MINING PLAN

(Submitted for Approval under Rule 16 of MCR, 2016)

For

"BHADRA IRON ORE MINE"

(M/s. Tungabhadra Minerals Pvt. Ltd., ML No. 2365)

Village: Ittanahalli

Taluka: Sandur, District: Ballari, State: Karnataka

(Open Cast - Category A - Fully Mechanized- Captive Mine)

Type of Land: Donimalai reserve forest

Lease Area: 130.53 Ha.

of

M/s. JSW STEEL LIMITED

IBM Registration No.: IBM/432/2011

Prepared by

B.P. Pandey

B. Tech (Mining)

Qualified Person

INTRODUCTORY NOTE

MINE DESCRIPTION

Bhadra Iron Ore Mine, ML No. 2365, located in Ittanahalli village, Sandur Taluka, Ballari District, over an extent of 130.53 Ha area of Forest Land of Donimalai range is an iron ore mining lease area, proposed to be granted to JSW Steel Limited as per the Letter of Intent of Govt. of Karnataka after e-auction **(Annexure-I).**

Bellary Iron Ore Mines (BIOM) of M/s. Tungabhadra Minerals Pvt. Ltd (TMPL) with Mine Lease No. 2365 is situated in 'Ettinahatti Range' of iron ore deposits in Taranagar village, Sandur Taluk, Bellary District, Karnataka. TMPL is a joint venture company between Salgaocar Mining Pvt. Ltd. of Goa and Mysore Minerals Limited (a Govt. of Karnataka Undertaking) and same has been granted/allotted to M/s. JSW Steel Limited after e-auction. The ML area has an extent of 125.58 ha as per the mining lease deed. The mining lease was first granted in favour of M/s. Mysore Minerals Limited for 20 years period from 30.07.1968 over an area of 728.44 ha, later it was transferred to TMPL in the year 1971. Mining lease was renewed on 04.05.2007 for 20 years w.e.f. 30.08.1988 over an area of 250.58 ha considering the area of 477.86 ha surrendered to forest department on 16.04.1998. Subsequently, a further area of 125 ha was surrendered on 31.12.2004 retaining 125.58 ha as lease area which created a break in continuity of the lease and resulted in two blocks *viz.* KH (Block-I) and UG (Block-II) blocks. Area of KH (Block-I) block is 90.58 ha and UG (Block-II) is 35.0 ha. Mining pit of KH block of 2365 is common for the adjacent lease ML 2366. Mining in Block-II has been done separately.

The Hon'ble Supreme Court of India, considering the severe devastation caused by the unscientific and unregulated mining in Bellary, Chitradurga and Tumkur districts in Karnataka and based on the Macro level Environmental Impact Assessment (EIA) report submitted by the Indian Council of Forestry Research and Education (ICFRE), has directed the Government of Karnataka to *submit* a *Reclamation* and *Rehabilitation (R & R) Plan* for the mines located in these districts. The Government of Karnataka, keeping in view the National Environmental Standards and the commitment for holistic approach for sustainable management of the area affected by mining, has awarded the formulation of R&R Plan to the ICFRE, Dehra Dun, *vide* letter No.DMG/MLS/R&R/2011-12 dated 27.12.2011 and the Director, Department of Mines and Geology, Bangalore, letter No. DMG/MLS/R&R/2011-12/15179 dated 31.03.2012. Accordingly, the R&R Plan of category A & B mines have been prepared in the first phase and that of the category-C mines initiated in second phase.

The mining lease is located in 'Ettinahatti Range' of iron ore deposits near Taranagar village, Sandur Taluk, Ballery District, Karnataka between Latitude 15^0 $07'$ 03.4'' to 15^0 $04'$ 20.4'' N and Longitude 76^0 $37'$ 22.4'' to 76^0 $38'$ 44.8 E. The lease area is situated between 580 to 938 m above msl and it lies in Survey of India Toposheet No. 57 A/12. The ML is situated at a distance of 15 km from Toranagallu

railway station. The nearest rail head for iron ore transport is Bannihatti railway siding at a distance of 7 km from mine. Mine is situated in Donimalai reserve forest.

As per the guidelines for preparation of the R&R Plans approved by the Hon'ble Supreme Court inter-alia provide that the concerned lessees will provide the baseline data to the FIMI for preparation of the draft R & R Plans. The R & R Plans will thereafter be finalized by the ICFRE on behalf of the State Government and which will be considered for approval by the CEC. The lease wise MPAP prescribed in the R & R plans is decided on the basis of (a) the assessed mineral resources (b) the extent of area available for overburden dumps and (c) the infrastructure facilities available in and around the mining leases.

However, as per letter no-61/CEC/SC/2012-PtII dated 20.08.2015, CEC is in view that with regard to the category- C mining leases it may be appropriate that while the R & R Plans for the areas found to be under illegal mining pit / overburden dump etc. are prepared and finalized before auction, the SEMP and MPAP may be prepared and finalized only after the auction of category–C mining leases is held and the successful bidders / lessees provide the baseline data to the FIMI / ICFRE particularly with regard to the extent and location of the areas identified for overburden dumps and the infrastructure facilities such as conveyer system, railway siding and slurry pipeline that are planned to be developed.

Accordingly, the provisional R&R Plan was prepared before auctioning of the mine which was approved by the CEC *vide* letter No. 2-76/CEC/SC/2015 dated 07.10.2015. *Vide* letter No. DMG/MLS/CCA/12/2365/2016-17 dated 26.10.2016, Govt. of Karnataka has issued Letter of Intent (LOI) (enclosed as **Annexure-I**) with reference to e-auction dated 04.10.2016 for grant of iron ore mining lease for "M/s. Tungabhada Minerals Pvt. Ltd., ML No. 2365" Block in Ittanahalli village, Sandur taluk, Bellary district over an extent of 130.53 ha of forest land in Donimalai range to M/s. JSW Steel Ltd., for a period of 50 years with certain conditions (copy of LOI enclosed). Accordingly, Govt. of Karnataka *vide* its letter No. DMG/MLS/CCA/12/2016-17 dated 02.11.2016 requested ICFRE to prepare the final R & R plan.

The information pertaining to all attributes of mining was mainly obtained from the records of the Directorate of Mines and Geology, Govt. of Karnataka up to the extent possible and also from the exploration data of M/s MECL and erstwhile lessee. Information from secondary sources such as EIA report, Mining Scheme, IBM Annual returns etc., was largely utilized for assessing the existing environmental status of the mine.

To ensure raw material self-sufficiency, JSW Steel Limited, having its integrated steel plant with an installed capacity of 18 Million Tons (i,e 12 Million Tons at Vijayanagar works, Karnataka, 5 Million

Tons at Dolvi, Maharashtra & 1 Million Ton at Salem, Tamilnadu), also decided to take part in aforesaid auction. JSW Steel Limited had been awarded this mining block vide **LOI** no. DMG/MLS/CCA/12/2365/2016-17 **(Annexure-I).**

The Department of Mines & Geology, in its LOI dated 26.10.2016, had directed M/s JSW Steel Limited to obtain all consents, approvals, permits, no objections and the like as may be required under applicable law before signing the MDPA. The Hon'ble Supreme court vide its judgement dated 30.07.2015 ordered to transfer the existing statutory clearances of previous lessees in favor of new lessees, who have obtained the blocks in the auction. Accordingly, the Director of Mines and Geology has furnished Forest Clearance **(Annexure-VII)** and Environmental clearance **(Annexure-VI)** of previous lessee. Accordingly, the Mining Plan is being submitted for 1.50 MTPA, as recommended in R & R Plan prepared by ICFRE and also duly concurred by Central Empowered Committee. Monitoring Committee has also issued a letter vide letter No.MC/R&R/CCA/2016-17/97/731 dated 29th May 2017 **(Annexure-II)** prescribing 1.25 MT as permissible annual production limit of iron ore which is the EC capacity of previous lessee. However, the mining plan is prepared for 1.50 MTPA and would be seeking fresh environment clearance in this behalf.

The Mining Plan is prepared as per the new lease boundary finalized by joint survey team constituted by CEC and is being submitted to IBM Bengaluru, as per Rule 16 of MCR, 2016, in compliance of clause no 3.2 (a)(iv) of Letter of Intent (LOI) issued by Government of Karnataka and also prescribed under sec.5 (2)(b) of MMDR amendment act,2016 for grant of Mining Lease.

Salient Features of Approved R & R Plan:

The R&R plan is aimed to protect the environment from further degradation by implementing suitable site specific bio-engineering measures for the encroached areas, inactive overburden/ waste dumps, seasonal water courses/ nalas, etc., taking into consideration, the hydrological condition on the micro watershed basins and compatibility of the surrounding area, stability and drainage density.

The plan includes enlisting of the existing as well as proposed engineering structures within and outside the ML area and their detailed cost estimation. Accordingly, a variety of engineering structures encompassing toe walls, garland drains, check dams, rainwater harvesting pits, silt settling tanks, etc., have been proposed for the protection of inactive and encroached waste dumps and the nalas in the lease area. Biological measures for management of overburden dumps, mine pit area, refractory sites, mine drainage, haul roads, etc., are suggested by providing an exhaustive list of indigenous species having multiple uses suitable for afforestation in these areas.

The R & R plan will also provide the essential insight into environmentally safe planning of mining activities in future. The engineering and biological measures have been proposed in this connection like,

retaining walls at the toe of waste dumps, garland drain all terraces, fixing geo textile in outer surfaces of waste dumps. As a part of water surface management, gully plugs, masonry check dams, rock filled check dams, stone masonry settling tanks are being proposed. Afforestation for stabilization of waste dumps, green belt in safety zone has been also suggested.

R & R programme is aimed to produce an ecosystem which fulfils and encourages the development of flora, fauna and soil characteristics similar to that of the pre mining stage. Regular monitoring of the all the measures taken in the lease area is essential for achieving the true spirit of Reclamation and Rehabilitation.

Based on the availability of Mineral reserves, dump capacity, volume of traffic and further planning for the resources, annual production levels are fixed. In case of this lease, an annual production level of 1.50 Million Tonnes per annum is considered as the feasible production level based on the reserves capacity, which is lowest amongst all the criteria considered. Accordingly, the waste generated will be accommodated in active dump and stabilization of the dump will be as per R & R plan. Criteria for estimation of permissible production limit are as below:

Sl. No.	Criteria	Feasible Production Limit (Million Tonnes Per Annum)
1	Reserves	1.50
2	Dump Capacity	1.80
3	Road Capacity	1.74

Out of the above criteria, feasible production capacity based on reserves i.e., 1.50 MTPA is the lowest and the same may be considered as the permissible production capacity of the mine for the next 20 years. The indicative cost estimated for the engineering and biological measure for Reclamation and Rehabilitation Plan of the encroached area, surface water management and green belt works out to be approx. Rs. 776.93 lakhs (Rupees Seven Crore Seventy-Six Lakhs and Ninety-Three Thousand only). The cost for implementation of Social Management Plan (SMP), Biodiversity Management Plan, monitoring and implementation of R&R plan, capacity building of the personal involved, infrastructure etc., is not being proposed and shall be met from the annual sale proceeds from the mines and may be transferred to Special Impose vehicle (SPV) as per the guidelines issued by CEC for the purpose of taking up various ameliorative and mitigation measures in district Bellary or as decided by task force to be constituted as per the recommendation of Macro-level EIA report and the direction of Hon'ble Supreme Court of India for implementation of R&R plan and EMP and finalization of composite plan. The proposed cost is only indicative and the work pertaining to various engineering and biological measures may vary subject to Scheduled rates of Karnataka State. The final dimensions of the engineering structures may be modified depending on the suitability of the local field conditions.

1.0 GENERAL

Table-1.1

a)

Name of lessee	M/s JSW Steel Limited Nominated Owner: Dr. Vinod Nowal Copy of Photo id of Nominated Owner is enclosed as **Annexure V**
Mine code and Rule 45 registration number	Not yet allotted IBM/432/2011 The copy of Certificate is Enclosed as **Annexure IV**
Address	JSW STEEL LIMITED, Mining Division, Near Talur Cross, Po: Vidyanagar, 583275 Taluk: Sandur
District	Ballari
State	Karnataka
Pin code	583275
Phone	08395-245956
Fax	08395-250132
Mobile	+91-9448286155
E-mail id	pandey.binay@jsw.in

b) Status of applicant/lessee:

Listed Public Limited Company

Copy of Memorandum of Association & Registration of Company are enclosed **in Annexure XV & Annexure XVI** respectively**. (Annexure V** shows photo ID of nominated Owner). List of board of directors, Resolution to appoint nominated owner, Letter of authorization to represent the company is enclosed as **Annexure XIX.**

c) Mineral(s) which is are included in the prospecting license (for fresh grant):

Not applicable

d) Mineral(s) which is included in the letter of Intent / lease deed:

Iron Ore

e) Mineral(s) which the lessee intends to mine:

Iron Ore

f) Name of Qualified Persons preparing Mining Plan

Name	Mr. B P Pandey
Qualification	B. Tech (Mining) (Qualification and Experience certificate attached as **Annexure III**
Address	S-2/14, Po: Vidyanagar, JSW Steel Limited., Sandur (Taluk), Ballari (District)
Phone	08395-245956
Fax	08395-250132
Mobile	+91-9448286155
E-mail id	pandey.binay@jsw.in

2.0 LOCATION AND ACCESSIBILITY

a) Lease Details (Existing Mine)

Name of the mine	Bhadra Iron Ore Mine (M/s. Tungabhadra Minerals Pvt. Ltd ML 2365)
Latitude/longitude of any boundary point	LBS -1 Latitude - 15° 06' 49.7" Longitude - 76° 37' 44.4" There are 21 corner pillars and lat/long values of these pillars are given in the sketch enclosed as key plan and surface plan **Plate-01** and **Plate-03** respectively and also listed in **Table-1.2**
Date of grant of lease	LoI grant date (26/10/2016)
Period/Expiry Date	50 years as per MMDR (Amendment) Act-2015
Name of the Lease Holder	M/s JSW Steel Limited.
Postal Address	JSW STEEL LIMITED., Mining Division, Near Talur Cross, Po: Vidyanagar, 583275 Taluk: Sandur
District	Ballari
State	Karnataka
Pin code	583119
Phone	08395-245956
Fax	08395-250132
Mobile	+91-9448286155
E-mail id	pandey.binay@jsw.in

b) Details of lease area with location map

Forest		Non-Forest	
Forest	**Area (Ha)**	**Non-forest**	**Area**
Donimalai Reserved Forest	130.53	i) Waste land ii) Grazing Land iii) Agriculture Land iv) Others	-
CEC sketch as enclosed in **Plate-02** Mahazar copy enclosed as **Annexure VIII**			

Total lease area	130.53 Ha
District & State	Ballari Dist, Karnataka State
Taluka	Sandur
Village	Ittanahalli
Whether the area falls under Coastal Regulation Zone (CRZ)?	No
Existence of public road/railway line, if any nearby and approximate distance	A Public Road connecting Bannihatti to Lingadahalli is around 6.5 km from mine boundary. The nearest railway station is Bannihatti Railway Siding is around 8 km from mine boundary.
Topo-sheet No. with latitude & longitude of all corner boundary point/pillar	Topo sheet no –57 A/12 Lat. / Long values are given in table below

Table 1.2: Latitude and longitudes of the corner pillars of the lease area (Datum WGS-1984) -

Sl No	Boundary Pillar No.	Co-ordinates	
		Northing	Easting
1	LBS-1	15°06'49.7"	76°37'44.4"
2	LBS-2	15°07'00.8"	76°37'22.4"
3	LBS-3	15°07'02.7"	76°37'23.8"
4	LBS-3A	15°06'02.6"	76°37'25.7"
5	LBS-3B	15°06'02.5"	76°37'29.3"
6	LBS-3C	15°07'03.0"	76°37'33.9"
7	LBS-4	15°07'03.3"	76°37'38.4"
8	LBS-4A	15°07'03.4"	76°37'47.4"

9	LBS-5	15°07'03.1"	76°37'52.9"
10	LBS-6	15°06'29.9"	76°37'54.2"
11	LBS-7	15°06'24.1"	76°37'47.5"
12	LBS-8	15°06'04.6"	76°37'00.0"
13	LBS-10	15°06'14.7"	76°37'12.5"
14	LBS-11	15°05'3.1"	76°37'16.2"
15	LBS-13	15°05'52.4"	76°37'56.2"
16	LBS-14	15°06'41.7"	76°37'28.5"
17	LBS-16	15°04'43.8"	76°37'35.1"
18	LBS-17	15°04'32.5"	76°37'43.1"
19	LBS-18	15°04'20.4"	76°37'44.8"
20	LBS-19	15°04'20.6"	76°37'26.8"
21	LBS-20	15°04'43.3"	'76°37'26.2"

The Ground Control Points (GCP) points are cement structures made at those points as there are no permanent points nearby lease area. These are shown in Surface Plan and photographs of boundary pillars and GCP are enclosed.

Table –1.3 (a): Ground control points (GCP) (Datum WGS-1984) for Block - I

GCP No.	**Co-ordinates**		**Distance and Direction**
	Northing	**Easting**	
GCP-1 From LBC-3	15^0 07’10.7’’	76^0 38’00.4’’	78.243 m Towards NW
2	15^0 07’04.5’’	76^0 37’37.5’’	45.796 m Towards NW
3	15^0 07’04.1’’	76^0 37’51.9’’	43.185 m Towards NW

Table –1.3 (b): Ground control points (GCP) (Datum WGS-1984) for Block - II

GCP No.	**Co-ordinates**		**Distance and Direction**
	Northing	**Easting**	
GCP-1 From LBC-16	$15^0$05’02.39’’	76^0 39’18.08’’	1403.3 m Towards -NE
GCP-2 From LBC-17	$15^0$04’34.17’’	76^0 39’28.52’’	1356.1 m Towards-E
GCP-3 From LBC-18	$15^0$04’14.56’’	76^0 39’13.05’’	862.5 m Towards-SE

The photos of Boundary pillars, GCP, and mine are enclosed in **Annexure XIV**

c) Location Map:

A general location map is attached as **Plate-01A** on administrative map and precise map showing lease area and access routes with area marked on a Survey of India topo-sheet of 1:50,000 scale as **Plate-01**. CEC sketch of the area is enclosed as **Plate-02.**

3.0 DETAILS OF APPROVED MINING PLAN

3.1) Date and reference of earlier approved Mining Plan

Not applicable as this is first Mining Plan after Issue of LOI to JSW Steel Limited.

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

Not applicable as this is first Mining Plan after Issue of LOI to JSW Steel Limited.

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

Not applicable as this is first Mining Plan after Issue of LOI to JSW Steel Limited.

3.4) Status of compliance of violations pointed out by IBM

Not applicable as this is first Mining Plan after Issue of LOI to JSW Steel Limited.

3.5) Indicate and give details of any suspension/closure/prohibitory order issued by any Government agency under any rule or Court of law:

Not applicable as this is first Mining Plan after Issue of LOI to JSW Steel Limited.

3.6) In case the MP/SOM is submitted under rules 9 and 10 of the MCDR 88 or under rule 17(3) of the MCR' 2016 for approval of modification, specify reason and justification for modification under these rules.

Not applicable.

PART – A

1.0 GEOLOGY AND EXPLORATION

a) Description of the topography, drainage pattern, vegetation, climate, and rainfall data of the mining lease area.

(i) Topography

The Lease area of Bhadra Iron ore mine (M/s Tungabhadra Minerals Pvt. Ltd., ML No. 2365) is covered under Survey of India topo-sheet no.57A/12 and bound by latitude $15^0$06'43.63" to $15^0$06'41.26" and longitude $76^0$37'25.38" to $76^0$37'26.66". The mine lease area has the strike extension of about 950 m length along the NNW-SSE within the wide area of about 100-250 m. The mine lease area includes quite extensive slope area. The area has Sub-dendritic pattern of drainage. The lease area is surrounded by forest lands. Majority of the land with-in the buffer-zone consists of hilly tract with ultimate spurs and valleys.

Physiography of the area is characterized by two elongated ridges trending NNW-SSE. The western ridge is named as Ramandurg range and the eastern ridge is named as Donimalai range and the E-W trending South East extension of Ramandurg range is called Kumaraswamy range. The height of these hill ranges is between 600 m to 950 m from MSL.

(ii) Drainage Pattern

Naturally, no rain water accumulates in the lease area. The rain water flows from hill slopes and it does not accumulate till it reaches the lower valleys. Hence, the drainage pattern is sub-dendritic in nature and is typical of the hilly area.

A total number of 12 *nalas* are originating from the lease are of 2365-I and 2366, while, 3 are originating from the lease area of 2365-II (Block-II). On the northern side of the lease area of 2365-I, 2 *nalas* are running and are blocked by the OB dump (AD-1/EID-1). There is another *nala* originating from N-E side of the lease area of 2366. From the S-E corner of the ML area of 2365-I and 2366, two primary *nalas* are originating. All the above *nalas* are joining together at the northern side of the ML area and are emptying into *Narihalla* stream. Another three *nalas* are originating from the western cliff of the ML area and are joining together and flowing towards north, emptying into the Narihalla stream and finally into the *Daroji* tank. From the ML area of Block-II, three *nalas* are originating towards north and north-east and are emptying into a tank near Marutla Village. The *nalas* from the western side of the ML area are flowing towards north, joining the downstream of *Narihalla* stream and finally emptying into the *Daroji* tank.

(iii) Vegetation

Even though the mining lease is in the forest, there is no growth of trees worth the name. Only small

bushes, shrubs and trees are seen in the area here and there. The density of forest is only 0.4. The impact on forest due to proposed mining is very minimal. The exposure of hard laterites are partially seen in the mine lease area and the vegetation around the area is mixed open jungle of neither commercial nor medicinal value.

(iv) Climate

The Sandur Schist Belt area of Ballari district experience dry semiarid climate with annual rainfall varying from 40cm to 80cm. The monsoon begins in June first week and continues up to September and winter from the month of October to January is somewhat pleasant however, hot to very hot summer is from the month of February to May**.**

(v) Rainfall Data

The annual rainfall in Sandur varies from 40cm to 80cm. The rainfall is mostly (60.22%) confined to the period from June to September. During south west monsoon (October to November) 22.21% of the annual rainfall is recieved, and another 17.57% of rainfall occurs as sporadic in other months of the year.

b) Brief description of Regional Geology with Reference to Location of lease

Lease area of Bhadra Iron Ore Mine (M/s Tungabhadra Minerals Pvt. Ltd., M.L. No. 2365) falls on Donimalai range of Sandur Schist Belt, at a distance of about 20 kms from Sandur.

The area is covered in Survey of India Toposheet No.57 A/12 **(Plate-01)**. The mine lease area has the strike extension of about 950 m length along the NNW-SSE within the wide area of about 100-250 m.

The Ballari-Hospet region forms a part of the 'Sandur Schist Belt' referable as the "Dharwars" a group of Precambrian schistose rocks of Mysore. The lithological units include green stones which are the metamorphosed into basic igneous rocks occupying the valley regions, with phyllite-quartzites forming the canoe-shaped amphitheatre of hill, trending NNW-SSE and enclosing Sandur. The phyllites are locally shale and the quartzites are of the nature of banded hematite jaspers (BHJ), and banded hematite quartizites, interbanded with each other. The banded hematite jaspers, the important source rocks for the iron ores in the area are prominent in the northern and western part of the ranges, whereas the associated shales become prominent in the southern and eastern parts of the area. The iron ores form a capping over the quartizites and shales and overlie a sequence of manganiferous phyllitic rocks. Lateralization is widespread in most of the flat topped ridges.

The Sandur Schist Belt is known for its economic deposits of Iron and Manganese and studied in detail by many prominent workers like New Bold (1838), Foote (1895), Roy and Biswas(1983), Martin and Mukhopadhyay (1987 & 1993), Naqvi et.al. (1987) on various aspects like depositional environment, structure etc. Iron ore, banded ferruginous cherty quartzite, are intimately associated with gabbro of pre-tectonic and post tectonic origin.

Structurally, the Sandur hills form a tightly folded synclinorium, plunging gently to NNW and the hill

ranges broadly delineate the folded limbs of synclines, with close repetition of strata due to minor folds. The strike of the ore bodies is generally parallel to the trend of the hill ranges, the dips are often steep, and being vertical in a number of places posing dip s towards NE and SW are found as in the Ramandurg and NEB ranges respectively.

