45%Fe
G2-General Exploration	15232		137101	
G3-Prospecting	--		--	
G4- Reconnaissance	--		--	
Total	**3859267**		**704833.9**	

Final Reserve & Grade as per United Nations Framework Classification :(As on 01.04.2020)

Reserve/ resources	Type	UNFC Code	Manganese ore (t)+10%-26%Mn	Manganese ore (t)+26%Mn	Manganese ore (t) +10%Mn	Iron ore (t)+45%-55%Fe	Iron ore (t)+55%Fe	Iron ore(t) +45%Fe
Reserves	Proved	111	--	--		--	--	--
	Probable	121	3482503	285920	3768423	450280	117452	567732.9
		122	14826	406	15232	121168	15933	137101
Sub-Total (a)	--	--	**3497329**	**286326**	**3783655**	**571448**	**133385**	**704833.9**
Remaining resources	Feasibility	211	--	--	--	0	0	0
	Pre-feasibility	221	7513.55	68069.01	**75582.56**	13907	0	13907
		222	--	--	--	0	0	0
	Measured	331	--	--	--	0	0	0
	Indicated	332	--	--	--	0	0	0
	Inferred	333	--	--	--	0	0	0
	Reconnaissance	--	--	--	--	0	0	0
Sub-Total(b)	--	--	**7513.55**	**68069.01**	**75582.56**	13907		**13907.75**
+ b)			**3504843**	**354395**	3859238	**585356**	**133385**	**718741.65**

As per the UNFC guide line a pre-feasibility Study report is enclosed as **Annexure - 17**

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.

JUSTIFICATION OF UNFC

Under **UNFC**, the reserves have been categorized by attributing 3-digit codes of (E) economic axis, (F) feasibility axis and (G) geological axis. The key parameter considered for mineral reserve/resource estimation under the axes of UNFC are (a) Exploration already done (drilling & analysis of ore samples), (b) Reserves updated as on date, (c) Processing technique adopted/to be adopted for saleable ore, (d) Approval of mining plan/scheme of mining with PMCP, (e) Forest Clearance, (f) Environmental Clearance and (g) Prevailing cost of mining/tonne of ore and sale value.

Economic Axis	Feasibility Axis	Geological Axis	Code
E1 (Economic)	**F2(Pre-Feasibility Study)**	**G1(Detailed exploration)**	
1. Exploration Total 225 core type boreholes and 3108nos of bore holes non-core type bore holes along with existing quarries within the lease area were taken into consideration for estimation of resources under G1 categories. The data from these bore holes have been considered for the preparation of geological map. Measured mineral resource is estimated from detailed explored area of 391.160 Ha which qualifies for G1 level of exploration. Within this 391.160 Ha area 3109 nos. of boreholes	Geological information has been detailed. Part of the ML area has been explored in detail through bore hole and by exposures in the existing quarry. The level of exploration in this part is high and hence falls under G1 category. Feasibility study has been undertaken based on the following factors: **1. Mining:** As the mining operation is going on within the lease area, details of method of Mining, Bench parameter, deployment of machineries, employment of man power, development of infrastructure etc has already been established within the lease.	Geological plan has been prepared showing the detailed topographical – cum - geological details including surface features, extent of deposit, location of borehole etc on a scale of 1:2000. Geological sections have been prepared based on the borehole data and mine development on a scale of 1:2000. Samples collected from the boreholes have been analyzed by NABL Accredited Lab.	121

Pravata Ku. Sahoo
Qualified Person

were drilled and are used for estimation of resources. The recovery of ROM manganese ore from these measured manganese ore pockets is taken as 65% with Bulk Density of 1.68 for the manganese ore grade varying from 10%Mn. & above. The recovery factor of Iron ore is taken as 25% and Bulk density as 2.50 T/m3 for the ore grade varying from 45% Fe & above.

Mining report/mining plan/ working mines.

Mining plan and subsequent Scheme of Mining has been approved by Indian Bureau of Mines, GOI time to time for working the mines systematically and scientifically.

2. Specific end – use grades of reserves (above economic cut – off grade).

Threshold value of iron ore has been kept at 45%Fe where as the cut-off grade has been kept at 55%Fe. The end use product of the mines i.e. 5-18 mm, 10-30mm and fines (screening and crushing materials) containing +55% Fe are sold to various consuming industries.

Threshold value of Mn ore has been kept at 10%Mn where as the cut-off grade has been kept at 25%Mn.

The end use product of the mines i.e. 30mm and fines (screening and crushing materials) containing +25% Mnwill be sold to various consuming Industries.

3. Specific knowledge of forest/non-forest and other land use data.

Land schedule of total ML area over is already exists.

5.Cost Benefit Analysis

Cost analysis has been carried out in the feasibility study report.

Therefore, the reserve of iron ore has been kept under **E1** category.

2. Processing:

Detail screen tests on the ROM ores from the mine have been done which has indicated its amenability to segregate the mineral in different sizes.

Crusher and screening plants have been established within the ML area based on the existing production capacity and characteristic of ore body.

The end use product of after processing is i.e. 5-18 mm, 10-30mm and fines.

3. Costing:

Cost analysis has been carried out in the feasibility study report. (Ref Annexure-16)

4.0Statutory Clearances

i. Mining Plan/Scheme:

The Mining Plan under Rule 22 of MCR 1960 has been approved by IBM. Subsequently, the scheme of Mining has been approved under Rule 12 of MCDR 1988 in favor of earlier lessee. Debabrata Behera has applied for approval of Mining plan under Rule 16(1) of MCR 2016.

ii. Forest Clearance

The Stage-II forest clearance for the entire forest area over 451.132 hectares has been obtained from Ministry of Environment Forest, Govt. of India under Forest Conservation Act 1980. The copy of the forest clearance is enclosed as Annexure –9).

III. Environment Clearance

Environmental clearance has been obtained from Ministry of Environment & Forests, Govt. of India vide letter no J-11015/691/2007-IA.II(M),dated 03.02.2009 for production of iron ore to 0.136 million tons per annum and Manganese ore to 0.189 million tons. The copy of the Environmental Clearance is enclosed as **Annexure-10.**

Mineable reserve from the measured resource has been kept under F2 Axis as the entire area has not been explored under G1 category.

Total 225 core type boreholes & 3108nos of bore holes non-core type bore holes along with existing quarries within the lease area were taken into consideration for estimation of resources under G1 categories. The data from these bore holes have been considered for the preparation of geological map.

Measured mineral resource is estimated from detailed explored area of 391.160 Ha which qualifies for G1 level of exploration. Within this 391.160 Ha area 3109 nos. of boreholes were drilled and are used for estimation of resources. The recovery of ROM manganese ore from these measured manganese ore pockets is taken as 65% with Bulk Density of 1.68 for the manganese ore grade varying from 10%Mn. & above. The recovery factor of Iron ore is taken as 25% and Bulk density as 2.50 T/m3 for the ore grade varying from 45% Fe & above.

Pravata Ku. Sahoo
Qualified Person

E1 (Economic)	F2 (Feasibility Study)	G2(Detailed exploration)	Co
1.Exploration Measured mineral resource is estimated from detailed explored area of 391.160 Ha which qualifies for G1 level of exploration. Within this 391.160 Ha area 3109 nos. of boreholes were drilled and are used for estimation of resources. The recovery of ROM manganese ore from these measured manganese ore pockets is taken as 65% with Bulk Density of 1.68 for the manganese ore grade varying from 10%Mn. & above. The recovery factor of Iron ore is taken as 25% and Bulk density as 2.50 T/m3 for the ore grade varying from 45% Fe & above. **2. Mining report/mining plan/ working mines.** Mining plan and subsequent Scheme of Mining has been approved by Indian Bureau of Mines, GOI time to time for working the mines systematically and scientifically by previous lessee. **3. Specific end – use grades of reserves (above economic cut – off grade).** Threshold value of iron ore has been kept at 45%Fe where as the cut-off grade has been kept at 55%Fe. The end use product of the mines i.e. 5-18 mm, 10-30mm and fines (screening and crushing materials) containing +55% Fe are sold to various consuming industries. Threshold value of Mn ore has been kept at 10%Mn where as the cut-off grade has been kept at 25%Mn. The end use product of the mines i.e. 30mm and fines (screening and crushing materials) containing +25% Mnwill be sold to various consuming industries. **4. Specific knowledge of forest/non-forest and other land use data.** Land schedule of total ML area is already exists. **5.Cost Benefit Analysis** Cost analysis has been carried out in the feasibility study report. Therefore, the reserve of iron ore has been kept under **E1** category.	Geological information has been detailed. Part of the ML area has been explored in detail through bore hole and by exposures in the existing quarry. The level of exploration in this part is moderate and hence falls under G2 category. 1. **Mining:** As the mining operation is going on within the lease area, details of method of Mining, Bench parameter, deployment of machineries, employment of man power, development of infrastructure etc has already been established within the lease. **2. Processing:** Detail screen tests on the ROM ores from the mine have been done which has indicated its amenability to segregate the mineral in different sizes. Crusher and screening plants have been established within the ML area based on the existing production capacity and characteristic of ore body. The end use product of after processing is i.e. 5-18 mm, 10-30mm and fines. **3.Costing:** Cost analysis has been carried out in the feasibility study report. (Ref Annexure-17) **4.0Statutory Clearances** **I. Mining Plan/Scheme:** The Mining Plan under Rule 22 of MCR 1960 has been approved by IBM. Subsequently, the scheme of Mining has been approved under Rule 12 of MCDR 1988 in favor of earlier lessee. Debabrata Behera has applied for approval of Mining plan under Rule 16(1) of MCR 2016. (ii)**Forest Clearance** The Stage-II forest clearance for the entire forest area over 451.132 hectares has been obtained from Ministry of Environment Forest, Govt. of India under Forest Conservation Act 1980. The copy of the forest clearance is enclosed as Annexure –9). **Ii. Environment Clearance** Environmental clearance has been obtained from Ministry of Environment & Forests, Govt. of India vide letter no J-11015/691/2007-IA.II(M), dated 03.02.2009 for production of iron ore to 0.136 million tons per annum and Manganese ore to 0.189 million tons. The copy of the Environmental Clearance is enclosed as **Annexure-10.** Mineable reserve from the Indicated resource has been kept under F2 Axis.	Geological plan has been prepared showing the detailed topographical cum-geological details including surface features, extent of deposit, location of borehole etc. Geological sections have been prepared based on the borehole data and mine development. Samples collected from the boreholes have been analyzed by NABL Accredited Lab. Indicated mineral resource is estimated from General explored area of 324.479 Ha which qualifies for G2 level of exploration. The area is demarcated in Geological plan considering 224nos of boreholes drilled at an interval of 100m as well as 50m extrapolated area outside the G1 area. Estimation of Indicated mineral resources is based on the manganese ore zones encountered in boreholes. As the boreholes are distantly spaced and the lateral extension is also very much restricted the recovery of Manganese ore from these scattered manganese ore pockets is taken as 5% with Bulk Density of 1.68 for the manganese ore grade varying from 10%Mn. & above. The recovery factor of Iron ore is taken as 25% and Bulk density as 2.50 T/m3 for the ore grade varying from 45% Fe & above. The geological map has been prepared on a scale of 1:2000. Based on these drilled borehole data and existing quarries, measured resource has been estimated. The depth of the bore hole where the mineralization ends has been considered as the depth of measured ore zone. However, the thickness of the ore body is variable from section to section. Further, a lateral influence of 50m from both sides of the proved limit is considered for estimation of the resource/reserve.	122

Pravata Ku. Sahoo
Qualified Person

E2 (Intrinsically Economic)	F2(Pre-Feasibility Study)	G1 (Detailed exploration)	
The blocked ore within the safety zone, ultimate pit slope cannot be mined out. Hence, the reserve of this category has been kept under the E2 category of UNFC norms.	Geological Information has been detailed. Part of the ML area has been explored in detail through bore hole and by exposures in the existing quarry. The level of exploration in this part is high and hence falls under G1 category. Feasibility study has been undertaken based on the following factors: **1. Mining:** As the mining operation is going on within the lease area, details of method of Mining, Bench parameter, deployment of machineries, employment of man power, development of infrastructure etc has already been established within the lease. **2. Processing:** Detail screen tests on the ROM ores from the mine have been done which has indicated its amenability to segregate the mineral in different sizes. Crusher and screening plants have been established within the ML area based on the existing production capacity and characteristic of ore body. **3.Costing:** Cost analysis has been carried out in the feasibility study report. **4.0Statutory Clearances** **(i)Mining Plan/Scheme:** The Mining Plan under Rule 22 of MCR 1960 has been approved by IBM. Subsequently, the scheme of Mining has been approved under Rule 12 of MCDR 1988 in favor of earlier lessee. M/s JSW steel Ltd has applied for approval of Mining plan under Rule 16(1) of MCR 2016. (ii)Forest Clearance The Stage-II forest clearance for the entire forest area over 451.132 hectares has been obtained from Ministry of Environment Forest, Govt. of India under Forest Conservation Act 1980. The copy of the forest clearance is enclosed as Annexure –9). **(iii)Environment Clearance** Environmental clearance has been obtained from Ministry of Environment & Forests, Govt. of India vide letter no J-11015/691/2007-IA.II(M), dated 03.02.2009 for production of iron ore to 0.136 million tons per annum and Manganese ore to 0.189 million tons. The copy of the Environmental Clearance is enclosed as Annexure-10. Mineable reserve from the measured resource has been kept under F2 Axis.	Geological plan has been prepared showing the detailed topographical cum - geological details including surface features, extent of deposit, location of borehole etc. on a scale of 1:2000. Geological sections have been prepared based on the borehole data and mine development on a scale of 1:2000. Samples collected from the boreholes have been analyzed by NABL Accredited Lab. **Measured mineral resource** is estimated from detailed explored area of 391.160 Ha which qualifies for G1 level of exploration. Within this 391.160 Ha area 3109 nos. of boreholes were drilled and are used for estimation of resources. The recovery of ROM manganese ore from these measured manganese ore pockets is taken as 65% with Bulk Density of 1.68 for the manganese ore grade varying from 10%Mn. & above. The recovery factor of Iron ore is taken as 25% and Bulk density as 2.50 T/m3 for the ore grade varying from 45% Fe & above. Based on these drilled borehole data and existing quarries, measured resource has been estimated. The depth of the bore hole where the mineralization ends has been considered as the depth of measured ore zone (G1).	
Economic Axis(E2)	**Pre-Feasibility Axis(F2)**	**Geological Axis(G2)**	
The blocked ore within the safety zone, ultimate pit slope cannot be mined out. Hence, the reserve of this category	Geological information has been detailed. Part of the ML area has been explored in detail through bore hole	Geological plan has been prepared showing the detailed topographical - cum-geological details including	

Pravata Ku. Sahoo
Qualified Person

has been kept under the E2 category of UNFC norms.	and by exposures in the existing quarry. The level of exploration in this part is moderate and hence falls under G2 category. 1. **Mining:** As the mining operation is going on within the lease area, details of method of Mining, Bench parameter, deployment of machineries, employment of man power, development of infrastructure etc has already been established within the lease. 2. **Processing:** Detail screen tests on the ROM ores from the mine have been done which has indicated its amenability to segregate the mineral in different sizes. Crusher and screening plants have been established within the ML area based on the existing production capacity and characteristic of ore body. 3. **Costing:** Cost analysis has been carried out in the feasibility study report. **4.0Statutory Clearances** **i. Mining Plan/Scheme:** The Mining Plan under Rule 22 of MCR 1960 has been approved by IBM. Subsequently, the scheme of Mining has been approved under Rule 12 of MCDR 1988 in favor of earlier lessee. M/s JSW steel Ltd has applied for approval of Mining plan under Rule 16(1) of MCR 2016. **ii. Forest Clearance** The Stage-II forest clearance for the entire forest area over 451.132 hectares has been obtained from Ministry of Environment Forest, Govt. of India under Forest Conservation Act 1980. The copy of the forest clearance is enclosed as Annexure –9). **iii. Environment Clearance** Environmental clearance has been obtained from Ministry of Environment & Forests, Govt. of India vide letter no J-11015/691/2007-IA.II(M), dated 03.02.2009 for production of iron ore to 0.136 million tons per annum and Manganese ore to 0.189 million tons. The copy of the Environmental Clearance is enclosed as Annexure-10. Mineable reserve from the Indicated resource has been kept under F2 Axis.	surface features, extent of deposit, location of borehole etc. Geological sections have been prepared based on the borehole data and mine development. Samples collected from the boreholes have been analyzed by NABL Accredited Lab. Indicated mineral resource is estimated from General explored area of 324.479 Ha which qualifies for G2 level of exploration. The area is demarcated in Geological plan considering 224nos of boreholes drilled at an interval of 100m as well as 50m extrapolated area outside the G1 area. Estimation of Indicated mineral resources is based on the manganese ore zones encountered in boreholes. As the boreholes are distantly spaced and the lateral extension is also very much restricted the recovery of Manganese ore from these scattered manganese ore pockets is taken as 5% with Bulk Density of 1.68 for the manganese ore grade varying from 10%Mn. & above. The recovery factor of Iron ore is taken as 25% and Bulk density as 2.50 T/m3 for the ore grade varying from 45% Fe & above. The geological map has been prepared on a scale of 1:2000. Based on these drilled borehole data and existing quarries, measured resource has been estimated. The depth of the bore hole where the mineralization ends has been considered as the depth of indicated ore zone. However, the thickness of the ore body is variable from section to section. Further, a lateral influence of 50m from both sides of the proved limit is considered for estimation of the resource/reserve	

Pravata Ku. Sahoo
Qualified Person

Chapter-2
Mining

2.0 Mining

Open cast mining

a) Briefly describe the existing as well as proposed method for excavation with all design parameters indicating on plans /sections.

Mining Method:

Siljora-Kalimati Mn. & Iron Mine is an "A"- OTFM (Other than fully mechanised) category mine and mining operation is Semi- mechanised & opencast. The company is having permission of general shift operation. . There are six well developed quarries named as Block-1, 2,3,4,5, 6 for manganese ore and Block 6(Iron) for iron ore. In the quarries bench height is maintained up to 6 mt. & width up to 20 mt. only. a screening plant of 60TPH is already under operation.

Use of Machinery: The conventional open cast mining method by using excavator, dumper, rock breaker, deep hole drilling & Blasting is adopted for mining operation. ROM & Waste excavation is done by excavator & tipper combination. Excavator of capacity 2.1m^3, 1.2m^3& 0.9 m^3 is now used for excavation purpose. Dumpers of capacity 20/25 MT are used for ROM ore transportation from quarry to ore sorting yard and for waste transportation from quarry to dumping yard or backfilling site. Compressor with wagon drill is used for drilling purpose. Rock breaker is utilized to break the big boulders to avoid secondary blasting. Loader is used for loading purpose dozer is used in dump levelling and road development. Mobile water sprinklers are used for dust suppuration on haulage road.

Ore and waste transportation: Waste transportation is through dumpers of capacity 10 m3 to 12.5 m3 only. The sorted and sized ore are despatched to buyers destination by truck.

Dumping: From face waste material is transported to dumping yard or back filling area through dumpers of capacity 20- 25 MT. Waste materials are dumped in dump yard or backfilling areas by maintaining terraces. Dozers are also used for leveling of dump. Dead terraces of the dump are already covered by coir matting or plantation. Coir matting, plantation and catch drain in dead slope of the dump is already done to prevent soil erosion. The dumping site is surrounded by Retaining wall and Garland drain.

Others: In this mine there are some old labours which are engaged in social point of view. They are engaged in sorting & sizing of lump & boulders of ore produced from quarry which is mixed with ROM.

Details of the Existing Quarry

Name of pit/Block	Length(m)	Breadth	Top mRL	Bottom mRL
Block-1	1320	800	771	697
Block-2	978	1000	768	730
Block-3	315	198	752	731
Block-4	260	250	768	733
Block-5	345	302	746	688
Block-6 (Iron)	590	580	656	630

Pravata Ku. Sahoo
Qualified Person

Details of the Existing dump

At present the quantity and quality of existing dumps is given below.

Name	Area (Ha)	Bottom RL (m)	Top RL (m)
Waste Dump – A	28.28	712m	779m
Waste Dump – H.	23.46	701m	770m
Backfilling B-2	3.82	680	718
Backfilling B-3	12.00	560	614
Backfilling B-4	7.00	680	717
Backfilling B-1	4.78	670m	700

Proposed Mining Operation (From 2020-21 to 2024-25)

On account of exposures of iron ore as well as manganese ore and its limited depth of occurrence, opencast mechanized method of mining will continue on three shift basis with the deployment of drills, associated compressors, dumpers/tippers, excavators and other auxiliary equipment for development, production, processing, protection of environment and safety. As per the MCDR, 2017, the mine comes under Category -A (Fully Mechanized) Mine.

Selection of area for development

During proposed mining operation period for manganese ore production it is proposed to work in total 6 nos. of blocks i.e. block-1, Block-2, Block-3, Block-4, Block-5 & Block-6 for manganese ore and 01 block i.e. Block-6(Iron) for Iron ore. As Silijora is an old mine, all the blocks are well exposed and well explored. So, in all the blocks instead of working haphazardly, only few parts of each block are selected for quality manganese ore production with comparatively less waste generation. Then excavation in different blocks (1,2,3,4,5 & 6) are redesigned keeping in view of mineral conservation and reclamation of the mined out area. After excavating out the left out mineral from these quarries, simultaneous backfilling will be done. Further, on mineral conservation point of view, it has been planned in different quarries to blend low grade material with high grade ore so that low grade material can be usable/saleable.

Strategy for Development:

The proposed mining operation will also be same as existing, semi-mechanised opencast with manual breaking, sorting, sizing of manganese ore. The production target for manganese ore will be 1.89 lakhs MT and for Iron ore will be 1.36 lakhs MT. The bench height and width will be up to 6m and 9m respectively. The conventional opencast mining method with the utilization of excavator, dumper, Rock breaker, Dozer , drilling and blasting will be adopted.

During the period from 2021-22 to 2024-25 maximum production of ROM manganese ore will be 1.89 lakh tonne and maximum ROM Iron ore will be 1.36 lakh tonne. During excavation, huge quantity of OB/IB will be generated. Excavation of manganese ore zone will produce manganese ore with recovery of 65% with respect to waste. Similarly excavation of iron ore zone will produce iron ore with recovery of 25% only with respect to waste.

Pravata Ku. Sahoo
Qualified Person

Haul Road:

The layout of roads for haulage of ore/ waste and access to different installation in the mine will be developed complying with the statutory regulations stipulated in the Metalliferrous Mines Regulations, 1961. Waste and sub-grade ore /mineral reject will be dispatched to the dumping and stacking sites located in the lease area. Nine meter wide haul road will be developed in the lease area as per need at a gradient up to 1:16. Regular maintenance will be done throughout the mine life to protect the road from damage and vehicles from wear & tear.

Location of waste dump:

Waste dump location has been selected taking into consideration of barrenness of the dumping ground. During plan period, the dumping will be done on eastern extension of Dump-H and over the dump-A. The earmarked area in Dump-H is already proved barren by exploration of 24 boreholes having nos D1, D2, D3, D4, D5, D6, D7, D8, D9 etc. The Dump A is a old dump and is already proved barren by exploration of 25 boreholes having nos BH-365, 366 etc. During the proposed mining operation overburden and waste materials will be generated in considerable amount. These waste materials are proposed to be dump in selected dump yard properly. The proposed dumping ground within the lease area is absence of mineral deposits and is outside the UPL.

Garland drain will be made all around the retaining wall to receive the wash-off materials coming out of the retaining wall during rain. Finally, run-off water in garland drain will be allowed to pass through a settling tank to settle the silt content and release clean water to the natural drainage course. Silt content settled by the retaining wall, garland drain and settling tank will be cleared periodically.

Site Services:

As far as day to day mine operation is concerned, the infrastructure such as site office, weigh bridge, rest shed, First-aid Centre, blasting shed, security house, etc. are already made available in the lease area.

Drilling and blasting

Drilling is proposed to be done using 85 -115mm diameter drills with 10% sub grade drilling. Blasting will be done by adopting the State of Art technology by using mostly SME (Site Mixed Emulsion Explosives) along with conventional explosives such as PGC, toe blast. Controlled blasting along with shock tube initiation system / NONEL system will be practiced for getting optimum blast results and minimization of hazards. Boulders generated during the course of blasting will be broken in to smaller pieces by using rock breaker.

Use of machinery:

During mining operation period from 2020-21 to 2024-25 for excavator of capacity 2.1m3 will be used with some existing excavator with combination of dumper of capacity 20 to 25MT. Deep hole drilling, blasting will be used in over burden/waste benches. Rock breakers are used for dislodging of manganese ore from ore benches. Both waste & ore from mine faces will be transported through dumpers of capacity 20 MT & 25 MT. Dozer will be used for dump levelling and road development.

Pravata Ku. Sahoo
Qualified Person

Loader will be used for loading of ore to despatch trucks. Mobile water sprinkler will also be used for sprinkling on haulage road.

Ore and waste transportation: Waste transportation will be through dumpers of capacity 20t to 35t. The sorted and sized ore will be dispatched to buyer's destination by truck.

a) **Dumping:** From face waste material will be transported to dumping yard or back filling area through dumpers of capacity 20 - 35 MT. Waste materials will be dumped in dump yard or backfilling areas by making terraces. Dozers will also be used for leveling of dump. All the waste dumping will be done by making terraces also. The waste dumping site will be surrounded by retaining wall and garland drain as per the requirement.

b) **Others:** In this mine there are some old labours. These labours are also engaged in social point of view. They are also engaged in sorting & sizing of ore produced from quarry which is mixed with ROM.

Year Wise Excavation Proposal

Development during (2020-21)

During this year, both iron ore and Manganese ore will be produced. It has been planned to produce 189000TPA of Manganese ore (ROM) and 136000MT of iron ore by developing the block-1, 2,3,4,5 and 6. Iron ore will be produced from quarry-6. Height and width of the benches will be maintained at 6m and 9m respectively. The individual bench slope will be maintained at 850 whereas the gradient of the proposed road will be maintained at 1:16 and at ramp the gradient will be at 1:12.

Manganese ore strata will be loosened through drilling and blasting. Blasted rocks in each bench will be carried by mechanized means to the processing unit. Drilling is proposed to be done using 115mmdiameter drills with 10% sub grade drilling. Blasting will be done by adopting the State of Art technology by using mostly SME (Site Mixed Emulsion Explosives) along with conventional explosives such as PGC, Toe blast. Controlled blasting along with shock tube initiation system/NONEL system will be practiced for getting optimum blast results and minimization of hazards. Boulders generated during the course of blasting will be broken in to smaller pieces by using rock breaker. Excavators of 2.1m3 capacities will be deployed for excavation & loading of ROM ore and dumpers 20T-35t capacity shall be deployed for transportation of ROM ore, Sub grade and OB. The details of production will be as follows:

Particulars		BLOCK - 6	
		MANGANESE	IRON
Level	Higher adjoining ground level (m. RL)	620	
	Lower adjoining ground level (m. RL)	582	
	Quarry bottom level (m. RL)	582	
Bench Geometry	Height	6	
	Width	12	
	Bench slope angle	6	
Pit / quarry development	Direction of advancement	12	
	Size of the quarry(m x m)	37°	
	Overall quarry slope angle	SOUTH WARD	
	Production of saleable ore (MT)	18900	122400
	Generation of Mineral Reject (MT)	170100	13600
	Total waste(CUM)	326797	509340
	ROM (Saleable ore + mineral reject)	189000	136000.

