KHONDBOND LEASE

(M/s TATA STEEL LIMITED)

SECOND REVIEW OF MINING PLAN & SCHEME OF MINING FOR THE PERIOD 2013-14 TO 2017-18 OVER AN AREA OF 978 HECTARES

(Submitted under rule 12 of MCDR 1988)

पत्र संख्या 314 (3)/ 2012 एमसीसीएम (मध्य)/एमसी/
एमएस/पीएमसीपी. 51 दिनांक 19.06.2013
द्वारा अनुमोदित किया गया।
Approved vide letter No.314(3)/ 2012
MCCM(CZ)/MP/MS/PMCP 51 dated 19.06.2013

(i) Name of the Mine: Khondbond Iron & Manganese Mine
(ii) Lease area: 978 ha
(iii) Forest Area: 836.757 ha
(iv) Non Forest Area:141.243 ha
(v) Date of execution of lease:27.10.1984
(vi) Period of the lease: 20 years
(vii) Executed Lease period: 17.01.1983 to 16.01.2003
(viii) Lease area applied for renewal: 978.00 ha
(ix) Category of Mine: Category A (Fully Mechanised)
(x) Name of the mineral : Iron & Manganese Ore
(xi) District : Keonjhar, Odisha
(xii) Period of Scheme:2013-14 to 2017-18
(xiii) Diverted forest land: 453.15 ha
(xiv) Area applied for diversion: 369.245 ha

अनुमोदित
APPROVED
19/6/13
खान नियंत्रक (मध्यांचल)
Controller of Mines (Central Zone)
भारतीय खान ब्यूरो
Indian Bureau of Mines

RQP: TATA STEEL LIMITED
REGN. No. : RQP/CAL/039/87/B
Signature of Key Person

Awnish Kumar

ABBREVATIONS & DEFINITIONS

1.	Steel Company	M/s Tata Steel Limited
2.	MCDR 1988	Mineral Conservation & Development (Amend) Rules 2003
3	RQP	Recognised Qualified Person under Rule 22B of the MCR 1960
4	DGMS	Director General of Mines Safety
5	IBM	Indian Bureau of Mines
6	MoEF, GOI	Ministry of Environment & Forest , Government of India
7	ROM	Run of Mine
8	CMRI	Central Mining Research Institute
9	CPCB	Central Pollution Control Board
10	ISO	International Organization for Standardization
11	MEMC Week	Mines Environment & Mineral Conservation Week
12	OMQ	Ore Mines & Quarries Division of Tata Steel Limited
13	UNFC	United Nations Framework Classification
14	MTPA	Million Tonnes Per Annum
15	BHJ	Banded Hematite Jasper
16	SME	Site Mixed Emulsion Explosive
17	Nonel	Non Electric Initiation System
18	HEMM	Heavy Earth Moving Machine
19	KL	Kilo Liters
20	EMP	Environment Management Plan
21	PMCP	Progressive Mine Closure Plan
22	TSIL	Tata Sponge Iron Limited
23	RL	Reduced Level
24	LTPA	Lakh Tonnes Per Annum
25	FMCP	Final Mine Closure Plan
26	Mn or mn	Manganese

ROM:

The part of the excavation which has Fe content more than 58% and is fed to the dry or wet processing plant.

Subgrade:

The part of the excavation which has Fe content between 45% to 58% and is stacked separately in subgrade dump for future use.

Waste:

The part of the excavation which has Fe content less than 45% and is dumped separately in waste dump.

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RQP: TATA STEEL LIMITED
REGN. No. : RQP/CAL/039/87/B
Signature of Key Person

Awnish Kumar

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INTRODUCTION :

Location: The mine is located in villages of Khondbond, Gurda and Baitarani R.F., P.S. Joda under Champua Sub-Division of Keonjhar district in Odisha State. The entire lease area falls within Survey of India Top Sheet No. 73 G/5. This mine is located about 5 km from the Banspani-Palaspanga road and 18 km from NH-215 connecting Joda to Panikoili. The mine is surrounded by M/s OMC ltd. in the eastern side and M/s Serajuddin & Co in the southern side and M/s KC Pradhan, M/s K S Ahulawlia , M/s MG Mohanty on western side and surrendered area of M/s Tata Steel Ltd on the northern side.

The lease can be approached by morrum road from two sides, one from Jorudih and other from M/s OMC (Khondbond) route. Both approach roads are passing from various Manganese and iron ore leases belonging to other lessees. At present, the approach road from Jorudih is being used for transportation of minerals from the mine to M/s TSIL at Bileipada and companyôs railway siding at Joda East Iron Mine.

Status of Lease: The Kondbond Iron & Manganese lease of M/s Tata Steel Limited was originally granted for a period of 30 years with effect from 17.01.1933 over an area of 12.17 sq. miles(3152.018 ha) including Joda West & Katamati blocks.

The **first lease renewal** was granted for a period of 20 years with effect from 17.01.1963 over an area of 12.17 sq. miles(3152.018 ha) including Joda West & Katamati blocks.
During the **second lease renewal** for a period of 20 years with effect from 17.01.1983,Khondbond formed an independent lease over an area of 1293.433 ha. During the **third lease renewal** for a period of 20 years with effect from 17.01.2003, the Steel Company has applied for renewal of the mining lease over an area of 978.00 ha only vide letter no. MD/LO/1061/1205 dated 27.10.2001. The balance area of 315.433 ha has been relinquished and Final Mine Closure Plan of the relinquished area has been approved by IBM vide letter no. 314(3)/2008-MCCM(CZ)/FMCP-02 dated 09.03.2009.

The part of the surrendered area by M/s Tata Steel Ltd. has been allocated to M/s Deepak Mineral and Power Ltd and M/s Shree Metaliks Pvt. Ltd and to M/s SMC Power Ltd on the eastern side. These are the only adjoining leases to Khondbond Iron & Mn. Mine in the district of Keonjhar.

The operations of the iron mine is fully mechanized and currently the mine produces Lump ore of sizes (+5-18mm), (+10-40) and Fines ore (-5 mm). The mine supplies lump ore to M/s Tata Sponge Iron Ltd., Bileipada dist:Keonjhar and M/s Tata Metallicks, and other sister concerns ,by road transport/ rail.. The fines ore is transported by road to the companyôs Joda East Iron Mine railway siding or Juruli, public railway siding and subsequently transported to the companyôs steel plant at Jamshedpur by Rail, other sister concerns.

The manganese operations are semi-mechanised and Mn. Ore is supplied to the companyôs Ferro Alloys plant, Joda and other customers. The Mn. Ore supplies will continue through road transport.

The proposed expansion of the mine and transport system is required to cater to the requirement of Iron Ore of the companyôs steel plant at Kalinganagar, Odisha and also to create some reserve capacity for its steel plant at Jamshedpur.

Forest Clearance:

- The Mine was granted Forest Clearance from Ministry of Environment & Forests, Government of India, vide letter No. F.No. 8-98/2004-FC, under section -2 of the Forest (Conservation) Act,1980 for diversion of 453.150 ha. (including 136.50 ha. Of broken up area) of forest land.

Environmental Clearance:

- The Mine was first granted Environment Clearance from the Ministry of Environment & Forests, Government of India, vide letter No. J-11015/50/2003.IA.II(M), dated 28.03.2005 for production of 2.0 MTPA Sponge grade finished ore and 0.36 LTPA Manganese ore.

- Further, vide MoEF letter No. J-11015/888/2007-IA.II (M), dated 21st December, 2011 expansion project of Khondbond Iron & Manganese Ore Mine has been granted Environmental Clearance for enhancement of production of Iron ore from 5.4 MTPA (ROM) to 8.0 MTPA (ROM) and Manganese Ore from 0.036 MTPA to 0.1 MTPA (ROM) and installation of a wet Iron ore beneficiation plant of capacity 8 MTPA throughput.

Consent to Establish:

- Vide OSPCB letter No. 21730/IND-II-NOC-5093, dated 23rd November, 2011 the mine has been granted Consent to Establish for enhancement of production of Iron ore of 8. 0 MTPA & Manganese ore of 1.0 LTPA.

- Further, the mine has also been granted Consent to Establish for installation of conveyer belt for transportation of Iron ore from the ML area of Khondbond Iron & Manganese Mine to the Railway siding at Joda East Iron Mine vide OSPCB letter No. 4099/IND-II-NOC-5359, dated 7th March, 2013.

Consent to Operate:

- Vide OSPCB letter No. 2574/IND-I-CON-1127, dated: 18.02.2013, the mine has been granted Consent to Operate for production of 2.0 MTPA SIZED Iron ore and 1.0 LTPA Manganese ore. The consent is valid till 31st March, 2014.

Details of Metalliferrous Mining Lease, held by Company are given below:

METALLIFERROUS MINING LEASES HELD BY TATA STEEL LTD.											
Sl.No.	Name of Leases	State	District	Lease Ref. & Date	Area (ha.)	Mineral	Validity (From - To)	Targeted Production of Mineral		Present Status	Remarks
1	JODA WEST	ODISHA	KEONJHAR	65 Dt. 27.11.1984	1437.719	Iron & Manganese	17.01.1983 to 16.01.2003	Mn.Ore	0.180 MTPA	Working	3rd Renewal appled on 07.12.2001
2	BAMEBARI	ODISHA	KEONJHAR	2150 Dt.15.05.1985	464	Iron & Manganese	01.04.1980 to 31.03.2000	Mn.Ore	0.0832 MTPA	Working	3rd Renewal appled on 05.01.1999
3	TIRINGPAHAR	ODISHA	KEONJHAR	1133 Dt.21.03.1985	169	Iron & Manganese	01.03.1980 to 28.02.2000	Mn.Ore	0.0850 MTPA	Working	3rd Renewal appled on 05.01.1999
4	MALDA	ODISHA	SUNDARGARH	34 Dt.19.01.1997	822	Manganese	13.08.1990 to 12.08.2010	Mn.Ore	0.550 MTPA	Operation stopped due ot want of FC	4th Renewal appled on 24.04.2009
5	MANMORA	ODISHA	KEONJHAR	357 Dt.24.04.1998	16.35	Manganese	01.07.1985 to 30.06.2005	Mn.Ore	0.0009 MTPA	Working	4th Renewal appled on 14.05.2004
6	SUKINDA	ODISHA	JAJPUR	1137 Dt.04.06.1998	406	Chromite & Pyroxenite	12.01.1993 to 11.01.2013	Chromite Pyroxenite	2.4 MTPA 0.5 MTPA	Working	3rd Renewal appled on 04.01.2012
7	GOMARDIH	ODISHA	SUNDARGARH	987 / 902 Dt.10.07.1998	372.796	Dolomite	06.03.1993 to 05.03.2013	Dolomite	0.816 MTPA	Working	3rd Renewal appled on 27.02.2012
8	KATAMATI	ODISHA	KEONJHAR	67 Dt. 28.11.1985	403.3238	Iron	17.01.1983 to 16.01.2003	Iron Ore	8.0 MTPA	Working	3rd Renewal applied on 05.09.2001
9	JODA EAST	ODISHA	KEONJHAR	23 Dt. 20.01.1996	671.093	Iron	01.07.1985 to 30.06.2005	Iron Ore	6.0 MTPA	Working	3rd Renewal applied on 27.04.2004
10	KHONDBOND	ODISHA	KEONJHAR	69 Dt. 27.11.1984	1293.433	Iron & Manganese	17.01.1983 to 16.01.2003	Iron Ore Mn.Ore	8.0 MTPA 0.1 MTPA	Working	3rd Renewal applied on 27.10.2001
11	NOAMUNDI	JHARKHAND	WEST SINGHBHUM	3170 13.01.1986	1160.06	Iron	01.01.1992 to 31.12.2011	Iron Ore	10.0 MTPA	Working	3rd Renewal applied on 17.12.2009

Future Land Use Pattern: Considering the expansion with respect to enhancement in production and introduction of new beneficiation plant, additional land requirement is envisaged. Accordingly, the proposals are enumerated in relevant chapters of this document.

PART-A

(Review of the Mining Plan)

1.0 REVIEW OF SALIENT FEATURES OF APPROVED MINING PLAN

1.1 NAME OF THE MINE KHONDBOND IRON & MANGANESE MINE
M/s TATA STEEL LTD.
VILLAGE: KHONDBOND
TAHSIL/TALUK: CHAMPUA
PO: BICHAKUNDI, JODA
DIST. KEONJHAR,ODISHA
PIN: 758034

1.2 PARTICULARS OF APPROVED MINING PLAN

The Mining Plan of Khondbond Lease containing detailed proposals for the period Fyô02 to Fyô08 was prepared over original lease area of 1293.433ha and was approved under Rule 11 of MCDR 1988 by the Controller of Mines (Central Zone) vide letter no. 314(3)/2000-MCCM(C)/MP-29 dated 11.12.2001.
The approved Mining Plan was modified (for period Fyô04 to Fyô08) in accordance with provisions of Rule 10 of MCDR, 1988 in view of its proposed increase in production of sponge grade iron ore from the existing quarry and commencement of flaky iron ore mining covering original lease area of 1293.433 ha. The modification of mining plan was approved by the Controller of Mines (CZ) vide letter no. 314(3)/2003-MCCM(C)/MP-15 dated 11.06.2004.

Progressive mine closure plan was approved by the Controller of Mines (CZ), Indian Bureau of Mines vide letter no. 314(3)/2003-MCCM(C)/MP-15 dt. 11.03.06.

The Mining Plan was further modified under Rule 22(6) of MCR 1960 for change in lease hold area (from original lease area of 1293.433 ha to applied lease area of 978 ha) with proposal of relinquishing the balance area of 315.433 ha .The modification of the approved Mining Plan along with the Progressive Mine Closure Plan covering an area of 978 ha was approved by the Controller of Mines (CZ), Indian Bureau of Mines vide letter no. 314(3)/2008-MCCM(C)/MP-38 dt. 09.03.09.

The Final Mine Closure Plan for the relinquished area of 315.433 ha submitted under Rule 23C of MCDR 1988 has been approved by the Controller of Mines (CZ), Indian Bureau of Mines vide letter no. 314(3)/2008-MCCM (CZ)/FMCP-02 dt. 09.03.2009.

First Review of Mine Plan & Scheme of Mining for the period from FYô09 to FYô13 was approved by the Controller of Mines (CZ), Indian Bureau of Mines vide letter no. 314(3)/2008-MCCM (CZ)/MS-20 dt. 31.03.2009.

1.3 DATE OF COMMENCEMENT OF MINING OPERATIONS

Khondbond Iron & Mn. Mine belongs to M/s Tata Steel Limited and is in operation since 1972 for manganese ore and since 1994 for both iron and manganese ore.

1.4(a) DEFICIENCIES, IF ANY, THAT EXISTED IN THE APPROVED MINING PLAN.

None

1.4(b) REVIEW OF COMPLIANCE OF SALIENT FEATURES OF THE APPROVED MINING PLAN (INCLUDING MODIFICATION PROPOSAL AND PROGRESSIVE MINE CLOSURE PLAN)

1.4(b).1: PRESENT NAME AND ADDRESS OF THE OWNER OF THE MINE

Name of the lessee: M/s. Tata Steel Limited

Name & address of nominated owner: H.M.Nerurkar
Managing Director
TATA STEEL LTD,
Jamshedpur - 831001.
Tel: 0657 - 2145625
Fax: 0657 ï 2424098

The list of directors of the company has undergone a change since approval of the Mining Plan. The list of Board of directors as on 26th February 2013 is given below:

TABLE – 1.4b.1
LIST OF BOARD OF DIRECTORS

S.No.	Name of the Directors	Address
1	Mr. Cyrus Pallonji Mistry	Bombay House,24, Homi Mody Street, Fort, Mumbai ,400001
2	Mr. B. Muthuraman	Bombay House,24, Homi Mody Street, Fort, Mumbai ,400001
3	Mr. Nusli Neville Wadia	The Bombay Dyeing & Mfg Co Ltd.,Neville House Ballard Estate Mumbai 400038 "Hemming Building" Pandurang Budhkar Marg,New Prabhadevi,Mumbai 4000025
4	Mr. Sam Palia	The Bombay Community Public Trust,Earnest House,8th floor Nariman Point,Mumbai 400021
5	Mr. Ishaat Hussain	Bombay House 24,Homi Mody Street,Fort, Mumbai ,400001
6	Mr. Subodh Bhargava	Tata Communications Ltd.,Videsh Sanchar Bhavan,Bangla Sahib Road,New Delhi 110001
7	Mr. Jacobus Schraven	Tata Steel Netherland BV,PO Box 10000,1970 CA Ijmuiden,The Netherlands
8	Mr. Andrew M. Robb	Tata Steel Europe Ltd.,30 Millbank,London SW1P 4WY,United Kingdom
9	Mrs. Mallika Srinivasan	Chairman & CEO, Tractors and Farm Equipment Limited,No.35,Nungambakkam High Road,Chennai 6000034
10	Mr.D.K.Mehrotra	Chairman,Life Insurance Corporation of India,7th Floor,West Wing,"Yogakshema",Jeevan Bima Marg,Nariman Point,Mumbai-400021
11	Mr. H. M. Nerurkar	Managing Director, Tata Steel Limited , Jamshedpur 831001,Jharkhand State
12	Dr. Karl-Ulrich Koehler	Chief Executive Officer & Managing Director, Tata Steel Europe Ltd.30 Millbank, London SW1P 4WY,United Kingdom
13	Mr. Kaushik Chatterjee	Bombay House,24, Homi Mody Street, Fort, Mumbai ,400001
14	Mr. T. V. Narendran	Managing Director - Designate, India and South East Asia, Tata Steel Limited , Jamshedpur 831001,Jharkhand State

1.4. (b) 2: EXPLORATION:

The exploration proposed in the approved mining plan vis-a -vis the actual exploration carried out is given below:

(a) Iron Ore:

TABLE – 1.4b.2
REVIEW OF EXPLORATION FOR IRON ORE

YEAR	PROPOSED		ACTUAL	
	No.	Mtrs.	No	Mtrs
2008-09	10	500	NIL	0
2009-10	25	1250	11	389.40
2010-11	NIL	0	NIL	0
2011-12	NIL	0	NIL	0
2012-13	NIL	0	NIL	0
Total	**35**	**1750**	**11**	**389.40**

Reason for deviation:

2008-09:
In 2008-09, all the10 boreholes were proposed in the forest area for which DRP has been applied vide letter no. JCO/13/12/33/2009 but forest clearance was not granted that is why the exploration could not be done.

2009-10:
The exploration proposal for the year 2009-10 was for 25 boreholes ,out of which only 11 boreholes proposed in the stage-II cleared forest area could be completed and the balance number of 14 boreholes were proposed in the forest area for which DRP has been applied vide letter no. JCO/13/12/33/2009 but forest clearance was not granted that is why we could not complete the proposed exploration.

(b) Manganese Ore:

TABLE – 1.4b.3
REVIEW OF EXPLORATION FOR MANGANESE ORE

Year	Proposal		Actual	
	No. of holes	Metreage	No. of	Metreage
2008-09	20	1000	23	845.60
2009-10	19	870	12	219.00
2010-11	20	1000	18	790.80
2011-12	20	1000	5	197.00
2012-13	15	750	0	0
Total	**94**	**4620**	**58**	**2052.40**

Reasons for deviation:

2009-10:
The exploration proposal for the year 2009-10 was for 19 boreholes in the manganese bearing area, out of which only 12 boreholes have been completed and the balance 7 boreholes could not be accomplished due to poor performance of the drill machines.

2011-12:
During 2011-12, the entire 20 bore holes were planned in forest area with an anticipation to get forest clearance by 2010-11 for which forest diversion proposal has been applied vide letter no. JCO/13/12/33/2009. But due to non-approval of forest clearance, the company has applied to DFO, Keonjhar division for permitting us to carry out drilling of 5 bore holes in forest area (as per the rules) for which permission has been granted by DFO, Keonjhar and 5 holes were drilled in forest area.

2012-13:
During 2012-13, the entire 15 bore holes were planned in forest area with an anticipation to get forest clearance by 2010-11 for which forest diversion proposal has been applied vide letter no. JCO/13/12/33/2009. No bore holes could be drilled due to non-approval of forest clearance.

1.4(b).3: MINE DEVELOPMENT:
The development of iron ore pit as envisaged in the approved First Review of Mine Plan & Scheme of Mining vis-à-vis actual is given below in Table ï 1.4b.4.

TABLE – 1.4b.4
REVIEW OF MINE DEVELOPMENT: IRON ORE

Year	Plan (in Million Tons) - As per approved mine plan				Actual (in Metric Tons) - as per annual return			
	ROM	Reject	Waste	Total Excavation	ROM	Reject	Waste	Total Excavation
Fyð09	7.06	0.52	4.73	12.32	626947	0	1243307.42	1870254.42
Fyð10	7.08	0.51	2.56	10.15	593099.8	350000	550465.21	1493585.31
Fyð11	8.03	0.73	3.11	11.88	699148.3	282289	549756	1531217.05
Fyð12	8.01	0.37	3.8	12.18	523091.06	594800	0	1117915.42
Fyð13	8.02	0.29	2.42	10.73	779431.374	306600	0	1086031.374
Total	38.19	2.42	16.64	57.27	3221717.534	1533689	2343528.63	7098935.164

Reasons for deviation:
(1) The actual production is less than the plan due to the delay in proposed expansion programme of the company as the mine is a captive mine.
(2) Also in line with the above mentioned expansion, new facilities were planned at the mine site including the long distance conveyor for transportation of product from Khondbond to Joda East siding for augmenting the production but the project has been delayed due to want of statutory clearances such as grant of forest clearance, Environment clearance, Surface right, Land acquisition and permission of conveyor corridor.

(3) Mining operations/Excavations in J & K ore body was planned taking into consideration that mine will produce 8 million tonnes of ROM but due to pending statutory clearances the expansion of the mine has not been carried out hence the excavation in J & K ore body could not be commenced.

TABLE – 1.4b.5

REVIEW OF MINE DEVELOPMENT: MANGANESE ORE

(All figures are in tonnes)

Year	Plan (in Tonnes) - as per approved SOM						Actual (in Tonnes)					
	Production	Mineral Rejects	ROM	Subgrade Minerals	OB & waste	Total Excavation	Production	Mineral Rejects	ROM	Subgrade Minerals	OB & waste	Total Excavation
2008-09	36000	2160	38160	7920	130972	177052	35951	2191	42775	4633	666410	713818
2009-10	50000	3000	53000	11000	119722	183722	35996	2042	40840	4398	499800	545038
2010-11	75000	4500	79500	16500	107316	203316	35991	2194	42811	4626	152150	199587
2011-12	80000	4800	84800	17600	107316	209716	35985	2166	42773	4581	68000	115354
2012-13	100000	6000	106000	22000	107316	235316	38934	2386	46003	4683	71604	122290
Total	341000	20460	361460	75020	572642	1009122	182856	10979	215202	22921	1457964	1696087

Reasons for deviation: During the scheme period under review, the excavation plan encompassed 8 ha of area in Ore Zone - X which was under the diverted area. To carry out the excavation, tree felling permission was applied over the said 8 ha area and the approval is still awaited. Hence, the mining operation was more confined within Ore Zone - XII which has resulted in higher overburden excavation than planned.

Further, the Manganese ore deposits occur as small tabular lenses and pockets in an irregular manner within the mining lease hold. The excavation plan is prepared based on the ore body block models, which are developed by capturing the bore hole data drilled at a grid interval of 25m. Hence, the excavation plan becomes tentative in case of this type of manganese ore deposit. During the last scheme period, more overburden has been encountered than the plan.

1.4(b).4: ENVIRONMENT MANAGEMENT

(a) Afforestation: Afforestation activities undertaken vis-à-vis the proposal is given below:

TABLE – 1.4b.6

NO. OF TREES PLANNED v/s ACTUAL

Year	PLANNED	ACTUAL
Fyô09	5000	2500
Fyô10	5000	12150
Fyô11	5000	22950
Fyô12	11375	16000
Fyô13	13375	46060
Total	**39750**	**99660**

Out of this, 27500 saplings have been planted in Iron part and 72160 saplings have been planted in Manganese part.

As proposed in the approved First scheme of mining and progressive mine closure plan, plantation was done in the dump slope area, old iron pits and barren area. However, plantation target could not be achieved in FYô09 as waste dumps could not be matured by that time.

Proposal	Actual
After exhaustion of the mineral in Ore Zone XIII, backfilling shall be continuing during the next five years.	After exhaustion of the mineral, back filling has been done over an area of 3.55 ha. & is under rehablitation by plantation.
Dumps shall be developed systematically Before monsoon all garland drains and settling tanks shall be evacuated. Water channels shall be provided at each stage of dump to divert rain water to garland drains.	Dump No. 2 & 3 has been developed systematically with proper terracing and each terrace having the inwards slope to guide the rain water to garland drain. One double stage check dam and one additional check dam with settling pit has been provided at the designated place near waste dump-2 (presently waste dump-1) to channalise the rain water.
Stabilisation of Dump No. 1 of Iron area by afforestation over dump slopes covering about 10 ha area	The afforestation over an area of 1.6 ha has been done during plan period. The less area covered due to non-availability of additional area on account of less development
Stabilisation of Dump No. 2 of manganese area by afforestation over dump top and slopes covering about 1.50 ha area by planting 6000 saplings during 2011-12 & 2012-13.	Total 37000 saplings have been planted during 2009-10 to 2012-13 over the dump slope covering an area of 4.0 ha for stabilisation.
Stabilisation of Dump No.3 of manganese area by afforestation over dump top and slopes covering about 2.00 ha area.	Total 35160 saplings have been planted during 2009-10 to 2012-13 over the dump slope covering an area of 4.6 ha for stabilisation.
Three season monitoring will be carried out at stations indicated in the environment management plan.	All the parameters as prescribed in EC/ CTO, were monitored at regular interval.
Three number of check dams shall be constructed as indiacted in Drawing No. MP/KIMM/R1/35/07	Four number of check dams(including 1 double stage) have been constructed.
In addition to the above, 1224m of old boulder retaining wall (out of total 1338m along the toe of waste dumps) has been converted to cemented retaining wall. Further, 240m of cemented, 45m of boulder retaining wall with 32m of check dam has been provided at toe of the developing corridor along the northern lease boundary.	

(b) Control of Dust, Noise and Ground Vibration:

As mentioned in the approved mining plan, all point sources and non-point sources of dust are effectively managed to reduce the dust generation in the mines. All parameters pertaining to ambient air and water quality are within the prescribed limits. Studies have been conducted by CIMFR, Dhanbad in the month of Augustô11, Novemberô11 & Decemberô11 to determine the blasting parameters, sequence of firing, charge per delay etc. to minimize the adverse impact of blast induced ground vibrations. The recommendations of CIMFR are being followed during blasting.

(c) Reclamation of Mined out areas:

As mentioned in the approved First Review of Mining Plan & Scheme of Mining, the mined out area of ore zone-XIII is being back filled and also 37000 nos. of saplings have been planted over backfilled area during 2009-10 to 2012-13.

1.4(c): REVIEW OF COMPLIANCE OF CONDITIONS IMPOSED WHILE APPROVING THE MINING PLAN AND PROGRESSIVE MINE CLOSURE PLAN.

Specific directives issued by the Indian Bureau of Mines in the approval letter no. 314(3)/2008-MCCM(CZ)/MS-20 dated 31/03/2009 for First Review of Mining plan and Scheme of Mining .

(i) The Environmental Monitoring Cell established by the company shall continue monitoring ambient air quality, dust-fall rate, water quality, soil sample analysis and noise level measurements at various stations established for the purpose both in the core zone and buffer zone as per the requirement of Environment Guidelines and keeping in view IBMôs Circular no. 3/92 & 2/93 season-wise every year or by engaging the services of an Environmental Laboratory approved by MoEF/CPCB. The data so generated shall be maintained in a bound-paged register for the purpose and the same shall be made available to the inspecting officers, on demand.

Compliance: Environmental Monitoring Cell established by the company undertakes monitoring of air, water, noise and soil parameters on regular basis and the same are recorded in a bound paged register.

1.4(d): REVIEW OF COMPLIANCE OF VIOLATIONS POINTED OUT DURING INSPECTIONS MADE UNDER THE MCDR, 1988 DURING LAST FIVE YEARS.

(A) The following violations were pointed out vide your letter no. ORI/IRON/KJR/MCDR-35/BBS dt.15.10.2008 & 20.04.2009, which were replied vide our letter no.JE/CHO/172/IBM/08 dated 21.11.2008 & JE/CHO/49/IBM/09 dated 02.05.2009.

(i) Rule 13 (1):
The overburden dump developed adjacent to the iron ore quarry has encroached iron ore mineralized zone against no such proposal in approved plan.

Compliance:
The dump was surveyed and the material which had encroached the iron ore mineralized zone, has been rehandled.The same was proposed in the scheme of mining approved by letter no. 314(3)/2008-MCCM (CZ) /MS-20 dated 31.03.2009. Around five thousand cubic meters of material has been rehandled to clear the area.

(ii) Rule 13(1):
It was proposed for plantation of 5000 saplings during the year 2007-08,against these proposals,2000 saplings has been carried out.

Compliance:
The proposal was to plant saplings along the dump slopes but in absence of availability of fresh area only 2000 saplings were planted against the target of 5000 saplings. Working permission of diverted forest land was accorded to us in the month

of October 2008 and site preparation for commencement of mining operation continued upto December 2008.Till March 2009, the waste dump was still active and gradually the mining operation has shifted to the new area. Now, since the waste dump become inactive, we will be undertaking plantation in the forthcoming monsoon. The initial preparatory work of leveling the site, layering with top soil has commenced. Saplings will be planted once this preparatory job gets completed and monsoon sets in. We are targeting 6000 saplings to be planted in the current financial year 2009-10.

Rule 33(2):
No protection measures have been provided around the fines stacks to prevent the surface run off due to rain water.

Compliance:
The job of construction of protection measures around the fines stack is complete. The dimension of Toe wall is 210 meters length, 3feet width and 3 feet height.

(B) The following violations were pointed out vide your letter no. ORI/IRON/KJR/MCDR-35/BBS dt.26.08.2010which were replied vide our letter no.JE/CHO/175/2010 dated 15.09.2010 & JE/CHO/188/2010 dated 15.10.2010.

(i) Rule 13(1):
The exploration as proposed in the mining plan approved on 31.03.09 for the year 2009-10 (44 BHs) were not carried out fully as only 23 BHs were drilled.

Compliance:
The exploration proposal for the year 2009-10 was for 44 boreholes of which 25 boreholes were in the iron bearing area and 19 boreholes were in the manganese bearing area.
In the iron bearing area, only 11 boreholes proposed in the stage-II cleared forest area could be completed and the balance number of 14 boreholes proposed in the forest area where DRP has been applied vide letter no. JCO/13/12/33/2009 but forest clearance not yet granted could not be completed.
In the manganese bearing area out of 19 boreholes, 12 boreholes have been completed and the balance 7 boreholes could not be accomplished due to poor performance of the drill machines. However, these 7 boreholes have been taken up with the proposed exploration during 2010-11 and will be completed during the year. The location of boreholes for the year 2009-10 in the forest and stage-II cleared forest area has been shown in the enclosed surface geological plan.

(ii) Rule 13(1):
Also, the production of iron ore for the year 2009-10 is 0.45 MT i.e. only 6.35% of the approved proposal for the year 2009-10(i.e. 7.08 MT).

Compliance:
7.08 MT from KIMM was planned to meet the proposed increase in requirement of the companyôs steel plant at JSR, M/s Tata Sponge Iron Ltd & M/s Tata Metalliks Limited. However, there was shortfall in the demand due to the temporary slump in the iron & steel industry during last 2 years.

Also in line with the above mentioned expansion, new facilities were planned at the mine site including the long distance conveyor for transportation of product from Khondbond to Joda East siding for augmenting the production but the project has been delayed due to want of statutory clearances such as grant of Surface right, Land acquisition and permission of conveyor corridor.

(iii) Rule 23 (E):
The annual report of protective and rehabilitative works as envisaged in the approved PMCP has not been submitted for the year 2009-10.

Compliance:
The annual report of protective and rehabilitative works as envisaged in the approved PMCP for the year 2009-10 has been sent vide our letter no. MD/PL/168/184/2010 dated 11.09.10. A copy of the PMCP has been enclosed.

(iv) Rule 29:
Also updated plans and sections as required under rule 29 of MCDRõ88 have not been submitted**.**

Compliance:
Updated plans and sections as required under rule 29 of MCDRõ88 has already been sent vide our letter no. JE/CHO/171A/IBM/10 dated 10.09.10. A copy has been enclosed.

(C) The following violations were pointed out vide your letter no. ORI/IRON/KJR/MCDR-33/BBS dt.13.07.2011which were replied vide our letter no.KIM/CHO/175/2011 dated 16.08.2011& KIM/712/58B dated 10.12.2011.

(i) Rule 13 (1):
Mining operations are not being carried out in accordance with the approved Scheme of Mining dated 31.03.2009 to the extent indicated below

a) Dumping operation at Dump No. 3 in iron ore quarry (made between P & N ore body) has not been carried out in retreating manner as proposed. Also no protective measures have been found around this dump.

b) Mining operations/Excavation as proposed in J & K ore body was not carried out.

Compliance:

a) The existing method of dumping by advancing method has been discontinued and dumping at bottom most terrace is being carried out in retreating method. The construction of toe wall of dimension 289mX1.2mX1.0m alongwith garland drain and settling tank has already been constructed.

b) Mining operations/Excavations in J & K ore body was planned taking into consideration that mine will produce 8 million tonnes of ROM but due to pending statutory clearances the expansion of the mine has not yet been carried out hence we could not commence excavation in J & K ore body.

(ii) Rule 16(1):
No protective measures have been found around the fines stacks (near weigh bridge) to prevent surface run off due to rain water.

Compliance:
The protective measures in the form of toe wall have been made all along the periphery of the fines dump.

(iii) Rule 33(2):
The waste dump lying near the main iron ore quarry (Q-quarry) has not been properly secured. Height of dump observed during inspection was about 50 to 60 mtrs more than proposed also terraces/lifts have not been maintained properly.

Compliance:
The waste dump mentioned above has been properly secured and terraced as per plan. The dump slope of the old portion of dump where terracing could not be carried out has been stabilized by afforestation and secured by concrete retaining wall additional to the existing toe wall.

(iv) Rule 42(1):
Geologist employed under this rule Mr. Ajay Kr. Nandi appointed on 01.10.2006 is not having ten years of professional experienced of working in a supervisory capacity on the field of mining as required under the amended rule.

Compliance:
We have already appointed Mr. Rajeev Ranjan , Sr. Geologist having approximately 15 years of experience in the field of mining as geologist of Khondbond Iron Mine and the appointment was communicated to IBM vide letter no. KIM/323/31 dated: 20th June 2011.

(D) The following violations were pointed out vide your letter no. ORI/IRON/KJR/MCDR-35/BBS dt.13.08.2012 which were replied vide our letter no.KIMM/784/58-B dated 08.09.2012.

(a) Violation under Rule (13) 1:

(1) During the year 2011-12, only 5 nos.of exploratory bore holes (197 meterage) had been drilled, against the approved proposal of 20 nos. of bore holes (1000 meterage).

Compliance:

The approved proposal of bore holes for the year 2011-12 is within the forest area. However, based on the MoEF Circular No.F.No.5-3/2007-FC dated 19.08.2010, 5 nos. of bore holes within the forest area were permitted by Divisional Forest Officer, Keonjhar. Accordingly, 5 nos. of exploratory bore holes have been drilled with 197 meterage within the proposed area. The copy of Circular and subsequent permission are enclosed as Annexure I & II respectively for kind reference.

The back log exploratory bore holes shall be carried out as soon as the forest clearance and subsequent permissions are obtained.
However,some of these backlog exploratory boreholes could be diverted in the non-forest areas of eastern part as infilling boreholes.In this regard,a separate J form will be submitted at your perusal.

(2) In manganese ore, óOre Zone X quarryô is found merged with Ore Zone XII quarry in grid East 8600 to 9340 & North 13820 to 14300 against the approved excavation of Ore Zone X in grid 13850N ï 14050N & 8700W-8970W and Ore Zone XII in grid North 13980 ï 14250 & West 9170 ï 9290 independently. It seems that more ore zone excavation has been carried out than the quantity approved.
Compliance Status:

The approved excavation for Ore Zone X is confined within the grid 13850N-14050N & 8700E-8970E, however the excavation could not take place within the extent of 13850N-13878N & 8880E-8970E due to delay in obtaining the tree felling permission. The development of Ore Zone X was very much confined within the grids as per approved Scheme of Mining till recently, when softer formations were encountered which posed the risk of slope failure. As a preventive measure, a gentle slope towards north-eastern side was felt essential and hence, two nos. of benches were developed within the extent of 14050N ï 14085N & 8775E ï 8985E. No ore zone has been excavated within these two benches and production has been confined within the approval. The actual manganese ore production during 2011-12 from these two quarries was 35985 MT against the approval of 80000 MT and the rate of production during the current year is very much similar to last year. The development of these two benches are also well within the diverted broken up forest land and also considered for financial assurance in the approved Progressive Mine Closure Plan till 31st Marô2013. The excavations beyond the approved grid shall be included while putting up the next Scheme of Mining which is due for submission by Novô12.

(3) Dumping in óWaste Dump ï 2ô has been carried out in grid North 14330 to 14600 & East 8950 to 9250 (near ML pillars 48 & 49) to a height of about 35 m within 20 m distance from Kundra Nala against the approved proposal of dumping in grid North 14100 to 14300 & East 8740 to 9020 with 20 m height beyond 50 m distance from Kundra Nala (refer drawing no. MP/KMM/R1/34/07).

Compliance Status:

The Waste Dump ï 2 exists within the grid of 14353N ï 14568N & 9019E ï 9276E at height of 35m after complete back filling of Ore Zone XIII against the approved proposal of 14315N ï 14516N & 9065E ï 9200E at height of 20m. The lateral extension and increase in height of waste dump beyond the approved limits had taken place few years back due to higher stripping ratio encountered than envisaged in approved Scheme of Mining. Because of scattered and pocket nature of manganese ore deposit, it has been very difficult to precisely estimate the stripping ratio. However, no more dumping in waste dump 2 has been taken place since more than last two years and it has been stabilized by terracing and plantation of native species. The Google image dated 21.12.2010 in this regard is enclosed for your kind reference.

Further, to prevent the inrush of wash offs from the said dump in to Kundra nala, a cemented retaining wall with garland drain has been provided along the toe of the dump and old boulder retaining wall is also being replaced with cemented wall. Photographs are being enclosed as Annexure ï IV for your kind reference.

(4) Dumping in Waste Dump-3 has been carried out in grid North 14310 to 14090 & East 8710 to 9100 (near ML pillars 50, 50A and 51) to a height of about 35 m ,within 50 m from Kundra Nala by complete back filling of Ore Zone XIII quarry against the approved proposal of dumping in grid East 8710 to 9030 & North 14050 to 14310 by partially back filling of Ore Zone XIII beyond 50 m distance from Kundra Nala(refer drawing no. MP/KMM/R1/34/07).

Compliance Status:

The Waste Dump ï 3 exists within the grid of 14100N ï 14320N & 8710E ï 9030E at height of 35m against the proposal within 14050N ï 14310N & 8710E ï 9030E at height of 20m. The lateral extension and increase in height of waste dump beyond the approved limits had taken place few years back due to higher stripping ratio encountered than envisaged in approved Scheme of Mining. Because of scattered and pockety nature of manganese ore deposit, it has been very difficult to precisely estimate the stripping ratio. However, no more dumping in waste dump 3 is being taken place and it has been stabilized by terracing and plantation of native species.

Further, to prevent the inrush of wash offs from the said dump in to Kundra nala, a cemented retaining wall with garland drain has been provided along the toe of the dump. Photographs are being enclosed as Annexure ï XXII for your kind reference.

(5) Retaining Wall along the bottom periphery of waste dump-3 in manganese ore zone and along bottom periphery of fines ore stack near crushing & screening plant in iron ore zone has not been maintained effectively to prevent escape of material there from.

Compliance Status:

We would like to mention that, 1st lift of waste dump ï 3 was completed during 2010-11 and simultaneously, cemented retaining wall all along the toe was provided. However, during repairing of the public road from Joda to Malda during Aprõ2012, the height of retaining wall got reduced only due to the increase in road level. Hence, we plan to enhance the height of the retaining wall wherever required. New retaining wall along bottom periphery of fines ore stack near C&S plant is being constructed and shall be completed by the end of Octoberõ12.
Photographs of dated 20.06.2011 and 25.07.2012 in this regard are enclosed as Annexure ï VI for kind reference.

(6) No check dam has been constructed against the approved proposal of 4 check dams.

Compliance Status:

Out of 4 check dams in iron ore zone, 2 check dams were proposed in forest area (khesra forest) for which diversion proposal is submitted to MoEF but approval has not yet been accorded so we could not construct these 2 check dams. The rest 2 check dams shall be constructed within 2 monthsô time.

Apart from the proposal of 4 nos. of check dams within iron ore zone, one more check dam shall be provided at the designated place near waste dump-2 as suggested by you during the inspection. This shall be completed by Septemberô12 after extension of cemented retaining wall.

(b) Violation under Rule 27(4):

Plans and Sections maintained updated in the mines are not matching with actual field conditions in respect of quarries, waste dumps in manganese ore zones etc. Updated plans & sections should be submitted to RCOM, IBM, Bhubaneswar as per provision of Rule 29.

Compliance Status:

The survey work for quarries, waste dumps and surface features has commenced and the updated plans are expected to be made ready by Septô2012 and shall be submitted to RCOM, IBM, Bhubaneswar by 1st Week of Octô2012.