The stratigraphic succession of Sandur Schist belt

Nandihalli formation	Metabasalt, metagabbro, acid volcanics and intercalated bands of greywacke-argillite, etc.
Donimalai formation	Banded ferruginous or pyrite ferrous chert (with its various metamorphic equivalents), metabasalt/amphibolite, metagabbro, andesitic tuff, acid volcanics, conglomerate, meta-greywacke and metapelites, (garnet-mica schist, andalusite schist, cordierite-garnet gneiss, etc.)
Deogiri formation	a. Manganiferous greywacke-argillite, with some bands of banded ferruginous chert and thin dolomitic limestone. b. Metabasalt and rare acid tuff. c. Arenites, dolomitic limestone and phyllite.
Yeshwantnagar formation	Metabasalt/amphibolite with meta-pyroxenite, metagabbro and thin intercalated bands of quartzite and quartz-mica schist.
Peninsular gneiss: (banded granodiorite/tonalite gneiss)	

(Source: Stratigraphy and Structure of the Sandur Schist Belt, Karnataka, Abhinaba Roy and SK Biswas in Journal of Geological Society of India, Vol. 24. Jan. 1983)

The manganese ore deposits are mainly concentrated along the western part of the Sandur schist belt and restricted to Lower Deogiri formations. The important deposits are found in the Kammathuru, Yeshwantnagar and Ramdurg areas. The chief ores are wad and psilomelane and usually they occur as a mixture of wad and psilomelane. The better grades of ores are found in the Kumaraswamy area. Lateritization has played an important role in the concentration of manganese and iron deposits in the profile, giving rise to rich accumulation of manganese and iron ore for which this schist belt is well known *(Source: Geology of Karnataka-BP Radhakrishna & R Vaidyanathan).*

Yeshwantnagar Formation: This formation is dominated by metamorphosed ultramafic rocks, metagabbro and amphibolites on the south western margin of the schist belt.

Deogiri Formation: The sedimentary sequence overlies the amphibolites of the Yeshwanth nagar formation. The lowest of the formation are mostly greywacke and the top most are manganiferous grey

wacks which immediately underlie the lowest banded chert of Ramanmala Formation. The grey wacks are commonly calcareous. Much of the manganiferous grey wacks occur as secondary concentrations of oxides or hydroxides in the form of nodules or encrustations on fractures.

Ramanmala Formation: The lower of the Ramanmala formation is dominated by banded ferruginous cherts and interbedded amphibolites. The chert layers increase in number along the strike of the formation from north-west to south-east. Many of these chert layers are banded iron formations which are host to economic deposits of secondary haematite on the top of the Ramanmala and Deogiri hill ranges.

Donimalai Formation: This formation comprises amphibolites and banded ferruginous cherts with subordinate polymict conglomerate and greywacks. Numerous banded units of chert characterise the Donimalai Formation. They vary in thickness from 10 to 100m. The banded haematite-enriched types of rocks have magnetite, Jasper and pyrite rich cherts to non-ferruginous grey cherts.

Taluru Formation: The formation mostly comprises of schistose amphibolites and pillow structured metabesalts, which are host to thin, but persistent intercalations of banded cherts and local pods of coarse grained grey carbonates. The lower of the formation comprises inter bedded banded ferruginous cherts, schistose chlorite carbonate rich amphibolites and siliceous schist.

Vibhutigudda Formation: The hill ranges northeast of Donimalai range includes formations comprising sedimentary and volcanic rocks such as greywacks and banded ferruginous chert that immediately overlies the amphibolites of the Taluru formations.

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

The rock formations belong to the iron ore stage of Dharwar system. The general sequence of rock formations found in the area is as given below,

- Soil Cover/ Float Ore
- Banded Heamatite Quartzite (BHQ)
- Iron Ore Formation
- Shale/ Phyllites

Soil Cover/ Float Ore

Since the mine has been in operation for several decades before falling into 'C' category, hence area is already considered as broken up. There is no likelihood of generation of topsoil. However if, some quantity is generated during the mining operations from lease area, at the same time it will be used for afforestation purpose.

Banded Hematite Quartzite's (BHQ)

The Banded Hematite Quartzite's is exposed in the area of ML Block-I and Block-II in the form of discontinuous bands at places along the hill slopes. The BHQ exposed in patches over the iron ore formation, is banded in nature and following the trend of the iron ore formation with dip of 55˚ to 68˚ towards west. The BHQ in the area is considered as waste due to low Fe content and exhibit, fine grained, cherry red in color and has metallic luster.

Iron Ore Formation

The iron ore formation/ Deposit of the lease area is a part of donimalai range and it is known for good quality of iron ore. In this area the iron deposit is in the form of reef with BHQ, Shale-Phillete. The mining lease area is divided by two blocks namely Block-I and Block-II.

Block-I

In this Block there are two iron ore bands are passing through the lease area. One band is exactly middle of the area with dimensions 1500m x 40m x 50m (Length x width x Depth) another band is passing through the eastern side of the lease area with dimension 1300m x 10m x 20m (Length x width x Depth), all iron ore bands are passing with direction NNW-SSE with the dip angle is around 55^0 to 68^0 west.

The iron ore formation occurs in the form of a reef having reddish brown in color and hard metallic luster. The ore is occurring in the form of lumps and fines with the ration 70:30 is observed in many places. The quality of iron ore is good and with grade varies from +45 to 65+ of fe content, and intercalated waste is also minimum, hence recoverable ore in this area is considered as 95%.

Block-II

In this Block there are two iron ore bands are passing through the lease area. One band is western side of the area with dimensions 600m x 30m x 20m (Length x width x Depth). Another band is passing through the eastern side of the lease area with dimension 400m x 10m x 10m (Length x width x Depth), all iron ore bands are passing with direction NNW-SSE with the dip angle is around 55^0 to 62^0 west.

The iron ore formation occurs in the form of a reef having reddish brown in color and metallic luster. The ore is occurring in the form of lumps and fines with the ratio 70:30 respectively is observed in many places. The iron ore bands occur in this block with in the BHQ, hence the quality of the iron ore varies from +45 to <58. and intercalated waste is very high as compared to Block-I, hence recoverable ore in this area is considered as 90%.

Considering the above mentioned orebody dimensions and also the exploratory drilling carried out by M/s MECL, the total mineralized area established so far is 63.30 Ha.

Dimension	Block-I	Block-II
Trend	NNW-SSE/Steep Westerly dip	NNW-SSE/Steep Westerly dip
Strike length (m)	1700m	710m
Average Wide area (m)	200-300m (Main Band)	250-300m (50m Western band, 90m lean-zone and 150 m Eastern band)

The iron ore band persists even beyond the explore depth is evitable as could be visualizes from the geological cross sections.

Shale/ Ferruginous Clay

Shale / Ferruginous Clay are exposed as wall rocks at places and also exposed within the iron ore formation, as intercalated waste. It is light yellow to light pinkish red in color.

The shape of the ore body

The shape of the ore body on the cross section line has been obtained by interpretation and correlation of the borehole data. Each borehole gives a point for the location in space of the ore bottom which, in general is BHQ or siliceous ore.

The possibility of the ore body being in the nature of ore folded sedimentary bed, behaving as a stratigraphic unit was considered. The alternative hypothesis of the ore body, being a leached and replaced portion of some pre- existing rock, in this case the BHQ, appeared to be more realistic and adopted for determination of the ore bottom configuration. The ore bottom was out-lined by joining intersection on adjacent boreholes through smooth lines, though these lines may cut across the general dip of the formation

The shape of the non ore consisting essentially of BHQ at times ferruginous clay has been ascertained by joining the upper limit of the ore zone [>45% Fe] in adjacent boreholes. However, in certain cases the thickness of non ore zone [< 45% Fe] is negligible, while in other sections it is considerable. Or else, the iron band / lens are different one.

The intercalation of ferruginous clay, clayey iron ore and remnant BHQ in the ore body has been impersistent. However, in Block-II the bands of BHQ occur more predominantly

Influence of each cross section has been taken up to half the distance following “rule of gradual change” and “rule of nearest point”. However at the extreme end of the area of exploration (S1-S1’ and S18-S18’) sectional influence up to buffer zone of mine lease area (7.5m from mine lease boundary) has been considered.

In the north western part of the Block-II of the mine lease area specifically beyond borehole MTB 30 over the strike length of 170m, amidst 45-50m wide area, the average true thickness of the ore zone of 30m (RL. 940-914m) has been exposed. Outcrop chip samples have been collected across 50 m interval whose analysis has been provided in table give below.

Sl. no.	**Sample Number**	**Fe**	**SiO_2**	**Al_2O_3**
1.	TMLS 1	66.29	2.80	2.04
2.	TMLS 2	64.50	3.22	2.30
3.	TMLS 3	64.91	4.14	2.81
4.	TMLS 4	62.40	7.42	2.04

d) Details of Exploration Agency

Name of Exploration agency	**M/s Mineral Exploration Corporation Limited**
Address	Dr.Babasaheb Ambedkar Bhawan, Highland Drive Road, Seminary Hills, Nagpur, Maharashtra 440006
E-mail id	headband@mecl.gov.in
Phone No.	0712 251 0310

e) Details of prospecting/exploration already carried out

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

Exploration of the lease area was carried out by M/s MECL. No pitting or trenching was carried out by M/s MECL. As it was a working mine earlier, most of the orebody has been exposed, wherein pits were already available

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

M/s MECL has drilled 4 nos. of Core drill holes (157.50m) and 36 nos. of RC drill holes (2431.00m). These Boreholes are marked in Geological Plan and the respective borehole logs are enclosed as **Annexure- X**

Table 1.4: Details of boreholes drilled

BH No.	LATITUDE	LONGITUDE	Section
BLOCK - I			
MTBR-1	674691.557	1671133.267	S18-S18’
MTBR-2	675219.966	1670412.991	S7-S7’
MTBR-3	674755.4746	1671052.532	S17-S17’
MTBR-4	674866.9232	1670886.97	S16-S16’
MTBR-5	675277.6613	1670328.912	S6-S6’
MTBR-6	675471.3353	1670089.536	S3-S3’
MTBR-7	675524.99	1670006.62	S2-S2’
MTBR-8	675347.6049	1670245.486	S5-S5’
MTBR-9	674922.4099	1670806.378	S15-S15’
MTBR-10	674815.3013	1670972.113	S16-S16’
MTBR-11	675008.5834	1670663.647	S17-S17’
MTBR-12	674944.8266	1670923.946	S15-S15’
MTBR-13	674997.1647	1670839.166	S14-S14’
MTBR-14	675055.8912	1670753.082	S12-S12’
MTBR-15	675120.148	1670701.026	S10-S10’
MTBR-16	675225.3596	1670535.382	S9-S9’
MTBR-17	675289.1938	1670451.108	S7-S7’
MTBR-18	675190.3799	1670608.115	S9-S9’
MTBR-19	675396.6616	1670157.343	S3-S3’
MTBR-20	675153.123	1670474.843	S8-S8’
MTBR-21	675088.1878	1670543.652	S9-S9’
MTBR-22	674958.6031	1670727.192	S13-S13’
MTBR-23	674837.523	1671112.734	S17-S17’
BLOCK - II			
MTBR-24	675510.0227	1669878.958	SS1-SS1’
MTBR-25	676432.4805	1667581.078	SS6-SS6’
MTBR-26	676452.8865	1667386.546	SS4-SS4’
MTBR-27	676366.7108	1667379.55	SS4-SS4’
MTBR-28	676378.3251	1667478.057	SS5-SS5’
MTBR-29	676420.3917	1667279.414	SS3-SS3’
MTBR-30	676347.9771	1667575.124	SS6-SS6’
MTBR-31	676619.0862	1667206.374	SS2-SS2’
MTBR-32	676467.6844	1667182.879	SS2-SS2’
MTBR-33	676494.7695	1667091.472	SS1-SS1’
MTBR-34	676543.0178	1666994.118	SS1-SS1’
MTBR-35	676642.3827	1667098.616	SS1-SS1’
MTBR-36	676758.1004	1667003.864	SS1-SS1’
MTBR-37	676749.5543	1667105.665	SS1-SS1’
MTBR-38	676554.2393	1667390.035	SS4-SS4’

MTBR-39	676586.7682	1667311.611	SS20-SS20’
MTBR-40	676468.5826	1667689.951	SS3-SS3’

iii) Details of samples analysis indicating type of sample (surface/subsurface from pits/trenches/borehole, etc.):

Total 2524 nos. of Samples of ore and waste from the boreholes were analyzed. Analytical Results of litho-logs and chemical analysis of Borehole samples are enclosed in **Annexure X.** and NABL certificate of Accreditation of MECL laboratory is enclosed as **Annexure XVIII**

iv) Expenditure incurred in various prospecting operations:

Entire prospecting operation of the lease area has been carried out by M/s MECL. The actual expenses incurred by the Government of Karnataka on mine exploration, preparation of Provisional R&R Plans, survey, construction of pillars and DGPS survey, amounts to **INR Rs 6,96,94,1651-(Rupees Six Crores Ninety Six Lakhs Ninety Four Thousand One Hundred And Sixty Five Only).**

f) Surface Plan

The Surface Plan has been prepared on a scale of 1:2000 R.F with contour interval of 5m and is enclosed as **Plate -03**

g) Geological Plan

The Geological Plan has been prepared on a scale of 1:2000 R.F, incorporating already carried out and proposed exploration data, mineralized zone, lithologs, and structural features and is enclosed as **Plate- 04**

h) Geological Section

Based on the Geological Plan, geological Cross Sections has been drawn at an interval of 100 m on a scale of 1:2000 R.F. and enclosed as **Plate-05**

i) Future exploration program:

Most of the area is exposed and MECL has carried out exploration. However, the MECL has estimated reserves under G1, G2 & G3 category. Therefore, to know the variation in the grade and recovery, ascertain the extent and depth and also for converting G3 category to G1 category lessee proposes to drill about 32 vertical core/RC boreholes of about 50 m depth to establish the G1 category and to identify the small ore bands lying within the lease area. The proposed exploration program will commence from second year of the plan period. The Proposed position of the boreholes are marked in the Geological Plan enclosed as **Plate-04**

Table-1.5 (a) Future Exploration Programme

Year	No. of Boreholes (Core/RC/DTH)	Grid Interval	Total Meterage	No. of Pits, Dimensions and Volume	No. of Trenches, Dimensions and Volume	Remarks
I	-	-	-	-	-	Confirmation of Ore reserves, to ascertain the extent and depth of mineralizatio n.
II	15	100x100	750	-	-	
III	27	100x100	1350	-	-	
IV	-	-	-	-	-	
V	-	-	-	-	-	
Total	**42**	**100x100**	**2100**	**-**	**-**	-

Table 1.5 (b) Location of Proposed boreholes

Proposed Year	Bore Hole No.	Latitude	Longitude	Section
II-YEAR	BLOCK - I			
	PBH 01	675595.598	1669933.567	S1-S1’
	PBH 02	675466.8813	1669970.586	S2-S2'
	PBH 03	675629.8484	1670073.385	S2-S2'
	PBH 04	675435.0596	1670067.455	S3-S3’
	PBH 05	675566.1112	1670149.941	S3-S3’
	PBH 06	675440.0121	1670185.309	S4-S4’
	PBH 07	675408.4161	1670286.405	S5-S5’
	PBH 08	675348.7795	1670374.394	S6-S6’
	PBH 09	675136.0768	1670575.815	S9-S9’
	PBH 10	675022.4246	1670642.487	S10-S10’
	PBH-19	675407.63	1669933.21	S2-S2’
	PBH-20	675365.74	1670023.55	S3-S3’
	PBH-21	675316.06	1670107.12	S4-S4’
	PBH-22	675274.51	1670200.00	S5-S5’
	PBH-23	675206.23	1670284.47	S6-S6’
	PBH-24	675155.98	1670368.18	S7-S7’
III-YEAR	PBH 11	675071.289	1670670.304	S10-S10’
	PBH 12	674979.1025	1670703.396	S11-S11’
	PBH 13	675011.8613	1670725.93	S12-S12’

	PBH 14	674951.4014	1670808.667	S13-S13’
	PBH 15	674894.6771	1670892.934	S15-S15’
	PBH 16	674832.7731	1670982.987	S16-S16’
	PBH 17	674768.5251	1671069.832	S17-S17’
	PBH 18	674723.4583	1671154.011	S18-S18’
	Block-II			
	PBH 25	676605.17	1667017.95	SS1-SS1’
	PBH 26	676538.59	1667097.83	SS2-SS2’
	PBH 27	676687.93	1667106.04	SS2-SS2’
	PBH 28	676576.01	1667156.58	SS3-SS3’
	PBH 29	676432.59	1667203.26	SS3-SS3’
	PBH 30	676663.35	1667213.73	SS3-SS3’
III-YEAR	PBH 31	676531.90	1667267.96	SS4-SS4’
	PBH 32	676457.65	1667312.12	SS4-SS4’
	PBH 33	676513.15	1667352.83	SS5-SS5’
	PBH 34	676576.87	1667397.44	SS5-SS5’
	PBH 35	676486.86	1667449.65	SS6-SS6’
	PBH 36	676408.51	1667484.78	SS6-SS6’
	PBH 37	676565.22	1667491.90	SS6-SS6’
	PBH 38	676386.96	1667584.77	SS7-SS7’
	PBH 39	676524.57	1667593.02	SS7-SS7’
	PBH 40	676453.96	1667644.72	SS7-SS7’
	PBH 41	676341.39	1667689.53	SS8-SS8’
	PBH 42	676385.60	1667690.64	SS8-SS8’

j) Mineral Reserves/Resources as per UNFC with respect to the threshold value notified by IBM

(i) Mineralisation

All the materials analyzing more than 45% and above have been considered as ore. The ore exhibits vide variations of physical properties ranging from compact, hard and massive ore to soft, flaky, laminated, granular, unconsolidated sandy blue dust or reddish brown powdery ore. However, categorization/classification of ore based on quantitative data such as hard, soft, laminated, powdery etc., have been possible based on mine data (size range or granulometry). It is based on physical properties like color, presence or absence of weakness, cohesiveness of the grains etc. This lithological classification helped in revealing a strati graphical picture of the relative preponderance of different ore

types. The iron ore in nature is not homogeneous, but consists of a mixture of many ore types. Hence, practical approach of demarcating the ore zones based on predominant nature of the lithology/ore substantiated with analytical data have been applied.

(ii) Types of Ores

Various types of iron ores are derived from hematite viz. massive ore, laminated ore and blue dust.

Type of Ore	Characteristic Features
Lateritic	Porous and cavernous in nature
Laminated	Closely spaced laminae, which give rise to biscuity ores.
Blue dust (-)10 mesh	Ore constituting of hematite and martite
Massive (Hematitic)	No planar structure

The blue dust consists of 10-15% of (-) 100 mesh size fractions and above 80% of (-)100 to (-)325 mesh size.

Besides the float ore gets accumulated along the slope and foot hills which are of more pure in iron content. In Ballari-Hospet region also the float ore occurs with >64% Fe. The gangue materials are of shale pieces, banded hematite quartzite, dolerite and clay. If lateritisation is extensive, the alumina to silica ratio will be high.

Type of Ore	Fe%
Massive ore (Hematitic)	67.69
Compact laminated ore	67
Powdery ore	65
Laminated ore	65

(iii) Grade Classification

The exploration efforts in 70’s were mainly for lumpy ores. Fines were not given economic importance. Similarly, exploration will also be required to categorize the ore reserves based on end user’s grade classifications. At threshold cutoff of 45% Fe as stipulated by IBM and at 55% Fe cutoff, the mineralized zones within the lease hold area have been delineated and presented in the **Table-1.6**

Table 1.6 : Details of Iron Ore Zone Intersected in The Boreholes (At 45% Fe Cut-Off)

Bore Hole Number	From (m)	To (m)	Thickness (m)	True Thickness (m)	Fe%	SiO2%	Al2O3%
MTBR 1	0.00	87.00	87.00	83.52	58.76	7.82	4.10
MTBR 2	0.00	95.00	95.00	91.20	47.32	28.97	1.51
MTBR 3	0.00	57.00	57.00	54.72	66.89	1.40	1.55
MTB 4	12.00	57.00	45.00	43.20	66.35	2.27	1.53
MTBR 5	64.00	65.00	1.00	0.96	46.63	31.04	1.79
MTBR 5	73.00	115.00	42.00	40.32	45.62	30.01	2.29
MTBR 6	69.00	75.00	6.00	5.76	48.16	21.72	2.34
MTBR 7	0.00	14.00	14.00	13.44	53.77	18.90	2.46
MTBR 8	3.00	12.00	9.00	8.64	52.04	21.24	0.98
MTBR 8	18.00	20.00	2.00	1.92	48.85	24.36	2.73
MTBR 8	34.00	35.00	1.00	0.96	45.79	26.26	4.59
MTBR 9	2.00	45.00	43.00	41.28	51.15	16.81	5.53
MTBR 10	18.00	58.00	40.00	38.40	57.09	12.34	3.95
MTBR 11	26.00	84.00	58.00	55.68	62.80	5.02	2.63
MTBR 14	0.00	10.00	10.00	9.60	60.00	7.83	3.23
MTBR 15	5.00	17.00	12.00	11.52	59.70	7.42	5.06
MTBR 16	0.00	9.00	9.00	8.64	65.33	2.38	1.99
MTBR 17	0.00	27.00	27.00	25.92	62.70	4.47	3.32
MTBR 18	0.00	17.00	17.00	16.32	51.76	10.27	9.24
MTBR 20	38.00	63.00	25.00	24.00	53.21	20.81	1.76
MTBR 20	96.00	109.00	13.00	12.48	59.79	12.66	1.14
MTBR 21	94.00	96.00	2.00	1.92	54.30	12.04	6.12
MTBR 21	102.00	106.00	4.00	3.84	62.89	6.82	2.55
MTBR 22	42.00	80.00	38.00	36.48	59.23	11.18	2.37
MTB 30	0.00	9.00	9.00	8.64	62.33	8.59	1.62
MTB 31	0.00	33.50	33.50	32.16	50.60	25.07	1.85
MTBR 36	11.00	12.00	1.00	0.96	57.55	9.42	4.34
MTBR 37	18.00	22.00	4.00	3.84	61.21	6.26	5.23

(iv) Mineralisation Factor

Mineralogy of an iron deposit has a great influence in the ore treatment characteristics and economics. Magnetite is recoverable by relatively simple, economical magnetic separation while, hematite, goethite,

siderite require expensive roasting or flotation processes. Although when the grains are coarse, hematite ore may get treated with low cost. Mineralisation factor is the ratio of net ore bearing area to gross area. It is referred as the co-efficient of impurities. The mineralized area for M/s Tungabhadra Minerals Pvt. Ltd., Mine Lease Area (ML No. 2365) is 0.1137 km^2 out of total area of 1.25 km^2

(v) Physical Characteristics of Ore

The ore are massive + laminated, soft laminated, blue dust, lateritic and powdery. Principal ore minerals are hematite + magnetite, goethite and limonite. The iron content ranges from 62.7% to 65.5% in blue dust. Besides lumpy ore and massive ore, rarely blue dust occurs in M/s Tungabhadra Minerals Pvt. Ltd., Mine Lease Area (ML No. 2365).

(vi) Chemical Characteristics of the Iron Ore

In the entire deposit, the high grade ore is almost free from lateralization and the laterite area is very less (2-3%), whereas the blue dust area ranges about 10-15%. However, the blue dust mostly contains more hematite; therefore, good quantity of hematitic ore could be easily available from the blue dust. The hematitic ore persists even beyond the level of exploration as could be visualize from the geological cross sections.

Silica to Alumina ratio ranges between 0.90 and 16.59 with the average of 5.56 indicating low level of lateralization; whereas the Iron to Alumina ratio ranges from 8.10 to 43.36 with average of 23.00 for the M/s Tungabhadra Minerals Pvt. Ltd., Mine Lease Area (ML No. 2365). The ore in general, is rich in iron [>56%Fe], but they also contain 2.80% Al_2O_3. Owing to the association of iron bearing minerals more with laterite and clayey gangue than with siliceous minerals, the alumina to silica ratio is generally greater than one.

(vii) Estimation of Reserves / Resources and Grade

After delineating the limit of non-ore (<45%) and boundaries of different litho- units, the geometry of the ore body have been demarcated and the sectional area or volume has been computed by the software using AutoCAD. Thus, the volume has been calculated by multiplying the sectional area with sectional influence.

Ore resource tonnage has been estimated by multiplying the volume with the tonnage factor of specific gravity of 3. The sum has been considered as geological in-situ reserves.

At the back drop of iron ore extraction from the Sandur schist belt of Bellary – Hospet area since independence has been quite predominant. More over iron ore has been extracted from Kumaraswamy range not only by NMDC but also by SMIORE. However, Dalmia International had extracted the ore from NEB range for export for quite some time.

Therefore, UNFC code pertains to economical, feasibility and geological axis of (111) (121) & (122) have been assigned. The estimates of reserves and resources at 45% Fe cut off are given in Table -1.7 It reveals that the ore body has the extension of about 1700m in strike length along the NNW-SSE with an average wide area of 200-300m. A total 33.89 m.t. of net reserves with average grade of 57.87% Fe, 9.76% SiO_2 and 3.83% Al_2O_3 have been estimated; out of which, Block-I of the lease area accounts for 29.712 m.t. with average grade of 58.76% Fe, 7.82% SiO_2 and 4.10 Al_2O_3 whereas Block-II of the lease area accounts for 4.178 m.t. with average grade of 51.56% Fe, 23.57% SiO2 and 1.96% Al_2O_3. Besides, as an additional resource, which belong to Block-II of mine lease area towards north of bore hole MTB 30 until the lease boundary, is 0.648 m.t. under (G3) of UNFC with an average grade of 63.07% Fe, 7.03 SiO_2 and 2.07% Al_2O_3 has also been estimated.