The section wise and RL wise calculation of production details are given below:

Pravata Ku. Sahoo
Qualified Person

SILJORA-KALIMATI MANGANESE & IRON MINE
LESSEE – DEBABRATA BEHERA

Manganese ore

YEAR	Section considered	R.L. of the Benches	Cross sectional Area of OB (m2)	Cross sectional Area of ore zone (m2)	Length of Influence (m)	Volume of Excavation of ore zone (m3)	Recovery Factor	Actual Volume of Ore (m3)	Bulk Density	Production (MT)	Volume of IB (m3)	Volume of OB (m3)	Volume of Waste (IB+OB) (m3)	Stripping Ratio	Sub-grade/mineral reject (MT)	Saleable ore (MT)
		A	B	C	D	E=CXD	F	G=EXF	H	I=GXH	J=EX35%	K=BXD	L=J+K		M=IX90%	N=IX10%
2020-21 (BLOCK -6 MN)	334288	582	0	27	60	1620	1	1053	2	1769	567	0	567	1:0.54	1592	177
		588	0	84	60	5040	1	3276	2	5504	1764	0	1764	1:0.54	4953	550
		594	0	787	60	47220	1	30693	2	51564	16527	0	16527	1:0.54	46408	5156
		600	0	526	60	31560	1	20514	2	34464	11046	0	11046	1:0.54	31017	3446
		606	0	102	60	6120	1	3978	2	6683	2142	0	2142	1:0.54	6015	668
		612	0	256	60	15360	1	9984	2	16773	5376	0	5376	1:0.54	15096	1677
		618	0	423	60	25380	1	16497	2	27715	8883	0	8883	1:0.54	24943	2771
		SUB TOTAL				**132300**		**85995**		**144472**	**46305**		**46305**	1:0.54	**130024**	**14447**
	334188	582			60	0	1	0	2	0	0	0	0	1:0	0	0
		588			60	0	1	0	2	0	0	0	0	1:0	0	0
		594			60	0	1	0	2	0	0	0	0	1:0	0	0
		600	457	65	60	3900	1	2535	2	4259	1365	27420	28785	1:11.36	3833	426
		606	665	106	60	6360	1	4134	2	6945	2226	39900	42126	1:10.2	6251	695
		612	687	116	60	6937	1	4509	2	7575	2428	41220	43648	1:9.68	6818	758
		618	585	89	60	5340	1	3471	2	5831	1869	35100	36969	1:10.66	5248	583
		624	458	65	60	3900	1	2535	2	4259	1365	27480	28845	1:11.38	3833	426
		630	489	86	60	5160	1	3354	2	5635	1806	29340	31146	1:9.29	5071	563
		636	312	43	60	2580	1	1677	2	2817	903	18720	19623	1:11.71	2536	282
		642	784	110	60	6600	1	4290	2	7207	2310	47040	49350	1:11.51	6486	721
		SUB TOTAL				**40777**		**26505**		**44529**	**14272**	**266220**	**280492**	1:10.59	**40076**	**4453**
		TOTAL				**173077**		**112500**		**189000**	**60577**	**266220**	**326797**	1:2.91	**170100**	**18900**

Pravata Ku. Sahoo
Qualified Person

IRON ORE

YEAR	Section considered	R.L. of the Benches	Cross sectional Area of OB (m2)	Cross sectional Area of ore zone (m2)	Length of Influence (m)	Volume of Excavation of ore zone (m3)	Recovery Factor	Actual Volume of Ore (m3)	Bulk Density	Production (MT)	Volume of IB (m3)	Volume of OB (m3)	Volume of Waste (IB+OB) (m3)	Stripping Ratio	Sub-grade ore (MT)	Saleable ore (MT)
		A	B	C	D	E=CXD	F	G=EXF	H	I=GXH	J=EX75%	K=BXD	L=J+K		M=IX 90%	N=I XI0%
2020-21 (BLOCK - 6 IRON)	334288	582	154		60	0	25%	0	2.5	0	0	9240	9240	1:0	0	0
		588	70		60	0	25%	0	2.5	0	0	4200	4200	1:0	0	0
		594	102		60	0	25%	0	2.5	0	0	6120	6120	1:0	0	0
		600	182	119	60	7140	25%	1785	2.5	4462.5	5355	10920	16275	1:9.12	4016	446
		606	612	249	60	14940	25%	3735	2.5	9337.5	11205	36720	47925	1:12.84	8404	934
		612	801	339	60	20340	25%	5085	2.5	12712.5	15255	48060	63315	1:12.46	11441	1271
		618	989	851	60	51060	25%	12765	2.5	31912.5	38295	59340	97635	1:7.65	28721	3191
		SUB TOTAL				**93480**		**23370**		**58425**	**70110**	**174600**	**244710**	1:10.48	**52583**	**5843**
	334188	582	28	15	60	875	25%	219	2.5	547	656	1680	2336	1:10.69	492	55
		588	256	144	60	8640	25%	2160	2.5	5400	6480	15360	21840	1:10.12	4860	540
		594	289	163	60	9780	25%	2445	2.5	6113	7335	17340	24675	1:10.1	5501	611
		600	298	124	60	7440	25%	1860	2.5	4650	5580	17880	23460	1:12.62	4185	465
		606	278	136	60	8160	25%	2040	2.5	5100	6120	16680	22800	1:11.18	4590	510
		612	136	72	60	4325	25%	1081	2.5	2703	3244	8160	11404	1:10.55	2433	270
		618	335	145	60	8700	25%	2175	2.5	5438	6525	20100	26625	1:12.25	4894	544
		624	256	145	60	8700	25%	2175	2.5	5438	6525	15360	21885	1:10.07	4894	544
		630	354	186	60	11160	25%	2790	2.5	6975	8370	21240	29610	1:10.62	6278	698
		636	457	215	60	12900	25%	3225	2.5	8063	9675	27420	37095	1:11.51	7256	806
		642	37	235	60	14100	25%	3525	2.5	8813	10575	2220	12795	1:3.63	7931	881
		648	135	489	60	29340	25%	7335	2.5	18338	22005	8100	30105	1:4.11	16504	1834
		SUB TOTAL				**124120**		**31030**		**77575**	**93090**	**171540**	**264630**	1:8.53	**69818**	**7758**
		TOTAL				**217600**		**54400**		**136000**	**163200**	**346140**	**509340**	1:9.37	**122400**	**13600**

Pravata Ku. Sahoo
Qualified Person

Development during (2021-22)

During this year, both iron ore and Manganese ore will be produced. It has been planned to produce 189000TPA of Manganese ore (ROM) and 136000MT of iron ore by developing the block-1, 2,3,4,5 and 6. Iron ore will be produced from quarry. Height and width of the benches will be maintained at 6m and 9m respectively. The individual bench slope will be maintained at 85° whereas the gradient of the proposed road will be maintained at 1:16 and at ramp the gradient will be at 1:12. Manganese ore strata will be loosened through drilling and blasting. Blasted rocks in each bench will be carried by mechanized means to the processing unit. Drilling is proposed to be done using 115mmdiameter drills with 10% sub grade drilling. Blasting will be done by adopting the State of Art technology by using mostly SME (Site Mixed Emulsion Explosives) along with conventional explosives such as PGC, Toe blast. Controlled blasting along with shock tube initiation system/NONEL system will be practiced for getting optimum blast results and minimization of hazards. Boulders generated during the course of blasting will be broken in to smaller pieces by using rock breaker.

Excavators of 2.1m^3 capacities will be deployed for excavation & loading of ROM ore and dumpers 20T-35t capacity shall be deployed for transportation of ROM ore, Sub grade and OB. The details of production will be as follows:

Particulars		BLOCK - 6	
		MANGANESE	IRON
Level	Higher adjoining ground level (m. RL)	620	
	Lower adjoining ground level (m. RL)	582	
	Quarry bottom level (m. RL)	582	
Bench Geometry	Height	6	
	Width	12	
	Bench slope angle	6	
Pit / quarry development	Direction of advancement	12	
	Size of the quarry(m x m)	37°	
	Overall quarry slope angle	SOUTH WARD	
	Production of saleable ore (MT)	18900	13600
	Generation of Mineral Reject (MT)	170100	122400
	Total waste(CUM)	469297	336090
	ROM (Saleable ore + mineral reject)	189000	136000

The section wise and RL wise calculation of production details are given below:

Pravata Ku. Sahoo
Qualified Person

SILJORA-KALIMATI MANGANESE & IRON MINE
LESSEE – DEBABRATA BEHERA

MANGANESE ORE

YEAR	Section considered	R.L. of the Benches	Cross sectional Area of OB (m2)	Cross sectional Area of ore zone (m2)	Length of Influence (m)	Volume of Excavation of ore zone (m3)	Recovery Factor	Actual Volume of Ore (m3)	Bulk Density	Production (MT)	Volume of IB (m3)	Volume of OB (m3)	Volume of Waste (IB+OB) (m3)	Stripping Ratio	Sub-grade ore/Mineral Reject (MT)	Saleable ore (MT)
		A	B	C	D	E=CXD	F	G=EXF	H	I=GXH	J=EX35%	K=BXD	L=J+K		M=IX90%	N=IX10%
2021-22 (BLOCK-6 MN)	334288	582	998	456	60	27360	65%	17784	1.68	29877.12	9576	59880	69456	1:3.91	26889.408	2987.712
		588	978	354	60	21240	65%	13806	1.68	23194.08	7434	58680	66114	1:4.79	20874.672	2319.408
		594	987	678	60	40680	65%	26442	1.68	44422.56	14238	59220	73458	1:2.78	39980.304	4442.256
		600	968	526	60	31560	65%	20514	1.68	34463.52	11046	58080	69126	1:3.37	31017.168	3446.352
		606	958	191.62	60	11497.2	65%	7473.18	1.68	12554.9424	4024.02	57480	61504.02	1:8.23	11299.44816	1255.49424
		612	945	256	60	15360	65%	9984	1.68	16773.12	5376	56700	62076	1:6.22	15095.808	1677.312
		618	978	423	60	25380	65%	16497	1.68	27714.96	8883	58680	67563	1:4.1	24943.464	2771.496
		SUB TOTAL				**173077**		**112500**		**189000**	**60577**	**408720**	**469297**	1:4.18	**170100**	**18900**

IRON ORE

YEAR	Section considered	R.L. of the Benches	Cross sectional Area of OB (m2)	Cross sectional Area of ore zone (m2)	Length of Influence (m)	Volume of Excavation of ore zone (m3)	Recovery Factor	Actual Volume of Ore (m3)	Bulk Density	Production (MT)	Volume of IB (m3)	Volume of OB (m3)	Volume of Waste (IB+OB) (m3)	Stripping Ratio	Sub-grade ore/Mineral Reject (MT)	Saleable ore (MT)
		A	B	C	D	E=CXD	F	G=EXF	H	I=GXH	J=EX75%	K=BXD	L=J+K		M=IX90%	N=IX10%
2021-22 (BLOCK-6 IRON)	334188	582	154	386	90	34740	25%	8685	2.5	21712.5	26055	13860	39915	1:4.6	19541	2171
		588	70	521	90	46890	25%	11722.5	2.5	29306.25	35167.5	6300	41467.5	1:3.54	26376	2931
		594	102	587	90	52830	25%	13207.5	2.5	33018.75	39622.5	9180	48802.5	1:3.7	29717	3302
		600	182	421	90	37890	25%	9472.5	2.5	23681.25	28417.5	16380	44797.5	1:4.73	21313	2368
		606	612	249	90	22391	25%	5597.775	2.5	13994.4375	16793.325	55080	71873.325	1:12.84	12595	1399
		612	801	253.99	90	22859.1	25%	5714.775	2.5	14286.9375	17144.325	72090	89234.325	1:15.62	12858	1429
		SUB TOTAL				**217600.2**		**54400.05**		**136000**	**163200.15**	**172890**	**336090.15**	1:6.18	**122400**	**13600**

Pravata Ku. Sahoo
Qualified Person

Development during (2022-23)

During this year, both iron ore and Manganese ore will be produced. It has been planned to produce 189000TPA of Manganese ore (ROM) and 136000MT of iron ore by developing the block-1, 2, 3, 4, 5 and 6. Iron ore will be produced from quarry-6. Height and width of the benches will be maintained at 6m and 9m respectively. The individual bench slope will be maintained at 85^0 whereas the gradient of the proposed road will be maintained at 1:16 and at ramp the gradient will be at 1:12.

Manganese ore strata will be loosened through drilling and blasting. Blasted rocks in each bench will be carried by mechanized means to the processing unit. Drilling is proposed to be done using 115mmdiameter drills with 10% sub grade drilling. Blasting will be done by adopting the State of Art technology by using mostly SME (Site Mixed Emulsion Explosives) along with conventional explosives such as PGC, Toe blast. Controlled blasting along with shock tube initiation system/NONEL system will be practiced for getting optimum blast results and minimization of hazards. Boulders generated during the course of blasting will be broken in to smaller pieces by using rock breaker.

Excavators of $2.1m^3$ capacities will be deployed for excavation & loading of ROM ore and dumpers 20T-35t capacity shall be deployed for transportation of ROM ore, Sub grade and OB. The details of production will be as follows:

Particulars		Block-1	Block-2	Block-3	Block-4	Block-5	Block - 6
Level	Higher adjoining ground level (m. RL)	722	752	743	746	751	667
	Lower adjoining ground level (m. RL)	708	742	737	700	710	607
	Quarry bottom level (m. RL)	708	742	737	700	710	624
Bench Geometry	Height	6	6	6	6	6	6
	Width	12	12	12	12	12	12
	Bench slope angle	37°	37°	37°	37°	37°	37°
Pit / quarry development	Direction of advancement	Depth	East wards	All direction	North ward	North ward	South East
	Size of the quarry(m x m)	300 X 67	341 X 78	248 X 248	298 X 93	235 X 127	340 X 210
	Overall quarry slope angle	37°	37°	37°	37°	37°	37°
	Production of saleable ore (MT)	917.28	2469.012	5634	5274	4606	13600
	Generation of Mineral Reject (MT)	8255.52	22221.108	50703	47469	41452	122400
	Total waste(cum)	46340	156313.5	371977	269395	244222	420400
	ROM (Saleable ore + mineral reject) (MT)	9173	24690.12	56336	52744	46057	136000
	TOTAL ROM	189000					136000

The section wise and RL wise calculation of production details are given below:

Pravata Ku. Sahoo
Qualified Person

SILJORA-KALIMATI MANGANESE & IRON MINE
LESSEE – DEBABRATA BEHERA

MANGANESE ORE

YEAR	Section considered	R.L. of the Benches	Cross sectional Area of OB (m2)	Cross sectional Area of ore zone (m2)	Length of Influence (m)	Volume of Excavation of ore zone (m3)	Recovery Factor	Actual Volume of Ore (m3)	Bulk Density	Production (MT)	Volume of IB (m3)	Volume of OB (m3)	Volume of Waste (IB+OB) (m3)	Stripping Ratio	Sub-grade ore/Mineral Reject (MT)	Saleable ore (MT)
2022-23		A	B	C	D	E=CXD	F	G=EXF	H	I=GXH	J=EX35%	K=BXD	L=J+K		M=IX90%	N=IX10%
(BLOCK - 1 MN)	331888	716	620	120	70	8400	65%	5460	1.68	9172.8	2940	43400	46340	1:8.49	8255.52	917.28
	SUB TOTAL					8400		5460		9172.8	2940	43400	46340	1:8.49	8255.52	917.28
(BLOCK - 2 MN)	332488	734	897	98	70	6860	65%	4459	1.68	7491.12	2401	62790	65191		6742.008	749.112
		740	625	102	70	7140	65%	4641	1.68	7796.88	2499	43750	46249		7017.192	779.688
		746	598	123	70	8610	65%	5596.5	1.68	9402.12	3013.5	41860	44873.5		8461.908	940.212
		SUB TOTAL				**22610**		**14696.5**		**24690.12**	**7913.5**	**148400**	**156313.5**	1:10.64	**22221.11**	**2469.012**
(BLOCK - 3 MN)	333088	716	697	79	70	5530	65%	3595	1.68	6039	1936	48790	50726		5435	604
		722	758	65	70	4550	65%	2958	1.68	4969	1593	53060	54653		4472	497
		728	365	95	70	6650	65%	4323	1.68	7262	2328	25550	27878		6536	726
		734	456	125	70	8750	65%	5688	1.68	9555	3063	31920	34983		8600	956
	333188	722	564	65	70	4550	65%	2958	1.68	4969	1593	39480	41073		4472	497
		728	678	54	70	3780	65%	2457	1.68	4128	1323	47460	48783		3715	413
		734	864	98	70	6860	65%	4459	1.68	7491	2401	60480	62881		6742	749
		740	674	156	70	10920	65%	7098	1.68	11925	3822	47180	51002		10732	1192
	SUB TOTAL					**51590**		**33534**		**56336**	**18057**	**353920**	**371977**	1:11.1	**50703**	**5634**
(BLOCK - 4 MN)	333188	728	898	112	70	7840	65%	5096	1.68	8561	2744	62860	65604		7705	856
		734	951	235	70	16450	65%	10693	1.68	17963	5758	66570	72328		16167	1796
		740	893	154	70	10780	65%	7007	1.68	11772	3773	62510	66283		10595	1177
		746	865	189	70	13230	65%	8600	1.68	14447	4631	60550	65181		13002	1445
	SUB TOTAL					**48300**		**31395**		**52744**	**16905**	**252490**	**269395**	1:8.59	**47469**	**5274**
(BLOCK - 5 MN)	333688	686	897	189	70	13230	65%	8600	1.68	14447	4631	62790	67421		13002	1445
		692	689	149	70	10397	65%	6758	1.68	11354	3639	48230	51869		10218	1135
		698	798	145	70	10150	65%	6598	1.68	11084	3553	55860	59413		9975	1108
		704	894	120	70	8400	65%	5460	1.68	9173	2940	62580	65520		8256	917
		SUB TOTAL				**42177**		**27415**		**46057**	**14762**	**229460**	**244222**	1:8.91	**41452**	**4606**
		TOTAL				**173077**		**112500**		**189000**	**60577**	**1027670**	**1088247**	1:9.68	**170100**	**18900**

52 Pravata Ku. Sahoo
Qualified Person

IRON ORE

YEAR	Section considered	R.L. of the Benches	Crosssectional Area of OB (m2)	Crossectional Area of ore zone (m2)	Length of Influence (m)	Volume of Excavation of ore zone (m3)	Recovery Factor	Actual Volume of Ore (m3)	Bulk Density	Production (MT)	Volume of IB (m3)	Volume of OB (m3)	Volume of Waste (IB+OB) (m3)	Stripping Ratio	Sub-grade ore (MT)	Saleable ore (MT)
		A	B	C	D	E=CXD	F	G=EXF	H	I=GXH	J=EX75%	K=BXD	L=J+K		M=IX90%	N=IX10%
2022-23 (BLOCK - 6 IRON)	334288	630	358	425	150	63700.5	25%	15925.13	2.5	39812.81	47775.38	53700	101475.4	1:6.38	35832	3981
		624	424	355	100	35500	25%	8875	2.5	22187.5	26625	42400	69025	1:7.78	19969	2219
		SUB TOTAL				**99200.5**		**24800.13**		**62000.31**	**74400.38**	**96100**	**170500.4**	1:6.88	**55800**	**6200**
	334188	654	354	283	100	28300	25%	7075	2.5	17688	21225	35400	56625	1:8.01	15919	1769
		648	256	185	100	18500	25%	4625	2.5	11563	13875	25600	39475	1:8.54	10406	1156
		642	289	185	100	18500	25%	4625	2.5	11563	13875	28900	42775	1:9.25	10406	1156
		636	298	166	100	16600	25%	4150	2.5	10375	12450	29800	42250	1:10.19	9338	1038
		630	278	187	100	18700	25%	4675	2.5	11688	14025	27800	41825	1:8.95	10519	1169
		624	136	178	100	17800	25%	4450	2.5	11125	13350	13600	26950	1:6.06	10013	1113
		SUB TOTAL				**118400**		**29600**		**74000**	**88800**	**161100**	**249900**	1:8.45	**66600**	**7400**
		TOTAL				**217601**		**54400**		**136000**	**163200**	**257200**	**420400**	1:7.73	**122400**	**13600**

Pravata Ku. Sahoo
Qualified Person

Development during (2023-24)

During this year both iron and Manganese ore will be produced. Manganese ore will be produced @ 189000TPA and iron ore will be produced @ 136000TPA. Manganese ore will be produced by developing Block- 6 and iron ore will be produced by developing block-6.Height and width of benches will be kept at 6m and 9m respectively to obtain the production of said production. The individual bench slope will be maintained at 85^0 whereas the gradient of the proposed road will be maintained at 1:16 and at ramp the gradient will be at 1:12.

Both iron and Manganese ore strata will be loosened through drilling and blasting. Blasted rocks in each bench will be carried by mechanized means to the processing unit. Drilling is proposed to be done using 115mm diameter drills with 10% sub grade drilling. Blasting will be done by adopting the State of Art technology by using mostly SME (Site Mixed Emulsion Explosives) along with conventional explosives such as PGC, Toe blast. Controlled blasting along with shock tube initiation system / NONEL system will be practiced for getting optimum blast results and minimization of hazards. Boulders generated during the course of blasting will be broken in to smaller pieces by using rock breaker.

Excavators of $2.1m^3$ capacities will be deployed for excavation & loading of ROM ore and dumpers 20T/35T capacity shall be deployed for transportation of ROM ore, Sub grade and OB.

Particulars		Block-1	Block-2	Block-3	Block-4	Block-5	Block - 6
Level	Higher adjoining ground level (m. RL)	725	745	751	757	697	624
	Lower adjoining ground level (m. RL)	709	735	737	730	694	607
	Quarry bottom level (m. RL)	709	735	735	730	690	594
Bench Geometry	Height	6	6	6	6	6	6
	Width	12	12	12	12	12	12
	Bench slope angle	37°	37°	37°	37°	37°	37°
Pit / quarry development	Direction of advancement	N-E	N-E	NORTH WARD	NORTH WARD	ALL DIRECTION	South East and depth
	Size of the quarry(m x m)	348 X 125	112X146	251 X 208	193 X 171	129 X 236	210 x 175
	Overall quarry slope angle	37°	37°	37°	37°	37°	37°
	Production of saleable ore (MT)	2515	2461	5297	5645	2981	13600
	Generation of Mineral Reject (MT)	22634	22152	47676	50808	26830	122400
	Total waste(MT)	137211	145579	293619	327004	229985	414400
	ROM (Saleable ore + mineral reject)	25149	24614	52973	56453	29812	136000
	TOTAL ROM	189000					136000

The section wise and RL wise calculation of production details are given below:

Pravata Ku. Sahoo
Qualified Person

IRON ORE

YEAR	Section considered	R.L. of the Benches	Crosssectional Area of OB (m2)	Crossectional Area of ore zone (m2)	Length of Influence (m)	Volume of Excavation of ore zone (m3)	Recovery Factor	Actual Volume of Ore (m3)	Bulk Density	Production (MT)	Volume of IB (m3)	Volume of OB (m3)	Volume of Waste (IB+OB) (m3)	Stripping Ratio	Sub-grade ore (MT)	Saleable ore (MT)
		A	B	C	D	E=CXD	F	G=EXF	H	I=GXH	J=EX75%	K=BXD	L=J+K		M=IX90%	N=IX10%
2023-24 (BLOCK-6 IRON)	334188	518	358	387	100	38700	25%	9675	2.5	24187.5	29025	35800	64825	1:6.71	21769	2419
		612	255	321	100	32100	25%	8025	2.5	20062.5	24075	25500	49575	1:6.18	18056	2006
		606	424	324	100	32400	25%	8100	2.5	20250	24300	42400	66700	1:8.24	18225	2025
		SUB TOTAL				**103200**		**25800**		**64500**	**77400**	**103700**	**181100**	1:7.02	**58050**	**6450**
	334288	618	354	324	100	32400	25%	8100	2.5	20250	24300	35400	59700	1:7.38	18225	2025
		612	256	202	100	20200	25%	5050	2.5	12625	15150	25600	40750	1:8.07	11363	1263
		606	289	213	100	21300	25%	5325	2.5	13313	15975	28900	44875	1:8.43	11981	1331
		600	298	212	100	21200	25%	5300	2.5	13250	15900	29800	45700	1:8.63	11925	1325
		594	278	193	100	19300	25%	4825	2.5	12063	14475	27800	42275	1:8.77	10856	1206
		SUB TOTAL				**114400**		**28600**		**71500**	**85800**	**147500**	**233300**	1:8.16	**64350**	**7150**
		TOTAL				**217600**		**54400**		**136000**	**163200**	**251200**	**414400**	1:7.62	**122400**	**13600**

Pravata Ku. Sahoo
Qualified Person

Manganese ore

The section wise and RL wise calculation of production details are given below:

YEAR	Section considered	R.L. of the Benches	Crosssectional Area of OB (m2)	Crossectional Area of ore zone (m2)	Length of Influence (m)	Volume of Excavation of ore zone (m3)	Recovery Factor	Actual Volume of Ore (m3)	Bulk Density	Production (MT)	Volume of IB (m3)	Volume of OB (m3)	Volume of Waste (IB+OB) (m3)	Stripping Ratio	Sub-grade ore (MT)	Saleable ore (MT)
2023-24		A	B	C	D	E=CXD	F	G=EXF	H	I=GXH	J=EX35%	K=BXD	L=J+K	1:0	M=IX90%	N=IX10%
(BLOCK -1 MN)	331988	704	523	89	70	6230	65%	4050	1.68	6803	2181	36610	38791	1:9.58	6123	680
		710	545	98	70	6860	65%	4459	1.68	7491	2401	38150	40551	1:9.1	6742	749
		716	456	88	70	6160	65%	4004	1.68	6727	2156	31920	34076	1:8.52	6054	673
		722	321	54	70	3780	65%	2457	1.68	4128	1323	22470	23793	1:9.69	3715	413
	SUB TOTAL					**23030**				25149	**8061**	**129150**	**137211**	1:9.17	**22634**	**2515**
(BLOCK -2 MN)	332588	722	658	102	70	7140	65%	4641	1.68	7797	2499	46060	48559	1:10.47	7017	780
		728	520	89	70	6230	65%	4050	1.68	6803	2181	36400	38581	1:9.53	6123	680
		734	514	86	70	6020	65%	3913	1.68	6574	2107	35980	38087	1:9.74	5916	657
		740	275	45	70	3150	65%	2048	1.68	3440	1103	19250	20353	1:9.95	3096	344
	SUB TOTAL					**22540**				24614	**7889**	**137690**	**145579**	1:9.94	**22152**	**2461**
(BLOCK -3 MN)	333088	716	485	79	70	5530	65%	3595	1.68	6039	1936	33950	35886	1:9.99	5435	604
		722	378	65	70	4550	65%	2958	1.68	4969	1593	26460	28053	1:9.49	4472	497
		728	487	95	70	6650	65%	4323	1.68	7262	2328	34090	36418	1:8.43	6536	726
		734	625	113	70	7910	65%	5142	1.68	8638	2769	43750	46519	1:9.05	7774	864
	333188	722	358	65	70	4550	65%	2958	1.68	4969	1593	25060	26653	1:9.02	4472	497
		728	298	54	70	3780	65%	2457	1.68	4128	1323	20860	22183	1:9.03	3715	413
		734	565	98	70	6860	65%	4459	1.68	7491	2401	39550	41951	1:9.41	6742	749
		740	756	124	70	8680	65%	5642	1.68	9479	3038	52920	55958	1:9.92	8531	948
SUB TOTAL						**48510**				52973	**16979**	**276840**	**293819**	1:9.32	**47676**	**5297**
(BLOCK -4 MN)	333188	728	685	124	70	8680	65%	5642	1.68	9479	3038	47950	50988	1:9.04	8531	948
		734	687	119	70	8330	65%	5415	1.68	9096	2916	48090	51006	1:9.43	8187	910
		740	598	89	70	6230	65%	4050	1.68	6803	2181	41860	44041	1:10.88	6123	680
		746	675	102	70	7140	65%	4641	1.68	7797	2499	47250	49749	1:10.72	7017	780
		752	654	112	70	7807	65%	5075	1.68	8525	2732	45780	48512	1:9.56	7673	853
		758	525	95	70	6650	65%	4323	1.68	7262	2328	36750	39078	1:9.05	6536	726
		764	589	98	70	6860	65%	4459	1.68	7491	2401	41230	43631	1:9.79	6742	749
	SUB TOTAL					**51697**				56453	**18094**	**308910**	**327004**	1:9.74	**50808**	**5645**
(BLOCK -5 MN)	333788	656	689	47	70	3290	65%	2139	1.68	3593	1152	48230	49382	1:23.1	3233	359
		662	624	87	70	6090	65%	3959	1.68	6650	2132	43680	45812	1:11.58	5985	665
		668	685	98	70	6860	65%	4459	1.68	7491	2401	47950	50351	1:11.3	6742	749
		674	412	58	70	4060	65%	2639	1.68	4434	1421	28840	30261	1:11.47	3990	443
		680	554	75	70	5250	65%	3413	1.68	5733	1838	38780	40618	1:11.91	5160	573
		686	185	25	70	1750	65%	1138	1.68	1911	613	12950	13563	1:11.93	1720	191
		692	0	0	70	0	65%	0	1.68	0	0	0	0	1:0	0	0
	SUB TOTAL					**27300**		**17745**		**29812**	**9555**	**220430**	**229985**	1:12.97	**26830**	**2981**
		TOTAL				**173077**		**112500**		**189000**	**60577**	**1072820**	**1133397**	1:10.08	**170100**	**18900**

Pravata Ku. Sahoo
Qualified Person

Development during (2024-25)

During this year both iron and Manganese ore will be produced. Manganese ore will be produced @ 189000TPA and iron ore will be produced @ 136000TPA. Manganese ore will be produced by developing Block- 6 and iron ore will be produced by developing block-6.Height and width of benches will be kept at 6m and 9m respectively to obtain the production of said production. The individual bench slope will be maintained at 85^0 whereas the gradient of the proposed road will be maintained at 1:16 and at ramp the gradient will be at 1:12.