1.4(e) POINTS REQUIRING ATTENTION IN THE INTEREST OF PROPER MINE DESIGN, DEVELOPMENT AND CONSERVATION OF MINERALS:

The mine was re-certified under ISO 14001:2004 in February 2007 for effective maintenance of Environmental Management Systems as per the above standard.

Khondbond Iron & Manganese Mine also bagged following awards in MEMC Week Celebrations 2011:

1st Prize for Afforestation
2nd Prize for Installation & use of mechanized beneficiation
2nd Prize for Overall performance

PART-B

(Proposals for the next five years)

2.0 PROPOSAL UNDER SCHEME OF MINING FOR THE NEXT FIVE YEARS

2.1 NAME AND ADDRESS OF THE APPLICANT:

Name and address of applicant	: Mr. H. M. Nerurkar Managing Director TATA STEEL LTD, Jamshedpur - 1. Phone: 0657-2145625 Fax : 0657-2424098
District	: Singhbhum East
State	: Jharkhand
Phone	: 0657-2145625
Fax	: 0657-2424098

2.1.1 NAME AND ADDRESS OF THE NOMINATED OWNER UNDER SECTION 76 OF MINES ACT, 1952:

Name of the lessee:	Tata Steel Limited
Name & address of nominated owner:	Mr. H. M. Nerurkar Managing Director TATA STEEL LTD, Jamshedpur - 1. Phone: 0657-2145625 Fax : 0657-2424098

However, any correspondence meant for the owner may be addressed to General Manager (OMQ) at Noamundi for quick disposal in the following address:

General Manager (OMQ)
Tata Steel Limited, Mines Division,
Noamundi ï 833217, Dist. Singhbhum West,
State: Jharkhand
Phone: 06596-233740
Fax : 06596-233706

2.2 NAME, ADDRESS AND REGISTRATION NUMBER OF THE RQP

The Second Scheme of Mining of Khondbond Lease is being prepared by the following Key Person of Tata Steel Limited, recognized as RQP by the Central Government. (Certificate enclosed as Annexure-I).

Key Person	: Awnish Kumar
Address (Key Person)	: Head (Planning) OMQ Division Tata Steel Limited
District	: West Singhbhum
State	: Jharkhand
Phone	: +91-9234301835
Fax	: 06596-233706
E-mail	: awnish.kumar@tatasteel.com
Registration No.	: RQP/CAL/039/87/B
Date of grant/renewal	: 22.11.2011
Valid up to	: 22.11.2021

The Key Person has been assisted by Mr. Pinku Kumar, Sr. Manager (Planning) and staff of Planning Department. Services of the Geological, Land & Lease, Safety and Environment sections and the field personnel of Khondbond Iron & Mn Mine were also availed of in the relevant areas of their expertise.

2.3 MINERAL TO BE MINED:

Iron Ore & Manganese Ore

2.4 AREA AND DATE OF EXPIRY OF LEASE:

The mining lease was originally granted for a period of 30 years with effect from 17.01.1933 over an area of 12.17 sq. miles (3152.018 ha) including Joda West & Katamati blocks.

The first lease renewal was granted for a period of 20 years with effect from 17.01.1963 over an area of 12.17 sq. miles (3152.018 ha) including Joda West & Katamati blocks.

During the second lease renewal for a period of 20 years with effect from 17.01.1983, Khondbond formed an independent lease over an area of 1293.433 ha.

During the third renewal for a period of 20 years with effect from 17.01.2003, the Steel Company has applied for renewal of the mining lease over an area of 978.00 ha only vide letter no. MD/LO/1061/1205 dated 27.10.2001. The balance area of 315.433 ha has been relinquished and Final Mine Closure Plan of the relinquished area has been approved by IBM vide letter no. 314(3)/2008-MCCM(CZ)/FMCP-02 dated 09.03.2009.

2.5 DATE OF EXPIRY OF THE APPROVED MINING PLAN:

The Mining Plan of Khondbond Lease containing detailed proposals for the period Fyô02 to Fyô08 was prepared over original lease area of 1293.433ha and was approved under Rule 11 of MCDR 1988 by the Controller of Mines (Central Zone) vide letter no. 314(3)/2000-MCCM(C)/MP-29 dated 11.12.2001.

The approved Mining Plan was modified (for period Fyô04 to Fyô08) in accordance with provisions of Rule 10 of MCDR, 1988 in view of its proposed increase in production of sponge grade iron ore from the existing quarry and commencement of flaky iron ore mining covering original lease area of 1293.433 ha. The modification of mining plan was approved by the Controller of Mines (CZ) vide letter no. 314(3)/2003-MCCM(C)/MP-15 dated 11.06.2004.

Progressive mine closure plan was approved by the Controller of Mines (CZ), Indian Bureau of Mines vide letter no. 314(3)/2003-MCCM(C)/MP-15 dt. 11.03.06.

The Mining Plan was further modified under Rule 22(6) of MCR 1960 for change in lease hold area (from original lease area of 1293.433 ha to applied lease area of 978 ha) with proposal of relinquishing the balance area of 315.433 ha .The modification of the approved Mining Plan along with the Progressive Mine Closure Plan covering an area of 978 ha was approved by the Controller of Mines (CZ), Indian Bureau of Mines vide letter no. 314(3)/2008-MCCM(C)/MP-38 dt. 09.03.09.

The Final Mine Closure Plan for the relinquished area of 315.433 ha submitted under Rule 23C of MCDR 1988 has been approved by the Controller of Mines (CZ), Indian Bureau of Mines vide letter no. 314(3)/2008-MCCM (CZ)/FMCP-02 dt. 09.03.2009.

First Review of Mine Plan & Scheme of Mining for the period from FYô09 to FYô13 was approved by the Controller of Mines (CZ), Indian Bureau of Mines vide letter no. 314(3)/2008-MCCM (CZ)/MS-20 dt. 31.03.2009.

3.0 RESERVES

3.1 Iron ore:

The resource and reserve estimation has been done considering all the old and new boreholes drilled till date. In Khondbond lease, boreholes have been drilled in a regular grid pattern at 50m interval in Q ore body, in the central and northern portion of the lease area drilling has been carried at 100-200m grid interval. So, to estimate the resources in this area, sectional method followed by block estimation has been adopted for resource calculation using surpac software most part of the iron bearing areas. However, in some part, section method is adopted and the resources have been calculated manually or polygonal method has been used for resource estimation. The details of estimation of reserves (section wise) and resources are given in Annexure XVI.

Ore body modeling:

Vertical borehole sections were extracted along the transverse direction at regular interval and interpreted to prepare the transverse geological sections. The transverse geological sections are given in drawing no. MP/KIMM/R2/4-4A/12. The interpreted sections were digitized and slices were extracted for the preparation of slice maps at 6 m interval.

Compositing:

Downhole compositing of assays based on lithology was carried out. Compositing of depths are taken as 3m with condition of inclusion of any sample with length upto 75% of the designated composite length. This has been done for all types of ores, subgrade material and waste rocks. The cutoff grade for iron ore is 58 % Fe (min) and subgrade material is Fe 45%.

Block Grade Estimation:

Grade estimation of the deposit has been done using Inverse Square Distance (ISD) method. The norms adopted for grade estimation and reserve calculations are described below:

For block grade estimation, block size has been chosen 50m X 50m X 6m, considering borehole spacing, which was at 100m X 100m.

Minimum and maximum number of samples considered for estimation is 1 and 50 respectively. An ellipsoidal search with a maximum search distance of 200m in the horizontal plane and 6m in the vertical plane from the centroid of the block has been considered for estimation.

The specific gravity for different types of rocks considered for resource estimation is given below:

Lithology	**Insitu Specific gravity (t/cu.m)**
Hard Ore	4.0
Soft Ore	3.5
Flaky Ore	3.0
Powdery Ore	3.0
Blue dust	3.0
Subgrade	3.0
Waste	2.5

Resource & reserve as indicated in approved scheme are given below in Table 3.1.1 (as on 01.04. 2008)

TABLE: 3.1.1
GEOLOGICAL RESOURCE OF IRON ORE AS ON 01.04.2008

(All figures in million tonnes)

Classification	**Resource**	**Grade**
Total Mineral Resources (A+B)	215.17	Fe > 58%
A Mineral Reserve (1) Proved Mineral Reserve(111) (2) Probable Mineral Reserve(121 and 122)	128.70	Fe > 58%
B Remaining Resources (1) Feasibility Mineral Resource(211) (2) Pre-feasibility Mineral Resource(221 and 222) (3) Measured Mineral Resource(331) (4) Indicated Mineral Resource(332) (5) Inferred Mineral Resource(333)	 28.95 0.00 0.00 0.00 57.52	 Fe > 58%

Year-wise excavation:

Excavation of the ore year-wise is given below as per annual return:

TABLE: 3.1.2

Year	**Quantity in Million**
2008-09	0.63
2009-10	0.59
2010-11	0.70
2011-12	0.52
Total	**2.44**

Updated resource and reserve of Iron ore as on 01/04/12:

The ore reserves & resources quantity and quality above Fe 58% as on 1.04.2012 is shown in the table 3.1.3(a).

Table 3.1.3(a)
Ore resources as on 01.04.2012

Classification	Ore Resource (Mt)	Grade
Total Mineral Resources (A+B)	**212.73**	
A Mineral Reserve		
(1) Proved Mineral Reserve (111)	126.26	
B Remaining Resources	**86.47**	
(1) Feasibility Mineral Resource (211)	28.95	Fe >58%
(2) Pre-feasibility Mineral Resource(222)	0	
(3) Measured Mineral Resource(331)	0	
(4) Indicated Mineral Resource(332)	0	
(5) Inferred Mineral Resource(333)	57.52	

Updated resource and reserve of Iron ore as on 01/11/12:

The resources/reserves have been re-examined with all the boreholes drilled from 1959 to 2012. Re-classification of the resource/reserves has been done keeping in view of the ultimate pit, other mining restrictions and also in line with the present status of forest clearance. Accordingly, the resources and reserves have been modified as given in table 3.1.3 (b)." The details of estimation section wise are given in Annexure XVII.. Depletion due to mining during the period April 2012 to October 2012 is 0.40 Mt. The ore reserves & resources quantity and quality above Fe 58%, as on 01.11.2012 are shown in the table 3.1.3(b).

Table 3.1.3(b)
Ore resources as on 01.11.2012

Classification	Ore Resource (Mt)	Grade
Total Mineral Resources (A+B)	**212.34**	
A Mineral Reserve	**164.16**	
(1) Proved Mineral Reserve (111)	66.90	
(2) Probable Mineral Reserve (121)	94.85	
(3) Probable Mineral Reserve (122)	2.41	
B Remaining Resources	**48.18**	
(1) Feasibility Mineral Resource (211)	3.95	Fe >58%
(2) Pre-feasibility Mineral Resource (221+222)	0.09	
(3) Measured Mineral Resource(331)	0	
(4) Indicated Mineral Resource(332)	0	
(5) Inferred Mineral Resource(333)	44.14	

Subgrade Resources:

The sub-grade or low grade patches that is produced from mineralized zones may not conform to the present specifications of marketable ores as applicable to a particular

region or period at present stage of technological development and economy, but may have a scope to make them saleable in future through advanced mining, beneficiation and utilization techniques.

Distribution of the sub/low-grade patches

The formation of these ores is found to be heterogeneous and the continuity spatially in the mineralized zone is not observed. The thickness varies from place to place both laterally and vertically. This could be further seen in the geological cross-sections. The heterogonous nature of these litho types may be due to:

1) weathering is not uniform in the ridge and/or
2) controlled by structural disturbances.

The subgrade material is found in the form of intercalated patches within the ore zone which has been delineated by exploratory drilling, sampling and assaying. This subgrade consists of ferruginous shale and clay material having high alumina (deleterious) with low iron content ranging from 45% to 58% averaging around Fe53-54%. The mine development has been planned accordingly delineating iron ore (Fe>58%) for plant feed, subgrade patches (<45% & <58%Fe) and waste material (<45%Fe) for stacking. The entire exercise of mine planning is being carried out by using sophisticated mine planning software ñSURPAC VISSIONò for systematic and scientific excavation planning.
Further, short term mine planning is being practiced using blast hole drilling and sampling for deciphering the iron ore, subgrade patches and waste material separately.
As such there is no program for disposal of subgrade outside the lease and its use for beneficiation and blending purposes, it is stacked separately as shown in the mining scheme.
The mineralogical amenability of this low grade material has been initiated, however, detailed mineral characterisation, mineral liberation and beneficiation studies will be conducted shortly.

The resources/reserves of material having Fe% > 45% and <58% at Khondbond Iron Mine as on 01/11/12 has also been estimated based on actual availability of such material in the different categories of reserves and resources reported. The subgrade resources quantity and quality Fe 45-58% has also been shown in the table 3.1.4.

Table 3.1.4
Subgrade resources as on 01.11.2012

Classification	Ore Resource (Mt)	Grade
A Mineral Reserve	**0.00**	
(1) Proved Mineral Reserve (111)	0.00	
(2) Probable Mineral Reserve (122)	0.00	
B Remaining Resources	**91.82**	
(1) Pre-feasibility Mineral Resource (221)	60.37	Fe 45-58%
(2) Pre-feasibility Mineral Resource(222)	7.92	
(3) Measured Mineral Resource(331)	0.00	
(4) Indicated Mineral Resource(332)	0.00	
(5) Inferred Mineral Resource(333)	23.53	
Total Insitu Resources (A+B)	**91.82**	
Resources in Dumps	**10.54**	
Total subgrade resources	**102.36**	

Method for classification for Resources

The geological insitu resources have been established based on the geological mapping, other geological information and exploratory borehole data till 01/11/12. This has been grouped in three categories viz. Measured, Indicated and Inferred resources as per UNFC classification in geological axis (Table 3.1.5).

Table 3.1.5

Name of Block	Geological Resources	Pit	Spacing of the borehole (m)	Area Covered in ha	Barren Area in ha	Fe > 58%		Fe (45 - 58%)	
						Tonnages (Mt)	Grade Range	Tonnage (Mt)	Grade Range
Iron Ore	Measured Resources	Q Ore body	50 X 50	649	84	165.69	58 ï 66%	60.37	45 ï 58%
		Outside Q ore body	100 X 100, 100 X 200						
	Indicated Resources		~ 200m			2.5		7.92	
	Inferred Resources		Limited exploration Ó400m			44.14		23.53	
	Total			**649**	**84**	**212.33**		**91.82**	

After establishing the geological resources in G1& G2 axis, these resources are further classified into Proved, Probable reserve and Feasibility & Pre-feasibility resources as per the UNFC guidelines.

The resources provided in the subgrade stack (10.54 Mt) have been estimated on the basis of the cumulative figures provided in the annual return.

Table 3.1.7 Composite Table of Resources & Reserves as on 01.11.2012
Figures in million tonnes

UNFC Classification (Codes)	Iron Ore Fe +58%	Constraints	Subgrade Fe 45-58%	Constraints
Reserves				
111	66.90	Nil	-	
121	94.85	Partly in forest area, FC will be obtained shortly	-	
122	2.41	G2 category resources; Partly in forest area, FC will be obtained shortly	-	
Sub Total	**164.15**			
Insitu Resources				
211	3.95	Lease Boundary	60.37	Economic /Subgrade
221+222	0.09	G2 category Resources	7.92	G2 category Economic/Subgrade
333	44.14	G3 category Resources	23.53	G3 category Economic/Subgrade
Sub Total	**48.18**		**91.82**	
Non In-situ Resources				
Subgrade Stacks/Dumps			10.54	
Total	**212.33**		**102.36**	

Classification for Ore Resources and Reserves (Fe > 58%) in different types of forest and non-forest land:

The classification of resources and reserves in different types of land is given in Table 3.1.8.

A Mineral Reserve	Broken/ Diverted	Applied For FD	Non Forest	Total
(1) Proved Mineral Reserve(111)	66.90			66.90
(2) Probable Mineral Reserve(121)	78.72	16.12		94.85
(3) Probable Mineral Reserve(122)	1.30	0.84	0.27	2.41
B Remaining Resources				
(1) Feasibility Mineral Resource(211)		3.95		3.95
(2) Pre-feasibility Mineral Resource (221+222)		0.09		0.09
(3) Measured Mineral Resource (331)				
(4) Indicated Mineral Resource (332)				
(4) Inferred Mineral Resource (333)		44.14		44.14
Total	**66.90**	**145.17**	**0.27**	**212.33**

Classification for Subgrade Ore Resources and Reserves (Fe >45-58%) in different types of forest and non-forest land:

The classification of resources and reserves in different types of land is given in Table 3.1.9.

A Mineral Reserve	Broken/ Diverted	Applied For FD	Non-Forest	Total
(1) Proved Mineral Reserve(111)				
(2) Probable Mineral Reserve(121)				
(3) Probable Mineral Reserve(122)				
B Remaining Resources				
(1) Feasibility Mineral Resource(211)	50.11	10.26		60.37
(2) Pre-feasibility Mineral Resource (221+222)		7.05	0.87	7.92
(3) Measured Mineral Resource (331)				
(4) Indicated Mineral Resource (332)				
(4) Inferred Mineral Resource (333)		23.53		23.53
Total	**50.11**	**40.84**	**0.87**	**91.82**

Justification of reserve & resources above cut-off grade (Fe> 58%)
Reserve UNFC 111: 66.90 Mt.

GEOLOGICAL AXIS

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

FEASIBILITY AXIS

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

ECONOMIC AXIS

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

Probable reserve UNFC 121: 94.85 Mt.

GEOLOGICAL AXIS

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

FEASIBILITY AXIS

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

ECONOMIC AXIS

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

Probable reserve UNFC 122: 2.41 Mt.

GEOLOGICAL AXIS

G2(General Exploration)	Work carried out
1.Geological survey : (i)Mapping on 1:25,000 to 1:5,000 or larger scale with triangulation points, benchmarks, if any shown For coal, mapping on 1:10,000 scale (ii) Linking of maps so prepared with topogrid; (iii)Assessment of lithology, structure, surface mineralisation, analysis of old history of mining.	1) i) Geological mapping done at 1: 5000 scale ii) Furnished in the surface geological plan iii) Done
2. Geochemical survey: (i)Detailed litho-geochemical channel sampling from fresh rock exposures, trenches, pits; (ii)Recording of deleterious elements, likely by-product elements (e.g. Ga in bauxite, Ni, PGE etc. in chromite, Au in Fe ore, etc. (Nil for coal/lignite exploration);	2) i) Detailed analyses of the borehole and are available. ii) Recording of deleterious elements like alumina and phosphorous has been done.
3.Geophysical survey: (i)Borehole geophysical survey; (ii)Special geophysical traverses for problem solving, if required .	3) Not done.
4.Technological: (a)Pitting/trenching: systematic pitting/trenching for deciphering extent of mineralisation at surface. (b)Drilling: grid reduction needed: spacing (i) for coal, gypsum near surface potash and salt beds-400 to 1000m; (ii) Iron and manganese ore-100 to 200m. (iii) limestone and dolomite and barytes- 200 to 400m up to a depth of at least 30 m; (c) Sampling: (i) Systematic pit and trench sampling, deep pitting if necessary; (ii) Core sampling: lithology and strength of mineralisation wise (check sampling -10%). (d) Laboratory scale scanning/chemical analysis, (e) Bulk sampling if necessary for testing processing technology. (f) Collection of abiotic geo-environmental parameters.	4) Drilling done at 200m interval Detailed core sampling and analyses of the borehole are available.
5.Petrographic: Study of petrographic character of rocks including grain size, texture etc.	5) Petrographic study has been done.

FEASIBILITY AXIS

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

ECONOMIC AXIS

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

Resource UNFC 211: 3.95 Mt.

GEOLOGICAL AXIS

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

FEASIBILITY AXIS

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

ECONOMIC AXIS

E2 (Potentially Economic)	Work carried out
1.General and detailed exploration 2 .Specific end-use grades of reserves (above /marginally below economic cut-off grade). 3. General knowledge of forest/non-forest and other land use data.	1) Detailed exploration has been carried out 2) Cannot be mined right now 3) Locked up in lease boundaries and in forest areas.

Resource UNFC 222: 0.09 Mt.

GEOLOGICAL AXIS

G2(General Exploration)	Work carried out
1.Geological survey : (i)Mapping on 1:25,000 to 1:5,000 or larger scale with triangulation points, benchmarks, if any shown For coal, mapping on 1:10,000 scale (ii) Linking of maps so prepared with topogrid; (iii)Assessment of lithology, structure, surface mineralization, analysis of old history of mining.	1) i) Geological mapping done at 1: 5000 scale ii) Furnished in the surface geological plan iii) Done
2. Geochemical survey: (i)Detailed litho-geochemical channel sampling from fresh rock exposures, trenches, pits; (ii)Recording of deleterious elements, likely by-product elements (e.g. Ga in bauxite, Ni, PGE etc. in chromite, Au in Fe ore, etc. (Nil for coal/lignite exploration);	2) i) Detailed analyses of the borehole and are available. ii) Recording of deleterious elements like alumina and phosphorous has been done.
3.Geophysical survey: (i)Borehole geophysical survey; (ii)Special geophysical traverses for problem solving, if required .	3) Not done.
4.Technological: (a)Pitting/trenching: systematic pitting/trenching for deciphering extent of mineralisation at surface. (b)Drilling: grid reduction needed: spacing (i) for coal, gypsum near surface potash and salt beds-400 to 1000m; (ii) Iron and manganese ore-100 to 200m. (iii) limestone and dolomite and barytes- 200 to 400m up to a depth of at least 30 m; (c) Sampling: (i) Systematic pit and trench sampling, deep pitting if necessary; (ii) Core sampling: lithology and strength of mineralisation wise (check sampling -10%). (d) Laboratory scale scanning/chemical analysis, (e) Bulk sampling if necessary for testing processing technology. (f) Collection of abiotic geo-environmental parameters.	4) Drilling done at 200m interval Detailed core sampling and analyses of the borehole are available.
5. Petrographic: Study of petrographic character of rocks including grain size, texture etc.	5) Petrograhic of study samples have been done.

FEASIBILITY AXIS

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

ECONOMIC AXIS

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

Resource UNFC 333: 44.14 Mt.

GEOLOGICAL AXIS

G3 (Prospecting)	Work carried out
1.**Geological survey:** (i) Mapping on 1:50,000 to 1:25,000 scale (for coal, lignite exploration- mapping on 1:10,000); (ii)Linking of maps so prepared with topo-grids; (iii)Assessment of lithology, structure, surface mineralisation, analysis of old history of mining. **2.Geochemical survey**: Geochemical sampling, rock type-wise and if necessary, rock type-cum-skeletal soil-domain-wise (for all metallic mineral exploration). **3.Geophysical survey:** Detailed ground geophysical work; bore-hole geophysical logging, if possible. **4)Technological**: (a)Pitting/trenching to explore bed rock/mineralised zone; (b)Drilling: Preliminary drilling (dry drilling for bauxite and in formation vulnerable to wash). Bore-hole spacing - (ii) Iron and manganese ore - 200 to 400 m; (c) Sampling: Sampling at well-defined locations at surface and also from pits/trenches, boreholes and existing mine openings. **5.Petrographic/mineralogaphic studies:** (i)Petrographic study of rocks of the deposit and its surroundings, alterations (if any) connected with mineralisation; (ii)Determination of phase in which mineral of interest occur; (iii)Mineralogical studies including paragenesis, identification of zones of oxidation and primary zones, grain size distribution, overall characteristics of useful minerals.	1) i) Geological mapping done at 1: 5000 ii) Furnished in the surface geological plan iii) Done 2) Surface samples analyses has been done. 3) Not done. 4) Boreholes drilled > 400m spacing. Analyses of the borehole samples are available. 5) Preliminary study of the petrography has been done

FEASIBILITY AXIS

F3 (Geological Study)	Work carried out
1.Geological and related study: (i) Geological, mineralogical and chemical analysis data; (ii) Topographical setting and nature of land; (iii) Infrastructure; (iv) Meteorological and preliminary ecology data if possible.	1) Geological study, exploration and mineralogical study has been done. Topography survey has been conducted. Meteorological and preliminary ecology data available.
2. The activities as above or less than that required for **F2** **i). Mining:** Methods, pre-production plan, development plan, manpower (rough estimate). **ii). Environment:** Base line data on environment. **iii). Processing:** Proven laboratory scale/pilot scale beneficiation, investigation data,likely establishment, **iv).Infrastructure and services, construction activities**: Brief details **v).Costing**: Capital and operating cost - rough estimates based on comparable mining operations. **vi) .Marketing**: Overview like industrial structure, demand supply relation, pricing, etc. **vii) Economic viability:** Preliminary study of cash flow forecasts. **viii). Other factors**: Statutory provisions relating to labour, land, mining, taxation, etc.	2) i) Not done ii) EIA studies and EMP has been done iii) Not done. iv) Enclosed in Mining Plan. v) Costs details have provided in annual returns vi) Captive Mine. vii) Economic viability is being calculated on the basis of our captive requirement. viii) Complied.

ECONOMIC AXIS

E3(Intrinsically Economic)	Work carried out
1. Reconnaissance to detailed geological study, rough estimates of grades (may be below economic cut-off), general idea about forest /non ï forest and land use status.	1) Has been carried out
2. The activities as above or less than that required for **E** i .Specific end-use grades of reserves (above /marginally below economic cut-off grade). ii. General knowledge of forest/non-forest & other land use data.	2) i)Not established. ii) Mostly in forest areas

Justification of subgrade resources (Fe 45-58%)
Resource UNFC 221: 60.37 Mt.

GEOLOGICAL AXIS

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

FEASIBILITY AXIS

F2 (Pre-feasibility Study)	Work carried out
1. Geology: Local geology, mineralogy, identification of ore types and geometry. **2. Mining:** Methods, pre-production plan, development plan, manpower (rough estimate). **3. Environment:** Base line data on environment. **4. Processing:** Proven laboratory scale/pilot scale beneficiation, investigation data, likely establishment, **5.Infrastructure and services, construction activities**: Brief details **6. Costing**: Capital and operating cost - rough estimates based on comparable mining operations. **7. Marketing**: Overview like industrial structure, demand supply relation, pricing, etc. **8. Economic viability:** Preliminary study of cash flow forecasts. **9. Other factors**: Statutory provisions relating to labour, land, mining, taxation, etc.	1) Geological study, exploration and mineralogical study has been done. Topography survey has been conducted. Meteorological and preliminary ecology data available. 2) i) Not done ii) EIA studies and EMP has been done iii) Not done. iv) Enclosed in Mining Plan. . v) Costs details have provided in annual returns vi) Not established, presently this will be stacked separately. vii) Not established viii) Complied.

ECONOMIC AXIS

E2(Potentially Economic)	Work carried out
1.General and detailed exploration 2 .Specific end-use grades of reserves (above /marginally below economic cut-off grade). 3. General knowledge of forest/non-forest and other land use data.	1) Has been carried out 2) i) Not established. ii) Partly in forest areas

Resource UNFC 222: 7.92Mt.

GEOLOGICAL AXIS

G2(General Exploration)	Work carried out
1.Geological survey : (i)Mapping on 1:25,000 to 1:5,000 or larger scale with triangulation points, benchmarks, if any shown For coal, mapping on 1:10,000 scale (ii) Linking of maps so prepared with topogrid; (iii)Assessment of lithology, structure, surface mineralization, analysis of old history of mining.	1) i) Geological mapping done at 1: 5000 scale ii) Furnished in the surface geological plan iii) Done
2. Geochemical survey: (i)Detailed litho-geochemical channel sampling from fresh rock exposures, trenches, pits; (ii)Recording of deleterious elements, likely by-product elements (e.g. Ga in bauxite, Ni, PGE etc. in chromite, Au in Fe ore, etc. (Nil for coal/lignite exploration);	2) i) Analyses of the borehole and are available. ii) Recording of deleterious elements like alumina and phosphorous has been done.
3.Geophysical survey: (i)Borehole geophysical survey; (ii)Special geophysical traverses for problem solving, if required .	3) Not done.
4.Technological: (a)Pitting/trenching: systematic pitting/trenching for deciphering extent of mineralisation at surface. (b)Drilling: grid reduction needed: spacing (i) for coal, gypsum near surface potash and salt beds-400 to 1000m; (ii) Iron and manganese ore-100 to 200m. (iii) limestone and dolomite and barytes- 200 to 400m up to a depth of at least 30 m; (c) Sampling: (i) Systematic pit and trench sampling, deep pitting if necessary; (ii) Core sampling: lithology and strength of mineralisation wise (check sampling -10%). (d) Laboratory scale scanning/chemical analysis, (e) Bulk sampling if necessary for testing processing technology. (f) Collection of abiotic geo-environmental parameters.	4) Drilling done at ~200m interval Core sampling and analyses of the borehole are available. No laboratory test has been done.
5. Petrographic: Study of petrographic character of rocks including grain size, texture etc.	5) Mineralogical of study samples have been done.

FEASIBILITY AXIS

F2 (Pre-feasibility Study)	Work carried out
1. Geology: Local geology, mineralogy, identification of ore types and geometry. **2. Mining:** Methods, pre-production plan, development plan, manpower (rough estimate). **3. Environment:** Base line data on environment. **4. Processing:** Proven laboratory scale/pilot scale beneficiation, investigation data, likely establishment, **5.Infrastructure and services, construction activities**: Brief details **6. Costing**: Capital and operating cost - rough estimates based on comparable mining operations. **7. Marketing**: Overview like industrial structure, demand supply relation, pricing, etc. **8. Economic viability:** Preliminary study of cash flow forecasts. **9. Other factors**: Statutory provisions relating to labour, land, mining, taxation, etc.	1) Geological study, exploration and mineralogical study has been done. Topography survey has been conducted. Meteorological and preliminary ecology data available. 2) i) Not done ii) EIA studies and EMP has been done iii) Not done. iv) Enclosed in Mining Plan. . v) Costs details have provided in annual returns vi) Not established, presently this will be stacked separately. vii) Not established viii) Complied.

ECONOMIC AXIS

E2(Potentially Economic)	Work carried out
1.General and detailed exploration 2 .Specific end-use grades of reserves (above /marginally below economic cut-off grade). 3. General knowledge of forest/non-forest and other land use data.	1) Has been carried out 2) i) Not established. ii) Partly in forest areas

Resource UNFC 333: 23.53 Mt.

GEOLOGICAL AXIS

G3 (Prospecting)	Work carried out
1.**Geological survey:** (i) Mapping on 1:50,000 to 1:25,000 scale (for coal, lignite exploration- mapping on 1:10,000); (ii)Linking of maps so prepared with topo-grids; (iii)Assessment of lithology, structure, surface mineralisation, analysis of old history of mining. **2.Geochemical survey**: Geochemical sampling, rock type-wise and if necessary, rock type-cum-skeletal soil-domain-wise (for all metallic mineral exploration). **3.Geophysical survey:** Detailed ground geophysical work; bore-hole geophysical logging, if possible. **4)Technological**: (a)Pitting/trenching to explore bed rock/mineralised zone; (b)Drilling: Preliminary drilling (dry drilling for bauxite and in formation vulnerable to wash). Bore-hole spacing - (ii) Iron and manganese ore - 200 to 400 m; (c) Sampling: Sampling at well-defined locations at surface and also from pits/trenches, boreholes and existing mine openings. **5.Petrographic/mineragr-aphic studies:** (i)Petrographic study of rocks of the deposit and its surroundings, alterations (if any) connected with mineralisation; (ii)Determination of phase in which mineral of interest occur; (iii)Mineralogical studies including paragenesis, identification of zones of oxidation and primary zones, grain size distribution, overall characteristics of useful minerals.	1) i) Geological mapping done at 1: 5000 ii) Furnished in the surface geological plan iii) Done 2) Surface samples analyses has been done. 3) Not done. 4) Boreholes drilled > 400m spacing. Analyses of the borehole samples are available. 5) Preliminary mineralogical study has been done

FEASIBILITY AXIS

F3 (Geological Study)	Work carried out
1.Geological and related study: (i) Geological, mineralogical and chemical analysis data; (ii) Topographical setting and nature of land; (iii) Infrastructure; (iv) Meteorological and preliminary ecology data if possible. **2**. The activities as above or less than that required for **F2** **i). Mining:** Methods, pre-production plan, development plan, manpower (rough estimate). **ii). Environment:** Base line data on environment. **iii). Processing:** Proven laboratory scale/pilot scale beneficiation, investigation data,likely establishment, **iv).Infrastructure and services, construction activities**: Brief details **v). Costing**: Capital and operating cost - rough estimates based on comparable mining operations. **vi) .Marketing**: Overview like industrial structure, demand supply relation, pricing, etc. **vii) Economic viability :**Preliminary study of cash flow forecasts. **viii). Other factors**: Statutory provisions relating to labour, land, mining, taxation, etc.	1) Geological study, exploration and mineralogical study has been done. Topography survey has been conducted. Meteorological and preliminary ecology data available. 2) i) Not done ii) EIA studies and EMP has been done iii) Not done. iv) Enclosed in Mining Plan. . v) Costs details have provided in annual returns vi) Not established, presently this will be stacked separately. vii) Not established viii) Complied.

ECONOMIC AXIS

E3(Intrinsically Economic)	Work carried out
1. Reconnaissance to detailed geological study, rough estimates of grades (may be below economic cut-off), general idea about forest /non ï forest and land use status. 2. The activities as above or less than that required for **E** i .Specific end-use grades of reserves (above /marginally below economic cut-off grade). ii. General knowledge of forest/non-forest and other land use data.	1) Has been carried out 2) i) Not established. ii) Forest area

3.2 Manganese Ore:

The deposit evaluation and resource estimation procedure is given below:

- Deposit evaluation has been done by using mine planning software Gemcom Surpac Version 6.1.
- Data collection from graphical borehole logs, recording and codification.
- Data recording in excel file and validation of data is being carried out.
- Creation of database in application software ï Gemcom Surpac Version 6.1.
- Creation of digital database of topography, geological features (litho contact) and surface features by digitization.
- Preparation of Digital Terrain Model (DTM) of topography using survey data and extraction of surface profiles along cross section lines.
- Preparation of transverse geological cross sections from geology and assay database of boreholes.
- Correlation of ore bodies in transverse cross sections.
- 3D Solid ore body modeling by triangulation method.
- Block Modeling and estimation of grade by Inverse Square Distance (ISD) method.
    - In this method, down-hole compositing of assays was carried out for manganese ore zones. Compositing of depths are taken as 2m with condition of inclusion of any sample with length upto 75% of the designated composite length. Other litho-types were not considered.
    - For block grade estimation, block size chosen is 2m X 2m X 1m, considering the pockety nature of manganese ore bodies.
    - Minimum and maximum number of samples considered for estimation is 1 and 15 respectively. An ellipsoidal search with a maximum search distance of 50m in the horizontal plane and 3m in the vertical plane has been considered for estimation.
- Insitu bulk density is considered to be 2.5 t/Cu m for calculating tonnage.
- The cut-off grade for manganese ore is considered to be 25% Mn and the threshold limit is considered as 10% Mn. Manganese mineralization with 10% to 25% Mn content is considered as sub-grade ore.
- Resource classification has been done as per UNFC norms. 331 category mineral resources has been established for the areas where there is proving information with higher confidence level provided by less than 50 m x 50 m grid space drilling. Indicated mineral resource (UNFC 332 category), is categorized for the resource estimated for the areas where there is proving information with lower confidence level provided by more than 50 m x 50 m and less than 100 m x 100 m grid space drilling. Inferred mineral resource (UNFC 333 category), is categorized for resource estimated for the areas where there is proving information with lowest confidence level provided by more than 100 m x 100 m grid space drilling and also for exposed outcrops mapped in 1:5000 scale.
- Following the UNFC norms for codifying reserve under Proved (111) and Probable (122) category, mine feasibility as well as economic aspects are implied on the geologically Measured (331) and Indicated (332) mineral resources.
- The subgrade manganese resources has been categorized into Measured (331), Indicated (332) and Inferred (333) resources as per UNFC norms since feasibility

study has not been carried out and it is not economically mineable at the present moment.

- All the outcrops of manganese ore mapped (on 1:5000 scale) in the lease area (including the forest areas) which indicate occurrence of potential ore zones, however, feasibility of mining, economics and the exact geological details in terms of actual depth and grade distribution cannot be qualified for such outcrops at this stage are brought under inferred (333) category. Possible depth for such outcrops is taken to be 3 meters for resource estimation. Based on the above estimations there was revision of inferred category of resources.

The details of estimation of reserves (section wise) and resources are given in Annexure XVIII.

The category-wise resource and reserve of manganese ore as on 01.04.2008 as indicated in the approved Scheme of Mining is given below in Table: 3.2.1:

TABLE: 3.2.1

Category wise geological resources & reserve of manganese ore as on 01.04.2008

Category	Mn. Ore (Lakh tones)	Grade
Total mineral resource (A+B)	7.66	Mn > 25%
A. Mineral Reserve		
(1) Proved Mineral Reserve (111)	1.32	
B. Remaining Resources		
(1) Feasibility mineral resource (211)		
(2) Pre-feasibility mineral resource (221&222)	2.34	
(3) Inferred Mineral resource (333)	4.00	

Year-wise excavation:

Excavation of the ore year-wise is given below as per annual return in Table 3.2.2:

TABLE - 3.2.2

Year wise excavation of manganese ore reserves (Figs in Lakh tones)

Year	Chemical & High	Med. Gr.	Low Gr.	Total
2008-09	0.33429	0.08394	0.00952	0.42775
2009-10	0.33192	0.06224	0.01424	0.40840
2010-11	0.17524	0.22257	0.03030	0.42811
2011-12	0.14128	0.26964	0.01681	0.42773
Total	**0.98273**	**0.63839**	**0.07087**	**1.69199**

The updated resource position as on 01.04.2012 has been calculated after depletion of the ore after mining from 2008-09 to 2011-12 and new resource estimation carried out during 2009-10,which is given below:

TABLE: 3.2.3
Category wise geological resources & reserve of manganese ore as on 01.04.2012

Category	Mn. Ore (Lakh tones)
Total mineral resource (A+B)	5.96
A. Mineral Reserve	
(1) Proved Mineral Reserve (111)	3.13
B. Remaining Resources	
(1) Feasibility Mineral Resource (211)	
(2 Pre-feasibility Resource (221&222)	1.41
(3) Indicated Mineral Resource (332)	
(4) Inferred Mineral Resource (333)	1.42

Additional resources/reserves established

Resource evaluation has been done based on the new boreholes drilled during the approved scheme of mining for the period FY–09 to FY–13 and all old boreholes drilled till FY–08. Resource estimation has been carried out using ore body modeling and block modeling technique as described above.

A total of 2.20 lakh tonnes additional resources of +25% Mn have been established during this new re-estimation process with the resource figures as on 01.04.2012 (after adding 0.29 lakh tonnes mining during the periodApril2012 to October 2012).

At the same time, the subgrade resource (Mn 10-25 %) has also been established in the leasehold which is around 9.33 lakh tonnes. Details are shown in table 3.2.3, table 3.2.4 and table 3.2.5.

Updated resource & reserves in Manganese Ore as on 01/11/12:

TABLE: 3.2.4
Category wise geological resource & reserve of manganese ore for +25% mn ore as on 01.11.2012

Category	Mn. Ore (Lakh tones)
Total mineral resource (A+B)	7.87
A. Mineral Reserve	
(1) Proved Mineral Reserve (111)	6.36
B. Remaining Resources	
(1) Feasibility Mineral Resource (211)	
(2) Pre-Feasibility Mineral Resource	
(3) Indicated Mineral Resource (332)	0.04
(4) Inferred Mineral Resource (333)	1.47

TABLE: 3.2.5
Category wise geological resource of manganese ore for +10-25% mn ore (subgrade)
as on 01.04.2012

Category	Mn. Ore (Lakh tones)
Total mineral resource	9.33
(3) Measured Mineral Resource (331)	7.79
(4) Indicated Mineral Resource (332)	1.14
(5) Inferred Mineral Resource (333)	0.40

Table 3.2.6 Composite Table of Resources & Reserves as on 01.11.2012
Figures in Lakh tonnes

UNFC Classification (Codes)	**Mn Ore Mn +25%**	**Constraints**	**Subgrade Mn 10-25%**	**Constraints**
Reserves				
111	6.36	Nil	-	
121			-	
122				
Sub Total	**6.36**			
Insitu Resources				
211				
221+222			8.93	G1 & G2 category Economic/Subgrade
332	0.04	G2 category Resources		
333	1.47	G3 category Resources	0.40	G3 category Economic/Subgrade
Sub Total	**1.51**		**9.33**	
Non Insitu Resources				
Subgrade Stacks/Dumps			**0.50**	
Total	**7.87**		**9.83**	

Classification for Ore Resources and Reserves (Mn > 25%) in different types of forest and non-forest land:

The classification of resources and reserves in different types of land is given in Table 3.2.7.

Table 3.2.7: MN ORE (Mn > 25%) Resources & Reserves in different types of land

A Mineral Reserve	Broken/ Diverted	Forest	Non Forest	Total
(1) Proved Mineral Reserve(111)	6.36			6.36
(2) Probable Mineral Reserve(121)				
(3) Probable Mineral Reserve(122)				
B Remaining Resources				
(1) Feasibility Mineral Resource(211+221)				
(2) Pre-feasibility Mineral Resource (222)				
(3) Measured Mineral Resource (331)				
(4) Indicated Mineral Resource (332)	0.04			0.04
(4) Inferred Mineral Resource (333)		1.47		1.47
Total	**6.40**	**1.47**	**0.00**	**7.87**

Classification for Subgrade Ore Resources and Reserves (Mn >10-25%) in different types of forest and non-forest land:

The classification of resources and reserves in different types of land is given in Table 3.2.8.