A summary of the category wise Geological reserve estimated for this mine is given in table below:

Table-1.7: Geological Reserves

Category	**UNFC**	**Geological Reserves (tonnes)**
Proved	111	16502172
Probable	122	17388265
Inferred	333	-
Total		33890437
Average Fe %		**58.76%(Block-I) and 51.56%(Block-II)**
Source: Table-5 of Page No. 27-29 of MECL Report		

k) (i) Detailed calculation of reserves /resources section wise

As detailed exploration has been carried out by MECL, the details of estimation of reserves /resources are based on their report. Resources have been estimated by geological cross section method. In order to delineate the ore and non-ore zones, the grade or threshold value of 45% Fe has been adopted, thus non-ore above and below ore zones has been demarcated. At threshold cutoff of 45% Fe as stipulated by IBM, the mineralized zone was demarcated within the lease hold area and the respective ore reserves are estimated.

A total of 26 cross sections has been prepared; out of which, serially numbered S1 – S1' to S18 – S18', 18 sections are from Block-I of the mine lease area from west to east and section numbers SS1-SS1' to SS8-SS8', 8 sections from Block-II of the mine lease area from west to east based on the interpretation of sub surface borehole qualitative data along with surface geological data which is perpendicular to general strike of the ore body

50.0m on either side of the iron ore intersection of the borehole has been placed under (111) and the next

50m under (122) category of UNFC. Correction factor of 1.035 for Thickness of Iron ore in strike direction has been applied. Similarly, a correction factor of 0.96 has been applied to get true thickness. A call factor of 10% reduction has been applied to calculate net geological reserves.

Area explored under different level of exploration has been marked on the geological plan **(Plate No.04).**

As detailed exploration has been carried out by M/s MECL, following data is furnished based on M/s MECL report. Section Wise, Borehole Wise, as well as UNFC Category wise reserves are furnished in the **Table. 1.8 (a) & 1.8(b)**

Detailed calculation of Mineable ore reserves/resources section-wise

TABLE 1.8 (a) : SECTION-WISE, BOREHOLE-WISE, CATEGORY-WISE ORE RESERVES ESTIMATED BY CROSS SECTION METHOD

Section Number	Borehole Number	Intersection (m)		Diff (m)	True Width (m)	Average Sectional Influence (m)	Area (Sq. m) (1)	Area (Sq. m) (2)	Bulk Density	Reserves (Tonnes) (G1)	Reserves (Tonnes) (G2)	Total Reserves (Tonnes)	Grade %		
		From	To										Fe	SiO2	Al2O3
S2-S2'	MTBR 07	0	14	14	13.44	99.4	1197.29	657.44	3.0	357031.878	196048.608	553080.486	53.77	18.9	2.46
											Sub Total	**553080.486**	**53.77**	**18.9**	**2.46**
S3-S3'	MTBR 06	69	75	6	5.76	98	604.86	2977.61	3.0	177828.84	875417.34	1053246.18	48.16	21.72	2.34
											Sub Total	**1053246.18**	**48.16**	**21.72**	**2.34**
S5-S5'	MTBR 08	3	12	9	8.64	104	0	1450	3.0	0	452400	452400	52.04	21.24	0.98
		18	20	2	1.92	104	0	350	3.0	0	109200	109200	48.85	24.36	2.73
											Sub Total	**561600**	**51.43**	**21.84**	**1.32**
S6-S6'	MTMR 07 *	17	21	4	3.84	106	0	84.29	3.0	0	26804.22	26804.22	52.26	9.44	10.45
	MTBR 05	73	115	42	40.32	106	0	11531.5	3.0	0	3667017	3667017	45.62	30.01	2.29
											Sub Total	**3693821.22**	**45.75**	**29.6**	**2.45**
S7-S7'	MTBR 17	0	27	27	25.92	95	2371.78		3.0	675957.3	0	675957.3	62.7	4.47	3.32
	MTBR 02	0	95	95	91.2	95	8218.84	9974.63	3.0	2342369.4	2842769.55	5185138.95	47.32	28.97	1.51
											Sub Total	**5861096.25**	**50.76**	**23.48**	**1.92**
S8-S8'	MTBR 16	0	9	9	8.64	90.4	743.42	214.6	3.0	201615.504	58199.52	259815.024	65.33	2.38	1.99
	MTBR 20	38	63	25	24	90.4	2495.04	1935.33	3.0	676654.848	524861.496	1201516.344	53.21	20.81	1.76
		96	109	13	12.48	90.4	1377.29	5180.71	3.0	373521.048	1405008.55	1778529.6	59.79	12.66	1.14
											Sub Total	**3239860.968**	**57.13**	**15.41**	**1.61**
S9-S9'	MTBR 18	0	17	17	16.32	104.4	0	750.5	3.0	0	235056.6	235056.6	51.76	10.27	9.24
	MTBR 21	94	96	2	1.92	104.4	0	316.97	3.0	0	99275.004	99275.004	54.3	12.04	6.12
		102	106	4	3.84	104.4	0	3046.57	3.0	0	954185.724	954185.724	62.89	6.82	2.55
											Sub Total	**1288517.328**	**55.39**	**9.51**	**6.83**

S10'-S10'	MTBR 15	5	17	12	11.52	72	957.9		3.0	206906.4	0	206906.4	59.7	7.42	5.06
											Sub Total	**206906.4**	**59.7**	**7.42**	**6.83**
S11-S11'	MTBR 11	26	84	58	55.68	39.15	5502.91	2812.43	3.0	646316.78	330319.904	976636.683	62.8	5.02	2.63
											Sub Total	**976636.683**	**62.8**	**5.02**	**2.63**
S12-S12'	MTBR 14	0	10	10	9.6	40.2	608.47		3.0	73381.482	0	73381.482	60	7.83	3.23
											Sub Total	**73381.482**	**60**	**7.83**	**3.23**
S13-S13'	MTBR 22	42	80	38	36.48	52.05	3125.09	5271.79	3.0	487982.804	823190.009	1311172.812	59.23	11.18	2.37
											Sub Total	**1311172.812**	**59.23**	**11.18**	**2.37**
S14-S14'	MTBR 09	2	45	43	41.28	86.85	3147.87		3.0	820177.529	0	820177.5285	51.15	16.81	5.53
											Sub Total	**820177.5285**	**51.15**	**16.81**	**5.53**
S15-S15'	MTB 04	12	57	45	43.2	105	0	6576.91	3.0	0	2071726.65	2071726.65	66.35	2.27	1.53
											Sub Total	**2071726.65**	**66.35**	**2.27**	**1.53**
S16-S16'	MTBR 10	18	58	40	38.4	108.45	0	5048.77	3.0	0	1642617.32	1642617.32	57.09	12.34	3.95
											Sub Total	**1642617.32**	**57.09**	**12.34**	**3.95**
S17-S17'	MTBR 03	0	57	57	54.72	101.15	0	4542.14	3.0	0	4646.3	4646.3	66.89	1.4	1.55
											Sub Total	**4646.3**	**66.89**	**1.4**	**1.55**
S18-S18'	MTBR 01	0	87	87	83.52	137.6	0	7733.78	3.0	0	3192504.38	3192504.384	58.76	7.82	4.1
											Sub Total	**3192504.384**	**58.76**	**7.82**	**4.1**
											Total	**26550992.0**	**58.76**	**7.82**	**4.1**

Geological Insitu Reserves	**26550992.0**			
Net Reserves (tonnes)	**25223442.38**	**58.8**	**7.82**	**4.1**
Net Reserves (million tonnes)	**25.223**			

* - The influence of positive intersections of the bore holes from adjoining mine lease area (ML. No. 2366) has been considered

Estimation of ore reserves by cross section method Tungabhadra Minerals Pvt. Ltd. Mine Lease Area ML. No. 2365 Part II

Section Number	Borehole Number	Intersection (m)		Diff (m)	True Width (m)	Average Sectional Influence (m)	Area (Sq. m) (1)	Area (Sq. m) (2)	Bulk Density	Reserves (Tonnes) (G1)	Reserves (Tonnes) (G2)	Total Reserves (Tonnes)	Grade %		
		From	To										Fe	SiO2	Al2O3
SS2-SS2'	MTBR 37	18	22	4	3.84	104.3	0	467.66	3.0	0	146330.8	146330.814	61.21	6.26	5.23
SS3-SS3'	MTB 31	0	33.5	33.5	32.16	107.65	0	11342.83	3.0	0	3663167	3663166.949	50.6	25.07	1.85
SS7-SS7'	MTB 30	0	9	9	8.64	103.8	0	627.63	3.0	0	195444	195443.982	62.33	8.59	1.62
							Geological Insitu Reserves					**4004941.745**	**51.56**	**23.57**	**1.96**
							Net Reserves (tonnes)					**3604447.57**			
							Net Reserves (million tonnes)					**3.604**			

From field observation, some parameters are considered for estimation of reserve and resources. Parameters are mentioned below.

In Block-I, the quality of iron ore is good and grade varies from +45 to +65 of Fe content, while intercalated waste is also minimum, hence recoverable ore in this area is considered as 95%.

In Block-II the iron ore bands occur within the BHQ, hence the quality of the iron ore is varying from +45 to <58 while intercalated waste is also very high as compared to Block-I, hence recoverable ore in this area is considered as 90%.

Table. 1.8 (b) Detailed calculation of reserves /resources by Slice plan method

GEOLOGICAL IRON ORE RESERVES (Slice wise)

Level	IRON ORE (Block-I)					
	Area sqm.	Vertical Influence Mtr	Volume CuMtr	Recovery 95%	TF	Quantity tons
864	5663.2351	8	45305.9	43041	3.5	142713.5245
856	12416.815	8	99334.5	94368	3.5	312903.7254
848	16686.463	8	133492	126817	3.5	420498.8676
840	57849.894	8	462799	439659	3.5	1457817.334
832	36215.092	8	289721	275235	3.5	912620.3134
824	13345.568	8	106765	101426	3.5	336308.3186
816	23699.093	8	189593	180113	3.5	597217.136
808	23484.918	8	187879	178485	3.5	591819.9336
800	23970.657	8	191765	182177	3.5	604060.5564
792	22929.084	8	183433	174261	3.5	577812.9168
784	33732.488	8	269860	256367	3.5	850058.7077
776	71985.466	8	575884	547090	3.5	1814033.753
768	112278.45	8	898228	853316	3.5	2829416.837
760	112642.46	8	901140	856083	3.5	2838589.869
752	117340.57	8	938725	891788	3.5	2956982.477
744	102261.31	8	818090	777186	3.5	2576984.979
736	62902.375	8	503219	478058	3.5	1585139.847
728	59253.741	8	474030	450328	3.5	1493194.266
720	62502.459	8	500020	475019	3.5	1575061.967
712	41001.845	8	328015	311614	3.5	1033246.489
704	22330.683	8	178645	169713	3.5	562733.2192
696	23864.274	8	190914	181368	3.5	601379.7124
688	24632.204	8	197058	187205	3.5	620731.5458
SUB TOTAL(BLOCK-I)						**27291326.3**
Level	IRON ORE (Block-II)					
	Area sqm.	Vertical Influence Mtr	Volume CuMtr	Recovery 90%	TF	Quantity tons
928	2940.199	8	23521.6	21169	3.5	74093.0148
920	11368.873	8	90951	81856	3.5	286495.6046
912	5296.1457	8	42369.2	38132	3.5	133462.8716
904	7365.193	8	58921.5	53029	3.5	185602.8636
896	10465.375	8	83723	75351	3.5	263727.4601

888	25648.934	8	205191	184672	3.5	646353.1267
880	30434.728	8	243478	219130	3.5	766955.1532
872	41982.239	8	335858	302272	3.5	1057952.42
864	30909.984	8	247280	222552	3.5	778931.5918
856	32460.62	8	259685	233716	3.5	818007.6348
848	31185.279	8	249482	224534	3.5	785869.0384
840	25407.691	8	203262	182935	3.5	640273.8031
832	27331.429	8	218651	196786	3.5	688751.9982
SUB TOTAL (BLOCK-II)						**7126476.581**
TOTAL RESERVE						**34417802.88**

MINEABLE IRON ORE RESERVES (Slice wise)

Level	IRON ORE (Block-I)					
	Area sqm.	Vertical Influence Mtr	Volume CuMtr	Recovery 95%	TF	Quantity tons
864	5663.2351	8	45305.9	43041	3.0	129121.7603
856	12416.815	8	99334.5	94368	3.0	283103.3706
848	16686.463	8	133492	126817	3.0	380451.3564
840	57849.894	8	462799	439659	3.0	1318977.588
832	36215.092	8	289721	275235	3.0	825704.093
824	13345.568	8	106765	101426	3.0	304278.955
816	23699.093	8	189593	180113	3.0	540339.3136
808	23484.918	8	187879	178485	3.0	535456.1304
800	23970.657	8	191765	182177	3.0	546530.9796
792	22929.084	8	183433	174261	3.0	522783.1152
784	33732.488	8	269860	256367	3.0	769100.7355
776	71985.466	8	575884	547090	3.0	1641268.634
768	112278.45	8	898228	853316	3.0	2559948.567
760	112642.46	8	901140	856083	3.0	2568247.976
752	117340.57	8	938725	891788	3.0	2675365.099
744	102261.31	8	818090	777186	3.0	2331557.838
736	62902.375	8	503219	478058	3.0	1434174.148
728	59253.741	8	474030	450328	3.0	1350985.288
720	62502.459	8	500020	475019	3.0	1425056.065
712	41001.845	8	328015	311614	3.0	934842.0614
704	22330.683	8	178645	169713	3.0	509139.5792
696	23864.274	8	190914	181368	3.0	544105.454
688	24632.204	8	197058	187205	3.0	561614.2558
SUB TOTAL(BLOCK-I)						**23392565.4**

Level	IRON ORE (Block-II)					
	Area sqm.	Vertical Influence Mtr	Volume CuMtr	Recovery 90%	TF	Quantity tons
928	2940.199	8	23521.6	21169	3.0	63508.2984
920	11368.873	8	90951	81856	3.0	245567.6611
912	5296.1457	8	42369.2	38132	3.0	114396.7471
904	7365.193	8	58921.5	53029	3.0	159088.1688
896	10465.375	8	83723	75351	3.0	226052.1086
888	25648.934	8	205191	184672	3.0	554016.9658
880	30434.728	8	243478	219130	3.0	657390.1313
872	41982.239	8	335858	302272	3.0	906816.3602
864	30909.984	8	247280	222552	3.0	667655.6501
856	32460.62	8	259685	233716	3.0	701149.4013
848	31185.279	8	249482	224534	3.0	673602.0329
840	25407.691	8	203262	182935	3.0	548806.117
832	27331.429	8	218651	196786	3.0	590358.8556
SUB TOTAL (BLOCK-II)						**6108408.498**
TOTAL RESERVE						**29500973.898**

Bench wise slice plans are enclosed a **Plate No. VIII** (Slice 688, 696, 704.…864 for Block – I and 832,840,848…….928 for Block – II)

Geological reserves are estimated by slice plan method also and compared with respect to the cross sectional method.

The comparison table is given below

Comparison of reserves /resources in tonnes

Iron ore +45% Fe	**Reserves/ Resources**	**Slice Plan Method**	**Cross Sectional Method**	**Variation**
	Geological resources	34417803	33890437	1.56%

From the above it is evident that the geological resources estimated by cross section method is lower than that of by slice plan method and the variance is also within the limits.

Blocked Reserves (211)-Block-I				
Section Number	Sectional influence	Sectional area	Volume	Quantity @ 3 b.d with 95% Rec.
m	m	m2	m3	Tonnes
S1-S1'	0.00	0	-	-
S2-S2'	99.40	8.806	875	2,495
S3-S3'	98.00	32.764	3,211	9,151
S4-S4'	0.00	0	-	-
S5-S5'	104.00	0	-	-
S6-S6'	106.00	11140.2	11,80,862	33,65,456
S7-S7'	95.00	12598.85	11,96,891	34,11,139
S8-S8'	90.40	9797.16	8,85,663	25,24,140
S9-S9'	104.40	3363.971	3,51,199	10,00,916
S10-S10'	72.00	381.282	27,452	78,239
S11-S11'	39.15	6165.525	2,41,380	6,87,934
S12-S12'	40.20	0.000	-	-
S13-S13'	52.05	5325.057	2,77,169	7,89,932
S14-S14'	86.85	968.392	84,105	2,39,699
S15-S15'	105.00	4257.663	4,47,055	12,74,106
S16-S16'	108.45	1325.354	1,43,735	4,09,644
S17-S17'	101.15	1881.596	1,90,323	5,42,422
S18-S18'	137.60	4552.711	6,26,453	17,85,391
Total				1,61,20,663

Blocked Reserve (211)-Block-II				
Section Number	Sectional influence	Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.
m	m	m2	m3	Tonnes
SS1-SS1'	0.00	0	-	-
SS2-SS2'	104.30	0.008	1	2
SS3-SS3'	107.65	413.937	44,560	1,20,313
SS4-SS4'	0.00	0	-	-

SS5-SS5'	0.00	0	-	-
SS6-SS6'	0.00	0	-	-
SS7-SS7'	103.80	41.025	4,258	11,498
SS8-SS8'	0.00	0	-	-
Total				1,31,813

Total Blocked Reserve (211) Block-I & Block-II	**16252476**

Total reserves:

Category	**UNFC**	**Reserves/Resources (tonnes) (A+B-C)**	**Average Grade**
Proved(A)	111	6687757	58.76%(Block-I) and 51.56%(Block-II)
Probable(B)	122	22140133	
Blocked reserves (C)	211	16252476	
Total Mineable reserves **(A+B-C)**		**12575414**	

l) Mineral Resources:

Govt. of Karnataka has provided the estimated geological reserves based on exploration data carried out by M/s. MECL. A total of 26 cross sections comprising 18 sections in KH block and 8 sections in Block-II Block have been prepared by M/s. MECL. Reserves have been estimated considering the following:

(i) Bulk density of 3.5 t/m^3

(ii) Cut-off grade of 45% Fe

(iii) Call factor of 10% reduction

(iv) Correction factor of 1.035 and 0.96 based on the true thickness of the ore body in strike and dip directions respectively.

(v) 50 m on either side of the ore intersection of the bore holes has been placed under 111 and the next 50 m under 122 level of UNFC.

(vi) 7.50 m Buffer zone (safety zone) area has been considered.

Geological reserves have been estimated by M/s. MECL. Whereas, mineable reserves have not been estimated. Bulk density of 3.5 t/m^3 considered by MECL is high. Taking into account physical characteristics and grade of the ore, a bulk density of 3 t/m^3 and 90% of the ore recovery has been considered for estimating the mineable reserves. Following are the details of the reserves estimated:

Details of section wise geological reserves as per MECL is given in Annexure **XI**, a summary of same is

given below:

Category	UNFC	Reserves/Resources (tonnes)	Average Grade
Proved	111	16502172	58.76%(Block-I) and 51.56%(Block-II)
Probable	122	17388265	
Inferred	333	-	
Total		**33890437**	

However mineable reserves have not been estimated by MECL. Taking into account physical characteristics and grade of the ore, a bulk density of 3 t/m^3 and 90% of the ore recovery has been considered for estimating the mineable reserves. The same parameters have also been considered in the approved R&R plan. Following are the details of the reserves estimated:

Category	UNFC	Reserves/Resources (tonnes) (A+B+C)	Average Grade
Proved(A)	111	5406138	58.76%(Block-I) and 51.56%(Block-II)
Probable(B)	122	7169276	
Blocked reserves (C)	211	16252476	
Total		**28827890**	

Table – 1.9: Total resources in tonnes as on 01.01.2017

Level of Exploration	Iron Ore(tonnes)	Average Grade
G1 - Detailed Exploration	6687757	58.76%(Block-I) and 51.56%(Block-II)
G2 - General Exploration	22140133	
G3 – Prospecting	-	
G4- Reconnaissance	-	

ESTIMATION OF RESERVES / RESOURCES AND GRADE

After delineating the limit of non-ore (<45%) and boundaries of different litho- units, the geometry of the ore body have been demarcated. Thus, the sectional area or volume has been computed by the software using AutoCAD.

Ore resource tonnage has been estimated by multiplying the volume with the tonnage factor of specific gravity of 3.50. The sum has been considered as geological in-situ reserves.

At the back drop of iron ore extraction from the leasehold area of Bhadra Iron Ore Mine, (ML No. 2365), over an average strike length of 950m, and 200.00m wide and up to an average thickness (depth) of 50m,

allows us to presume that the iron ore zone has wide consistent continuity. Moreover, iron ore has been extracted from Kumaraswamy range not only by NMDC but also by SMIORE. However, Dalmia International, also extracting the ore from NEB range since Independence only for export. Therefore, UNFC code pertains to economical, feasibility and geological axis of (111) (121) and (121) have been assigned. The reserves estimated by cross section method at 45% Fe cut off are given in Table 1.8(a) for Block-I and Block-II of mine lease area respectively.

It reveals that the ore body has the extension of about 950m in strike length along the NNW-SSE with an average wide area of 200 m.

A total 33.89 m.t. of net reserves with average grade of 57.87% Fe, 9.76% SiO2 and 3.83% Al2O3 have been estimated; out of which, Block-I of the lease area accounts for 29.712 m.t. with average grade of 58.76% Fe, 7.82% SiO2 and 4.10 Al2O3 whereas Block-II of the lease area accounts for 4.178 m.t. with average grade of 51.56% Fe, 23.57% SiO2 and 1.96% Al2O3. Besides, as an additional resource, which belong to Block-II of mine lease area towards north of bore hole MTB 30 until the lease boundary, is 0.648 m.t. under (G3) of UNFC with an average grade of 63.07% Fe, 7.03 SiO_2 and 2.07% Al_2O_3 has also been estimated.

RICE RATIO

Fe: SiO_2 + Al_2O_3 is 5.48 and 4.43 for the Block-I and Block-II respectively for lease lease hold area. The SiO_2 : Al_2O_3 ratio (Block-I) is 5.56 and Fe : Al_2O_3 (Block-I) is 23.00 whereas for Block-II SiO_2 : Al_2O_3 is 6.68 and Fe : Al_2O_3 is 25.84.

Table-1.10: Resources and Reserves in tonnes

Classification	UNFC Code	Iron Ore (tonnes)	Average Grade
A. Total Mineral Reserve			58.76%(Block-I) and 51.56%(Block-II)
1.Proved Mineral Reserve	111	5406138	
2.Probable Mineral Reserve	121&122	7169276	
B. Total Remaining Resources			
1.Feasibility Mineral Resource	211	16252476	
2.Prefeasibility Mineral Resource	221 and 222	-	
3.Measured Mineral Resource	331	-	
4.Indicated Mineral Resource	332	-	
5.Inferred Mineral Resource	333	-	
6.Reconnaissance Mineral Resource	334	-	
Total Reserve + Resources		**28827890**	

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

2.0 MINING

A. Open Cast Mining

a) Brief description of the existing as well as proposed method for excavation with all design parameters indicating on plans /sections

i) Existing Method of Excavation

The mining operations were earlier carried out by open cast, fully mechanized mining method using HEMM. Only one pit has been worked at NW-SE direction spreading all along the length of the lease area. A portion of mine pit was encroached towards east and north . The ML area is divided into two blocks *i.e*., Block-I and Block-II, which were worked on both slopes of the hill all along the strike length of the ML. The mine pit was worked in unsystematic/haphazard manner by selective mining leaving leaner grade and hard strata of ore/non mineralized portion in between. The benches were worked in uneven manner and no regular or systematic benches were formed. The total number of 10-11 benches were worked in the mining pits and an overall pit slope angle is about 45 degrees. The total strike length of the mine working is about 950m for and its width is ranging from 200m to 250m. The average height of the benches is varying between 8-12m and width 8m with slope of 60 degrees. Top most RL is 928m while ultimate pit depth would be 688m.

ii) Proposed Method for Excavation

Fully mechanized open cast method of mining by drilling and blasting and deployment of HEMM equipment like hydraulic excavators, wheel loaders and dumpers, will be undertaken. For this plan period, benches which were worked unsystematically and haphazardly need to be corrected at the beginning, to achieve optimum exploitation of the mineral deposit, the mine will be developed by top slicing, making benches with a height and width of 8m each and keeping the necessary berm width. The slope of faces will be maintained as 80^0-85^0 to horizontal and the direction of advancement will be towards northern side of the proposed working area. These aspects have been depicted on the production & development plans. The ROM excavated will be processed in the mobile crushing and screening plants to obtain the final product and the waste generated will be dumped in the designated places.