Both iron and Manganese ore strata will be loosened through drilling and blasting. Blasted rocks in each bench will be carried by mechanized means to the processing unit. Drilling is proposed to be done using 115mm diameter drills with 10% sub grade drilling. Blasting will be done by adopting the State of Art technology by using mostly SME (Site Mixed Emulsion Explosives) along with conventional explosives such as PGC, Toe blast. Controlled blasting along with shock tube initiation system / NONEL system will be practiced for getting optimum blast results and minimization of hazards. Boulders generated during the course of blasting will be broken in to smaller pieces by using rock breaker.

Excavators of $2.1m^3$ capacities will be deployed for excavation & loading of ROM ore and dumpers 20T/35T capacity shall be deployed for transportation of ROM ore, Sub grade and OB.

Particulars		Block-1	Block-2	Block-3	Block-4	Block-5	Block - 6
Level	Higher adjoining ground level (m. RL)	715	764	740	750	740	624
	Lower adjoining ground level (m. RL)	704	746	716	740	704	607
	Quarry bottom level (m. RL)	704	740	716	740	704	582
Bench Geometry	Height	6	6	6	6	6	6
	Width	12	12	12	12	12	12
	Bench slope angle	37°	37°	37°	37°	37°	37°
Pit / quarry development	Direction of advancement	EAST WARD	SOUTH WARD	EAST	DEPTH	SOUTH	South East
	Size of the quarry(m x m)	189 X 115	142X175	251 X 208	230 X 180	151 X 164	270 x 190
	Overall quarry slope angle	37°	37°	37°	37°	37°	37°
	Production of saleable ore (MT)	2194	2461	2217	5779	6249	13600
	Generation of Mineral Reject (MT)	19744	22152	19951	52010	56243	122400
	Total waste(cum)	138422	142849	130585	351162	405939	416800
	ROM (Saleable ore + mineral reject)	21938	24614	22168	57789	62491	136000
		189000					136000

The section wise and RL wise calculation of production details are given below:

Pravata Ku. Sahoo
Qualified Person

SILJORA-KALIMATI MANGANESE & IRON MINE
LESSEE – DEBABRATA BEHERA

Manganese ore

YEAR	Section considered	R.L. of the Benches	Crosssectional Area of OB (m2)	Crossectional Area of ore zone (m2)	Length of Influence (m)	Volume of Excavation of ore zone (m3)	Recovery Factor	Actual Volume of Ore (m3)	Bulk Density	Production (MT)	Volume of IB (m3)	Volume of OB (m3)	Volume of Waste (IB+OB) (m3)	Stripping Ratio	Saleable ore (MT)	Sub-grade ore (MT)
2024-25		A	B	C	D	E=CXD	F	G=EXF	H	I=GXH	J=EX35%	K=BXD	L=J+K	1:0	M=IX90%	N=IX10%
(BLOCK -1 MN)	332088	716	565	78	70	5460	65%	3549	1.68	5962	1911	39550	41461	1:11.69	5366	596
		722	498	89	70	6230	65%	4050	1.68	6803	2181	34860	37041	1:9.15	6123	680
		728	814	120	70	8400	65%	5460	1.68	9173	2940	56980	59920	1:10.98	8256	917
	SUB TOTAL					**20090**		**13059**		**21938**	**7032**	**131390**	**138422**	1:10.61	**19744**	**2194**
(BLOCK -2 MN)	332488	740	589	102	70	7140	65%	4641	1.68	7797	2499	41230	43729	1:9.43	7017	780
		746	548	89	70	6230	65%	4050	1.68	6803	2181	38360	40541	1:10.02	6123	680
		752	489	86	70	6020	65%	3913	1.68	6574	2107	34230	36337	1:9.29	5916	657
		758	302	45	70	3150	65%	2048	1.68	3440	1103	21140	22243	1:10.87	3096	344
		SUB TOTAL				**22540**		**14651**		**24614**	**7889**	**134960**	**142849**	1:9.76	**22152**	**2461**
(BLOCK -3 MN)	333288	622	658	120	70	8400	65%	5460	1.68	9173	2940	46060	49000	1:8.98	8256	917
		628	542	87	70	6090	65%	3959	1.68	6650	2132	37940	40072	1:10.13	5985	665
		634	564	83	70	5810	65%	3777	1.68	6345	2034	39480	41514	1:11	5710	634
	SUB TOTAL					**20300**		**13195**		**22168**	**7105**	**123480**	**130585**	1:9.9	**19951**	**2217**
(BLOCK -4 MN)	333188	698	687	124	70	8680	65%	5642	1.68	9479	3038	48090	51128	1:9.07	8531	948
		704	654	119	70	8330	65%	5415	1.68	9096	2916	45780	48696	1:9	8187	910
		710	589	89	70	6230	65%	4050	1.68	6803	2181	41230	43411	1:10.72	6123	680
		716	598	102	70	7140	65%	4641	1.68	7797	2499	41860	44359	1:9.56	7017	780
		722	678	112	70	7840	65%	5096	1.68	8561	2744	47460	50204	1:9.86	7705	856
		728	748	125	70	8750	65%	5688	1.68	9555	3063	52360	55423	1:9.75	8600	956
		734	548	85	70	5950	65%	3868	1.68	6497	2083	38360	40443	1:10.46	5848	650
		740	250	0	70	0	65%	0	1.68	0	0	17500	17500	1:0	0	0
	SUB TOTAL					**52920**		**34398**		**57789**	**18522**	**332640**	**351162**	1:10.21	**52010**	**5779**
(BLOCK -5 MN)	333788	686	564	152	70	10640	65%	6916	1.68	11619	3724	39480	43204	1:6.25	10457	1162
		692	568	115	70	8050	65%	5233	1.68	8791	2818	39760	42578	1:8.14	7912	879
		698	547	98	70	6860	65%	4459	1.68	7491	2401	38290	40691	1:9.13	6742	749
		704	878	165	70	11550	65%	7508	1.68	12613	4043	61460	65503	1:8.73	11351	1261
		710	788	113	70	7877	65%	5120	1.68	8602	2757	55160	57917	1:11.32	7742	860
		716	458	91	70	6370	65%	4141	1.68	6956	2230	32060	34290	1:8.29	6260	696
		722	548	84	70	5880	65%	3822	1.68	6421	2058	38360	40418	1:10.58	5779	642
		728	578	0	70	0	65%	0	1.68	0	0	40460	40460	1:0	0	0
		734	584	0	70	0	65%	0	1.68	0	0	40880	40880	1:0	0	0
	SUB TOTAL					**57227**		**37198**		**62491**	**20029**	**385910**	**405939**	1:10.92	**56243**	**6249**
		TOTAL				**173077**		**112500**		**189000**	**60577**	**1108380**	**1168957**	1:10.4	**170100**	**18900**

Pravata Ku. Sahoo
Qualified Person

SILJORA-KALIMATI MANGANESE & IRON MINE
LESSEE – DEBABRATA BEHERA

Iron Ore

YEAR	Section considered	R.L. of the Benches	Cross sectional Area of OB (m2)	Cross sectional Area of ore zone (m2)	Length of Influence (m)	Volume of Excavation of ore zone (m3)	Recovery Factor	Actual Volume of Ore (m3)	Bulk Density	Production (MT)	Volume of IB (m3)	Volume of OB (m3)	Volume of Waste (IB+OB) (m3)	Stripping Ratio	Sub-grade ore (MT)	Saleable ore (MT)
		A	B	C	D	E=CXD	F	G=EXF	H	I=GXH	J=EX75%	K=BXD	L=J+K		M=IX90%	N=IX10%
2024-25 (BLOCK - 6 IRON)	334388	624	356	366	100	36600	25%	9150	2.5	22875	27450	35600	63050	1:6.9	20588	2288
		618	425	396	100	39580	25%	9895	2.5	24738	29685	42500	72185	1:7.3	22264	2474
		612	356	303	100	30250	25%	7563	2.5	18906	22688	35600	58288	1:7.71	17016	1891
		606	289	229	100	22900	25%	5725	2.5	14313	17175	28900	46075	1:8.05	12881	1431
		600	298	212	100	21180	25%	5295	2.5	13238	15885	29800	45685	1:8.63	11914	1324
		594	345	254	100	25400	25%	6350	2.5	15875	19050	34500	53550	1:8.44	14288	1588
		588	278	215	100	21490	25%	5373	2.5	13431	16118	27800	43918	1:8.18	12088	1343
		582	189	202	100	20200	25%	5050	2.5	12625	15150	18900	34050	1:6.75	11363	1263
		SUB TOTAL				**217600**		**54400**		**136000**	**163200**	**253600**	**416800**		**122400**	**13600**

Pravata Ku. Sahoo
Qualified Person

भारतीय खान ब्यूरो, भुवनेश्वर
INDIAN BUREAU OF MINES, BHUBANESWAR

Indicate year-wise tentative Excavation in Cubic Meters indicating development, ROM, bit wise as in table below.

I. In situ Tentative Excavation (cum)

Manganese ore

Year	Name of quarry	Total Excavation (m^3)	Top Soil (m^3)	OB/IB (m^3)	ROM (m^3)		Total ROMm^3)	ROM /Waste Ratio (m3/m3)
					Ore (m^3)	Mineral reject (m^3)		
2020-21	Block 1, 2,3,4, 5 & 6	439297	0	326797	11250	101250	112500	1:2.90
2021-22		581797	0	469297	11250	101250	112500	1:4.17
2022-23		1200747	0	1088247	11250	101250	112500	1:9.67
2023-24		1245897	0	1133397	11250	101250	112500	1:10.07
2024-25		1281457	0	1168957	11250	101250	112500	1:10.39
Total	—	4749195		4186695	56250	506250	562500	

Iron ore

Year	NAME OF QUARRY	Total Excavation (m^3)	Top Soil (m^3)	OB/IB (m^3)	ROM (m^3)		Total ROM (m^3)	ROM /Waste Ratio (m3/m3)
					Ore (m^3)	Mineral reject (m^3)		
2020-21	Block 6	563740	0	509340	5440	48960	54400	1:9.36
2021-22		390490	0	336090	5440	48960	54400	1:6.18
2022-23		474800	0	420400	5440	48960	54400	1:7.73
2023-24		468800	0	414400	5440	48960	54400	1:7.62
2024-25		471200	0	416800	5440	48960	54400	1:7.66
Total	---	2369030		509340	27200	244800	272000	

*Tentative tonnage of the ore may be arrived by computing approximate bulk density and recovery factor as these data are variable and may be established on time series.

NOTE: Mineral rejects include all the excavated materials that do not constitute useful material, such material may be either grade or size reject. The mineral reject may be (i) chemically sub-grade which is below the acceptable limits of specifications that is below the cutoff grade and above the threshold value, (ii) materials of physical characteristics not acceptable to the market, (iii) material having deleterious constituents.

अनुमोदित
APPROVED

ROM constitutes the material excavated from mineralized zone and includes mineral reject and useable mineral component.

OB: Means overburden capping waste

SB: means side burden waste on both hang wall and foot wall sides of the ore body.

IB : means intermediate burden waste between two or more ore body.

Based on present mining practices and processing (crushing & screening), the following parameters have been considered to calculate waste, Mineral reject and saleable ore:

Ore Type	Recovery %	Bulk density
Iron ore(45 to 55% Fe)	25%	2.5MT/cum
Iron ore(+ 55% Fe)	25%	2.5MT/cum
Manganese ore (10 to 25% Mn)	65%	1.68MT/cum

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

Pravata Ku. Sahoo
Qualified Person

Summarized production of iron ore, Mineral Reject, waste and stripping ratio(MT/cum)

Manganese ore

Year	ROM (MT)		Total (MT)
	Ore (MT)	Mineral reject (MT)	
2020-21	18900	170100	189000
2021-22	18900	170100	189000
2022-23	18900	170100	189000
2023-24	18900	170100	189000
2024-25	18900	170100	189000
Total	**94500.151**	**850500**	945000

Iron ore

Year	ROM (MT)		Total (MT)
	Ore (MT)	Mineral reject (MT)	
2020-21	13600	122400	136000
2021-22	13600	122400	136000
2022-23	13600	122400	136000
2023-24	13600	122400	136000
2024-25	13600	122400	136000
Total	68000	612000	680000

Waste in cum

Summarized Statement of waste

Year	Iron ore Zone			Mn ore Zone			Total Waste(m^3)
	Intercalated waste (m^3)	Overburden and side burden (m^3)	Total Waste (m^3)	Intercalated waste (m^3)	Overburden and side burden (m^3)	Total Waste (m^3)	
2020-21	163200	346140	509340	60577	266220	326797	836137
2021-22	163200	172890	336090	60577	408720	469297	805387
2022-23	163200	257200	420400	60577	1027670	1088247	1508647
2023-24	163200	251200	414400	60577	1072820	1133397	1547797
2024-25	163200	253600	416800	60577	1108380	1168957	1585757
Total	816000	1281030	2097030	302885	3883810	4186695	6283725

Stripping Ratio(MT/cum)

Iron ore zone

Year	Total ROM (MT)	Total Waste (m^3)	Stripping Ratio(MT/cum)
2020-21	136000	509340	1:3.75
2021-22	136000	336090	1:2.47
2022-23	136000	420400	1:3.09
2023-24	136000	414400	1:3.05
2024-25	136000	416800	1:3.06
Total	**680000**	**2097030**	

Manganese ore

Year	Total ROM (MT)	Total Waste (m^3)	Stripping Ratio(MT/cum)
2020-21	189000	326797	1:1.73
2021-22	189000	469297	1:2.48
2022-23	189000	1088247	1:5.76
2023-24	189000	1133397	1:6.00
2024-25	189000	1168957	1:6.18
Total	**945000.151**	**4186695**	

II. Dump re-handling (for the purpose of recovery of mineral):

Not proposed

Pravata Ku. Sahoo
Qualified Person

C. Enclose Individual year wise development plans and sections showing pit layouts, dumps, stacks of mineral reject, if any, etc in case of 'A' category mines

Ref : Individual year wise development plans and sections vide **Plate-VII and XI** showing pit layouts, dumps, stacks of mineral reject since it is 'A' category mine.

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

On account of exposures of iron ore as well as manganese ore and its limited depth of occurrence, opencast mechanized method of mining will continue on three shift basis with the deployment of drills, associated compressors, dumpers/tippers, excavators and other auxiliary equipment for development, production, processing, protection of environment and safety. As per the MCDR, 2017, the mine comes under Category -A (Fully Mechanized) Mine.

Selection of area for development

As per the Geological Report, Manganese ore occurs Block 1, 2, 3, 4, 5 and 6. Similarly in the block -6 Iron ore occurs along with manganese ore. Hence, it has been planned to produce iron and manganese ore from these proposed area only. Production of iron ore will be obtained from 4th year onwards.

Strategy For Development:

In the approved Mining Plan,block-1,2,3,4, 5 and 6 was proposed to be developed to produce @ 3,5000 tons of manganese ore (ROM) per annum. The new lessee is now kept the manganese ore production @ 1,89000MT and iron ore @ 136000MT.The height and width of the benches for iron ore and manganese ore will be kept at 6m and 12m respectively.

Drilling and blasting

Drilling is proposed to be done using 115mm diameter drills with 10% sub grade drilling. Blasting will be done by adopting the State of Art technology by using mostly SME (Site Mixed Emulsion Explosives) along with conventional explosives such as PGC, toe blast. Controlled blasting along with shock tube initiation system / NONEL system will be practiced for getting optimum blast results and minimization of hazards. Boulders generated during the course of blasting will be broken in to smaller pieces by using rock breaker.

Excavation, Loading and transportation

The mine will be operated in a three shift basis. Process of excavation and loading of overburden/waste will be done by deploying hydraulic excavators and dumpers. Excavators of 2.1m^{3}to 3.2m^3 capacities will be deployed for excavation & loading of ROM ore and dumpers 20T/35T capacity shall be deployed for transportation of ore and OB. The blasted material will be excavated by shovels of 2.1 cum – 3.2cum capacity and loaded onto 20 - 35T dumpers for transportation of the ROM, mineral reject and waste. Loading will be done mechanically. The ROM ore from different mining faces will be transported by dumpers of 20 -35T in a pre-determined proportion (for blending different qualities of ore), and delivered to the processing plant. ROM will be evacuated from the lease area by road to the destination point. Similarly for manganese ore, will be loaded to the tipper of 20t capacity.

Pravata Ku. Sahoo
Qualified Person

The lease is having Mn ore of soft and friable in nature. Therefore, drilling and blasting will be adopted for loosening of hard rock mass containing Manganiferous laterite which is about 60% of the total excavation. Blast holes will be drilled by DTH drills. The drilling details are as follows:

Extent of Mechanization

Iron ore is mostly soft and friable in nature. Blue dust also occurs in the ore zone. Therefore, drilling and blasting will be adopted for loosening of hard rock mass containing massive & laminated ore which is about 60% of the total excavation. Similarly, manganese ore zone is soft in nature and 60% of ore zone is amenable to mining without drilling & blasting. Blast holes will be drilled by DTH drills. The drilling details are as follows:

Drills

Drilling Parameters	Iron Ore Zone	Manganese Ore Zone
Burden m	2.0	2.0
Spacing m	2.5	2.5
Bench height	6	6
Output / hole m3	2.0 x 2.5 x 6 = 30 m^3	2.0 x 2.5 x 6.0 = 30m^3
Sub-grade drilling (S) (10% of the height of the bench)	0.1	0.1
Depth of the hole m	6.1	6.1
Drill diameter mm	100	32
Drilling speed m/hr	30	10
Working hours in a shift	8	8
Number of shifts per day	3	3
Annual working days	300	300
Expected utilization	85%	85%
Operating efficiency	85%	85%
Meters to be drilled/ drill / annum	30 x 8 x 3 x 300 x 80% x 80%	10 x 8 x 3 x 300 x 85%x 80%
Total Meters per annum	156060	48960

❖ **Drilling machines required**

Item	Fe-Ore Zone	Mn-Ore Zone
Volume of excavation (Max) m3	563740	1281457
Volume to be loosened through drilling and blasting	60%	60%
	343225	398982
Annual requirement of holes	768894	338244
Meterage of drilling required	11274.8	25629.8
No. of drills required to be in operation	4.34	6.08
No. of drills required (Rounded)	4	6

BLASTING:

As the nature of the ore is hard, about 60% of the total production will be obtained through blasting within iron ore zone and 60% in manganese ore zone. The proposed mining will have 6.0m height benches in iron ore zone & in manganese ore zone. Drilling will be done for blast hole by 100mmdia DTH in iron ore zone and in manganese ore zone fed by compressed air. These holes will be drilled in staggered pattern with burden and spacing of 2.0m and 2.5m in both iron and manganese ore zone. No secondary blasting will be done. Rock breaker will be utilized for the purpose.

Pravata Ku. Sahoo
Qualified Person

Drilling Parameters	Iron Ore Zone	Manganese Ore Zone
Burden m	2.0	2.0
Spacing m	2.5	2.5
Bench height	6	6
Output / hole m3	2.0 x 2.5 x 6 = 30 m^3	2.0 x 2.5 x 6.0 = 30 m^3
Sub-grade drilling (S) (10% of the height of the bench)	0.1	0.1
Depth of the hole m	6.1	6.1
Drill diameter mm	100	32
Drilling speed m/hr	30	10
Working hours in a shift	8	8
Number of shifts per day	3	3
Annual working days	300	300
Expected utilization	85%	85%
Operating efficiency	85%	85%
Meters to be drilled/ drill / annum	30 x 8 x 3 x 300 x 80% x 80%	10 x 8 x 3 x 300 x 85%x 80%
Total Meters per annum	**156060**	**48960**

Powder factor

Calculation of powder factor:-

Output / hole m3 – 30 cum or 90 tone

Explosive required 2/3rd of the hole – 14 Kg

Powder factor- 90/14 = 6.4

A powder factor of 7 tonne of saleable ore per Kg explosive is considered for estimating explosive requirement. However, this may suitably be changed depending upon the type of ore and other site conditions.

Type of explosive to be used:

High explosives will be loaded by bottom charging or deck charging. The stemming length is proposed to be one third of the hole depth. The explosive column will be blasted under 'V' type blasting pattern initiated by detonator & NONEL and safety fuse. The calculation is however made as follows:

Particulars		Iron ore zone	Mn ore zone
Max Annual Excavation in a year	=	136000 T	189000
Production to be obtained from blasting	=	136000x 0.6	189000 x 0.6
	=	81600	113400
Powder factor	=	7.0t / kg	
Explosive requirement per annum	=	81600/7	113400/7
	=	11657Kg	16200kg

Storage of Explosive

Explosive shall be out sourced from external agencies having explosive license

The major hazards associated with blasting are as follows:

i) Ground vibration and resulting damage to structure and surrounding rock strata.
ii) Fly rock
iii) Noise and air overpressure and
iv) Dust and fumes

Some of measures proposed to be adapted to restrict these hazards with acceptable limit are:

i) Provision of a safe zone of about 500m radius around the blasting location, wherever feasible.

Pravata Ku. Sahoo
Qualified Person

ii) Adopting the safe charge per day to restrict the peak particle velocity (ppv) controlled vibration as per blasting test results.

iii) Avoiding holes of uneven depth of blocked holes from tie-up sequence.

iv) Avoiding water accumulation in the holes, and if there is any water accumulation in the hole, the same has to be dewatered wherever practicable.

v) Muffing the blasting, as far as practicable , particularly where safe zone is not possible to be adhered to and

vi) Covering the detonating cords by soil layers.

Precautions Proposed to be taken for Storage and Handling of Ammonium Nitrate.