Table 3.2.8: MN ORE (Fe>10-25%) Resources & Reserves in different types of land

A Mineral Reserve	Broken/ Diverted	Forest	Non Forest	Total
(1) Proved Mineral Reserve(111)				
(2) Probable Mineral Reserve(121)				
(3) Probable Mineral Reserve(122)				
B Remaining Resources				
(1) Feasibility Mineral Resource(211+221)				
(2) Pre-feasibility Mineral Resource (221+222)	8.93			8.93
(3) Measured Mineral Resource (331)				
(4) Indicated Mineral Resource (332)				
(4) Inferred Mineral Resource (333)		0.40		0.40
Total	**8.93**	**0.40**		**9.33**

Justification of Manganese Ore Resources & Reserves above cut-off grade (Mn>25%):

Proved Mineral Reserve (111): 6.36 lakh tonnes

GEOLOGICAL AXIS

G1(Detailed Exploration)	Work carried out
1.Geological survey: (i)Mapping-For coal, mapping 1:5000;for other minerals 1:1000 (ii)Preparation of detailed topographical-cum-geological map including all surface geological features, extent of deposit, structure, location of boreholes, assay plan & sections of exploratory mine development &borehole data; (iii)Topogrid/triangulation stations linked in the maps. **2.Geochemical survey:** Detailed grid pattern sampling and analysis. **3.Geophysical survey:** Detailed and specific borehole geophysical survey. **4.Technological:** (i)Pitting - 2 to 5 per sq. km. for simple deposits; (ii)Trenching - At spacing of 200-300m; (iii)Drilling- closer spaced (with definite grid pattern) than that for G2 category; For opencast project grid spacing may be 100m x 50m (iv)Exploratory mining and check drilling results if possible (v)Sampling- systematic pit and trench sampling, core and sludge sampling for laboratory scale and bulk sample for the pilot plant scale beneficiation studies. **5.Petrographic and mineragraphic study:** Refining of data on the petrographic character of rocks of the deposit and its surroundings, alterations (if any), including study of grain size texture gangue and its liberation characteristics for further refining of data **6.Geostatistical analysis** of borehole data thickness of ore: waste encountered in holes, assay values of samples if considered necessary.	1) i) Geological mapping done at 1: 5000 and 1:1000 scale. ii) Detail topographic contouring has been with contour spacing of 5m and other relevant features are furnished in surface geological plan. iii) Done. 2) Detailed analyses of the borehole are available. 3) Not done. 4) i) Mine already exists. ii) Mine already exists. iii) Drilling done at 25m & 50m grid interval. iv) Mine already exists. v) Detailed analyses of the borehole and blastholes, face samples are available. 5) Mineralogical study has been done for manganese ore and its associated rocks. 6) Geostatistical analyses have been done.

FEASIBILITY AXIS

F1 (Feasibility Study)	Work carried out
1. Geology: Geology of area and project, detailed exploration, closed spaced drilling, ore body modelling, bulk samples for beneficiation, geotechnical and ground water &surface waters studies.	1) Detailed geological study, exploration, ore body modeling mineralogical studies has been done. There is no problem for geotechnical and ground water problem for ore excavation.
2. Mining: Mining plan, mine recoveries and efficiencies, equipment selection, manpower requirement.	2) Enclosed in Mining Plan.
3.Environment: EIA studies & EMP including socio-economic impact, rehabilitation of project affected persons, waste disposal/reclamation, detailed land use data.	3) EIA studies and EMP has been done.
4. Processing: Pilot scale/industrial scale investigation data, list of equipment, manpower and environmental considerations like waste disposal of tailing, etc.	4) The manganese ore is being dressed, sorted, sized and graded manually at sorting yard.
5. Infrastructure and services, construction activities: Full details	5) Enclosed in Mining Plan.
6. Costing: Detailed break-up of capital cost, operating cost, details of working capital.	6) Costs details have provided in annual returns
7.Marketing: Overview, specific market aspects.	7) Marketing of Manganese Ore is being done by Companyôs central team.
8. Economic viability: Cash flow forecast, inflation effects, sensitivity studies.	8) This is being constantly monitored by Companyôs accounts department
9. Other factors: Statutory provisions relating to labour, land, mining, taxation etc.	9) Statutory provisions pertaining to mines are being strictly adhered

ECONOMIC AXIS

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

Indicated Mineral Resource (332): 0.04 Lakh tonnes

GEOLOGICAL AXIS

G2(General Exploration)	Work carried out
1.Geological survey: (i)Mapping on 1:5,000 to 1:1,000 or larger scale with triangulation stations, benchmarks, if any; (ii)Linking of maps so prepared with topo- grids, (iii)Assessment of lithology, structure, surface mineralisation, analysis of old history of mining.	1. Geological survey i) Mapping on 1:5000 has been done. (ii) Local coordinate system has been set. (iii) Completed.
2. Geochemical survey: (i)Detailed litho-geo-chemical channel sampling from fresh rock exposures, trenches, pits for further refinement of data; (ii) Recording of deleterious elements and likely by-product elements.	2. Geochemical survey: Not done.
3.Geophysical survey: (i) Borehole geophysical survey ; (ii)Special geophysical traverses for problem solving if required.	3.Geophysical survey: (i) NA
4. Technological (i) Pitting/trenching for helping surface and subsurface, correlation of mineralised zones; (ii)Drilling-close ï spaced drilling to decipher the ore - shoot behaviour atleast upto two levels; in general, spacing of probe points along strike may be 100m but in specific cases, depending on the necessity, it may be brought down to 50 m. especially for precious metals; a few probe points for deeper intersections; (iii)Detailed core sampling, bulk sampling for testing of processing technology; (iv)Collection of abiotic geo-environmental parameters. (10% check sampling).	4. Technological (i) Pitting and trenching not done. (ii)Drilling- In this case the spacing is taken to be between 50m and 100m. (iii)Detailed core sampling has been done in such cases.
5. Petrographic; Detailed study of data on the petrographic character of rocks including study of grain size, texture, liberation characteristics.	5. Petrographic: NA

FEASIBILITY AXIS

F3 (Geological Study)	Work carried out
1.Geological and related study: (i) Geological, mineralogical and chemical analysis data; (ii) Topographical setting and nature of land; (iii) Infrastructure; (iv) Meteorological and preliminary ecology data if possible.	1) Geological study, exploration and mineralogical study has been done. Topography survey has been conducted. Meteorological and preliminary ecology data available.
2. The activities as above or less than that required for **F2** **i) Mining:** Methods, pre-production plan, development plan, manpower (rough estimate). **ii) Environment:** Base line data on environment. **iii) Processing:** Proven laboratory scale/pilot scale beneficiation, investigation data,likely establishment, **iv) Infrastructure and services, construction activities**: Brief details **v) Costing**: Capital and operating cost - rough estimates based on comparable mining operations. **vi) Marketing**: Overview like industrial structure, demand supply relation, pricing, etc. **vii) Economic viability:** Preliminary study of cash flow forecasts. **viii) Other factors**: Statutory provisions relating to labour, land, mining, taxation, etc.	2) i) Not done ii) EIA studies and EMP has been done iii) Not done. iv) Enclosed in Mining Plan. v) Costs details have provided in annual returns vi) Marketing of Manganese Ore is being done by Companyôs central team. vii) This is being constantly monitored by Companyôs accounts department. viii) Statutory provisions pertaining to mines are being strictly adhered

ECONOMIC AXIS

E3 (Intrinsically Economic)	Work carried out
1.Reconnaissance to detailed geological study, rough estimates of grades (may be below economic cut-off), general idea about forest /non ï forest and land use status. 2. The activities as above or less than that required for **E2** i .Specific end-use grades of reserves (above /marginally below economic cut-off grade). ii. General knowledge of forest/non-forest, other land use data.	1) Has been carried out, however, the data is not sufficient enough to carry economic study. 2) i) Grades of ore have been partly established. ii) Present in forest cleared area.

Inferred Mineral Resource (333): 1.47 Lakh tonnes

GEOLOGICAL AXIS

G3 (Prospecting)	**Work carried out**
1.**Geological survey:** (i) Mapping on 1:50,000 to 1:25,000 scale (for coal, lignite exploration- mapping on 1:10,000); (ii)Linking of maps so prepared with topo-grids; (iii)Assessment of lithology, structure, surface mineralisation, analysis of old history of mining.	1) i) Geological mapping done at 1: 5000 ii) Done iii) Done
2.Geochemical survey: Geochemical sampling, rock type-wise and if necessary, rock type-cum-skeletal soil-domain-wise (for all metallic mineral exploration).	2) Surface samples analyses has been done.
3.Geophysical survey: Detailed ground geophysical work; bore-hole geophysical logging, if possible.	3) Not done.
4)Technological: (a)Pitting/trenching to explore bed rock/mineralised zone; (b)Drilling: Preliminary drilling (dry drilling for bauxite and in formation vulnerable to wash). Bore-hole spacing - (ii) Iron and manganese ore - 200 to 400 m; (c) Sampling: Sampling at well-defined locations at surface and also from pits/trenches, boreholes and existing mine openings.	4) (a)Pitting and trenching done for all manganese outcrops. (b)Boreholes drilled at more than 100m spacing. Analyses of the borehole samples are available.
5.Petrographic/mineragr-aphic studies: (i)Petrographic study of rocks of the deposit and its surroundings, alterations if any connected with mineralisation; (ii)Determination of phase in which mineral of interest occur; (iii)Mineralogical studies including paragenesis, identification of zones of oxidation and primary zones, grain size distribution, overall characteristics of useful minerals.	5) Preliminary mineralogical study has been done.

FEASIBILITY AXIS

F3 (Geological Study)	Work carried out
1.Geological and related study: (i) Geological, mineralogical and chemical analysis data; (ii) Topographical setting and nature of land; (iii) Infrastructure; (iv) Meteorological and preliminary ecology data if possible.	1) Geological study, exploration and mineralogical study has been done. Topography survey has been conducted. Meteorological and preliminary ecology data available.
2. The activities as above or less than that required for **F2**	2)
i) Mining: Methods, pre-production plan, development plan, manpower (rough estimate).	i) Not done
ii) Environment: Base line data on environment.	ii) EIA studies and EMP has been done
iii) Processing: Proven laboratory scale/pilot scale beneficiation, investigation data,likely establishment,	iii) Not done.
iv) Infrastructure and services, construction activities: Brief details	iv) Enclosed in Mining Plan.
v) Costing: Capital and operating cost - rough estimates based on comparable mining operations.	v) Costs details have provided in annual returns
vi) Marketing: Overview like industrial structure, demand supply relation, pricing, etc.	vi) Marketing of Manganese Ore is being done by Companyôs central team.
vii) Economic viability: Preliminary study of cash flow forecasts.	vii) This is being constantly monitored by Companyôs accounts department.
viii) Other factors: Statutory provisions relating to labour, land, mining, taxation, etc.	viii) Statutory provisions pertaining to mines are being strictly adhered

ECONOMIC AXIS

E3 (Intrinsically Economic)	Work carried out
1.Reconnaissance to detailed geological study, rough estimates of grades (may be below economic cut-off), general idea about forest /non ï forest and land use status.	1) Has been carried out, however, the data is not sufficient enough to carry economic study.
2. The activities as above or less than that required for **E2** i .Specific end-use grades of reserves (above /marginally below economic cut-off grade). ii. General knowledge of forest/non-forest, other land use data.	2) i)Not established. ii) locked up in forest areas and hence it is not possible to mine out right now.

Justification of Manganese Resources of Sub-Grade ore (+10-25% Mn):

Pre-feasibility Mineral Resource (221): 7.79 lakh tonnes

GEOLOGICAL AXIS

G1(Detailed Exploration)	Work carried out
1.Geological survey: (i)Mapping-For coal, mapping 1:5000;for other minerals 1:1000 (ii)Preparation of detailed topographical-cum-geological map including all surface geological features, extent of deposit, structure, location of boreholes, assay plan & sections of exploratory mine development &borehole data; (iii)Topogrid/triangulation stations linked in the maps.	1) i) Geological mapping done at 1: 5000 and 1:1000 scale. ii) Detail topographic contouring has been with contour spacing of 5m and other relevant features are furnished in surface geological plan. iii) Done.
2.Geochemical survey: Detailed grid pattern sampling and analysis.	2) Detailed analyses of the borehole are available.
3.Geophysical survey: Detailed and specific borehole geophysical survey.	3) Not done.
4.Technological: (i)Pitting - 2 to 5 per sq. km. for simple deposits; (ii)Trenching - At spacing of 200-300m; (iii)Drilling- closer spaced (with definite grid pattern) than that for G2 category; For opencast project grid spacing may be 100m x 50m depending on the geology, weather mantle cover , (iv)Exploratory mining and check drilling results if possible (v)Sampling- systematic pit and trench sampling, core and sludge sampling for laboratory scale and bulk sample for the pilot plant scale beneficiation studies.	4) i) Not Done. ii) Not Done. iii) Drilling done at 25m & 50m grid interval. iv) Not Done. v) Detailed analyses of the borehole samples are available.
5.Petrographic and mineragraphic study: Refining of data on the petrographic character of rocks of the deposit and its surroundings, alterations (if any), including study of grain size texture gangue and its liberation characteristics for further refining of data	5) Preliminary mineralogical study has been done
6.Geostatistical analysis of borehole data thickness of ore: waste encountered in holes, assay values of samples if considered necessary.	6) Geostatistical analyses has been done.

FEASIBILITY AXIS

F2 (Pre-Feasibility Study)	Work carried out
1. Geology: Local geology, mineralogy, identification of ore types and geometry. **2. Mining:** Methods, pre-production plan, development plan, manpower (rough estimate). **3. Environment:** Base line data on environment. **4. Processing:** Proven laboratory scale/pilot scale beneficiation, investigation data, likely establishment, **5.Infrastructure and services, construction activities**: Brief details **6. Costing**: Capital and operating cost - rough estimates based on comparable mining operations. **7. Marketing**: Overview like industrial structure, demand supply relation, pricing, etc. **8. Economic viability:** Preliminary study of cash flow forecasts. **9. Other factors**: Statutory provisions relating to labour, land, mining, taxation, etc.	1) Geological study, exploration and mineralogical study has been done. Topography survey has been conducted. Meteorological and preliminary ecology data available. 2) i) Not done ii) EIA studies and EMP has been done iii) Not done. iv) Enclosed in Mining Plan. v) Not estimated. vi) Not done. vii) Not done. viii) Statutory provisions pertaining to mines are being strictly adhered

ECONOMIC AXIS

E2 (Potentially Economic)	Work carried out
1.General and detailed exploration 2 .Specific end-use grades of reserves (above /marginally below economic cut-off grade). 3. General knowledge of forest/non-forest and other land use data.	1) Has been carried out. 2) i) Grades of ore established. It is lower than the cut-off grade ii) Present in forest cleared area.

Pre-feasibility Mineral Resource (222): 1.14 lakh tonnes

GEOLOGICAL AXIS

G2(General Exploration)	Work carried out
1.Geological survey: (i)Mapping on 1:5,000 to 1:1,000 or larger scale with triangulation stations, benchmarks, if any; (ii)Linking of maps so prepared with topo- grids, (iii)Assessment of lithology, structure, surface mineralisation, analysis of old history of mining.	1. Geological survey i) Mapping on 1:5000 has been done. (ii) Local coordinate system has been set. (iii) Completed.
2. Geochemical survey: (i)Detailed litho-geo-chemical channel sampling from fresh rock exposures, trenches, pits for further refinement of data; (ii) Recording of deleterious elements and likely by-product elements.	2. Geochemical survey: Not done.
3.Geophysical survey: (i) Borehole geophysical survey ; (ii)Special geophysical traverses for problem solving if required.	3.Geophysical survey: (i) NA
4. Technological (i) Pitting/trenching for helping surface and subsurface, correlation of mineralised zones; (ii)Drilling- close ï spaced drilling to decipher the ore -shoot behaviour atleast upto two levels; in general, spacing of probe points along strike may be 100m but in specific cases, depending on the necessity, it may be brought down to 50 m. especially for precious metals; a few probe points for deeper intersections; (iii)Detailed core sampling, bulk sampling for testing of processing technology; (iv)Collection of abiotic geo-environmental parameters. (10% check sampling).	4. Technological (i) Pitting and trenching not done. (ii)Drilling- In this case the spacing is taken to be between 50m and 100m. (iii)Detailed core sampling has been done in such cases.
5. Petrographic; Detailed study of data on the petrographic character of rocks including study of grain size, texture, liberation characteristics.	5. Petrographic: Not done.

FEASIBILITY AXIS

F2 (Pre-Feasibility Study)	Work carried out
1. Geology: Local geology, mineralogy, identification of ore types and geometry. **2. Mining:** Methods, pre-production plan, development plan, manpower (rough estimate). **3. Environment:** Base line data on environment. **4. Processing:** Proven laboratory scale/pilot scale beneficiation, investigation data, likely establishment, **5.Infrastructure and services, construction activities**: Brief details **6. Costing**: Capital and operating cost - rough estimates based on comparable mining operations. **7. Marketing**: Overview like industrial structure, demand supply relation, pricing, etc. **8. Economic viability:** Preliminary study of cash flow forecasts. **9. Other factors**: Statutory provisions relating to labour, land, mining, taxation, etc.	1) Geological study, exploration and mineralogical study has been done. Topography survey has been conducted. Meteorological and preliminary ecology data available. 2) i) Not done ii) EIA studies and EMP has been done iii) Not done. iv) Not done. v) Not estimated. vi) Not done. vii) Not done. viii) Statutory provisions pertaining to mines are being strictly adhered

ECONOMIC AXIS

E2 (Potentially Economic)	Work carried out
1.General and detailed exploration 2 .Specific end-use grades of reserves (above /marginally below economic cut-off grade). 3. General knowledge of forest/non-forest and other land use data.	1) Has been carried out, however, the data is not sufficient enough to carry economic study. 2) i) Grades of ore established. It is lower than the cut-off grade ii) Present in forest cleared area.

Inferred Mineral Resource (333): 0.40 lakh tonnes

GEOLOGICAL AXIS

G3 (Prospecting)	Work carried out
1.**Geological survey:** (i) Mapping on 1:50,000 to 1:25,000 scale (for coal, lignite exploration- mapping on 1:10,000); (ii)Linking of maps so prepared with topo-grids; (iii)Assessment of lithology, structure, surface mineralisation, analysis of old history of mining. **2.Geochemical survey**: Geochemical sampling, rock type-wise and if necessary, rock type-cum-skeletal soil-domain-wise (for all metallic mineral exploration). **3.Geophysical survey:** Detailed ground geophysical work; bore-hole geophysical logging, if possible. **4)Technological**: (a)Pitting/trenching to explore bed rock/mineralised zone; (b)Drilling: Preliminary drilling (dry drilling for bauxite and in formation vulnerable to wash). Bore-hole spacing - (ii) Iron and manganese ore - 200 to 400 m; (c) Sampling: Sampling at well-defined locations at surface and also from pits/trenches, boreholes and existing mine openings. **5.Petrographic/mineragr-aphic studies:** (i)Petrographic study of rocks of the deposit and its surroundings, alterations (if any) connected with mineralisation; (ii)Determination of phase in which mineral of interest occur; (iii)Mineralogical studies including paragenesis, identification of zones of oxidation and primary zones, grain size distribution, overall characteristics of useful minerals.	1) i) Geological mapping done at 1: 5000 ii) Done iii) Done 2) Not done. 3) Not done. 4) Boreholes drilled at more than 100m spacing. Analyses of the borehole samples are available. 5) Not done.

FEASIBILITY AXIS

F3 (Geological Study)	Work carried out
1.Geological and related study: (i) Geological, mineralogical and chemical analysis data; (ii) Topographical setting and nature of land; (iii) Infrastructure; (iv) Meteorological and preliminary ecology data if possible. **2**. The activities as above or less than that required for **F2** **i) Mining:** Methods, pre-production plan, development plan, manpower (rough estimate). **ii) Environment:** Base line data on environment. **iii) Processing:** Proven laboratory scale/pilot scale beneficiation, investigation data,likely establishment, **iv) Infrastructure and services, construction activities**: Brief details **v) Costing**: Capital and operating cost - rough estimates based on comparable mining operations. **vi) Marketing**: Overview like industrial structure, demand supply relation, pricing, etc. **vii) Economic viability:** Preliminary study of cash flow forecasts. **viii) Other factors**: Statutory provisions relating to labour, land, mining, taxation, etc.	1) Geological study, exploration and mineralogical study has been done. Topography survey has been conducted. Meteorological and preliminary ecology data available. 2) i) Not done ii) EIA studies and EMP has been done iii) Not done. iv) Not done. v) Not estimated. vi) Not done. vii) Not done. viii) Statutory provisions pertaining to mines are being strictly adhered

ECONOMIC AXIS

E3 (Intrinsically Economic)	Work carried out
1.Reconnaissance to detailed geological study, rough estimates of grades (may be below economic cut-off), general idea about forest /non ï forest and land use status. 2. The activities as above or less than that required for **E2** i .Specific end-use grades of reserves (above /marginally below economic cut-off grade). ii. General knowledge of forest/non-forest & other land use data.	1) Has been carried out, however, the data is not sufficient enough to carry economic study. 2) i) Grades of ore established. It is lower than the cut-off grade ii) Present in forest area.

4.0 CONCEPTUAL PLAN

The Khondbond Iron & Manganese Mine is presently producing around 0.7 MTPA of ROM (Iron ore) and 0.45 LTPA of ROM (Mn ore) . During the next five years it is proposed to increase its capacity gradually to 8MTPA of ROM (Iron ore) and 1LTPA of ROM (Mn ore). The company has applied for lease renewal over an area of 978.00 hectares. Hence all the proposals have been restricted to the applied area of 978.00 ha only, as the Final Mine Closure Plan for the relinquished area (315.433 ha) has already been approved by IBM. The part of the surrendered area has already been allocated to M/s Deepak Mineral and power Ltd,M/s Shree Metaliks Pvt. Ltd and M/s SMC Power Ltd. Therefore, the proposal for the relinquished area (315.433ha) is not being addressed in this document. Over the years, mining operation for both iron and manganese will be limited to applied area of 978.00 ha only.

At present, the lease area has limited land available for the disposal of tailings, subgrade, waste and the construction of ore stockpiles as the mining activities shall be confined to the approved forest limits only till the forest clearance is granted for the applied area. However, in coming years, mine is poised for an expansion to meet the increased requirement of Companyôs Steel Plants and its sister concerns like Tata Sponge Iron Limited, Tata Metalliks Limited, Ferro Alloy Plant, Joda and upcoming steel plants in Odisha. In line with the expansion programme ,Environment Clearance has been obtained for production of 8.0MTPA (ROM) of Iron ore and 0.1 MTPA(ROM) of Manganese ore alongwith an iron ore beneficiation plant of 8.0MTPA throughput from MoEF vide letter no.J-11015/888/2007-IA.II (M) dated 21.12.2011. The total project area is 1019.472ha which includes mine lease area of 978 ha and an area of 41.472 ha for transport corridor, outside the mine lease. The major expansion activities will involve expansion of mining operations in new ore zones, commissioning of a new beneficiation plant & logistics facilities, development of access route, construction of slime dam and long distance conveyor corridor for transportation of finished products from Khondbond to Joda East sidings. It is proposed that the finished product will be transported from Khondbond lease to Joda & Jurili or other private railway sidings by road and through conveyor as per the requirement. Therefore to some extent it has become essential to incorporate these proposals in conceptual plan of the mine.

It is proposed that the existing plant will continue to work upto 2016-17.Whereas the new beneficiation plant is proposed to start partially from 2015-16 and will start operating in full capacity of 8 MTPA from 2016-17 onwards. After the operation of new beneficiation plant at full capacity, the existing old plant will stop operating. In the case of delay in commissioning of beneficiation plant mobile crushing & screening plants will be set up during the plan period to meet the demand of steel plants. Iron ore to the beneficiation plant will be fed from different mining pits. During the next five years P ore body(pit 3&2b), N Ore body(pit 1,2,&4),Q ore body (Pit22), Pit11, Pit7,Pit 5, Area 13 (conveyor corridor/access road) & Pit21(located in south region) will be the major source of iron ore to the beneficiation plant . These ore bodies are developed simultaneously so that

consistent quality of Run-of-Mine can be fed to the beneficiation plant. After exhaustion of ore, Pit7, 11 & 2 will be converted into slime dams.

At present, the ore bodies are developed by series of 6m bench height but during the plan period, the initial development of these orebodies shall include making approach roads and developing benches in series of 12 mtrs bench height by mechanized open cast method of mining. The bench height shall be increased initially to 10m then subsequently will be made 12m.Shovels of 1.2/1.8/3.5/5.7/6.0 Cu.M capacities and dumpers of 10/15/35/50/60/100 tonnes capacities are proposed to be deployed. Drilling will be done by 100mm & 150 mm diameter drills and blasting will be done using conventional slurry and SME explosives. The blasted ore shall be handled by Shovel-Dumper combination and transported to either ore stock piles or directly be fed to the existing processing Plant and proposed new beneficiation plant. Other types of iron ore (i.e. hard ore, flaky iron and lateritic iron ore) encountered during excavation for sponge grade iron ore will be stocked either at ore stockpile No.1 (located near the proposed beneficiation Plant)towards the north or at ore stockpile no.2 (located near P ore body)which is a temporary intermittent stockpile based on the lead distance. The ore so stocked will subsequently be utilized in blend with iron ore from other pits in the proposed beneficiation plant. The temporary intermittent stockpile no.2 is proposed to facilitate feeding of existing plant as well as the new plant for various quality trials.

The waste generated from these pits will be transported and dumped at waste dumps. However, during the initial period, some quantity of waste will also be utilized for landfills, preparation of embankment for tailing dams, developing infrastructure facilities required for expansion programme, making haul roads and short ramps to connect different levels, maintenance of haul road, berms etc. and the balance waste will be stacked at waste dump no.1, 5 & 8 as indicated in drawing no. MP/KIMM/R2/10/12. After the plan period, waste dump no. 4 shall also be used for dumping of waste which includes backfilling of some excavated portion of P & N ore body. Similarly, a part of waste dump no.5 shall also include backfilling of some excavated portion of P&N ore body. Thus at conceptual stage the mine will have four waste dumps namely dump no.1, 5, 8 & 4.

The subgrade generated during the plan period shall be stacked separately at subgrade dumps 1A, 2A, 2, 3 & 6 for future use as indicated in drawing no. MP/KIMM/R2/10/12.After the plan period, these subgrade dumps shall continue to be used for stacking of subgrade material for future use.
The iron ore deposits of the lease have been explored extensively by core drilling. Based on the exploratory drilling data, the extent of the ore body has been interpreted in lateral as well as vertical direction and it has been found that iron ore bodies of Khondbond are patchy in nature. Different ore zones are separated by wastes patches, as well as ore bodies itself comprises intercalated subgrades and wastes. Therefore, it has been anticipated that dilution by way of mechanized mining operation shall be considerable and ROM quality will further be deteriorated. To make best use of the deposit, it has been proposed to beneficiate entire iron ore and converting the final products into iron ore lumps and fines of desired specifications suitable for Blast Furnace. In view of the above, it has been

proposed to install a new beneficiation plant at Khondbond with State-ofï theï Art beneficiation facilities. It shall be a major breakthrough in companyôs effort towards Scientific Mining and Mineral Conservation.

It has been also envisaged that to obtain consistent quality of Run-of-Mine to process plant, iron ore to beneficiation plant will be supplied from the different mining pits having different quality of iron ore. Therefore, multi pit mining is essential, which will require expansion of mining operation into fresh areas. As, all iron ore zones at Khondbond are located within forest land only, the proposed expansion of mining operation into new area will require forest clearances.

The expansion of Khondbond for iron ore will be associated with development of various infrastructure facilities i.e. approach road, conveyor corridor, power transmission line, water pipe lines, maintenance complex, workshop, administrative buildings (including canteen, first aids station, time office), stacking and reclaiming facilities, dispatch facilities, magazine, water reservoirs, slurry pipeline ,tailing dams etc. GPS-based truck dispatch system has also been proposed for effective utilization of HEMM. A new approach route shall also be constructed along the conveyor corridor between Joda to Khondbond for smooth journey of men and material. After the new beneficiation plant start operating at its full capacity of 8MTPA , the existing crushing & screening Plant will be dismantled and transferred to other operating units of the company.

(a) Conceptual plan for iron ore mining:

Iron ore mining at Khondbond is carried out by mechanized open cast method of mining using shovel & dumper combination in series of 6mtrs benches, which will gradually be increased to height of 12m during the plan period. The bench height shall be increased initially to 10m then subsequently will be made 12m.

Based on the deposit characterization, the iron ore deposit of Khondbond Iron & Manganese Mine can be divided into North Region & South Region. The south region consists of three pits namely Pit21, 22 &23. During the plan period only pit 21 will be worked and existing pit i.e. Q ore body will be utilized for water harvesting purpose . But during the life of the mine, after the plan period Pits 22 (covers the existing Q ore body) & Pit 23 will also be worked.

The north region consists of 14 pits namely Pit 1,2,2b,3,4,5,6,7,8,9,10,11,12 and Area 13. The Area 13 refers to the excavation required for conveyor corridor & access road only. The map showing the different pits are mentioned in Plate-VI.

P ore body consists of pit3 & 2b whereas N ore body consists of pit1,2 &4.During the first two years i.e. 13-14 &14-15 P ore body & N ore body will be worked as separate pits but in 2015-16 both of them will get merged and form P & N ore body as a single pit. Mining will commence in the existing northern areas in P ore body, N ore body, Pit7, Pit11, Pit21, Pit5 and Area13. After the plan period, other ore bodies like Pit 6, 8,9,10 & 12 are proposed to be developed. As, pit 6, 8, 9 & 10 are

located in the forest area, mining operation in these ore bodies shall commence only after approval of forest clearance.

It is also observed that there is a large variation in ore quality through the mineralization. Hence the successful mining of the deposit can only be achieved by a diligent and controlled blending of ore from North region with that from the South region. Therefore, multiple blending faces will be required (in the order of 5-8) to provide sufficient flexibility and maintain efficiency, though at any point in time only up to 2 or 3 will be mined due to the batch nature of the processing plant.

A key aspect of the blending plan will be stockpiling and in-pit blending by mining from multiple faces to maintain the feed quality to plant. Due to variation in ore quality, large stockpiles will be required in the early mining phase until sufficient working faces are established. However, in pit blending will be given preference to reduce rehandling of ore from different stockpiles. At present, sponge grade iron ore is being excavated from P ore body & N Ore body. During the plan period, in addition to extension of P & N ore bodies, other iron ore pits like Pit11, Pit7, Pit 5 & Pit21 along with the Area 13 (which is conveyor corridor /access road) shall be developed. Other types of iron ore (i.e. hard ore, flaky iron and lateritic iron ore) encountered during excavation for sponge grade iron ore will be stocked either at ore stockpile No.1 (located near the proposed beneficiation Plant) or at ore stockpile no.2 (located near P ore body)which is a temporary intermittent stockpile based on the lead distance.The ore so stocked will subsequently be utilized in blend with iron ore from other pits in the proposed beneficiation plant. The temporary intermittent stockpile no.2 is proposed to facilitate feeding of existing plant as well as the new plant for various quality trials.To meet increased production targets, small capacity HEMMôs will be replaced gradually with larger capacity fleet.

The blasted ore shall be handled by Shovel-Dumper combination and transported to either ore stock piles or directly be fed to the existing processing Plant and proposed new beneficiation plant.

After the plan period, there will be substantial reduction in ore stockpiles and successful in-pit bending will be adopted to meet plant feed specifications. The blending efficiency will be gained by typically having at least 6 active faces available for blending throughout the period. In the later stage, the operation will be more challenging due to low alumina ore not being readily available. This is partly due to a substantial increase in ore from the lower quality Southern region.The inaccessibility of suitable ore will result in reduced number of working faces say 3-4 for blending in the final years of operation.

The deposition of iron ore at Khondbond is such that at upper horizons all orebodies will be worked in separate pits, which at lower horizons will get merged. At the end of life of mine there shall be two quarries North Quarry & South Quarry The dimension of these quarries at conceptual stage is given below in table 4.1:

TABLE – 4.1

Quarry name		Length (m)	Breadth (m)	Top (mRL)	Bottom (mRL)
Iron Ore Quarries	North Quarry	3400	2750	760	560
	South Quarry	1650	1250	720	570

The proposed area for mining, five yearly pit limits, ultimate pit limit, proposed area for storing minerals and subgrade, location of waste dumps and tailing dams are shown in the Conceptual Plan drawing no. MP/KIMM/R2/10/12.

The quantity of waste to be handled during the life of the mine is approximately 47.17 million tonnes. Considering a bulk density of 2.5t/cu.m ,the volume of waste generation will be 18.87 million cum.

The waste shall be used for landfills, preparation of embankment for tailing dams, developing infrastructure facilities required for expansion program, making haul roads and short ramps to connect different levels, maintenance of haul road, berms etc. Any excess quantity of waste generated from the mining operations from different pits during the life of the mine shall be dumped in waste dumps no. 1, 4, 5 & 8 .All waste dumps have been planned on non-mineralized zones. The capacities of waste dumps are given below in Table4.2:

TABLE: 4.2
WASTE DUMP CAPACITY

WASTE DUMP NO.	VOLUME
	MCUM
DUMP1	0.5
DUMP4	5.986
DUMP5	13.664
DUMP8	5.253
TOTAL	25.401

The quantity of subgrade to be handled during the life of the mine will be approximately 61.46 million tonnes. Considering the bulk density of 3.0 t/cu.m , the volume of subgrade generation will be 20.49 million cu.m.

The subgrade encountered during the development of these areas shall be stacked in existing subgrade dumps 1A, 2A, 3 and proposed subgrade dumps 2 & 6 as per the requirements.The total capacity of subgrade dumps is 21.21 mcum which is sufficient to accommodate the subgrade generated during the life of the mine.

The capacities of subgrade dumps are given below in table 4.3:

TABLE 4.3
SUBGRADE DUMP CAPACITY

SUBGRADE DUMP NO.	VOLUME
	MCUM
SUBGRADE DUMP2	4.1
SUBGRADE DUMP3	1.501
SUBGRADE DUMP6	16.803
TOTAL	21.21

The locations of existing dump and proposed dumps have been indicated in the drawing no. MP/KIMM/R2/02/12 and MP/KIMM/R2/36/12 respectively.

In future, as the mining operations get expanded into new areas, it has been conceptualized that present operating pits shall be used for backfilling by dumping of waste and tailings after exhaustion of the mineral.

(b) Conceptual plan for manganese ore mining:

At Khondbond, all manganese ore deposits falls under forest area. In coming years manganese ore zones IV, X, and XII are proposed to be developed. Semi mechanized method of open cast mining is being adopted for mining manganese ore.

Overburden and ROM are being removed by using shovel-dumper combination. The benches are 6 to 8 m high. Blast holes for both overburden and ore are drilled by 100mm diameter crawler drills with 365cfm compressors. For blasting, conventional slurry / emulsion explosives are used. Bottom initiation pattern with controlled blasting technique is being followed by using down the hole (DTH) and trunk line delay (TLD) to minimize ground vibration, fly rock etc. Hydraulic excavator / front end loader and rear dump truck combination is used to bring the blasted overburden to dump yard.

Similarly, the blasted run-off mine ore is being hauled to sorting places located at the top of the quarry. The ROM is then dressed, sorted, sized and graded manually at sorting place. The piece-rated workers (Mazdoor/Reja) are deployed at different sorting places considering the average output per man shift of 1 ton viewing the finished ore production required from the particular quarry.

As per the past experience in geological investigation and exploitation of manganese ore, the conceptualized ultimate pit generalized plan is shown in Plate No.-I. The ultimate generalized land use pattern and corresponding ultimate section is shown in Plate No.-II.

At present, manganese mining operation at Khondbond has three dumps namely Dump No.-1, 2 & 3. Dump No.-1 is outside the applied lease boundary and has already been reclaimed by afforestation. Dump No.-2 & 3 has been exhausted and are under rehabilitation by plantation. As proposed in the approved Mining Plan, Dump No.2 & 3 was developed for Ore Zone-X & XII. Dump No.-2 will be fully stabilized over mined out area of Ore Zone-XIII which has already been exhausted of manganese ore. It is also envisaged that, the Ore Zone IV will be exhausted during 2013-14 and sub-grade ore and mineral reject generated from Ore Zone X & XII will be stacked during subsequent years.

As the Dump No. 1 is outside the applied lease area, Dump No. 2 & 3 is being renamed as 1 & 2 respectively and accordingly shown in the drawing no. MP/KIMM/R2/02/12

New Dump no. 3 will be developed in the extent of 13350N- 13700N & 6275E ï 6650E after obtaining the Forest Clearance and subsequent permissions.

In the intervening time, overburden from Ore Zone X & XII will be used for back filling of an old exhausted quarry within Joda West Manganese Mines of Tata Steel Limited situated at northern side of the lease at a distance of 5.3 km. which is under same management control.

Some quantity (~15,000 cum/annum) of overburden shall be used to fill up the undulated surface of the proposed corridor from the ML Pillar No. 16F to 16D for leveling of the surface and developing it as a utility corridor.

It is also envisaged that, after obtaining the tree felling permission over the Ore Zone IV,the entire ore will be excavated during 2014-15 & after the exhaustion of ore the sub-grade and mineral rejects will be stacked there for future use.

As a part towards mechanization, crushing, screening and mechanical sorting (based on Radiometric X-Ray technology) unit is proposed to be commissioned during the scheme period for mechanizing the subsequent processing of the ROM. The plant shall have a capacity of 50-100 TPH to crush the ROM to -75mm size. The screening shall be done at 10 mm size. The products of -75 +10mm shall be shifted to stack yard for preparation of stacks in geometrical shape. The fines (-10mm) shall be shifted to the mineral reject stacking area by using loader and dumpers. The waste generated if any shall be shifted to waste dumps.

The above unit shall be of dry process and the following environment protection measures shall be taken to control the air pollution:
ÅEnclosures shall be provided to trap the dust while crushing, screening and conveying.
ÅWater spray shall be provided at all transfer points.

To make use of low grade manganese ore for the production of Mn. alloys, it is envisaged to evaluate various available technologies and its techno-economic

viability for beneficiation. It is proposed to take up pilot plant studies for assessing the feasibility of beneficiation of the low grade manganese ores.

The proposed areas for mining and waste dumping area are shown in conceptual plan in drawing no. MP/KIMM/R2/10/12.

(iii) Life of mine (Iron & Manganese):

The reserves of iron ore is about 164.16 million tons (please refer Table-3.1.3b). At the proposed rate of ROM excavation (i.e. 8.0 MTPA), the anticipated life of mine is about 20 years. The proved and probable reserves of Manganese ore body of Khondbond is about 6.36 Lakh tonnes(please refer Table-3.2.4). On basis of the proposed production, the anticipated life of the Manganese ore quarries is about 8 years. However, the life of mine may increase depending upon findings from future exploration program.

4.1 SALIENT FEATURES OF GEOLOGICAL INVESTIGATIONS:

4.1.1 Introduction

The Khondbond iron deposit was first explored by E. Parsons in 1917 from TISCO who delineated the present block for acquisition. Khondbond iron and manganese mining lease of 12.93 sq. miles was granted to TISCO in 16th January 1933. The present area of the Khondbond block is 978 ha and located in the district of Keonjhar, Odisha (Fig.TP IA).

The deposit has a widely undulating terrain with steep escarpments, moderately elevated plateau and narrow winding valleys. The extreme north and north west of the area lies on the southern slopes of Tiring pahar and southern portion of the western boundary of the block runs along the Satkutnia hill. The highest elevation is 755.43mRL. The contour extents from 750mRL to 558mRL. A major ridge is running almost centrally in NNE- SSW direction making the central portion elevated and slope towards east and west. However, there are intervening ridges and valleys running NW-SE direction arranged in an echelon pattern in the eastern portion. In the western potion, steep valleys continued upto the lease boundary.

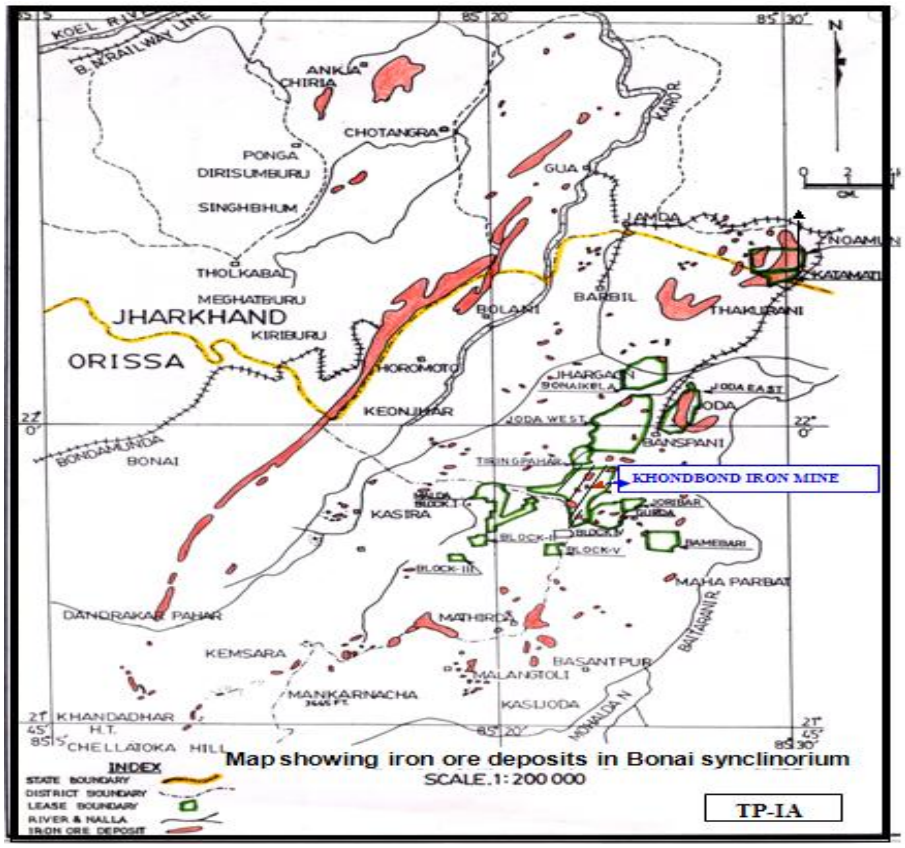
Quality of raw materials is of great importance in controlling the quality and cost of hot metal. With the knowledge of various deleterious material in the ore, the operating mines can plan and supply iron ore of requisite quality and quantity for our captive uses.