The finished products, i.e. lump ore and fine ore will be loaded into tippers and will be stacked at the ore stockyard. As this mine will be used for captive purpose only, entire quantity of finished product from stockyards will be dispatched to JSW Steel Plant by railway wagons (Rakes), trucks. In future pipe conveyor may also be used after carrying out necessary feasibility studies.

The total Mining lease area having two blocks i.e Block – I and Block – II, and Dimensions of pit are given below:

Pit Number	Dimension LXWX D	Top RL	Bottom RL	No. of benches
Block - I	725 x 215 x 136	880	744	17
Block - II	150 x 60 x 40	920	888	5

b) Year-wise tentative Excavation in Cubic Meters indicating development, ROM, pit wise

(i) Insitu Tentative Excavation:

As per the Plans and Production and Development Sections **(Plate no. 6A to 6E & 07** drawn for the designed parameters, the year wise tentative excavation both in Cum. and tonnage is given below:

Table 2.1 (a) Proposed year wise tentative Excavation in Cum (Block-I)

Year	Total tentative Excavation (m^3)	Top soil (m^3)	OB/SB/IB (m^3)	ROM (m^3)		Total Mineral Reject (m^3)	ROM/ waste Ratio
				Ore (m^3)	Intercalated Waste (m^3)		
I	3414520	-	2963887	450633	-	-	**1:6.58**
II	3489645	-	3040922	448723.1	-	-	**1:6.78**
III	1688136	-	1274995	413140.8	-	-	**1:3.09**
IV	2979148	-	2479146	500002	-	-	**1:4.96**
V	1532682	-	1032654	500028.4	-	-	**1:2.07**
Total	**13104131**		**10791603.7**	**2312527.24**	-	-	-

Table 2.1 (b) Proposed year wise tentative Excavation in Cum (Block-II)

Year	Total tentative Excavation (m^3)	Top soil (m^3)	OB/SB/IB (m^3)	ROM (m^3)		Total Mineral Reject (m^3)	ROM/ waste Ratio
				Ore (m^3)	Intercalated Waste (m^3)		
I	55314	-	5902.2	49411.8	-	-	**1:0.12**
II	56981	-	5698.1	51282.9	-	-	**1:0.11**
III	118235	-	31372.4	86862.6	-	-	**1:0.36**
IV	NIL	-	NIL	NIL	-	-	-
V	NIL	-	NIL	NIL	-	-	-
Total	**230530**		**42972.7**	**187557.3**	-	-	-

Table 2.2 (a) Proposed year wise tentative Excavation in Tonnes (Block-I)

Year	Total tentative Excavation (tonnes)	Top Soil (tonnes)	OB/SB/IB (tonnes)	ROM (tonnes)		Total Mineral Reject (tonnes)	ROM/ waste Ratio
				Ore (tonnes)	Intercalated Waste (Tonnes)		
I	**7279672.14**	-	5927773	1351899	-	-	**1: 4.38**
II	**7428013.89**	-	6081845	1346169	-	-	**1: 4.52**
III	**3789412.27**	-	2549990	1239422	-	-	**1: 2.06**
IV	**6458297.88**	-	4958292	1500006	-	-	**1: 3.31**
V	**3565392.99**	-	2065308	1500085	-	-	**1: 1.38**
Total	**28520789.2**	-	**21583207.4**	**6937581.73**	-	-	-

Table 2.2 (b) Proposed year wise tentative Excavation in Tonnes (Block-II)

Year	Total tentative Excavation (tonnes)	Top Soil (tonnes)	OB/SB/IB (tonnes)	ROM (tonnes)		Total Mineral Reject (tonnes)	ROM/ waste Ratio
				Ore (tonnes)	Intercalated Waste (Tonnes)		
I	160039.8	-	11804.4	148235.4	-	-	**1: 0.08**
II	165244.9	-	11396.2	153848.7	-	-	**1: 0.07**
III	323332.6	-	62744.8	260587.8	-	-	**1: 0.24**
IV	NIL	-	NIL	NIL	-	-	-
V	NIL	-	NIL	NIL	-	-	-
Total	**648617.3**	-	**85945.4**	**562671.9**	-	-	-

As the entire ROM (up to threshold value of +45% Fe) is consumed by the JSW steel plant, no mineral rejects are generated.

a) First year development & production

Block-I

From the maps prepared for development and production **Plate No-6A & its Section Plate No-7**, the benches are proposed to be formed between 880 and 824 m Above MSL with 7 benches of width and height of 8 m each for Block-I. For 1st year the total area Proposed for dumping is 14.9 Ha. The average ore to waste ratio works out to be 1:6.58 (in cum) and 1:4.38 (in tonnes). The total saleable ore amounts to 1351899 tonnes, while, the total waste of 5927773 tonnes likely to be generated will be stocked in the dump yard designated for the purpose.

Block-II

From the maps prepared for development and production **Plate No-6A & its Section Plate No-7**, the benches are proposed to be formed between 928 and 912 with 3 benches of width and height of 8 m each for Block-II. For 1st year the total area Proposed for temporary dumping is 3.00 Ha. The average ore to waste ratio works out to be 1:0.12 (in cum) and 1: 0.08 (in tonnes). The total saleable ore amounts to 148235.4 tonnes, while, the total waste of 11804.4 tonnes likely to be generated will be stocked in the dump yard designated for the purpose

b) Second year development & production

Block-I

From the maps prepared for development and production **Plate No-6B & its Section Plate No-7**, the benches are proposed to be formed between 880 and 800 m Above MSL with 10 benches of width and height of 8 m each for Block-I, for 2nd year the total area Proposed for dumping is 14.9 Ha. The average ore to waste ratio works out to be 1:6.78 (in cum) and 1:4.52 (in tonnes). The total saleable ore amounts to 1346169 tonnes, while, the total waste of 6081845 tonnes likely to be generated will be stocked in the dump yard designated for the purpose.

Block-II

From the maps prepared for development and production **Plate No-6B & its Section Plate No-7**, the benches are proposed to be formed between. 928 and 904 with 4 benches of width and height of 8 m each for Block-II For 2nd year the total area Proposed for temporary dumping is 3.00 Ha. The average ore to waste ratio works out to be 1:0.11 (in cum) and 1: 0.07 (in tonnes). The total saleable ore amounts to 153848.7 tonnes, while, the total waste of 11396.2 tonnes likely to be generated will be stocked in the dump yard designated for the purpose.

c) Third year development & production

Block-I

From the maps prepared for development and production **Plate No-6C & its Section Plate No-7**, the benches are proposed to be formed between 880 and 760 m Above MSL with 15 benches of width and height of 8 m each for Block-I. For 3rd year the total area Proposed for dumping is 14.9 The average ore to waste ratio works out to be 1:3.09 (in cum) and 1: 2.06 in tonnes. The total saleable ore amounts to 1239422 tonnes, while, the total waste of 2549990 tonnes likely to be generated will be stocked in the dump yard designated for the purpose.

Block-II

From the maps prepared for development and production **Plate No-6C & its Section Plate No-7**,, the benches are proposed to be formed between 928 and 912 with 3 benches of width and height of 8 m each for Block-II. the benches are proposed to be formed between 928 and 888 with 6 benches of width and height of 8 m each for Block-II. For 3rd year the total area Proposed for temporary dumping is 3.00Ha. The average ore to waste ratio works out to be 1:0.36 (in cum) and 1: 0.24 in tonnes. The total saleable ore amounts to 260587.8 tonnes, while, the total waste of 262744.8 tonnes likely to be generated will be stocked in the dump yard designated for the purpose.

d) Fourth year development & production

From the maps prepared for development and production **Plate No-6D & its Section Plate No-7**, the benches are proposed to be formed between 856 and 744 m Above MSL with 10 benches of width and height of 8 m each for Block-I, for 4th year the proposed dumping area 4.77 Ha. The average ore to waste ratio works out to be 1: 4.96 (in cum) and 1: 3.31 in tonnes. The total saleable ore amounts to 1500006 tonnes, while, the total waste of 4958292 tonnes likely to be generated will be stocked in the dump yard designated for the purpose.

e) Fifth year development & production

From the maps prepared for development and production **Plate No-6E & its Section Plate No-7**, the benches are proposed to be formed between 792 and 744 m Above MSL with 9 benches of width and height of 8 m each for Block-I, for 5th year the proposed dumping area 3.37 Ha. The average ore to waste ratio works out to be 1:2.07 (in cum) and 1:1.38 in tonnes. The total saleable ore amounts to 1500085 tonnes, while, the total waste of 2065308 tonnes likely to be generated will be stocked in the dump yard designated for the purpose.

Year-wise opening and closing balance of mineable reserves is mentioned in **Table 2.3**

Table 2.3 Tentative opening and closing balance of mineable reserves for plan period

Year	Opening balance (Tonnes)	Tentative Yearwise Production (Tonnes)	Closing Balance (Tonnes)
I	12575414	1500000	11075414
II	11075414	1500000	9575414
III	9575414	1500000	8075414
IV	8075414	1500000	6575414
V	6575414	1500000	5075414

First Year:

PRODUCTION AND DEVELOPMENT PLAN - I YEAR

BLOCK - I

SECTION S2 - S2'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+856	99.4	-	-	-	-	**303**	30,144	60,288	60,288
+848	99.4	-	-	-	-	**630**	62,611	1,25,223	1,25,223
+840	99.4	598	59,447	1,60,506	11,889	**338**	33,598	67,196	79,085
+832	99.4	1095	1,08,820	2,93,813	21,764	**184**	18,279	36,559	58,323
+824	99.4	152	15,147	40,898	3,029	**1,365**	1,35,715	2,71,430	2,74,460
Total				**4,95,216**	**36,683**			**5,60,696**	**5,97,379**

SECTION S3 - S3'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+856	98	-	-	-	-	**134**	13,175	26,350	26,350
+848	98	-	-	-	-	**853**	83,626	1,67,252	1,67,252
+840	98	-	-	-	-	**1,573**	1,54,141	3,08,282	3,08,282
+832	98	-	-	-	-	**1,834**	1,79,733	3,59,465	3,59,465
+824	98	-	-	-	-	**1,727**	1,69,285	3,38,570	3,38,570
Total				**-**	-			**11,99,919**	**11,99,919**

SECTION S4 - S4'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+856	98	-	-	-	-	**603**	59,057	1,18,114	1,18,114
+848	98	-	-	-	-	**1,762**	1,72,629	3,45,257	3,45,257
+840	98	-	-	-	-	**1,835**	1,79,871	3,59,743	3,59,743
+832	98	-	-	-	-	**1,707**	1,67,327	3,34,655	3,34,655
+824	98	-	-	-	-	**1,578**	1,54,684	3,09,368	3,09,368
Total				**-**	-			**14,67,136**	**14,67,136**

SECTION S5 - S5'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+880	104	-	-	-	-	**26**	2,694	5,387	5,387
+872	104	-	-	-	-	**112**	11,693	23,385	23,385
+864	104	-	-	-	-	**209**	21,769	43,538	43,538
+856	104	-	-	-	-	**371**	38,581	77,163	77,163
+848	104	-	-	-	-	**1,090**	1,13,388	2,26,776	2,26,776
+840	104	**773**	80,390	2,17,054	16,078	**836**	86,933	1,73,866	1,89,944
+832	104	**160**	16,640	44,928	3,328	**780**	81,094	1,62,188	1,65,516
+824	104	-	-	-	-	**883**	91,816	1,83,632	1,83,632
Total				**2,61,982**	**19,406**			**8,95,935**	**9,15,342**

SECTION S6 - S6'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+872	106	-	-	-	-	**195**	20,657	41,315	41,315
+864	106	**83**	8,808	23,782	1,762	**303**	32,070	64,139	65,901
+856	106	-	-	-	-	**545**	57,817	1,15,634	1,15,634
+848	106	-	-	-	-	**759**	80,454	1,60,909	1,60,909
+840	106	-	-	-	-	**957**	1,01,470	2,02,941	2,02,941
+832	106	-	-	-	-	**1,268**	1,34,445	2,68,890	2,68,890
+824	106	-	-	-	-	**1,388**	1,47,112	2,94,223	2,94,223
Total				**23,782**	**1,762**			**11,48,051**	**11,49,813**

SECTION S7 - S7'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+864	95	**30**	2,834	7,653	567	**88**	8,329	16,659	17,225
+856	95	**132**	12,566	33,928	2,513	**96**	9,080	18,160	20,674
+848	95	**258**	24,485	66,110	4,897	**103**	9,765	19,530	24,427
+840	95	**329**	31,255	84,388	6,251	**264**	25,067	50,134	56,385
+832	95	**321**	30,481	82,298	6,096	**421**	39,995	79,990	86,086
+824	95	**369**	35,095	94,756	7,019	**519**	49,295	98,589	1,05,608
Total				**3,69,132**	**27,343**			**2,83,062**	**3,10,405**

SECTION S8 - S8'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+864	90.4	**36**	3,261	8,806	652	**133**	12,055	24,110	24,762
+856	90.4	**217**	19,628	52,994	3,926	**136**	12,273	24,546	28,472
+848	90.4	**319**	28,874	77,959	5,775	**58**	5,263	10,526	16,301
+840	90.4	**254**	22,973	62,026	4,595	**149**	13,456	26,913	31,507
+832	90.4	-	-	-	-	**462**	41,777	83,555	83,555
+824	90.4	-	-	-	-	**571**	51,592	1,03,183	1,03,183
Total				**2,01,786**	**14,947**			**2,72,833**	**2,87,780**

TOTAL ORE IN MT	**1.352**
Total Ore	**1351899**
Total waste	**5927773**
Ore to waste Ratio	**1 : 4.38**

BLOCK - II

Section Number	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
SS3-SS3'	107	181	19,367	52,291	3,873	-	-	-	3,873
SS7-SS7'	103	345	35,535	95,945	7,107	4	412	824	7,931
Total				**1,48,235**	**10,980**			**824**	**11,804**
Total Ore				***1,48,235***	***Total waste***				***11,804***

TOTAL ORE IN MT	**0.15**
Total Ore	**1,48,235**
Total waste	**11,804**
Ore to waste Ratio	**1:0.08**

TOTAL ORE IN MT (Block-I & Block-II	**1.500**
Total Ore	**1500134**
Total waste	**5939578**
Ore to waste Ratio	**1 : 3.96**

Second Year

PRODUCTION AND DEVELOPMENT PLAN - II YEAR

BLOCK - I

SECTION S2 - S2'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+816	99.4	-	-	-	-	-	-	-	-
+808	99.4	-	-	-	-	-	-	-	-
+800	99.4	-	-	-	-	-	-	-	-
+792	99.4	-	-	-	-	-	-	-	-
+784	99.4	-	-	-	-	-	-	-	-
Total				-	-			-	-

SECTION S3 - S3'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+832	98	-	-	-	-	**20**	1,960	3,920	3,920
+824	98	-	-	-	-	**92**	9,016	18,032	18,032
+816	98	-	-	-	-	**1,690**	1,65,620	3,31,240	3,31,240
+808	98	-	-	-	-	**1,562**	1,53,076	3,06,152	3,06,152
+800	98	-	-	-	-	**1,434**	1,40,532	2,81,064	2,81,064
+792	98	-	-	-	-	-	-	-	-
+784	98	-	-	-	-	-	-	-	-
Total				-	-			9,18,456	**9,18,456**

SECTION S4 - S4'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+816	98	-	-	-	-	**1,451**	1,42,198	2,84,396	2,84,396
+808	98	-	-	-	-	**1,323**	1,29,654	2,59,308	2,59,308
+800	98	-	-	-	-	**1,195**	1,17,110	2,34,220	2,34,220
+792	98	-	-	-	-	-	-	-	-
+784	98	-	-	-	-	-	-	-	-
Total				-	-			7,77,924	**7,77,924**

SECTION S5 - S5'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+832	104	**382**	39,728	1,07,266	7,946	-	-	-	7,946
+824	104	**474**	49,279	1,33,052	9,856	-	-	-	9,856
+816	104	-	-	-	-	**1,228**	1,27,712	2,55,424	2,55,424
+808	104	-	-	-	-	**1,100**	1,14,400	2,28,800	2,28,800
+800	104	-	-	-	-	**972**	1,01,088	2,02,176	2,02,176
+792	104	-	-	-	-	-	-	-	-
+784	104	-	-	-	-	-	-	-	-
Total				2,40,318	17,801			6,86,400	**6,86,400**

SECTION S6 - S6'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+816	106	-	-	-	-	**1,260**	1,33,560	2,67,120	2,67,120
+808	106	-	-	-	-	**1,131**	1,19,886	2,39,772	2,39,772
+800	106	-	-	-	-	**1,003**	1,06,318	2,12,636	2,12,636
+792	106	-	-	-	-	-	-	-	-
+784	106	-	-	-	-	-	-	-	-
Total				-	-			7,19,528	**7,19,528**

SECTION S7 - S7'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+816	95	**853**	81,035	2,18,795	16,207	**293**	27,835	55,670	71,877
+808	95	**950**	90,250	2,43,675	18,050	**133**	12,635	25,270	43,320
+800	95	**940**	89,300	2,41,110	17,860	**96**	9,120	18,240	36,100
+792	95	-	-	-	-	-	-	-	-
+784	95	-	-	-	-	-	-	-	-
Total				7,03,580	52,117			**99,180**	**1,51,297**

SECTION S8 - S8'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+816	90.4	-	-	-	-	**757**	68,433	1,36,866	1,36,866
+808	90.4	-	-	-	-	**956**	86,422	1,72,845	1,72,845
+800	90.4	-	-	-	-	**1,137**	1,02,785	2,05,570	2,05,570
+792	90.4	-	-	-	-	-	-	-	-
+784	90.4	-	-	-	-	-	-	-	-
Total				-	-			5,15,280	**5,15,280**

SECTION S9 - S9'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+896	104.4	-	-	-	-	-	-	-	-
+888	104.4	-	-	-	-	-	-	-	-
+880	104.4	-	-	-	-	-	-	-	-
+872	104.4	-	-	-	-	-	-	-	-
+864	104.4	-	-	-	-	**9**	919	1,837	1,837
+856	104.4	**37**	3,863	10,430	773	**131**	13,676	27,353	28,125
+848	104.4	**290**	30,276	81,745	6,055	**122**	12,737	25,474	31,529
+840	104.4	**390**	40,716	1,09,933	8,143	**76**	7,934	15,869	24,012
+832	104.4	**31**	3,236	8,738	647	**471**	49,172	98,345	98,992
+824	104.4	-	-	-	-	**498**	51,991	1,03,982	1,03,982
+816	104.4	-	-	-	-	**649**	67,756	1,35,511	1,35,511
+808	104.4	-	-	-	-	**792**	82,685	1,65,370	1,65,370
+800	104.4	-	-	-	-	**1,098**	1,14,631	2,29,262	2,29,262
+792	104.4	-	-	-	-	-	-	-	-
+784	104.4	-	-	-	-	-	-	-	-
Total				**2,10,846**	**15,618**			**8,03,003**	**8,18,621**

SECTION S10 - S10'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+896	72	-	-	-	-	-	-	-	-
+888	72	-	-	-	-	-	-	-	-
+880	72	-	-	-	-	-	-	-	-
+872	72	-	-	-	-	**18**	1,296	2,592	2,592
+864	72	-	-	-	-	**215**	15,480	30,960	30,960
+856	72	-	-	-	-	**280**	20,160	40,320	40,320
+848	72	-	-	-	-	**331**	23,832	47,664	47,664
+840	72	**95**	6,840	18,468	1,368	**263**	18,936	37,872	39,240
+832	72	**388**	27,936	75,427	5,587	-	-	-	5,587
+824	72	**93**	6,696	18,079	1,339	**310**	22,320	44,640	45,979
+816	72	-	-	-	-	**413**	29,736	59,472	59,472
+808	72	-	-	-	-	**489**	35,208	70,416	70,416
+800	72	-	-	-	-	**547**	39,384	78,768	78,768
+792	72	-	-	-	-	**665**	47,880	95,760	95,760
+784	72	-	-	-	-	**816**	58,752	1,17,504	1,17,504
Total				**1,11,974**	**8,294**			**6,25,968**	**6,34,262**

SECTION S11 - S11'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+896	39.15	-	-	-	-	-	-	-	-
+888	39.15	-	-	-	-	-	-	-	-
+880	39.15	-	-	-	-	-	-	-	-
+872	39.15	-	-	-	-	-	-	-	-
+864	39.15	-	-	-	-	-	-	-	-
+856	39.15	-	-	-	-	-	-	-	-
+848	39.15	-	-	-	-	**111**	4,346	8,691	8,691
+840	39.15	-	-	-	-	**346**	13,546	27,092	27,092
+832	39.15	-	-	-	-	**530**	20,750	41,499	41,499
+824	39.15	-	-	-	-	**544**	21,298	42,595	42,595
+816	39.15	-	-	-	-	**583**	22,824	45,649	45,649
+808	39.15	-	-	-	-	**611**	23,921	47,841	47,841
+800	39.15	-	-	-	-	**659**	25,800	51,600	51,600
+792	39.15	-	-	-	-	**740**	28,971	57,942	57,942
+784	39.15	-	-	-	-	**958**	37,506	75,011	75,011
Total				**-**	**-**			**3,97,921**	**3,97,921**

SECTION S12 - S12'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+896	40.2	-	-	-	-	-	-	-	-
+888	40.2	-	-	-	-	-	-	-	-
+880	40.2	-	-	-	-	-	-	-	-
+872	40.2	-	-	-	-	**112**	4,502	9,005	9,005
+864	40.2	-	-	-	-	**289**	11,618	23,236	23,236
+856	40.2	-	-	-	-	**439**	17,648	35,296	35,296
+848	40.2	-	-	-	-	**474**	19,055	38,110	38,110
+840	40.2	-	-	-	-	**471**	18,934	37,868	37,868
+832	40.2	-	-	-	-	**531**	21,346	42,692	42,692
+824	40.2	**270**	10,854	29,306	2,171	**278**	11,176	22,351	24,522
+816	40.2	**462**	18,572	50,145	3,714	**141**	5,668	11,336	15,051
+808	40.2	-	-	-	-	**607**	24,401	48,803	48,803
+800	40.2	-	-	-	-	**662**	26,612	53,225	53,225
+792	40.2	-	-	-	-	**753**	30,271	60,541	60,541
+784	40.2	-	-	-	-	**918**	36,904	73,807	73,807
Total				**79,451**	**5,885**			**4,56,270**	**4,62,155**

TOTAL ORE IN MT	**1.346**
Total Ore	**1346169**
Total waste	**6081845**
Ore to waste Ratio	**1 : 4.52**

BLOCK - II

Section Number	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
SS3-SS3'	107	263	28,141	75,981	5,628	-	-	-	5,628
SS7-SS7'	103	280	28,840	77,868	5,768	-	-	-	5,768
Total				**1,53,849**	**11,396**			**-**	**11,396**
Total Ore				***1,53,849***	***Total waste***				***11,396***

TOTAL ORE IN MT	**0.15**
Total Ore	**1,53,849**
Total waste	**11,396**
Ore to waste Ratio	**1:0.074**

TOTAL ORE IN MT (Block-I & Block-II	**1.500**
Total Ore	**1500018**
Total waste	**6093241**
Ore to waste Ratio	**1 : 4.06**

Third Year:

PRODUCTION AND DEVELOPMENT PLAN - III YEAR

BLOCK - I

SECTION S2 - S2'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+792	99.4	-	-	-	-	-	-	-	-
+784	99.4	-	-	-	-	-	-	-	-
+776	99.4	-	-	-	-	-	-	-	-
Total				**-**	-			-	-

SECTION S3 - S3'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+792	98	-	-	-	-	**1,309**	1,28,282	2,56,564	2,56,564
+784	98	-	-	-	-	**1,180**	1,15,640	2,31,280	2,31,280
+776	98	**799**	78,302	2,11,415	15,660	**268**	26,264	52,528	68,188
+768	98	**922**	90,356	2,43,961	18,071	-	-	-	18,071
+760	98	**432**	42,336	1,14,307	8,467	**395**	38,710	77,420	85,887
Total				5,69,684	42,199			1,29,948	**1,72,147**

SECTION S4 - S4'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+792	98	-	-	-	-	**1,067**	1,04,566	2,09,132	2,09,132
+784	98	-	-	-	-	**938**	91,924	1,83,848	1,83,848
+776	98	-	-	-	-	-	-	-	-
Total				-	-			**3,92,980**	**3,92,980**

SECTION S5 - S5'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+792	104	-	-	-	-	**844**	87,776	1,75,552	1,75,552
+784	104	-	-	-	-	**716**	74,464	1,48,928	1,48,928
+776	104	-	-	-	-	-	-	-	-
Total				-	-			**3,24,480**	**3,24,480**

SECTION S6 - S6'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+792	106	-	-	-	-	**875**	92,750	1,85,500	1,85,500
+784	106	-	-	-	-	**747**	79,182	1,58,364	1,58,364
+776	106	-	-	-	-	**619**	65,614	1,31,228	1,31,228
+768	106	-	-	-	-	**491**	52,046	1,04,092	1,04,092
+760	106	**118**	12,508	33,772	2,502	**231**	24,486	48,972	51,474
Total				**33,772**	**2,502**			**2,84,292**	**2,86,794**