Stock of ammonium nitrate will be maintained in the store. The precautions proposed to be taken for storage and handling of ammonium nitrate are given below:

i) Ammonium nitrate would not be stored with other explosives in the magazine. It would be stored separately in waterproof bags.

ii) Ammonium nitrate should be handled like gasoline. Under all normal circumstances, the material is quite safe to handle.

iii) Under conditions of extreme heat, confinement or open flame, ammonium nitrate can be dangerous and therefore these situations will not be allowed to arise.

iv) Fertilizer grade ammonium nitrate should be stored on dry, clean floor. The floor should be constructed with non-combustible materials unless it is protected against impregnation with ammonium nitrate. Floor drains into which molten nitrate could flow and be confined in case of a fire, should be eliminated. These precautions would be taken.

v) It would be stored in a building with good ventilation.

vi) The storage premises would be of waterproof construction and on raised ground not liable to flooding.

vii) Ammonium nitrate should not be stored in close proximity to steam pipes, light bulbs and similar sources of heat.

viii) The bags of ammonium nitrate shall be stacked in piles, each pile being not more than 1m high and shall be readily accessible in case of fire.

ix) Metallic substances in powder form, combustible materials (including diesel oil and other fuels) of acids should not be left in the same storage premises.

x) The ammonium nitrate should be used in sequence of delivery to prevent accumulation of old materials.

xi) Smoking, naked light or open flame should not be allowed in the vicinity of ammonium nitrate.

xii) Flooding with water is the only effective way to fight a nitrate fire as the nitrate has its own built-in oxygen supply

Pravata Ku. Sahoo
Qualified Person

Excavation and Loading: Run-off-mine iron ore will be excavated & loaded in the 30T/35T dumpers by 2.1&3.2 m^3 capacity excavators. However, calculation has been made for higher capacity. The detailed calculation is as follows:

❖ **Excavation parameters**

Excavators		
Excavators Parameters	**For Iron ore**	**For Manganese**
C =Nominal Bucket Capacity m3	3.2	3.2
F =Bucket fill factor	85%	85%
S =Swell factor (at 25% swell)	82%	82%
t =Time cycle per pass at 90 degree swing in seconds	60	60
e=Overall efficiency working shift	80%	80%
T =Seconds per hour	3600	3600
n=Number of working shifts/day	3	3
h =Hours per shift	8	8
W = Working days in a year	330	330
A = Availability of machine	75%	75%
U = Utilization Factor	75%	75%

Rate of Production

Output/shovel/hour	(C x F x S x T)/(t)	133.824	133.824
	Or says (TPH)	134	134
Output/shovel/ year	O x h x n x w x e x A x U	1343628	1343628

Number of Excavators

Volume to be handled/ annum m3		563740	1281490
No. of excavator proposed		2	3
Additional (standby)		1	2
Total No. of excavator proposed		3	5

HAULAGE & TRANSPORT EQUIPMENT FOR ORE, WASTE & MINERAL REJECTS:

Waste will be dumped and R.O.M ore will be transported to the crushing / screening / manual processing site for sizing by using 20t to 35 t. Calculation has been made for higher capacity.

Dumper / Tipper Parameters

Parameters	**Unit**	**Iron Ore Zone**	**Manganese Ore Zone**
Dumper Capacity	Tonne	35	35
Average bucket capacity	Cum	3.2	3.2
Bucket fill factor		0.85	0.85
Swell factor		0.8	0.8
Tonnage factor	t/m3	3	3
Tonnes per pass	Tonne	=3.2 X 0.85 X 0.8 X 3 = 5.1 t	=3.2 X 0.85 X 0.8 X 3 = 5.1 t
	Tonne	6.5	6.5
No. of passes		Tonnage rating of tipper/tons per pass = 35 / 6.5	Tonnage rating of tipper/tons per pass = 35 / 6.5
	Nos.	5.3	5.3
	Nos.	5	5

❖ **Dumper / Tippers requirement**

Particular	Unit	Iron	OB	Mn
Loading time seconds	Second	360	420	540
Lead (One way)	Km	1.5	2.5	0.5
Load travel time seconds @ 10 KMPH	Second	540	900	180
Empty travel time seconds @ 15 KMPH	Second	360	600	120

Pravata Ku. Sahoo
Qualified Person

Spotting time	Second	60	60	60
Dumper cycle time	Second	1320	1980	900
Number of rear dump trucks required /shovel	Nos.	3.14	3.13	1.5
Number of excavators		3	3	2
Number of Dumpers required in all total		6	15	18

Requirement of loader

Loading will be done by mechanized method. The usable ore, mineral rejects and waste material will be loaded by the loader to the dumper. The bucket capacity of the loader will be 2.5Cu.m. The detail calculation of loader will be as follows:

Loader Parameters	For Iron ore	For Iron Mn
C =Nominal Bucket Capacity m^3	2.5	1.5
F =Bucket fill factor	80%	80%
S =Swell factor (at 25% swell)	85%	85%
t =Time cycle per pass at 90 degree swing in seconds	120	120
e=Overall efficiency working shift	80%	80%
T =Seconds per hour	3600	3600
n=Number of working shifts/day	3	3
h =Hours per shift	8	8
W = Working days in a year	330	330
A = Availability of machine	85%	85%
U = Utilization Factor	80%	80%
B. D. = Bulk Density	3	2.5

Rate of Production

Output / Loader / hour	(C x F x S x T)/(t)	51	30.6
	Or says (TPH)	153	76
Output / Loader / Year	O x h x n x w x e x A x U		
	Or says (TPA)	826200	410400

Number of Loaders

Volume to be handled/ annum Tonne			
Rate of production per Annum	TPA	136000	189000
No. of Loader proposed (Rounded)	Nos.	1	1
10% Additional (standby)		2	2
Total No. of loader proposed		3	3

Loading Machine Details

Type	Nos	Size/Capacity
Loader	3	2.5 cum
Loader	3	1.5 cum

Note: Crushing and screening will be done outside the lease area. Hence, calculation of crusher and screen has not been envisaged.

List of Machinery / equipment: Mining operation will be continued as Category-A (fully mechanized) mine. Heavy earth moving machine (HEMM) population is required to be arranged in the following manner:

Pravata Kr. Sahoo
Qualified Person

Sl. No.	HEMM Requirement	Size	HEMM Required during peak rated capacity		
			Requirement	Standby	Total
A. Excavation & Loading					
1	Shovel	3.2cum	1	1	2
1	Shovel	2.1 Cum	1	1	2
2	Shovel(Mn)	3.2 Cum	3	2	5
3	Loaders	2.5cum	1	2	3
4	Loaders	1.5 cum	1	2	3
B. Hauling(for iron, Mn and OB)					
1	Dumper	20 T	5	2	7
2	Dumper	35 T	31	2	33
D. Drilling					
2	Drill Machine	100 mm	For Mn (6nos) For Iron(4nos)	--	10
E	**Mineral Processing (Mobile)**				
	Screening Unit	400 TPH	1	1	2
	Crushing Unit	250 TPH	1	1	2
	Grizzly for Mn processing	100tph	1	1	2
F. Auxiliary Equipment					
1	Dozer	400 - 440 HP	1		1
2	Grader	120 HP	1		1
3	Rock Breaker		1		1
4	Ambulance		1		1
5	Water tanker	20 KL	4		4
6	Diesel Browser		2		2
7	Mobile Maintenance Van		4		4
8	Crane		1		1
11	Excavator for Quick Dispatch System	1 Cum	2	1	3
12	Staff bus		1		1

(e) Describe briefly the layout of mine workings, pit road layout, the layout of faces and sites for disposal of overburden/waste along with ground preparation prior to disposal of waste, reject etc. A reference to the plans and sections may be given. UPL or ultimate size of the pit is to be shown for identification of the suitable dumping site.

Lay out of mine working

It has been planned to develop block – 1,2,3,4,5 & 6 for manganese ore. The existing benches within the quarries will be moved due laterally and downward to achieve the production. At the end of plan period the dimension of the proposed quarries will be as follows:

Sl. No.	Name of the ore zone	Name of the Quarry	Dimension				Top RL	Bottom RL
			Length (m)	Breadth (m)	Area (m^2)	Area (ha)	(m)	(m)
1	Manganese	Block - 1	360	270	97200	9.72	**722**	**704**
2		Block - 2	530	350	185500	18.55	758	734
3		Block - 3	520	320	166400	16.64	734	722
4		Block - 4	610	315	192150	19.215	764	698
5		Block - 5	370	250	92500	9.25	734	656
6		Block - 6	400	370	148000	14.8	648	582
	Iron	Block - 6	400	370	148000	14.8	648	582
		Block-6 (New pit)	320	370	118400	11.84	654	582

Pravata Ku. Sahoo
Qualified Person

PIT ROAD LAYOUT
Existing Haul Road

The width of main haul road has been kept at 15m. However, width of the benches within the quarry it has been kept at 12 m which is acting as haul road and is joined with the main haul road. The width of the existing haul road quite sufficient for movement of fleets smoothly.

Proposed Haul Road

The width of main haul road is kept at 15m which is the way for the entry into the blocks. Further, the benches of the proposed quarry will be utilized for haul road. The bench width has been kept at 12m and after putting the berm width of 1m, the bench width will remain 10m.It is proposed to deploy 20t dumper for the transportation purpose which can smoothly pass through the proposed road. The gradient of the haul road 1:16. In case of ramp the gradient will be maintained at 1:12.

Similarly for Iron ore the width of main haul road has been kept at 15m and the width of benches of proposed quarry will be 9m and after putting the berm width of 1m, the bench width will remain 10m.It is proposed to deploy 35t dumper for the transportation purpose which can smoothly pass within the proposed road.

Site for disposal of waste along with ground preparation

Selection of dumping site mostly depends upon the factors like topography, drainage, land use, mineral inventory, pit configuration, mine waste characteristics, its volume of generation and economy in transportation. During plan period, the dumping will be done on eastern extension of Dump-H and over the dump-A. The earmarked area in Dump-H is already proved barren by exploration of 24 boreholes having nos D1, D2, D3, D4, D5, D6, D7, D8, D9 etc. The Dump A is a old dump and is already proved barren by exploration of 25 boreholes having nos BH-365, 366 etc. During the proposed mining operation overburden and waste materials will be generated in considerable amount. These waste materials are proposed to be dump in selected dump yard properly. The proposed dumping ground within the lease area is absence of mineral deposits and is outside the UPL.

Garland drain will be made all around the retaining wall to receive the wash-off materials coming out of the retaining wall during rain. Finally, run-off water in garland drain will be allowed to pass through a settling tank to settle the silt content and release clean water to the natural drainage course. Silt content settled by the retaining wall, garland drain and settling tank will be cleared periodically.

Site for disposal of mineral rejects along with ground preparation

The proposed mineral rejects will be stored temporarily near camp site over the granted surface right area. No ground preparation is required as stacking of mineral reject stock are already continuing in the same area.

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

- **LIFE OF THE MINE**

	Particulars	Manganese ore	Iron ore
A.	Total reserves under proved & probable category	3783655	704833.9
B.	Production during 5 years of plan period	562560.2	272000.3
C	Balance reserves for conceptual period	3221095	432833.7
D	Production per annum	189000	136000
E	No of years production will be carried out during Conceptual period	17.04283	3.1826
F	Life of the mine(plan period + conceptual period)	17+5=22	3+5=8

Further, the life of the mines may not hold constant for all the time. Based on the market demands the life of the deposit may increase or decrease, accordingly the life of mine may vary from time to time.

Pravata Ku. Sahoo
Qualified Person

- **TIME FRAMES FOR COMPLETION OF EXPLORATION WITHIN THE LEASE HOLD AREA**

The lease area has been explored both in G1 and G2 level. Total .....nos of bore holes have been proposed during plan period. It has been planned convert the entire potential mineralized area under G1 level. Accordingly, the reserve may be changed based on the bore hole results.

- **ULTIMATE EXTENT & SIZE OF THE PIT**

Existing pit position

At present 278.109Ha is already degraded due to mining. None of the area has been exhausted till date.

Pit position during plan period:

Sl. No.	Name of the ore zone	Name of the Quarry	Dimension			
			Length (m)	Breadth (m)	Area (m^2)	Area (ha)
1	Manganese	Block - 1	360	270	97200	9.72
2		Block - 2	530	350	185500	18.55
3		Block - 3	520	320	166400	16.64
4		Block - 4	610	315	192150	19.215
5		Block - 5	370	250	92500	9.25
6		Block - 6	400	370	148000	14.8
	Iron	Block - 6	400	370	148000	14.8
		Block-6 (New pit)	320	370	118400	11.84

Pit position at the end of conceptual period:

The ultimate pit limit for iron and manganese ore has been delineated considering the mineablility of ore at the end of the life of the mine. Ultimately, there will be one pit at the end of life of the mine for manganese ore and iron ore. Ultimate extent and size of the quarry will be as follows:

Name of the UPL	Size (m x m)	Ultimate Extent		Top RL	Bottom RL
		(m^2)	(in hectares)		
UPL-1	2895 x 1160	3355712	335.57	764	526

Optimum Exploitation & Utilization of Minerals: Based on the exploratory evidences, the ultimate working depth will be 526 mRL. Height and width of the benches will be kept at 6m each for iron ore and 6m each for manganese ore to (a) mine out the optimum amount of ores from the quarries, (b) keep the ultimate pit slope safe & stable and (c) maintain final slope angle of the pit at around 45^0 with the horizontal.

Final slope angle at the close of mine:

The individual bench slope would be kept nearly vertical, height and width of the benches would be kept at 6m for iron ore and Mn ore. The individual bench slope will be kept at 85^0 with the horizontal whereas the overall quarry slope angle would be maintained at 31^0 to the horizontal during plan period as well as at the end of the life of the mine.

Ultimate capacity of dump

The dump has been planned to be created considering the topography, barrenness of ore/mineral, ultimate pit limit. The details of back-filling during plan period are furnished below:

Pravata Ku. Sahoo
Qualified Person

Plan period
Waste generation

Year	Iron ore Zone			Mn ore Zone			
	Intercalated waste (m^3)	Overburden and side burden (m^3)	Total Waste (m^3)	Intercalated waste (m^3)	Overburden and side burden (m^3)	Total Waste (m^3)	Total Waste(m^3)
2020-21	163200	346140	**509340**	60577	266220	**326797**	**836137**
2021-22	163200	172890	**336090**	60577	408720	**469297**	**805387**
2022-23	163200	257200	**420400**	60577	1027670	**1088247**	**1508647**
2023-24	163200	251200	**414400**	60577	1072820	**1133397**	**1547797**
2024-25	163200	253600	**416800**	60577	1108380	**1168957**	**1585757**
Total	**816000**	**1281030**	**2097030**	**302885**	**3883810**	**4186695**	**6283725**

Waste management during plan period

As per the above table, it is envisaged that 2097030cum from iron ore zone and 4186695cum from manganese ore zone will be generated. Waste from manganese ore will be disposed of at Back-filled area -1, 2,3 dump-A and H and waste from iron ore will be disposed of a Back-filled area -3. Out of total waste generation about 20% will be utilized for road maintenance and balance 80% will be back-filled/dumped during plan period. The details of utilization of waste will be as follows:

Waste Management during plan period
Manganese ore zone
Road maintenance

Year	Manganese ore Zone			Road Maintenance @20%
	Intercalated waste (m^3)	Overburden and side burden (m^3)	Total Waste (m^3)	
2020-21	60577	266220	326797	65359.0
2021-22	60577	408720	469297	93859.4
2022-23	60577	1027670	1088247	217649.4
2023-24	60577	1072820	1133397	226679.4
2024-25	60577	1108380	1168957	233791.4
Total	**302885**	**3883810**	**4186695**	**837339**

BACKFILLING – 1

Year	Waste to be backfilled (cum)	Area of Back filling (m2)	Top RL(m)	Bottom RL(m)
2020-21	78431	10882	670	662
2021-22	112631	11334	680	670
2022-23	261179	11690	690	680
2023-24	272015	3268	690	700
2024-25	280550	5299	690	700
Total	1004807	**42473**		

Pravata Ku. Sahoo
Qualified Person

BACKFILLING – 2

Year	Waste to be backfilled (cum)	Area of Back filling	Top RL(m)	Bottom RL(m)
2020-21	65359	10883	730	721
2021-22	93859	11334	740	730
2022-23	217649	11690	750	740
2023-24	226679	3268	760	750
2024-25	233791	5299	770	760
Total	837339			

Dumping
Dump – A

Year	Waste to be dumped (cum)	Area of Dumping	Top RL(m)	Bottom RL(m)
2020-21	65359	21765.18	746	723
2021-22	93859	22668.18	756	746
2022-23	217649	23379.38	773	756
2023-24	226679	6535.89	789	773
2024-25	233791	10597.48	789	773
Total	251202			

Dump – H

Year	Waste to be dumped(cum)	Area of Dumping (m2)	Top RL(m)	Bottom RL(m)
2020-21	52288	21765.18	670	655
2021-22	75088	22668.18	685	670
2022-23	174120	23379.38	700	685
2023-24	181344	6535.89	715	700
2024-25	187033	10597.48	730	715
Total	**209335**			

IRON (BLOCK-6)
Backfilling – 3

Year	Total generation (cum)	Road maintenance (cum)	Back-filling (cum)	Area of Backfilling (m2)	Top RL	Bottom RL
2020-21	509340	101868	407472	21765.18	566	556
2021-22	336090	67218	268872	22668.18	576	566
2022-23	420400	84080	336320	23379.38	586	576
2023-24	414400	82880	331520	50934.02	596	586
2024-25	416800	83360	333440	30889.01	596	586
Total	**2097030**	419406	1677624			

Quantity of waste to be generated during conceptual period.

During conceptual period it has been envisaged that about 5424976cum from manganese ore and 1992058 cum of waste will be generated from iron ore zone.

Utilization of conceptual waste

As per the above table, waste generation during conceptual period is 5424976cum from iron ore zone and 1992058cum from Manganese ore zone. The total waste so generated will be utilised for back-

Pravata Ku. Sahoo
Qualified Person

filling of mined out land. This will be utilised for back-filling of exhausted pit during conceptual period.

The details of back-filling during conceptual period will be as follows:

Year	Back-filling No	Area(m2)	Volume of waste to be back-filled (m3)	Top RL
Beyond 2024-25	1	671938	2207196	650
	2	188359	1565492	700
	3	188993	1565492	730
	4	802107	2078855	650
	Total	**1851397**	7417034	

Bench plantation during the conceptual Period

A total of 150.37Ha will be covered under plantation during conceptual period. The details of bench plantation will be as follows:

YEAR	Bench Plantation No	Area(m2)	Top RL	Bottom RL	Nos of Plants(@ 1600/Ha.)
Beyond 2024-25	1	**1503700**	650	545	240592

Generation of Mineral Rejects:

During conceptual period mineral reject of Manganese ore available is 3441073MT and that of iron is 544248MT. The mineral rejects will be temporarily stored and blended with high grade ore to make it saleable.

Environmental Aspects
Land Degradation/Utilization:

Head	Existing (Ha)	Proposed Land use After plan period (Ha)	At the end of Conceptual period (Ha)
Area to be excavated	278.109	304.109	335.57
Storage for top soil	0.00	-	-
Overburden/Dump	51.75	51.75	80.037
Mineral Storage	63.872	63.872	23.151
Infrastructure	2.32	2.32	1.480
Mine camp	15.416	15.419	11.870
Roads	19.25	23.330	23.33
Railways	-	-	-
Green Belt	19.79	29.79	34.865
Tailing Pond(settling pond)	0.00	0.00	-
Effluent treatment plant	0.000	0.000	
Mineral processing plant	1.488	1.488	1.488
Total (Area used for mining)	**451.995**	492.075	**511.791**
Other (Land used for public purpose + Plantation)	261.515	221.435	201.719
Total Lease Area	**713.510**	**713.510**	**713.510**

Grass Seeding: -

It is suggested to sow grass seeds along the slope of terrace of waste dump and bench slope for preservation of top soil during the process of reclamation and rehabilitation of conceptual period. The grass shall be fresh free from weed and rank vegetation but leaving rhizome with sufficient

Pravata Ku. Sahoo
Qualified Person

nodes. Other soil forming local grasses like dichathium annultum, cenchrusciliaris, stand panicum, repones (lemon grass) vertiver grass, elephant grass, citrella A, baughanvilla, would also be useful preferably a mix of the above grass.

Afforestation

During plan period it has been planned to make plantation over vacant area in the northern part of the lease area. Further, after back-filling, it has been planned to make plantation over back-filled area(B1, B2, B3 and B-4). During plan period, about 11.50Ha will be covered under plantation. The details of Plantation will be as follows:

Year	Vacant Area	Back-filled area	Total Area Proposed(Ha)	No. of saplings
2020-21	0.5	1.5	2.0	4000
2021-22	0.5	1.5	2.0	4000
2022-23	0.5	1.5	2.0	4000
2023-24	0.5	2.0	2.5	5000
2024-25	0.5	2.5	3.0	6000
Total	2.5	9.0	11.5	**23000**

RECLAMATION / REHABILITATION

Proposed:

During ensuing plan period 26.00ha additional area will be utilized for mining activities. Hence, at the end of 2024-25 total area under mining will be 304.109Ha.

Reclamation & rehabilitation measures during ensuing plan period.

During plan period

Year wise generation and utilization of waste during plan period are furnished below;

Manganese ore zone

BACKFILLING – 1

Year	Waste to be backfilled (cum)	Area of Back filling (m2)	Top RL	Bottom RL
2020-21	78431	10882	670	662
2021-22	112631	11334	680	670
2022-23	261179	11690	690	680
2023-24	272015	3268	690	700
2024-25	280550	5299	690	700
Total	1004807			

BACKFILLING – 2

Year	Waste to be backfilled (cum)	Area of Back filling (m2)	Top RL	Bottom RL
2020-21	65359	10883	730	721
2021-22	93859	11334	740	730
2022-23	217649	11690	750	740
2023-24	226679	3268	760	750
2024-25	233791	5299	770	760
Total	837339			

Pravata Ku. Sahoo
Qualified Person

IRON (BLOCK-6)

Backfilling – 3

Year	Total generation (cum)	Road maintenance (cum)	Back-filling (cum)	Area of Backfilling (m2)	Top RL	Bottom RL
2020-21	509340	101868	407472	21765.18	566	556
2021-22	336090	67218	268872	22668.18	576	566
2022-23	420400	84080	336320	23379.38	586	576
2023-24	414400	82880	331520	50934.02	596	586
2024-25	416800	83360	333440	30889.01	596	586
Total	**2097030**	419406	1677624			

Back-filling During Conceptual period

It has been planned to back-fill and make plantation over 185.1397Ha during conceptual period.The details of back-filling and plantation will be as follows:

Year	Back-filling No	Area(m2)	Volume of waste to be back-filled (m3)	Top RL
Beyond 2024-25	1	671938	2207196	650
	2	188359	1565492	700
	3	188993	1565492	730
	4	802107	2078855	650
	Total	**1851397**	7417034	

Bench-Plantation

After exhaust of iron and manganese ore, the dead benches will be reclaimed by means of plantation. About 150.37Ha of mined out land will be covered under plantation during conceptual period.

Post Mining Land use Pattern

Based on the existing exploration status, ultimate pit limits have been earmarked. Infrastructures will be demolished. Road will be left as such for public use. Mineral separation plant area will be rehabilitated by way of plantation after cessation of mineral processing. However, the post mining land use pattern will be as follows:

Head	Conceptual Land use (Ha)	Method of reclamation
Area to be excavated	335.57	Back-filling and Plantation-185.139Ha
		Bench-plantation- 150.37Ha
Storage for top soil	-	
Overburden/Dump	80.037	Plantation
Mineral Storage	23.151	Plantation
Infrastructure	1.480	Plantation
Mine camp	11.870	Plantation
Roads	23.33	Public use
Railways	-	--
Green Belt	34.865	Plantation
Mineral processing plant	1.488	Plantation
Total (Area used for mining)	511.791	
Other (Land used for public purpose + Plantation)	201.719	
Total Lease Area	713.510	

B. Underground Mining

Not Applicable

Pravata Ku. Sahoo
Qualified Person

CHAPTER - 3
MINE DRAINAGE

3.0 Mine drainage:

3.1 Maximum and minimum depth of water table:

Siljora Manganese & Iron Mine is situated in a hilly terrain with maximum RL of 768m and minimum bottom RL of 676 m. within the lease area. Due to sloped surfaces and prevailing of several streams and streamlets the area is well drained and there is no chance of any flood in this area. A perennial stream flows along the western boundary and is roughly taken as the boundary line. Another stream flows beside the boundary lines in the eastern flank. It is also a perennial one.

3.2 Indicate maximum and minimum depth of working:

At present mining operation is at an RL of 748 m which will go up to RL of 526 m in conceptual period. As ground water table is at an RL of 504 m.

At present at the bottom of the quarry manganese ore along with shale is exposed. The shale patch at the floor of the quarry represents very low porosity. As a result rainwater creates water logging at the some places of quarry floor. This water will ultimately be used for water sprinkling on mine road through static/truck mounted water sprinkler and other purposes in the mines.

3.3 The area receives an appreciable amount of rainfall which is on an average 1492 mm per annum (May to Oct):

The water runoff has been channelized and being passed through retaining wall, check dam and settling pond before leaving the lease area. As a result the silt free runoff will go out of the lease. The water quality analysis result of all locations including nallas/rivers near to the lease show that all the parameters are within the prescribed limits as per the standard of IS:10500 and IS:2296(class C). Rain water runoff only likely to cause turbidity for which retaining wall check dams/settling ponds has been constructed at strategic locations below the dumps, within rain cuts etc. The check dams within rain cuts are constructed by boulders to check the speed of the water, as well, the wash off material also get arrested. The water after passing through the retaining wall, garland drain is collected in settling tanks. The over flow, free from silt only allowed to leave the lease area.

3.4 Regional & local drainage pattern, Annual rainfall, catchment area, quantity of rain water to flow through the lease area, arrangement for arresting sold wash off etc.:

The area is an undulating hilly terrain. Surface elevation within lease varies in between 768 m AMSL and 676 m AMSL. The top of the hill is more or less undulated. Revenue land of two villages namely Siljora and Kalimati falls within the lease area. The area between Siljora & Kalimati is divided by a valley, running north to south and having a steep slope on either side which are traversed by some seasonal streams. The streams flows from east to west in western side and north to south as well as N W to S E in other areas. There is another valley in the N E flank of Siljora plateau. The buffer zone (5km radius) is drained by perennial streams i.e. Jalpa in the south and Turivilnala in the north. There are some seasonal streams which join in the perennial streams.

Pravata Ku. Sahoo
Qualified Person

The rainy season lasts from early June to end of September. The average annual rainfall (last 20 years) of the area is 1640mm.The average rainfall of the area during May to October was found to be 1492mm. The area belongs to sub-tropical monsoon climate. The monsoon is characterized by wet and dry spells, high intensity, short duration and variation over space. The area experiences occasional high intensity of rainfall. In the last 10 years, the area has experienced maximum rainfall of 225mm on 20 th August, 2007. The average (10 years) max. daily rainfall of the area is 138.55mm. Rainfall intensity more than 138.55mm/day or 140mm/day is rare and may be occurring in the area once or twice in a year. Surface runoff with 140mm/day rainfall with respect to different regions of the lease area is described below. Quarries have already taken shapes of depression. Runoff generated from these areas is being retained in the area itself. There is no scope of runoff being overflow the area irrespective of the intensity of rainfall. Runoff generated from the individual quarry is given in details.

Quarry 1 &2:

The total quarry area is 10,19,000 sq.m. Surface runoff generated from the area remains within the area in 5nos. of quarry bottom/depressions which serve as retention ponds. The runoff generated with 140mm/day and taking runoff coefficient factor of 0.5 is given as below.

Runoff (m3)= Area (m2)x Rainfall (m)x Runoff Coefficient factor

=1019000 m2x0.14 mx0.5=71,330 m3/day.

The combined storage volume of 5nos. of depressions is much more than the volume of surface runoff.