The geology of the Khondbond area, the synthesis of the exploration programme carried out in different campaigns, future exploratory drilling programme and the reserves and the resources for excavation planning of iron ore have been described in detail in the sections given below.

4.1.2 Regional Geology

Khondbond iron and manganese deposit lies in the western portion of Singhbhum-Odisha craton. The Iron Ore Group (IOG) surrounds the batholithic complex and consists of low-grade meta-sediments, acid-intermediate and mafic volcanics and sills. The IOG rocks are exposed in three major basins around the Singhbhum granite batholith (Saha et. al., 1988).

The eastern basin extends from south of Jamshedpur through Gorumahisani-Badampahar and extends southward up to near Nausahi. The southern basin lies between Daitari ï Tomka, while the northern-western basin is represented by the western Singhbhum- Bonai-Keonjhargarh Iron Ore basin which extends for about 100km in length and 20 to 30km width in NNE-SSW direction from Chakradharpur to south of Koira. The iron ore deposits of Noamundi, Katamati, Joda, Khondbond are located in this basin along with many other good quality iron ore deposits of varying dimensions.



The generalised chronostratigraphic succession of Singhbhumï Orissa iron ore craton after Saha et. al., 1988 is given below:

Newer Dolerite dykes & Sills C1600 - 950 Ma
Mayurbhanj Granite C.2000-21000 Ma
Gabbro ï anorthosite -ultrabasics

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ Un-conformity ~~~~~~~~~~~~~~~~~~~~~~~~~~~

Jagannathpur Lavas Dhanjori ï Simlipal lava
Dhanjori Group
Quartzite conglomerate

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ Un-conformity ~~~~~~~~~~~~~~~~~~~~~~~~~~~

Singhbhum granite C.3100 Ma
Mafic lava, tuff, acidic volcanics,

Tuffaceous shales, BHJ & BHQ with Iron Ore Group
Iron Ores, Ferruginous chert, local
Dolomite, Quartzite & Sandstone

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ Un-conformity ~~~~~~~~~~~~~~~~~~~~~~~~~~~