SECTION S7 - S7'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+792	95	**849**	80,655	2,17,769	16,131	-	-	-	16,131
+784	95	**763**	72,485	1,95,710	14,497	-	-	-	14,497
+776	95	**652**	61,940	1,67,238	12,388	-	-	-	12,388
+768	95	**524**	49,780	1,34,406	9,956	-	-	-	9,956
+760	95	**396**	37,620	1,01,574	7,524	-	-	-	7,524
Total				**4,03,218**	**29,868**			**-**	**29,868**

SECTION S8 - S8'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+792	90.4	-	-	-	-	**1,009**	91,214	1,82,427	1,82,427
+784	90.4	-	-	-	-	**881**	79,642	1,59,285	1,59,285
+776	90.4	-	-	-	-	**754**	68,162	1,36,323	1,36,323
+768	90.4	**305**	27,572	74,444	5,514	**329**	29,742	59,483	64,998
+760	90.4	**497**	44,929	1,21,308	8,986	-	-	-	8,986
Total				**1,95,752**	**14,500**			**1,95,806**	**2,10,307**

SECTION S9 - S9'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+792	104.4	-	-	-	-	**1,152**	1,20,269	2,40,538	2,40,538
+784	104.4	-	-	-	-	**1,024**	1,06,906	2,13,811	2,13,811
+760	104.4	-	-	-	-	-	-	-	-
Total				**-**	-			**4,54,349**	**4,54,349**

SECTION S10 - S10'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+776	72	-	-	-	-	**816**	58,752	1,17,504	1,17,504
+768	72	-	-	-	-	**690**	49,680	99,360	99,360
+760	72	-	-	-	-	**562**	40,464	80,928	80,928
Total				**-**	-			**2,97,792**	**2,97,792**

SECTION S11 - S11'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+776	39.15	-	-	-	-	**952**	37,271	74,542	74,542
+768	39.15	-	-	-	-	**825**	32,299	64,598	64,598
+760	39.15	**350**	13,703	36,997	2,741	**362**	14,172	28,345	31,085
Total				**36,997**	**2,741**			**1,67,484**	**1,70,224**

SECTION S12 - S12'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+776	40.2	-	-	-	-	**1,003**	40,321	80,641	80,641
+768	40.2	-	-	-	-	**875**	35,175	70,350	70,350
+760	40.2	-	-	-	-	**747**	30,029	60,059	60,059
Total				**-**	-			**2,11,050**	**2,11,050**

SECTION S13 - S13'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+896	52.05	-	-	-	-	-	-	-	-
+888	52.05	-	-	-	-	-	-	-	-
+880	52.05	-	-	-	-	-	-	-	-
+872	52.05	-	-	-	-	-	-	-	-
+864	52.05	-	-	-	-	-	-	-	-
+856	52.05	-	-	-	-	-	-	-	-
+848	52.05	-	-	-	-	-	-	-	-
+840	52.05	-	-	-	-	-	-	-	-
Total				**-**	-			**-**	**-**

SECTION S14 - S14'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+896	86.85	-	-	-	-	-	-	-	-
+888	86.85	-	-	-	-	-	-	-	-
+880	86.85	-	-	-	-	-	-	-	-
+872	86.85	-	-	-	-	-	-	-	-
+864	86.85	-	-	-	-	-	-	-	-
+856	86.85	-	-	-	-	-	-	-	-
+848	86.85	-	-	-	-	-	-	-	-
+840	86.85	-	-	-	-	-	-	-	-
Total				**-**	-			**-**	-

TOTAL ORE IN MT	**1.239**
Total Ore	**1239422**
Total waste	**2549990**
Ore to waste Ratio	**1 : 2.09**

BLOCK - II									
Section Number	Sectional influence	Proved (G - 1) Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.	Intercalated waste @ 2 b.d with 10% rec	WASTE Sectional area	Volume	Quantity @ 2 b.d	TOTAL WASTE
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
SS3-SS3'	107	902	96,514	2,60,588	19,303	203	21,721	43,442	62,745
Total				**2,60,588**	**19,303**			**43,442**	**62,745**
Total Ore				***2,60,588***	***Total waste***				***62,745***

TOTAL ORE IN MT	**0.26**
Total Ore	**2,60,588**
Total waste	**62,745**
Ore to waste Ratio	**1:0.24**

TOTAL ORE IN MT (Block-I & Block-II	**1.500**
Total Ore	**1500010**
Total waste	**2612735**
Ore to waste Ratio	**1 : 1.74**

Fourth Year:

PRODUCTION AND DEVELOPMENT PLAN - IV YEAR

BLOCK - I

SECTION S2 - S2'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+752	99.4	-	-	-	-	-	-	-	-
+744	99.4	-	-	-	-	-	-	-	-
Total				-	-			-	-

SECTION S3 - S3'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+752	98	-	-	-	-	-	-	-	-
+744	98	-	-	-	-	-	-	-	-
Total				-	-			-	-

SECTION S4 - S4'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+752	98	-	-	-	-	-	-	-	-
+744	98	-	-	-	-	-	-	-	-
Total				-	-			-	-

SECTION S5 - S5'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+752	104	-	-	-	-	-	-	-	-
Total				-	-			-	-

SECTION S6 - S6'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+752	106	**235**	24,910	67,257	4,982	-	-	-	4,982
+744	106	**107**	11,342	30,623	2,268	-	-	-	2,268
Total				**97,880**	**7,250**			-	**7,250**

SECTION S7 - S7'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+752	95	**268**	25,460	68,742	5,092	-	-	-	5,092
+744	95	**165**	15,675	42,323	3,135	-	-	-	3,135
Total				**1,11,065**	**8,227**			-	**8,227**

SECTION S8 - S8'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+752	90.4	**370**	33,448	90,310	6,690	-	-	-	6,690
+744	90.4	**158**	14,283	38,565	2,857	**83**	7,503	15,006	17,863
Total				**1,28,874**	**9,546**			**15,006**	**24,553**

SECTION S9 - S9'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+752	104.4	-	-	-	-	-	-	-	-
+744	104.4	-	-	-	-	-	-	-	-
Total				**-**	-			-	**-**

SECTION S10 - S10'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+752	72	-	-	-	-	**433**	31,176	62,352	62,352
+744	72	-	-	-	-	**306**	22,032	44,064	44,064
Total				**-**	-			**1,06,416**	**1,06,416**

SECTION S11 - S11'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+752	39.15	**569**	22,276	60,146	4,455	-	-	-	4,455
+744	39.15	**441**	17,265	46,616	3,453	-	-	-	3,453
Total				**1,06,762**	**7,908**			-	**7,908**

SECTION S12 - S12'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+752	40.2	-	-	-	-	**619**	24,884	49,768	49,768
+744	40.2	-	-	-	-	**491**	19,738	39,476	39,476
Total				**-**	-			**89,244**	**89,244**

SECTION S13 - S13'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+832	52.05	-	-	-	-	**633**	32,948	65,895	65,895
+824	52.05	-	-	-	-	**647**	33,676	67,353	67,353
+816	52.05	-	-	-	-	**682**	35,498	70,996	70,996
+808	52.05	-	-	-	-	**704**	36,643	73,286	73,286
+800	52.05	-	-	-	-	**759**	39,506	79,012	79,012
+792	52.05	-	-	-	-	**870**	45,284	90,567	90,567
+784	52.05	-	-	-	-	**1,109**	57,723	1,15,447	1,15,447
+776	52.05	-	-	-	-	**1,097**	57,099	1,14,198	1,14,198
+768	52.05	-	-	-	-	**969**	50,436	1,00,873	1,00,873
+760	52.05	-	-	-	-	**841**	43,774	87,548	87,548
+752	52.05	-	-	-	-	**713**	37,112	74,223	74,223
+744	52.05	**432**	22,486	60,711	4,497	**153**	7,964	15,927	20,424
Total				**60,711**	**4,497**			**9,55,326**	**9,59,823**

SECTION S14 - S14'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+832	86.85	-	-	-	-	**762**	66,180	1,32,359	1,32,359
+824	86.85	-	-	-	-	**799**	69,393	1,38,786	1,38,786
+816	86.85	-	-	-	-	**826**	71,738	1,43,476	1,43,476
+808	86.85	-	-	-	-	**915**	79,468	1,58,936	1,58,936
+800	86.85	-	-	-	-	**1,066**	92,582	1,85,164	1,85,164
+792	86.85	-	-	-	-	**1,160**	1,00,746	2,01,492	2,01,492
+784	86.85	**293**	25,447	68,707	5,089	**1,019**	88,500	1,77,000	1,82,090
+776	86.85	**506**	43,946	1,18,654	8,789	**705**	61,229	1,22,459	1,31,248
+768	86.85	**455**	39,517	1,06,695	7,903	**628**	54,542	1,09,084	1,16,987
+760	86.85	**394**	34,219	92,391	6,844	**561**	48,723	97,446	1,04,289
+752	86.85	**327**	28,400	76,680	5,680	**501**	43,512	87,024	92,704
+744	86.85	**202**	17,544	47,368	3,509	**497**	43,164	86,329	89,838
Total				**5,10,496**	**37,814**			**16,39,554**	**16,77,369**

SECTION S15 - S15'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+832	105	-	-	-	-	**80**	8,400	16,800	16,800
+824	105	-	-	-	-	**334**	35,070	70,140	70,140
+816	105	-	-	-	-	**630**	66,150	1,32,300	1,32,300
+808	105	-	-	-	-	**803**	84,315	1,68,630	1,68,630
+800	105	-	-	-	-	**956**	1,00,380	2,00,760	2,00,760
+792	105	-	-	-	-	**1,191**	1,25,055	2,50,110	2,50,110
+784	105	-	-	-	-	**1,435**	1,50,675	3,01,350	3,01,350
+776	105	**288**	30,240	81,648	6,048	**1,171**	1,22,955	2,45,910	2,51,958
+768	105	**375**	39,375	1,06,313	7,875	**804**	84,420	1,68,840	1,76,715
+760	105	**380**	39,900	1,07,730	7,980	**733**	76,965	1,53,930	1,61,910
+752	105	**385**	40,425	1,09,148	8,085	**669**	70,245	1,40,490	1,48,575
+744	105	**280**	29,400	79,380	5,880	**604**	63,420	1,26,840	1,32,720
Total				**4,84,218**	**35,868**			**19,76,100**	**20,11,968**

SECTION S16 - S16'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+832	108.5	-	-	-	-	-	-	-	-
+824	108.5	-	-	-	-	-	-	-	-
+816	108.5	-	-	-	-	-	-	-	-
+808	108.5	-	-	-	-	**6**	651	1,302	1,302
+800	108.5	-	-	-	-	**296**	32,116	64,232	64,232
Total				**-**	-			**65,534**	**65,534**

TOTAL ORE IN MT	**1.500**
Total Ore	**1500006**
Total waste	**4958292**
Ore to waste Ratio	**1 : 3.31**

Fifth Year

PRODUCTION AND DEVELOPMENT PLAN - V YEAR

BLOCK - I

SECTION S11 - S11'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+736	39.15	**313**	12,254	33,086	2,451	-	-	-	2,451
+728	39.15	**185**	7,243	19,555	1,449	-	-	-	1,449
+720	39.15	**57**	2,232	6,025	446	-	-	-	446
Total				**58,666**	**4,346**			-	**4,346**

SECTION S12 - S12'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+736	40.2	-	-	-	-	**363**	14,593	29,185	29,185
+728	40.2	-	-	-	-	**235**	9,447	18,894	18,894
+720	40.2	-	-	-	-	**107**	4,301	8,603	8,603
Total				**-**	-			**56,682**	**56,682**

SECTION S13 - S13'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+736	52.05	**457**	23,787	64,224	4,757	-	-	-	4,757
+728	52.05	**329**	17,124	46,236	3,425	-	-	-	3,425
+720	52.05	**201**	10,462	28,248	2,092	-	-	-	2,092
Total				**1,38,708**	**10,275**			-	**10,275**

SECTION S14 - S14'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+736	86.85	-	-	-	-	**572**	49,678	99,356	99,356
+728	86.85	-	-	-	-	**444**	38,561	77,123	77,123
+720	86.85	-	-	-	-	**316**	27,445	54,889	54,889
Total				**-**	-			**2,31,368**	**2,31,368**

SECTION S15 - S15'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+736	105	**136**	14,280	38,556	2,856	**540**	56,700	1,13,400	1,16,256
+728	105	**251**	26,355	71,159	5,271	**298**	31,290	62,580	67,851
+720	105	**299**	31,395	84,767	6,279	**121**	12,705	25,410	31,689
Total				**1,94,481**	**14,406**			**2,01,390**	**2,15,796**

SECTION S16 - S16'

Level	Sectional influence	Proved (G - 1)			Intercalated waste @ 2 b.d with 10% rec	WASTE			TOTAL WASTE
		Sectional area	Volume	Quantity @ 3 b.d with 90% Rec.		Sectional area	Volume	Quantity @ 2 b.d	
m	m	m2	m3	Tonnes	Tonnes	m2	m3	Tonnes	Tonnes
+792	108.5	-	-	-	-	**576**	62,496	1,24,992	1,24,992
+784	108.5	-	-	-	-	**1,071**	1,16,204	2,32,407	2,32,407
+776	108.5	-	-	-	-	**1,129**	1,22,497	2,44,993	2,44,993
+768	108.5	**679**	73,672	1,98,913	14,734	**491**	53,274	1,06,547	1,21,281
+760	108.5	**824**	89,404	2,41,391	17,881	**385**	41,773	83,545	1,01,426
+752	108.5	**766**	83,111	2,24,400	16,622	**484**	52,514	1,05,028	1,21,650
+744	108.5	**704**	76,384	2,06,237	15,277	**504**	54,684	1,09,368	1,24,645
+736	108.5	**627**	68,030	1,83,680	13,606	**453**	49,151	98,301	1,11,907
+728	108.5	**183**	19,856	53,610	3,971	**832**	90,272	1,80,544	1,84,515
+720	108.5	-	-	-	-	**825**	89,513	1,79,025	1,79,025
Total				**11,08,230**	**82,091**			**14,64,750**	**15,46,841**

TOTAL ORE IN MT	**1.500**
Total Ore	**1500085**
Total waste	**2065308**
Ore to waste Ratio	**1 : 1.38**

Table 2.4 (a): Summary of production program (Block-I)

Year	Ore in Million tonnes	Waste in Million tonnes	Ore to waste ratio
First	1351899	5927773	**1: 4.38**
Second	1346169	6081845	**1: 4.52**
Third	1239422	2549990	**1: 2.06**
Fourth	1500006	4958292	**1: 3.31**
Fifth	1500085	2065308	**1: 1.38**

Table 2.4 (b): Summary of production program (Block-II)

Year	Ore in Million tonnes	Waste in Million tonnes	Ore to waste ratio
First	148235.4	11804.4	**1: 0.08**
Second	153848.7	11396.2	**1: 0.07**
Third	260587.8	62744.8	**1: 0.24**
Fourth	NIL	NIL	-
Fifth	NIL	NIL	-

c) Individual year wise Production & Development Plans and sections

Year wise Production and Development plans and sections are enclosed in 1:2000 scale. **(Plate No.6, Plate No.6B , Plate No.6C , Plate No.6D , Plate No.6E)**

Also combined production and development sections are enclosed in 1:2000 scale **(Plate No.7)**

d) Salient features of the proposed method of working

Open cast fully mechanized (category 'A') method of mining will be adopted to mine the iron ore deposit keeping in mind the quality, cost, safety and conservation of mineral.

Bench height will be 8m and width will be more than 8 m. The overall pit slope angle will be 45^0 max from the horizontal and individual bench slope will maintained at $80^{0.}$ Deep hole drilling and blasting techniques will be adopted to fragment the ore/waste formation. ROM will be fed to mobile crushing and screening plants to produce usable ore fractions. All waste material will be dumped systematically in the area earmarked.

Ore dispatch will be done by road to siding and JSW steel plant through trucks of 10/16/20 tons capacity.

Loading will be carried out systematically and care will be taken to prevent spillage and dust generation. All loaded trucks will be covered by tarpaulins and water sprinkling will be ensured all along the haul roads and benches to avoid generation of dust during haulage. Other activities like water supply for domestic use, water sprinkling and afforestation will be done by water tankers.

(i) Drilling & Blasting:

Drilling and blasting will be carried out in hard formations. Drilling will be carried out with the help of hydraulic top hammer drills of 105 mm diameter. Blast parameter like Spacing, Burden, Depth of holes, explosive charge, stemming etc. will be decided as per the strata conditions. In general, for hard rock, spacing and Burden of 3 X 2.5 mts and depth of 8 mts will be followed. Controlled blasting with diagonal pattern firing will be in practice which is much safe, fragmentation is good and throw is within control. Sequential blasting, is done by using delay detonator or NONEL system of initiation which reduces vibration and fly rock has been proposed to be continued during the plan period. Rock breaker will be deployed to avoid secondary blasting. Scientific and safe blasting, as mentioned above, will be practiced for getting optimum blast results and minimization of hazards while preventive measures like marking of danger zone, arrangement of warning signals by siren etc. shall be adopted. Blasting shelters will be provided within the blasting danger zone.

Type of Explosives to be used

The most common type of explosive available readily e.g. Slurry/Emulsion cartridge explosives (83 mm)/ ammonium nitrate, fuel oil mixture (ANFO) will be used in the mines. Ammonium nitrate will be mixed with fuel oil (diesel) in a proportion of 94:6 prior to blasting at site.

(ii) Handling of Ore/Waste

In-situ Ore/Waste and Blasted Ore/Waste will be excavated by 1.6 Cum Bucket excavators and shifted by 20 T dumpers to the mobile Crushing and Screening plant for processing. The waste is mainly consisting of shale and BHQ. The waste generated will be dumped in designated area in the active dump AD-1 and eastern side of the Block-I in section 5-5’ of the lease as per R&R Plan and the Ore will be fed either directly to the screen or to the crushers depending on the type of ore. In the mobile Crushing & Screening unit two fraction of products will be segregated, undersize below 10mm which is treated as fines and 10 to 40 mm, is treated as calibrated lump ore.

In soft zone ore will be excavated by excavator/loader and loaded into 20 tonnes tippers and transported to screening plant. The oversize product will be transported to the mobile crushing unit for crushing. The fines and C-ore are stocked separately and based on the plant demand the Iron Ore products will be dispatched. Finished products will be dispatched to the JSW Steel Plant, as the entire production is being consumed by the plant itself, where further beneficiation and upgradation of ore will be carried out inside the plant.

As per the requirement of the steel plant it is proposed to transport the ROM directly to the plant for further blending. Alternatively, ROM could also be sent to the stockyard located outside the lease area for processing and further transportation to the steel plant by prevailing system of transportation.

(iii) Production & Development Plan

Based on the availability of Mineral reserves, dump capacity and volume of traffic, annual production of 1.50 million tonnes per annum is considered as the feasible production level based on the capacity of reserves which is approved by CEC.

In the entire mine production and development benches in the waste and ore zone are oriented and worked along the strike of the ore body. The present position of working /pit layout dumps are shown in surface plan **(Plate NO.03** and Geological Plan **(Plate No.4)** and It is proposed to work in the sections from S1-S1' to S16-S16' during the plan period. The benches will be properly developed for a height of 8m & width of at least 8m.

The year wise benches proposed to be worked both in ore and overburden are shown in P&D plans and Cross Sections **(Plate No.6A to 6E)** for the plan period.

e) The layout of mine workings, pit road layout, the layout of faces and sites for disposal of overburden/waste along with ground preparation prior to disposal of waste, reject etc.

Bench height will be 8m and width will be more than 8m. The overall pit slope angle will be 45^0 max from the horizontal. Approach road to workings will from western portion of lease area. The excavation of ore and waste will be done by excavators and hauled by 20 ton dumpers. Slope of the faces will be maintained at 80^0 degrees. Benches will be advancing towards southwest from northeast, including the benches would be laid along with the strike of the deposit. Drilling and blasting techniques will be used to break the hard ore/waste formation.

ROM will be fed to mobile crushing and screening plant to produce useable fractions. Haulage roads will be maintained with a gentle gradient of not more than 1:16 (except short ramps). The haul road will be maintained with prescribed width and gradient (except short ramp) and care will be taken to ensure all the safety measures in place. The approach road from active mining area to dump yard will be maintained with more than 8 mts width and ramp with the gradient of 1:16.

During the first five years, it is proposed to produce 1.50 million tonnes of iron ore per annum at a stripping ratio of 1: 4.06 (Maximum)about 21.67 Million tonnes of waste is required to be handled during the first five-year plan period.

The waste mainly consists of shale/Phylite and BHQ. The waste generated will be dumped in eastern side of the Block-I of the lease as per R & R plan. The area demarcated for the dumping in this plan period is 21.75 Ha and 3.07 Ha Temporary dump Which is sufficient as it can hold More than 22 Million tonnes and

the expected waste generation of about 21.67 Million tonnes in this plan period. Details of extent, co-ordinates and levels of working etc., are given below:

Table- 2.5: Year wise working details

Year	Area In Ha	No. of Benches		Level in mRL		Location Co-ordinates	
		Block-I	Block-II	Block-I	Block-II	Northing	Easting
First	19.06	7	3	824 to 880	928 to 912	1670620 to 1669900	675000 to 675600
Second	26	10	4	800 to 880	904 to 928	1670820 to 1669900	674950 to 675600
Third	27.59	15	6	760 to 880	888 to 928	1670850 to1669900	674930 to 675600
Fourth	30.07	10	-	744 to 856	-	1671020 to 1669900	674800 to 675600
Fifth	32.93	9	-	744 to 792	-	1671100 to 1669900	674750 to 675600

Table-2.6: Year wise quantity of Waste to be generated

Year	Topsoil		Waste			Mineral rejects		
	Reuse / Spreading	Storage	Backfilling	Storage	Temporary Dump(Block-II)	Blending	Storage	Beneficiation
First	-	-	-	5927773	11804	-	-	-
Second	-	-	-	6081845	11396	-	-	-
Third	-	-	-	254990	62745	-	-	-
Fourth	-	-	-	4958292	NIL	-	-	-
Fifth	-	-	-	2065308	NIL	-	-	-

f) Conceptual Mining plan

The mineable reserves estimated are 27.50 million tons and with the proposed production of 1.50 MTPA, the life of mine will be 20 years. Conceptual mine planning has been made considering the life of the mine. The life of mine will be enhanced depending upon the result of the exploration carried out during conceptual plan periods. The various R & R measures which is approved by ICFRE like Dump and encroached area management, Surface water management, Green belt Development, afforestation and Environmental monitoring (which are detailed in Table 2.8 and 2.9) are provided with a specific timeline which already

detailed in Table 2.10, and we are committed to implement the recommendation on ground with prescribed timelines.

Conceptual Plan is enclosed in **Plate No. 10.**

i) Excavation: In this lease about 36.56 ha area is mineralized. Considering the current exploration data and geology, pit layout is designed. The mining will be carried out in the already opened pits in this plan period and in the conceptual stage. The final pit limit is designed based on the ultimate pit slope and ultimate pit limit.

UPL Parameters

Area (ha)	Pit Dimension			
	Length (m)	Width (m)	Depth (m)	Pit Slope
36.56	1433	210	136	45^{o}

The ultimate pit limit is demarcated on the Geological Plan and Cross Sections are enclosed as **Plate No.04** and **Plate No.05** respectively. Location of proposed workings are shown in the year wise layout plans, **Plate No.6A to Plate No.6E**

ii) Recovery of ROM: The recovery of ore from the reef ore zone is considered as 90% for production planning. The entire ROM (+45% Fe) has been proposed to be consumed by the JSW steel plant.

iii) Disposal of Waste: The waste mainly consist of shale/Phylite and BHQ. The waste generated will be Dumped in active dump AD-1 and proposed dump in eastern side of the Block-I and also proposed temporary dump in the lease area as per R & R plan. The area demarcated for the dumping in this plan period is 21.75 Ha and 3.07 Ha Temporary dump Which is sufficient as it can hold 21.67 Million tonnes in this plan period. Temporary dumping as well as Dumping/Backfilling will be continued in the conceptual period also. There is no mineral reject generation during plan period as all the +45% Fe material produced will be sent to JSW Steel plant.

iv) Backfilling of voids: No Backfilling proposed for this plan period.

v) Reclamation and Rehabilitation

For protection of the mining area and to prevent further degradation of land and stabilization of dumps, the measures that are proposed in the R&R plan will be carried out. The details of the same are given below:

The successful Reclamation and Rehabilitation plan for the mine will primarily depend on following considerations:

1. Rehabilitation and Reclamation of Encroached Areas.
2. Loose OB dumps and their stabilization
3. Mining pits, their back filling and stabilization

4. Nala/Stream courses and their stabilization
5. Development of vegetation on non-mineralized areas
6. Safety zone and Greenbelt Development
7. Avenue plantation all along mine haul roads

Reclamation and Rehabilitation Measures

The measures contemplated under the R and R plan are broadly categorized under the following heads:

1. R and R measures for areas considered under encroachment.
2. Stabilization of Dumps
3. Surface Water Management
4. Afforestation/ Plantation
5. Green Belt Development

R&R Measures for Area under encroachment

An area of 83.19 ha has been identified by the CEC as encroachment (Major encroachment in ML No. 2365) under categories such as mining pit, over burden dumps and others in both the ML areas (2365 & 2365). The encroached area should be reclaimed and rehabilitated by afforesting with suitable vegetation as well as engineering measures.