Quarry in block 6 & its surrounding Area:

The total area of quarry in block-6 and its surrounding area is 655800 sq.m. Runoff generated from the area is partly retained in the quarry and rest retained in the depression on the east side. The volume of runoff generated with 140mm/day rainfall and 0.4% as runoff coefficient is 36725 m^3.

Dump-E (Already stabilised):

Total dump-E area is 7963 sq.m. Surface runoff generated from the dump area is being retained in the de-silting ponds south of it. There are two (2) nos. of de-silting ponds with total area of 4000 sq.m with average depth of 2.0m and combined storage capacity of 8000 m^3. In case of max. intensity of 140mm, 445 m^3 runoff will be generated which will be retained in the ponds.

Dump-A & Surrounding Sloping Area:

The total dump-A and surrounding sloping area is 582000 sq. m from which runoff is accumulated in a depression of 72700 sq. m area. With rainfall intensity of 140mm/day and runoff coefficient factor of 0.5%, 40700 m^3 runoff will be available which can be retained in the depression.

Pravata Ku. Sahoo
Qualified Person

Establishment Area:

Colony, office and hutting constitute the establishment area. Roof-top rainwater harvesting* and artificial recharging to ground water structures have been constructed to cover part of the existing roofs. The structures have been constructed taking max. hourly intensity of 25mm rainfall. So the structures can sustain max. day intensity of 140mm.

Maximum area of the lease is virgin, no mining activity is going. These areas are step covered with lots of vegetation. Only a little portion is used as dump-H & E. From this area runoff generated is going out of the lease area in existing natural nalas. Except dump H & E, all other area contribute very little loads to the surface runoff. Measures have been taken to reduce the load.

Arrangement for arresting solid wash off etc.

Siljora -Kalimati Manganese and Iron Mines of M/s. Rungta Mines is managing storm water from the very beginning of mining. Various measures have been taken up and measures are being taken up in view of the changing land use pattern. Siljora-Kalimati Mines spreads over a huge area of 715.639 hectares. There is variation in the topography as well as slope within the lease area. Direction of Surface flow is wide. Moreover mining activities such as quarry, dump area, mineral stack area, non-mining area, road and establishment are dispersed over the lease area. So the approach towards arrangement of solid wash off is area specific and within each area approach are in conformity with the pre-developed hydrology or topography. But the basic aims of the management practices are

1. To prevent the surface runoff to take a shape of a storm. This is achieved through detaining/arresting the surface runoff at or near the source of its generation.
2. Wherever there is storm, efforts have made to reduce their impact

Micro-level controls have been taken up at distributed locations and these controls are in the form of construction of Rainwater Harvesting structures. Storage structures have been constructed at strategic locations to catch the surface runoff generated locally. Moreover, quarry bottom also act as retention pond by default for storage of runoff from the entire quarry. The stored surface runoff either percolates downward and join in underlying ground water resources or used or lost due to evaporation. All these efforts minimize the volume of surface runoff going out of lease area. Retention wall on the toe of dump has been constructed. Check dams have been constructed on the natural flow channel to reduce the impact of storm. The dump slope is covered with coir netting to prevent rain cuts. From the strom water management point of view entire area has been categorized on the basis of

A. Area where Storm water (surface runoff) is being generated and retained within the area i.e. quarries and abandoned old quarries.

B. Area where generated surface runoff is being retained in nearby natural depression, or flow towards nearby quarry pit & get retained or retained in artificial de-silting pond.

Pravata Ku. Sahoo
Qualified Person

Topographically low lying depression has been converted to retention ponds. These area constitute overburden dump, unused vacant space and adjoin quarry area. Runoff generated remains inside lease area.

C. Area where runoff generated is partly retained and harvested and recharged to ground water system and rest is being allowed to flow to nearby streams. Such area constitute the establishment area i.e. office, colony, hospital, hutting etc.

D. Area where runoff is allowed to join in natural streams but with little measures to reduce the impact of runoff. These area mainly constitute the dumps and unused area in south, south-west of the lease area, north-west and south-east of the lease area.

Approaches taken towards the category of the area described above is being given below in details.

From mining point of view entire area has been divided into 6 blocks namely 1,2,3,4,5 and 6 . Presently mining activities is going on in blocks no. 1,2, 3, 4, and 5. Again each block has numbers of quarries.

Rain falling on entire quarry area flow towards the pit bottom (sumps) where it is being accumulated for storage. So, entire rainfall (surface flow) on quarry area remain inside the quarry area.

Block 6 constitutes numbers of active and inactive quarries. Some quarries retain the surface flow due to rain over their surface. Surface runoff from some portion flows towards a natural depression on the east (right side) where it is being retained. The natural depression serves as a retention pond where surface flow gets accumulated and percolates down.

There are old abandoned/inactive quarries in the lease area. These quarries are in the shape of small depression. These quarries retain rainfall over their surface and do not generate surface runoff going out of the area.

The present active excavated quarry area is 113.54 ha. So the surface runoff generated in these excavated area remain within the area and does go out of the lease area.

Overburden and non-mineral containing rock are dumped in specific area known as dump area and back filled area. There are 8nos. of such area numbering A,B,C,D,E,F,G, and H. Runoff generated over these area is being managed properly. Runoff generated over some of the dump area is being channelized to nearby quarry bottom or depressions where it is retained.

Dump-A exists in the north-east of the lease area in between block 1 & 2 in west and a natural depression in the east. Surface runoff from the eastern portion goes to the depression and from the west goes to quarries 1 & 2 where it is being retained cent percent. Surface runoff from this dump does not go out of the lease area. Measures have been taken to reduce the impact of surface runoff. Coir-netting, catch drains, retaining walls and vegetation have been established.

Pravata Ku. Sahoo
Qualified Person

Dump-E is located in the south-east in block-6 of the lease area and it is well vegetated. Garland drain and retaining wall have been constructed in east and south of the dump. Surface runoff generated from the dump is channelized to de-silting pits constructed south of the dump. Vegetation has been grown on the dump to reduce the impact of the runoff.

Depression no.3 has been converted in to a rainwater harvesting reservoir. Surface runoff from the surrounding area is being retained in the reservoir. The harvested rain water is being utilized for dust suppression, green belt development and maximum is being recharges to ground water system through natural seepage.

Depression no .2 serves as a retaining pond for surface runoff generated from the surrounding area. Runoff generated partly from quarry 6, dump-E and the area lying north of the depression gets accumulated. Garland drains have been provided to channelize runoff from dump and quarry area.

This category of area comprises of area from which surface runoff goes out of the lease area. This area comprise of mainly non-mining virgin area and dump area. These area are the southward face of the mountain ranges and their valley portion, establishment in the south-east, virgin area in the north west and area in patches in north-east. This area slopes away from the lease area. This area is covered with lots of vegetation. Surface runoff generated over the area except dump area carries less load due to covered surface. On the basis of direction of surface flow, the entire area has been divided in to five (5 nos.) of sectors.

Dump-H is the oldest dump of the Siljora-Kalimati Mines. Dump-H is located in the north-west of the lease area. Dump surface slopes towards west. Measures have been taken to reduce the impact of surface runoff over the dump. Some portion of the dump surface is covered with coir net. Around 980m.long retaining wall has been put on the toe portion of the dump. Garland drains have been constructed on benches of the dump to channelize surface runoff. Slope of the dump surface and slope of bench and their width have been designed and maintained properly for smooth flow of surface runoff and to reduce impact of runoff. Vegetation has been grown on dump to reduce the impact of surface runoff. Surface runoff generated over the dump flows through natural streams which ultimately go to Jalpanadi. Check dams have been constructed along the streams to arrest the silt or load if any in the runoff. Silt accumulated on check dams are being de-silted at regular intervals.

Dump-D exists south of dump-H in block-2. Surface runoff from this dump flow southward and join in river Jalpa. Measures have been taken to reduce the impact runoff on dump surface. Dumps have been provided with benches and vegetation are grown on the dump surface.

Non-mining area constitute a major part of the area and the total area is around 274 hectares. These area are the southward faces of hills Jeraida and Bishadharapaharh and their valley. The surface elevation varies from 760m to 560m AMSL with very steep slope in

Pravata Kr. Sahoo
Qualified Person

the north and slope decrease southward. This area is covered with dense forest. Surface runoff generated from this area does not come in contact with mining activities except at some pockets and hence more or less is contamination free. Runoff goes through numbers of seasonal nalas which join in Jalpanadi. On some of the streams where there is possibility of silt, check-dams have been constructed to control silt.

Sector 2 area constitute plantation, establishment i.e. colony, hutting and mining office. This area is almost flat and occasional runoff generated goes to Jalpanadi. Runoff, if any is uncontaminated and carries less load.

Sector-3 is a valley on the top of hill sloping towards north-east. The valley slopes towards the lease area of OMC. There is an abandoned old quarry on top and one abandoned OMC Quarry on the downward side. Surface runoff generated from the area get accumulated on OMC quarry, loose its load if any and overflow to nala down. The sector is covered with dense vegetation. Possibility of load in runoff is very remote.

Sector-4 is plateau with flat surface at the extreme north-western part of the lease area. The edge of the plateau is sloping towards northwest. This is a barren non-mining area with little back filled. Surface runoff flow towards north-west along nala on the valley of the slope and join in Kakrapaninala.

Sector-5 comprises of dump-C and surrounding area. Surface runoff generated from the area flows under gravity towards east and goes out of the lease area. The total area of the dump is around 2.4 hec.

Mineral stack yard are the space used for temporary storage of minerals. Presently all the stack yards are located within the area where runoff generated is retained in quarries or surface runoff retaining ponds.

To arrest the wash off generated from mining area during rain, the following Engineering structure will be required. Details are given below:

1. Garland drain at the toe of Dump/Stack.
2. Retaining wall at the toe of dump/stack
3. Terracing on dump slope
4. Catch drain on dump slope check dam within the small steams
5. Check dam within the small streams
6. Settling tank

Engineering construction design and other required for the above is discussed below.

1) **Garland drain**:

Cleaning of Jungle & bushes will be done. Then earth work in hard soil in embankment roads within 50m. initial lead and 1.50 m. initial lift including rough dressing & breaking clods to maximum 5 cm. to 7 cm & laying layers not exceeding 0.30 mtr depth as per specification with proper compaction with HRR excavation. Rough stone dry packing with local boulders.

Pravata Ku. Sahoo
Qualified Person

Size of garland drain:
Width- 1.5 mt
Depth -1.0 mt
Length- variable

2) **Retaining Wall:**

Rough stone dry packing with local boulder. Irregular cement sand patches on the both side of the wall with 2" thick cement sand mortar (1:6) on top

Size of retaining wall:

Width -1.50 m
Height above ground- 1.20 m
Below ground-0.30 m
Length-variable

3. **Terracing on dump slope:**

Terrace of height upto 10MT and width upto 10mt will be done at dump slope by engaging exaction on hour basis.

4. **Catch drain on dump slope:**

Rough stone dry packing with local boulders will be done on the slope of the dump in selected area. Then no. of steps will be made on the stone patched slope. Then the total stone patched area will be covered by cement + sand + stone mixture

Size of catch drain:

Width–Upto 3.0 mtr

Depth- Upto 0.8/ mtr

Length-Variable.

5. **Check dam with small stream:**

Earth work is hard soil in embankment roads within 50 mtr. Initial lead & 1.50 mtr. Initial lift including rough dressing & breaking clods to maximum 5.0 cm to 7.0 cm & laying layers not exceeding 0.30 mtr. Depth as per specification approved by department along with proper compaction. Then check dams will constructed with plain cement concrete.

Above ground level height will be 1.0 mt., width will be 3.5 mt. wing wall width 0.40 mtr. and height 1.00 length of check dam will be upto 4.0 mtr.

Below ground level of check dam there will be base, wing wall, approximate and cut of wall.

6. **Settling tank:**

Earth work in hard soil in embankment roads within 50 mt. initial lead & 1.50 mtr. initial lift including rough dressing & breaking clods to max. 5.0 cm to 7.0 cm & laying layers not exceeding 0.30 mtr. depth as per specification. Rough stone dry packing with local boulders.

Size of settling tank:
Length-upto 15 mtr

Pravata Ku. Sahoo
Qualified Person

Width-10mtr
Depth-upto2 mt
Side stone packing- Upto 1.0 mt.

The area falls in Sub-Tropical monsoon climate with average monsoon rainfall of 1470mm. The rainfall generates huge surface runoff in the lease area. The mine has taken up measures to manage runoff being generated. Surface runoff generated in the virgin barren land is allowed to flow through natural nallas (streams). Runoff generated in mining and allied activities such as dump & back filled area being hold/harvested and stored in quarry bottoms which is being recharged to ground water system through natural seepage. In some quarry bottoms harvested water is also available for use for different purposes. To reduce the impact surface runoff, dump surface is covered with coir matting and grass/vegetation. Garland drains, retention wall, catch drains, rainwater harvesting ponds and de-silting pits have been constructed across flow paths.

Runoff generated from roof area of the colony and other establishments are harvested and recharged to ground water system.

The mine is practicing conservation of water through various measures. The STP treated water is being used for green belt development and dust suppression. Surface run off generated over quarry area is being used for dust suppression and green belt development.

Pravata Ku. Sahoo
Qualified Person

CHAPTER-4.0

4.1 Indicate briefly the nature and quantity of Top soil, overburden/waste and mineral reject to be disposed off.

Nature of Top soil: During plan period top soil generation is observed to be nil.

Nature of Overburden/side burden waste/Intercalated waste: Iron with less than 45%Fe containing laterites, & shale, BHJ/BHQ etc. has been considered as waste. The material above the ROM termed as over burden and occurs side of the ROM has been considered as side burden.

Mineral Reject: As per guidelines of IBM threshold value of iron ore is considered as 45% Fe and calculation of reserves is done under different range of Fe% i.e. 45 to 55% Fe and 55 % Fe above. While above 55% Fe ore is termed as saleable/usable iron ore, below that up to 45% Fe is termed as mineral reject. Similarly, threshold value of Manganese ore has been considered as 10%Mn and cut-off grade has been considered as 25%Mn.

Year wise generation of waste and mineral reject during plan period and its utilisation:

Iron ore

Year	Top soil		Waste (cum)				Mineral Reject (cum)			
	Re use/ spreading	Storage	Total generation	Back-filling	Storage (Dumping)	Utilisation	Generation	Blending @ 80%	Storage @ 20%	Beneficiation
2020-21	0	0	509340	407472	0	101868	48960	39168	9792	0
2021-22	0	0	336090	268872	0	67218	48960	39168	9792	0
2022-23	0	0	420400	336320	0	84080	48960	39168	9792	0
2023-24	0	0	414400	331520	0	82880	48960	39168	9792	0
2024-25	0	0	416800	333440	0	83360	48960	39168	9792	0
Total	**0**	**0**	**2097030**	1677624	0	419406	244800	195840	48960	**0**

Manganese ore

Year	Top soil		Waste (cum)				Mineral Reject (cum)			
	Re use/ spreading	Storage	Total generation	Back-filling	Storage (Dumping)	Utilisation	Generation	Blending @ 80%	Storage @ 20%	Beneficiation
2020-21	0	0	326797	143790	117647	65359	101250	81000	20250	0
2021-22	0	0	469297	206490	168947	93859	101250	81000	20250	0
2022-23	0	0	1088247	478828	391769	217649	101250	81000	20250	0
2023-24	0	0	1133397	498694	408023	226679	101250	81000	20250	0
2024-25	0	0	1168957	514341	420824	233791	101250	81000	20250	0
Total	**0**	**0**	**4186695**	1842143	1507210	837339	506250	405000	101250	**0**

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

Selection of dumping site mostly depends upon the factors like topography, drainage, land use, mineral inventory, pit configuration; mine waste characteristics, its volume of generation and economy in transportation etc. Total four locations have been selected for dumping during plan period of 5 years. All the dumps have been proposed outside the Ultimate Pit Limit.

Pravata Ku. Sahoo
Qualified Person

During plan period, the dumping will be done on eastern extension of Dump-H and over the dump A. The earmarked area in Dump-H is already proved barren by exploration of 24 boreholes having nos D1, D2, D3, D4, D5, D6, D7, D8, D9 etc. The Dump A is a old dump and is already proved barren by exploration of 25 boreholes having nos BH-365, 366 etc. During the proposed mining operation overburden and waste materials will be generated in considerable amount. These waste materials are proposed to be dump in selected dump yard properly. The proposed dumping ground within the lease area is absence of mineral deposits and is outside the UPL.

Garland drain will be made all around the retaining wall to receive the wash-off materials coming out of the retaining wall during rain. Finally, run-off water in garland drain will be allowed to pass through a settling tank to settle the silt content and release clean water to the natural drainage course. Silt content settled by the retaining wall, garland drain and settling tank will be cleared periodically.

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.

Plan period
Waste generation

Year	Iron ore Zone			Mn ore Zone			Total Waste(m^3)
	Intercalated waste (m^3)	Overburden and side burden (m^3)	Total Waste (m^3)	Intercalated waste (m^3)	Overburden and side burden (m^3)	Total Waste (m^3)	
2020-21	163200	346140	509340	60577	266220	326797	836137
2021-22	163200	172890	336090	60577	408720	469297	805387
2022-23	163200	257200	420400	60577	1027670	1088247	1508647
2023-24	163200	251200	414400	60577	1072820	1133397	1547797
2024-25	163200	253600	416800	60577	1108380	1168957	1585757
Total	**816000**	**1281030**	**2097030**	**302885**	**3883810**	**4186695**	**6283725**

Waste management during plan period

As per the above table, it is envisaged that 2097030cum from iron ore zone and 4186695cum from manganese ore zone will be generated. Waste from manganese ore will be disposed of at Back-filled area -1, 2,3 dump-A and H and waste from iron ore will be disposed of a Back-filled area -3. Out of total waste generation about 20% will be utilized for road maintenance and balance 80% will be back-filled/dumped during plan period. The details of utilization of waste will be as follows:

Waste Management during plan period
Manganese ore zone
Road maintenance

Year	Manganese ore Zone			Road Maintenance @20%
	Intercalated waste (m^3)	Overburden and side burden (m^3)	Total Waste (m^3)	
2020-21	60577	266220	326797	65359.0
2021-22	60577	408720	469297	93859.4
2022-23	60577	1027670	1088247	217649.4
2023-24	60577	1072820	1133397	226679.4
2024-25	60577	1108380	1168957	233791.4
Total	**302885**	**3883810**	**4186695**	**887330**

Pravata Ku. Sahoo
Qualified Person

BACKFILLING – 1

Year	Waste to be backfilled (cum)	Area of Back filling (m2)	Top RL(m)	Bottom RL(m)
2020-21	78431	10882	670	662
2021-22	112631	11334	680	670
2022-23	261179	11690	690	680
2023-24	272015	3268	690	700
2024-25	280550	5299	690	700
Total	1004807	**42473**		

The details back-filling, location, terrace height, slope etc

Year	Back-filling in cum	Dump name	Location of Back-filling	Existing / New	Top RL (m)	No. Of terrace	Terrace Height (m)	Slope of terrace	Overall Slope angle of dump
2020-21	78431	Back-filling -1	331680 E TO 331890E – 2421680N TO 2421950N	Existing	670	1	8	36^0	27^0
2021-22	112631				680	1	10	36^0	27^0
2022-23	261179				690	1	10	36^0	27^0
2023-24	272015				690	1	10	36^0	27^0
2024-25	280550				690	1	10	36^0	27^0
Total	1004807								

BACKFILLING – 2

Year	Waste to be backfilled (cum)	Area of Back filling	Top RL(m)	Bottom RL(m)
2020-21	65359	10883	730	721
2021-22	93859	11334	740	730
2022-23	217649	11690	750	740
2023-24	226679	3268	760	750
2024-25	233791	5299	770	760
Total	837339			

The details back-filling, location, terrace height, slope etc

Year	Back-filling in cum	Dump name	Location of Back-filling	Existing / New	Top RL (m)	No. Of terrace	Terrace Height (m)	Slope of terrace	Overall Slope angle of dump
2020-21	65359	Back-filling -4	331420 E TO 331700E-2421030N TO 2421300	Existing	730	1	9	36^0	27^0
2021-22	93859				740	1	10	36^0	27^0
2022-23	217649				750	1	10	36^0	27^0
2023-24	226679				760	1	10	36^0	27^0
2024-25	233791				770	1	10	36^0	27^0
Total	837339								

Pravata Ku. Sahoo
Qualified Person

Dumping
Dump – A

Year	Waste to be dumped (cum)	Area of Dumping	Top RL(m)	Bottom RL(m)
2020-21	65359	21765.18	746	723
2021-22	93859	22668.18	756	746
2022-23	217649	23379.38	773	756
2023-24	226679	6535.89	789	773
2024-25	233791	10597.48	789	773
Total	251202			

The details back-filling, location, terrace height, slope etc

Year	Dumping in cum	Dump name	Location of Back-filling	Existing / New	Top RL (m)	No. of terrace	Terrace Height (m)	Slope of terrace	Overall Slope angle of dump
2020-21	65359	Dump -A	332388E TO 332988 - 2420578 N TO 2420978N	Existing	746	1	23	36^0	27^0
2021-22	93859				756	1	10	36^0	27^0
2022-23	217649				773	1	17	36^0	27^0
2023-24	226679				789	1	16	36^0	27^0
2024-25	233791				789	1	16	36^0	27^0
Total	251202								

Dump – H

Year	Waste to be dumped(cum)	Area of Dumping (m2)	Top RL(m)	Bottom RL(m)
2020-21	52288	21765.18	670	655
2021-22	75088	22668.18	685	670
2022-23	174120	23379.38	700	685
2023-24	181344	6535.89	715	700
2024-25	187033	10597.48	730	715
Total	**209335**			

The details back-filling, location, terrace height, slope etc

Year	Dumping in cum	Dump name	Location of Back-filling	Existing / New	Top RL (m)	No. of terrace	Terrace Height (m)	Slope of terrace	Overall Slope angle of dump
2020-21	52288	Dump - H	331488E 331888E TO 2420 378N TO 2420678N	Existing	670	1	23	36^0	27^0
2021-22	75088				685	1	10	36^0	27^0
2022-23	174120				700	1	17	36^0	27^0
2023-24	181344				715	1	16	36^0	27^0
2024-25	187033				730	1	16	36^0	27^0
Total	**209335**								

Pravata Ku. Sahoo
Qualified Person

IRON (BLOCK-6)

Backfilling – 3

Year	Total generation (cum)	Road maintenance (cum)	Back-filling (cum)	Area of Backfilling (m2)	Top RL	Bottom RL
2020-21	509340	101868	407472	21765.18	566	556
2021-22	336090	67218	268872	22668.18	576	566
2022-23	420400	84080	336320	23379.38	586	576
2023-24	414400	82880	331520	50934.02	596	586
2024-25	416800	83360	333440	30889.01	596	586
Total	**2097030**	419406	1677624			

The details back-filling, location, terrace height, slope etc

Year	Back-filling in cum	Back-filling name	Location of Back-filling	Existing / New	Top RL (m)	No. of terrace	Terrace Height (m)	Slope of terrace	Overall Slope angle of dump
2020-21	407472	Backfilling – 3	334460E TO 334788E – 2419060 N TO 2419478	Existing	566	1	10	36^0	27^0
2021-22	268872				576	1	10	36^0	27^0
2022-23	336320				586	1	10	36^0	27^0
2023-24	331520				596	1	10	36^0	27^0
2024-25	333440				596	1	10	36^0	27^0
Total	1677624								

Sub-grade ore/Mineral rejects:

As per the threshold value, iron ore containing above 45%Fe and below 55%Fe which has not got the market at present, is considered as sub-grade iron ore. Similarly, for manganese ore 10-20%Mn has been considered as mineral reject.

Rate of yearly generation of sub-grade mineral with reference to threshold values and proposals for stacking during the of plan period:

Proposed sub-grade/Mineral reject stack

Generation of mineral reject and its utilisation is furnished below:

Summarized Statement of production of Manganese ore and Iron ore zone

Year	Manganese ore zone	Iron ore zone(MT)
2020-21	170100	122400
2021-22	170100	122400
2022-23	170100	122400
2023-24	170100	122400
2024-25	170100	122400
Total	**850500**	**612000**

Manganese ore

Year	Mineral Reject (cum)		
	Generation	Blending @ 80%	Storage@ 20%
2020-21	170100	136080	34020
2021-22	170100	136080	34020
2022-23	170100	136080	34020
2023-24	170100	136080	34020
2024-25	170100	136080	34020
Total	**850500**	**680400**	**170100**

Pravata Ku. Sahoo
Qualified Person

Iron ore zone

Year	Iron ore zone(MT)	Blending @ 80%	Storage@20%
2020-21	122400	97920	24480
2021-22	122400	97920	24480
2022-23	122400	97920	24480
2023-24	122400	97920	24480
2024-25	122400	97920	24480
Total	**612000**	489600	122400

The mineral rejects will be temporarily stored for future use. About 6.0Ha has been earmarked for storing of Manganese ore and 2.0Ha for iron ore. The mineral reject stack will be at new location. None of the existing mineral reject dump/stack area will be used for the stacking of mineral reject.

Protective measures

Existing protective measures

About existing protective measures, the details have been furnished in chapter –III.

Year wise proposed protective Measures

Year	Dimension								
	Retaining wall			Garland drain			Settling Pond(2Nos)		
	Length (m)	width (m)	Height (m)	Length (m)	Width (m)	Depth (m)	Length (m)	Width (m)	Depth (m)
2020-21	1541	1.0	1.0	1560	1.0	1.0	10	8	2
2021-22	1541	1.0	1.0						
2022-23	Maintenance			Maintenance			Maintenance		
2023-24	Maintenance			Maintenance			Maintenance		
2024-25	Maintenance			Maintenance			Maintenance		
Total	1064			1050			10	8.0	2

Engineering details of retaining walls & Garland drains

The average rain fall has been considered as 1300mm/year. Since the proposed waste dumps are located in areas which is a steep slope, maximum flow of water in rainy season will endanger the retaining walls. Therefore, it has been proposed to construct concrete wall along the toe of the proposed dump. However, the following precautionary measures shall be taken while designing the retaining walls.

Retaining Walls

Retaining wall (1.0m high and 1.0 m width) of substantial strength shall be constructed all around the bottom periphery of waste dumps with locally available boulders mixed with sand and cement, to arrest any rolling down of the dump materials. Perforation shall be left at around 10 m intervals to allow for passage of water.

Garland drain

Garland drains of 1.0 m deep and 1.0 m wide shall be constructed all along the bottom periphery of waste dumps followed by the retaining wall to prevent any wash off or leaching of dump materials during heavy rains. Side walls and the base shall be pitched with locally available boulders. Joints shall be filled up with cement and sand mixture so that water cannot percolate.

Pravata Ku. Sahoo
Qualified Person

Settling Tank

The garland drain shall be channelized to settling tank of 10m long, 8m width and 2.0m deep. Side walls and base shall be packed with locally available boulders mixed with cement and sand.