Nilgiri Granite
Singhbhum Granite

Bonai Granite

~~~~~~

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

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4.1.3 Local Geology

Khondbond iron deposit belongs to Iron ore group in the Singhbhum Super Group formed during Pre-Cambrian era (c. 3100 Ma), of Dharwarian age as observed from the stratigraphic tables. The area consists of slightly metamorphosed sedimentary formations viz,, Banded Hematite Jasper (BHJ), phyllites, shales with intercalations of lava flows & tuffs.

Soil is quite widespread in this area and at places it is associated with iron ore and laterite boulders. Massive patches of BHJ are exposed predominantly in the north-western and north-eastern portion of the block. Iron ore exposures are patchy and mostly occur on hill slopes. Laterite occurs throughout with major concentration in northwestern and western part and some portion in the southeastern part. Shales highly leached, often ferruginous and with varying colours have been encountered in boreholes. Manganese occurs at places in the western and northwestern part as encountered and also in some exposures in association with laterite and shales.
The stratigraphic succession of this area is given below (Saha 1990):

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

Generally strike of the formations in the area varies from N-S to NNE-SSW and at some places in NNW-SSE direction. Dip varies from 10-45°due East. Locally there are reversals in dip directions at places in some of the ore bodies which are due to folding. Plunge of the small-scale folds ranges from 5°-30°. In comparison to iron ore bodies dips are steeper in BHJ at some places. There are multiple cross folds within the area.

The general agreement for the origin of iron ore and manganese ore is that it has formed due to continuous leaching and replacement of BHJ and Shale respectively by the action of meteoric water which has percolated through joints & fissures. Thus the minor structural elements viz hinge of folds, joints, and fissure form the loci of mineralization.

There are discontinuous iron ore bodies within the area occurring as patchy exposures separated by BHJ and alluvial cover on surface. In the eastern portion, ore body occurs as scattered out crops of hard ore at the cliff sections and patches of laterite with soil and floats while in the western part, which is in the lower elevation and small compared to the eastern part is mainly composed of laterite and lateritic ore with isolated patches of hard ore. Mn-oxide deposits are intimately associated with practically unmetamorphosed shale (occasionally tuffaceous) & cherts of the Precambrian age. In the valley portion of western Khondbond area, manganese ore occur as subcrop below the soil and lateritic cover.

(i) Hard Ore

Massive - Steel grey, compact, very hard massive variety hematite. Grade is very high and usually found in unbroken form, continuous core. No lamination found. This type is less frequent.

Laminated - Steel grey, compact and hard nature as of massive variety. Very thin laminae present throughout having thickness of a mm to less. High grade ore. Most of the hard ore in Khondbond is of this variety.

Brecciated - Steel grey, compact and very hard with lot of inclusions of randomly oriented BHJ laths, 1-5cm size within hematitic matrix and looks like well consolidated sedimentary breccia. Some of the laths are gouged out leaving pock marks on the surface of the hard ore due to weathering and leaching effect. The grade is poor and associated with silica content. This kind is found on the top of some of the ore bodies and grades into better quality hard ore and friable to powdery ore underneath.

Alterations are seen along the laminations and fracture/joint planes. The alteration mineral is mostly limonitic in form of ochres. When the alteration is intense, cavities of ocherous, laterite and kaolin are found within the hard ores. At places, thin shale bands are also observed parallel to the bedding planes.

Fe%	SiO2%	Al2O3%
60.00- 68.50	0.50 ï 4.00	1.00 - 4.00

(ii) Lateritic Ore

Lateritic ores are generally found in the upper part of the iron ore horizon below the laterite zone. This type of iron ore is partly laterised. It is hard, massive or laminated, porous, unevenly fractured. It consists of haematite with goethite and limonite. Minor quantities of clay minerals are also associated with it.

The colour is brownish yellow to reddish brown and consists of fine lateritic powdery material and nodular lumps, sometimes ocherous along with irregular hard chips and flakes of ore and laterite. Grade of the ore depends on the proportion of ore chips and flakes.

The general range of variation of quality of lateritic ore is given below:

Fe%	SiO2%	Al2O3%
58.00 - 64.00	2.00 - 6.00	3.0 - 7.00

(iii) Friable and Flaky Ore

These are thinly laminated loosely packed, breaks down into flakes with little pressure and associated with powder. Sometimes, the flaky ore are intercalated with ferruginous shales.
This type occurs in shades of dark grey to greyish brown powdery portion with high proportion of flat, tabular and angular ore chips and thin hard laminated ore flakes

ranging from few mm to 3-4cm. Sometimes, the laminations are so thin that it appears as biscuits.

Powdery portion occurs in shades of brown to reddish brown. It contains lesser proportion of ore chips, pieces and flakes. Sometimes ochre and shale are mixed in the powdery portion.

The general range of variation of quality of flaky ore is:

Fe%	SiO2%	Al2O3%
60.00 - 67.00	2.00 - 6.00	1.00ï 5.00

(iv) Laterite

Laterite forms the capping over the iron ores. Laterisation is quite intense at places along the bedding and joint planes. The colour of the laterite is yellowish to yellowish brown. Goethite, limonite and hematite are the dominant minerals found in laterite. Kaolinous material and ochreous patches are commonly associated with this variety. It is poor in Fe with high alumina and phosphorous content. The thickness of the laterite horizon is not consistent over the whole area and varies from 1m to 30m. The general range of variation of quality is:

Fe%	SiO2%	Al2O3%
20.0 ï 45.0	6.0ï 30.00	7.00 ï 30.00

(v) BHJ & Shale

BHJ are considered as host rocks of the iron ore mineralization. BHJ comprise alternate bands of hematite and jasper with their thickness of the bands is variable from mm to tens of meters. Generally, the jasper bands are thicker than hematite bands. In the borehole cores, these bands display signature of structural features like minor folding, puckers and crumpling etc as described above. The range of analyses of core samples is given below in the table.

Fe%	SiO2%	Al2O3%
15.0 ï 45.0	20.00 ï 50.00	7.00 ï 33.00

vi) Manganese ore

Manganese ore is found in the western part of the valley portion of the Khondbond block. The manganese bearing horizon is generally overlain by laterite and underlain by shales. Manganese ore bodies occur as discontinuous ore patches as lenses and pockets.

The manganese ore / mineral are mainly oxides and generally occur as pyrolusite, psilomelane and wad. The surface indications are scanty and deceptive. Both physical nature and chemical quality and also the proportions of different grades vary widely from ore zones to ore zones as well as with the ore zones. The manganese ore available within the lease is classified into the following grades as shown in Table 4.1.3:

TABLE – 4.1.3
GENERAL QUALITY OF MANAGNESE ORE

QUALITY OF MANGANESE	% Mn content
High	> 46%
Medium	35% ï 46%
Low	25% - 35%
Sub-grade	10% - 25%

4.1.4 EXPLORATION:

The iron and manganese ore deposits of Khondbond iron and manganese mines have been explored in different phases starting from 1917 till date.
E Parsons (1917) of Tata Steel first explored the Khondbond area and delineated the present block for acquisition. Other great geologists like C.T. Teychenne (1920-21) of the Geological Survey of India, M.S. Krishnan (1925-27), Dr. F.G. Percival (1932) have carried out geological exploration in the companyôs leasehold, area.
Dr. A. Dutta, a Geologist of the steel company, carried out prospecting of iron ore in Khondbond lease in detail during field session 1959-62. Prospecting work consisted of topographical survey, geological mapping, test pitting-trenching, drilling and sampling with a view to collect iron and manganese data.
However, limited drilling has been carried out initially and later on extensive drilling has been carried by the companyôs geologists to prove the extension of the ore bodies which occur as discontinuous and patchy as observed in the field in various grid patterns.
The tables given below show the summary of the exploratory drilling carried in Khondbond lease area.

Iron bearing areas:

Table: 4.1.4a

Year	No. of holes	Meterage
1959-62	14	360.9
1959-62	4	105.4
1992-2000	242	9396.7
2002-06	143	4748.7
2009-10	11	389.4
Total	414	15001.0

Manganese bearing areas:

Table: 4.1.4b

Year	No. of holes	Meterage
1971-73	66	1459.6
1994-96	55	3791.6
2006-08	48	2050.3
2008-09	23	845.6
2009-10	12	219.0
2010-11	18	790.80
2011-12	5	197.00
2012-13	-	-
Total	227	9353.90

The details of exploration carried out in the lease area in term of extent of area covered are given in table 4.1.4c.

Table 4.1.4c

Name of Block	No. of Bhs drilled	Grid Interval (m)	Area Covered (including G1, G2 & G3 Stage) (Ha)	Barren Area Proven (Ha)	Avg. Thickness of ore encountered (m)	Grade Range	Remarks
Iron area	414	50m X 50m, 100m X 100m, 100m X 200m	649	84	10-15m	45%Fe to 66% Fe	
Mn area	227	25m X 25m, 50m X 50m, 50m X 100m	235	10	4-5m	10% Mn to 63% Mn	

EXPLORATION:

Exploration Proposal for Plan period:

Iron Ore

Future exploration primarily aims in increasing the confidence level of the resource established by infilling drill holes in the northern part of the lease area above the ñQò ore body. Boreholes have been proposed both in non-forest area and forest area. Exploration in the forest area will commence only after obtaining forest clearances in this area. Detailed exploration proposal for iron ore during next five years from FYô14 to FYô18 is indicated below in table 4.1.4a.

Table– 4.1.4a
Exploration Proposal: Iron ore

Year of Drilling	Nos. of Borehole Proposed	Metreage Proposed	Remarks
2013-14	20	1000	Subject to statutory clearances
2014-15	20	1000	
2015-16	20	1000	
2016-17	20	1000	
2017-18	25	1250	
Total	**105**	**5250**	

Manganese Ore:

Future investigation in manganese bearing area shall consist of exploratory drilling in areas with forest clearances and also in forest areas towards the western part of the lease area (for covering the lease area). Exploration in the forest area (from 2015-16 onwards) will be done only after getting necessary clearances. Simultaneously, if required, we shall also drill in the areas demarcated for waste dumping to prove the area is barren. Detailed exploration proposal for manganese ore during next five years from FYô14 to FYô18 is indicated below in table 4.1.4b.

Table– 4.1.4b
Exploration Proposal: Mn ore

Year	No. of Boreholes	Drilling meterage (m)	Remarks
2013-14	0	0	
2014-15	15	750	Subject to tree felling permission
2015-16	15	750	Subject to Forest Clearance.
2016-17	10	500	
2017-18	10	500	
Total	**50**	**2500**	

An updated geological plan showing exploration carried out so far as well as exploration proposed to be carried out in the next five years is shown in drawing no. MP/KIMM/R2/3/12.

Updated transverse geological sections of iron bearing areas are shown in drawing no. MP/KIMM/R2/4/12 & MP/KIMM/R2/4A/12 respectively.

Updated transverse geological sections of manganese bearing areas are shown in drawing no. MP/KIMM/R2/4B/12 & MP/KIMM/R2/4C/12

4.2 Salient features of Mine Development:

4.2(a) Iron Ore Mining:

At present, iron ore mining at Khondbond is carried out by mechanized open cast method of mining using shovel & dumper combination in series of 6mtrs benches. During the plan period, the initial development of these orebodies shall include making approach roads and developing benches in series of 12 mtrs bench height by mechanized open cast method of mining. The bench height shall be increased inially to 10m then subsequently will be made 12m.Shovels of 1.2/1.8/3.2/5.7/6.0 Cu.M capacities and dumpers of 10/15/35/50/60/100 tonnes capacities are proposed to be deployed. Drilling will be done by 100mm and 150 mm diameter drills and blasting will be done using conventional/SME explosives. It is also proposed that the small capacity HEMMôs will be replaced gradually with larger capacity fleet for better productivity and meeting increased production target from these pits. The blasted ore shall be handled by Shovel-Dumper combination and transported to either ore stock piles or directly be fed to the existing Processing Plant and proposed New Beneficiation Plant. In the case of delay in commissioning of beneficiation plant one additional crushing & screening plant will be set up during the plan period to meet the demand of steel plants. Sponge grade iron ore is presently being excavated from P & N Ore bodies.Other types of iron ore (i.e. hard ore, flaky iron and lateritic iron ore) encountered during excavation for sponge grade iron ore will be stocked either at ore stockpile No.1 (located near the proposed beneficiation Plant) or at ore stockpile no.2 (located near P ore body)which is a temporary intermittent stockpile based on the lead distance.The ore so stocked will subsequently be utilized in blend with iron ore from other pits in the proposed beneficiation plant. The temporary intermittent stockpile no.2 is proposed to facilitate feeding of existing plant as well as the new plant for various quality trials.

During the next five years P&N Ore body will be a major source of iron ore to the beneficiation plant. Other ore bodies like Pit7, Pit5, Pit11, Pit21 (south region) and Area13 (conveyor corridor & access road) will also be developed simultaneously so that consistent quality of iron ore can be supplied to the beneficiation plant. Excavation of Pit7, Pit11 and Pit2 (part of N ore body) is proposed to convert them into future tailing dams no.4,2 &1 respectively. whereas excavation of area 13 is proposed for conveyor corridor & access road.

The majority of waste rock excavated during the initial period will be used for construction and rehabilitation or more typically disposed of in waste dumps. Waste material will particularly be required during pre-development phase for the construction of roads, dam walls (both tailings and water storage) and leveling infrastructure areas. The waste shall also be used for making haul roads, short ramps, berms and maintenance of roads etc. Any excess quantity of waste shall be dumped in proposed waste dumps 1,4,5 and 8 as shown in drawing no. MP/KIMM/R2/10/12.

The subgrade encountered during the development of these areas shall be stacked for future use in existing subgrade dumps 1A, 2A, 3 and proposed subgrade dumps 2 & 6 as per requirements as indicated in drawing no. MP/KIMM/R2/10/12.

Salient Features of Conceptual Mining: Iron ore

The deposition of iron ore at Khondbond is such that at upper horizons all orebodies will be worked in separate pits, which at lower horizons will get merged. At the end of life of mine there shall be two quarries in iron ore zones of the following dimensions:

TABLE – 4.2a.1

Quarry name		Length (m)	Breadth (m)	Top (mRL)	Bottom (mRL)
Iron Ore Quarries	North Quarry	3400	2750	760	560
	South Quarry	1650	1250	720	570

After the plan period, new Ore bodies Pit6,Pit8,Pit9,Pit10,Pit12 of North region and Pit21,Pit22,Pit23 of South region are proposed to be developed .Some of these ore bodies are located in the forest area. Mining operation in these orebodies shall commence only after obtaining forest clearance from MoEF.

The proposed area for mining, five yearly pit limits, ultimate pit limit, proposed area for storing minerals and reject dumping are shown in the Conceptual Plan drawing no. MP/KIMM/R2/10/12.

The quantity of waste to be handled during the life of the mine is approximately 47.17 million tonnes. Considering a bulk density of 2.5 t/cu.m , the volume of overburden generation will be 18.87 million cu.m.

The waste generated from the mining operations during the plan period shall be dumped in waste dumps 1, 5 &8, whereas after the plan period, one more waste dump no.4 will come up during the life of the mine. It is also envisaged that some part of the mined out area shall be backfilled with waste material during the life of the mine. Hence, at conceptual stage there will be 4 waste dumps namely, 1, 4, 5 & 8. All waste dumps have been planned on non-mineralized zones.

The quantity of subgrade to be handled during the life of the mine is approximately 61.46 million tonnes. Considering the bulk density of 3.0 t/cu.m, the volume of subgrade generation will be 20.49 million cu.m.

The subgrade generated from the mining operations during the plan period shall be stacked for future use in subgrade dumps 1A,2A,2,3, & 6, whereas after the plan period, the subgrade will continue to be stacked in these dumps for future use. Hence, at conceptual stage there will be 5 subgrade dumps namely 1A,2A,2,3 & 6.

The location of existing dump and proposed dumps have been indicated in the drawing no. MP/KIMM/R2/02/12 and MP/KIMM/R2/10/12 respectively.

The ultimate dimension of the dumps at conceptual stage is given below:

TABLE – 4.2a.2
ULTIMATE DIMENSION OF IRON ORE WASTE DUMPS AT CONCEPTUAL STAGE

Details of Dump	Waste Dump No.1	Waste Dump No.4	Waste Dump No.5	Waste Dump No.8
Dump area at the base	4.08 ha	20.03 ha	54.20 ha	14.92 ha
RL at the base of the dump	705 m	670 m	650 m	636 m
RL at the top of the dump	750 m	726 m	720 m	670 m
Height of Dump	45 m (in three terraces)	44 m (in three terraces)	70 m (in five terraces)	34 m (in three terraces)
Overall slope at conceptual stage	$< 28^o$	$< 28^o$	$< 28^o$	$< 28^o$
Total capacity of dump	0.5 MCum	5.99 MCuM	13.66 MCuM	5.25 MCuM

TABLE – 4.2a.3
ULTIMATE DIMENSION OF IRON ORE SUBGRADE DUMPS AT CONCEPTUAL STAGE

Details of Dump	Subgrade Dump No.1A	Subgrade Dump No.2A	Subgrade Dump No.2	Subgrade Dump No.3	Subgrade Dump No.6
Dump area at the base	13.8 ha	11.90 ha	24.13	11.26	33.7
RL at the base of the dump	642 m	642 m	700	665	652
RL at the top of the dump	695 m	705 m	745	695	720
Height of Dump	53 m (in two terraces)	63 m (in two terraces)	45(in three terraces)	30 m(in two terraces)	68 m(in four terraces)
Overall slope at conceptual stage	$<28^o$	$<28^o$	$< 28^o$	$< 28^o$	$< 28^o$
Total capacity of dump	2.3 MCum	1.83 MCum	4.1 MCum	1.5 MCum	16.8 MCum

All dumps will be provided with garland drain and toe wall. Each terrace shall have inward slope with catch drains at the inward side of the terrace. The catch drains of the individual terrace shall be connected to the garland drain outside the periphery of the dump. Each terrace shall also have a provision of berms at the outer end to reduce gully formation due to rain water wash offs.

It has been conceptualized that in future, as the mining operations get expanded into new areas, present operating pits shall be backfilling by dumping of waste & tailings after exhaustion of the mineral.

Stockpile management:

Ore stockpiles are used for storing ore after it is mined from the pits and before it is fed to the processing plant. Two ore stock piles have been proposed during the plan period . One permanent stockpile no.1 located towards the north of the proposed beneficiation Plant, whereas the other stockpile no.2 proposed near the P ore body is a temporary intermittent stockpile. The ore from access road i.e. Area 13 will be stacked primarily at stockpile 1 whereas the ore from Pit7,P & N ore bodies will be stacked primarily in temporary stockpile no. 2. The blasted ore from the mine shall be transported to either of these two ore stock piles based on the lead distance or directly be fed to the existing processing Plant and proposed new beneficiation plant. The stockpile no.2 is proposed to facilitate feeding of existing plant as well as the new plant for various quality trials.

There are some stockpiles currently existing which contain fines from the existing processing plant. These existing stockpiles have a total capacity of 1.5 Mt .

After the plan period,i.e. during the life of the mine, when the location of the stockpile no.1 becomes a pit, it is proposed that it will be shifted to a new location adjacent to the new beneficiation Plant towards the south.

4.2(b) Manganese Ore Mining:

At Khondbond, all manganese ore deposits falls under forest area. In the coming years, manganese ore zones IV, X and XII are proposed to be developed. Semi mechanized method of open cast mining is being adopted for mining manganese ore.

Overburden and ROM are being removed by using shovel-dumper combination. The benches are 6 ï 8 m high. Blast holes for both overburden and ore are drilled by 100mm diameter crawler drills with 365cfm compressors. For blasting, conventional slurry / emulsion explosives are used. Bottom initiation pattern with controlled blasting technique is being followed by using down the hole (DTH) and trunk line delay (TLD) to minimize ground vibration, fly rock etc. Hydraulic excavator / front end loader and rear dump truck combination is used to bring the blasted overburden to dump yard. Similarly, the blasted run-off mine ore is being hauled to sorting places located at the top of the quarry. The ROM is then dressed, sorted, sized and graded manually at sorting place. The piece-rated workers (Mazdoor/Reja) are deployed at different sorting places considering the average output per man shift of 1 ton viewing the finished ore production required from the particular quarry.

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

Thereafter, the stacks are dispatched to our FAP Plant Joda and railway siding. The ore from railway siding is transported through rail to different parties. The fines generated in the process are kept separately for screening to recover residual lump. After recovery of the lumps, the fines are stacked separately and sold whenever a market for such ore is available.

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

Salient Features of Conceptual Mining: Manganese Ore:

The conceptualized ultimate pit generalized plan is shown in Plate No.-I. The ultimate generalized land use pattern and corresponding ultimate section is shown in Plate No.-II.

At present, manganese mining operation at Khondbond has three dumps namely Dump No.-1, 2 & 3. Dump No.-1 is outside the applied lease boundary and has already been reclaimed by afforestation. Dump No.-2 & 3 has been exhausted and are under rehabilitation by plantation. As proposed in the approved Mining Plan, Dump No.2 & 3 was developed for Ore Zone-X & XII. Dump No.-2 will be fully stabilized over mined out area of Ore Zone-XIII which has already been exhausted of manganese ore. It is also envisaged that, the Ore Zone IV will be exhausted during 2013-14 and sub-grade ore and mineral reject generated from Ore Zone X & XII will be stacked during subsequent years.

As the Dump No. 1 is outside the applied lease area, Dump No. 2 & 3 is being renamed as 1 & 2 respectively and accordingly shown in drawing no. MP/KIMM/R2/2/12. New Dump no. 3 will be developed in the extent of 13350N-13700N & 6275E ï 6650E after obtaining the Forest Clearance and subsequent permissions.

In the intervening time, overburden from Ore Zone X & XII will be used for back filling of an old exhausted quarry within Joda West Manganese Mines of Tata Steel Limited situated at northern side of the lease at a distance of 5.3 km. which is under same management control. Some quantity (~45,000 cum/annum) of overburden shall be used to fill up the undulated surface of the proposed corridor from the ML Pillar No. 16F to 16D for leveling of the surface and developing it as a utility corridor.

It is also envisaged that, after obtaining the tree felling permission over the Ore Zone IV,the entire ore will be excavated during 2014-15 & after the exhaustion of ore the sub-grade and mineral rejects will be stacked there for future use.

As a part towards mechanization, crushing, screening and mechanical sorting (based on Radiometric X-Ray technology) unit is proposed to be commissioned during the scheme period for mechanizing the subsequent processing of the ROM. The plant shall have a capacity of 50-100 TPH to crush the ROM to -75mm size. The screening shall be done at 10 mm size. The products of -75 +10mm shall be

shifted to stack yard for preparation of stacks in geometrical shape. The fines (-10mm) shall be shifted to the mineral reject stacking area by using loader and dumpers. The waste generated if any shall be shifted to waste dumps.
The above unit shall be of dry process and the following environment protection measures shall be taken to control the air pollution:
ÅEnclosures shall be provided to trap the dust while crushing, screening and conveying.
ÅWater spray shall be provided at all transfer points.

To make use of low grade manganese ore for the production of Mn. alloys, it is envisaged to evaluate various available technologies and its techno-economic viability for beneficiation. It is proposed to take up pilot plant studies for assessing the feasibility of beneficiation of the low grade manganese ores.

The proposed areas for mining and waste dumping area are shown in conceptual plan in drawing no.MP/KIMM/R2/10/12.
The ultimate dimension of manganese ore waste dumps are given in table-4.2b.1

TABLE – 4.2b.1
ULTIMATE DIMENSION OF MANGANESE ORE WASTE DUMPS AT CONCEPTUAL STAGE

Details of Dump	Dump No.1	Dump No.2	Dump No.3 (New)	External Dump at Joda West Manganese Mine
Dump area at the base (ha.)	5.080	5.500	12.000 ha.	3.240 ha.
RL at the base of the dump	542 m	547 m	560 m	524 m (Bottom of exhausted pit)
RL at the top of the dump	586 m	597 m	620 m	582 m
Height of Dump	44 mtr. (Three terraces)	50 mtr. (Four terrace)	60 mtr. (Four terrace)	30 mtr. (Four terrace above ground level)
Total capacity of dump	4.5 LCuM	6.35 LCuM	35 LCuM	9 LCuM (Additional holding capacity will increase by 6 LCuM by merging the lifts in eastern side with existing dumps of Joda West Manganese Mine.
Reclamation and rehabilitation measures of waste dump.	After rehandling of material, subsequent afforestation by method of contour trenching and pitting will be undertaken in the coming years and top floor will be used for mineral storage		The dump will remain active during plan period. After exhaustion, the dump shall be fully rehabilitated by afforestation.	The dump will remain active till 2014-15. The open terraces in the western side shall be rehabilitated by plantation during subsequent years.

4.4 SALIENT FEATURES OF MINERAL BENEFICIATION

4.4 (a) Iron Ore:

Presently, the ROM, from ñP & Nò-Ore body, is fed to Crushing and Screening Plant which after three stages of crushing and screening is finally converted into lump ore of size (+5-18 mm), (+10-40 mm) as finished product. The finished product is loaded into trucks and dispatched to TSIL,TML & Joda siding after weighment. Fines ore(-5mm) generated from crushing & screening is transported to Joda East siding or Juruli siding for onward dispatch to companyôs steel plant as per the requirements. The balance fines are being stacked at different locations as shown in drawing MP/KIMM/R2/02/12

4.4a.1 Process Flow of Existing Crushing & Screening Plant :

The sponge grade iron ore lump from mines will be transported to existing Crushing and Screening plant.The blasted ore, predominantly hard ore, of -800 mm size is fed into 35 tonne capacity hopper, from where it goes to grizzly feeder. From the grizzly feeder, the +100 mm size is fed to primary jaw crusher.

The -100 mm size from grizzly goes to a vibrating screen. From this vibrating screen, the -5 mm size is taken out as rejects (approx. 10-15 % of ROM). The +5 mm along with output of primary crusher (-100 mm) goes to another vibrating screen. At this screen, the +60 mm is fed into a Superior secondary crusher where it
is crushed to -60mm. This -60 mm size (both from secondary crusher as well as that directly obtained from screen) goes to a double deck vibrating screen. From this screen, -60+18 mm size is fed into a Tertiary hydrocone crusher, the product of which (-18 mm) is recirculated to the double deck vibrating screen. From this screen, the -18+5 mm size (55-60 % of ROM) is stored into two hoppers of 150 t capacity each and -5 mm size (32-38% of ROM) is stored into a single hopper of 150 t capacity.

The specifications of the products obtained are given in Table -4.4a.1

TABLE- 4.4a.1:
PRODUCT SPECIFICATION OF EXISTING CRUSHING & SCREENING PLANT AT KHONDBOND

Product	Product Physical Quality		Chemical Quality	
	Under Size	Over Size	Fe%	
Lump Ore (+5-18mm)	7 %	7 %	64.0-66.0	(Al2O3+SiO2) 5.0-6.0%
Lump Ore (+10-40 mm)	7%	8 %	64.5-65.5	Al2O3:(1.3-1.6) %
Fines(-5mm, -8mm)	5%	5%	63.5-65.5	Al2O3:(1.5-3.5) %

The flow sheet of the existing crushing & screening plant is given in Plate ï III .

Tata Steel has programme for expansion of iron ore mining at Khondbond by installation of a new beneficiation plant with state-of-the-art technology for beneficiating different grades of iron ore and converting into suitable grade iron ore lumps and fines. Finished products produced from the beneficiation plant shall be transported to the steel plant from Juruli Siding (or any other private siding) and Joda East Siding. Mode of transportation of finished products from minehead to the proposed sidings will be by belt conveyors through conveyor corridor or by road through tippers as per the requirements. The conveyor has been planned from Khondbond to Joda East siding through Joda West Lease of the Company. The conveyor from mine head to proposed siding will pass through different leases. The Steel Company is in process of filling applications to various authorities for necessary permissions for the proposed conveyor route.

It is proposed that the existing plant will continue to work upto 2016-17.Whereas the new beneficiation plant is proposed to start partially from 2015-16 and will start operating in full capacity of 8 MTPA from 2016-17 onwards. After the new beneficiation plant achieves its full capacity(8 MTPA), the existing old plant will stop operating In the case of delay in commissioning of beneficiation plant mobile crushing & screening plants will be set up during the plan period to meet the demand of steel plants.

The proposed beneficiation plant shall involve wet processing of iron ore .There will be generation of iron ore tailing from the plant, which shall require a suitable place for storage. Therefore, during the plan period, the ore from pit 7 shall be excavated completely by 2015-16 and will be converted into tailing dam no.4 for storage of tailings which will have enough capacity to accommodate tailings upto 2017-18.By that time pit 2 shall also be excavated completely and shall be converted into tailing pond 1, which will work for balance plan period upto FYô18 if required.

4.4a.2 Process Flow of Proposed Beneficiation Plant:

The proposed beneficiation plant consists of two units

1. Crushing & Washing Plant
2. Beneficiation Plant

ROM of Khondbond will be processed through the wet processing route as per the details given below:

1. Crushing & Washing Plant:

1.1 Plant feed

A dumping station is being made for feeding the ROM ore to a Primary crusher (Gyratory type). The ore is crushed to (-) 165 mm / 375 mm in this crusher and fed to two (2) nos of apron feeders below the crusher. The crushed material is conveyed to two stockpiles, each with 7000 T live storage capacity. The primary crushed ore is reclaimed from the stockpiles by apron feeders

1.2 Primary Screening

After reclaiming the crushed ore from the stockpiles is conveyed to the screens provided for separation of (+) 85 mm, (+) 40 to (-) 85 mm and (-) 40 mm. The material fraction (+) 85 mm is conveyed by conveyors to a surge bin above one (1) no. of cone crusher (CR-1) for crushing the (+) 80 mm material (-) 40 mm, This crushed material feeds to two (2) nos. of drum scrubbers

1.3 Scrubbing, secondary screening and tertiary crushing

After scrubbing, the material is fed to one (1) no. of double deck wet screen (banana type) for separation of (+) 32 mm, (+) 16 to (-) 32 mm and (-) 16 mm.

The (+) 32 mm fraction is conveyed to two (2) nos of cone crushers by conveyors .One surge bin is provided before feeding to each crusher.

The crushed product from the crusher is fed to the banana screen by conveyors. The material fraction of (-) 32 mm to (+) 8 mm is conveyed to beneficiation plant. The material fraction of (-) 8 mm (+)1mm is fed through another conveyor. The (-) 1 mm slurry is pumped to beneficiation plant

2. Beneficiation Plant:

2.1 Beneficiation of 32-8 mm size fraction

The ore of 32-8 mm size as segregated from the crushing plant is fed to coarse jig where the jig beneficiates the ore. The beneficiated ore is dewatered and send to product stockpile. The rejects as produced from the coarse fraction are further ground and processed in middling jigs depending upon the quality.

2.2 Beneficiation of 8 -1 mm size fraction

The ore of 8-1 mm size fraction as segregated from the crushing plant is fed to fines jig where the jig beneficiates the ore. The beneficiated ore is dewatered and send to product stockpile. The rejects as produced from the fines fraction are further ground and processed depending upon the quality

2.3 Beneficiation of -1 mm size faction

The slurry is fed to hydrocyclones for separation of finer size fractions and then using a TBS & spiral combinations further product grade material is recovered.

The tailings generated from the process plant will be disposed off in a slime dam located in the Khondbond lease.

The flow sheet of proposed beneficiation plant at Khondbond is shown in the Plate-IV.

The average Physical and Chemical specifications of the products generated from the proposed beneficiation plant at Khondbond are given in table-4.4a.2

TABLE- 4.4a.2
PRODUCT SPECIFICATION OF PROPOSED BENEFICIATION PLANT AT KHONDBOND

Product	Product Physical Quality		Chemical Quality	
	Under Size	Over Size	Fe%	Al2O3%
Lump Ore (+5-18mm)	7%	7 %	64.0-66.0	(Al2O3+SiO2) 5.0-6.0%
Lump Ore 32mm,+8mm	7% avg	8% max	>65%	1.6 ± 0.5%
Fines -8mm,	10% avg	4% max	>64%	2.2 ± 0.5%

4.4a.3 Process flow of Proposed Mobile Crushing & screening plants at Khondbond:

It is proposed that a fraction of ROM (run off mine) of iron ore from Khondbond Iron & Manganese Mine will also be processed in Mobile Crushing & Screening Plants. The mobile crushing & screening plants will work at different levels of P & N ore body, Pit5, Pit 7, Pit11 & Pit21 as per the requirement .The ROM will be stacked near mobile crushing unit from where ROM will be fed to primary crusher (Jaw crusher) with the help of back hoe. The input size of the Jaw crusher is -500mm and it operates at 2x250 TPH. The output size of the Jaw crusher is -120mm,which is fed to a double-deck screen having a screen sizes of 40mm and 10mm. the three products generated from the screen are lump ore (-40mm to +10mm), fines ore(-10mm) and oversize (+40mm) . The oversize is fed to secondary crusher which is a closed circuit Cone Crusher. The output of the secondary crusher is again fed to a double deck screen producing three products lump ore (-40mm to +10mm), fines ore (-10mm) and oversize (+40mm). The oversize is again fed to cone crusher in a closed circuit. Hence the Secondary crusher ultimately produces two final products namely lump ore (-40mm to +10mm) and fines ore (-10mm). Lump ore and fines ore produced from mobile crushing & screening unit will be dispatched to TSIL,TML,Joda East Siding and Juruli sidings(other private sidings) for onward despatch to Steel Plants at Jamshedpur & Odisha.

The plant is capable of producing products of different size specifications as mentioned in Table No. 4.4a.3 with changing screening size and crusher settings. The flow sheet of Mobile Crushing & Screening plant is given in Plate -V.

TABLE – 4.4a.3
SPECIFICATIONS OF PRODUCTS OF MOBILE CRUSHING & SCREENING PLANT AT KHONDBOND

Product	Product Physical Quality		Chemical Quality	
	Under Size	Over Size	Fe%	Al2O3%
Lump Ore (+10,-40mm)	8% avg	2.5% avg	>64.0-66%	1.5-3.0
Fines -10mm,+0.15mm	5.5% avg	4.08% avg	>62.5%	3.5-4.5

The location of existing Crushing & Screening Plant and proposed Beneficiation Plant and tailing dam are indicated in drawing no.MP/KIMM/R2/02/12 and MP/KIMM/R2/10/12.

4.4 (b) Manganese Ore :

At present, the manganese ore is being dressed, sorted, sized and graded manually at sorting yard. The process of mineral beneficiation of the low grade manganese ore is known since long. A beneficiation process flow sheet is in process to explore to upgrade these ores using high intensity magnetic separators and reduction roasting followed by low intensity magnetic separation. Beneficiation and agglomeration test is being carried out to demonstrate the beneficiation process flow sheet at R & D, Tata Steel, IIMT- Bhubaneswar and Mintek Laboratrory of South Africa. High Intensity magnetic separation can upgrade the Mn ore upto usable for Silico manganese Production and detail test work on reduction roasting process is in progress to upgrade this resource, which can be used for Ferro manganese making.
However, the economic viability of the process has been doubtful in view of the high energy cost. Our companyôs R&D proposed to take up pilot plant studies for assessing the feasibility of beneficiation of the low grade manganese ores and fines.

4.5 SALIENT FEATURES OF ENVIRONMENT MANAGEMENT

The Khondbond lease covers an area of 978 ha consists of 836.757ha of forest land & 141.243 ha of non-forest land. The company has got forest clearance of 435.15ha out of which working permission has been granted over an area of 235.42ha. The company has applied for working permission for the balance area of 218.73 ha.At present mining operation for iron and manganese is being carried out in approved and already broken up forest area only. In future as mining operation will expand into new area, fresh forest land will be required to be diverted.Hence,the steel company has applied for fresh diversion proposal for balance forest area of 369.245 ha(except 14.362 ha of safety zone) vide letter no. JCO/13/12/33/2009 dated 27.01.2009 against which the state government has allotted State Serial no. 486/2011 dated 31.05.2011.

The Steel Company is committed for judicious utilization of forest land but as all iron ore and manganese ore deposits of Khondbond falls under forest land and has spread over entire lease hold area, future expansion of mining operations for iron and manganese ore shall require additional fresh forest land.
The abstract of land schedule and existing landuse pattern of Khondbond Iron & Mn. Mine is given below in table 4.5.1a & 4.5.1b:

TABLE – 4.5.1a
LAND SCHEDULE ABSTRACT

ABSTRACT	
Tenanted Land	104.320 ha
Government Land	
I. Reserve Forest	681.718 ha
II. Khesra Forest	44.653 ha
III. DLC	110.386 ha
IV. Other Land (Govt.)	36.923 ha
Total	978.000 ha

TABLE – 4.5.1b
EXISTING LANDUSE PATTERN

(All figures in hectares)

(As on 01.04.2012)

Sl.No.	Head	Forest Land(ha)	Non Forest Land(ha)	TOTAL
1	Mining	139.920	0.000	139.920
2	Storage for top soil	0.000	0.000	0.000
3	Overburden dump	24.303	0.800	25.103
4	Mineral Storage	5.710	1.222	6.932
5	Infrastructure (Workshop, Admin. Bld)	4.600	0.000	4.600
6	Roads,Conveyor route,pipeline etc	19.100	0.000	19.100
7	Railways	0.000	0.000	0.000
8	Green Belt	5.962	0.000	5.962
9	Tailing pond	0.000	0.000	0.000
10	Effluent treatment Plant	0.000	0.000	0.000
11	Mineral Separation Plant	2.500	0.000	2.500
12	Township area	0.000	0.000	0.000
13	Others(Magazine)	0.000	0.000	0.000
Total Utilised area		202.095	2.022	204.117
Unutilized		634.662	139.221	773.883
Total Lease Area		836.757	141.243	978.000

As ore zones for iron and manganese ore at Khondbond are wide spread, it is envisaged that in future mining operation shall spread over large area covering most of unutilized land. The conceptual land use pattern at the life of mine is indicated in the table 4.5.1c.

TABLE – 4.5.1c
LANDUSE PATTERN AT CONCEPTUAL STAGE

Sl. No.	**Head**	Forest area (ha)	Non-Forest area(ha)	Total area (ha)
1	Excavation/ Mining	489.672	96.743	586.415
2	Storage for top soil	0.500	0.000	0.500
3	Overburden/dump	146.000	18.000	164.000
4	Mineral storage	4.400	12.500	16.900
5	Infrastructure (Workshop, administrative building etc.)	17.500	0.000	17.500
6	Roads, conveyor route, pipe line etc.	32.535	4.200	36.735
7	Railways	0.000	0.000	0.000
8	Green Belt	14.362	0.000	14.362
9	Tailing Pond	105.700	7.300	113.000
10	Water & Effluent Treatment Plant	0.350	0.000	0.350
11	Mineral Separation Plant	15.000	0.000	15.000
12	Township area	0.000	0.000	0.000
13	Others(Magazine)	1.557	0.000	1.557
	Total Utilised	827.576	138.743	966.319
	Unutilised	9.181	2.500	11.681
	Total Applied Area	836.757	141.243	978.000

Justification for requirement of land for mining and associated activities:

During 2008-09 to 2012-13 mining operation and related activities have been concentrated within already broken up area only as fresh forest land has not been handed over to the Steel Company.

During the next five years and up to conceptual stage there will be increase in utilization of forest land for expansion projects. As explained earlier, present mining operation for iron and manganese ore is at a very small scale, mining operation and allied activities were concentrated within already broken up area only. It has been proposed to increase its capacity up to 8.0 MTPA of iron ore and 1.0 LTPA of manganese ore. The proposed expansion will require expansion of mining and associated activities in new area.Further, so as to maintain consistent grade of ROM to the proposed beneficiation plant, ROM needs to be supplied from different pits having different grade of material.

Therefore in future as the mine gears up for higher production levels, development of new pits is essential. Because all iron ore zones are located within forest area only, use of fresh forest land cannot be avoided. However, major part of forestland will be used for iron ore mining only and a small part will be used for expansion of manganese mining.

As iron ore bodies at Khondbond are located in discontinuous form, mining operation will be more difficult and huge quantity of waste and subgrade will be generated which will require large area for waste and subgrade dumping. Dumps are required to be developed in non mineralized area and also near respective pits so as to optimize the cost of operation. All dumps for iron ore has been proposed and designed with above considerations therefore requirement for additional land for waste and subgrade dumps is justified. However, requirement of additional land for these dumps is only for initial years thereafter waste will be dumped in mined out area only and no additional land will be required.

It is assumed that tailings of 1 Mcu.m would be produced per 8 Mtpa of ore processed. Hence tailings disposal is a key driver for the project and the mining sequence has been adjusted to preferentially mine areas that would yield tailing storage capacity. Tailings dam space is particularly tight in the first five years due to forestry limits. After this time tailings space is available, but only with particular mining sequences.

It is proposed that Pit 7 shall be converted into slime dam 4 and shall be ready for disposal of tailings before the commencement of new beneficiation plant during 2015-16. Slime dam 4 will be made in two lifts. Lift -1 and shall be used upto 2017-18. By that time pit2 (part of N orebody) will have been excavated completely & converted into slime dam & be ready for slime disposal after the dam4 gets full in 2017-18. After the plan period ,pit 11 shall be used for slime disposal hence excavation of Pit11 shall start in 2017-18. The required amount of waste needed to construct the dam walls of tailing dam 4 will be about 2.45 M Cu.m. The total capacity of dam4 (i.e. Pit7)will be 4.88 M Cum.

Slime dam area has been chosen with great care taking into account of all environmental and technological aspects. Slime dam will be constructed with zero discharge concepts.

At present, the mine supplies Lump ore to M/s Tata Sponge Iron Ltd., M/s TML & TSL Jamshedpur (through Joda East siding) by road transport. The fines ore is transported by road to the companyôs Joda East Iron Mine railway siding and subsequently transported to the companyôs steel plant at Jamshedpur by Rail.

The proposed expansion of the mine and transport system is required to cater to the requirement of Iron Ore of the companyôs steel plants at Odisha and Jamshedpur.

With the current infrastructure and environment the quantity through Truck Transport from the mine is limited about 6-8 lakh tonnes per annum (LTPA). After the expansions the mine will be supplying about 6.4 million tons of iron ore to the companysô steel plant at Odisha and Jamshedpur. The company also has a well-developed railway siding with mechanized loading facilities at its Joda East Iron Mine.

Therefore with the given topography of the area, location of other mines and flexibility of operations and change of layout etc. long distance conveyor is the only feasible option for transportation of mineral. Hence, it is proposed to lay a conveyor (pipe conveyor) from Khondbond Iron & Mn. Mine to Joda East siding. The Iron ores will be transported from the mine to Joda east Railway siding by conveyor and subsequently to various destinations through Rail.

The length of the conveyor corridor inside the lease will be around 2804 m of width 65 m and area 18.226 Ha. It involves 9.282 of Forest land, 4.732 Ha. of NF Govt. land and 4.212 Ha. of NF Pvt. Land.

The length of the conveyor corridor inside the Joda West Mn Mine lease belonging to Tata Steel will be around 3388 m of width 65 m and area 22.022 Ha. It involves 20.696 ha of Forest land, 0.988 Ha. of NF Govt. land and 0.338 Ha. of NF Pvt. Land

The length of the conveyor corridor inside the Joda East Iron Mine lease belonging to Tata Steel will be around 1364 m of width 65 m and area 8.866 Ha. It involves4.94 ha of Forest land,3.302 Ha. of NF Govt. land and 0.624 Ha. of NF Pvt. Land

The total length of the conveyor from the loading to destination point will be around 10580m.

About 41.472 ha of land have been identified for transport corridor outside the khondbond lease. The corridor has been designed along the lease boundary so as serve up to the life of the mine. The width of the corridor has been decided taking into account of topography of area, width of conveyor, width of road, safety distance for HT lines, statutory limits of 7.5 mtrs from lease boundary and safety zone of 7.5 mtrs as required under the diversion proposal of forest land.

Land required for beneficiation plant is about 15.88 ha. It is essential as the beneficiation plant will have series of beneficiation facilities (particularly for processing of low grade ore) including Crushing and Screening, beneficiation equipments (such as coarse & fines Jigs, Hydro cyclones, TBS, Spirals and mills). It is also proposed that before each series of equipments, sufficient buffer stocks will be maintained. Further Staking and Reclaiming facilities will also require huge area at Beneficiation plant. It is proposed that about one week of stock of finished products will be maintained at beneficiation plant.

The company has obtained Environment Clearance vide letter J-11015/888/2007-IA.II (M) dt. 21-12-2011for Enhancement of production from 5.4 MTPA of iron ore (ROM) to 8 MTPA and manganese ore from 0.036 MTPA to 0.1 MTPA for the total project area of 1019.472 ha. which includes mine lease area of 978 ha and an area of 41.472 ha. for the transportation corridor outside the mine lease.

The company has obtained Consent to Establish for increase in Iron ore Production from 2MTPA(ROM) to 8MTPA (ROM) ,Manganese ore production from 36000TPA to 1LTPA (ROM) and for establishing the proposed beneficiation plant vide letter no. 21730/IND-II-NOC-5093 dated 23.12.2011from SPCB.The company has also applied for Consent to Establish for conveyor corridor vide letter no. MD/ENV/241/106/2010 dated 04.09.2010.

The Environment Management activities as per the plans are periodically reviewed by the Eastern Regional Office of the Ministry of Env. & Forests located at Bhubaneswar.

Tata Steel has full-fledged Environment Management Department at Noamundi with personnel from different backgrounds to take care of all environmental aspects. A well-equipped laboratory for monitoring of different environmental parameters is also established at Noamundi. The Environment Management Department of Noamundi also takes care of the Environment Management activities of Khondbond Iron & Mn. Mine.

The monitoring of air, water, soil and noise levels are carried out at regular intervals and all the parameters are well within the prescribed limits. The Environmental monitoring parameters of last season is enclosed at Annexure-II, III & IV.

As a matter of policy, the company takes care of preserving greenery of the lease hold areas in the interest of ecological balance. The vacant spots and barren areas whenever possible have been afforestated. Table 4.5.1e indicates the afforestation done during the last six years.