Table 2.7: Particulars of area under encroachment are given below:

Particulars of Plantation	Area (ha)
Mine Pit	7.35
Over Burden Dumps	49.38
Others	26.46
Total	**83.19**

Measures for the management of OB dumps (Dump Management Plan)

In order to stabilize waste dumps, toe wall at its toe and catch water drains (garland drains) and Silt Traps (ST) should be constructed as per the design. The height of the dumps and its terraces should be strictly maintained as per the design suggested for the purpose in the statutory clearances. Dumping should be carried out by adopting retreating method starting from bottom and reaching to the top by creating terraces of 10 m height and 6-8 m width. Berms should be provided at the toe of each terrace to avoid water flow over the dump slopes. Wherever necessary, garland drains should be provided and connected to the vertical drains and finally to the check dams followed by Silt Settling Tanks (SSTs). Inactive dumps should be vegetated with suitable plantation immediately after the terraces are made and the active dumps should be protected from erosion by planting with suitable grass/legumes. All the plantation activities should preferably be taken up during monsoon seasons to enjoy the benefit of rainwater for the same. Geo-

textile/coir mat may be opted for the dumps which have adverse conditions like steep slopes, poor soil fertility, and instability of soil and lack of moisture. This will also enable to achieve good growth of vegetation cover over the dump slopes. Enriched plantation may also be adopted on top flat area and sloping area depending upon the condition. Rills and gullies should be treated with different types of gully plugs as suggested in the engineering measures

i) Existing Waste/ Over Burden Dumps

There are one active and seven inactive dumps in these two combined mines (ML 2365 and 2366). In KH block one active dump (AD-1/EID-1/EID-2) and four inactive dumps (ID-1/EID-3, ID-2/EID-4, ID-3 and ID-4/EID-5) are present and in Block-II block three inactive dumps (ID-5/EID-6, ID-6/EID-7 and EID-8) are present

- **AD-1/EID-1/EID-2:** This is the only active dump (AD-1) in the ML area and some of its portions are encroached towards north (EID-1) and south (EID-2). The dump height is 33 m and its slope angle is approximately 50 degree. Two terraces have been made at some places on this dump, however, no bio-engineering measures have been observed in this dump. Deep rills and gullies have been formed on the dump. Adjacent to this dump, two *nala* are running and both of them are blocked by this dump. The OB materials are severely eroded and rolled in to the *nalas*.
- **ID-1/EID-3:** This inactive dump is located on western side of the lease area of 2365-I. A major part of it is encroached towards western side (EID-3). The northern flank of the dump is inactive. Its height of the dump is 196 m and its average slope angle is approximately 50 degrees. No engineering measures are made. However, at some places, coir matting is observed on the dump slopes. Deep rills and gullies have been observed and at some places on the slopes the materials have been rolled down in to the forest area. At some places (north and central part), it is partially stabilized with vegetation comprising of *Prosopis juliflora, Acacia nilotica, Agave americana, Cassia siamea, Delonix regia, Azadirachta indica* and *Pongamia pinnata*.
- **ID-2/EID-4:** This is located towards north eastern corner of the lease area and is partially encroached towards north (EID-4). The height of the dump varies from 3 - 67m and its slope angle is approximately 50-60 degrees. At some places, one or two terraces have been made. No engineering measures are made. It is almost completely stabilized with vegetation comprising of *Cassia siamea, Acacia auriculiformis, Glyricidia maculata* and *Agave americana*. At some places, it is covered with coir mat also.
- **ID-3:** This dump is located within the lease area of 2365-I and is on the NE corner of mine pit IP-1. The height of the dump is 106 m and its slope angle is approximately 60 degrees. It is located on a steep slope. It is severely eroded and OB materials rolled down to forest within lease area. It is partially vegetated with *Eucalyptus* spp. No engineering measures are made. Several rills and gullies are formed at some places on the dump.

- **ID-4/EID-5:** This dump occupies a large area on the mine lease and is located on the SE corner of ML area of 2365-I and 2366. A major portion (90%) of OB dump is within the lease area (ID-4), while, a small portion (10%) of it is encroached towards SE side of the lease area (EID-5). The dump is having 4-5 terraces. Its slope angle is approximately 60 degrees. The height of the dump varies from 11 – 196 m. The OB material rolled into the forest. It is partially vegetated with *Agave americana, Acacia nilotica, Cassia siamea, Leucaena leucocephala* and *Eucalyptus* spp. Natural vegetation such as *Calotropis gigantea* and *Chromolena odorata* is observed on its slopes. No engineering measures are made. Several deep gullies and rills are observed on its slopes.
- **ID-5/EID-6:** This is located in Ubbalagandi Block (UG) of ML No. 2365-II. A major portion (80%) of the OB dump is rolled down into the forest at SW side of the lease adjacent to MP-2 (EID-6). The height of the dump varies from 8 - 104 m. It is having 2 terraces. The dump top is vegetated with *Cassia siamea, Acacia auriculiformis, Leucaena leucocephala, Agave americana* and *Acacia nilotica*, while its slope are exposed open. No engineering measures are made. It is severely eroded and deep rills and gullies are formed. The OB materials are rolled down into the *nala*.
- **ID-6/EID-7:** It is located on western side of 2365-II of UG Block. The major portion (90%) is encroached towards western side in the forest area (EID-7). Its height varies from 1- 122 m and slope angle is approximately 50-65 degrees. The dump is having 4 terraces. It is partially vegetated with *Cassia siamea, Acacia auriculiformis, Casuarina equisetifolia, Leucaena leucocephala, Prosopis juliflora, Acacia nilotica, Holoptelia integrifolia* and *Hardwicika binata*. No engineering measures are made. The OB materials are severely eroded and vertically rolled down into the forest.
- **EID-8:** It is located on the S-E side of 2365-II of UG Block. Its height is 64 m and slope angle is approximately 60 degrees. No engineering measures are made. At some places, deep gullies and rills and formed and OB materials are rolled down into the forest.

ii) Engineering measures for the waste dumps (as per R&R plan prepared by ICFRE)

Toe Wall: It is proposed at the toe of the dump to protect the material from erosion. Also, it is provided with weep holes at 1x1m grid points on its body to facilitate seepage of water. The RR stone masonry cement sand mortar toe wall of a height of 3.0 m are proposed for the waste dumps in the lease area, while, RR dry toe wall of a height of 2.0 m is proposed. Altogether, **8 TWs** are proposed for the management of waste dumps in the ML area (Design-1).

Garland Drains (Catch Water Drains): The GDs are proposed 1-2 m below the toe wall to collect the discharging runoff water at the toe of dump and to carry it safely to SST tanks followed by natural water courses. It should have 2.0 m top width, 1.0 m bottom width and 1.0 m depth. A total number of **8 GDs** are proposed for the management of waste dumps in the ML area (Design-2).

Geo-textile/ Coir mat: As the encroached waste dumps EID-3 and ID-4 are too large and are located on a steeply sloping terrain, there is an ample chance of further deterioration of the dump. Therefore, it is

proposed to protect the dump (IDs/EIDs) slopes from erosion/runoff by employing geo-textile/coir matting in an approximately **5.0 ha** area after terracing their slope to appropriate height (10 m) and width (6-8 m).

Table 2.8: Proposed engineering measures for management of waste dumps (ML No. 2365)											
Location	**Items**	**Particulars of works**	**No**	**Dimension in m**				**Qty.**	**Unit**	**Rate/ Unit (Rs.)**	**Amount (Rs. In Lakhs)**
				Length	**Width**		**Height**				
					Top	**Bottom**					
AD-1 / EID-1	TW-1: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	1206.00	2.00		0.60	1447.20	Cum	111	1.606
		Plain cement concrete (1:4:8) in foundation	1.0	1206.00	1.70		0.15	307.53	Cum	1860	5.720
		RR Stone masonry in cement sand mortar (1:6)	1.0	1206.00	0.50	1.50	3.00	3618.00	cum	1232	44.574
	GD-1	Garland drain below the toe wall	1.0	1215.00	2.00	1.00	1.00	1822.50	cum	111	2.023
ID-2 / EID-4	TW-2: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	627.00	2.00		0.60	752.40	cum	111	0.835
		Plain cement concrete (1:4:8) in foundation	1.0	627.00	1.70		0.15	159.89	cum	1860	2.974
		RR Stone masonry in cement sand mortar (1:6)	1.0	627.00	0.50	1.50	3.00	1881.00	cum	1232	23.174
	GD-2	Garland drain below the toe wall	1.0	640.00	2.00	1.00	1.00	960.00	cum	111	1.066
EID-3 / 1	TW-3/1: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	968.00	2.00		0.60	1161.60	cum	111	1.289
		Plain cement concrete (1:4:8) in foundation	1.0	968.00	1.70		0.15	246.84	cum	1860	4.591

		RR Stone masonry in cement sand mortar (1:6)	1.0	968.00	0.50	1.50	3.00	2904.00	cum	1232	35.777
	GD-3/1	Garland drain below the toe wall	1.0	980.00	2.00	1.00	1.00	1470.00	cum	111	1.632
EID-3 / 2	TW-3/2: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	166.00	2.00		0.60	199.20	cum	111	0.221
		Plain cement concrete (1:4:8) in foundation	1.0	166.00	1.70		0.15	42.33	cum	1860	0.787
		RR Stone masonry in cement sand mortar (1:6)	1.0	166.00	0.50	1.50	3.00	498.00	cum	1232	6.135
	GD-3/2	Garland drain below the toe wall	1.0	180.00	2.00	1.00	1.00	270.00	cum	111	0.300
EID-3 / 3	TW-3/3: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	132.00	2.00		0.60	158.40	cum	111	0.176
		Plain cement concrete (1:4:8) in foundation	1.0	132.00	1.70		0.15	33.66	cum	1860	0.626
		RR Stone masonry in cement sand mortar (1:6)	1.0	132.00	0.50	1.50	3.00	396.00	cum	1232	4.879
	GD-3/3	Garland drain below the toe wall	1.0	140.00	2.00	1.00	1.00	210.00	cum	111	0.233
EID-3 / 4	TW-3/4: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	307.00	2.00		0.60	368.40	cum	111	0.409
		Plain cement concrete (1:4:8) in foundation	1.0	307.00	1.70		0.15	78.29	cum	1860	1.456
		RR Stone masonry in cement sand mortar (1:6)	1.0	307.00	0.50	1.50	3.00	921.00	cum	1232	11.347

	GD-3/4	Garland drain below the toe wall	1.0	320.00	2.00	1.00	1.00	480.00	cum	111	0.533
EID-3 / 5	TW-3/5: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	883.00	2.00		0.60	1059.60	cum	111	1.176
		Plain cement concrete (1:4:8) in foundation	1.0	883.00	1.70		0.15	225.17	cum	1860	4.188
		RR Stone masonry in cement sand mortar (1:6)	1.0	883.00	0.50	1.50	3.00	2649.00	cum	1232	32.636
	GD-3/5	Garland drain below the toe wall	1.0	890.00	2.00	1.00	1.00	1335.00	cum	111	1.482
EID-7	TW-5: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	496.00	2.00		0.60	595.20	cum	111	0.661
		Plain cement concrete (1:4:8) in foundation	1.0	496.00	1.70		0.15	126.48	cum	1860	2.353
		RR Stone masonry in cement sand mortar (1:6)	1.0	496.00	0.50	1.50	3.00	1488.00	cum	1232	18.332
	GD-5	Garland drain below the toe wall	1.0	510.00	2.00	1.00	1.00	765.00	cum	111	0.849
EID-6	TW-6: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	789.00	2.00		0.60	946.80	cum	111	1.051
		Plain cement concrete (1:4:8) in foundation	1.0	789.00	1.70		0.15	201.20	cum	1860	3.742
		RR Stone masonry in cement sand mortar (1:6)	1.0	789.00	0.50	1.50	3.00	2367.00	cum	1232	29.161
	GD-6	Garland drain below the toe wall	1.0	800.00	2.00	1.00	1.00	1200.00	cum	111	1.332

EID-8	TW-7: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	226.00	2.00		0.60	271.20	cum	111	0.301
		Plain cement concrete (1:4:8) in foundation	1.0	226.00	1.70		0.15	57.63	cum	1860	1.072
		RR Stone masonry in cement sand mortar (1:6)	1.0	226.00	0.50	1.50	3.00	678.00	cum	1232	8.353
	GD-7	Garland drain below the toe wall	1.0	240.00	2.00	1.00	1.00	360.00	cum	111	0.400
ID-4	Geo-textile/ Coir-mat	Mannual terracing followed by Geo-textile/coir matting and plantation may be done on high steeply sloping part of the OB dump	--	--	--	--	--	2.00	ha	1000000	20.000
EID-3	Geo-textile/ Coir-mat	Mannual terracing followed by Geo-textile/coir matting and plantation may be done on high steeply sloping part of the OB dump	--	--	--	--	--	3.00	ha	1000000	30.000
Temporary dumping in pit	TW-8: Toe wall at the toe of waste dump	Foundation in hard soil mixed with boulders including hard rock	1.0	286.00	2.00		0.60	343.20	cum	111	0.381
		Plain cement concrete (1:4:8) in foundation	1.0	286.00	1.70		0.15	72.93	cum	1860	1.356
		RR Stone masonry Dry	1.0	286.00	1.00	3.00	2.00	1144.00	cum	400	4.576
	GD-8	Garland drain below the toe wall	1.0	291.00	2.00	1.00	1.00	436.50	cum	111	0.485
TOTAL											**316.25**

iii) Surface Water Management

Naturally, no rain water accumulates in the lease area. The rain water flows from hill slopes and it does not accumulate till it reaches the lower valleys. Hence, the drainage pattern is sub-dendritic in nature and is typical of the hilly area.

A total number of 12 *nalas* are originating from the lease are of 2365-I and 2366, while, 3 are originating from the lease area of 2365-II (UG Block). On the northern side of the lease area of 2365-I, 2 *nalas* are running and are blocked by the OB dump (AD-1/EID-1). There is another *nala* originating from N-E side of the lease area of 2366. From the S-E corner of the ML area of 2365-I and 2366, two primary *nalas* are originating. All the above *nalas* are joining together at the northern side of the ML area and are emptying into *Narihalla* stream. Another three *nalas* are originating from the western cliff of the ML area and are joining together and flowing towards north, emptying into the Narihalla stream and finally into the *Daroji* tank. From the ML area of UG Block, three *nalas* are originating towards north and north-east and are emptying into a tank near Marutla Village. The *nalas* from the western side of the ML area are flowing towards north, joining the downstream of *Narihalla* stream and finally emptying into the *Daroji* tank.

Control of erosion is important for both during mining and post mining period as the waste materials emanating from the fragmented areas such as mine pit and waste dumps can cause several damages to the local environment including soil, water, air, agriculture, etc. The main objective of the surface water management plan is to suggest suitable site specific bio-engineering measures for the protection of *nalas*, waste dumps, mine pits, sub-grade dumps, etc., from erosion/runoff due to rain. Erosion/runoff of waste materials through natural water channels should be arrested/ controlled by constructing silt retaining and grade stabilization structures like gabion check dams, stone masonry check dams, earthen check dams, silt settling tanks, etc. All these structures retain silt behind it and allow only relatively clear water to flow towards downstream. Due to retention of silt, channel gradient, flow velocity and consequently carrying capacity of the water course will be reduced. Engineering measures are the first line of defense in controlling erosion and they also facilitate quick re-establishment of vegetation over the disturbed areas.

Brush Wood Check Dam (BWCD): It is proposed for narrow gullies of about 1-3 m wide and is suitable for the areas where boulders are not available. It is essentially like logwood check dam and in this, brush wood such as branches, twigs, climbers, etc., are used instead of wooden logs. Altogether, **500 BCDs** are proposed for gullies in the waste dumps in the lease area.

Log Wood Check Dam (LWCD): This structure is proposed to be constructed in narrow gullies having a width of about 3-6 m. Wooden logs of sprouting species such as *Lannea coromandelica, Bombax ceiba, Erythrina suberosa, E. indica, Ficus benghalensis*, etc., needs be inserted up to a depth of about 30 cm on the dump terrace in series at distance of about 30 cm from centre to centre. Boulders of 40 cm size and above may be hand packed between risers and logs up to 1.0 m depth. A total number of **280 LWCDs** are

proposed for gullies in the waste dumps in the lease area.

Loose Boulder Check Dam (LBCD): (Random Rubble dry stone masonry): The LBCDs are proposed for gullies having a width of about 5-10 m and their bed slope less than 10%. A total number of **4 LBCDs** are proposed for the *nalas*, while, **200 LBCDs** are proposed for the gullies in EIDs and IDs in the lease area.

Gabion (Wire crate) Check Dam (GCD): This structure is usually proposed for gullies having a bed slope of more than 10% and a high discharge rate. Gabion check dams are very useful in the areas where sediment load is very high and are very cost effective for the reclamation of mine areas and waste lands. Altogether, **16 GCDs** are proposed for the *nalas* in the ML area.

Rain Water Harvesting Pit (RWHP): The function of the RWHP is to recharge ground water by harvesting runoff. This structure should have a length and width of 10.0 m each at the top and 5.0 m each at the bottom and a height of 2.0 m. It should be filled with sand over of 20 cm thick and 20cm thick cover of gravel of a size 20 mm. Altogether, **5 RWHPs** are proposed for the *nalas* in the lease area.

Silt Settling Tank (SST): This is particularly important for the water channels having a high discharge loaded with heavy sediments. The water in these natural courses should be allowed to flow out only after treatment through the silt settling tanks. A total number of **3 SSTs** of a dimension of 20x10x3 are proposed for the *nalas* in the ML area.

Silt Trap (ST): This is useful/ essential to prevent sediment and silt from entering into area outside the ML through the surface water runoff. One **ST** of a dimension of 10x5x2 is proposed for the *nala* N-3 in the ML area.

Stone Masonry Check Dam (SMCD) - cement sand mortar (1:6): This is usually considered as a key structure at the end of all the gully control structures like LBCD, GCD, etc. A total number of **5 SMCDs** are proposed for the *nalas* in the lease area

Design details of proposed bio-engineering measures are enclosed in **Annexure - XIII**

Table 2.9 : Proposed bio-engineering measures for surface water management (ML No. 2365)

Location	Items	No.	Dimension in m				Qty	Units	Rate/ Unit (Rs.)	Amount (Rs. In Lakhs)
			Length	Width		Height				
				Top	Bottom					
N-1	GCD-1	1.0	80.00	1.00	3.00	2.00	320.00	Cum	1200	3.8400
	GCD-2	1.0	80.00	1.00	3.00	2.00	320.00	Cum	1200	3.8400
	GCD-3	1.0	70.00	1.00	3.00	2.00	280.00	Cum	1200	3.3600
	GCD-4	1.0	60.00	1.00	3.00	2.00	240.00	Cum	1200	2.8800

	GCD-5	1.0	50.00	1.00	3.00	2.00	200.00	Cum	1200	2.4000
	SMCD-1	1.0	70.00	1.00	2.00	2.00	70.00	m	10000	7.0000
	SMCD-2	1.0	40.00	1.00	2.00	2.00	40.00	m	10000	4.0000
	RWHP-1	1.0	10.00	10.00	5*5	3.00	1.00	No.	35625	0.3563
	SST-1	1.0	20.00	10.00	-	3.00	1.00	No.	500000	5.0000
N-3	LBCD-1	1.0	8.00	1.00	2.00	1.00	12.00	Cum	400	0.0480
	LBCD-2	1.0	10.00	1.00	2.00	1.50	22.50	Cum	400	0.0900
	GCD-9	1.0	15.00	1.00	3.00	2.00	60.00	Cum	1200	0.7200
	GCD-10	1.0	20.00	1.00	3.00	2.00	80.00	Cum	1200	0.9600
	GCD-11	1.0	22.00	1.00	3.00	2.00	88.00	Cum	1200	1.0560
	SMCD-4	1.0	23.00	1.00	2.00	2.00	23.00	m	10000	2.3000
	RWHP-4	1.0	10.00	10.00	5*5	3.00	1.00	No.	35625	0.3563
	ST-1	1.0	10.00	5.00	--	2.00	1.00	No.	200000	2.0000
N-4	LBCD-3	1.0	10.00	1.00	2.00	1.00	15.00	Cum	400	0.0600
	LBCD-4	1.0	12.00	1.00	2.00	1.50	27.00	Cum	400	0.1080
	GCD-12	1.0	15.00	1.00	3.00	2.00	60.00	Cum	1200	0.7200
	GCD-13	1.0	18.00	1.00	3.00	2.00	72.00	Cum	1200	0.8640
	GCD-14	1.0	20.00	1.00	3.00	2.00	80.00	Cum	1200	0.9600
N-5	GCD-15	1.0	20.00	1.00	3.00	2.00	80.00	Cum	1200	0.9600
	GCD-16	1.0	20.00	1.00	3.00	2.00	80.00	Cum	1200	0.9600
	RWHP-5	1.0	10.00	10.00	5*5	3.00	1.00	No.	35625	0.3563
	SST-3	1.0	20.00	10.00	-	3.00	1.00	No.	500000	5.0000
	SMCD-5	1.0	23.00	1.00	2.00	2.00	23.00	m	10000	2.3000
EIDs & IDs	BWCD	200.0	2.00	-	1.50	1.00	400.00	m	300	1.2000
	BWCD	150.0	3.00	-	1.50	1.00	450.00	m	300	1.3500
	BWCD	100.0	4.00	-	1.50	1.00	400.00	m	300	1.2000
	BWCD	50.0	5.00	-	1.50	1.00	250.00	m	300	0.7500
	LWCD	100.0	4.00	-	2.00	1.00	400.00	m	1200	4.8000
	LWCD	80.0	5.00	-	2.00	1.00	400.00	m	1200	4.8000
	LWCD	60.0	6.00	-	2.00	1.00	360.00	m	1200	4.3200
	LWCD	40.0	7.00	-	2.00	1.00	280.00	m	1200	3.3600
	LBCD	80.0	4.00	1.00	2.00	1.50	720.00	cum	400	2.8800
	LBCD	60.0	5.00	1.00	2.00	1.50	675.00	cum	400	2.7000
	LBCD	40.0	6.00	1.00	3.00	1.50	720.00	cum	400	2.8800
	LBCD	20.0	8.00	1.00	3.00	2.00	640.00	cum	400	2.5600
TOTAL										**85.29**

Afforestation:

After excluding the area finally classified under green belt and road (7.38+1.50 = 8.88 ha), the area to be afforested in ML area at the conceptual stage of the mine has been worked out to be 121.65 ha (i.e., 130.53 – 8.88 ha). The afforestation covering 1000 trees and 2500 shrubs per ha, inclusive of maintenance for five years has been worked out as per the norms of State Forest Department, Karnataka.

Work of afforestation will be carried out in close coordination with the State Forest Department, Karnataka, utilizing local people and the periodical monitoring shall be assigned to a national specialized scientific institution.

Afforestation will be made through:

- Propagules (seeds, tubers, corms, bulbs, rhizomes and roots) stored in the topsoil and sowing seed.
- Planting nursery-raised seedlings
- By seed dibbling
- Silt accumulated in silt settling tanks/check dams etc. can be removed and could be used after mixing with FYM and sand in the ratio 2:1:1. This mixture could be used for plantation.

Table 2.10 : Implementation Schedule of Mitigation / Engineering Measures for BIOM (ML 2365)

Type	Particulars of work	Years																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Encroached/Dump Management																					
Inactive and Encroached dump	Toe wall at the toe of waste dump	√																			
	Garland drain	√																			
	Silt trap, settling tank, coir matting	√																			
Plantation on Encroached area as per CEC		√	√	√																	
Surface water management																					
Gully plugs (For Dumps)	Logwood Check Dams	√																			
	Brushwood Check Dam	√																			
	Loose Boulder Check Dam	√																			
Check dams	Wire crate (gabion) Check Dam	√	√																		
	Stone Masonry Check Dam	√	√																		
	Culvert	√	√																		
Greenbelt development		√																			
Environmental monitoring & watch –ward		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

Table 2.11: Indicative cost summary of above R&R measures

Sl. No.	Items	Total cost (Rs. Lakhs)
1	Cost of afforestation for Encroached area	144.75
2	Cost of engineering structures for waste Dump Management	316.25
3	Cost of engineering structures for Surface water management	85.29
4	Cost of afforestation of area under green belt	18.97
5	Cost of afforestation of the ML area at the conceptual stage	211.67
	Grand Total	**Rs. 776.93***

**Excluding the cost of SMP, BMP, Monitoring, etc*

Greenbelt development plan

In order to minimize the impact of mining on environmental components outside the mine lease area, greenbelt zone of 7.5 m width should be established in safety zone inside mine lease area. The establishment of greenbelt will help wildlife movement, and also reduce the impact of mining on human health. The greenbelt will act as a barrier to trap the suspended dust particles, noise and also suppresses air pollutants. It is also important to create a greenbelt with tall seedlings (>1 m height) of fast growing species to hasten the process of greening the area. No greenbelt has been raised by the lessee within the lease area.