Precaution for confinement of dump to prevent pollution of surface water bodies/ courses:

The waste generated from the mines shall be dumped in the non-mineralized area earmarked in the plan. The precautionary and protective measures to be adopted during waste disposal are as follows:

- The ultimate dump slope shall be maintained at around 27^0 with individual terrace slopes not exceeding 37^0.
- Each terrace will have inward slope with catch drain at the inward slope of terrace.
- Catch drain of the individual terrace shall be connected to the garland drain outside the periphery of dump. Catch drain preferably to be made up of the half concrete open pipes followed by settling tanks to avoid wash offs and have provision of berms at the outer side to reduce gully formation due to rain water wash offs.

Pravata Ku. Sahoo
Qualified Person

CHAPTER-5.0
USE OF MINERAL AND MINERAL REJECT

5.0 USE OF MINERAL AND MINERAL REJECT

a) Describe briefly the requirement of end-use industry specifically in terms of physical and chemical composition

The iron ore and manganese ore to be produced from the lease area will be utilised for non-captive purpose. Iron ore will be utilised in the lessee's sponge iron ore plant and the manganese ore to be produced will be used in the silico-manganese plant which is under the process of acquisition. For end use iron ore will be processed through different intermediate industries like beneficiation, Palletisation etc. The requirement of end-use industry specifically in terms of physical and chemical composition of iron and manganese ore is furnished below:

Iron ore

1	Steel Industry (End use industry)	2	Pig Iron Industry (End use industry)
a	Size: 10-30mm (for sintering plant 0-10 mm)	a	Size: 10-30mm
b	Fe: 60-62%	b	Fe: 60 - 63%
c	S_iO_2 : 6.5-3.5%	c	S_iO_2 : 4.5 - 3.5%
d	Al_2O_3 : 4-3%	d	Al_2O_3 : 4- 2.5%
e	P : 0.055%	e	P : 0.055%
f	S: 0.02%	f	S: 0.02%
3	**Sponge Iron Industry (Intermediate Industry)**	**4**	**Pelletisation Plant (Intermediate Industry)**
a	Size: 3-18mm	a	Size: Fines (0-10mm)
b	Fe: 60 - 63%	b	Fe: 62 to 64%
c	S_iO_2 : 4.5 to 3.5%	c	S_iO_2 : 4 to 3.5%
d	Al_2O_3 : 4.00%	d	Al_2O_3 : 3 - 3.5%
e	P : 0.055 to 0.050%	e	P : 0.05 %
f	S: 0.02%	f	S: 0.02%
5	**Beneficiation Plant (Intermediate Industry)**		**Export (others)**
a	Size: 3-18 mm	a	Size: Fines (0-10mm)
b	Fe: 45 - 58%	b	Fe: 57 - 63%
c	S_iO_2 : 9-4%	c	S_iO_2 : 3.5%
d	Al_2O_3 : 5-3%	d	Al_2O_3 : 3.0%
e	P : 0.06 - 0.050 %	e	P : 0.05 %
f	S: 0.005%	f	S: 0.02%

For Manganese ore

Requirement of Mn ore for end use in terms of physical and chemical specification are furnished below:

PARAMETERS	STEEL PLANT	FERRO MANGANESE PLANT	SILICO MANGANESE PLANT	BATTERY INDUSTRY
Mn	18-32%	42-46%	25-32%	>46%
Fe	24-16%	8-10%	10-16%	1.5%
SiO2	13% Max	5%	12%Max	0.5%
Al2O3	7.5% Max	3.5%	05% Max	0.5%
P	0.18% Max	0.10% Max	0.15% Max	0.05%
Moisture	3% Max	4.5% Max	4.5 % Max	7% Max
Size	10-40mm	20-50mm	10-50 % Max	10-40mm

Pravata Ku. Sahoo
Qualified Person

(b) Give brief requirement of intermediate industries involved in up-gradation of mineral before its end-use.

The intermediate industries involved in the up-gradation of mineral before its end use is crushing and screening unit, wet beneficiation plant, palletisation etc. ROM iron ore will be crushed and screened in the M.L area to cater to the need of the plant in respect of quality and size.

c) Give detail requirements for other industries, captive consumption, export, associated industrial use etc.

The Silijoda Iron and Manganese block has been awarded to Sri Debabrata Behera by the Auction process. Sri Debabrata Behera has been declared as the successful bidder and Letter of Intent has been issued in favour of him. The Iron and Manganese ore to be produced from the lease area will be sold to the market as the block has been granted for non-captive purpose.

The lessee has its own sponge plant of 300TPD capacity. Further, there is a proposal of establishment of beneficiation plant at Champadihi, Konjhar. The iron ore to be produced will be utilised in these plants.

The Manganese ore produced will be utilised in proposed silico-manganese plant located at Duburi, Jajpur, Odisha having 4 x 9 MVA Capacity.

Further, part of the material will sold in the open market as per the market requirement.

d) Indicate precise physical and chemical specification stipulated by buyers

Particulars of end use plants of the lessee

Iron ore

Sr. No	Name and address of the specified End use plant	Capacity (Plant capacity in MTPA)	Physical composition	Chemical composition
1	Champadihi, Konjhar.	Sponge iron plant : 300TPD	Size: 5 -18mm	Fe: 60 to 62.5% S_iO_2 : 4.5 to 3.5% Al_2O_3 : 4.00%
2	Beneficiation and Palletisation plant	Pellet	Size: 0 -10mm	Fe: 62 to 64% S_iO_2 : 4 to 3.5% Al_2O_3 : 3 - 3.5% P : 0.05 % S: 0.02%

Manganese ore

SILICO-MANGANESE PLANT AT DUBURI, JAJPUR	PARAMETERS	SILICO MANGANESE PLANT
	Mn	25-32%
	Fe	10-16%
	SiO2	12%Max
	Al2O3	05% Max
	P	0.15% Max
	Moisture	4.5 % Max
	Size	10-50 % Max

Pravata Ku. Sahoo
Qualified Person

e) Give details of processes adopted to upgrade the ROM to suit the user requirements.

Iron ore

It has been ascertained that ROM produced from the mines will pass through two streams namely unit 1 & Unit 2. Unit one will have only screening facility. The -10mm obtained from unit 1 which does not need any up gradation is directly sent for grinding. The +10m from unit 1 and RoM having grade of +55 to – 62%Fe will pass though Unit which has crushing facility. The +5 to -18mm produced from the crusher i.e. lumpy ore will be directly sent to the plant and the 5 -18 /10-30mm low grade material / mineral reject will be subjected to blending/ beneficiation as per the requirement.

Process Flow:

Keeping in view for the production of ROM, the lessee has planned to deploy mobile crushing and screening unit within the lease area. The screening unit will have 400TPH capacity and the crushing unit will have 250 TPH capacity. The processing will be done in a dry screening & conventional crushing route. The ROM produced from the mines will be processed through the screens. The screens are mobile in nature and are located near the mine face. The ROM when fed to the screen gets segregated into the following products:

1. 0-5 mm
2. 10-30 mm
3. 30-80 mm
4. +80 mm

The screened 30-80 mm and +80 mm are fed to the mobile and semi mobile crushers located near the mobile screens. The +30 mm is fed to the primary jaw crusher. In the jaw crusher the primary crushing takes place. The primary crusher product is sent to the screen to segregate into 0-5 mm, 5-18 mm and +18 mm. The +18 mm (oversize) is sent to the secondary crusher. The crushed product from the secondary crusher is sent to the same screen and the circuit continues to produce 0-5 mm and 5-18 mm.

Manganese ore

As far as size is concerned, size ranges are in three forms as 20-50mm as lumps, +6-20mm as Ruri materials and 3-6mm fines. The Chemical specification of the manganese ore is represented as follows:

Sl. No.	Constituents	Grade
1	Mn	30-34%
2	Fe	15-26%
3	SiO_2	5-13%
4	Al_2O_3	5-7.5%
5	P	0.10-0.20 %
6	Moisture	3% (max)

Pravata Ku. Sahoo
Qualified Person

CHAPTER-6.0

6.0 PROCESSING OF ROM AND MINERAL REJECT

As far as mineral conservation is concerned, up-gradation of ore is essentially required along with systematic development of the mine. Therefore, this chapter "Mineral Processing" is detailed to include the associated impurities, their removal process and the processing technique proposed in the M.L area.

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

In general, the essential impurities in Iron ore are silica, alumina, sulphur and phosphorus which are in the form of Al_2O_3, SiO_2, FeS_2 or CaSO4 and Ca3 (PO4)2 respectively. The Al2O3 / SiO2 ratio has an important role in the economics of Fe-ore smelting.

Product Quality and Grade Control: Grade control is managed throughout the mining sequence to meet the product specifications of the customers in terms of fines content and key elements such as Fe, SiO_2 and Al_2O_3. The following practices are in place or planned to manage product quality & grade control:

Blast hole sampling : The present practice consists of creating composite blast hole samples which are analysed in the site laboratory to provide an estimate of the grade within the ROM; based on which the appropriate destination of the material is determined.

Grade control at screening and crushing feed locations: Based on the outcome of the blast hole results, the grade of the ROM is ascertained. At present, the grade of ROM is controlled by blending at screening and crushing feed locations. High and low grade ROM delineated by the blast hole sampling process are blended/ proposed to be blended to have a grade of about 57-58% Fe and are stockpiled at screening and crushing locations which are fed to the crushing and screening plants. Regular assaying of the feed and final output product is done to enable the site technical team to vary the blend accordingly to maintain the appropriate grade for each product type.

During ensuing plan period both dry processing (through crushing and screening) for sizing and wet beneficiation will be adopted to upgrade the iron ore.

❖ **Proposed Dry processing (by crushing and screening)**

The lessee has planned to use the mobile processing unit i.e 250TPH screen unit for the purpose of screening. Further, one 150TPH crushing unit will also be established for crushing of over size material. The dry processing method will be adopted for processing of ROM by the help of crushing and screening unit. The details are as follows:

- The ROM ore will be subjected to screening, crushing, sizing, blending etc before finished product is ready for dispatch.
- For this purpose initially the processing of iron ore will be done through mobile crushing and screening.

Pravata Ku. Sahoo
Qualified Person

Process Flow:

The ROM produced from the mines will be processed through the screens. The screens are mobile in nature and are located near the mine face. The ROM when fed to the screen gets segregated into the following products:

5. 0-10 mm
6. 10-30 mm
7. 30-80 mm
8. +80 mm

The screened 30-80 mm and +80 mm are fed to the mobile and semi mobile crushers located near the mobile screens. The +30 mm is fed to the primary jaw crusher. In the jaw crusher the primary crushing takes place. The primary crusher product is sent to the screen to segregate into 0-5 mm, 5-18 mm and +18 mm. The +18 mm (oversize) is sent to the secondary crusher. The crushed product from the secondary crusher is sent to the same screen and the circuit continues to produce the following products.

1. 0-5 mm
2. 5-18 mm

Manganese ore

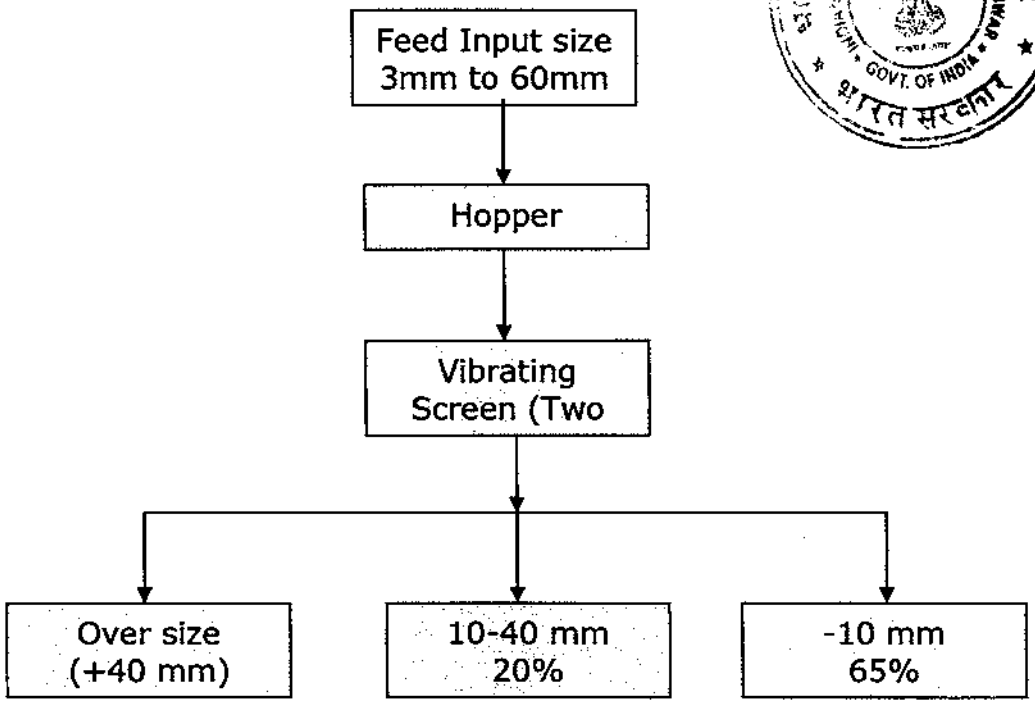
From the ore bed, rock would be dislodged with the help of drilling and blasting. The dislodged rocks are then subjected for hand sorting and picking of waste material from run-of-mine ore. The dislodged rocks contain a lot of waste materials including sub-grade ore and these are required to be eliminated from saleable ore and stacked separately. Hand sorting and picking of ore is the function of experienced workers are engaged for the purpose. Output Size, Grade & Recovery of Mn. Ore after manual sorting:

Grade	Grade Range	Output Size		Recovery %
		Lump	Fines	
Dioxide	+50% Mn.	10-40mm & 40-70mm	-10mm	1.30
High Grade	+46-50% Mn.	-do-	-do-	4.24
Medium Grade	+42-46% Mn.	-do-	-do-	4.52
Low Grade	+36-42% Mn.	-do-	-do-	24.34
Bisco Grade	+26-36% Mn.	-do-	-do-	64.59

As such, no mechanical beneficiation of ore is done. A screening plant of capacity 60 MT/hour is already installed in Siljora-Kalimati mine. The details of feed size and production size are given along with process flow diagram.

Pravata Ku. Sahoo
Qualified Person

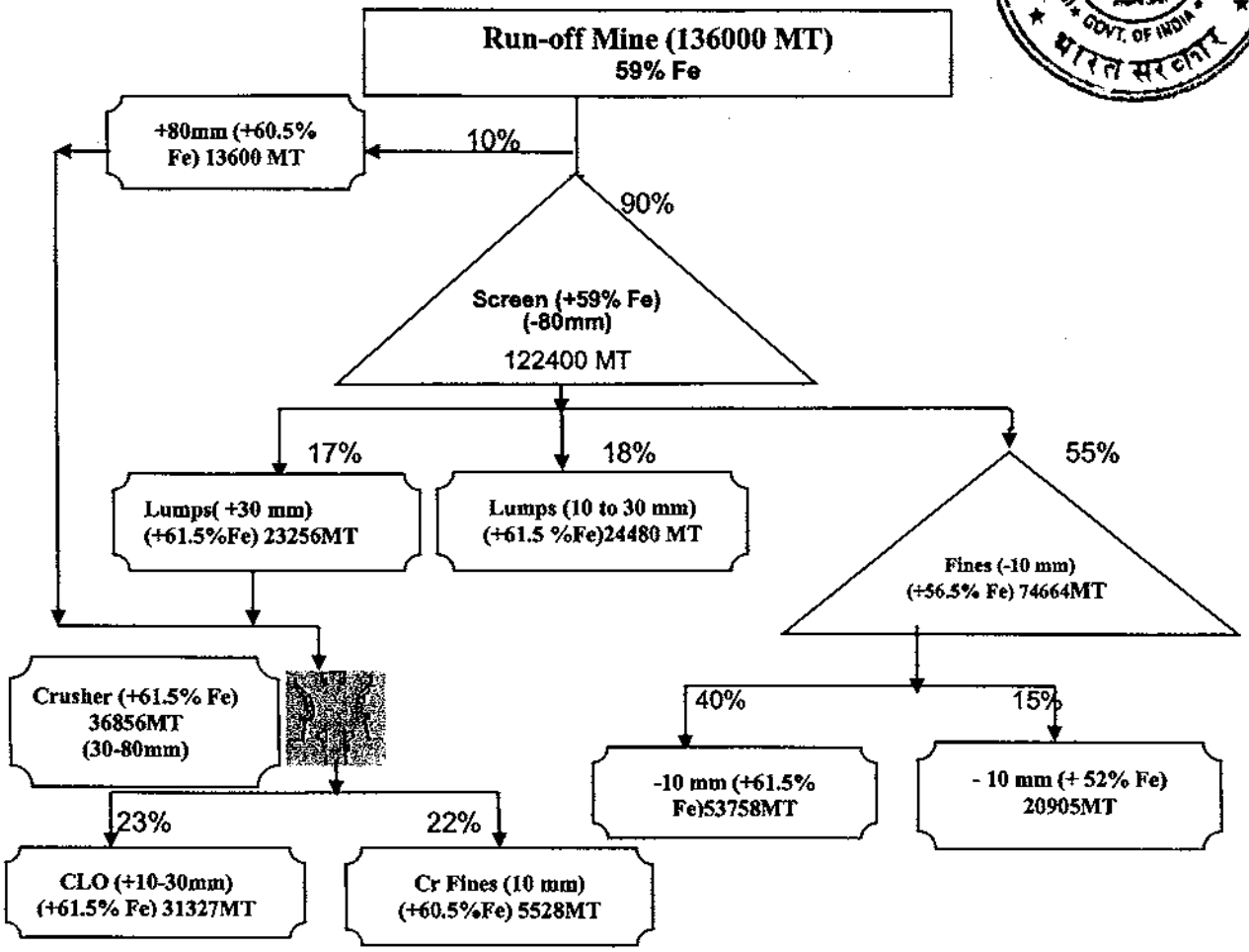
FLOW SHEET SCREENING PLANT (60 MT/Hour)



Pravata Ku. Sahoo
Qualified Person

6.2 Material balance chart with a flow sheet or schematic diagram of the processing procedure indicating feed, product, recovery and its grade at each stage of processing flow chart showing the production of Siljora-Kalimati Manganese & Iron Mine:

MATERIAL BALANCE OF IRON ORE



6.3 Explain the disposal method for tailing or reject from the processing plant:
No tailing/reject will be generated from dry screening plant.

6.4 Quantity and quality of tailing/reject proposed to be disposed, size and capacity of tailing pond, toxic effect of such tailing, if any, with process adopted to neutralize any such effect before their disposal and dealing of excess water from the tailing damp:
Not applicable

6.5 Specify quantity and type of chemicals if any to be used in the processing plant:

Not applicable

6.6 Specify quantity and type chemicals to be stored on site/plant:

Not applicable

6.7 Indicate quantity (m^3/day) of water required for mining and processing and sources of supply of water, disposal of water, and extent of recycling water balance chart may be given:

In Siljora-Kalimati Iron & Manganese Mine water is required for different operational purposes and also for domestic purpose. Details of water requirement are given below:

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

A. Surface water:

1. Dust suppression (Transportation road, inside quarry road, stack yards, mine camp, fogging in screening plant): 793.0 m^3/day
2. Green belt development: 65.0 m^3/day
3. Miscellaneous: 5.0 m^3/day

Sub -Total: 863.00 m^3/day

B. Ground water:

1. Drinking & domestic purposes: 400.00 m^3/day

Grand total: 1263.00 m^3/day

Total water requirement for the project will be 1263 m^3/day, out of which surface water requirement will be 863 m^3/day and ground water requirement will be 400 m^3/day. The project has the permission to draw 250 m^3/day surface water and 160 m^3 of ground water/day from Department of Water Resources, Government of Odisha. This has been vested to Mr Debabrata Behera.

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

CHAPTER-7
OTHERS

7.1 Site services:

Siljora Manganese & Iron mine is an old mine and there is an existing camp at the site. The administrative office and other support services like Garage, Workshop, Store, Geology & Survey office, time/cash office, Canteen, Crèche and Primary health Centre (Cess) are located at Camp. The electrical substation, water supply and lower primary school are also located in this camp. The mine camp is well connected to main Joda- Bamebari- Palaspanga express high way about 7 km. The lease area is about 22 km away from the Joda and 48 km from Keonjhar Township. The nearest Railway Station is Nayagarh from the leasehold area.

Proposed Site Services : For the smooth and optimal operation of the mine it is proposed to establish the facilities like DG Set, Diesel Pump, Electrical sub-station, Fine stacking, garland drain, Magazine Office area, Rest shelter, rest shed, Road , Security barrack, Siltation pond, Temporary Hul, Vacant land, Weigh bridges, Retaining wall, residential area, Road, Semi Pacha house, Placement of porta Cabins, Shed, Workshop area, Garage Area, Dispensary, Office Canteen & temporary Staff Quarters Play Ground, Pucca Building, Reigning Yard, Security Training Centre, Temporary Stack, Weigh Bridge Office, Equipment management, Centre, Equipment parking area, Infrastructure area, Power Room, Power transfer, Pump house, railway cabin, Temple, temporary stacking , high mast light, installation of sprinkler, wheel washing, display board,

These facilities shall be part of mining operation and mining operation inside the lease area being a dynamic concept these facilities will be no or less temporary in nature. As per the requirement it will be put up in the lease area including both forest and non-forest land and will be shifted to new locations.

7.2 Employment potential:

1	Manager	1
2	Mining Engineer	2
3	Geologist	3
4	Mine Surveyor	2
4	Mining Foreman	8
5	Mining Mate	16
6	Miner (Semi-skilled)	700
7	Operator(Skilled)	100
8	Unskilled	27
9	Others	18
	Total	**877**

Within 877 nos. of miner 700 nos. of miner will be engaged in manganese section and 177 nos. will be engaged in Iron ore section.

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

CHAPTER-8.0

8.0 PROGRESSIVE MINE CLOSURE PLAN UNDER RULE 23 OF MCDR'1988

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

8.1.1 Existing land use pattern indicating the area already degraded due to mining, roads, processing plant, workshop, township etc in a tabular form.

8.1.1 The existing land use pattern may be summarised as below in a tabular form.

EXISTING LAND USE PATTERN

Head	Existing (Ha)
Area to be excavated	278.109
Storage for top soil	0.00
Overburden/Dump	51.75
Mineral Storage	63.872
Infrastructure	2.32
Mine camp	15.416
Roads	19.25
Railways	-
Green Belt	19.79
Tailing Pond(settling pond)	0.00
Effluent treatment plant	0.000
Mineral processing plant	1.488
Total (Area used for mining)	**451.995**
Other (Land used for public purpose + Plantation)	261.515
Total Lease Area	**713.510**

8.1.2 Water regime:

The water quality monitoring was done at 6 locations within study area of lease. Out of 6 samples collected from different locations 4 were from surface water and 2 samples were from ground water/ drinking water.

Ground Water:

The water samples were from Bore well (within Mine Lease, W-5), intake well at Siljora Village (W-4).

Code No.	pH	Chloride (mg/l)	Fluoride (mg/l)	Nitrate (mg/l)	Iron (mg/l)	Hardness (mg/l)	Total Coliform (MPN/100ml)
W-4	6.5	7.5	0.45	0.25	0.02	15.0	nil
W-5	6.5	7.5	0.45	0.25	0.02	15.0	nil
Desirable Limits							
IS: 10500	6.5-8.5	250	1.0	45.00	0.30	300	-

The result shows all the parameters are well within the prescribed limit of IS: 10500.

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

Surface Water:

The water samples were from Kakarpaninala(W-1),Baitarani rive(w-2) &JalpaNadi(W-3).

Code No.	pH	TDS (mg/l)	Chloride (mg/l)	Fluoride (mg/l)	Nitrate (mg/l)	Iron (mg/l)	Total Coliform (MPN/100ml)
W1	6.7	35.0	7.5	0.60	0.50	0.02	
W2	7.04	38.0	5.0	0.60	0.40	0.03	21
W3	6.5	30.0	7.5	0.60	0.30	0.018	21
Desirable limit							
IS:2296 class C	6.5-8.5	1500	600	1.5	50.00	50.00	5000

The result shows all the parameters are well within the prescribed limit of IS: 2296 (Class C).

Water Flow:

The Water flow measurement was carried out during winter 2014 at 2 locations. The details of the findings are given below:

Sl. No.	Location	Flow m^3/hr
WF-1	Kakarpaninala	550
WF-2	Jalpanadi	280

From the result it is clear that the area has adequate supply of surface water

8.1.3 Quality of air:

Ambient air quality was monitored at 5 locations within 5.0 km. radius of the project site. The overall Maximum and Minimum values are discussed below:

Sl. No.	Parameter	$PM_{10}(\mu g/m^3)$		$SO_2(\mu g/m^3)$		NOx ($\mu g/m^3$)	
	Locations	Max.	Min.	Max.	Min.	Max.	Min.
1.	A1 Mine office area	19	50	03	26	30	<0.1
2.	A2 Mines colony area	15	42	04	24	69	<0.1
3.	A3 Kalimati colony area	27	73	04	14	61	<0.1
4.	A4 Handibhanga village	16	42	04	15	93	<0.1
5.	A5 Siljora village	12	32	03	08	53	<0.1
6.	National ambient air quality standards, CPCB Notification New Delhi,18.11.2009	60	100	80	80	400	4(1 hour average)

8.1.4 Ambient noise level:

The noise level survey was carried out at 6 locations and the details of the survey are given hereunder

Station Code		Noise level in dB(A)			
		Max.	Min.	Day (leq)	Night (leq)
Ambient Noise Level (dBA)					
N-1	Loader operator cabin	77.1	72.8	75.9	N.A
N-2	Excavator operator cabin	76.0	72.3	74.8	N.A
N-3	Drill with compressor	86.4	80.1	84.2	N.A
N-4	Dumper operator cabin	73.4	68.5	71.9	N.A
N-5	Mines office area	58.2	37.9	49.6	39.5
N-6	Residential colony area	55.6	37.2	47.3	38.9

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

8.1.5 Flora:

Floristic study was undertaken to document diversity and density of herb, shrub, climber and tree species prevalent in the areas falling within the Core site and Buffer area. Background information on floristic/vegetation diversity from literature survey was used to create the detailed account of local vegetation that may not have been encountered during the study.

Sampling was done by using Quadrates. Quadrates were laid randomly at various locations within the Core and Buffer region of the project. Random survey was also undertaken to create a detailed list of species. Important plants were photographed and specimens that could not be identified on field were preserved for off-field analysis. The specimens were identified by using keys from Floras and Pascal key was used for specimens without reproductive organs. Based on direct field observations and strategic selection of sampling locations primary data was collected to represent the current status of flora and fauna prevalent in the core site and the buffer region of the project.