TABLE: 4.5.1e

AFFORESTATION DONE DURING LAST FIVE YEARS

YEAR	PLANNED	ACTUAL (No. of saplings)
Fyê09	5000	2500
Fyê10	5000	12150
Fyê11	5000	22950
Fyê12	11375	16000
Fyê13	13500	46060
TOTAL	39875	99660

The following precautions are being practiced for controlling the pollution caused by mining activities:

- The haul road dust suppression is effected with the help of 9 KL water sprinklers,
- Drills are operated with in-built dust extraction & suppression system,
- The dump hoppers of crushers and all transfer chutes of belt conveyors are equipped with dry fog system of dust suppression systems to keep the dust emission under check,
- Belt conveyors at crushing and screening plant are covered with metallic shields,
- Blast induced vibration is effectively controlled by Nonel system of blasting and strictly following recommendations of CIMFR,
- Dumps are well protected with toe walls to prevent boulder rolling down from the dumps. The garland drains are also being provided to arrest surface run-offs and
- Part of the active dumps which have matured, has been stabilized by plantation.

4.5.2 POST MINING RECLAMATION:

Tata Steel envisages adopting State-of-the-Art technology for reclamation of the mined out pit and waste dumps in consultation with environmental and geological experts. Today, we conceptualized the post mining operations in the following manner:

1) To reclaim the abandoned pit: It is proposed to reclaim the mining benches after they reach the ultimate pit limits. It has been envisaged that some parts of mined out land of iron ore quarries shall be backfilled by waste and tailing, similarly manganese ore pits, as they get exhausted shall be back filled by waste encountered during excavation. The method of afforestation by **"Pitting and Planting"** will be followed to reclaim mined out area.

2) To afforest the abandoned dumps and back filled area: The method of **"Planting by Contour trenching"** will be followed.

3) The dump slopes shall also be strengthened by undertaking re-greening activities by planting grasses of Vetiver Zizcuaides and Jama Centronella varieties. The activities of afforestation shall be carried out by the our Environment Management Department which has in-house monitoring and analytical facilities also.

4) The bottom few benches shall be converted to a natural water reservoir.
5) Land used by other ancillary purposes shall be afforested at the end of the life of mine. However, some of the infrastructure may be required to leave as it is for use by general population.
The reclamation methods are described below:
a) Method of "Pitting and Planting"
i) The worked out mining benches will be reclaimed by making pits 0.5m x 0.5m x 0.5m size spaced every 2m apart. The pits will then be filled with sweet earth, sand and cow-dung.
ii) Neem cake powders are proposed to be applied in the pit to protect the plants from white ants.
iii) Such ground preparation is proposed to be done before monsoon after which appropriate varieties of saplings will be planted during the monsoon.
The method of Pitting and Planting has been shown in Plate ï I.

b) Method of "Planting by Contour trenching"
The method of contour trenching is proposed for active dump slopes wherein contour trenches are dug at 3m intervals along the contour. The excavated earth is stacked on the edge of the trench on the lower slope side to arrest the water flow that comes due to rains and accumulates on the trenches and gradually seeps through the strata enabling the planted saplings to get water and nutrients regularly for healthy growth.

This method of Planting by Contour Trenching has been shown in Plate- II.

The area already afforested so far, year wise reclamation plan for the next five years and reclaimed status of the mine at the end of life of mine has been indicated in the drawing no. MP/KIMM/R2/9/12 & MP/KIMM/R2/10/12.

Post mining land use is given below in the table 4.5.2a:

TABLE: 4.5.2a

PROPOSED RECLAMATION MEASURES

	CONCEPTUAL LAND DEGRADATION	PROPOSED RECLAMATION	
	Area in ha.	Area in ha.	Measures
Mining Excavation	586.415	560.415	Afforestation of top benches by plantation.
		5.00	Bottom benches shall be converted for water storage.
		12.00	Back-filling with waste& tailings and subsequent afforestation.*
		9.00	Back filling by waste**

* Back filling of part of Iron quarries after exhaustion of mineral.

** Back filling of Manganese quarries after exhaustion of mineral.

5.0 PRESENT MINING METHODS

5.1. IRON ORE MINING:

At present the Khondbond Iron and Manganese mine is producing about 0.7 MTPA of ROM of iron ore. The company has plans to expand production from its present level to 8 MTPA ROM (Iron ore) during the plan period. It is required to process about 8.0 MTPA ROM in the existing and proposed beneficiation plant.

The subgrade material is found in the form of intercalated patches within the ore zone which has been delineated by exploratory drilling, sampling and assaying. This subgrade consists of ferruginous shale and clay material having high alumina (deleterious) with low iron content ranging from 45% to 58%. The mine development has been planned accordingly delineating iron ore (Fe>58%) for plant feed, subgrade patches (<45% & <58%Fe) and waste material (<45%Fe) for stacking. The entire exercise of mine planning is being carried out by using sophisticated mine planning software ñSURPAC VISSIONò for systematic and scientific excavation planning.
Further, short term mine planning is being practiced using blast hole drilling and sampling for deciphering the iron ore, subgrade patches and waste material separately.
As such there is no program for disposal of subgrade outside the lease and its use for beneficiation and blending purposes, it is stacked separately for future use as shown in the mining scheme.
The mineralogical amenability of this low grade material has been initiated, however, detailed mineral characterisation, mineral liberation and beneficiation studies will be conducted in 2013-14, 2014-15 & in 2015-16 respectively.

During the plan period, mining operation will commence in the north region in continuation with the existing operations in P ore body, N ore body & Q orebody. From 2013-14 to 2014-15 P & N ore bodies will be worked as separate pits, whereas from 2015-16 both of them will get merged and form P & N ore body as a single pit. In addition to P ore body, N ore body & Q-orebody , mining in some new pits like Pit7, Pit11, Pit21,Pit5 and Area 13 (which is conveyor corridor /access road area located along the North East boundary) will also be undertaken during the plan period.

In 2013-14,P ore body, N ore body,Q ore body,Pit7 & Area 13 (conveyor corridor/access road) will be worked.It is proposed that the existing pit of Q-orebody will be used for rain water harvesting purpose hence some quantity of material will be excavated from it during 2013-14 to widen the area in order to accommodate more quantity of water before converting into rain water harvesting structure.It is proposed that pit No.7 to the west of the deposit will be used as initial tailings storage area (dam 4)for tailings disposal for the initial years of the Project hence this has to be mined before new processing plant is commenced . Excavation of Area 13 will also commence during the first year as it will contain access road and conveyor corridor, so this has to be mined before conveyor construction can commence. Therefore, the construction of the main northern access road will also start in the first year, which requires both cut and fill. Any sponge grade ore mined from these locations will be fed into the existing plant to meet its 1 Mtpa target. Other ore and subgrade material will be stockpiled until the new plant is operational. Other types of iron ore (i.e. hard ore, flaky iron and lateritic iron ore) encountered during excavation of sponge grade iron

ore will be stocked either at ore stockpile No.1 (located near the proposed beneficiation Plant towards north) or at ore stockpile no.2 (located near P ore body)which is a temporary intermittent stockpile based on the lead distance. The ore so stocked will subsequently be utilized in blend with iron ore from other pits in the proposed beneficiation plant. The temporary intermittent stockpile no.2 is proposed to facilitate feeding of existing plant as well as the new plant for various quality trials.
All waste will be directed to waste dump 1& 5, located to the south west of the main active mining area. Sub-grade material will be stockpiled for future use in proposed sub-grade dumps 1A,2A,2, 3 and 6 based on the lead distance.
Before the commencement of new plant, it is required to feed hard ore to the existing processing plant at a rate of 1 Mtpa. The excess quantity of ore will be directed to ore stockpiles and then will be reclaimed over time. Due to the excavation of Pit7(slime dam) & Area13 (accessroad/conveyor corridor),the total material movement will ramps during the first three years which will increase the strip ratio significantly during first three years

In 2014-15, mining will continue to progress in P ore body, N ore body, Pit7 and Area 13. All waste will be directed to waste dump 5, located to the south west of the main active mining area. Sub-grade material is stockpiled in proposed sub-grade dumps 1A,2A,2, 3 and 6 based on the lead distance. Stockpiling of ore continues, with ore directed to stockpile no.1 & temporary stockpile no.2 .Reclamation of ore from ore stockpiles starts in this year, predominantly from the existing fines stockpile, with minimal reclaim also from a new ore stockpile 1&2.

In 2015-16, P ore body & N ore body will get merged forming a single pit P&N ore body. It is proposed that New beneficiation Plant will partially come in operation during this year hence the excavation of Pit7 & Area 13 will be completed in this year and tailing dam 4 will be ready for disposal of tailings before the commencement of New Beneficiation Plant. Reclamation of stockpiled ore continues from both ore stockpiles. The waste continues to be sent to dump 5 with sub-grade stockpiling occurring in sub-grade stockpiles 1A,2A,2, 3 and 6 based on the lead distance.Tailings from the new beneficiation Plant will be disposed in tailing dam no.4.

In 2016-17, mining will continue in P&N ore body, in addition mining in Pit 5 will also commence. Pit 5 falls under J&K ore body. Waste from P&N ore body & pit5 continues to be directed to dump 5 with sub-grade dumping occurring in sub-grade dumps 1A,2A,2, 3 and 6 based on the lead distance. New plant is proposed to be operated at its full capacity and the old plant will stop operating once new plant is established fully to process 8MTPA of ROM. The tailings dam 4 will continue to be used for tailing disposal. Ore will be reclaimed from the existing stockpile only.Any excess quantity of ore from P & N ore body will be stacked in stockpile no.2 whereas the ore from Pit5 shall be stacked at stockpile no.1.

In 2017-18, mining will continue in P&N ore body & Pit 5. In addition mining in Pit21 & Pit11 will also commence in this year. Pit 21 is located in the South region. Pit11 is proposed to be excavated as it will be used as tailing dam after the plan period. The tailings dam 4 will continue to be used for tailing disposal, in case it gets full during 2017-18, then Pit 2 which is a part of N ore body shall be used for disposal of tailings

for the remaining period of 2017-18. Waste continues to be sent to dump 5 expanding to fill the excavated part of the previous pit 1(part of N ore body). Waste from Pit 21will be directed to waste dump 8. Sub-grade stacking will continue in sub-grade dumps 1A, 2A, 2, 3 and 6, with sub-grade dump 3 being completely filled by the end of this period. . The wall around pit 11 will be constructed from a suitable waste material, and is located immediately adjacent to subgrade dump 6.

During the plan period ,the ROM is proposed to be excavated from different pits namely P & N Ore body, Q ore body, Pit7,Pit 11, Pit 5, Pit21 and Area13 (conveyor corridor area).The year wise production & excavation programme for iron ore mining in the next five years have been indicated in table-5.1a:

TABLE 5.1a
YEAR WISE PRODUCTION & EXCAVATION PROGRAMME FOR IRON ORE MINING (in million tonnes)

YEAR	ROM	SUBGRADE	WASTE	TOTAL EXCAVATION	Stripping Ratio Ore:OB (t/t)
2013-14	6.33	2.45	3.76	12.54	1:0.98
2014-15	6.45	2.83	3.91	13.19	1:1.04
2015-16	7.36	4.40	3.37	15.13	1:1.06
2016-17	8.00	1.86	2.70	12.56	1:0.57
2017-18	8.00	2.55	1.86	12.41	1:0.55
TOTAL	36.14	14.09	15.60	65.83	1:0.82

- The approved production for iron ore as per the environmental clearance, granted by MoEF, vide MoEF letter No. J-11015/888/2007-IA.II (M), dated 21st December, 2011 for production of Iron ore of 8.0 MTPA (ROM) and installation of a wet Iron ore beneficiation plant of capacity 8 MTPA throughput.

At present, the ore bodies are developed by series of 6m bench height but during the plan period, the initial development of these orebodies shall include making approach roads and developing benches in series of 12 mtrs bench height by mechanized open cast method of mining. The bench height shall be increased initially to 10m then subsequently will be made 12m. The minimum bench width in the working benches will be maintained at 25-30 m, while in the ultimate stage the bench width will be reduced to 12 m thus having a final pit slope of 45 degrees. Drilling will be carried out by 100/150mm diameter drills with 10% sub-grade drilling and blasting will be carried out using SME explosives but in exceptional cases, blasting will also be carried out using slurry explosives such as Toe blast etc. Both conventional as well as non-electric initiation blasting will be done. The boulders generated during the course of blasting will be either broken by the use of Rock Breaker or hydraulic splitters. Secondary drilling (if required) will be done by using 100mm diameter drills . The blasted material will be excavated by using 1.2/1.8/3.2/5.7/6.5 Cu.M shovel and loaded onto 10/15/35/50/60/100 tonne tipper dumpers. Present operating fleets of small capacity shovels and dumpers will be gradually replaced with higher capacity shovel (6-6.5 cum) and dumper (50/100 tonner).

The sponge grade iron ore is presently being mined from P,N&Q Ore bodies. The sponge grade iron ore (primarily constituting hard ore) will be processed in the existing crushing and screening plant. The tippers/dumper dumps the ore into the hopper of the crushing and screening plant. Approximately, 10-15% of the ROM is separated as rejects by screening before crushing of the ore. The Lump ore (-18+5mm size and approximately 55-60% of ROM) obtained will be sent to M/s. TSIL and M/s TML by trucks. The recovery of fines (-5 mm) is approximately 32-38% of ROM and will be hauled by trucks to Joda East siding or Juruli siding(or any other private siding) till over land conveyor system is commissioned for onward despatch to companyôs steel plants at Jamshedpur & Odisha.

During the next five years, P&N Orebodies will be excavated for sponge grade iron ore. The hardore from these pits are proposed to be utilized in the existing Crushing & Screening plant to produce sponge grade lump ore(+5-18mm). Other types of ore (i.e. lateritic ore and flaky ore) encountered during sponge grade ore mining operation, will be stacked separately at stockpilesno.1 & 2 as indicated in drawing no. MP/KIMM/R2/10/12, which shall be utilised in proposed beneficiation plant in blend with iron ore from other pits. The capacity of stockpile no.1 is 7.57 mcum. The year wise excavation plan is given in Table- 5.1a,5.1b,5.1c,5.1d,5.1e,5.1f,5.1g ,5.1h & 5.1i.

For present status of mining, below is table showing position of Ore/ Waste / Subgrade of KIMM:

Table 5.1

Present Status of Mining				
Working Pit	Top RL	Bottom RL	Avg Bench Height	No. of Benches
P-Ore Body	702	659	5	8
N-Ore Body	690	668	5	4
Q-Ore Body	698	624	6	12

Present Status of subgrade Dumps		
Working Dump	Top RL	Bottom RL
Sub-grade Dump No 3	707.3	670.7

TABLE-5.1a

DEVELOPMENT PLAN OF N ORE BODY (in Lakh Tonnes)

YEAR	BENCH LEVEL	MID LEVEL	ROM	SUBGRADE	WASTE	EXCAVATION
2013-14	630	635	0.00	0.00	0.15	0.15
	640	645	1.10	0.02	0.46	1.58
	650	655	8.63	1.39	1.06	11.09
	660	665	8.64	0.38	3.21	12.23
	670	675	6.97	2.35	2.45	11.77
	680	685	3.01	0.95	1.10	5.06
	690	695	3.35	3.28	4.70	11.33
	TOTAL		**31.71**	**8.36**	**13.13**	**53.20**
2014-15	630	635	0.83	0.00	0.00	0.83
	640	645	0.19	0.00	0.00	0.19
	650	655	0.01	0.00	0.04	0.04
	660	665	1.15	0.00	0.00	1.15
	670	675	0.08	0.13	0.13	0.33
	680	685	9.02	2.31	1.29	12.62
	690	695	10.77	2.72	0.99	14.49
	700	705	3.15	2.05	2.66	7.86
	710	715	0.03	0.18	1.46	1.67
	720	725	0.00	0.04	0.07	0.12
	TOTAL		**25.23**	**7.43**	**6.64**	**39.30**
GRAND TOTAL			**56.94**	**15.79**	**19.77**	**92.50**

TABLE 5.1b

DEVELOPMENT PLAN OF P ORE BODY (in Lakh Tonnes)

YEAR	BENCH LEVEL	MID LEVEL	ROM	SUBGRADE	WASTE	EXCAVATION
2013-14	640	645	0.00	0.02	0.11	0.13
	650	655	0.00	0.03	0.02	0.05
	660	665	0.00	0.01	0.02	0.03
	670	675	0.00	0.00	0.00	0.00
	680	685	1.99	0.39	0.46	2.84
	690	695	5.81	3.76	1.60	11.17
	700	705	5.94	3.43	2.68	12.05
	710	715	4.55	0.90	1.08	6.53
	TOTAL		**18.28**	**8.55**	**5.96**	**32.79**
2014-15	670	675	0.21	0.18	0.01	0.40
	680	685	2.69	0.30	0.53	3.51
	690	695	4.44	1.80	1.57	7.81
	700	705	1.18	0.06	0.05	1.29
	710	715	0.00	0.02	0.00	0.02
	720	725	0.84	0.00	0.26	1.10
	TOTAL		**9.36**	**2.36**	**2.42**	**14.13**
GRAND TOTAL			**27.64**	**10.91**	**8.38**	**46.92**

TABLE 5.1c

DEVELOPMENT PLAN OF Q ORE BODY (in Lakh Tonnes)

YEAR	BENCH LEVEL	MID LEVEL	ROM	SUBGRADE	WASTE	EXCAVATION
2013-14	625	628	1.07	0.11	0.29	1.47
	631	634	0.77	0.00	0.25	1.02
	637	640	0.27	0.00	0.00	0.27
	TOTAL	675	2.11	0.11	0.54	2.76

TABLE 5.1d

DEVELOPMENT PLAN OF P&N ORE BODY (in Lakh Tonnes)

YEAR	BENCH LEVEL	MID LEVEL	ROM	SUBGRADE	WASTE	EXCAVATION
2015-16	630	635	0.08	0.03	0.04	0.15
	640	645	0.38	0.05	0.01	0.44
	650	655	0.10	0.06	0.02	0.17
	660	665	1.05	0.15	0.01	1.21
	670	675	16.79	2.11	1.34	20.24
	680	685	25.83	6.49	4.13	36.46
	690	695	2.13	0.00	0.00	2.13
	700	705	10.68	6.80	4.24	21.72
	710	715	4.58	2.92	1.82	9.31
	TOTAL		**61.62**	**18.61**	**11.60**	**91.84**
2016-17	620	625	5.20	0.00	0.00	5.20
	630	635	1.97	0.00	0.00	1.97
	640	645	1.46	3.82	0.00	5.28
	650	655	1.98	5.17	7.13	14.29
	660	665	7.92	0.89	15.28	24.09
	670	675	6.24	3.23	2.34	11.82
	680	685	7.13	0.22	0.37	7.72
	TOTAL		**31.91**	**13.33**	**25.12**	**70.36**
2017-18	610	615	3.10	0.00	0.00	3.10
	620	625	10.31	0.00	0.00	10.31
	630	635	0.00	0.00	0.08	0.08
	640	645	0.00	0.00	0.00	0.00
	650	655	0.00	0.00	0.00	0.00
	660	665	0.38	1.34	0.22	1.93
	670	675	4.66	0.33	0.14	5.13
	680	685	0.44	0.00	0.00	0.44
	TOTAL		**18.89**	**1.67**	**0.43**	**21.00**
GRAND TOTAL			**112.42**	**33.61**	**37.16**	**183.19**

TABLE-5.1e

DEVELOPMENT PLAN OF PIT 7 (in Lakh Tonnes)

YEAR	BENCH LEVEL	MID LEVEL	ROM	SUBGRADE	WASTE	EXCAVATION
2013-14	660	665	3.99	1.59	1.90	7.47
	670	675	1.95	1.82	1.53	5.30
	680	685	0.90	1.17	1.79	3.87
	690	695	0.71	1.24	4.01	5.95
	700	705	0.00	0.63	3.49	4.12
	710	715	0.00	0.00	2.29	2.29
	720	725	0.00	0.00	0.85	0.85
	730	735	0.00	0.00	0.07	0.07
	TOTAL		**7.55**	**6.45**	**15.92**	**29.91**
2014-15	630	635	0.64	4.40	3.63	8.67
	640	645	4.82	5.06	4.88	14.76
	650	655	8.14	1.86	4.98	14.98
	660	665	3.68	1.46	1.75	6.89
	670	675	1.80	1.68	1.41	4.89
	680	685	0.83	1.08	1.65	3.57
	TOTAL		**19.91**	**15.56**	**18.31**	**53.77**
2015-16	580	585	0.23	0.16	0.63	1.02
	590	595	2.33	0.41	0.27	3.01
	600	605	2.30	4.93	0.56	7.78
	610	615	0.50	7.30	5.71	13.51
	620	625	0.36	6.94	8.13	15.44
	630	635	0.52	3.60	2.97	7.09
	TOTAL		**6.24**	**23.35**	**18.27**	**47.85**
GRAND TOTAL			**33.69**	**45.35**	**52.49**	**131.53**

TABLE-5.1f

DEVELOPMENT PLAN OF PIT 11 (in Lakh Tonnes)

YEAR	BENCH LEVEL	MID LEVEL	ROM	SUBGRADE	WASTE	EXCAVATION
2017-18	660	665	3.34	0.96	0.78	5.08
	670	675	0.89	4.92	1.94	7.75
	680	685	0.00	0.56	0.24	0.80
	TOTAL		**4.24**	**6.44**	**2.96**	**13.63**

TABLE-5.1g

DEVELOPMENT PLAN OF PIT 21 (in Lakh Tonnes)

YEAR	BENCH LEVEL	MID LEVEL	ROM	SUBGRADE	WASTE	EXCAVATION
2017-18	640	645	2.57	1.90	3.34	7.81
	650	655	1.55	0.46	1.83	3.84
	660	665	0.36	0.00	0.84	1.20
	TOTAL		**4.48**	**2.37**	**6.00**	**12.85**

TABLE-5.1h

DEVELOPMENT PLAN OF PIT-5 (in Lakh Tonnes)

YEAR	BENCH LEVEL	MID LEVEL	ROM	SUBGRADE	WASTE	EXCAVATION
2016-17	700	705	27.93	1.69	0.00	29.61
	710	715	9.65	3.56	1.87	15.08
	720	725	9.66	0.00	0.04	9.69
	730	735	0.87	0.00	0.00	0.87
	TOTAL		**48.09**	**5.25**	**1.91**	**55.25**
2017-18	680	685	16.08	0.15	0.00	16.23
	690	695	18.91	9.49	0.54	28.94
	700	705	10.67	3.12	4.47	18.26
	710	715	6.73	2.31	4.17	13.20
	TOTAL		**52.39**	**15.07**	**9.17**	**76.63**
GRAND TOTAL			**100.49**	**20.32**	**11.08**	**131.88**

TABLE-5.1i

DEVELOPMENT PLAN OF AREA 13(CONVEYOR CORRIDOR) (in Lakh Tonnes)

YEAR	ROM	SUBGRADE	WASTE	EXCAVATION
2013-14	3.66	1.07	2.11	6.83
2014-15	9.46	2.61	11.31	23.38
2015-16	5.74	2.00	3.82	11.56
TOTAL	**18.85**	**5.68**	**17.23**	**41.77**

The year wise excavation, pit wise development plan and sections for iron ore mining are shown in drawing nos. MP/KIMM/R2/5-5I,5O,5P/12. & MP/KIMM/R2/6-6D/12

Ore Stockpiling:

Ore stockpiles are used for storing ore after it is mined from the pits and before it is fed to the processing plant. There are three main reasons for which the stockpiling of ore is required:

(i) Some areas, such as Pit7 which will act as the initial tailings dams and the Area13 which will be utilised for conveyor corridor and access roadway , contain ore that is mined before the process plant is commissioned, and hence needs be stockpiled for later use;

(ii) Access to sufficient open mining faces with suitable grades for blending. This is particularly relevant in the start-up period.

(iii) Alumina is variable by depth and so in a particular period either a higher or lower zone of alumina may be mined. Stockpiles are required so that this depth variability can be partially smoothed.

There are some stockpiles currently existing which contain fines from the existing processing plant. These existing stockpiles have a total capacity of 1.5 Mt Two ore stock piles have been proposed during the plan period . One permanent stockpile no.1 located towards the north of the proposed beneficiation Plant, whereas the other stockpile no.2 proposed near the P ore body is temporary intermittent stockpile. The ore from access road i.e. Area 13 will be stacked primarily at stockpile no.1 whereas the ore from Pit7,P & N ore bodies will be stacked primarily in temporary stockpile no. 2. The blasted ore from the mine shall be transported to either of these two ore stock piles based on the lead distance or directly be fed to the existing processing Plant and proposed new beneficiation plant. The stockpile no.2 is proposed to facilitate feeding of existing plant as well as the new plant for various quality trials.The capacity of stockpile no. 1is 7.57 million cum.

5.2: DEVELOPMENT PLANS FOR PROPOSED SLIME DAMS:

The proposed beneficiation plant at Khondbond will be equipped with the latest beneficiation facilities for production of lumps and fines. During the processing of iron ore ,tailings shall be generated. Therefore, a suitable place is needed for storage of tailings generated from the beneficiation plant. It is assumed that tailings of 1 Mcu.m would be produced per 8 Mtpa of ore processed. Hence tailings disposal is a key driver for the project and the mining sequence has been adjusted to preferentially mine areas that would yield tailing storage capacity.

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It is proposed that Pit 7 shall be converted into slime dam 4 and shall be ready for disposal before the commencement of new beneficiation plant during 2015-16. Slime dam 4 will be made in two lifts. Lift -1 will be used upto 2017-18. By this time pit2 (part of N orebody) have been excavated and can be utilized for slime storage as slime dam no.1,if dam 4 gets full during the plan period in 2017-18. After the plan period Pit11 is proposed to be converted into slime dam therefore, excavation of Pit11 shall

start in 2017-18 . While converting the pit7 into slime dam a total of 2.45 M cum of waste material shall be required to construct the dam walls .

The slime dam will be designed with zero discharge and the water recovered will be pumped back to the beneficiation plant for reuse. The proposed locations for tailing dams have been indicated in the drawing no. MP/KIMM/R2/10/12.

5.3: MANGANESE ORE MINING:

The manganese Ore Zones- IV,X and XII are proposed to be excavated during the next five years. The Ore Zone X & XII are being proposed for merger from 2013-14 considering the workings within diverted forest land. Semi mechanized method of open cast mining will be adopted for mining manganese ore. At present the height of the benches is maintained at 6 - 8 m. Overburden will be removed by the mechanized means. Ore raising will be done by excavating the mineral and transporting it to sorting yard where it will be manually sized, sorted and stacked to the required specification as mentioned in table no 7.1. The ore stack will be then verified by the State Government Officials, who then give the permission to dispatch the ore.

The overburden will be drilled by 100mm diameter drill and blasted using conventional explosives. The overburden will be handled by Shovel / Loader (1.2-1.7 CuM) and Tipper (15 /25 ton). The overburden will be dumped in the area earmarked for the purpose as shown in the drawing no. MP/KIMM/R2/02/12.

5.3.1: YEARLY DEVELOPMENT PROGRAMME FOR MANGANESE ORE:

During the next five years manganese Ore Zones-IV,X and XII are proposed to be excavated and Ore Zone X & XII will form a single pit. Year wise production plan is given in Table no. 5.3.1a, 5.3.1b & 5.3.1c.

TABLE: 5.3.1a

YEARLY DEVELOPMENT PROGRAMME FOR MANGANESE ORE AT ORE ZONE - IV
Extent of Working : 14240N-14340N & 9340E-9440E

Year	Overburden (CuM)	ROM (CuM)	Total Excavation (CuM)	ROM (MT)	Production (MT)	Sub Grade Minerals (MT)	Mineral Reject (MT)	Stripping Ratio (CuM of OB / T of ROM)
2013-14	0	0	0	0	0	0	0	0
2014-15	8439	1200	9639	3000	2550	300	150	2.81
2015-16	0	0	0	0	0	0	0	0
2016-17	0	0	0	0	0	0	0	0
2017-18	0	0	0	0	0	0	0	0
Total	8439	1200	9639	3000	2550	300	150	2.81

TABLE: 5.3.1b

YEARLY DEVELOPMENT PROGRAMME FOR MANGANESE ORE AT ORE ZONE X & XII
Extent of Working : 13830N-14265N & 8715E-9387E

Year	Overburden (CuM)	ROM (CuM)	Total Excavation (CuM)	ROM (MT)	Production (MT)	Sub Grade Minerals (MT)	Mineral Reject (MT)	Stripping Ratio (CuM of OB / T of ROM)
2013-14	571760	28240	600000	70600	60000	7070	3530	8.10
2014-15	608601	31760	640361	79400	67450	7980	3970	7.67
2015-16	617040	32960	650000	82400	70000	8280	4120	7.49
2016-17	662400	37600	700000	94000	80000	9300	4700	7.05
2017-18	710000	40000	750000	100000	85000	10000	5000	7.10
Total	3169801	170560	3340361	426400	362450	42630	21320	7.43

TABLE: 5.3.1c

TOTAL YEARLY DEVELOPMENT PROGRAMME FOR MANGANESE ORE

Year	Overburden (CuM)	ROM (CuM)	Total Excavation (CuM)	ROM (MT)	Production (MT)	Sub Grade Minerals (MT)	Mineral Reject (MT)	Stripping Ratio (CuM of OB / T of ROM)
2013-14	571760	28240	600000	70600	60000	7070	3530	8.10
2014-15	617040	32960	650000	82400	70000	8280	4120	7.49
2015-16	617040	32960	650000	82400	70000	8280	4120	7.49
2016-17	662400	37600	700000	94000	80000	9300	4700	7.05
2017-18	710000	40000	750000	100000	85000	10000	5000	7.10
Total	3178240	171760	3350000	429400	365000	42930	21470	7.40

- The approved production for iron ore as per the environemental clearance, granted by MoEF, vide MoEF letter No. J-11015/888/2007-IA.II (M), dated 21st December, 2011 for production of Manganese Ore of 0.1 MTPA (ROM).

ROM shown in Tonne is determined by considering the Conversion factor of 2.5, multiplied with figures in CuM .The despatchable ore is determined by considering recovery of 85 % of the ROM ore. The generation of sub-grade mineral and mineral fines (-6 mm) / Rejects are around 10% and 5% of ROM production respectively.

Sub Grade Mineral : The Mn. content >10% & <25% in ROM of all size is considered as Sub Grade Mineral.

Mineral Reject (Fines) : The fines generated during manual processing (dressing and sizing) of ROM (Size : < 6 mm) is considered as Mineral Fines. The mineral fines do not have a regular market throughout the year. It has got limited use and occasionally consumed by ferro alloys making plants.

The fines and sub-grade materials are stacked separately as shown in drawing no. MP/KIMM/R2/02/12.

The bench-wise and year-wise development of the ore zones are given below in table no. 5.3.1d

TABLE : 5.3.1d

Year	Extent of Working	Level (mRL)		OB (CuM)	ROM (CuM)	ROM (MT)	Total Excavation (CuM)
		From	To				
2013-14	13845N-14265N & 8800E-9387E	608	602	16925	0	0	16925
		602	596	20962	960	2400	21922
		596	590	34157	880	2200	35037
		590	584	57367	1080	2700	58447
		584	578	48635	910	2275	49545
		578	572	51935	836	2090	52771
		572	566	50865	802	2005	51667
		566	560	53814	836	2090	54650
		560	554	60097	1844	4610	61941
		554	548	54319	3588	8970	57907
		548	542	58491	6032	15080	64523
		542	536	64194	10472	26180	74666
	Sub-Total			571760	28240	70600	600000
2014-15	14240N-14340N & 9340E-9440E	612	606	1363	0	0	1363
		606	600	5032	0	0	5032
		600	594	8524	0	0	8524
		594	588	12565	252	630	12817
		588	582	8439	1200	3000	9639
	13833N-14265N & 8803E-9387E	608	602	6740	0	0	6740
		602	596	18597	472	1180	19069
		596	590	35555	237	594	35792
		590	584	54039	342	855	54381
		584	578	64684	776	1940	65460
		578	572	69067	1879	4697	70946
		572	566	71215	2217	5544	73432
		566	560	49157	3309	8273	52466
		560	554	35242	3567	8918	38809
		554	548	26177	3085	7712	29262
		548	542	17653	3590	8974	21243
		542	536	22543	3840	9601	26383
		536	530	60777	2773	6932	63550
		530	524	32361	2150	5375	34511
		524	518	17311	3270	8175	20581
	Sub-Total			617040	32960	82400	650000
2015-16	13830N-14265N & 8770E-9387E	608	602	7310	0	0	7310
		602	596	8098	494	1234	8592
		596	590	13194	248	621	13443
		590	584	16060	358	895	16418
		584	578	25003	812	2029	25815

		578	572	35317	1966	4914	37282
		572	566	62371	2320	5799	64691
		566	560	76419	3462	8654	79881
		560	554	80555	3732	9329	84287
		554	548	56001	3227	8068	59228
		548	542	43927	3755	9388	47682
		542	536	17359	4017	10043	21376
		536	530	8627	2900	7251	11528
		530	524	163052	2249	5623	165301
		524	518	3747	3421	8552	7168
	Sub-Total			617040	32960	82400	650000
2016-17	13830N-14265N & 8745E-9387E	608	602	5428	0	0	5428
		602	596	6824	0	0	6824
		596	590	9574	0	0	9574
		590	584	17629	255	636	17884
		584	578	27158	961	2402	28119
		578	572	38972	1638	4094	40610
		572	566	68662	1803	4508	70465
		566	560	84051	2959	7398	87010
		560	554	94225	3585	8962	97810
		554	548	80612	3903	9757	84515
		548	542	47662	4022	10054	51684
		542	536	28841	4189	10473	33030
		536	530	12179	4378	10945	16557
		530	524	140482	4722	11804	145204
		524	518	100	5186	12966	5286
	Sub-Total			662400	37600	94000	700000
2017-18	13830N-14265N & 8715E-9387E	608	602	134	0	0	134
		602	596	116	0	0	116
		596	590	13368	0	0	13368
		590	584	27610	0	0	27610
		584	578	55780	440	1100	56220
		578	572	31336	1304	3260	32640
		572	566	36226	1544	3860	37770
		566	560	58748	1660	4150	60408
		560	554	36818	2828	7070	39646
		554	548	30773	3424	8560	34197
		548	542	43524	3640	9100	47164
		542	536	62552	5160	12900	67712
		536	530	31018	6192	15480	37210
		530	524	61412	6808	17020	68220
		524	518	94742	4600	11500	99342
		518	512	125844	2400	6000	128244

	Sub-Total	710000	40000	100000	750000
Total		3178240	171760	429400	3350000

The proposed year wise, pit wise development plan and sections for manganese ore mining are shown in drawing nos. MP/KIMM/R2/5J-5N/12 & MP/KIMM/R2/6E12 respectively.

5.4: EQUIPMENT DEPLOYMENT

5.4.1: Equipment deployment for iron ore mining:

At present small capacity Shovels (1.2/1.8/3.2/5.7 Cum) and Tippers(10/15/35/50/60 tonner) are operated for iron ore mining. These equipments will be gradually replaced with higher capacity fleets. (i.e 6-6.5 Cu.M Shovel and 100 T Dumper). The replacement of these equipments is necessary to meet the increased production targets.

Development of new iron ore pits will require additional fleet of equipments which is proposed to be arranged either by outsourcing or by departmental procurement.

The existing fleet of equipment deployed for iron ore mining is given in the Table 5.4.1a.

TABLE: 5.4.1a
LIST OF EXISTING EQUIPMENTS FOR IRON ORE MINING

Equipment	Capacity of each unit	No. of units
Shovel EX-1100	5.7 Cu.M.	1
Tata Hitachi EX-200 hydraulic excavator	1.2 Cu.M	1
Tata Hitachi EX-350 hydraulic excavator	1.8 Cu.M	1
ICM 260 Drill	100 mm.	3
RECP DRILL C-650	150 mm	1
Dumper (Haul Pack)	35 ton	4
Dumper (BEML-210M)	60 ton	2
Tata Hyva /LPK/2518	15 ton	2
Tata 1210 Scoop Tipper	10 ton	2
Loader(Tata) TWL 3036		1
BEML Motor Grader(BEML GD605 R2)		1
Dozer, D-155A	395 h.p.	1
Water tanker	9 KL	1
Explosive Van	3.9 ton	1
Maintenance Van	52.5 KW	1
Diesel Tanker	9 KL	1
Escort Crane	8 ton	1
Tata 407 Mini Truck		1

In addition, the list of equipments proposed to be deployed for iron ore mining during the plan period is given in the Table 5.4.1b(i).The existing equipments shall be gradually replaced with the new equipments during the plan period.

TABLE: 5.4.1b(i)

LIST OF ADDITIONAL EQUIPMENTS PROPOSED FOR IRON ORE MINING

SL NO	EQUIPMENT	CAPACITY OF EACH UNIT	NO.OF UNITS
1	TRACK DOZER	300 KW	4
2	WHEEL DOZER	350 KW, 45 Ton Class	1
3	DRILL	150 mm	3
4	EXCAVATOR	6-6.5 Cum, 100 Ton Class	4
5	GRADER	16 Ft(200 KW Class)	2
6	Mining Loader	9 Cum(Iron Ore bucket)	2
7	Rear Dumper	100 Ton	12
8	Water Sprinkler	40-45 KL	2
9	Rock Breaker	100 mm Mole Point	1
10	Rock Splitter		1
SUPPORT EQUIPMENTS & VEHICLES			
1	Backhoe Loader	76 HP Capacity	1
2	Skid Steer Loader		1
3	Mobile Crane	75 Ton	1
4	Battery operated fork lift	3 Ton	1
5	Engine operated fork lift	5 Ton	1
6	Water Cum Foam tender	5500 Ltr Water+ 500 Ltr Foam	1
7	Service Van		2
8	Explosive van		1
9	Tire Handler	5 Ton	1
10	Mobile Crane	30 Ton	1
11	Compactor	20 Ton	1
12	Crane cum man lifter		1
13	Portable Lighting towers(Diesel)	30 ft	14
14	Light Vehicles		13
15	Diesel Bowser	12 KL in 4 compartments, 200 LPM	2
16	Flat body truck with tail lift		2
17	Mobile blasting shelter		1
18	JCB		2

In addition,some project activities shall also be carried out during the plan period hence ,the following equipments are proposed to be utilized for the project construction works during the plan period as given in table 5.4.1b(ii) below.

. TABLE: 5.4.1b(ii)
LIST OF EQUIPMENTS PROPOSED FOR PROJECT CONSTRUCTION WORK

S.No.	EQUIPMENT	CAPACITY
1	Excavator/Shovel	3.5-6.0
2	Dumper	10T/20T/25T/35T
3	Drill Machine	100/150mm
4	Dozer	D-155/D-9
5	Grader	12'/14'
6	Wheel Loader	3.5-4.0 Cu.m
7	Water Sprinkler	20KL
8	Mobile Blasting Shelter	As per DGMS standards
9	Crane	20T/80T/100T/180T/200T
10	Compactor	15 T
11	JCB	
12	Fork Lift	
13	Hydra	20T/30T
14	Trailer	
15	Miller	
16	Batching Plant	
17	Transit Mixture	

The fleet has been arrived by taking the maximum excavation in any year during the plan period. The detailed calculation for requirement of fleet is given below:

TABLE:5.4.1c
CALCULATIONS FOR DRILLS

No. of working days in a year	300
No. of working hours/shift	6.5
No. of shift/day	3
Max Tonnage per year	15124664
Specific gravity	3.5
Max Excavation	4321332
Bench Height	10
Burden	4.0
Spacing	4.5
Tonnage per Hole	630
Sub-grade drilling	1
Hole Length	11
Yeild /m	57
Total meterage required	264081
Average drilling rate	20
Meterage drilled/shift	130
Meterage drilled/year	117000
No. of working drills require	2.3
Drill fleet size(@80% availability)	3

TABLE: 5.4.1d
CALCULATIONS FOR SHOVEL

No. of working days in a year	300
No. of working hours/shift	6.5
No. of shift/day	3
Max Excavation	15124664
Excavation requirement /day	50415.5
Excavation requirement /shift	16805.2
Excavation requirement /hour	2585.4
Average loading capacity of 6.0 CuM shovel	650
No.of working shovel required	3.98
Shovel fleet required(Considering 80% availability)	5

4 shovels & 1 loader is proposed for excavation,purpose whereas the second loader will work in stockpiles for plant feed

TABLE:5.4.1e
CALCULATIONS FOR DUMPERS

No. of working days in a year	300
No. of working hours/shift	6.5
No. of shift/day	3
Max Excavation	15124664
Excavation requirement /day	50416
Excavation requirement /shift	16805
Excavation requirement /hour	2585
Dumper capacity	90.0
No. of trips require	28.7
Avg. distance to dump and plant	2.3
Dumper speed(upgradient)	20.0
Dumper speed(down gradient)	25.0
Time for up movement	6.9
Time for down movement	5.5
Total time for hauling	12.4
Time for Loading	3.5
Time for dumping	2.0
Time for spotting etc.	2.0
Total cycle time for one trip	19.9
Shift working time	390.0
No. of trips/dumper/hr	3.0
No. of working dumpers required	9.5
Dumper fleet required(Considering 80% availability)	12

5.4.2: Equipment deployment for manganese ore mining: The proposed fleet of equipment to be deployed in the next five yearôs excavation programme is given below in Table: 5.4.2a.

TABLE: 5.4.2a
LIST OF EQUIPMENT FOR MANGANESE ORE MINING

Equipment	Capacity of each unit	No. of units	
		Year : 2013-15	Year : 2015-18
SHOVELS	(1.7) Cu.M.	4	5
DRILLS	(100) mm .	2	2
DUMPERS	30 tonnes	23	14
DOZER	160 HP	1	1
WATER SPRINKLER	9 KL	2	2
DIESEL TANKER	10 KL	1	1
LOADER	1.53 CuM	1	1
COMPACTOR	20 Ton	1	1
Light Vehicles		4	4

TABLE:5.4.2b
Calculation Details for Deployment of Shovel (Back Hoe)

Sl.No.	Description	Unit	Shovel Type		Calculation Details	Remarks
			2013-15	2015-18		
			PC 300	PC 300		
a.	Excavation (OB + Ore) / Year	CuM	625000	700000		
b.	Tonnage Factor	T/CuM	2.5	2.5		In-situ Density
c.	Excavation Required / Year	Ton	1562500	1750000	a x b	
d.	Average Working Days / year	Days	300	300		
e.	No.of Working Shift / Day	No.	1	1		
f.	Avg. Working Hour / Shift	Hour	7	7		
g.	Bucket Capacity Choosen for operation	CuM	1.7	1.7		
h.	Fill Factor	-	0.95	0.95		Medium Hard & Soft rock
i.	Bucket Load Capacity per pass	Ton	4.038	4.038	b x g x h	
j.	Cycle time per Bucket pass	Second	25	25		
k.	Effective utilisation / hour	Minute	50	50		
l.	No. buckets passes per hour	Nos.	120	120	(k x 60) / j	
m.	Excavator capacity per hour	Ton	484.5	484.5	i x l	
n.	Tonnage to be handled per hour	Ton	31250	35000	c / (d x f)	
o.	Shovel working hours required	Hour	7740	8669	n / i	
p.	Available Hours for one Shovel (90%)	Hour	1890	1890	d x f x p x 0.9	
q.	No. of Shovels required	No.	4.10	4.59	o / p	
r.	No. of Shovels (Rounded off)	No.	4	5		

TABLE:5.4.2c

Calculation Details for Deployment of Dumpers

Sl.No.	Description	Unit	Shovel Type		Calculation Details	Remarks
			2013-15	2015-18		
			PC 300	PC 300		
a.	Excavated (OB+Ore) / Year	CuM	625000	700000		
b.	Tonnage Factor	T/CuM	2.5	2.5		
c.	Excavated (OB+Ore) / Year	Ton	1562500	1750000	a X b	In-situ Density
d.	Average Working Days per year	Days	300	300		
e.	No.of Working Shift / Day	No.	1	1		
f.	Avg. Working Hour / Shift	Hour	7	7		
g.	Effective Utilisation / hour	Min	50	50		
h.	Dumper Capacity	Ton	30	30		
i.	Shovel Bucket Capacity	CuM	1.7	1.7		
j.	Lead Distance (To & Fro)	KM	10.6	5.4		
k.	Travel Speed (Avg.)	Km/Hr	25	25		
l.	Travel Time (To & Fro)	Min	50.88	25.92	(j X 2)/(k X 60)	
m.	Loading Time / bucket pass	Sec	35	40		
n.	Bucket Load Capacity pass	Ton	4.038	4.038		Pt.I of Shovel Calculation
o.	No.of swings for loading / dumper	Nos.	7.43	7.43	h / n	
p.	Time required for loading of one dumper	Min	4.33	4.95	m X o / 60	
q.	Dumper unloading time	Min	1	1		
r.	Spotting time & Delays	Min	0.5	0.5		
s.	Total Cycle Time	Min	56.71	32.37	l + p + q + r	
t.	No. of trips can be make in a hour	Nos.	0.9	1.5	g / s	
u.	Production / Dumper / Shift	MT	185	324	f X h X t	
v.	Prodution / shift	MT	5208	5833	c / d	
x.	Dumpers required (with 80% availability)	Nos.	23	14	v / u x 0.8	

TABLE:5.4.2d

Calculation Details for Deployment of Wagon Drills

Sl.No.	Description	Unit	2013-15 Wagon Drill (100 mm dia)	2015-18 Wagon Drill (100 mm dia)	Calculation Details	Remarks
a.	Excavated (OB+Ore) to be handled / Year	CuM	625000	700000		
b.	Tonnage Factor	T/CuM	2.5	2.5		In-situ Density
c.	Excavated (OB+Ore) to be handled / Year	Ton	1562500	1750000	a X b	
d.	Overburden & Ore reqd. to be blasted	Ton	937500	1050000	b X 0.60	60% Hard Rock
e.	Average Working Days per year	Days	300	300		
f.	Blasted material required / day	Ton	3125	3500	d / e	
g.	No.of Working Shift / Day	No.	1	1		
h.	Avg. Working Hour / Shift	Hour	7	7		
i.	Effective Time in a hour	Min	50	50		
j.	Spacing	Mtr.	4	4		
k.	Burden	Mtr.	3.5	3.5		
l.	Bench Height	Mtr.	6	6		
m.	Yield / Hole	Ton	210	210	b X j X K X l	
n.	No. of holes required / shift	Nos.	15	17	f / m	
o.	Effective Length of the hole		6.6	6.6	l X 1.1	10% sub grade drilling
p.	Drilling reqd / shft	Mtrs	98	110	n X o	
q.	Drilling reqd / year	Mtrs	29464	33000	p X e	
r.	Speed of drilling	Mtr / hr	10	10		
t.	Possible drilling meterage per shift	Mtr.	70	70	h X r	
u.	Drilling with 75% availability	Mtr.	53	53	t X 0.75	
v.	Drilling / machine / year	Mtr.	15750	15750	u X e	
x.	Drilling Machine machine required	Nos.	1.87	2.10	q / v	

5.5 Infrastructure:

It is proposed that the existing infrastructure shall continue to be used upto 2016-17 due to the forest restrictions. Once the forest clearance is granted it will be relocated in the northern part of the lease .

The proposed infrastructure will be constructed in two parts
(i) Administrative Building
(ii) Workshop Facilities

The location of proposed infrastructure is mentioned in drawing no. MP/KIMM/R2/9/12.

5.6 Geo-referenced Cadastral Map:

In compliance to the circular no.02 of 2010 dated 06.04.2010 issued by CCOM,Indian Bureau of Mines,the Geo-referenced Cadastral Map prepared by M/s ORSAC is enclosed in Annexure- XIII

5.7 Weighbridge:

At present there are three weigh bridges in the mine located at the entry/exit point of the mine. Each and every tipper dumper from Khondbond, is being weighed at the weighbridge before dispatch to outside the lease area. The location of the existing weigh bridges are given in drawing no. MP/KIMM/R2/02/12.

During the plan period, after the commissioning of access road in the proposed area13,all the transportation outside the lease will be done through this road hence two more weighbridges of 100T capacity each are proposed to be installed near the lease pillar no. 16B.The locations of proposed weighbridges are mentioned in drawing no.MP/KIMM/R2/9/12.

6.0 GENERATION AND DISPOSAL OF SUBGRADE & WASTE

6.1(a) GENERATION AND DISPOSAL OF SUBGRADE & WASTE IN IRON ORE MINING:

The subgrade material is found in the form of intercalated patches within the ore zone which has been delineated by exploratory drilling, sampling and assaying. This subgrade consists of ferruginous shale and clay material having high alumina (deleterious) with low iron content ranging from 45% to 58%. The mine development has been planned accordingly delineating iron ore (Fe>58%) for plant feed, subgrade patches (<45% & <58%Fe) and waste material (<45%Fe) for stacking. The entire exercise of mine planning is being carried out by using sophisticated mine planning software ñSURPAC VISSIONò for systematic and scientific excavation planning.
Further, short term mine planning is being practiced using blast hole drilling and sampling for deciphering the iron ore, subgrade patches and waste material separately.
As such there is no program for disposal of subgrade outside the lease and its use for beneficiation and blending purposes, it is stacked separately for future use as shown in the mining scheme.
The mineralogical amenability of this low grade material has been initiated, however, detailed mineral characterisation, mineral liberation and beneficiation studies will be conducted shortly.

In iron ore mining at Khondbond, overburden consists of removal of waste consisting of BHJ, Canga, Shale, poor Laterite etc. and subgrade having iron bearing material having Fe % between 50-58 % .

As proposed, Pit7,Pit11,Pit5,Pit 21,Q ore body,ñP & Nò Ore bodies and conveyor corridor /access road (Area13) will be developed during the next five years. The generation of subgrade & wastes during the next five years from these pits has been indicated in Table 6.1a.

TABLE: 6.1a
GENERATION OF SUBGRADE & WASTES

(in million tonnes)

YEAR	SUBGRADE	WASTE	TOTAL EXCAVATION
2013-14	2.45	3.76	6.21
2014-15	2.83	3.91	6.74
2015-16	4.40	3.37	7.77
2016-17	1.86	2.70	4.56
2017-18	2.55	1.86	4.41
TOTAL	14.09	15.60	29.69

The subgrade encountered during the development shall be stacked for future use in existing subgrade dumps 1A, 2A, 3 and proposed subgrade dumps 2, & 6 as per requirements.

During the first year, the construction of the main northern access road will also commence, which requires both cut and fill. Initially,the waste generated shall be used for making haul roads, short ramps, berms,maintenance of roads,civil,preparation of slime dam wall and other infrastructure works. Any excess quantity of waste shall be dumped in proposed waste dumps 1, 5 and 8. Waste dump 1 will be filled in first year.

The proposed locations of existing dump and new dumps have been indicated in the drawing no. MP/KIMM/R2/02/12 and MP/KIMM/R2/10/12.

6.1(b): GENERATION AND DISPOSAL OF WASTE IN MANGANESE ORE MINING: During the next five years, manganese Ore Zones-IV, X and XII are proposed to be operated. The year wise generations of waste during the next five years are given in table 6.1b.1

TABLE: 6.1b.1
GENERATION OF WASTE DURING THE NEXT FIVE YEARS

Year	Overburden (Cu.M.)
2013-14	511760
2014-15	617040
2015-16	617040
2016-17	662400
2017-18	710000
Total	3178240

At present, manganese mining operation at Khondbond has three dumps namely Dump No.-1, 2 & 3. Dump No.-1 is outside the applied lease boundary and has already been reclaimed by afforestation. Dump No.-2 & 3 has been exhausted and are under rehabilitation by plantation. As proposed in the approved Mining Plan, Dump No.2 & 3 was developed for Ore Zone-X & XII. Dump No.-2 will be fully stabilized over mined out area of Ore Zone-XIII which has already been exhausted of manganese ore.

As the Dump No. 1 is outside the applied lease area, Dump No. 2 & 3 is being renamed as 1 & 2 respectively and accordingly shown in the drawing no. MP/KIMM/R2/2/12 and will remain inactive during this plan period.

New Dump no. 3 will be developed from 2015-16 in the extent of 13350N- 13700N & 6275E ï 6650E after obtaining the Forest Clearance and subsequent permissions for which the Forest Diversion Proposal has been submitted vide State Sl.No. XXX and is under active consideration by Forest Department.

In the intervening time, overburden from Ore Zone IV, X & XII will be used for back filling of an old exhausted quarry within Joda West Manganese Mines situated at northern side of the lease at a distance of 5.3 km. which is under same

management control till 2015-16. The details of waste dumps are given below in table 6.1b.2.

TABLE: 6.1b.2

Details of Dump	Dump No.1	Dump No.2	Dump No.3 (New)	External Dump at Joda West Manganese Mine
Dump area at the base (ha.)	5.080	5.500	12.000 ha.	3.240 ha.
RL at the base of the dump	542 m	547 m	560 m	524 m (Bottom of exhausted pit)
RL at the top of the dump	586 m	597 m	620 m	582 m
Height of Dump	44 mtr. (Three terraces)	50 mtr. (Four terrace)	60 mtr. (Four terrace)	30 mtr. (Four terrace above ground level)
Total capacity of dump at end of planned period.	4.5 LcuM	6.35 LcuM	35 LCuM	9 LCuM (Additional holding capacity will increase by 6 LCuM by merging the lifts in eastern side with existing dumps of Joda West Manganese Mine.
Reclamation and rehabilitation measures of waste dump.	After rehandling of material, subsequent afforestation by method of contour trenching and pitting will be undertaken in the coming years and top floor will be used for mineral storage		The dump will remain active during plan period. After exhaustion, the dump shall be fully rehabilitated by afforestation.	The dump will remain active till 2014-15. The open terraces in the western side shall be rehabilitated by plantation during subsequent years.

Some quantity (~45,000 cum/annum) of overburden shall be used to fill up the undulated surface of the proposed corridor from the ML Pillar No. 16F to 16D for leveling of the surface and developing it as a utility corridor.

Plan & section of new waste dump within the Khondbond lease is given in drawing no. MP/KIMM/R2/7B/12 whereas plan & section of External dump located in Joda West Lease is given in drawing no.MP/KIMM/R2/7C/12.
Further, an additional quantity of approximately 1,18,000 CuM of overburden from Waste Dump 1 & 2 (earlier 2 & 3 respectively) will be re-handled to maintain the 50m distance as safety zone from perennial Kundra Nala. The re-handled material will also be used for back filling of the above exhausted Quarry of Joda West.

Method of re-handling of waste dump to ensure safety, stability and environmental aspects:

- The ramp will be developed from top terrace to toe of the dumps for movement of shovel and dumpers while utmost care shall be taken to minimize the loss of saplings and damage to the environmental measures already in place.
- The overburden within the safety zone of 50m distance from perennial Kundra Nala will be evacuated from top to bottom by restricting the free surge of loose materials. The existing masonry retaining wall will remain intact.
- After evacuation, the terraces will be compacted and levelled with inward slope to prevent the gully formation along the slope and the ramp will be filled up.