Indicative cost of developing Green belt is given in the table below:

Sl. No.	Mine Lease	Area of	Rate/Ha	Total Amount
1	ML 2365	7.38	2.57	18.97

****The proposed cost is only indicative and the work pertaining to various engineering and biological measures may vary subject to Scheduled rates of Karnataka State. The final dimensions of the engineering structures may be modified depending on the suitability of the local field conditions.***

Plans & Sections

All the Reclamation & rehabilitation measures, listed above are shown on Land use plan at the end of ensuing plan period **(Plate No.08)** & Environment plan **(Plate No.09).**

g) Extent of Mechanization

As proposed above, fully mechanized method of working will be adopted for this mine. For the plan period, production of Iron ore of 1.50 MTPA has been planned. This envisages handling of 6.09 million tones (maximum during the plan period) of waste per year. The effective working hours will be 12 (twelve) and that is used only to calculate the mining machineries fleet. Operation will be spread over in two shifts and

care has been taken to deploy the manpower only for eight hours including recess, by virtue of the head count planning.

In order to achieve the targeted production, the different mining activities will be planned during the daylight hours only. The recovery of ore involves removal of over–burden/side burden removal and processing of ROM. By adopting, a combination of Drilling, Excavation, Hauling, Crushing & Screening, Loading and Transporting machinery will be used. Further ancillary machinery like water sprinklers, road graders, dozers, weighing machine etc., will also be deployed. The following are the list of machinery being deployed in the mine.

(1) Drilling Equipment

Type	Nos.	Dia. of hole (mm)	Motive power	H.P.
Self-propelled Hydraulic Drill with Top Hammer	3	102-115	Diesel	-

(2) Loading Equipment

Type	Nos.	Bucket capacity Cum	Motive power	H.P.
Pay Loader	3	2.6	Diesel	260
Front end loader	2	1.2	Diesel	96
Excavator	8+2	1.6	Diesel	200
Excavator-cum-rock breaker	1	0.9-1.1	Diesel	150

(3) Haulage and Transport Equipment

(a) Haulage within the Mining Leasehold

Type	Nos.	Body capacity Cum	Motive power	H.P.
Tippers/Dumpers	42	16-18	Diesel Engine	250-280

(b) Transport from Mine Head to the Destination

The transportation of Iron ore from mine head to JSW Steel plant will be carried out through tipper/trucks by road. 30% of the trucks are owned by company rest 70% of the trucks will be hired on a contractual basis. Above listed machineries in the mine are in good condition and as and when machine break-down, such machine will be repaired on site by the department engineers.

(4) Details of Auxiliary Operations and Related Machineries

Details of Machineries deployed for auxiliary operations are as follows:

Type	Nos.	capacity	Unit	Motive power	H.P.
Dozer	1	-	-	Diesel	183
Road Grader	1			Diesel	145
Mobile Crushing plant	1	250	TPH	-	
Screening Unit	2	250-300	TPH		
Weigh Bridge	4	60	T	-	-
Water Tanker	6	10,000	Ltrs.	-	180
Mobile Tower Lights	2	4	KVA	-	-
D.G Sets	2	100	KVA	-	25
Bus	1	40 Seater			
Jeeps	3	5 Seater			
Diesel Tankers	1	8	KL		180
Explosive Van	1	-			
Maintenance van	1				
Ambulance	1				

Calculations:

a) Drilling Equipment

In the plan period, the maximum quantity to be handled is 1.50 million tonnes of Ore and waste 6.10 (maximum out of five years) million tonnes of waste totaling to approximately 7.6 million tonnes PA. 50% of the total quantity requires drilling and blasting.

Assumptions. Bulk Density : 3 T/CuM for Ore and 2 T/CuM Waste Mines will operate during daylight hours only so effective working hours will be-12 Hours.		
Drilling		
Specification of drill machine		
Diameter of drill	**:**	102 mm
Maximum operating pressure	**:**	250 bar
Drilling parameters		
Hole Diameter (D)	**:**	105 mm
Height of the bench	**:**	8 m
Length of the blast hole	**:**	8.8 m (including sub grade drilling)
Burden (B)	**:**	2.5 m
Spacing (S)	**:**	3 m
Volume of earth to be broken/loosen per hole	**:**	B x S x H = 2.5 x 3 x 8 = 60 CuM

Meterage of drilling per drill for primary blasting in ore/waste zone		
Maximum volume of material to be excavated (in any year of plan period)	**:**	3546620.5 Cum
Volume of material require drilling and blasting, as per the nature of the deposit is around 50% of the total excavation as those are hard and massive in nature)	**:**	1773310.25 Cum / Year
Number of holes to be drilled/year	**:**	1773310.25 ÷ 60 = 29555.17 numbers
Number of holes to be drilled per day of 300 days in a year	**:**	29555.17083 ÷ 300 = 98.5 or 99 numbers
Total meter-age of drilling/day (length of blast hole = 8.8m including sub grade-drilling)	**:**	100×8.8 = 866.95 meters
Requirement of drills		
Av. Drilling rate	**:**	30 m / hr
Effective drilling meterage in a day by single drilling machine (effective working hrs = 12 hrs)	**:**	30 x 12 = 360
Number of drills required	**:**	866.95 ÷ 360 = 2.40
Considering Availability a s 90% and Utilisation 90% No. Of Drill Required		2.97 or say- 3

No. of Drills required to meet the drilling requirements taking into consideration availability, utilization and the operator efficiency is **Three**.

b) Excavation

Specification of excavators		
Bucket capacity (C)	:	1.6 Cum
Bucket fill factor (F)	:	0.8
Time cycle pass at 90^{O} swing (T)	:	35 sec
Swell factor (S)	:	0.8
Swing factor for (90^{0} swing) (Fs)	:	1
Time Scheduling		
Working days per year	:	300 days
Effective working hours per day(day	:	12
Seconds in hour	:	3600 sec
Total Availability hours/ year	:	3600
Output /1.6 CuM excavator/annum	:	[C x F x S x Avg. Density x 3600 x 12 x 300] ÷ (T*Fs) = 826596.21
No. of Excavators Required		
Maximum excavation in any year of plan period	:	3546620.5 Cum
Requirement of excavator	:	3546620.5 ÷ 826596.21= 4.29
By Considering availability as 90% and utilization as 90% Requirement of Excavator is	:	5.29 or 6

No. of Excavators required to meet the excavation taking into consideration availability, utilization and the operator efficiency is **Eight***

**Another two excavator of smaller capacity will be added to the existing fleet for feeding the mobile Crushing and Screening plant.*

c) Transportation

Wastes (OB/SB/IB) shall be generated during the proposed period of mining for ore removing ROM. Calculation for no. of dumper required for transportation of ROM and waste material to their respective sites is based on 6 km hauling distance from the quarries within the leasehold area.		
Loading time		
Capacity of the dumper	:	20 Tonnes
Tonnes per pass of excavator bucket	:	2.23
	:	Dumper capacity ÷ [C x F x S] = 6.67 ÷ [1.4 x 0.8 x 0.8] = 7.45 or 8 passes
No. of passes required to load the dumper	:	[20/2.3] = 8.95 or 8
Swing time	:	35 sec
Dumper loading time	:	(8*35)/60= 4.67
Spotting time	:	0.3 Min
Load travel speed	:	15 kmph
Empty travel speed	:	20 kmph
Haul road distance	:	3 km
Load travel speed	:	(3/15)*60= 12 Min
Empty travel time	:	(3/20)*60= 9 Min
Dumping Time	:	1.5 Min
Total no of dumpers required per excavator	:	(.03+4.67+12+9+1.5)/(0.3+4.67) =5.53
Considering availability as 90% and utilisation as 90%, No. of dumpers required per excavator	:	(5.27/0.9)/.9 = 6.82 or 7
Total no of dumper required (total no of excavator* no of dumper / excavator)	:	7*6 =42

No. of Tippers required to meet the excavation requirement taking into consideration availability, utilization and the operator efficiency is **Forty-two**.

*In future, Possibility of Deploying high capacity equipment will be explode after carrying out feasibility study, Considering the Pit Geometry.

Calculations:

DRILLING AND BLASTING

a) Drilling

The actual requirement of drilling and blasting is 50% of the total excavation. As per the Monthly Production Plan, the designated drilling area will be leveled with help of Dozer and loaders. Blast design parameters are fixed depending on the type of strata. The drill plan will be prepared prior to the systematic drilling. Drilling will be carried out with the help of DTH drills.

b) Blasting

Broad blasting parameters like charge per hole, blasting pattern, charge per delay and maximum number of holes blasted in a round, manner and sequence of firing, etc. are discussed below:

Bulk Density (In-situ)	Ore	3.0 T/cum
	Waste	2.0 T/cum
Spacing	3.0 m	
Burden	2.5 m	
Average Depth	8.8m (including sub grade drilling)	
Powder Factor	7 T/kg	

Maximum volume of material to be excavated (in any year of plan period)	:	3546620.5Cum
Volume of material require drilling and blasting, as per the nature of the deposit is around 50% of the total excavation as those are hard and massive in nature)	:	1773310.25Cum
Total Tonnage by Drilling & Blasting	:	1773310.25x 3= 5319930.75 Tonne
Total Tonnage by Drilling & Blasting/Month	:	5319930.75/12= 443327.56 Tonne
Powder Factor	:	7 T/Kg
Total Explosive Required/Month	:	4,47,877.31 /7= 63,332.50 Kg
Base Charge Required@20%	:	12,66.50 Kg i.e 12.7 Tonne
Column Charge (ANFO) @ 80%	:	50,666Kg i.e.50.7 Tonne
Nonel (Shock Tubes) Required in meter @14	:	2,488 x14= 34,832 Mtrs.

Mtrs./Hole in month		
Blasting Frequency /week	:	4
Total Blast/Month	:	4x4=16
Ordinary Detonator Required@4/Blast	:	16 x 4= 64 Nos.
Safety Fuse in Meter@1.25 Mtrs /OD	:	64 x1.25= 75 Mtrs.

Type of Explosives to be used

Slurry/ Emulsion Cartridge explosives (83 mm)/ Prills of ammonium nitrate (with diesel as fuel in the ratio of 94:6) is proposed to be used to load the blast hole as primer and Column charge.

Storage of Explosives

It is proposed to procure explosives and services from licensed vendors, till the time JSW steel Limited. obtains requisite permission for storage, transport and use of Explosive.

M/s JSW Steel LIMITED. has been awarded multiple mines following the auction process, (further expected to get some more mines in future auction process), which are located in vicinity to each other. In order to maximize the utilization of resources Centralized/ individual magazine is being planned. Necessary permissions regarding the establishment of magazine and ammonium nitrate store house will be taken.

3.0 MINE DRAINAGE

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

The water table near the mine vary from 30m to 50m bgl that is about 570 to 550 MSL as per the bore wells drilled nearby as general ground level is about 600 MSL.

b) Maximum and minimum depth of workings:

The mining activity will be concentrated on the elevated portions of the hill range. The RL of general ground level is 600 MSL and the minimum depth of workings will be at 880 mRL and maximum depth will be around 744 mRL.

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

There is no chance of encountering groundwater during mining as the lowest level in mining will be sufficiently higher than general ground level. The monsoon water gets drained off through the natural valleys.

d) Regional and local drainage pattern, indicating annual rainfall, catchments area, and likely quantity of rainwater to flow through the lease area, arrangement for arresting solid wash off etc.

There are no rivers or perennial water courses in the mine lease area. However, the area is traversed by numerous seasonal water courses which are usually active during monsoon season and draining into the nearby water bodies (Hulikunte tank). Usually, no rain water accumulates in the lease area. The rain water flows from hill slopes and it does not accumulate till it reaches the lower valleys. Hence, the drainage pattern is sub-dendritic in nature and is typical of the hilly area.

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

a) Nature and quantity of topsoil, overburden / waste and Mineral Reject to be disposed off:

Topsoil*:* The mining area has been broken-up and was worked on the higher elevation. Area where iron ore excavation is proposed contains no topsoil.

***Ov*erburden/Waste and Mineral Rejects:** The waste rock consists of shale and BHQ.

Shale*:* This is mainly friable material with light yellowish to red in color having fine grains.

BHQ*:* It is hard and compact layered rock formation with color ranging from grey to black.

Table -4.1: Year wise quantity of Waste to be generated

Year	Topsoil		Waste			Mineral rejects		
	Reuse / Spreading	Storage	Backfilling	Storage	Temporary Dump(Block-II)	Blending	Storage	Beneficiation
First	-	-	-	5927773	11804	-	-	-
Second	-	-	-	6081845	11396	-	-	-
Third	-	-	-	254990	62745	-	-	-
Fourth	-	-	-	4958292	NIL	-	-	-
Fifth	-	-	-	2065308	NIL	-	-	-

b) Dumping area:

The BHQ/shale waste material will be disposed off in the area earmarked Dumped in active dump AD-1 and proposed dump in eastern side of the block-I of the lease area as well as temporary dump. Apart from it there are one existing waste dump present in the lease area, the details are given below:

Table 4.2: Existing Waste Dumps

Details of Dumps in Block-I

Name of the dump	Name of the dump	Location	Top RL	Bottom RL	Height (m)	Area (ha)
AD-1	AD-1	Northern side of ML	611	578	33	11.1
ID-1	ID-1	Southwestern side of ML	852	812	40	5.12
ID-2	ID-2	Northern side of ML	706	639	67	3.8
ID-3	ID-3	Centre of ML	836	730	106	2.8
ID-4	ID-4	South eastern of ML	845	649	196	21.1
EID-1 (Part of AD-1)	EID-1 (Part of AD-1)	Northern side of ML	611	578	33	0.46
EID-2 (Part of AD-1)	EID-2 (Part of	Western side of ML	611	578	33	1.13

	AD-1)					
EID-3 (Part of ID-1)	EID-3 (Part of ID-1)	Northwestern side to Southeastern side of ML	841	649	192	34.58
EID-4 (Part of ID-2)	EID-4 (Part of ID-2)	Northern side of ML	639	636	3	0.53
EID-5 (Part of ID-4)	EID-5 (Part of ID-4)	Southeastern side of ML	660	649	11	0.91

There are one active and seven inactive / encroached dumps in these two mines (ML No. 2365 and part of ml. No. 2366). Most of the EIDs and IDs are in continuation hence, considered as one.

In KH block one active dump (AD-1/EID-1/EID-2) and four inactive dumps (ID-1/EID-3, ID-2/EID-4, ID-3 and ID-4/EID-5) are present.

AD-1/EID-1/EID-2: This is the only active dump (AD-1) in the ML area and some of its portions are encroached towards North (EID-1) and south (EID-2). The dump height is 33 m and slope angle is 50 degrees. There are two terraces made at some places on this dump. No bio-engineering measures have been made. Two Nalas are blocked by this dump. Deep gully has been formed on the dump. The OB materials are severely eroded and breached in to the Nalas.

ID-1/EID-3: This inactive dump is located on western side of 2365-I. The major part of it is encroached towards western side (EID-3). The southern flank of the dump is inactive. Deep gullies and rills were observed and the materials rolled down in to the forest area. The dump is partially stabilized with Prosopis juliflora, Acacia nilotica, Agave americana, Cassia siamea, Delonix regia, Azadirachta indica and Pongamia pinnata. The dump slopes are breeched at some places. No engineering measures are made. The dump slopes are covered with coir mat at some places. The height of the dump is 196 m and its average slope angle is 50 degrees. At the north and central part of the dump is partially stabilized and its other places has no vegetation.

ID-2/EID-4: This is located towards Northern boundary of lease which is partially encroached towards North (EID-4). The slope angle is 50-60 degrees. Height of the dump varies from 3-67 m. The slope is stabilized with Cassia siamea, Acacia auriculiformis, Glyricidia maculata and Agave americana. Dump is having one or two terraces at some places. The dump is fully stabilized with plantation. At some places, the dump is covered with coir mat. It is also observed that some portion of the inactive dump is not vegetated. The dump top towards south direction also not vegetated. No engineering measures made.

ID-3: This is located within the lease area of 2365-I and is on the NE corner of mine pit P-1. It is severely eroded and OB materials rolled down to forest within lease area. The dump was partially vegetated with Eucalyptus. The slope angle is 60 degrees. Height of the dump is 106 m. The dump is located on the steep

slope. It is observed rills and gullies at some places on the dump. No engineering measures are made.

ID-4/EID-5: A huge dump is located on the SE corner of ML area of 2365-I and 2366. A small portion is encroached towards SE side (EID-5). Major portion (90%) of OB dump is within the lease area (ID-4) and a small portion of OB dump (10%) is encroached (EID-5). The OB material rolled into the forest. It is partially stabilized with Agave americana, Acacia nilotica, Cassia siamea, Leucaena leucocephala and Eucalyptus. Natural vegetation such as Calotropis gigantea and Chromolena odorata is observed on the slopes of the dump. The dump is having 4-5 terraces. The slope angle is 60 degrees. The height of the dump varies from 11 to 196 m. Steep gullies and rills observed on the slopes. No engineering measures made.

Details of Dumps in Block-II

Name of the dump	Location	Top RL	Bottom RL	Height (m)	Area (ha)
ID-5	Southwestern side of ML	909	901	8	1.7
ID-6	Western side of ML	914	913	1	0.16
EID-6 (part of ID-5)	Southwestern side of ML	907	803	104	8.30
EID-7 (Part of ID-6)	Western side of ML	914	792	122	3.1
EID-8	South-eastern side of ML	884	820	64	0.83

In block-II three inactive/ dumps (ID-5/EID-6, ID-6/EID-7 and EID-8) are present.

ID-5/EID-6: Major portion (80%) of the OB dump (EID-6) rolled into SW side of the forest adjacent to P-2 in UG Block. Dump is having 2 terraces. The height of the dump varies from 8-104 m. The dump top is vegetated with Cassia siamea, Acacia auriculiformis, Leucaena leucocephala, Agave americana and Acacia nilotica. Dump slopes are exposed open. Dumps are severely eroded. Deep gullies are formed. OB materials are breeched into the Nala. No engineering measures made.

ID-6/EID-7: It is located on western side of UG Block. The major portion (90%) is encroached towards western side in the forest area (EID-7). The dump is having 4 terraces. Severely breeched and rolled into the forest. The height is nearly 120 m. The slope angle is 50-65 degrees. The dump is partially planted with Cassia siamea, Acacia auriculiformis, Casuarina equisetifolia, Leucaena leucocephala, Prosopis juliflora, Acacia nilotica, Holoptelia integrifolia and Hardwicika binata. The OB materials are vertically rolled down into the forest. No engineering measures made.

EID-8: It is located on the south-eastern side of UG Block. At some places, deep gullies and rills have formed and OB materials rolled down into the forest. It is also located near downside of the temple. The height of the dump is 64 m and slope angle is 60 degrees. No engineering measures made

c)Manner of disposal of waste, configuration and sequence of year wise build-up of dumps along with the proposals for protective measures.

The waste material generated from mining will be dumped in active dump AD-1 during the first three years plan period while in remaining two years the waste would be dumped on section 5-5' which is outside the pit limit on the eastern side of the Block-I

Table 4.3 : Year wise Dumping proposals

Year	Area (Ha)	No. of stages	Level in mRL	Location Co-ordinates	
				Northing	Easting
First	14.96	2	600-625	1671580-1671980	674675-675230
Second	12.12	3	625-650	1671580-1671950	674720-675230
Third	6.25	1	650-670	1671580-1671850	674860-675230
Fourth	4.77	6	625-695	1671180-1671440	674930-675150
Fifth	3.37	2	695-715	1671120-1671320	674950-675180

No sub-grade generation is proposed in this plan period.

Table 4.4: Proposed engineering measures for backfilling and temporary dump

Proposed engineering measures for management of waste dumps (ML No. 2365)											
Location	Items	Particulars of works	No	Dimension in m				Qty.	Unit	Rate/ Unit (Rs.)	Amount (Rs. In Lakhs)
				Length	Width		Height				
					Top	Bottom					
AD-1 / EID-1	TW-1: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	1206.00	2.00		0.60	1447.20	cum	111	1.606
		Plain cement concrete (1:4:8) in foundation	1.0	1206.00	1.70		0.15	307.53	cum	1860	5.720
		RR Stone masonry in cement sand mortar (1:6)	1.0	1206.00	0.50	1.50	3.00	3618.00	cum	1232	44.574
	GD-1	Garland drain below the toe wall	1.0	1215.00	2.00	1.00	1.00	1822.50	cum	111	2.023
ID-2 / EID-4	TW-2: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	627.00	2.00		0.60	752.40	cum	111	0.835
		Plain cement concrete (1:4:8) in foundation	1.0	627.00	1.70		0.15	159.89	cum	1860	2.974
		RR Stone masonry in cement sand mortar (1:6)	1.0	627.00	0.50	1.50	3.00	1881.00	cum	1232	23.174
	GD-2	Garland drain below the toe wall	1.0	640.00	2.00	1.00	1.00	960.00	cum	111	1.066
EID-3 / 1	TW-3/1: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	968.00	2.00		0.60	1161.60	cum	111	1.289
		Plain cement concrete (1:4:8) in foundation	1.0	968.00	1.70		0.15	246.84	cum	1860	4.591

		RR Stone masonry in cement sand mortar (1:6)	1.0	968.00	0.50	1.50	3.00	2904.00	cum	1232	35.777
	GD-3/1	Garland drain below the toe wall	1.0	980.00	2.00	1.00	1.00	1470.00	cum	111	1.632
EID-3 / 2	TW-3/2: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	166.00	2.00		0.60	199.20	cum	111	0.221
		Plain cement concrete (1:4:8) in foundation	1.0	166.00	1.70		0.15	42.33	cum	1860	0.787
		RR Stone masonry in cement sand mortar (1:6)	1.0	166.00	0.50	1.50	3.00	498.00	cum	1232	6.135
	GD-3/2	Garland drain below the toe wall	1.0	180.00	2.00	1.00	1.00	270.00	cum	111	0.300
EID-3 / 3	TW-3/3: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	132.00	2.00		0.60	158.40	cum	111	0.176
		Plain cement concrete (1:4:8) in foundation	1.0	132.00	1.70		0.15	33.66	cum	1860	0.626
		RR Stone masonry in cement sand mortar (1:6)	1.0	132.00	0.50	1.50	3.00	396.00	cum	1232	4.879
	GD-3/3	Garland drain below the toe wall	1.0	140.00	2.00	1.00	1.00	210.00	cum	111	0.233
EID-3 / 4	TW-3/4: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	307.00	2.00		0.60	368.40	cum	111	0.409
		Plain cement concrete (1:4:8) in foundation	1.0	307.00	1.70		0.15	78.29	cum	1860	1.456
		RR Stone masonry in cement sand mortar (1:6)	1.0	307.00	0.50	1.50	3.00	921.00	cum	1232	11.347

	GD-3/4	Garland drain below the toe wall	1.0	320.00	2.00	1.00	1.00	480.00	cum	111	0.533
EID-3 / 5	TW-3/5: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	883.00	2.00		0.60	1059.60	cum	111	1.176
		Plain cement concrete (1:4:8) in foundation	1.0	883.00	1.70		0.15	225.17	cum	1860	4.188
		RR Stone masonry in cement sand mortar (1:6)	1.0	883.00	0.50	1.50	3.00	2649.00	cum	1232	32.636
	GD-3/5	Garland drain below the toe wall	1.0	890.00	2.00	1.00	1.00	1335.00	cum	111	1.482
EID-7	TW-5: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	496.00	2.00		0.60	595.20	cum	111	0.661
		Plain cement concrete (1:4:8) in foundation	1.0	496.00	1.70		0.15	126.48	cum	1860	2.353
		RR Stone masonry in cement sand mortar (1:6)	1.0	496.00	0.50	1.50	3.00	1488.00	cum	1232	18.332
	GD-5	Garland drain below the toe wall	1.0	510.00	2.00	1.00	1.00	765.00	cum	111	0.849
EID-6	TW-6: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	789.00	2.00		0.60	946.80	cum	111	1.051
		Plain cement concrete (1:4:8) in foundation	1.0	789.00	1.70		0.15	201.20	cum	1860	3.742
		RR Stone masonry in cement sand mortar (1:6)	1.0	789.00	0.50	1.50	3.00	2367.00	cum	1232	29.161
	GD-6	Garland drain below the toe wall	1.0	800.00	2.00	1.00	1.00	1200.00	cum	111	1.332

EID-8	TW-7: Toe Wall at the toe of the dump	Foundation in hard soil mixed with boulders including hard rock	1.0	226.00	2.00		0.60	271.20	cum	111	0.301
		Plain cement concrete (1:4:8) in foundation	1.0	226.00	1.70		0.15	57.63	cum	1860	1.072
		RR Stone masonry in cement sand mortar (1:6)	1.0	226.00	0.50	1.50	3.00	678.00	cum	1232	8.353
	GD-7	Garland drain below the toe wall	1.0	240.00	2.00	1.00	1.00	360.00	cum	111	0.400
ID-4	Geo-textile/ Coir-mat	Mannual terracing followed by Geo-textile/coir matting and plantation may be done on high steeply sloping part of the OB dump	--	--	--	--	--	2.00	ha	1000000	20.000
EID-3	Geo-textile/ Coir-mat	Mannual terracing followed by Geo-textile/coir matting and plantation may be done on high steeply sloping part of the OB dump	--	--	--	--	--	3.00	ha	1000000	30.000
Temporary dumping in pit	TW-8: Toe wall at the toe of waste dump	Foundation in hard soil mixed with boulders including hard rock	1.0	286.00	2.00		0.60	343.20	cum	111	0.381
		Plain cement concrete (1:4:8) in foundation	1.0	286.00	1.70		0.15	72.93	cum	1860	1.356
		RR Stone masonry Dry	1.0	286.00	1.00	3.00	2.00	1144.00	cum	400	4.576
	GD-8	Garland drain below the toe wall	1.0	291.00	2.00	1.00	1.00	436.50	cum	111	0.485
TOTAL											316.25

5.0 USE OF MINERAL AND MINERAL REJECT

a) Requirement of end-use industry:

Since this mine is a captive mine to JSW Steel Limited., entire production will be utilized in the JSW Steel Plant.