Flora in the Core Site:

The Core site (Lease area) has small vegetation and little forest patches on the Eastern periphery and some plantation areas on the western periphery. The species of plants observed in the nearby areas are characteristic of disturbed and degraded natural systems. The tree diversity indicated dominance of *Shorearobusta,Termenaliatomentosa, Anogeissuslatifolia etc.* but the herbs and shrubs diversity was dominated by weeds and exotic species. In total 65 species of plants were observed in the core site (within the lease boundary). The floral diversity in the core site included 18 species of Shrubs, 15 species of Trees, 20 species of Herbs and Grasses, 11 species of Climbers and 1 species of Parasite.

No species classified as Rare, Endangered or threatened were observed during the study in the lease area. But, in the adjoining Khesra forest range there can be presence of ecologically important and protected species.

Domesticated plants during the survey:

List of plant species associated with plantations, avenues and agricultural landscapes (Domestic plants) were made. In total 24 species of plants were observed to be very commonly used as domesticated species in the nearby locations of the project site and the buffer region. Most of these species are exotic species. Native species must be promoted to enhance the native ecology.

Agriculture and Horticulture plant species some common plants planted in orchards and plantations by locals are:

Fruiting plants	Major Field crops	Vegetables
Mango	Paddy	Sweet Potato
Citrus	Maize	Chilly
Cashew	Green gram	Onion
Banana	Black gram	Potato
Litchi	Wheat	Tomato
Guava	Groundnut	
	Red gram	

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

8.1.6 Climatic conditions:

The area is characterized by extreme climate with very hot (42 °C) summer and very cold winter (4°C) winter. It experiences tropical and humid climate which shows three distinct seasons viz summer, rainy and winter. The summer is very hot and dry starting from March and continues till end of May or early June. The rainy season lasts from early June to end of September. October and November are the post monsoon months followed by a cold winter which lasts till end of February.

a) Temperature:

The area experiences a wide variation in temperature in respect of both day and night and seasonal. Generally winter starts from late November and continues till mid of February .December is the coldest month .The data shows that the temperature goes up to maximum of 41.5^{0}C in June and comes down to a minimum of 7.9 ^{0}C in December.

b) Humidity:

In general air is dry except in monsoon period. Average relative humidity varies from 37.0 to 87.3 %. In morning (8.30hrs) it varies from 60 to 87.3% (Average 69%) while in evening it varies from 37 to 87.3 %.(Average 60%).

c) Rainfall:

The rainfall data collected from Keonjhar is shown in **Table No 11.8.**

MONTHLY RAINFALL (mm) RECORDED AT KEONJHAR (2011-2013)

MONTH	2011	2012	2013
January	Nil	3.1	62.6
February	Nil	90.1	6.6
March	21.1	25.1	9.2
April	35.7	42.4	30.8
May	152.9	88.9	103.6
June	177.8	288.4	570.8
July	317.9	454.9	303.6
August	545.6	436.8	293.4
September	285.5	396.6	362.7
October	38.2	27.5	15.4
November	34.8	66.6	2.7
December	Nil	Nil	Nil
Total Annual Rainfall	**1609.5**	**1920.4**	**1761.4**

d) Wind:

Data from the nearby IMD station Keonjhar has been obtained. The prominent wind directions at Keonjhar are from south west and north east. The data indicates that variations in velocity ranging from 0 to 20 km per hour are common in this area. The directions become predominant from North West during May to October. The area remains calm for nearly 49% of the year. The dry winds of the northern plains are not common here.

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

However, higher wind speeds may be present for a short period before the rains during May and June. These periods are quite short, lasting not more than an hour. Dust storms and hurricanes are rare in this area.

8.1.7 Human settlements:

The socio-economic scenario in the 10 kms radius of theSiljora-Kalimati Manganese & Iron Mine is based on secondary data collected from statistical records. 2001census data has been used for demographic features.

The buffer zone falls under district Keonjhar of Odisha. Forest land occupies a major portion of the study area. The study area comprises of 27 census villages with a total population of 22506. The study area is depositories of minerals particularly iron ore. The economy of the area is therefore dominated by mining and related activity. Agriculture is also practiced and is dependent on the monsoons. The mining activity has led to the socio-economic development of this area which otherwise was a backward region of the state.

The study area is having a total population with 7.62 % of SC, 60.79% of ST; together they constitute about 68.41 % of the total population.

Demographic features and other Statistics for the Study Area
(Rural Area)

Sl.	Details	No./%
1	Total population (2001)	22506
2	No. Of House hold (2001)	5258
3	Average family size (2001)	4
4	Average no. of house hold per village	195
5	Average population per village	833
6	Sex ratio –females per thousand males	930
7	Percent of male population to total population (2001)	51.82
8	Percent of female population to total population (2001)	48.18
9	Percent of SC population to the total population (2001)	7.62
10	Percent of ST population to the total population (2001)	60.79
11	Percent of literate population to the total population	38.59
12	Percent of Male literate population to the total population	25.23
13	Percent of Female literate population to the total population	13.36
14	Percent of total main worker to the total population	36.0
15	Percent of total marginal worker to the total population	7.63
16	Percent of non worker to the total population	56.37

Note : All the environment, socio-economic data are furnished from previous mining plan. The lessee will undertake a detail monitoring and base line data during EIA study. Once the data is collected, the same will be submitted at IBM.

8.1.8 **Public buildings:**

There are no public buildings situated within the lease area.

8.1.9 **Places of worship and monuments:**

There is no place of worship and monument within the lease area.

8.1.10 **Indicate any sanctuary is located in the vicinity of leasehold:**

There is no sanctuary within 10KM radius of the lease area.

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

8.2 Impact Assessment: Attach an Environmental Impact Assessment Statement describing the impact of mining and beneficiation on environment on the following:

Keeping in mind the environmental baseline scenario as detailed above and proposed Opencast mining activity, it is attempted to assess the likely impact and its extent on various environmental parameters. The environmental attributes that may be affected are air quality, water quality & quantity, soil quality, noise level, ecology, land use, socio-economic, environment, infrastructure development, health, etc. The various activities causing impacts has been considered under various stages namely, "siting", "operational" (mining operation & secondary activities and mine closure).

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

The details of the land under existing use & proposed use are given below.

Head	Existing (Ha)	Proposed Land use After plan period (Ha)	At the end of Conceptual period (Ha)
Area to be excavated	278.109	304.109	335.57
Storage for top soil	0.00	-	-
Overburden/Dump	51.75	51.75	80.037
Mineral Storage	63.872	63.872	23.151
Infrastructure	2.32	2.32	1.480
Mine camp	15.416	15.419	11.870
Roads	19.25	23.330	23.33
Railways	-	-	-
Green Belt	19.79	29.79	34.865
Tailing Pond(settling pond)	0.00	0.00	-
Effluent treatment plant	0.000	0.000	
Mineral processing plant	1.488	1.488	1.488
Total (Area used for mining)	**451.995**	492.075	**511.791**
Other (Land used for public purpose + Plantation)	261.515	221.435	201.719
Total Lease Area	**713.510**	**713.510**	**713.510**

i) Ambient Air Quality.

Ambient Air Quality (AAQ) in respect of respirable suspended particulate matter (PM_{10}), Sulphur dioxide (SO_2), oxides of Nitrogen (Nox) and CO was studied and determined quantitatively through planned monitoring. AAQ monitoring was done at seven selected locations in the study area, taking into consideration all possible intervening factors and the criteria for selection of sampling stations relating to AAQ monitoring and the Indian Standards and Emissions Regulations published by notified the Ministry of Environmental & Forest, Central Pollution Control Board (CPCB). The monitoring was carried out in all the seasons. There was a very clear trend of record of lowest values in the night sampling hours and highest in the day time (fore noon) hours. This is due to very low activity in the area after evening hours. Nevertheless all the values (throughout year) across all parameters were much below the prescribed limit.

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

Existing Surface Water Bodies

Water quality monitoring at strategic points were done as per MoEF & State Pollution Control Board guidelines. The parameters for analysis are as per MoEF guidelines.

Water samples were collected manually from selected sampling points. Considering several possibilities of interference, the Poly tetra fluoro ethylene (TFE) sample bottles were used. These bottles were sterilized properly in an autoclave before being used for water sample collection. Procedure followed for sample collections were both grab sampling and composite. The grab samples were collected for analysis of BOD, DO, COD, Nitrates and Carbon Dioxides and composite sampling for rest of the parameters. Since the testing laboratory is located 350 kilometers away from the site, all the samples after collection were preserved immediately and then sent to the laboratory for testing. The analysis procedures adopted were American Standard Testing Methods, confirming to Central Pollution Control Board Guidelines.

Existing Ground Water Bodies

Bore well is the source of drinking water & domestic use in this lease area.

Ground water

As far as ground water is concerned, it shall not be affected, as the permeability in the rock formations is very poor.

Impact on quality of water

- Surface water samples from the nearby nala & ground water samples from different bore well/open wells of nearby villages will be analyzed for their pollutant levels which will help to decide the type of treatment needed.
- Working benches will be kept free from loose overburden/ waste materials. Retaining wall and garland drain has been constructed around the dump to prevent washing off of loose sediments.
- Though mining operation in this area will be opencast, there may be a chance of carrying the loose waste materials generated during mining with rain water flowing in downward direction through these nalas, gullies & streamlets.

However the measures will be taken to ensure that the surface water quality is not affected due to the mining operations by constructing necessary guard walls, check dams, etc. Surface run off of the mines will be directed to the settling ponds.

(iii) Noise Characteristics.

The main source of noise in the project area is limited to plying of Dumper & Tipper only. In order to have an idea of the present noise level of the project site, a detailed measurement of noise level was carried out at different locations within the proposed project (core zone) site and buffer zone. The ambient noise levels are much below the limits specified for adverse impacts even with 8 hour exposure under occupational health and safety.

But with implementation of the Opencast Mining (Fully Mechanized) project, the ambient noise level has been reduced considerably. No adverse impact on surrounding population is anticipated as most of

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

the noise generating source is far away from the Operational activities. In any case, the noise level in ambient environment will be lower in future than at present.

V) Vibration Levels (Due To Blasting)

The controlled blasting technique is being practiced and the impact of vibration due to blasting has been reduced to absolute lowest limits. The area in immediate vicinity is not feeling any vibration due to blasting. There is also no danger of fly rocks due to blasting in Mines.

(i) Impact on Water regime

The drainage pattern in this area is mostly controlled by River Sona and Karo river. As the Mining activities is far away from the river and there has been no change in the drainage system due to Present mining operation and there is no further changes anticipated. Hence there will be no adverse impact on the said water regime due to the mining and other allied activities.

(ii) Impact on Acid mine drainage

As on date there is no data about the acid Mine drainage within the surrounding water body

(viii) Impact on Surface subsidence

Not applicable

(ix) Impact on Socio- economics

The proposed project, does not involve any displacement of human habitation, hence no habitation package is needed for displacement.

The mining activity envisages the deployment of local laborers. So, it is likely that the general economic condition of the local people will improve. The peripheral development package will also improve their health and sanitation.

Apart from introducing eco-friendly mining special attention for up-liftment of socio economic conditions of the nearby villages by providing following facilities has been proposed. Health and education facilities created in the project shall be extended to villagers also.

1. Roads development in the project shall be utilized by the villagers also which shall connect them to nearby town,
2. Drinking water facilities, Cultural and recreational centers.
3. Afforestation of the village areas, distribution of seedlings and involving people in such programmes.
4. Providing employment to local people will be the one of the major factors for upliftment of the society.

The service sector has raised employment of local people by ancillary activities like transportation of mineral and supply of consumer goods to the mine. The impacts that have been and further will be are:

- Better economic status of the community
- Faster industrial development of the area
- Higher inputs in the area towards infrastructural facilities provided for better access to markets, health care, education, communication, etc

(x) Historical Monuments etc. There are no historical monuments within the buffer zone of the lease hold area. However, the mining lease hold area is falling within the seismic zone II, adverse impact is not anticipated.

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

(xi) Impact on Biodiversity.

The forest in and around the lease area is deciduous type with low density of tree. The forest of the buffer zone is undisturbed very thick, dry and deciduous type. The trees shed their leaf during February to march and during the period the forest floor is covered with litter. On the onset of rains new leaves emerge and reach their maximum leaf index by October. The forest is having good regeneration potential in the region.

Soil erosion is taking place due to deforestation, illicit felling of trees followed by podu cultivation. As this region is thick in forest cover, the place is also rich in types and kinds of animal inhabitants.

EIA study has indicated that the deforestation and illegal cutting of trees and Podu cultivation may have Impact on the area. However, these may not be discernible. Changes in and around leasehold area to impact biodiversity. Thus, existing impact on environment shall largely remain the same.

8.2.1 ENVIRONMENT MANAGEMENT PLAN

The Nuagaon Iron Mines is the oldest mines operating in Keonjhar District. The mine was started in the year 1953. The opencast mining activity is being operated in category of Fully Mechanized. In order to depict the present environmental scenario, various environmental factors were classified and analyzed by authorized third party SGS India Pvt. Ltd, which is also engaged by the company for monitoring these factors. The company shall continue to monitor all the relevant monitoring parameters. The monitoring stations with respect to air quality, noise level, water quality monitoring has been identified in both core and buffer zone.

To maintain ecological balance and to check the harmful effects due to mining and allied activities, an environment control measure has been integrated into the process of mine planning.

Many of the areas in environmental management planning are of multi-disciplinary dimension. Therefore, the measures envisaged in the report are to be regarded as a guide and depending upon the continuing advice to be taken from the experts of relevant fields like forestry, soil chemistry, ground water, etc. The changes warranted as per the specific site conditions are to be accounted for, during actual implementation phases. In this chapter, all technical, biological & socio-economic control measures have been envisaged and these pertain to patterns are as below.

- Air Quality
- Water Quality
- Noise Levels
- Measures against ground vibration
- Water regime
- Occupational Health & Safety
- Socio-economic measures.

(i) Measures for controlling air pollution

Existing air environment in the mining area is of desired quality i.e., all parameters are within limit. The extended mining activity in the area might add little pollutants to the existing air environment. Control measures have to be considered and implemented. The following preventive measures shall be taken to control the air pollution at different sites present inside the lease area.

a. Regular water spraying on haul roads, waste dumps and maintaining approach roads, to suppress the dust.

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

b. The volume of dust rising from waste dump areas, quarry site, roads, etc. by action of wind shall be checked by planting grasses and broad leaf trees.
c. Ensuring transporting vehicles not to cross the stipulated speed. A strict instructions should also be given in the board it shall be displayed that no vehicle should run greater than a speed of 30 Km/hour.
d. Over loading on transport vehicles to be prevented in order to stop spillage.
e. Strengthening further the green belt plantation around ML area, quarry and over burden dump as well as crushing plant site.
f. Water spraying in the ore stack yard will be done to check air borne dust.
g. Exhaust fumes in the internal combustion engines used in excavators, ensuring vigorous maintenance and stringent overhaul schedules shall minimize dumpers, dozers and other machinery.
h. Wet drilling method shall be adopted.
i. Water injection system in drill and wearing of PPE by driller to be proposed to control air pollution and minimization of its effect.

(ii) Measures for controlling water pollution

The surface run-off water of the lease area is being regulated in such a manner so as to cause minimum contamination and alteration of drainage system. There has been no adverse impact on the existing drainage system because of provision of cemented and tarpaulin cover drains all around the lease area to guide water through check dams & settling ponds down to outside nala. The water management scheme suggested for the project is Periodical cleaning of settling ponds, garland drains & check dam.

Ground water depth from surface are being measured in each of the 4 seasons starting from summer to winter and it was analyzed and observed that there is no adverse effect on GW level & quality in any of the case.

The regular monitoring of surface run-off and ground water shall be carried out by the authorized agency and record shall be maintained regularly. The preventive measures have been proposed are as below.

a. Drains to be cleaned up periodically.
b. Strengthen of small stone/ rock barriers across the drains at intervals to check the water current and to arrest the solid particles.
c. Effluent water from the quarry to be pumped regularly and discharged to the adjacent garland drains.
d. All the water of mines has to pass into the settling tanks and after settling, the water shall be used for plantation & dust suppression.

Water shall be treated before use for drinking purpose. Before water is supplied for consumption particularly for drinking purpose it has to be ensured that the water is free

(iii) Noise Pollution Control

As general precaution, to reduce the effect of high noise level, the following ameliorating measures have been proposed in addition to the measures being already taken up :

- Provision of protective devices like acoustic wool, earplugs, ear muffs to workers exposed to noise of more than 80 dB (A) provided.

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

- Provision of sound proof cabins for the workers deployed on machines producing higher level of sound like Dozers, dumpers, shovels etc.
- Proper maintenance of noise generating machinery including transporting vehicles would be ensured.
- A thick green belt shall be provided around the periphery of mine to screen the noise.
- Reducing the exposure time of workers wherever required.

The monitoring report for noise level in both core & buffer zone is found within the prescribed limit. The season-wise monitoring reports are also being submitted regularly to the competent authorities in time.

(iv) Vibration levels (due to blasting)

Measures to be taken while blasting in underground mines are as follows.

- The recommendation for vibration study by CMFRI, Dhanbad is being followed'
- Line drilling is being followed.
- Precise & accurate timing delays

- Acid Mine Drainage

As on date there is no data about the acid Mine drainage within the surrounding water body.

-Surface Subsidence

Not Applicable

10-Socio-Economics

The project, does not involve any displacement of human habitation, hence no habitation package is needed for displacement.

The mining activity envisages the deployment of local laborers. So, it is likely that the general economic condition of the local people will improve. The peripheral development package will also improve their health and sanitation.

Apart from introducing eco-friendly mining special attention for upliftment of socio economic conditions of the nearby villages by providing following facilities has been proposed. Health and education facilities created in the project shall be extended to villagers also.

The socio-economic measures suggested for the region in general are -

- Special care for irrigation should be provided to the locality to maximize the agricultural production and assumed output from the land. This in turn, improves the bargaining capacity of the labour.
- Alternative domestic fuel (Gobar gas/ night soil gas/ solar gas) would minimize fuel wood consumption and would be very important steps to check deforestation without safeguarding the forests.
- Proper road communication to all the surrounding villages is a necessary precondition for hiring labor.
- Different types of contractual labor disorganize the labor unity. Better coordination and improve the life style of workers is possible, if all the workers would be kept under the same umbrella.

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

- Providing employment to local people will be the one of the major factors for upliftment of the society.

The company has a separate CSR wing to focus on sustainable initiatives in the field of education, skill development, water and sanitation and women and child development, afforestation, with a focus on preventive health-care.

(viii)Occupational health & safety

The occupational health & safety is very closely related to the productivity & good employer- employee relationship. In this process, each and every activity has been evaluated for its implication on OHSAS related risk, suitable objective and targets are set and implementation in progress to reduce the concerned risk prone areas. Safety of employees during blasting operation, maintenance of mining equipment and handling of explosives materials are being taken care of, as per the Mines Rules & Regulations. To avoid any adverse effect on the health of workers due to dust, noise & vibration etc. sufficient measures have already been address in this chapter. Some other measures mainly relating to safety & health includes -

- Identification & assessment of risk of health hazards at work place.
- Training of employees for use of safety appliances & first-aid.
- Extensive publicity propaganda and awareness related to safety.
- All safety measures i.e. use of safety appliances, safety training, safety award, posters & slogans related to safety, etc.
- Provisions of first-aid in mines including training & refresh training for first-aiders.
- Provision of rest shelters for mine workers with amenities of drinking water, Latine & urinals, fans, etc.
- Working on mines as per the approved mining & environment management plan.
- Periodical/Regular maintenance & testing of all mining equipments, as per the manufacturer's guidelines & standards.
- Training on workmen on sanitation, cleanness, hygiene & health care.
- Monitoring the value of different environmental parameters, which may leads to occupational health & hazards to the workmen and specifying various control measures.

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

8.3 Progressive reclamation Plan:

To mitigate the impacts and ameliorate the condition, describe year wise steps proposed for phased restoration, reclamation of lands already/to be degraded in respect of following items separately for 2020-21 to 2024-25

8.3.1 Mined-Out Land:

8.3.1 Mined-Out Land: Describe the proposals to be implemented for reclamation and rehabilitation of mined-out land including the manner in which the actual site of the pit will be restored for future use. The proposals may be supported with yearly plans and sections depicting yearly progress in the activities for land restoration/ reclamation/ rehabilitation, afforestation etc. called "Reclamation Plan".

Proposed

During ensuing plan period 26.00ha additional area will be utilized for mining activities. Hence, at the end of 2024-25 total area under mining will be 304.109Ha Back-filling will be carried out in three different location during plan period of 5 years. The details of back-filling will be as follows:

Manganese ore zone

BACKFILLING – 1

Year	Waste to be backfilled (cum)	Area of Back filling (m2)	Top RL	Bottom RL
2020-21	78431	10882	670	662
2021-22	112631	11334	680	670
2022-23	261179	11690	690	680
2023-24	272015	3268	690	700
2024-25	280550	5299	690	700
Total	1004807			

BACKFILLING – 2

Year	Waste to be backfilled (cum)	Area of Back filling (m2)	Top RL	Bottom RL
2020-21	65359	10883	730	721
2021-22	93859	11334	740	730
2022-23	217649	11690	750	740
2023-24	226679	3268	760	750
2024-25	233791	5299	770	760
Total	837339			

IRON (BLOCK-6)

Backfilling – 3

Year	Total generation (cum)	Road maintenance (cum)	Back-filling (cum)	Area of Backfilling (m2)	Top RL	Bottom RL
2020-21	509340	101868	407472	21765.18	566	556
2021-22	336090	67218	268872	22668.18	576	566
2022-23	420400	84080	336320	23379.38	586	576
2023-24	414400	82880	331520	50934.02	596	586
2024-25	416800	83360	333440	30889.01	596	586
Total	2097030	419406	1677624			

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

Back-filling During Conceptual period

It has been planned to back-fill and make plantation over 185.1397Ha during conceptual period. The details of back-filling and plantation will be as follows:

Year	Back-filling No	Area(m2)	Volume of waste to be back-filled (m3)	Top RL
Beyond 2024-25	1	671938	2207196	650
	2	188359	1565492	700
	3	188993	1565492	730
	4	802107	2078855	650
	Total	**1851397**	7417034	

Bench-Plantation

After exhaust of iron and manganese ore, the dead benches will be reclaimed by means of plantation. About 150.37Ha of mined out land will be covered under plantation during conceptual period.

Back-filling during Conceptual Period

The details of back-filling during conceptual period will be as follows:

Year	Back-filling No	Area(m2)	Volume of waste to be back-filled (m3)	Top RL
Beyond 2024-25	1	671938	2207196	650
	2	188359	1565492	700
	3	188993	1565492	730
	4	802107	2078855	650
	Total	**1851397**	7417034	

Bench plantation during the conceptual Period

A total of 150.37Ha will be covered under plantation during conceptual period. The details of bench plantation will be as follows:

YEAR	Bench Plantation No	Area(m2)	Top RL	Bottom RL	Nos of Plants(@ 1600/Ha.)
Beyond 2024-25	1	**1503700**	650	545	240592

Afforestation

During plan period it has been planned to make plantation over vacant area in the northern part of the lease area. Further, after back-filling, it has been planned to make plantation over back-filled area(B1, B2, B3 and B-4). During plan period, about 11.50Ha will be covered under plantation. The details of Plantation will be as follows:

Year	Vacant Area	Back-filled area	Total Area Proposed(Ha)	No. of saplings
2020-21	0.5	1.5	2.0	4000
2021-22	0.5	1.5	2.0	4000
2022-23	0.5	1.5	2.0	4000
2023-24	0.5	2.0	2.5	5000
2024-25	0.5	2.5	3.0	6000
Total	2.5	9.0	11.5	**23000**

Grass Seeding:

It is suggested to sow grass seeds along the slope of terrace of waste dump and bench slope for preservation of top soil during the process of reclamation and rehabilitation of conceptual period. The grass shall be fresh free from weed and rank vegetation but leaving rhizome with sufficient nodes. Other soil forming local grasses like dichathium annultum, cenchruciliarii sand pannicium

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

repones (lemon grass) vertiver grass, elephant grass, citrella A, baughanvilla, would also be useful preferably a mix of the above grass.

8.3.2Topsoil Management: The topsoil available at the site and its utilization may be described.

Soil studies have shown that the average thickness of topsoil in the virgin areas will be around 30 cm. The topsoil is to be stripped in areas before initiation of mining operation. The quantity of topsoil to be stripped in a phased manner from the site will be used concurrently to rehabilitate the existing OB dumps, backfilling and other barren/degraded areas.

Prior to stripping, the area will be cleared by removing the unwanted growth. The proposed procedure for soil handling includes soil handling measures in order to optimize retention of soil characteristics (in terms of nutrients and micro-organisms) conducive to growth of plant.

There is no top soil cover in the iron ore mineable area which is mostly covered with laterite, float iron ore with laterite. The top soil cover from the Mn working quarry will be scrapped and stacked at the earmarked site. In addition, the top soil proposed to be generated from the extension of the existing rain water harvesting structure and from the new rain water harvesting pond proposed near NW side of the magazine will be stacked on the proposed top soil stockpile and its concurrent use for reclamation and rehabilitation of mined out area as well as waste dump. The detail generation of top soil has been explained in chapter-IV.