- Subsequent to completion of re-handling, saplings will be planted over the slope and terrace for its stabilization.

The corresponding plan & section is given in drawing no. MP / KIMM / R2 / 7D /12.

6.1.1 BUILDUP OF DUMPS:

6.1.1(a): IRON ORE:

(i) Waste dumps:

During the next five years the waste generated from P ,N & Q Ore bodies ,Pit 7,Pit11,Pit5,Area13 (conveyor corridor) shall be dumped in proposed Waste Dump No.-1 & waste dump no.5, whereas waste from pit21 will be dumped into dump no. 8. The dump no. 1 is proposed to be filled in first year itself. This dump has a capacity of 0.5 million CuM. Afterwards waste from the ñP &Nò-Orebody will be dumped in a proposed waste dump No.-5. located which has a total volumetric capacity of 13.66 million Cum .All the waste dumps have been proposed is non-mineralised. After the plan period the waste dump shall also cover the exhausted pits i.e. exhausted pits shall be backfilled by waste.

The total quantity of waste generated during the plan period is 15.60 million tonnes. Considering a bulk density of 2.5t/cu.m , the volume of waste generation will be 6.24 mcum whereas the total volumetric capacity of waste dumps is 12.98 mcum, which is sufficient to accommodate the waste generated during the plan period.
The design details of the waste dump no. 1, 5, & 8 are given below:

TABLE:6.1.1a.1
DETAILS OF WASTE DUMP NO. 1

Terrace	Length (m)	Width (m)	Area (ha)	Av. Height (m)	Av. slope of terrace	Over all slope	Capacity m.cum
A (705-720mRL)	326	185	4.08	15	< 37.5 degree	<28 degree	0.5
B (720-735mRL)	218	125	2.98	15	< 37.5 degree		
C (735-743 mRL)	180	70	0.62	8	< 37.5 degree		

TABLE:6.1.1a.2
DETAILS OF WASTE DUMP NO. 5

Terrace	Length (m)	Width (m)	Area (ha)	Av. Height (m)	Av. slope of terrace	Over all slope	Capacity m.cum
A (640-660mRL)	1200	715	47.9	20	< 37.5 degree	<28 degree	12.38
B (660-675mRL)	1100	510	35.3	15	< 37.5 degree		
C (675-690 mRL)	1050	450	32.5	15	< 37.5 degree		
D (690-705 mRL)	900	400	26.6	15	< 37.5 degree		

TABLE:6.1.1a.3
DETAILS OF WASTE DUMP NO. 8

Terrace	Length (m)	Width (m)	Area (ha)	Av. Height (m)	Av. slope of terrace	Over all slope	Capacity m.cum
A (635-650mRL)	180	146	1.5	15	< 37.5 degree	<28 degree	0.1

The year-wise build up of waste dumps for iron ore pits are depicted in plan and section and shown in drawing no. MP/KIMM/R2/7A/12.

(ii) Subgrade dump:

The total quantity of subgrade generated during the plan period is 14.09 million tonnes. Considering a bulk density of 3.0t/cu.m,the volume of subgrade generation will be 4.70 mcum whereas the total volumetric capacity of subgrade dumps is 22.4 mcum, which is sufficient to accommodate the subgrade generated during the plan period.

At present the mine has three existing dumps 1A, 2A & 3. Total quantity of subgrade material available in the dumps is about 10.54 million tonnes as on 1.04.2013. Two new subgrade dumps no. 2 & 6 have been proposed during the plan period. Hence, during the plan period, the subgrade generated will continue to be stacked for future use in existing subgrade dumps 1A,2A,3 and two new proposed dumps 2 & 6.

The dump design of existing subgrade dumps 1A & 2A is given below in table 6.1.1a.4:

TABLE:6.1.1a.4
DETAILS OF EXISTING SUBGRADE DUMP NO. 1A , 2A & 3

Details of Dump	Subgrade Dump No.1A	Subgrade Dump No.2A	Subgrade Dump No.3
Dump area at the base	13.8 ha	11.90 ha	14 ha
RL at the base of the dump	642 m	642 m	666 m
RL at the top of the dump	695 m	705 m	696
Height of Dump	53 m (in two terraces)	63 m (in two terraces)	30m (in two terraces)
Overall slope at conceptual stage	$<28^o$	$<28^o$	
Total capacity of dump	23 lakhs Cum	18.33 Lakh CuM	35.28 Lakh CuM

The design details of the subgrade dumps 2, 3, & 6 are given below:

TABLE:6.1.1a.5
DETAILS OF SUBGRADE DUMP NO. 2

Terrace	Length (m)	Width (m)	Area (ha)	Av. Height (m)	Av. slope of terrace	Over all slope	Capacity m.cum
A (700-715mRL)	735	486	24.13	15	< 37.5 degree	<28 degree	4.04
B (715- 730mRL)	430	410	19.34	15	< 37.5 degree		
C (730-745 mRL)	370	330	8.98	15	< 37.5 degree		

TABLE:6.1.1a.6
DETAILS OF SUBGRADE DUMP NO. 3

Terrace	Length (m)	Width (m)	Area (ha)	Av. Height (m)	Av. slope of terrace	Over all slope	Capacity m.cum
A (665-680mRL)	425	370	11.26	15	< 37.5 degree	<28 degree	1.34
B (680- 695mRL)	330	270	6.4	15	< 37.5 degree		

TABLE:6.1.1a.7
DETAILS OF SUBGRADE DUMP NO. 6

Terrace	Length (m)	Width (m)	Area (ha)	Av. Height (m)	Av. slope of terrace	Over all slope	Capacity m.cum
A (652-667mRL)	1070	520	33.7	15	< 37.5 degree	<28 degree	5.4
B (667-682mRL)	990	440	21.9	15	< 37.5 degree		

6.1.1(b): MANGANESE ORE

As mentioned in Para 6.1 (b), overburden from Ore Zone IV, X & XII will be used for back filling of an old exhausted quarry within Joda West Manganese Mines situated at northern side of the lease at a distance of 5.3 km. which is under same management control till 2015-16.

New Dump no. 3 will be developed from 2015-16 in the extent of 13350N- 13700N & 6275E ï 6650E after obtaining the Forest Clearance and subsequent permissions.

The sub grade will be stacked over the existing sub grade stacking area. The Ore Zone IV will be exhausted during 2014-15 and subsequently the sub-grade ore and mineral rejects will be stacked there for future use.

Plan & section of new waste dump within the khondbond lease is given in drawing no. MP/KIMM/R2/7B/12 whereas plan & section of External dump located in Joda West Lease is given in drawing no.MP/KIMM/R2/7C/12.

6.1.2 PRECAUTIONS AND PROTECTIVE MEASURES FOR DUMPS

Iron Ore:

Garland drain and toe wall will be provided around the dumps to arrest any surface run offs. Afforestation shall be done on dump slopes for stabilisation. The slopes of the dumps shall be maintained by dozing and leveling at suitable intervals to maintain overall slope less than 30 degree. Once the dumps mature, it will be stabilized by afforestation completely.

Iron Ore Waste Dumps No. 1, Dump No.5 and Dump No. 8 will be developed by retreat method of dumping with maximum 15 metres terrace height and ultimate slope of the dump will be maintained at less than 30 degrees. Each terrace will have inward slope with catch drains at the inward side of the terrace. During monsoon extra precautionary measures will be undertaken. The catch drains of the individual terrace will be connected to the garland drain outside the periphery of the dump. Each terrace will also have a provision of berms at the outer end to reduce gully formation due to rain water wash offs.

Manganese Ore:

Garland drain and toe wall will be provided around the dumps to arrest any surface run offs. Afforestation shall be done on dump slopes for stabilization. The slopes of the dumps shall be maintained by dozing and leveling at suitable intervals to maintain overall slope less than 35 degree. Once the dumps mature, it will be stabilized by afforestation completely. In addition to this, 1.2 mt. high retaining wall to be provided along the toe of Dump No.3. The dump will be developed by retreat method of dumping with 10 metres terrace height and ultimate slope of the dump will be maintained at less than 35 degrees. Each terrace will have inward slope with catch drains at the inward side of the terrace. During monsoon additional precautionary measures will be undertaken. The catch drains of the individual terrace will be connected to the garland drain outside the periphery of the dump. These catch drains will preferably have half concrete open pipes followed by settling tanks to avoid wash offs. Each terrace will also have a provision of embankments at the outer end to reduce gully formation due to rain water wash offs.

7.0 USE OF MINERAL:

Iron and manganese ore produced from the mine will be supplied to Companyôs Steel Plants at Jamshedpur & Odisha and sister concerns of Tata Steel Ltd like TSIL,TML etc.

7.1 END USE OF MINERAL

Manganese Ore:
Manganese Ore : There is no change in the use of mineral. As mentioned in the approved scheme of mining, manganese ore is mostly being mined to cater to the requirements of its Steel Plant at Jamshedpur and Ferro Alloys Plant at Joda. The company was in the past purchasing certain amount of ore to meet its requirements at the Ferro Alloys Plant, Joda at a very high cost. This was mainly because of its inability to produce the required quantities of high grade ore with Mn:Fe ratio greater than 5.3:1.

With the enhanced production of high grade manganese ore as envisaged in this mining scheme it is hoped that the purchase of manganese ore shall be substantially reduced. In the course of producing higher grade manganese ore a surplus quantity of medium and low grade manganese ore shall be produced.

The company may sell this surplus low and medium grade ore to domestic parties as and when such demand arises or in order to make space to stack such ore.

Sponge Grade Sized Iron Ore:
The lump ore will be supplied to M/s. TSIL, Belaipada,TML by road.

Iron Ore Fines:
The iron ore fines, generated incidental to lump ore iron ore production, will be transported to Joda East or Juruli siding (or any other private siding) by road, from where it will be dispatched to Companyôs Steel Plants at Jamshedpur & Odisha.

Beneficiated Lumps and fines:
Lumps and Fines to be produced through the proposed beneficiation plant will be transported to the Companyôs Steel Plants at Jamshedpur & Odisha.

7.2 Changes in the Specification of product

The specifications of various grades of manganese ore products are as follows;

TABLE: 7.2a

Grade Type	Chemical Specification	Physical Specification
Chemical Grade / Dioxide	Mn > 48 % & Fe < 4 %	+10 -75 mm
High Grade	Mn > 46 %	+10 -75 mm
Medium Grade	Mn > 35 % & Fe < 26 %	+10 -75 mm
		+ 6 -10 mm
Low Grade	Mn > 25 % & Fe < 35 %	+10 -75 mm
		+ 6 -10 mm
Sub Grade Mineral	Mn>10% & <25%	All Size.

The specifications of various grades of iron ore products proposed to be produced are shown in table: 7.2b.

TABLE - 7.2b

SPECIFICATION OF PRODUCTS FROM EXISTING PLANT: IRON ORE

Product	Product Physical Quality		Chemical Quality	
	Under Size	Over Size	Fe%	
Lump Ore (+5-18mm)	7%	7 %	64.0-66.0	(Al2O3+SiO2) 5.0-6.0%
Lump Ore (+10-40mm)	7%	8 %	64.5-65.5	Al2O3:(1.3-1.6) %
Fines(-5mm, -8mm)	5%	5%	63.5-65.5	Al2O3:(1.5-3.5) %

The average Physical and Chemical specifications of the products generated from the proposed beneficiation plant at Khondbond are as follows:

TABLE – 7.2c

SPECIFICATIONS OF PRODUCTS FROM PROPOSED BENEFICIATION PLANT

Product	Product Physical Quality		Chemical Quality	
	Under Size	Over Size	Fe%	Al2O3%
Lump Ore (+5-18mm)	7.65%	5 %	64.0-66.0	(Al2O3+SiO2) 5.0-6.0%
Lump Ore 32mm,+8mm	5% avg	5% max	>65%	1.6 ± 0.5%
Fines -8mm,	10% avg	4% max	>64%	2.2 ± 0.5%

The average Physical and Chemical specifications of the products generated from the proposed mobile crushing & screening plant at Khondbond are as follows:

TABLE – 7.2d

SPECIFICATIONS OF PRODUCTS OF PROPOSED MOBILE CRUSHING & SCREENING PLANT

Product	Product Physical Quality		Chemical Quality	
	Under Size	Over Size	Fe%	Al2O3%
Lump Ore (+10,-40mm)	8% avg	2.5% avg	>64.0-66%	1.5-3.0
Fines -10mm,+0.15mm	5.5% avg	4.08% avg	>62.5%	3.5-4.5

7.3 Utilisation of subgrade and waste:

A part of the waste generated in the mine will be used for bench floor leveling, haul road making, berm making, civil works etc. The balance quantity shall be dumped in waste dumps.

The sub grade ore will be stacked separately for future use.

The iron ore tailings generated from the proposed beneficiation plant will have no use, as it will be low in iron and high alumina. These tailings will be stored for future use in tailing dam as indicated in drawing no. MP/KIMM/R2/9/12.

The sub-grade in manganese ore mining constitute low grade manganese ore having manganese content 10%-25%. Sub-Grade ore generated from manganese ore mining will be stacked separately at an earmarked place for future use.

The sub-grade in manganese ore mining constitute low grade manganese ore having manganese content 10%-25%. Sub-Grade ore generated from manganese ore mining will be stacked separately at an earmarked place for future use.

The mineral rejects in manganese ore mining constitute manganese fines which are produced in the process of sorting and sizing of manganese ore lumps. As a new initiative, each lump stack contains 7% max mineral fines and consumed by ferro alloys plants. These balance rejects will be stacked separately for future use. A part of the reject may also be dispatched to outside customers as per the market demand.

8.0 MINERAL BENEFICIATION:

Khondbond has an existing Crushing and Screening Plant located at north of ñQò-Ore body. Presently,the sponge grade iron ore from ñP & Nò-Ore body is fed to Crushing and Screening Plant which after three stages of crushing and screening is finally converted into Lump ore (+5-18 mm) as finished product. The finished product (Lump ore & fines ore) is loaded into trucks and dispatched to Companyôs Steel Plants,TSIL,TML & Railway siding (Joda East/ Juruli/ any other private siding) after weighment as per the requirements. The balance fines are being stacked at different locations as shown in drawing MP/KIMM/R2/02/12

Tata Steel has programme for expansion of iron ore mining at Khondbond by installation of a new beneficiation plant with state-of-the-art technology for beneficiating different grades of iron ore and converting into suitable grade iron ore lumps and fines.

It is also proposed to install a mobile crushing & screening plant during the plan period to meet the requirements of Lump ore & fines ore at Jamshedpur and Odisha Steel Plants.

Year Wise Plant Feed, processed products with recovery percentage is given below:

Table No. 8.0a

YEAR	ROM FEED TO EXISTING PLANT & MOBILE CRUSHING &SCREENING PLANT	ROM FEED TO NEW BENEFECIATION PLANT	RECOVERY	PRODUCT	TAILINGS/ REJECT
2013-14	2.22	0	90%	2.0	0.22
2014-15	2.22	0	90%	2.0	0.22
2015-16	2.22	5	90%/ 70%	2.00 +3.5	0.22+1.5
2016-17	0	8	70%	5.6	2.4
2017-18	0	8	70%	5.6	2.4
TOTAL	6.66	21	-	15.2	5.24

8.1 (a) Process Flow of Existing Crushing & Screening Plant:

The sponge grade iron ore lump from mines will be transported to existing Crushing and Screening plant.The blasted ore, predominantly hard ore, of -800 mm size is fed into 35 tonne capacity hopper, from where it goes to grizzly feeder. From the grizzly feeder, the +100 mm size is fed to primary jaw crusher.

The -100 mm size from grizzly goes to a vibrating screen. From this vibrating screen, the -5 mm size is taken out as rejects (approx. 10-15 % of ROM). The +5 mm along with output of primary crusher (-100 mm) goes to another vibrating screen. At this screen, the +60 mm is fed into a Superior secondary crusher where it
is crushed to -60mm. This -60 mm size (both from secondary crusher as well as that directly obtained from screen) goes to a double deck vibrating screen. From this screen, -60+18 mm size is fed into a Tertiary hydrocone crusher, the product of which (-18 mm) is recirculated to the double deck vibrating screen. From this screen, the -18+5 mm size (55-60 % of ROM) is stored into two hoppers of 150 t capacity each and -5 mm size (32-38% of ROM) is stored into a single hopper of 150 t capacity.

The specifications of the products obtained are given in Table -8.1a

TABLE- 8.1a
PRODUCT SPECIFICATION OF EXISTING CRUSHING & SCREENING PLANT AT KHONDBOND

Product	Product Physical Quality		Chemical Quality	
	Under Size	Over Size	Fe%	
Lump Ore (+5-18mm)	7 %	7 %	64.0-66.0	(Al2O3+SiO2) 5.0-6.0%
Lump Ore (+10-40mm)	7%	8 %	64.5-65.5	Al2O3:(1.3-1.6) %
Fines(-5mm, -8mm)	5%	5%	63.5-65.5	Al2O3:(1.5-3.5) %

The flow sheet of the existing crushing & screening plant is given in Plate ï III.

8.1(b) Process flow of Proposed Beneficiation Plant:

Tata Steel has programme for expansion of iron ore mining at Khondbond by installation of a new beneficiation plant with state-of-the-art technology for beneficiating different grades of iron ore and converting into suitable grade iron ore lumps and fines. Finished products produced from the beneficiation plant shall be transported to the steel plant by Juruli Siding or Joda East Siding. Mode of transportation of finished products from minehead to the proposed sidings will be by belt conveyors through conveyor corridor or tippers. The conveyor has been planned from Khondbond to Joda East siding through Joda West Lease of the Company. The

conveyor from mine head to proposed siding will pass through different leases. The Steel Company is in process of obtaining necessary permissions for the proposed conveyor route.

The company has obtained Consent to Establish for increase in Iron ore Production from 2MTPA(ROM) to 8MTPA (ROM) ,Manganese ore production from 36000TPA to 1LTPA (ROM) and for establishing the proposed beneficiation plant vide letter no. 21730/IND-II-NOC-5093 dated 23.12.2011from SPCB.The company has also applied for Consent to Establish for conveyor corridor vide letter no. MD/ENV/241/106/2010 dated 04.09.2010.

It is proposed that the new beneficiation plant is proposed to start partially from 2015-16 and will start operating in full capacity of 8 MTPA from 2016-17 onwards. After the new beneficiation plant achieves its full capacity(8 MTPA), the existing old plant will stop operating.

The proposed beneficiation plant shall involve wet processing of iron ore .There will be generation of iron ore tailing from the plant, which shall require a suitable place for storage. Therefore, during the plan period, the ore from pit 7 shall be excavated completely by 2015-16 and will be converted into tailing dam no.4 for storage of tailings which will have enough capacity to accommodate tailings upto 2017-18.By that time Pit2(part of N orebody) shall have been excavated completely and shall be converted into tailing dam no.1and will be used after the filling of tailing dam 4 if required during the plan period.

Process Flow of Proposed Beneficiation Plant:

The proposed beneficiation plant consists of two units
1. Crushing & Washing Plant
2. Beneficiation Plant
ROM of Khondbond will be processed through the wet processing route as per the details given below:

1. Crushing & Washing Plant:

1.1 Plant feed

A dumping station is being made for feeding the ROM ore to a Primary crusher (Gyratory type). The ore is crushed to (-) 165 mm / 375 mm in this crusher and fed to two (2) nos of apron feeders below the crusher. The crushed material is conveyed to two stockpiles, each with 7000 T live storage capacity. The primary crushed ore is reclaimed from the stockpiles by apron feeders

1.2 Primary Screening

After reclaiming the crushed ore from the stockpiles is conveyed to the screens provided for separation of (+) 85 mm, (+) 40 to (-) 85 mm and (-) 40 mm. The material fraction (+) 85 mm is conveyed by conveyors to a surge bin above one (1) no. of cone crusher (CR-1) for crushing the (+) 80 mm material (-) 40 mm, This crushed material feeds to two (2) nos. of drum scrubbers

1.3 Scrubbing, secondary screening and tertiary crushing

After scrubbing, the material is fed to one (1) no. of double deck wet screen (banana type) for separation of (+) 32 mm, (+) 16 to (-) 32 mm and (-) 16 mm.

The (+) 32 mm fraction is conveyed to two (2) nos of cone crushers by conveyors .One surge bin is provided before feeding to each crusher.

The crushed product from the crusher is fed to the banana screen by conveyors. The material fraction of (-) 32 mm to (+) 8 mm is conveyed to beneficiation plant. The material fraction of (-) 8 mm (+)1mm is fed through another conveyor. The (-) 1 mm slurry is pumped to beneficiation plant

2. Beneficiation Plant:

2.1 Beneficiation of 32-8 mm size fraction

The ore of 32-8 mm size as segregated from the crushing plant is fed to coarse jig where the jig beneficiates the ore. The beneficiated ore is dewatered and send to product stockpile. The rejects as produced from the coarse fraction are further ground and processed in middling jigs depending upon the quality.

2.2 Beneficiation of 8 -1 mm size fraction

The ore of 8-1 mm size fraction as segregated from the crushing plant is fed to fines jig where the jig beneficiates the ore. The beneficiated ore is dewatered and send to product stockpile. The rejects as produced from the fines fraction are further ground and processed depending upon the quality

2.3 Beneficiation of -1 mm size faction

The slurry is fed to hydrocyclones for separation of finer size fractions and then using a TBS & spiral combinations further product grade material is recovered. The tailings generated from the process plant will be disposed off in a slime dam located in the Khondbond lease.

The flow sheet of proposed beneficiation plant at Khondbond is shown in the Plate-IV. The average Physical and Chemical specifications of the products generated from the proposed beneficiation plant at Khondbond are given in table-8.1b

TABLE- 8.1b

PRODUCT SPECIFICATION OF PROPOSED BENEFICIATION PLANT AT KHONDBOND

Product	Product Physical Quality		Chemical Quality	
	Under Size	Over Size	Fe%	Al2O3%
Lump Ore (+5-18mm)	7.65%	5 %	64.0-66.0	(Al2O3+SiO2) 5.0-6.0%

Lump Ore 32mm,+8mm	5% avg	5% max	>65%	1.6 ± 0.5%
Fines -8mm,	10% avg	4% max	>64%	2.2 ± 0.5%

8.1(c) Process flow of Proposed Mobile Crushing & screening plants at Khondbond:

It is proposed that a fraction of ROM (run off mine) of iron ore from Khondbond Iron & Manganese Mine will also be processed in Mobile Crushing & Screening Plants. The mobile crushing & screening plants will work at different levels of P & N ore body, Pit5, Pit 7, Pit11 & Pit21 as per the requirement .The ROM will be stacked near mobile crushing unit from where ROM will be fed to primary crusher (Jaw crusher) with the help of back hoe. The input size of the Jaw crusher is -500mm and it operates at2X 250 TPH. The output size of the Jaw crusher is -120mm,which is fed to a double-deck screen having a screen sizes of 40mm and 10mm. the three products generated from the screen are lump ore (-40mm to +10mm), fines ore(-10mm) and oversize (+40mm) . The oversize is fed to secondary crusher which is a closed circuit Cone Crusher. The output of the secondary crusher is again fed to a double deck screen producing three products Lump ore (-40mm to +10mm), fines ore (-10mm) and oversize (+40mm). The oversize is again fed to cone crusher in a closed circuit. Hence the Secondary crusher ultimately produces two final products namely Lump ore (-40mm to +10mm) and fines ore (-10mm). Lump ore and fines ore produced from mobile crushing & screening unit will be dispatched to TSIL,TML or Joda East Siding and Juruli sidings for onward despatch to Steel Plants at Jamshedpur & Odisha

The plant is capable of producing products of different size specifications as mentioned in Table No. 8.1c with changing screening size and crusher settings. The flow sheet and layout for Mobile Crushing & Screening plants is given in Plate -V.

TABLE – 8.1c
SPECIFICATIONS OF PRODUCTS OF MOBILE CRUSHING & SCREENING PLANTS AT KHONDBOND

Product	Product Physical Quality		Chemical Quality	
	Under Size	Over Size	Fe%	Al2O3%
Lump Ore (+10,-40mm)	8% avg	2.5% avg	>64.0-66%	1.5-3.0
Fines -10mm,+0.15mm	5.5% avg	4.08% avg	>62.5%	3.5-4.5

The locations of existing Crushing & Screening Plant, proposed Beneficiation Plant, are indicated in drawing no.MP/KIMM/R2/02/12 and MP/KIMM/R2/10/12.

The material balance of the proposed Beneficiation Plant, are as given in table -8.1d:

TABLE – 8.1d

MATERIAL BALANCE OF THE PROPOSED BENEFICIATION PLANT				
YEAR	ROM feed to Plant	Output of Proposed Beneficiation Plant		
		Lumps	Sinter fines	Tailing /Reject
2013-14	0	0	0	0
2014-15	0	0	0	0
2015-16	0	0	0	0
2016-17	8	1.2	4.6	2.2
2017-18	8	1.2	4.6	2.2

At full production of 8 Mtpa ROM, the new processing plant feed will require 8 Mt of ROM and it is estimated that the process plant will have recovery of 70%. So, approximately 30% mass (tailings) need to be disposed in available land in the approved lease. This poses challenges for tailings disposal due to restriction of operations within the approved forest areas only. So, for selection of site for tailing dam, following points were checked:

a) Forest Limits
b) Mineralization of the area
c) Development of the mineralized area

So as to confirm with the above criteria, we have concluded that a substantial quantity must be concurrently backfilled in already excavated areas particularly pit 7 & 2(part of N ore body), which will be converted into tailing dams No 4, and 1 respectively in a manner that does not sterilise future ore.That is why pit 7 is proposed to be excavated during 2013-14.

8.1(d) Tailing Management:

The proposed beneficiation plant at Khondbond will be equipped with the latest beneficiation facilities for production of lumps and fines. During the processing of iron ore, tailings shall be generated. Therefore, a suitable place is needed for storage of tailings generated from the beneficiation plant. It is assumed that tailings of 1 Mcu.m would be produced per 8 Mtpa of ore processed. Hence tailings disposal is a key driver for the project and the mining sequence has been adjusted to preferentially mine areas that would yield tailing storage capacity.

It is proposed that Pit 7 shall be converted into slime dam 4 and shall be ready for disposal before the commencement of new beneficiation plant during 2015-16. Slime dam 4 will be made in two lifts will be used upto 2017-18. By this time pit2 (part of N orebody) have been excavated and can be utilized for slime storage as slime dam no.1,if dam 4 gets full during the plan period in 2017-18. After the plan period Pit11 is proposed to be converted into slime dam therefore, excavation of Pit11 shall start in 2017-18. While converting the pit7 into slime dam, a total of 2.45 M cum of waste material shall be required to construct the dam walls.

The space available (year wise) for disposal of tailings is given in table 8.1 e:

TABLE – 8.1e
SPACE AVAILABLE FOR TAILING DAM

YEAR	TAILINGS STORAGE REQUIREMENT	CUMMULATIVE VOLUME	TAILINGS DAM ALLOCATION	CUMMULATIVE SPACE AVAILABLE
	M.CUM	MCUM		MCUM
2013-14	0.0	0.0		0.0
2014-15	0.0	0.0		0.0
2015-16	0.0	0.0		0.0
2016-17	2.2	2.2	SLIME DAM- 4	2.4
2017-18	2.2	4.4		4.8

The slime dam will be designed with zero discharge and the water recovered will be pumped back to the beneficiation plant for reuse. The proposed locations for tailing dams have been indicated in the drawing no. MP/KIMM/R2/10/12.

Kundra nallah flowing by the western side of the leasehold has been identified as the source of water**.** This nallah is assumed to be perennial and water flow rate is also sufficient for tapping water at the rate of 19200 KL per day **.** The tapping point will be located at northern part of the leasehold boundary**.** At that point**,** the pickup water with an intake well will be provided for installation of multi-stage pumps for pumping water to a storage tank near plant site and also to other miscellaneous consumers**.** The pipeline from the pump house to the plant site storage reservoir will be laid along the northern boundary of applied lease area. The length of the pipeline is estimated about 5.5 km**.**

The estimated power requirement for the expansion of mining facilities and new beneficiation plant at Khondbond including auxiliary facilities, utilities, water system and ore transportation will be about 64 x 10^6 kWh per annum. Power will be made available to Khondbond at 33 kV from the 220 kV/132 kV/33 kV Joda Substation of GRIDCO located 25 KM away from the mines. It is proposed to bring 33 kV power supply to the mines by tapping the GRIDCO substation at Joda. The estimated length from the tapping point to the 33 kV/3.3 kV receiving substation at KIMM is about 7 km.

A tentative flow sheet of proposed beneficiation plant is shown in Plate-IV.

Location of the proposed beneficiation plant and tailing dam has been indicated in the drawing no. MP/KIMM/R2/10/12.

8.1(e) SUBGRADE BENEFICIATION:

The subgrade material is found in the form of intercalated patches within the ore zone which has been delineated by exploratory drilling, sampling and assaying. This subgrade consists of ferruginous shale and clay material having high alumina (deleterious) with low iron content ranging from 45% to 58%. The mine development has been planned accordingly delineating iron ore (Fe>58%) for plant feed, subgrade patches (<45% & <58%Fe) and waste material (<45%Fe) for stacking. Further, short term mine planning is being practiced using blast hole drilling and sampling for deciphering the iron ore, subgrade patches and waste material separately.

As such there is no program for disposal of subgrade outside the lease and its use for beneficiation and blending purposes, it is stacked separately for future use as shown in the mining scheme.

The mineralogical amenability of this low grade material has been initiated, however, detailed mineral characterization , mineral liberation and beneficiation studies will be conducted in 2013-14, 2014-15 & in 2015-16 respectively.

8.2 MANGANESE ORE BENEFICIATION:

Present method of manual processing of Manganese Ore :

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

Sub grade minerals generated during dressing and sorting are transported to separate place for its storage for future use.

Mineral fines generated during dressing and sorting are kept at sorting yard and dispatched to different parties when there is a market demand.

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

Stacking of Lump ore is done as per the grade in different area. Ore Stack is kept within 100 MT to 300 MT depending upon the availability of that grade ore and space at stack yard. The face workers are deployed for making the stack in a geometrical shape. Then samples are drawn by Samplers and prepare the pulp. The pulps are analyzed at our own laboratory to ascertain the grade is finalized after sampling

The face workers deployed at sorting yard are provided with all safety appliances (i.e. helmet, safety shoe, goggles, knee guard, hand gloves etc) and the supervisors are responsible for implementation of all safety procedures at work place.

Future proposal for mechanized processing of Manganese Ore :

As a part towards mechanization, crushing, screening and mechanical sorting (based on Radiometric X-Ray technology) unit is proposed to be commissioned during the scheme period for mechanizing the subsequent processing of the ROM. The plant shall have a capacity of 50-100 TPH to crush the ROM to -75mm size. The screening shall be done at 10 mm size. The products of -75 +10mm shall be shifted to stack yard for preparation of stacks in geometrical shape. The fines (-10mm) shall be shifted to the mineral reject stacking area by using loader and dumpers. The waste generated if any shall be shifted to waste dumps.

The above unit shall be of dry process and the following environment protection measures shall be taken to control the air pollution:
ÅEnclosures shall be provided to trap the dust while crushing, screening and conveying.
ÅWater spray shall be provided at all transfer points.

To make use of low grade manganese ore for the production of Mn. alloys, it is envisaged to evaluate various available technologies and its techno-economic viability for beneficiation. It is proposed to take up pilot plant studies for assessing the feasibility of beneficiation of the low grade manganese ores.

At present, the manganese ore is being dressed, sorted, sized and graded manually at sorting yard. The process of mineral beneficiation of the low grade manganese ore is known since long. A beneficiation process flow sheet is in process to explore to upgrade these ores using high intensity magnetic separators and reduction roasting followed by low intensity magnetic separation. Beneficiation and agglomeration test is being carried out to demonstrate the beneficiation process flow sheet at R & D, Tata Steel, IIMT- Bhubaneswar and Mintek Laboratrory of South Africa. High Intensity magnetic separation can upgrade the Mn ore upto usable for Silico manganese Production and detail test work on reduction roasting process is in progress to upgrade this resource, which can be used for Ferro manganese making.
However, the economic viability of the process has been doubtful in view of the high energy cost. Our companyôs R&D proposed to take up pilot plant studies for assessing the feasibility of beneficiation of the low grade manganese ores and fines.

Proposed beneficiation of Low Grade, Sub grade and Mineral rejects of Manganese:

Tata Steel manganese mines, Joda produces ~ 5 lakh tons/annum high and low grade manganese ores by semi mechanized mining. Around 17.5% of ore material is get converted into low grade fines, Chips and lumps (Mn: 15-35%, Mn/Fe: <1) as sub grade mineral or mineral rejects. The preferred feed size of Manganese ore for ferro Alloys making is -75, +10mm size lumps. These low grade resources cannot be used in the Submerged arc furnace and these are dumped at different subgrade/mineral reject dumps. Khondbond Manganese Mine is producing about 10,000 ton/annum of such low/sub grade ore and existing dumps contain 20000 tons of such material at Khondbond Iron & Manganese Mine. R &D studies have been carried out to utilize these resources in a cost effective and environmental friendly manner. R &D studies find that these fines can be beneficiated and agglomerated to use in ferro alloys making process.

Proposed Methodology:

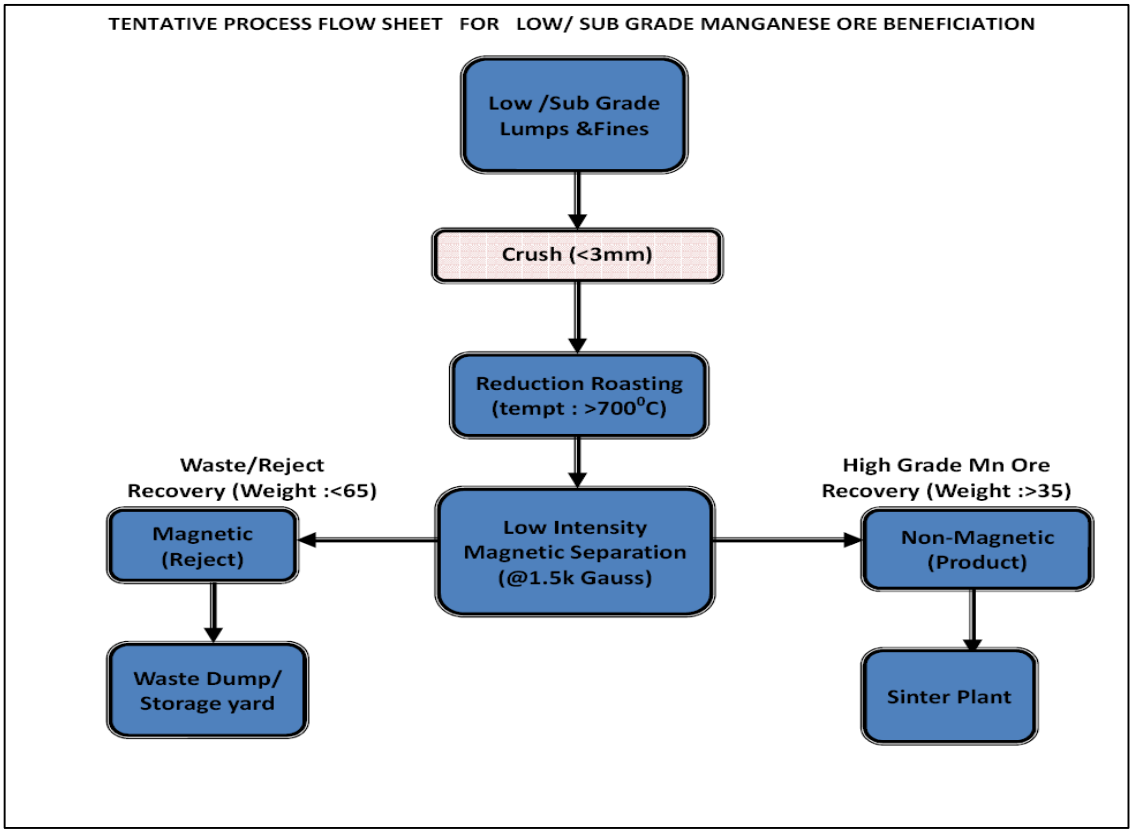
The details of study for beneficiation of Low/ Sub Grade Manganese Ore and Fines carried out so far:- Reduction roasting has been explored to convert the feebly magnetic hematite to magnetite using coal but techno economics can be able debateable issue. The high intensity magnetic separator can recover the feebly magnetic particles but particle size as well as liberation characteristics play a crucial role in this process. Reduction roasting studies were carried out for temperature range 500 to 10000C using various types of reductant. These studies were carried out and major findings are:

1. Roasting in coarser sizes (>6mm) is not successful and <3mm is most suitable size.
2. FeMn grade product (Mn >46%, Mn/Fe >7%) can be achieved at yield depends on roasting temperature (700-10000C) and time. Weight Recovery was 37-45%, and test work in progress to optimize that.
3. R&D Tata Steel and MINTEK, South Africa is doing detailed test work (tempt: 800, 900,1000oC, Time: 2,4 and 6 hours, Ore types : 5) to produce high grade Mn ore concentrate using Low grade ore fines.
4. Yield and product grade is sensitive to sources of low grade at different mines sites and composition (Fe & SiO2).

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

1. Techno-economic studies of different process flow sheets (Fig. 7)
2. Material balance for beneficiation plant inputs and output disposal plans
3. Detailed Project Report for Sinter plant and beneficiation plant
4. Statutory requirements for beneficiation and sinter plant.

Figure – 1


TENTATIVE PROCESS FLOW SHEET FOR LOW/ SUB GRADE MANGANESE ORE BENEFICIATION
Low /Sub Grade Lumps &Fines
Crush (<3mm)
Reduction Roasting (tempt : >700°C)
Waste/Reject Recovery (Weight :<65)
Magnetic (Reject)
Low Intensity Magnetic Separation (@1.5k Gauss)
High Grade Mn Ore Recovery (Weight :>35)
Non-Magnetic (Product)
Waste Dump/ Storage yard
Sinter Plant

9.0 ENVIRONMENTAL MANAGEMENT PLAN:

At present mining operation at Khondbond is concentrated in the already broken up forest area only. As stated earlier, MoEF, GoI has granted working permission over an area of 235.42 ha forest land for expansion of mining and allied activities. These shall include development of new area for mining, storage location for disposal of wastes, infrastructure facilities such as road, building, water pipe line, conveyor routes, transmission line and new beneficiation plant with stacking and reclaiming facilities. The proposed expansion shall require additional 324.504 ha of fresh land (forest + non forest) during the next five years. Breakup of land required during the next five years under different category is mentioned in the table-9.1:

TABLE - 9.1
ADDITIONAL LAND REQUIREMENT DURING THE NEXT FIVE YEARS
(in Ha)

Sl. No.	**Head**	FOREST	NON FOREST	TOTAL
1	Area under excavation	87.400	15.130	102.530
2	Storage for top soil	1.000	0.000	1.000
3	Overburden/dump	71.967	30.370	102.337
4	Mineral storage	32.120	7.018	39.138
5	Infrastructure (Workshop, administrative building etc.)	7.360	0.320	7.680
6	Roads, conveyor route, pipe line etc.	14.720	5.240	19.960
7	Railways	0.000	0.000	0.000
8	Green Belt	0.000	0.000	0.000
9	Tailing Pond	24.660	1.550	26.210
10	Water & Effluent Treatment Plant	0.350	0.000	0.350
11	Mineral Separation Plant	16.440	2.150	18.590
12	Township area	1.000	0.000	1.000
13	Others(Magazine)	0.000	1.557	1.557
	Total	257.017	63.335	320.352

The additional land requirement includes the following major activities which will take place during the plan period:

- Expansion of mining activities into the new area,
- Storage of top soil
- Waste & subgrade disposal
- Ore stockpile for storage of mineral
- Construction of Infrastructure facilities
- Construction of roads, utility corridor, (for power line, water pipeline, approach road and conveyor)

- laying of slurry pipelines & pipelines for recovery of water from tailing dams
- Construction of New Beneficiation Plant with stacking & reclaiming facility ,
- Construction of Slime Dam,

- Construction of pump house, effluent treatment plant & water treatment plant
- Construction of Magazine
- Construction of temporary labourer housing.

The Environment Impact Assessment for the above activities has been done in house by our Environmental Experts of our Environment Department at Noamundi. The assessment for the above programs is detailed below:

(i) General Observations:

Present conditions of the environmental parameters are dealt with earlier. Since the mine has been in operation for the last several decades, the impacts of the past operations have already been reflected in the study results.

In near future, as mining operation for both iron and manganese ore will be expanded, proposed activities are likely to add to the load of pollutants. Major expansion activities will include development of mining in new area, commissioning of beneficiation plant, waste disposal facilities, construction of slime dam, construction of utility corridor for power, water, conveyor and development of infrastructure facilities. These factors are considered in anticipated impact assessment for devising control measures.

(ii) Climatic Conditions:

The factors responsible for changes in climate are on regional scale. Since the area of activity is quite small as compared against the area of the region, it is envisaged that the increase in production is not going to have any say on the climate. Further, since there will be only a marginal increase in natural resource consumption, it can be expected that the production increase is not going to introduce additional emissions in significant levels that will affect the climate.

(iii) Topography:

The portion of the mine working on iron ore is expanding. The bottom most level is 585 mRL.New iron ore pits are planned to be opened in the southern and northern part. New pits will be developed along the general direction of natural contours .

Utility corridor is proposed to be developed along the slope of the north east boundary of the applied area. Corridor will be developed along the slope of the hill therefore no substantial change in topography is anticipated from this activity.

We do not envisage any substantial change in the topography of the area due to the construction of beneficiation plant and slime dam.

(iv) Land use:

During FYô09 to FYô13 mining operation and related activities were concentrated within already broken up area only as fresh forest land has not been handed over to the Steel Company.

During the next five years and up to conceptual stage there will be increase in utilization of forest land for expansion projects. As explained earlier, present mining operation for iron and manganese ore is at a very small scale, mining operation and allied activities were concentrated within already broken up area only. It has been proposed to increase its capacity up to 8.0 MTPA ROM of iron ore

and 1.0 LTPA ROM of manganese ore. The proposed expansion will require expansion of mining and associated activities in new area. Further, so as to maintain consistent grade of ROM to the proposed beneficiation plant, ROM needs to be supplied from different pits having different grade of material. Therefore, in future as the mine gears up for higher production levels, development of new pits is essential. Because all iron ore zones are located within forest area only, use of fresh forest land cannot be avoided. However, major part of forestland will be used for iron ore mining only. and no additional land has been anticipated for development of manganese mining as the proposals are well within the diverted area. Further due to lack of space for waste disposal, additional 13.75 ha of area is being proposed within forest area and will be in operational during 2015-16 after obtaining the forest clearance and subsequent clearances. Similarly, additional 6 ha (1.90 ha within diverted forest land & 4.10 ha within un-diverted forest land) is also being proposed for stacking of ore and erection of infrastructures to augment the production of manganese ore during this scheme period

As iron ore bodies at Khondbond are located in discontinuous form, mining operation will be more difficult and huge quantity of waste and subgrade will be generated. In general, for iron ore mining stripping ratio will be high in the initial years which will require large area for dumping of waste & subgrade and area for ore stockopiles. Dumps are required to be developed in non mineralized area and also near respective pits so as to optimize cost of operation. All dumps for iron ore has been proposed and designed with above considerations therefore requirement for additional land for dumps is justified. However, requirement of additional land for dumps is only for initial years thereafter waste & tailings will be stacked in mined out area only and no additional land will be required.

Slime dams will be constructed with zero discharge concepts. All the slime dams are inpit slime dams and hence no fresh area will be required.

About 18.226 ha of land have been identified for utility corridor within the lease. The corridor has been designed along the lease boundary so as serve up to the life of the mine. The total length of corridor will be about 2.8 KM and width about 65 mtrs within the lease. The width of the corridor has been decided taking into account of topography of area, width of conveyor, width of road, safety distance for HT lines, statutory limits of 7.5 mtrs from lease boundary and safety zone of 7.5 mtrs as required under the diversion proposal of forest land.

Land required for beneficiation plant is about 15.88 ha. It is essential as the beneficiation plant will have series of beneficiation facilities (particularly for processing of low grade ore) including Crushing and Screening, mills, beneficiation equipments (such as Jigs, Hydro cyclones and Spirals). It is also proposed that before each series of equipments, sufficient buffer stocks will be maintained. Further Staking and Reclaiming facilities will also require huge area at Beneficiation plant. It is proposed that about one week of stock of finished products will be maintained at beneficiation plant.

On basis of above justification, the landuse pattern at the end of the 5-year period (up to Fyô18) is shown in Table-9.2

TABLE – 9.2

PROPOSED SURFACE AREA UTILISATION AT THE END OF 5-YEAR PLAN PERIOD

(All figures in hectares)

Sl. No.	Head	FOREST	NON FOREST	TOTAL
1	Area under excavation	227.320	15.130	242.450
2	Storage for top soil	1.000	0.000	1.000
3	Overburden/dump	96.270	31.170	127.440
4	Mineral storage	37.830	8.240	46.070
5	Infrastructure (Workshop, administrative building)	11.960	0.320	12.280
6	Roads, conveyor route, pipe line etc.	33.820	5.240	39.060
7	Railways	0.000	0.000	0.000
8	Green Belt	5.962	0.000	5.962
9	Tailing Pond	24.660	1.550	26.210
10	Water & Effluent Treatment Plant	0.350	0.000	0.350
11	Mineral Separation Plant	18.940	2.150	21.090
12	Township area	1.000	0.000	1.000
13	Others(Magazine)	0.000	1.557	1.557
	Total Utilised	459.112	65.357	524.469
	Unutilised	377.645	75.886	453.531
	Total Applied Area	836.757	141.243	978.000

(v) Generation of Wastes and Subgrade:

Since, the iron and manganese ore bodies at Khondbond are scattered, it is proposed to have dumping area, which are close to a group of iron and manganese ore bodies. Furthermore, all dumps have been planned in non-mineralized zones (areas that have either been proved barren by geological exploration or having outcrops of BHJ / BHQ). The dumping areas identified for waste disposal shall only suffice for initial stages of development. Afterwards no fresh area for dumping will be utilized and concept of concurrent back filling will be adopted. As soon as the reserves of any mineralized zone are exhausted, the waste excavation from the other pits shall be dumped in the mined out area. For example, óPit7of iron area and Quarry No. XIII of manganese area will be exhausted at an early stage and it is been proposed to back-fill these pits by waste & tailings. Locations of dumps are shown in drawing no. MP/KIMM/R2/8/12.The sub-grade ore will be stacked for future use in the dumps as shown in drawing no. MP/KIMM/R2/02/12.

In iron ore mining, after the introduction of threshold limit of 45% fe ,the waste generated in the past was very less and used primarily for haul road & short ramp making, bench floor leveling and making berms, etc. Subgrade generated was stacked for future use in subgrade dumps 1A,2A and 3 ,whereas the fines generated from the

processing plant consists primarily of low quality fines have been stored as fines stocks in areas ear-marked for the purpose as shown in drawing no. MP/KIMM/R2/02/12.

(vi) Air Quality:

The measures, namely, sprinkling of haul roads with water sprinkler and dry fog dust suppression system provided at strategic locations in the plant, are expected to keep dust generated well below the maximum permissible limits, both from the ambient air quality and work environment quality standards. No significant adverse impact is expected from increased production.As the beneficiation plant will have wet processing only the generation of dust will be low. Further to reduce the dust due to the processing of ore, all the transfer points will be covered and suitable dust suppression system will be provided to check air borne dust generation. Therefore, no negative impact on air quality is envisaged due to the operation of beneficiation plant. Further, necessary avenue plantation and green belt will be developed in and around the plant area to minimize the impact.Conveyor for transportation of mineral will be covered and all transfer points will be provided with dust suppression system. Therefore, no impact on air quality is being envisaged.

(vii) Ground vibration, fly rocks and noise exposures:

All efforts are taken to ensure that blast-induced ground vibrations remain within safe limits. CIMFR has been engaged for blast study and their recommendations are strictly followed. Noisy operations have been identified and persons engaged in such operations are provided with ear protection so that exposures to noise are within limits. It is envisaged that there will be no additional issues associated with ground vibration, fly rocks and exposure to noise because of the proposed activities.

The beneficiation plant will be designed with state of art technology and all noise generation points will be equipped with noise dampening measures (rubber pads and screens, sealings etc). Further, all standard practices will be adopted for efficient maintenance of the machines, which will control noise generation.

Apart from above, persons employed in the plant will be provided with earmuffs and ear plugs wherever required. Further, noise sampling station (please refer drawing no. MP/KIMM/R2/8/12) has been proposed in the beneficiation plant area to monitor the noise level. We do not envisage any noise exposure due to operation of the conveyor.

(viii) Water regime and Water Quality:

At present water is used mainly for dust suppression in mine and plant. However in coming years water requirement is going to increase due to installation of beneficiation plant and expansion of mining activities. It is proposed that water requirement will be made from nearby Kundra Nallah which has sufficient capacity throughout the year. As all mining operations will be concentrated on top of the hill, it will not intersect ground water table even at ultimate depth. There are also no discharges from the mine. During monsoon, mine wash-off from pits will be arrested by series of check dams proposed on the downstream side and only clear water will leave from lease boundary. Because of the above, no impact is envisaged on water regime and surface water quality. To monitor quality of water in downstream side, water quality sampling points have been proposed at all prominent locations. (Please refer drawing no. MP/KIMM/R2/8/12).