Year	Dimension								
	Retaining wall			Garland drain			Settling Pond(2Nos)		
	Length (m)	width (m)	Height (m)	Length (m)	Width (m)	Depth (m)	Length (m)	Width (m)	Depth (m)
2020-21	1541	1.0	1.0	1560	1.0	1.0	10	8	2
2021-22	1541	1.0	1.0						
2022-23	Maintenance			Maintenance			Maintenance		
2023-24	Maintenance			Maintenance			Maintenance		
2024-25	Maintenance			Maintenance			Maintenance		
Total	1064			1050			10	8.0	2

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

SUMMARY OF THE YEAR 2020- 21 (1st Year) PROPOSAL FOR ITEM NO. 11.3

Items	Details	Proposed
Dump management	Area afforested (ha)	1.5Ha
	No. of saplings planted	3000
	Cumulative no of plants	3000
	Cost including watch and care during the year (Rs in Lakh	Rs 75000.00
	Retaining Wall (L x W X H)	1541x1x1.0= 1541 m3 Cost = Rs 3.50 lakhs
	Garland drain (L x W X D)	1560 x 1 x 1 =1560m3 Cost 3.50 Lakhs
	Settling pond (L x W X D)	10 x 8 x 2=160cum Cost =Rs 50000.00
Management of worked out benches	Area available for rehabilitation (ha)	-
	Afforestation done(ha)	-
	No of saplings planted in the year	-
	Cumulative no of plants	-
	Any other method of rehabilitation (specify)	-
	Cost including watch and care during the year	-
Reclamation and Rehabilitation by backfilling	Void available for Backfilling (L x B x D) pit wise /stope wise (CuM)	43530.36 m2 Cost = Rs.1.00Cr
	Void filled by waste /tailings	435303.6m^3
	Afforestation on the backfilled area	–
	Rehabilitation by making water reservoir	NIL
	Any other means (specify)	NIL
Rehabilitation of waste land within lease	Area available (ha) Gap plantation in barren area	0.50ha
	Area rehabilitated	0.50ha
	Method of rehabilitation	Plantation 1000nos
Others (specify)	Quarterly Environmental monitoring as per MoEF &CC guide line.	Cost 5.00 Lakhs

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

SUMMARY OF THE YEAR 2021 -22 (2nd Year) PROPOSAL FOR ITEM NO. 11.3

Items	Details	Proposed
Dump management	Area afforested (ha)	1.5Ha
	No. of saplings planted	3000
	Cumulative no of plants	6000
	Cost including watch and care during the year (Rs in Lakhl	Rs 75000.00
	Retaining Wall (L x W X H)	1541x1x1.0= 1541 m3 Cost = Rs 3.50 lakhs
	Garland drain (L x W X D)	1560 x 1 x 1 =1560m3 Cost 3.50 Lakhs
	Settling pond (L x W X D)	10 x 8 x 2=160cum Cost =Rs 50000.00
Management of worked out benches	Area available for rehabilitation (ha)	-
	Afforestation done(ha)	-
	No of saplings planted in the year	-
	Cumulative no of plants	-
	Any other method of rehabilitation (specify)	-
	Cost including watch and care during the year	-
Reclamation and Rehabilitation by backfilling	Void available for Backfilling (L x B x D) pit wise /stope wise (CuM)	45336.36 Cost = Rs.90 Lakhs
	Void filled by waste /tailings	453363.6cum
	Afforestaion on the backfilled area	NIL
	Rehabilitation by making water reservoir	NIL
	Any other means (specify)	NIL
Rehabilitation of waste land within lease	Area available (ha) Gap plantation in barren area	0.50ha
	Area rehabilitated	0.50ha
	Method of rehabilitation	Plantation 1000nos
Others (specify)	Quarterly Environmental monitoring as per MoEF &CC guide line.	Cost 5.00 Lakhs

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

SUMMARY OF THE YEAR 2022 -23 (3rd Year) PROPOSAL FOR ITEM NO. 1.8

Items	Details	Proposed
Dump management	Area afforested (ha)	1.5Ha
	No. of saplings planted	3000
	Cumulative no of plants	9000
	Cost including watch and care during the year (Rs in Lakhl	Rs 75000.00
	Retaining Wall (L x W X H)	Maintenance 2.00Lakhs
	Garland drain (L x W X D)	Maintenance 1.00Lakhs
	Settling pond (L x W X D)	Maintenance 0.5 Lakhs
Management of worked out benches	Area available for rehabilitation (ha)	-
	Afforestation done(ha)	-
	No of saplings planted in the year	-
	Cumulative no of plants	-
	Any other method of rehabilitation (specify)	-
	Cost including watch and care during the year	-
Reclamation and Rehabilitation by backfilling	Void available for Backfilling (L x B x D) pit wise /stope wise (CuM)	46758.76 m2 Cost = Rs.85 Lakhs
	Void filled by waste /tailings	467587.6cum
	Afforestation on the backfilled area	NIL
	Rehabilitation by making water reservoir	NIL
	Any other means (specify)	NIL
Rehabilitation of waste land within lease (safety zone)	Area available (ha) Gap plantation in barren area	0.50ha
	Area rehabilitated	0.50ha
	Method of rehabilitation	Plantation 1000nos
Others (specify)	Quarterly Environmental monitoring as per MoEF &CC guide line.	Cost 5.00 Lakhs

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

SUMMARY OF THE YEAR 2023 - 24 (4th Year) PROPOSAL FOR ITEM NO. 11.3)

Items	Details	Proposed
Dump management	Area afforested (ha)	1.5Ha
	No. of saplings planted	4000
	Cumulative no of plants	13000
	Cost including watch and care during the year (Rs in Lakhl	Rs 125000.00
	Retaining Wall (L x W X H)	Maintenance 2.00Lakhs
	Garland drain (L x W X D)	Maintenance 1.00Lakhs
	Settling pond (L x W X D)	Maintenance 0.5 Lakhs
Management of worked out benches	Area available for rehabilitation (ha)	-
	Afforestation done(ha)	-
	No of saplings planted in the year	-
	Cumulative no of plants	-
	Any other method of rehabilitation (specify)	-
	Cost including watch and care during the year	-
Reclamation and Rehabilitation by backfilling	Void available for Backfilling (L x B x D) pit wise /stope wise (CuM)	57469.91m2 Cost = Rs.110.00 Lakhs
	Void filled by waste /tailings	574699.1cum
	Afforestation on the backfilled area	NIL
	Rehabilitation by making water reservoir	NIL
	Any other means (specify)	NIL
Rehabilitation of waste land within lease	Area available (ha) Gap plantation in barren area	0.50ha
	Area rehabilitated	0.50ha
	Method of rehabilitation	Plantation 1000nos
Others (specify)	Quarterly Environmental monitoring as per MoEF &CC guide line.	Cost 5.00 Lakhs

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

SUMMARY OF THE YEAR 2024 - 25 (5th Year) PROPOSAL FOR ITEM NO. 11.3

Items	Details	Proposed
Dump management	Area afforested (ha)	1.5Ha
	No. of saplings planted	3000
	Cumulative no of plants	5000
	Cost including watch and care during the year (Rs in Lakhl	Rs 75000.00
	Retaining Wall (L x W X H)	Maintenance 2.00Lakhs
	Garland drain (L x W X D)	Maintenance 1.00Lakhs
	Settling pond (L x W X D)	Maintenance 0.5 Lakhs
Management of worked out benches	Area available for rehabilitation (ha)	-
	Afforestation done(ha)	-
	No of saplings planted in the year	-
	Cumulative no of plants	-
	Any other method of rehabilitation (specify)	-
	Cost including watch and care during the year	-
Reclamation and Rehabilitation by backfilling	Void available for Backfilling (L x B x D) pit wise /stope wise (CuM)	41486.49m2 Cost = Rs.80.00 Lakhs
	Void filled by waste /tailings	414864.9cum
	Afforestation on the backfilled area	NIL
	Rehabilitation by making water reservoir	NIL
	Any other means (specify)	NIL
Rehabilitation of waste land within lease	Area available (ha) Gap plantation in barren area	0.50ha
	Area rehabilitated	0.50ha
	Method of rehabilitation	Plantation 1000nos
Others (specify)	Quarterly Environmental monitoring as per MoEF &CC guide line.	Cost Rs.5.00 Lakhs

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

8.3.3 Tailings Dam Management: The steps to be taken for protection and stability of tailing dam, stabilization of tailing material and its utilization, periodic de-silting measures to prevent water pollution from tailings etc, arrangement for surplus water overflow along with detail design, structural stability studies, the embankment seepage loss into the receiving environment and ground water contaminant if any may be described.

No tailing dam is involved due to installation of filter press which is a fully automatic process, which produces a cake for easy handling and transport, the system is ideal for convenient disposal of tailings.

Toxic effect of the tailings: Nil

Dealing of excess water from the tailings dam: not required.

8.3.4 Acid mine drainage, if any and its mitigative measures.

Acid mine drainage is not expected (ref: Para-11.2.7) and mitigative measures is not necessitated.

8.3.5 Surface subsidence mitigation measures through backfilling of mine voids or by any other means and its monitoring mechanism.

The information on protective measures for reclamation and rehabilitation works year wise may be provided as per the following table.

8.3.6 Summary of yearwise proposal

The information on protective measures for reclamation and rehabilitation works year wise may be provided as per the following table:

8.4 Disaster Management and Risk Assessment:

Risk assessment is a process whereby risks are analyzed, assessed and risk management priorities are evaluated. It is defined as the characterization of the potential adverse effect to human health & environment due to environmental hazards.

Objectives of risk assessment:-

- identifying hazardous activities
- assessment of risk level and severity in different operations
- identification of control measures
- setting monitoring process
- reduce the impact of mishaps of all kinds
- reduce the inherent potential for major accidents

Methodology of Risk assessment:-

- Collection of information & identification of hazard
- Classify their severity and probability of occurrence
- Identification of exposed risks
- Assess the risk and risk rating based on
  - Probability
  - Exposure
  - Consequence
- Prioritization of the risks
- Implementation of control measures

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

- Monitoring risk assessment
- Evaluation and correction

Risk assessment is mainly based on the environmental impact of various parameters.

i) Land contamination:-

The potential for contamination during operation of mine site is, waste rock dump which is regard as contaminated land.

ii) Aquatic toxicity:-

The risk assessment in aquatic toxicity system is based on the total metal concentration in various chemical form or oxidation state. Iron ore does not contain appreciable concentration of toxic elements.

iii) Acid mine drainage:-

The mining of iron ore does not involved any processing operation by using chemicals. Hence there is no risk at mine site with regard to control of acid mine drainage

iv) Tailing dam:-

Not Applicable

v) Human health:-

The chemicals from tailing dam and waste heaps may severely affect the human health. However there is no tailing dam or any effluent generation during the mining of iron ore. Hence there is no risk involved to human health due to iron ore mining operation.

Factors of risks involved due to human induced activities in connection with mining operations are 1) Removal of O.B and side burden 2) Drilling 3) Blasting 4) Excavation of ore and 5) transportation of ore.

Other factors due to natural activities are 1) fire 2) water inundation 3) electricity and 4) natural calamities.

Sl. No	Factors	Causes of risks	Control measures
1	Removal of O.B	a) Top soil & O.B bench may slide due to its unconsolidated nature. b) Vibration due to movement of vehicles in the O.B benches	Over all O.B bench slope angle will be maintained not more than 45°.Bench height shall not exceed 10 m in O.B
2	Drilling	a) Due to high pressure of compressed air hoses may burst.	During preventive & Periodical maintenance and replacement of worn out accessories in the compressor and drill equipment
3	Blasting	a) Fly rock, ground vibration and noise etc., b) Improper charging of explosives	Burden and spacing will be kept optimum on trial basis and inclined drilling will be done. Explosive charge per delay will be minimized.
4	Excavation of Ore	a) Hauling and loading equipment are in such proximity while excavation b) Swinging of bucket over the body of tipper c) Driving of unauthorized person	Operator shall not operate the machine when person & vehicles are in such proximity Shall not swing the bucket over the cab and operator leaves the machine after ensuring the bucket is on ground Shall not allow any unauthorized person to operate the machine by effective supervision.

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

5	Transportation of ore	a) Operating the vehicle "nose to tail" b) Overloading of material c) While reversal & overtaking of vehicle d) Operator of truck leaving his cabin when it is loaded	It will be ensured that all these causes will be nullified by giving training to the operators. No overloading. Audio visual reverse horn will be provided Proper training will be given.
6	Fire due to electricity and Oil	a) Due to the short circuit of cables & other electrical parts b) Due to the leakage of inflammable liquid like diesel, oil etc,	Commutator& electrical parts shall be cleaned frequently with the help of dry air blower All fastening parts and places will be lighted.
8	Natural calamities	Unexpected happenings	The mine management is capable to deal with the situation
9	Disaster due to failure of waste dump	Sliding of waste dump causes more hazards as compared with quarry slope failure. Hence, it is imperative that the degree of hazard against potential failure of waste dump slope should be identified and precautionary measures adopted. However during the operation of last decade, no waste dump failure has been reported.	All measures for scientific mining are being taken for stabilization of dumps. Use of geo-textiles, tree plantations and grass patching on the dump will be implemented to stabilize the waste dump. The details are given below: 1. Catch drain have been provided for flow of water from the waste dump to prevent erosion of waste dump here and there due to erratic flow of rainwater. The same will be properly maintained. 2. On the slope of the terrace, small manual terrace of 0.5 x 0.5 M will be made and seedlings planted so that the bench slope and consequently the waste dump slope will get stabilized. 3. A stone barrier/toe wall will be made all around the waste dumps on down side to prevent waste dump wash-off material being carried out of the dump area and mixing with the general drainage system. The toe wall will act as wedge and prevent its slipping/failure. 4. A garland drain along with settling tank will be constructed all around the waste dump area for smooth flow and settling of suspended solids, water and safety of the dump.
10	Disaster due to failure of pit slope failure	The benches will be kept 9 m high. As the depth planned is shallow and the iron ore, in which benches are to be made, is very strong in nature, no failure of pit slope is anticipated. More so, as there are no weak strata at top or in subsequent layers. The ultimate quarry slope is designed at 45^0 angles. Hence, no pit slope failure is envisaged.	-
11	Possible dangers	Danger to explosion during storage and handling of explosives	Approval has been obtained and a magazine with 5 tonnes capacity exists

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

	due to storage of explosives in the magazine		on the south of the lease, on a more mineralized area so that there are no activities within statutory safety distances around the magazine. There is no habitation close-by. Proper watch and guard will be provided, hence no danger from the magazine is anticipated.

Disaster Management Plan:-

The management is able to deal with the situation efficiently to reduce confusion keeping in view of the likely sources of danger in the mine.

Structure of the Disaster Management Plan:-

Out line of Disaster management plan :-

The purpose of disaster management plan is to restore the normalcy for early resumption of mining operation due to an unexpected, sudden occurrence resulting to abnormalities in the course of mining activity leading to a serious danger to workers or any machinery or the environment.

1) **System of communication**:-

An Internal communication system for the department head and to their line of command with telephone will be provided. Also the telephone nos and addresses of adjoining mines, rescue station, police station, Fire service station, local hospital, electricity supply agency and standing consultative committee members are made available for the mine management

2) **Consultative committee**:-

A standing consultative committee will be formed under the head of Mines head. The members consists of safety officer / medical officer / Asst. manager/ public relation officer/ Foreman/ and environmental engineer.

3) **Facilities & Accommodation**:-

Accommodation and facilities for medical center, rescue room and for various working groups will be provided.

4) **First Aid & medical facilities**:-

The mine management will have first aid for use in emergency situation. All casualties would be registered and will be given first aid. The center will have facilities for first aid & minor treatment, resuscitation, ambulance and transport. It will have proper telephone / wireless set for quick communication with hospitals where the complicated cases are to be sent.

5) **Stores and equipment** :-

A detailed list of equipment available its type & capacity and items reserved for emergency.

6) **Transport services**:-

A well-defined transport control system will be provided to deal with the situation.

7) **Functions of public relations group**:-

To make a cordial relation with government officials and other social service organization and working groups. To liaise with representatives of the mine to ameliorate the situation of panic,

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

tension, sentiments, grievances and misgivings created by any disaster. To ameliorate the injured, survivors and family members of affected persons by providing material, moral support and establishing contact with relatives of victims.

Security :

Manning of security posts

8) Catering & Refreshment :

Arrangement to be made for the victims, rescue teams and others.

8.5 Care and maintenance during temporary discontinuance:

If the mine is discontinued due to extraneous factors like government ruling or unforeseen circumstances, the proper safety measures like bunds and security arrangements will be made. Watch and ward is arranged to take care of plantation and installations.

The pit safety committee would draw up emergency plan for a temporarily-closed mine, detailing all the actions that would be taken in case of emergency in the mine. Detailed procedures and action plans will be evolved on the following points. Person's in-charge to handle the situation, infrastructure required to gather and disseminate information to take actions, men and material requirement, inspection schedules, getting outside help, training needs to take care of emergency, logistics, etc is already in place.

If the mine is to be discontinued temporarily for more than 120 days, notice will be given 30 days before the date of such discontinuance to the concerned authorities. During discontinuance period safety arrangement and fencing will be provided to avoid the entry of unauthorized persons. The accessibility to the mine from the surface will be prevented by providing fencing arrangement.

Emergency plan:-

1. On realizing anything serious happening anywhere in the mine, the nearest mining official is informed who can take prompt action.
2. On being informed about the emergency it will be verified for the correctness of information to the Manager and other part of the mine officials and managers of adjoining mine will be altered so that persons may be withdrawn from the area of danger.
3. On receiving information of emergency, intimation will be sent to the consultative committee which is already formed. Shift in-charge will ensure that all the materials and transport system to deal with emergency situation are at place for prompt action.
4. First aid facilities to be made ready to receive the cases.

Protocol in case of any accident and monitoring committee:

The objective of onsite disaster management plan for the non-captive mine is to be always in a state of perceptual readiness through training, development to immediately control and arrest any emergency situation so as to avert a full-fledged disaster and the consequence of human and property damage and in the event of a disaster still occurring, to manage the same so that the risk of the damage consequences to life and property is minimized. Jajang iron ore block has formulated a disaster management plan for Emergency Preparedness & Responses. The salient features are elaborated as below:

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

- Emergency response Organization
- Communication System
- Action on the site

Site Controller:

- The head of the department/Mine agent shall have overall responsibility for controlling the incident/accident and directing the personnel.
- To prepare full proof plan for control of accident like, landslides, subsidence flood and other natural calamities
- To inform statutory bodies of the State and Central Governments.
- To inform communicate
- on officer about the emergency, control centre and assembly point.
- To provide all assistance and call for Fire Squad, Security Officer and other services required for removing/control of danger.
- To ensure that all necessary personnel to assemble at assembly point.

Accident Controller/Shift In charge

- Mock rehearsal of plan prepared for accident.
- To withdraw men/machines from the affected area with priority for safety of personnel, minimize damage to the machines, environment and loss of material.
- To act as accident controller to all.
- To make a report based on the facts and
- figure and submit to the Site Controller/and others.

Primary Controller

- To inform the Accident Controller / shift in charge by the nearest mode of communication about the location and the nature of accident.
- To assist in clearing any obstruction in relief to accident affected person or site.
- To carry out all instructions of accident controller.

Capability of Applicant: Following facilities will be created at Jajangiron ore block.

- Public addressing system
- Telephones/ Mobile handsets
- Runners/messenger
- Emergency alarm
- Firefighting equipment & accessories with trained manpower
- Training centre
- Fire tender, Ambulance

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

Facilities available:

Silijoda iron and manganese ore Block will create hospital and dispensary in core area of mining lease area having modern diagnostic, pathological and treatment. Mobile medical facilities and ambulance will be available in hospital. Medical checkup camps will be organized in the villages around applied. However, considering extreme situation, district authorities, including police, would be informed about any on/offsite emergency if situation arises.

8.5 Care and maintenance during temporary discontinuance:

In case of temporary discontinuance following care & maintenance will be done.

i) If the mine is discontinued due to extraneous factors like government ruling or unforeseen circumstances, the proper safety measures like bunds and security arrangements will be made. Watch and ward is arranged to take care of plantation and installations.

ii) The pit safety committee would draw up emergency plan for a temporarily-closed mine, detailing all the actions that would be taken in case of emergency in the mine. Detailed procedures and action plans will be evolved on the following points. Person's in-charge to handle the situation, infrastructure required to gather and disseminate information to take actions, men and material requirement, inspection schedules, getting outside help, training needs to take care of emergency, logistics, etc is already in place.

iii) Plantation will be kept under active watch and ward to maintain the greenery.

iv) All the ore / mineral reject stacks will be maintained properly.

v) All the movable machineries will be kept in a particular place to avoid any theft of the parts.

vi) Watch & ward will be kept near all the static machineries or building

vii)If the mine is to be discontinued temporarily for more than 120 days, notice will be given 30 days before the date of such discontinuance to the concerned authorities. During discontinuance period safety arrangement and fencing will be provided to avoid the entry of unauthorized persons. The accessibility to the mine from the surface will be prevented by providing fencing arrangement.

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

8.6 Financial Assurance:

The financial assurance can be submitted in any encashable form preferably a Bank Guarantee from a Scheduled Bank as stated in Rule 27 of Mineral Conservation and Development Rules, 2017 for five years period expiring at the end of validity of the document. Table indicating the break-up of areas in the Mining Lease for calculation of Financial Assurance

I. No.	Head	Area put on use at start of plan (H)	Additional requirement during plan period (H)	Total (H)	Area considered as fully reclaimed (H)	Net area considered for calculation (H)
				E		G
A	B	C	D	(E=C+D)	F	(G=E-F)
1	Area to be excavated for mining	278.109	26.00	304.109	0	304.109
2	Storage for top soil	0	0	0	0	0
3	OB + waste Dump	51.75	0	51.75	0	51.75
4	Mineral storage	63.872	0	63.872	0	63.872
5	Infrastructure	2.32	0	2.32	0	2.32
6	Roads	19.25	4.08	23.33	0	23.33
7	Railways	-	-	0	0	0
8	Green belt	19.79	10.00	29.79	0	29.79
9	Tailing Pond	0	0	0	0	0
10	Effluent treatment plant	0	0	0	0	0
11	Mineral separation plant	1.488	0	1.488	0	1.488
12	Mine camp	15.416	0	15.416	0	15.416
13	Others	0	0	0	0	0
Total		**451.995**	**40.08**	**492.075**		**492.075**

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

Since it is a Category-A Mine, financial assurance is Rs.300000/- per hectare Therefore, financial assurance here for the scheme period is 492.075 x Rs.300000 = Rs.147622500- (Rupees fourteen crore seventy six lakh twenty two thousand five hundred only). However, the provisions of 27(1) of MCDR Rule- 2017 shall not be applicable for a mining lease granted through the mining lease granted under the provisions of clause (c) of sub-section (2) of section 10A.

(Financial Assurance is not required to be submitted by lease holder, where mining lease is granted through the auction or the mining lease granted under the provisions of clause (b) or clause (c) of sub-section (2) of section 10A, wherein the Mine Development and Production Agreement has been signed between the lessee and the State Government.)

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

PART - B

9.0 Certificate and Undertaking

This is to certify that the Progressive Mine Closure Plan of Silijora- Kalimati Iron &Mn ore Mines shall comply all statutory rules, regulations, orders made by the State or Central Government, Statutory organizations, Court etc. Wherever any specific permission is required, the lessee will approach the concerned authorities. The lessee also undertakes to the effect that all the measures proposed in this closure plan will be implemented in a time bound manner.

10Plans & Sections - This Progressive Mine Closure Plan is submitted as per the Rule 23 under MCDR 2017. Plans and sections for this plan have been referred to that of Mining Scheme, which is being submitted simultaneously for approval.

PRAVATA KUMAR SAHOO
(QUALIFIED PERSON)

Debabrata Behera

GSTIN - 21AAZPB2915N1Z1

SILJORA - KALIMATI IRON & MN. MINES

Regd. Office : 1234-P, Gobindprasad
Bomikhal, Bhubaneswar
Pin - 751010, Odisha, India
Tele : 0674-2549944
E-mail : dbmines2020@gmail.com

CONSENT LETTER/ UNDERTAKING/ CERTIFICATE FROM THE LESSEE

1.0 The Mining Plan in respect of Siljora-Kalimati Iron & Manganese ore block over an area of 713.510 Ha (As per DGPS Survey) and 712.993 Ha (As per ROR) in Village- Siljora, Badakalimati, Balda, Dabuna, Handibhanga and Tadapani, Tahasil- Barbil, Sub-division Champua, District Keonjhar, Odisha under Rule16 (1) of MCR2016 has been prepared by qualified person Shri Pravat Kumar Sahoo, M.Sc. in Geology having professional experience so far more than five years of working in the field of mining after obtaining the Degree as per Rule15 of MCR,2016.

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

Name	Pravat Kumar Sahoo
Qualification	M. Sc- Geology
Address	At-Plot No.1234(P), Govind Prasad, Bomikhal, Cuttack-Puri Road, Bhubaneswar

I here by undertake that all modifications / updatingas made in the said Mining Plan by the said qualified persons be deemed to have been made with my knowledge and consent and shall be acceptable on me and binding in all respects.

2.0 It is certified that the CCOM Circular No-2/2010 dated 06.04.2010 will be implemented and complied with when an authorized agency is approved by the State Government.

3.0 It is certified that the Progressive Mine Closure Plan in respect of Siljora-Kalimati Iron & Manganese ore block over an area of 713.510 Ha (As per DGPS Survey) and 712.993 Ha (As per ROR) in Village- Siljora, Badakalimati, Balda, Dabuna, Handibhanga and Tadapani, Tahasil- Barbil, Sub-division Champua, District Keonjhar, Odishacomplies with all statutory Rules,

Debabrata Behera
GSTIN - 21AAZPB2915N1Z1
SILJORA - KALIMATI IRON & MN. MINES

Regd. Office : 1234-P, Gobindprasad
Bomikhal, Bhubaneswar
Pin - 751010, Odisha, India
Tele : 0674-2549944
E-mail : dbmines2020@gmail.com

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.

The information furnished in the Progressive Mine Closure Plan is true and correct to the best of my knowledge and records.

4.0 The provisions of Mines Act, Rules and Regulations made there under have been observed in the preparation of the Mining Plan over an area of 713.510 Ha (As per DGPS Survey) and 712.993 Ha (As per ROR) in Village- Siljora, Badakalimati, Balda, Dabuna, Handibhanga and Tadapani, Tahasil- Barbil, Sub-division Champua, District Keonjhar, Odisha belonging to Siljora-Kalimati Iron & Manganese ore block, and where specific permissions are required, the applicant will approach the DGMS. Further, standards prescribed by DGMS inrespect of miners' health will be strictly implemented.

For DEBABRATA BEHERA

LESSEE

Siljora-Kalimati Iron & Mn Ore Mines
Shri DebabrataBehera
Lessee
Siljora-Kalimati Iron & Mn. Mines

Debabrata Behera

GSTIN - 21AAZPB2915N1Z1
SILJORA - KALIMATI IRON & MN. MINES

Regd. Office : 1234-P, Gobindprasad
Bomikhal, Bhubaneswar
Pin - 751010, Odisha, India
Tele : 0674-2549944
E-mail : dbmines2020@gmail.com

UNDERTAKING

We hereby undertake that, with reference to CCOM circular No. 2/2010, we will submit the Geo-referenced Mining Lease Map superimposed on latest high resolution satellite data in respect of **Siljora-Kalimati Iron & Manganese ore block** within a period of one year.

For DEBABRATA BEHERA

LESSEE
Siljora-Kalimati Iron & Mn Ore Mines
Debabrata Behera
(Lessee)
Siljora-Kalimati Iron & Mn. Mines

Place- Bhubaneswar
Date- 27.10.2020

CERTIFICATE

The provisions of the Mineral Conservation and Development Rules 2017 have been observed in the preparation of the Mining Plan for Siljora Iron & Manganese Ore block over an area of 713.510Ha, of Debabrata Behera in village Siljora, Badakalimati, Balda, Dabuna, Handibhanga and Tadapani in Barbil Tahasil of , District Keonjhar of Odisha State and Whenever specific permissions are required, the applicant will approach the concerned authorities of Indian Bureau of Mines.

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

Place: Bhubaneswar
Date :27.10.2020

(Pravata Kumar Sahoo)
Qualified Person

For Debabrata Behera
Authorised Signatory
Siljora-Kalimati Iron & Mn Ore Mines