Slime dam area has been chosen with great care taking into account of all environmental and technological aspects. Slime dam will be designed and constructed with zero discharge concepts by recirculating the water from the tailing dam back to the beneficiation plant so that water from slime dam does not percolate to the ground water. Hence, we do not envisage any impact on ground water quality due to the operation of slime dam.

An Effluent Treatment Plant, is proposed towards the Northern boundary of the lease for the treatment of the seepage ground water to balance the content of Mn & Fe before its usage in mining or its allied activities.

A water treatment plant & pump house is also proposed towards the Northern boundary of the lease for supply of water to beneficiation plant .A pipe line of about 4.5 km length will be provided along the northern lease boundary for the purpose.

The location of effluent treatment plant, water treatment plant, pump house, water pipe line for supplying water from pump house to water storage tank at the beneficiation plant, slurry pipeline from beneficiation plant to tailing dam and pipeline for recirculation of water from the tailing dam to beneficiation plant is mentioned in drawing no. MP/KIMM/R2/9/12.

Rain Water Harvesting:

A Water harvesting system is also proposed during the plan period in the existing pit of Q ore body after excavation of 0.28 mt of material in 2013-14 to recharge ground water as well as to fulfill the requirement of water for the proposed beneficiation plant during post monsoon. In future, this rain water harvesting structure will be shifted to a new location in the mid-west part of the lease where next void will be created after exhaustion of mineral and this area of Q ore body will again be mined.

(ix) Flora and fauna:

Compensatory afforestation as per the requirements of Forest Conservation Act, 1980 shall be undertaken before diversion of additional forestland. Our annual afforestation programme will adequately compensate the vegetation loss due to the diversion of forestland for mining and allied purposes. The multi-species bio-diversified saplings planted will ensure the development of green covers that will match the natural vegetation around. This is likely to keep intact the fauna of the region as well.Majority of the land for the beneficiation plant is non-forest, therefore, impact on flora and fauna is minimal. Further, the beneficiation plant will be designed, constructed and operated with state-of-the-art technology; therefore we do not envisage any adverse impact on flora and fauna of the area.The slime dam will be barricaded all along the periphery, to restrict any possible movement of fauna.

The utility corridor will also be utilized for electricity and water pipeline . As, both will be designed, constructed and operated with all safety precautions, therefore we do not envisage any adverse impact on flora and fauna of the area.There are no rare, endangered or endemic species within this area.The fauna reported in this area are

not of any rare species and all are common migratory type. Specific corridors for movements of elephants and breeding grounds are also not reported.

(x) Socio-economic conditions:

There is no residential area within core-zone or near to the lease area. There is no proposal for construction of colony. Hence there is no likelihood of effect of outside people or influx on the existing local population. The lessee is spending substantial amount through its Tata Steel Rural Development Society for peripheral developments such as education, health, sports, afforestation etc. Further, the expansion activities will also generate immense employment for local population. Hence the benefits to the community and its economy because of this project are quite appreciable.

(xi) Historical Monuments:

There are no historical monuments within a radius of 10 kilometres from the area of activity. Hence there will not be any impact on historical monuments.
The environment proposals of last five years are reviewed and proposals for the next five years are given in the prescribed format. No negative impact due to mining and allied activities is envisaged on environmental parameters as a result of implementation of environmental safeguards as proposed in Table - 9.3.

TABLE - 9.3

Sl. No.	SALIENT ITEMS	PROPOSAL AS PER APPROVED MINING PLAN	POSITION AT THE END OF 5 YEAR OF MINING PLAN PERIOD	PROPOSAL FOR THE NEXT FIVE YEAR PLAN PERIOD.
1	TOP SOIL STORAGE AND PREVENTION	It is envisage based on the geological exploration that the area proposed to be utilised for mining other activities do not have top soil. However, top soil, if any, coming out of new areas will be stacked separately at earmarked place as shown in the drawing no. MP/KMM/R2/11/07 and used during subsequent monsoon for afforestation.	No top soil generation during the last five years. Also no fresh area broken during the period.	Any topsoil coming out of new areas will be stacked separately at an earmarked place as shown in the drawing no.MP/KMM/R2/36/12 and used during subsequent monsoon for afforestation.

2	LAND RECLAMATION & REHABILITATION	1. It was proposed to reclaim barren areas and backfilling and reclamation of Ore Zone-XIII of manganese area.	1. The mined out area of Ore Zone-XIII has been back filled fully with overburden covering an area of 3.55ha & consequently afforested.	1.During the plan period, no further back filling in Ore Zone XIII is proposed. Only plantation programme to be undertaken for its rehabilitation. 2. In iron area, Pit7 & 2 will be backfilled with tailings after exhaustion of mineral.
3	WASTE DUMP MANAGEMENT	1. Proposed for systematic development of dump. Garland drain and toe walls shall be provided for each dump.	1. Dumps have been developed in a systematic manner at a place indicated in the approved mining plan. All the dumps were provided with garland drains and toe walls.	1.Dumps shall be developed systematically. Garland drain and toe walls shall be provided for each dump. 2. Before monsoon all garland drains and settling tanks shall be evacuated. 3. Water channels shall be provided at each stage of dump to divert rain water to garland drains.
		2. Afforestation of Waste Dump No.-1 of iron area covering about 2.0 ha dump slope area.	2. Slope of subgrade Dump No.-1 of iron area has partly been afforestated covering about 1.50 ha area.	2. Stabilization of Waste Dump No.-1 & 5 of iron area by afforestation over dump slopes covering about 2ha & 6ha area respectively. 3. Stabilisation of subgrade Dump No.-3 & 6 of iron area by afforestation over dump slopes covering about 2ha & 2ha area respectively.
		3. Afforestation of Dump No.-1 & 2 of Manganese area	3. Dump No.-1&2 of manganese area, covering about 8.85 ha has been reclaimed by plantation of 72010 saplings.	3. Stabilisation of Dump No1 of manganese area by afforestation over dump top and dump slopes. covering about 3.0 ha area. 4. Stabilisation of Dump No.2 of manganese area by afforestation over dump top and dump slopes. covering about 1.50 ha area

4.	AFFORESTATIO N PROGRAMME WITH PRECAUTIONS PROPOSED.	Proposed Plantation of 32000 saplings.	Afforestation done during the 5 years: 99510 saplings.	Plantation shall be done over the area proposed above and also for gap filling in already afforestated area. Total 41250 saplings will be planted in the next five years. Precaution Proposed: 1. Watch & Ward 2. Fencing 3. Watering 4. Manuring 5. Pesticides
5.	QUALITY OF AIR	1. No adverse impact on ambient air quality was expected.	1. Air quality is regularly assessed at the pre-determined stations and the results are enclosed in Annexure-II. Results show no adverse impact on ambient air quality. To improve air quality following measures are adopted in the mine:- - Water spraying on haulroads by one nos of 10 KL water sprinklers. -Dry Fog Dust suppression at Crushers. - Wet Drilling is being adopted for small and large dia drilling. - Belt conveyors are covered with metallic shields.	1. Three seasons Monitoring will be carried out at stations indicated in the environment management plan. 2. Dust suppression system as water sprinkler, wet drilling, and dry fog will continue to operate in existing and new areas.

Sl. No.	SALIENT ITEMS	PROPOSAL AS PER APPROVED MINING PLAN	POSITION AT THE END OF 5 YEAR OF MINING PLAN PERIOD	PROPOSAL FOR THE NEXT FIVE YEAR PLAN PERIOD.
6	NOISE LEVEL & VIBRATION	Proposed control measure were 1. All heady machineries shall have silencers.	1. All heady machineries are operated with silencers.	1. All heavy machineries shall have silencers. 2. Blasting will be done by using with Nonel system to minimize adverse effect such as Blast vibration, Noise, Fly rock etc. Recommendations made by CMRI shall be adhered to. 3. The Noise survey will continue.
		2. Controlled Blasting shall be done.	2. A study on blasting was conducted by CMRI in June@2006. Blasting pattern is adhered strictly to the recommendations of CMRI to minimize pick particle velocity.	
		3. Plant and machineries shall be maintained in well condition.	3. Plant and machineries are maintained in well condition.	
			4. Noise pressure is regularly monitored at the locations mentioned in the approved mining plan and results are enclosed in Annexure-IV.	
7	TREATMENT OF MINE WATER AND RECIRCULATION	1. No discharge from the mine is joining to Kundra nallah. Also mining operation has not intercepted ground water.	1. No discharge from the mine is joining to Kundra nallah. Also mining operation has not intercepted ground water.	1. No discharge from the mine shall join to Kundra nallah. Also mining operation will not intercept ground water. 2. Three nos of check dams shall be constructed as indicated in the drawing no. MP/KMM/R2/35A/12.
		2. Two Check Dams shall be constructed, one in the eastern side of the existing plant and one on the eastern side of the	2. One check dam on the eastern side of the existing plant has been constructed.	

		proposed mining operation.		
8	QUALITY OF MAKEUP WATER INCLUDING SURFACE & GROUND WATER.	1. Water quality will be monitored in all seasons.	1.Water quality is monitored in all seasons. All parameters are within the prescribed limit. Pls refer Annexure ï III	1. Water quality will be monitored in all seasons. 2. Down stream water quality of Kundra Nallah will be monitored in all three seasons. 3. During monsoon lowest bench of the pit will not be operated. Cross Cuts shall be made at each bench to divert water at lowest bench where water will be accumulated for settling down. No rain water will be allowed to join natural nallah without passing thro check dams.
		2. Water will be required only for dust suppression and drinking.	2. Water is required only for dust suppression and drinking.	2. No adverse impact is envisaged due to mining operations on surface and ground water quality.
				3. Water shall be required for proposed beneficiation system, water sprinkling, dust suppression in plant and drinking purpose.

PART-C
(Progressive Mine Closure Plan)

1. INTRODUCTION

a) Name of the lessee: Tata Steel Limited

Name & address of nominated owner : H.M.Nerurkar
Managing Director
TATA STEEL, Jamshedpur - 1.

Tel : 0657 - 2431598
Fax : 0657 - 2424098

b) Extent of applied lease area :
Lease area : 978.00 ha.
Toposheet No. : 73G/5
Latitude : Between 21°54ô50òN & 21°57ô47òN
Longitude : Between 85°21ôE & 85°24ô17òE

c) Mineral/s, which are occurring in the area
and which the applicant intends to mine : Iron & Manganese ore

d) Period for which the mining lease is granted / renewed / proposed to be applied:

(i) The mining lease was originally granted for a period of 30 years with effect from 17.01.1933 over an area of 12.17 sq. miles (3152.018 ha.) including Joda West & Katamati blocks.

(ii) The first lease renewal was done for a period of 20 years with effect from 17.01.1963 over an area of 12.17 sq. miles (3152.018 ha.)

(iii) During the second lease renewal for a period of 20 years with effect from 17.01.1983, Khondbond formed an independent lease over an area of 1293.433 ha. Tata Steel has applied for renewal of the mining lease for a period of 20 years with effect from 17.01.2003 over an area of 978 ha.

e) Type of Lease: The abstract of land schedule is given below:

TABLE:1e
LAND SCHEDULE ABSTRACT

ABSTRACT	
Tenanted Land	104.320 ha
Government Land	
I. Reserve Forest	681.718 ha
II. Khesra Forest	44.653 ha
III. DLC	110.386 ha
IV. Other Land (Govt.)	36.923 ha
Total Applied Area	**978.000**

f) Land Use pattern: Present land use pattern is given below :

TABLE:1f
EXISTING LANDUSE PATTERN

(As on 1.04.2012) (All figures in hectares)

Sl.No.	Head	Forest Land(ha)	Non Forest Land(ha)	TOTAL
1	Mining	139.920	0.000	139.920
2	Storage for top soil	0.000	0.000	0.000
3	Overburden dump	24.303	0.800	25.103
4	Mineral Storage	5.710	1.222	6.932
5	Infrastructure(Workshop,Admin. Bld)	4.600	0.000	4.600
6	Roads,Conveyor route,pipeline etc	19.100	0.000	19.100
7	Railways	0.000	0.000	0.000
8	Green Belt	5.962	0.000	5.962
9	Tailing pond	0.000	0.000	0.000
10	Effluent treatment Plant	0.000	0.000	0.000
11	Mineral Separation Plant	2.500	0.000	2.500
12	Township area	0.000	0.000	0.000
13	Others(Magazine)	0.000	0.000	0.000
Total Utilised area		202.095	2.022	204.117
Unutilized		634.662	139.221	773.883
Total Lease Area		836.757	141.243	978.000

g) Mining Methods: The method of mining for iron and manganese has been detailed in section 5 of Part B.

1.1 REASONS FOR CLOSURE: The mine is an operating mine and is intended to be closed after exhaustion of mineral.

1.2 STATUTORY OBLIGATIONS: Requirement of this para has been mentioned detail in Para-1.4 (d) of Part-A.

1.3 CLOSURE PLAN PREPARATION:

Name and address of Applicant	: H.M.Nerurkar Managing Director (India & South East Asia) TATA STEEL Ltd. Jamshedpur-1
District	: Singhbhum East
State	: Jharkhand
Phone	: 0657-2145625
Fax	: 0657-2424098

Name and address of RQP:

Key Person	: Awnish Kumar
Address	: Head (Planning) OMQ, Tata Steel Limited Noamundi
District	: West Singhbhum
State	: Jharkhand
Phone	: +91-9238306273
Fax	: 06596-233706
Registration No.	: RQP/CAL/039/87/B
Date of grant/renewal	: 22.11.2011
Valid up to	: 22.11.2021

A photocopy of the RQP certificate is enclosed as Annexure-I.

Name of the Executing Agency	: OMQ Division, TATA STEEL LIMITED P.O. - Noamundi Dist. ï Singhbhum West State - Jharkhand

2.0 MINE DESCRIPTION

2.1 GEOLOGY: Please refer section 3 of Part B

2.2 RESERVES: Please refer section 3 of Part B

2.3 MINING METHOD: Please refer section 5 of Part B

2.4 MINERAL BENEFICIATION: Please refer section 8 of Part B

3.0 REVIEW OF IMPLEMENTATION OF MINING PLAN:

Review of the approved First Scheme of Mining has been done in detailed in Para-1.4(b) of Part-A. In addition to this, the land use pattern, is being reviewed and furnished in following table 3.1:

Review of Land Use as per last approved scheme		Area Approved till March'2013	Actual as on 1st October'12
Sl.No.	Head	TOTAL	TOTAL
1	Area to be excavated	215.9	139.92
2	Storage for top soil	0.5	0
3	Overburden dump	56.700	25.103
4	Mineral Storage	8.3	6.932
5	Infrastructure (Workshop,Admin. Bld)	9.85	4.6
6	Roads,Conveyor route,pipeline etc	36.735	19.1
7	Railways	0	0
8	Green Belt	5.962	5.962
9	Tailing pond	33.25	0
10	Effluent treatment Plant	0	0
11	Mineral Separation Plant	46	2.5
12	Township area	1	0
13	Others(Magazine)	5.25	0
Total Utilised area		419.447	204.117
Unutilized		558.553	773.883
Total Lease Area		978	978

Reasons for Deviation:

Area to be excavated, overburden dump , conveyor corridor, tailing pond and mineral separation plant, including infrastructure are less due to delay in execution of expansion plan of beneficiation project, for want of statutory clearances.

4. CLOSURE PLAN:

4.1 Mined out land: At the conceptual stage (end of life of mine), there will be three iron ore quarries and two manganese ore quarries. The quarry wise size, top & bottom RLs at the end of the life of the mine are as given in Table-4.1a:

TABLE:4.1a

QUARRY DIMENSIONS AT END OF LIFE OF MINE

Quarry name		**Length (m)**	**Breadth (m)**	**Top (mRL)**	**Bottom (mRL)**
Iron Ore Quarries	North Quarry	3400	2750	760	560
	South Quarry	1650	1250	720	570
Manganese Ore Quarries	Mn. Ore Zones(VI,V,X,XII,XII)	1000	500	615	515
	Mn. Other Ore Zones (Western Part of the Lease)	1500	900		

The land degradation by way of mining / excavation at the conceptual stage (end of life of mine) and the proposed reclamation measures are given below in Table: 4.1b:

TABLE: 4.1b

PROPOSED RECLAMATION MEASURES

	CONCEPTUAL LAND DEGRADATION	PROPOSED RECLAMATION	
	Area in ha.	Area in ha.	Measures
Mining Excavation	586.415	560.415	Afforestation of top benches by plantation.
		5.00	Bottom benches shall be converted for water storage.
		12.00	Back-filling with waste & tailings and subsequent afforestation.*
		9.00	Back filling by waste**

* Back filling of part of Iron quarries after exhaustion of mineral.

** Back filling of Manganese quarries after exhaustion of mineral.

Reclamation status of mined out land and proposal for the next five year:
As the mining operation has just expanded, there is no possibility of any area getting abandoned. Hence, in the coming five years reclamation of mined out area has not been envisaged. Proposal for reclamation of mined out area during the plan period has been indicated in table given below in Table: 4.1c.

TABLE: 4.1c
PROPOSED RECLAMATION OF MINING AREA DURING THE PLAN PERIOD

Land already utilised for mining	Additional Land to be utilised for mining during the plan period	Total utilisation of land for mining at the end of plan period	Area already reclaimed	Area Reclaimed & Rehabilitated during the year (ha)	Mined out area at the end the year (ha)
139.92	102.53	242.45	NIL	Nil	242.45

However,it is proposed that pit 7 after being exhausted by 2015-16 shall be utilized for tailing disposal.

4.2 Water Quality Management:

There are no surface water bodies within the lease area. The nearest water source is Kundra nallah, which runs along the major part of western boundary of the lease. The working has not intercepted any ground water sources and there is no possibility of its intercepting the ground water table even at the ultimate pit level in future. Therefore, there is no possibility of ground water regime being affected by the operations of Khondbond Mine.

Soil erosion and attendant sedimentation of watercourses are also likely to precipitate because of the mining and allied operations. To prevent this from happening, the following measures shall be taken:

- Construction of check dams from where the water will be collected and settled before being finally discharged into the natural drainage,
- Stabilisation of dumps with plantation,
- Toe wall and garland drains wherever required,
- The beneficiation process does not use any chemicals and hence there is no likelihood of any chemical contamination of water bodies due to the mining activities. Water is required for dust suppression and drinking purposes only,
- There is no colony within the lease. Overflows reach soak pits, which later get percolated in earth. There will not be any impact on surface water quality because of domestic discharges.
- The present water quality is monitored regularly on a four season basis. The monitoring results are shown in Annexure-III. All the parameters are within the prescribed limits.

- Even after the mine closure, there is no likelihood of deterioration of the water quality of the surrounding area on account of the steps which are proposed to be taken, as enumerated below:
- Check-dams to prevent siltation,
- Stabilisation of dumps with plantation and
- Toe wall and garland drains around the dump, wherever required.

Proposal for the next five years:

(a) Check dams:

- Two check-dams have been proposed as mentioned below:

TABLE: 4.2a

PROPOSED LOCATION OF CHECK DAM

Year	Location	Particulars and size (LxBxH) of Check Dam to be constructed
2014-15	South of Q-orebody (N-10600,E-10000)	35 m x 3m x 4 m
2015-16	Near proposed beneficiation plant (N-13550,E-10750)	35 m x 3m x 4 m

(b) Plantation over dumps:

- Waste Dump No.-5 of iron area shall be stabilised by afforestation during the year 2016-17 over 2.0 ha and 2017-18 by covering about 4.0 ha area.
- Waste Dump No.-1 of iron area shall be stabilized by afforestation over dump slopes during the year 2014-15 over 0.5 ha and 2015-16 over 1.5 ha area.
- No proposal is made in Waste Dump No.-8 of iron area ,as it will come up in 2017-18.
- Subgrade dump No.-3 of iron area shall be stabilized by afforestation over dump slopes during the year 2016-17 over 2.0 ha.
- Subgrade dump No.-6 of iron area shall be stabilized by afforestation over dump slopes during the year 2017-18 over 2 ha area.
- No proposal is made in Subgrade Dump No.-2 of iron area, as a part of it covers forest area and the rest part of it will remain active during the plan period.
- Waste Dump No.-1 of manganese area shall be stabilized by afforestation over dump slopes during the year 2013-14 over 1.0 ha area, during 2014-15 over 1.0 ha area and during 2015-16 over 1.0 ha area.
- Waste dump No.-2 of manganese area shall be stabilized by afforestation over dump slopes during the year 2013-14 over 0.75 ha area and during 2014-15 over 0.75 ha area.
- No proposal is made in new Waste Dump No.-3 of manganese area, as it will come in 2015-16 after obtaining forest clearance and will remain active during the scheme period.

(c) Garland drain & Toe wall:

Table 4.2c indicates the garland drains and toe wall to be constructed during the plan period.

TABLE: 4.2c
PROPOSAL FOR GARLAND DRAINS AND TOE WALL AROUND DUMPS

Year	DUMP	Garland Drain	Toe Wall
2013-14	IRON ORE SUBGRADE DUMP NO.-2	500mtrs	500mtrs
2013-14	IRON ORE WASTE DUMP NO.-1	750 mtrs	750 mtrs
2014-15	IRON ORE SUBGRADE DUMP NO.-2	500mtrs	500mtrs
2014-15	IRON ORE SUBGRADE DUMP NO.-6	500mtrs	500mtrs
2014-15	IRON ORE WASTE DUMP NO.-5	800 mtrs	800 mtrs
2015-16	IRON ORE SUBGRADE DUMP NO.-3	800mtrs	800mtrs
2015-16	IRON ORE SUBGRADE DUMP NO.-6	400mtrs	400mtrs
2015-16	IRON ORE WASTE DUMP NO.-5	800 mtrs	800 mtrs
2015-16	MN. ORE NEW WASTE DUMP NO.-3	600 mtrs	600 mtrs
2016-17	IRON ORE SUBGRADE DUMP NO.-6	350 mtrs	350 mtrs
2017-18	IRON ORE WASTE DUMP NO.-8	300 mtrs	300 mtrs

In addition to above, boulder retaining wall is also proposed along the proposed conveyor corridor as given below:

TABLE: 4.2d
PROPOSAL FOR RETAINING WALL ALONG CONVEYOR CORRIDOR

Year	Dimension of boulder retaining wall	Length
2013-14	1.2m height X 1m width	400mtrs
2014-15	1.2m height X 1m width	400mtrs
2015-16	1.2m height X 1m width	375mtrs

Two nos. of settling tanks have been proposed in Iron Part, one each around waste dump no.1 & subgrade dump no.2 during the plan period

The specifications for the settling tanks are mentioned below:

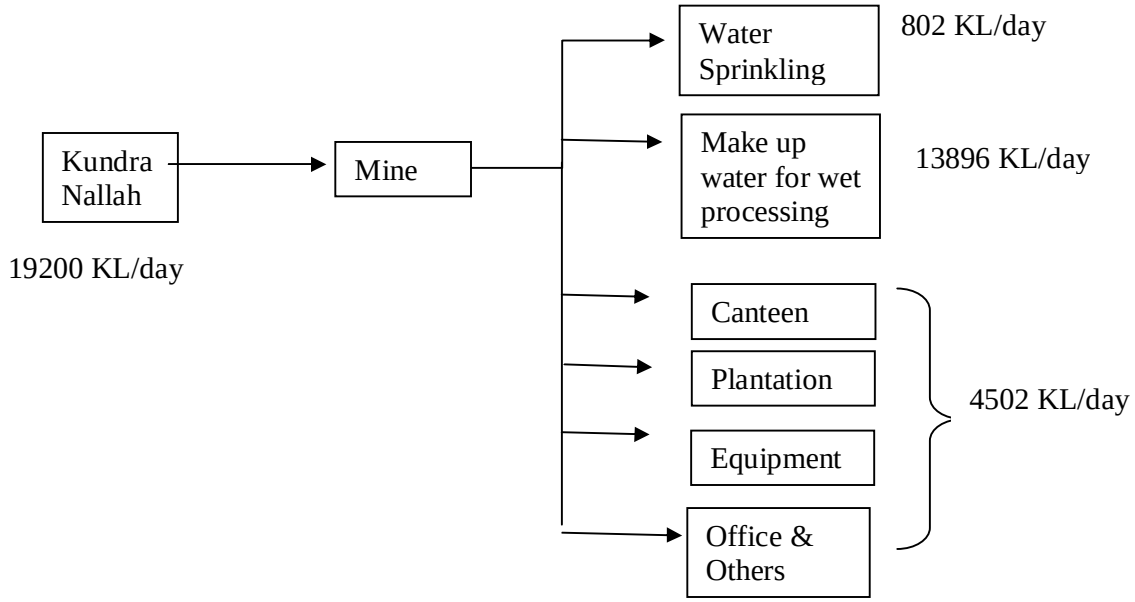
TABLE: 4.2e

Proposal for Construction of Settling Tank		
Year	**Location**	**Particulars and size (L X W X D) (in mts)**
2013-14	Waste Dump No.1	15x 4 x 4
2014-15	Subgrade Dump No.2	15x 4 x 4

The location of proposed toe wall, garland drain and settling tank has been indicated in the Drawing no. MP/KIMM/R2/9/12.

The proposed water balance diagram is indicated below:

Water Balance Diagram(Peak Requirement)



4.3 Air Quality Management:

The air quality parameters, viz. Suspended Particulate Matter, NOx, SOx & CO are regularly monitored on a three-season basis. The monitoring results are enclosed in Annexureï II. All the parameters are within the prescribed limit.

After the mine closure, all activities involving movement of heavy vehicles, operation of plant and machinery etc. will cease. The upper benches of the mined out area and the dump are proposed to be afforested and therefore the fugitive emissions shall be insignificant. In view of this, there shall be no adverse impact on the air quality of the area.

4.4 Waste & Subgrade Management:

At the conceptual stage, the iron ore mining area shall have four waste dumps namely dump no. 1, 4, 5 & 8. Waste dump No. 4 shall cover the mined out area of P& N ore bodies.Whereas there will be five subgrade dumps at the conceptual stage namely subgrade dump 1A,2A,2,3 & 6 .

At conceptual stage,the manganese area will have three waste dumps namely waste dump1,2& 3within the lease area. Whereas one external dump is proposed which is nothing

but back filling of an old exhausted quarry within Joda West Manganese Mines situated at northern side of the lease at a distance of 5.3 km. which is under same management control. The quantity of waste to be handled during the life of the mine is approximately, 47.17 million tonnes. Considering a specific gravity of 2.5 t/cu.m and a bulking factor of 40%, the volume of overburden generation will be 26.42 million cum.

TABLE – 4.4a

ULTIMATE DIMENSION OF IRON ORE WASTE DUMPS AT CONCEPTUAL STAGE

Details of Dump	Waste Dump No.1	Waste Dump No.4	Waste Dump No.5	Waste Dump No.8
Dump area at the base	4.08 ha	20.03 ha	54.20 ha	14.92 ha
RL at the base of the dump	705 m	670 m	640 m	635 m
RL at the top of the dump	750 m	725 m	720 m	670 m
Height of Dump	45 m (in three terraces)	55 m (in three terraces)	80 m (in five terraces)	35 m (in three terraces)
Overall slope at conceptual stage	$< 28^o$	$< 28^o$	$< 28^o$	$< 28^o$
Total capacity of dump	0.5 MCum	5.99 MCuM	13.66 MCuM	5.25 MCuM

TABLE- 4.4b

ULTIMATE DIMENSION OF IRON ORE SUBGRADE DUMPS AT CONCEPTUAL STAGE

Details of Dump	Subgrade Dump No.1A	Subgrade Dump No.2A	Subgrade Dump No.2	Subgrade Dump No.3	Subgrade Dump No.6
Dump area at the base	13.8 ha	11.90 ha	24.13	11.26	33.7
RL at the base of the dump	642 m	642 m	700	665	652
RL at the top of the dump	695 m	705 m	745	695	720
Height of Dump	53 m (in two terraces)	63 m (in two terraces)	45(in three terraces)	30 m(in two terraces)	68 m(in four terraces)
Overall slope at conceptual stage	$<28^o$	$<28^o$	$< 28^o$	$< 28^o$	$< 28^o$
Total capacity of dump	2.3 MCum	1.83 MCum	4.1 MCum	1.5 MCum	16.8 MCum

TABLE – 4.4c
DIMENSION OF MANGANESE ORE WASTE DUMPS AT CONCEPTUAL STAGE

Details of Dump	Dump No.1	Dump No.2	Dump No.3 (New)	External Dump at Joda West Manganese Mine
Dump area at the base (ha.)	5.080	5.500	12.000 ha.	3.240 ha.
RL at the base of the dump	542 m	547 m	560 m	524 m (Bottom of exhausted pit)
RL at the top of the dump	586 m	597 m	620 m	582 m
Height of Dump	44 mtr. (Three terraces)	50 mtr. (Four terrace)	60 mtr. (Four terrace)	30 mtr. (Four terrace above ground level)
Total capacity of dump	4.5 LCuM	6.35 LCuM	35 LCuM	9 LCuM (Additional holding capacity will increase by 6 LCuM by merging the lifts in eastern side with existing dumps of Joda West Manganese Mine.
Reclamation and rehabilitation measures of waste dump.	After rehandling of the material, subsequent afforestation by method of contour trenching and pitting will be undertaken in the coming years and top floor will be used for mineral storage		The dump will remain active during plan period. After exhaustion, the dump shall be fully rehabilitated by afforestation.	The dump will remain active till 2014-15. The open terraces in the western side shall be rehabilitated by plantation during subsequent years.

The overburden generated incidental to manganese ore mining is proposed to be used for backfilling the manganese pits.

Dumps are designed to be in stages and stabilized through natural compaction by movement of heavy vehicles. Garland drain and toe-wall have been provided along the entire outer periphery of the existing dumps.
The land degradation by way of dumping of waste during the conceptual period (End of life of mine) and the proposed reclamation measures are given in Table: 4.6.

The waste & subgrade proposed to be generated during the plan period for iron and manganese mining is given below:

TABLE: 4.4d
GENERATION OF SUBGRADE & WASTE DURING THE NEXT FIVE YEARS
IRON ORE

(in million Tonnes)

YEAR	SUBGRADE	WASTE	TOTAL EXCAVATAION
2013-14	2.45	3.76	6.21
2014-15	2.83	3.91	6.74
2015-16	4.40	3.37	7.77
2016-17	1.86	2.70	4.56
2017-18	2.55	1.86	4.41
TOTAL	14.09	15.60	29.69

TABLE: 4.4e
GENERATION OF WASTE DURING THE NEXT FIVE YEARS
MANGANESE ORE

(All figures are in Tonnes)

Year	Waste (CuM)
2013-14	511760
2014-15	617040
2015-16	617040
2016-17	662400
2017-18	710000
Total	3178240

During the plan period,it is proposed that the subgrade dumps shall be stabilized by grass plantation as in future the subgrade shall be fed to the plant after the introduction of beneficiation technology to beneficiate the subgrade ore. Whereas the waste dumps shall be stabilized by planting trees.

The proposed reclamation measures during the plan period are given below in Table No. 4.4f:

Table: 4.4f

PROPOSED RECLAMATION OF DUMPS DURING THE PLAN PERIOD

Year	Location	Area	Saplings	Proposed reclamation
2013-14	Manganese waste dump no.-1	1.0 ha	2500	Afforestation over dump slopes by tree plantation
	Manganese waste dump no.-2	0.75 ha	1875	Afforestation over dump slopes by tree plantation
2014-15	Manganese waste dump no.-1	1.0 ha	2500	Afforestation over dump slopes by tree plantation
	Manganese waste dump no.-2	0.75 ha	1875	Afforestation over dump slopes by tree plantation
	Iron ore waste dump no.-1	0.5 ha	1250	Afforestation over dump slopes by tree plantation
2015-16	Iron ore waste dump no.-1	1.5 ha	3750	Afforestation over dump slopes by tree plantation
	Manganese waste dump no.-1	1.0 ha	2500	Afforestation over dump slopes by tree plantation
2016-17	Iron ore waste dump no.-5	2.0 ha	5000	Afforestation over dump slopes by tree plantation
	Iron ore subgrade dump no.- 3	2.0 ha	5000	Afforestation over dump slopes by grass plantation
2017-18	Iron ore waste dump no.-5	4.0 ha	10000	Afforestation over dump slopes by tree plantation
	Iron ore subgrade dump no.- 6	2.0 ha	5000	Afforestation over dump slopes by grass plantation

The year wise proposal for plantation is given below:

Table: 4.4g

YEAR	PROPOSED PLANTATION
2013-14	4375
2014-15	5625
2015-16	6250
2016-17	10000
2017-18	15000
TOTAL	41250

All the proposed dumps will be developed by retreat method of dumping with ultimate slope of the dump is maintained at less than 28 degrees. Each terrace shall have inward slope with catch drains at the inward side of the terrace. The catch drains of the individual terrace shall be connected to the garland drain outside the periphery of the dump. Each terrace shall also have a provision of berms at the outer end to reduce gully formation due to rain water wash offs.

Iron subgrade dump No. 3 is in operation and has been developed by advance method of dumping, therefore, the same has been proposed to continue.

4.5 Topsoil Management:

About 109.01 ha fresh areas are likely to be broken for mining purpose during the plan period. Any top-soil generated shall be stacked separately at an earmarked place as indicated in drawing no. MP/KIMM/R2/10/12 and shall be used for subsequent afforestation programme.

4.6 Tailing Dam Management: Mentioned in section8 of Part- B

4.7 Infrastructure:

During the plan period, the mining shall be expanded into new area for meeting increased requirement of steel plant. It shall be associated with installation of new beneficiation plant alongwith stacking, reclaiming, conveying and loading facilities. Other infrastructure development during the next five years includes preparation of approach road from Joda to Khondbond, haul roads for new mining pits, erection of power transmission line, laying of water pipe lines and water withdrawal facilities, laying of slurry pipeline from beneficiation plant to slime dam, laying of pipeline from slime dams to processing plant for recovery of water from slime dams, maintenance complex, workshop, administrative buildings (including canteen, first aids station, time office), explosive magazine and slime dam.

During the final closure, all the movable infrastructure such as conveyors belts, power lines, HEMM and plant machinery etc. are proposed to be transferred for use in other

establishments of the company. It is proposed that all access roads to the mine will be permanently blocked by cutting of large-size trenches. The other permanent establishments, which include office buildings etc., are proposed to be dismantled. There is no residential colony within the lease area.

It has also been envisaged that during the plan period, after commissioning of new beneficiation plant, existing crushing & screening plant located at ñQò-orebody may be dismantled and transported to other units of the company.

4.8 Disposal of Mining Machinery:

During the Final Mine Closure, all the Heavy Earth Moving Machinery such as drills, shovels, dumpers, dozers, graders etc. and associated service vehicles such as explosive vans, water tankers etc. shall be dismantled and transferred to other establishments of the company. The machinery in the beneficiation plant, such as crushers and screens, etc. shall also be de-commissioned and transferred to other establishments of the company, based on the need. In the event, these machineries cannot be utilized in-house, they shall be sold/auctioned to other entrepreneurs, as decided by the management.

4.9 Safety & Security: During the Closure stage following Safety and Security measures shall be adopted.

(i) During the closure period, entry to all access roads to the mine, be marked ñMINE ROADï TRESSPASSING PROHIBITEDò.

(ii) The top of every mine working is proposed to be adequately fenced so as to prevent any inadvertent fall within the pit.

(iii) The top of every slime dam shall be adequately fenced so as to prevent any inadvertent fall.

(iv) Toe-wall with adequate height is proposed to be provided around every dump to prevent rolling of boulders and to avoid any person from approaching the tip of the dump slope.

(v) Buildings of permanent nature such as, Office buildings, workshops, stores, magazine etc. and the residential colony is proposed to be handed over to government / non-government organization involved in the development of the area in future. Buildings which cannot be handed over for beneficial use shall be demolished and the area afforested.

4.10 Disaster Management and Risk Assessment: Potential risks which may cause severe environmental degradation with or without the damage to properties, loss of life or serious bodily injuries are assessed based on the identified environmental impacts of all operations carried out in the mine. The potential emergency situations at Khondbond Iron & Mn. Mine may arise from the following causes:

(i) Damage to lubricant and HSD storage chambers / tankers
(ii) Failure of slime dam / check dams
(iii) Explosions (in magazine, HSD tankers / storage chambers, LPG storage)
(iv) Fire

Action plan to deal with the above emergency situations are as follows:

No.	Emergency Situation	Steps to deal with the emergency
(i)	Damage to lubricant and HSD storage chambers / tankers	(a) Shift injured personnel, if any, to hospital (b) Cordon of the area (c) Plug the leakages, as far as possible (d) Stop the spillages spreading to larger areas (e) Arrange to collect the spilled material, as far as possible (f) Arrange to scrap the contaminated ground, if possible and dispose of the same as oily waste (g) Assess the impact and restore the normal situation
(ii)	Failure of slime dam / check dams	(a) Arrange medical assistance, in case of injury (b) Block and plug the leakages with cement / sand bags (c) Intimate the people downstream or those likely to be affected by Public Address System (d) Assess the water quality leaving the lease area and environmental impacts
(iii)	Explosions / Fire	(a) Cordon of the area (b) Shift injured personnel, if any, to hospital (c) Arrange water tanker / fire brigade to deal with the fire (d) Roll call to search for missing person (e) Assess the impact and restore the normal situation (f) Investigate reasons for failure and take necessary corrective action for future

4.11 Care and maintenance during temporary discontinuance: During temporary discontinuance, the following shall be complied.

(i) All access roads to the mine site are proposed to be stopped by a temporary drop gate.

(ii) Display boards are proposed in the access roads indicating ñMine Closed Temporarily ï No Trespassers Allowedò.

(iii)The top of every mine working is proposed to be adequately fenced so as to prevent any inadvertent fall within the pit.

(iv)Toe-wall with adequate height is proposed around every dump to prevent rolling of boulders and avoid any person from approaching the tip of the dump inadvertently.

The abandoned area shall be inspected once in every week by security personnel to determine any incident of illegal activity and once in a month by the Mining Engineer / Manager of the mine to determine any unsafe condition that may have developed during the period.

5.0 ECONOMIC REPURCUSSIONS OF CLOSURE OF MINE AND MANPOWER RETRENCHMENTS:

Presently the local population constitutes a significant fraction of the direct employment. Over the years such people have been trained in various vocations and they form a part of the semi-skilled and skilled employees. After the mine closure, such population is likely to engage themselves either in other neighboring mines or may take up entrepreneurship in their own profession, such as motor garage, workshops, general & electrical repairs etc.

Iron ore mining operations at Khondbond is fully mechanized and the employment in the mine is mostly in the semi-skilled and highly-skilled category. During closure of the mine, such employees will be transferred to the other working units depending upon the need.

Manganese ore mining operations are semi-mechanised, wherein the ore sorting and raising operations are manual in nature. After the closure of the mine, such population may be engaged in similar operations in other mines in the area or in other units of the company on the basis of their skill and requirement at that point of time.

Other employees who cannot be provided with alternative employment will be separated from the company, as per the provisions of the government rules prevalent at the point of time.

Khondbond lease lies in the iron ore and manganese ore mining belt. There are many iron and manganese ore mines located around the lease area. The satellite operations around this region have grown up over the years to cater to the requirement of all these mines. Therefore discontinuance of mining operations at Khondbond alone is not likely to affect these satellite operations.

6. TIME SCHEDULING FOR ABANDONMENT

The mine closure activity is proposed to be spread over 3 years (12 quarters). Tentative time scheduling for abandonment operations is given below in the form of a Bar Chart.

Activities	Quarterly Time frame for completion of jobs for mine closure operation from date of cessation of production
Quarter →	1 2 3 4 5 6 7 8 9 10 11 12
Reclamation of mined out land	About 456.415ha of the Mined Out land to be reclaimed concurrently during the active mining operation. Remaining 130 ha. of mined out area shall be reclamation by afforestation as per the scheduled mentioned below:
Waste dump Management	Dumps to be reclaimed during the active mining period.
Tailing Dam Management	Out of 113 ha area of tailing dam,about 80ha area to be reclamation during the active mining operation.Remaining about 33 ha will be reclaimed by afforestation as per the scheduled mentioned below:
De-commissioning of infrastructure	Infrastructure shall be dismantled and area shall be reclamation by afforestation as per the scheduled mentioned below:
Safety & Security	
Disposal of Mining Machinery	
Air & Water quality monitoring	

7. ABANDONMENT COST:

Tentative abandonment cost has been estimated based on the activities discussed above and as per the present rate and given below

Activity	Work Description	Approximate cost (in Rs. Lakhs)
Reclamation of mined out land	Reclamation of about 130 ha mined out land by plantation of about 2,70,000 saplings	53.44
Reclamation of Tailing Dam	Reclamation of about 33 ha are by plantation of about 65,000 saplings	12.80
De-commissioning of infrastructure	(1) Dismantling and / or ï To be realized from auction / sale (2) Reclamation of 88.542 ha area by plantation of about 2,80,000 saplings @ 2500 per ha	- 42.74
Disposal of Machinery	Dismantling and / or transportation ï To be realized from auction / sale	-
Total		108.98

Table: 7.1:
ITEMWISE EXPENDITURE PROPOSAL FOR FY14

ITEMS	DETAILS	AREA (HECT.)	QUANTITY	EXPENDITURE (Rs.)	REMARKS
		PROPOSED	PROPOSED	PROPOSED	
(A) RECLAMATION & REHABILITATION OF MINED OUT LAND AREA.	(i) Backfilling	NIL	NIL	NIL	
	(ii) Afforestation on the backfilled area.	NIL	NIL	NIL	
	(iii) Others (please specify) e.g Afforestation exhausted benches.	NIL	NIL	NIL	
	(iv) Pisciculture	NIL	NIL	NIL	
	(v) Converting into water reservoir.	NIL	NIL	NIL	
	(vi) Picnic Spot.	NIL	NIL	NIL	
(B) STABILIZATION & REHABILITAION OF DUMPS (with lease)	(i) Terracing	NIL	NIL	NIL	
	(ii) Pitching.	NIL	NIL	NIL	
	(iii) Construction of parapet Walls/Retaining wall at toe of dumps.	1250mx1.2mx1m	1500 cum	6,75,000	Around Dumps
		400mx1.2mx1m	480 cum	216000	Along corridor(Mn part)
	(iv) Constructions of Check Dams along slope of valleys etc.				
	(v) Construction of Garland drain	1250mx1mx1m	1250 cum	156250	
	(vi) Construction of Settling Ponds	15x4x4 m	240 cum	40,800	
	(vii) De silting of settling ponds, channels.			50,000	Lumpsum Expenditure
	(viii) Afforestation on dumps.	1.75 ha	4375	2,62,500	
	(ix) Others (Please specify)	NIL	NIL	0	
(C) REHABILITAITON OF BARREN AREA WITHIN LEASE	(i) Afforestation (Green belt building)	NIL	NIL	0	
	(ii) Other (Please specify)	NIL	NIL	0	
(D) ENVIRONMENTAL MONITORING (Core zone & Buffer Zone separately)	(i) Ambient Air Quality			1,50,000	Includes administrative, manpower, equipment, chemical expenditure.
	(ii) Water Quality			55,000	
	(iii) Noise Level Survey			32,000	
	(iv) Ground Vibration			2,45,000	
	(v) Soil Testing			25,000	
	TOTAL			19,07,550	

RQP: TATA STEEL LIMITED
REGN. No. : RQP/CAL/039/87/B
Signature of Key Person

Awnish Kumar

Table: 7.2:
ITEMWISE EXPENDITURE PROPOSAL FOR FY15

ITEMS	DETAILS	AREA (HECT.)	QUANTITY	EXPENDITURE (Rs.)	REMARKS
		PROPOSED	PROPOSED	PROPOSED	
(A) RECLAMATION & REHABILITATION OF MINED OUT LAND AREA.	(i) Backfilling	NIL	NIL	NIL	
	(ii) Afforestation on the backfilled area.	NIL	NIL	NIL	
	(iii) Others (please specify) e.g Afforestation exhausted benches.	NIL	NIL	NIL	
	(iv) Pisciculture	NIL	NIL	NIL	
	(v) Converting into water reservoir.	NIL	NIL	NIL	
	(vi) Picnic Spot.	NIL	NIL	NIL	
(B) STABILIZATION & REHABILITAION OF DUMPS (with lease)	(i) Terracing	NIL	NIL	NIL	
	(ii) Pitching.	NIL	NIL	NIL	
	(iii) Construction of parapet Walls/Retaining wall at toe of dumps.	1800mx1.2mx1m	2160 cum	9,72,000	Around Dumps
		400mx1.2mx1m	600 cum	2,16,000	Along corridor(Mn part)
	(iv) Constructions of Check Dams along slope of valleys etc.	35x3x4 m	420 cum	71,400	
	(v) Construction of Garland drain	1800 m	1800 cum	2,25,000	
	(vi) Construction of Settling Ponds	15x4x4 m	240 cum	40,800	
	(vii) De silting of settling ponds, channels.			50,000	Lumpsum Expenditure
	(viii) Afforestation on dumps.	2.25 ha	56250	3,37,500	
	(ix) Others (Please specify)	NIL	NIL	0	
(C) REHABILITAITON OF BARREN AREA WITHIN LEASE	(i) Afforestation (Green belt building)	NIL	NIL	0	
	(ii) Other (Please specify)	NIL	NIL	0	
(E) ENVIRONMENTAL MONITORING (Core zone & Buffer Zone separately)	(i) Ambient Air Quality			1,50,000	Includes administrative, manpower, equipment, chemical expenditure.
	(ii) Water Quality			55,000	
	(iii) Noise Level Survey			32,000	
	(iv) Ground Vibration			2,45,000	
	(v) Soil Testing			25,000	
	TOTAL			24,19,700	

Table: 7.3:
ITEMWISE EXPENDITURE PROPOSAL FOR FY16

ITEMS	DETAILS	AREA (HECT.)	QUANTITY	EXPENDITURE (Rs.)	REMARKS
		PROPOSED	PROPOSED	PROPOSED	
(A) RECLAMATION & REHABILITATION OF MINED OUT LAND AREA.	(i) Backfilling	NIL	NIL	NIL	
	(ii) Afforestation on the backfilled area.	NIL	NIL	NIL	
	(iii) Others (please specify) e.g Afforestation exhausted benches.	NIL	NIL	NIL	
	(iv) Pisciculture	NIL	NIL	NIL	
	(v) Converting into water reservoir.	NIL	NIL	NIL	
	(vi) Picnic Spot.	NIL	NIL	NIL	
(B) STABILIZATION & REHABILITAION OF DUMPS (with lease)	(i) Terracing	NIL	NIL	NIL	
	(ii) Pitching.	NIL	NIL	NIL	
	(iii) Construction of parapet Walls/Retaining wall at toe of dumps.	2600mx1.2mx1m	3120 cum	14,04,000	Around dumpd
		375mx1.2mx1m	450 cum	2,02,500	Along corridor(Mn part)
	(iv) Constructions of Check Dams along slope of valleys etc.	35x3x4 m	420 cum	71,400	
	(v) Construction of Garland drain	2600 mx1mx1m	2600 cum	3,25,000	
	(vi) Construction of Settling Ponds				
	(vii) De silting of settling ponds, channels.			50,000	Lumpsum Expenditure
	(viii) Afforestation on dumps.	2.5 ha	6250	3,75,000	
	(ix) Others (Please specify)	NIL	NIL	NIL	
(C) REHABILITAITON OF BARREN AREA WITHIN LEASE	(i) Afforestation (Green belt building)	NIL	NIL	NIL	
	(ii) Other (Please specify)	NIL	NIL	NIL	
(F) ENVIRONMENTAL MONITORING (Core zone & Buffer Zone separately)	(i) Ambient Air Quality			1,50,000	Includes administrative, manpower, equipment, chemical expenditure.
	(ii) Water Quality			55,000	
	(iii) Noise Level Survey			32,000	
	(iv) Ground Vibration			2,45,000	
	(v) Soil Testing			25,000	
	TOTAL			29,34,900	

Table: 7.4:
ITEMWISE EXPENDITURE PROPOSAL FOR FY17

ITEMS	DETAILS	AREA (HECT.)	QUANTITY	EXPENDITURE (Rs.)	REMARKS
		PROPOSED	PROPOSED	PROPOSED	
(A) RECLAMATION & REHABILITATION OF MINED OUT LAND AREA.	(i) Backfilling	NIL	NIL	NIL	
	(ii) Afforestation on the backfilled area.	NIL	NIL	NIL	
	(iii) Others (please specify) e.g Afforestation exhausted benches.	NIL	NIL	NIL	
	(iv) Pisciculture	NIL	NIL	NIL	
	(v) Converting into water reservoir.	NIL	NIL	NIL	
	(vi) Picnic Spot.	NIL	NIL	NIL	
(B) STABILIZATION & REHABILITAION OF DUMPS (with lease)	(i) Terracing	NIL	NIL	NIL	
	(ii) Pitching.	NIL	NIL	NIL	
	(iii) Construction of parapet Walls/Retaining wall at toe of dumps.	350mx1.2mx1m	420 cum	189000	
	(iv) Constructions of Check Dams along slope of valleys etc.				
	(v) Construction of Garland drain	350mx1mx1m	350 cum	43750	
	(vi) Construction of Settling Ponds				
	(vii) De silting of settling ponds, channels.			50,000	Lumpsum Expenditure
	(viii) Afforestation on dumps.	4 ha	10000	6,00,000	
	(ix) Others (Please specify)	NIL	NIL	NIL	
(C) REHABILITAITON OF BARREN AREA WITHIN LEASE	(i) Afforestation (Green belt building)	NIL	NIL	NIL	
	(ii) Other (Please specify)	NIL	NIL	NIL	
(G) ENVIRONMENTAL MONITORING (Core zone & Buffer Zone separately)	(i) Ambient Air Quality			1,50,000	Includes administrative, manpower, equipment, chemical expenditure.
	(ii) Water Quality			55,000	
	(iii) Noise Level Survey			32,000	
	(iv) Ground Vibration			2,45,000	
	(v) Soil Testing			25,000	
	TOTAL			1389750	

Table: 7.5:
ITEMWISE EXPENDITURE PROPOSAL FOR FY18

ITEMS	DETAILS	AREA (HECT.)	QUANTITY	EXPENDITURE (Rs.)	REMARKS
		PROPOSED	PROPOSED	PROPOSED	
(A) RECLAMATION & REHABILITATION OF MINED OUT LAND AREA.	(i) Backfilling	NIL	NIL	NIL	
	(ii) Afforestation on the backfilled area.	NIL	NIL	NIL	
	(iii) Others (please specify) e.g Afforestation exhausted benches.	NIL	NIL	NIL	
	(iv) Pisciculture	NIL	NIL	NIL	
	(v) Converting into water reservoir.	NIL	NIL	NIL	
	(vi) Picnic Spot.	NIL	NIL	NIL	
(B) STABILIZATION & REHABILITAION OF DUMPS (with lease)	(i) Terracing	NIL	NIL	NIL	
	(ii) Pitching.	NIL	NIL	NIL	
	(iii) Construction of parapet Walls/Retaining wall at toe of dumps.	300mx1.2m x1m	360 cum	1,62,000	
	(iv) Constructions of Check Dams along slope of valleys etc.				
	(v) Construction of Garland drain	300mx1mx1m	300 cum	37,500	
	(vi) Construction of Settling Ponds				
	(vii) De silting of settling ponds, channels.			50,000	Lumpsum Expenditure
	(viii) Afforestation on dumps.	6 ha	15000	9,00,000	
	(ix) Others (Please specify)	NIL	NIL	NIL	
(C) REHABILITAITON OF BARREN AREA WITHIN LEASE	(i) Afforestation (Green belt building)	NIL	NIL	NIL	
	(ii) Other (Please specify)	NIL	NIL	NIL	
(H) ENVIRONMENTAL MONITORING (Core zone & Buffer Zone separately)	(i) Ambient Air Quality			1,50,000	Includes administrative, manpower, equipment, chemical expenditure.
	(ii) Water Quality			55,000	
	(iii) Noise Level Survey			32,000	
	(iv) Ground Vibration			2,45,000	
	(v) Soil Testing			25,000	
	TOTAL			16,56,500	

8.0 The area considered for calculation of Financial Assurance with applied area of 978.00 ha is given below:

The Financial Assurance has been calculated as per the CCOMôs circular no. 4/2006 dated 17.02.2006.

TABLE – 8.1 (Area in Ha.)

Sl. No.	Head	Area put on use at start of plan	Additional Requirement During plan period	Total	Area considered as fully reclaimed & rehabilitated	Net Area considered for calculation
A	b	c	d	E	f	G
				E=(c+d)		G=(e-f)
1	Area to be excavated	139.920	102.530	242.450		242.450
2	Storage for top soil	0.000	1.000	1.000		1.000
3	Overburden/dump	25.103	102.337	127.440		127.440
4	Mineral storage	6.932	39.138	46.070		46.070
5	Infrastructure (Workshop, administrative building)	4.600	7.680	12.280		12.280
6	Roads, conveyor route, pipe line etc.	19.100	19.960	39.060		39.060
7	Railways	0.000	0.000	0.000		0.000
8	Green Belt	5.962	0.000	5.962		5.962
9	Tailing Pond	0.000	26.210	26.210		26.210
10	Water & Effluent Treatment Plant	0.000	0.350	0.350		0.350
11	Mineral Separation Plant	2.500	18.590	21.090		21.090
12	Township area	0.000	1.000	1.000		1.000
13	Others(Magazine)	0.000	1.557	1.557		1.557
TOTAL		204.117	320.352	524.469		524.469
Un-utilised		773.883		453.531		453.531
Total Applied Area		978.000		978.000		978.000

449.

Financial Assurance(ñAò-CategoryMines) = 524.469X 25000 = Rs. 1,31,11,725/-å Rs.1,31,12,000
(Rs. One Crore Thirty One Lakh Twelve Thousand Only)

Financial Assurance has been submitted is enclosed in Annexure-VII.

9.0 : CERTIFICATE: Enclosed .