Name of the Firm Company	Chemical Specification	Physical Specification
M/s JSW Steel Limited.	+45% Fe	Lumps 10-40 mm
	+45% Fe	Fines 0-10 mm

b) Requirement of intermediate industries involved in up gradation of mineral before its end-use:

Since this mine is captive, entire production will be utilized in the JSW Steel Plant. Hence no intermediate industries are involved in upgradation of mineral.

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

i) Entire quantity of Iron ore mined (as captive) from this mine will be utilized in JSW steel plant.

Name of the Firm Company	Chemical Specification	Physical Specification
M/s JSW Steel Limited.	+45% Fe	Lumps 10-40 mm
	+45% Fe	Fines 0-10 mm

ii) As per the requirement of the steel plant there is also a proposal to transport the ROM directly to the steel plant as ore beneficiation Unit is already existing and is operational in the plant. Alternately ROM could also be sent through stockyard by appropriate prevailing system of transportation.

d**) Precise physical and chemical specification stipulated by buyers**

Presently the material produced will be transported to M/s JSW Steel Plant for its own captive use, so there are no stipulated buyer.

e) Details of processes adopted to upgrade the ROM to suit the user requirements:

ROM produced will be sent for dry processing (Crushing / screening) to generate +10-40mm calibrated lumpy Iron ore and -10mm fines Iron ore by Crushing / screening plant. Since all +45% Fe grade Iron ore will be useful in the steel plant, and hence there will be no specific blending of different grade of ore.

6.0 PROCESSING OF ROM AND MINERAL REJECT

a) Nature of processing / beneficiation of ROM or Mineral Reject, indicating size and grade of feed material and concentrate (finished marketable product), recovery etc. Processing of Mineral Reject

No beneficiation of ROM or mineral reject will be carried out in the lease area during the plan period. However, sorting and sizing will be carried out by mobile crushing and screening of the ore to the required physical specification. The crusher will process the mineral to different sizes of 0-10 (fines) and 10-40mm (c-ore), which will be stacked separately outside the lease area.

Processed ore stacked separately will be transported to JSW Steel Plant, as entire production of Iron ore mined from this mine will be consumed by the plant for its captive uses.

Tentative location of C & S and Processed stock are given below

C & S Plant unit (Mobile/Fixed) and Stock yard	Location Co-ordinates	
	Northing	Easting
I	1671800 to 1671850	674600 to 674650

Location of crushing and screening plant is shown in **Plate No.6A to Plate No.6E**

b) Material balance chart with a flow sheet or schematic diagram of the processing procedure

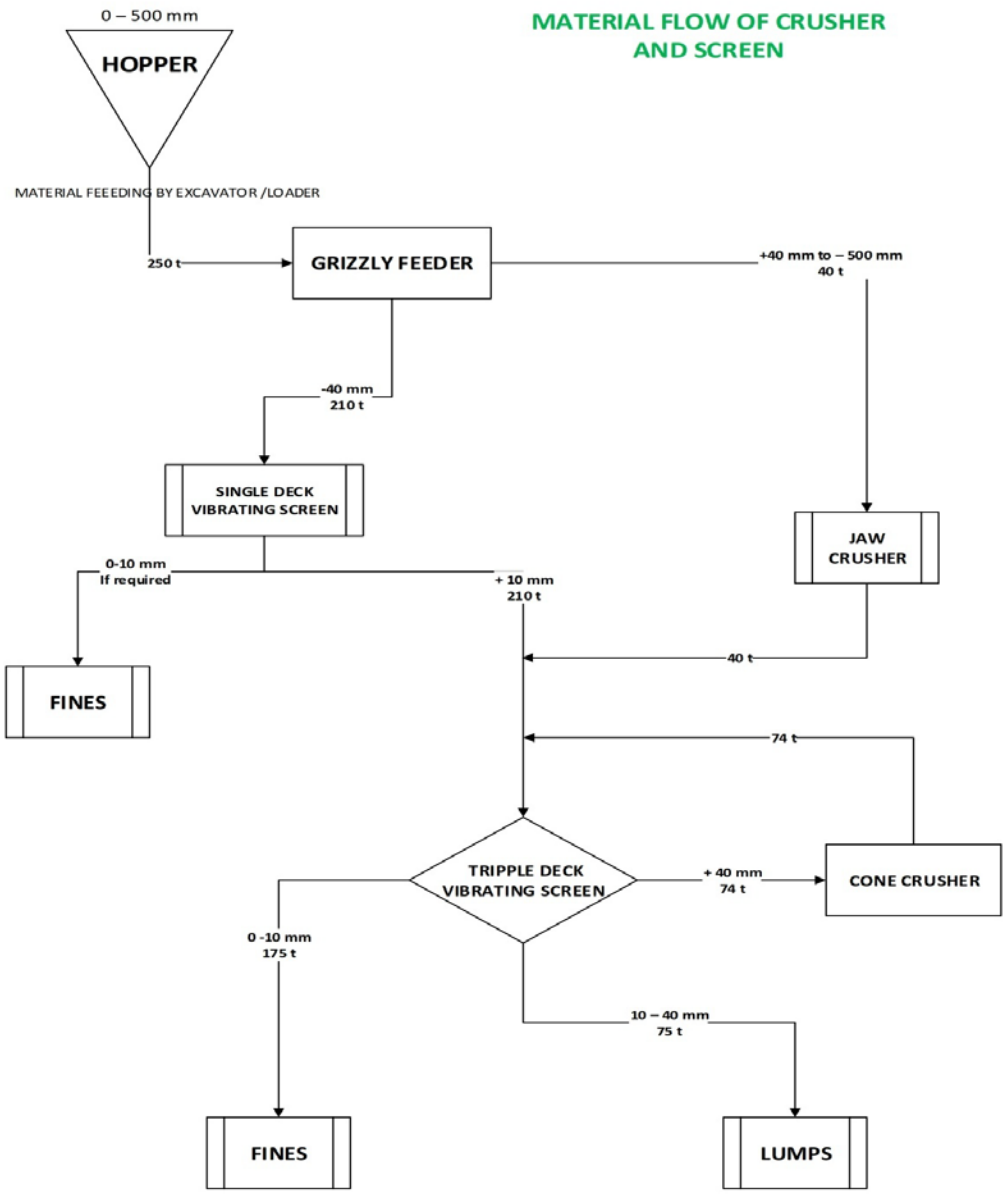
i) A mobile crushing plant of 200/250 tonnes/hour and screening unit of 250-300 tonnes/hour capacity will be established in the mine, to process the ROM upto 500 mm sizes. The crusher will process the mineral to different sizes of 0-10 (fines) and 10-40mm (c-ore), which will be stacked separately at the designated stock yard outside the lease area for further transportation to JSW Steel plant.

ii) Further, Possibility will be explode after carrying out techno economic study to install a stationary Crushing and Screening Plant for proceeding of ROM.

iii) As per the requirement of the steel plant, we also propose to transport the ROM directly to the steel plant as Ore Crushing and Screening with Beneficiation Unit is already established in the plant. Alternatively, ROM may also be sent through intermediate stockyard by appropriate prevailing system of transportation.

Table -6.1: Likely material balance in percentage

Description	Rate in percentage
Feed (+10 mm ROM)	100%
Cal. Ore (+10 to -40 mm)	30%
Fines (-10mm)	70%


MATERIAL FLOW OF CRUSHER AND SCREEN
0 – 500 mm
HOPPER
MATERIAL FEEEDING BY EXCAVATOR /LOADER
250 t
GRIZZLY FEEDER
+40 mm to – 500 mm
40 t
-40 mm
210 t
SINGLE DECK VIBRATING SCREEN
JAW CRUSHER
0-10 mm
If required
+ 10 mm
210 t
FINES
40 t
74 t
TRIPPLE DECK VIBRATING SCREEN
+ 40 mm
74 t
CONE CRUSHER
0 -10 mm
175 t
10 – 40 mm
75 t
FINES
LUMPS

c) The disposal method for tailings or reject from the process Plant.
Not applicable.

d) Quantity and quality of tailings/reject proposed to be disposed, size and capacity of tailing pond, toxic effect of such tailings, if any, with process adopted to neutralize any such effect before their disposal and dealing of excess water from the tailings dam.

Not applicable.

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

Not applicable.

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

Not applicable.

g) Water usage of the mine, disposal of waste water

Approximately 610 Cum is daily water requirement for dust suppression, afforestation purpose, canteen and other general requirements, for this mine. Water will be drawn from company bore wells dug in nearby mining areas.

Crushing & Screening process does not have any water requirement as C&S units will be fitted with dust suction system.

7.0 OTHERS

a) Site services:

All major and capital repairs including maintenance and servicing of all mining equipment and machinery will be carried out at the mine workshop and central workshop. The workshop is provided with all essential facilities under following sections:

i. Heavy vehicles section
ii. Medium and light vehicles section
iii. Auto-Electrical section
iv. Welding and blacksmith section
v. Machinery and lathe section

All activities of the workshop are carried out under the supervision and control of qualified Mechanical and Electrical engineers with the help of experienced mechanics and electricians. An independent store for all essential spare parts will also be maintained at the mine workshop.

Power Supply

As mentioned earlier the requirement of the electric power will be tapped from the HT line passing near to the lease area by means of a suitable transformer. Till the time power is made available, DG set will be used. HEMM will be fueled by HSD. Most of the HEMM, C&S plants will be operated by HSD till power supply is provided.

Water Supply

The requirement of water supply, both for drinking and mine will be drawn from the company bore wells dug in nearby mining area.

Office

Since the mine working area spread is more, makeshift office in portable cabins have been proposed with necessity amenities.

Canteen

A small canteen has been proposed near the mine office to cater the needs of persons employed in mine and ancillary activities.

Dispensary

A dispensary/ cum-clinic is maintained at Toranagallu Office, where from all basic medical needs of workers and staff can be fully met. The company has undertaken various health camps and also strengthened the existing primary health centers located in the surrounding villages. And first aid room/stations will be provided with prescribed appliances.

b) Employment potential:

Vice president, Mines (JSW Steel Limited) heads the central mine organization followed by senior mining

professionals (GM, DGM) and Mines Manager holding 1st class Certificate of competency. This mine will provide employment to 264 people and also generates indirect employment to around 300 people. Most of the work force employed by the lessee are for mine supervision.

Table -7.1: Category wise employment

Category: Mine Official (Highly skilled)

Designation	No. of Persons
Mines Manager	1
Asst. Mines Manager	2
Mining Engineer	1
Environment Engineer	1
Geologist	1
Mechanical Engineer	1
Electrical Engineer	1
Mine Surveyor	1
Mining Foreman	4
Mining Mate cum Blaster	2
Welfare officer	1
IT officer	1
Total	**17**

Category: Skilled

Designation	No. of Persons
HEMM operator	127
Maintenance Dept. Staff	6
Office Staff	5
Total	**138**

Category: Semi-skilled

Designation	No. of Persons
Helpers	57
Drivers	32
Total	**89**

Category: Unskilled

Designation	No. of Persons
Workmen	20
Total	**20**

8.0 PROGRESSIVE MINE CLOSURE PLAN UNDER RULE 23 OF MCDR 2017

8.1 Environment Base line information:

This mine is recently reallocated to JSW Steel Limited., through an E-Auction process, conducted in accordance with the Mineral (Auction) Rules, 2015. The transfer of statutory clearances is under process. This has restricted our access to the core as well as buffer zones of mining lease. After the commencement of mining operations, a detailed EIA/EMP will be carried out.

The Mining lease area for Iron ore will be worked by opencast fully mechanized method. Deep-hole drilling and blasting operations are envisaged for production of the ore and waste. This is estimated to be about 60% of the total mining operations and resorted only if hard rock formation is encountered during mining operations. It is a known fact that any mining activity will alter the existing ecology. The following chapter discuss in detail the effects of mining on the existing environment and the proposed measures to mitigate the same.

8.1.1 Existing land use pattern:

Table 8.1: Existing and conceptual land use pattern within mine lease area of ML 2365

Sl. No.	Land use particulars	Existing Area (ha) Blocks-I & II (KH & UG)	Conceptual Area (ha) Blocks-I & II (KH & UG)
1	Area for Mining	34.39	57.89
2	Area for Dumping	39.93	34.57
3	Area for roads	1.50	1.50
4	Safety zone/green belt	7.38	7.38
5	Infra structures	0.30	0.30
6	Virgin/Untouched area	47.03	28.89
Total		**130.53**	**130.53**

8.1.2 Water regime*:*

Naturally, no rain water accumulates in the lease area. The rain water flows from hill slopes and it does not accumulate till it reaches the lower valleys. Hence, the drainage pattern is sub-dendritic in nature and is typical of the hilly area. There is only **one second order *nala*** originating from S-E corner of the lease area of 2365. This nala is ultimately emptying into *Narihalla* stream.

The ground water in the buffer-zone area is tapped for irrigation and drinking water purpose. There is no ground water occurrence within the lease area. Mine area is subjected to moderate annual rainfall of 40 to 80 cm.

8.1.3 Quality of air and Ambient noise level

Ambient Air Quality: Since the existing mine is not in operation since 2011, we do not envisage any change in the ambient air quality from the baseline environmental parameters. As the mine is not in operation, ambient air quality for both the core zone (mining lease area) and buffer zone (within 10 km

from the boundary of mining lease) is expected to be within the prescribed standards.

However, once the mining becomes operational, regular monitoring of air quality for the core and buffer zone will be undertaken. Air quality will be closely monitored, data collected will be analysed to understand the quality of air. In case, the air quality does not meet the norms for certain parameters, adequate measures will be taken to contain the air quality parameters well within the prescribed limits.

Noise Levels: Since the existing mine is not in operation since 2011, change in the ambient noise levels is not envisaged.

However, once the mining becomes operational, regular monitoring of noise levels for the core and buffer zone will be undertaken. Data collected will be analysed to understand the sources for excessive noise levels. In case, the noise levels do not meet the norms for certain parameters, adequate measures will be taken to contain the noise level parameters well within the prescribed limits.

8.1.4 Flora & Fauna

a) Flora*:*The vegetation occurring in the area belongs to Southern tropical dry deciduous forests. The dominant tree species found in the area are:

Table-8.2: Flora Species

S.No	Local Name	Botanical Name
1	Khair	Acacia catechu
2	Pachali	Dalbergia Paniculata
3	Rose wood	Dalbergia latifolia
4	Hudi	Stereospermum chelonoides
5	Maradi	Buchanania lanzan
6	Channaagi	Lagerstroemia parviflora
7	Dindal	Anogeissus latifolia
8	Honne	Pterocarpus marsupium
9	Beete	Dalbergia latifolia
10	Somi	Soymida febrifuga
11	După	Boswellia Serrata
12	Mashiwala	Chloroxylon swietenia
13	Maddi	Morinda tinctoria
14	Nobela	Limonia acidissima
15	Bela	Feronia elephantum
16	Bikke	Gardenia gummifera
17	Kakke	Cassia fistula
18	Boravi	Ixora arborea
19	Tega	Tectona grandis
20	Jagalaganti	Diospyros Montana
21	Bamboo	Dendrocalamus strictus

b) Fauna*:* In the buffer zone area, a total of 36 vertebrates and 20 invertebrates were recorded. Out of this, 26 were mammals, 7 were reptiles, 2 were amphibians and 20 were arthropods.

Antelope, spotted deer, Sambhar, Red and black mouth monkey, pig, Rabbit, Cow, Buffalo, Mouse, Porcupine and Horse observed belong to mammals.

House Lizard, Garden lizard, Krait, Cobra, Viper, Python and chameleon were among the reptiles observed. Frog and Todd were the amphibians found in the region.

Millipede, Centipede, Cockroach, Ant, Honey Bee, House fly, Red ant, Silver Fish, Earthworm, Cricket and grasshopper observed fall under the category, arthropods.

Major avifauna observed in the region include Nilkanth, Crow, Pigeon, Batair, Koel, Teetar, Owl, Kite, peacock, Parrot, Bulbul, Whistling teal, Vultures, Maina, Egred, Brahmany Kite, Shikra, Buzzard, Blue jay and Shrike.

8.1.5 Climatic conditions

The study area forms a part of the region dominated by tropical climate with hot summer days moderately cool winters and moderate monsoon. The maximum & minimum temperatures with in core zone area were observed to be 41^0C and20^0C, respectively and the relative humidity varied between 30% & 80%.

8.1.6 Human Settlements

No human settlements within the lease area. However, within 10 km radius from mine lease area there are 25 villages and the demographic profile of the villages are given below:

Sl. No.	Name of the village	Arial Distance from Mine (Kms.)	Total Population
1.	Talur	7.50	4694
2.	Nagalapur	5.80	1932
3.	Bannihatti	5.30	2016
4.	Gangalapur	4.80	812
5.	Chikkaantapur	8.00	1449
6.	Gouripur	4.10	532
7.	Muraripur	5.80	1410
8.	Taranagar	3.90	6722
9.	Kodalu	6.30	2056
10.	Lingadahalli	4.80	1467
11.	Antapura	8.80	3225
12.	Marutala	6.10	205

13.	Krishnanagar	8.30	7027
14.	Sandur	9.20	37431
15.	Avaniamaduga	10.0	447
16.	Bhujanganagar	6.60	5535
17.	Lashmipur	9.10	1155
18.	Malapur	7.20	1847
19.	NMDC Colony	7.00	6672
20.	Narasingapur	7.00	2291
21.	Ubbalangandi	6.00	1713
22.	Ranjitpur	5.00	1376
23.	Rajapur	8.00	2696
24.	Vittalanagar	6.00	1109
25.	Devgiri	7.00	3606

8.1.7 Public buildings, places of worship and monuments

There are no public buildings, natural parks, places of worship & monument within the core zone or within the vicinity of the mine area.

8.1.8 Any sanctuary located near leasehold

There is no sanctuary located near the lease area.

Environmental Plan is enclosed in 1:5000 **(Plate No.09)**

8.2 Impact Assessment:

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

The mining pits are present in the lease area serving as production benches. The major impacts observed include soil erosion, loss of topsoil, creation of pits and deforestation and possibility of adding silt load in the natural nallah nearby the lease area.

ii) Air quality

The semi-arid climatic condition of the area coupled with mining activities on the top of the hills through open-cast, contributes to air pollution. The dust is observed to be the predominant air pollutant when the mining is in operation.

iii) Water quality

The major impact on water pollution is due to erosion of waste dump and sub-grade dump, oil and grease, contamination of water bodies due to discharge of mine water/effluent and sedimentation of the seasonal nallahs flowing nearby.

iv) Noise levels

Noise pollution by mining activities is mainly because of excavation, handling and transportation of ore and overburden and operation of processing equipment.

v) Vibration levels (due to blasting)

As deep hole drilling and blasting would be conducted, certain impact on ground vibration is likely to be caused. However, well designed blasting pattern, use of shock tube initiation system, use of M.S. delay detonators, will be used to minimise the ground vibration levels. Hence there is no major impact due to blasting.

vi) Water regime

The existing seasonal nallahs in the buffer zone remain dry and become active during rainy season. Since the watercourse are shallow and the workings are situated at higher elevations, water will not pose any problem. Since rainfall is comparatively low, there will not be much siltation or run-off problem. However, suitable engineering measures are proposed, as mentioned in the Environment management plan **(Plate No.09)** to avoid any impact on water regime.

The mining operations are conducted at hill top which is at much higher level than ground water level. Mining activities will not intersect the groundwater as the groundwater table is 226 m below the pit bottom.

vii) Acid mine drainage

Not applicable as no acidic material is present in the mining area.

viii) Surface subsidence

Not applicable as it is opencast mining in a stable area.

ix) Socio-economics

The mining will bring positive effect by way of generation of employment and business opportunities to local people. Apart from this, lessee will undertake CSR activities focusing on measures to improve education, health, literacy of the people of surrounding villages.

x) Historical monuments etc.

There are no public buildings, places of worship or monuments are located near the lease area.

Mitigative measures:

Air: It is proposed to deploy Water tankers with automated sprinkling system to suppress dust by regular water spraying on all the roads used for haulage and around mobile Crushing &Screening Plant. Plantation will be carried out as green belt all along the lease boundary which will act as windbreaks.

Water*:* For protection of the mining area and for arresting solid wash-off the surface water management measures will be implemented as proposed in the R&R report.

Noise: The management plan for controlling noise pollution are by providing noise insulation/padding in plants and machinery wherever practicable, limiting of speed of haulage vehicles/tippers, proper maintenance of noise generating parts of the machine, provision of earmuffs to workers.

Regular monitoring of all the environmental parameters will be undertaken as per CCOM circular, Location of monitoring stations has been marked on Environment plan **(Plate No.09).**

8.3 Progressive reclamation Plan

8.3.1. Mined-Out Land:

The existing land use pattern is as follows

Table. 8.3 Existing Land Use Pattern

Type of Land Use	Existing Area (ha) Blocks-I & II
Area for Mining	34.39
Area for Dumping	39.93
Area for roads	1.50
Safety zone/green belt	7.38
Mineral Storage area	0.85
Infra structures	0.30
C & S area	0.20
Virgin/Untouched area	45.98
Total	**130.53**

The proposed conceptual land use pattern is as follows:

Table 8.4 Proposed Land Use Pattern

Type of Land Use	Existing Area (ha) Blocks-I & II
Area for Mining	44.68
Area for Dumping	46.78
Mineral Storage	1.50
C & S	0.85
Area for roads	1.50
Safety zone/green belt	7.38
Infra structures	0.50
Engineering Measures	0.30
Virgin/Untouched area	27.04
Total	**130.53**

Mining activity is yet to start in this area. The proposed area to be worked during the plan period is shown in the year-wise production and development plans. Mining in this plan period is proposed in the existing benches of earlier mined out area..

Hence reclamation by afforestation of encroached area, Active dumps and green belt development along the lease boundary will be carried out.

The environmental protective works such as afforestation, avenue plantation, settling tank, geo-textile matting, green belt development, dump management, check dam, retaining wall will be taken up in the mine effectively as per the ICFRE - R & R Plan.

Year-wise afforestation programme is furnished below and same has been marked on year-wise Production and Development plans **(Plate No.6A) to Plate No.6E).**

Year	Type	Quantity	Location
I	Agave roots Saplings	18,000 Nos.	Greenbelt development & area under encroachment
II	Agave roots Saplings	18,000 Nos.	Greenbelt development & area under encroachment
III	Agave roots Saplings	18,000 Nos.	Greenbelt development & area under encroachment
IV	Agave roots Saplings	18,000 Nos.	Greenbelt development & area under encroachment
V	Agave roots Saplings	18,000 Nos.	Greenbelt development & area under encroachment

8.3.2 Topsoil Management:

Since the mine has been operation for several years before falling into 'C' category, entire area is already broken up. As per proposed mining programme over next five years, there is no likelihood of generation of topsoil. The soil is also not conducive for agricultural purpose. However if, some quantity is generated from cavities the same will be stacked and used for afforestation purpose.

8.3.3 Tailings Dam Management:

Not required as no tailing dam is present or proposed.

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

Not applicable as no acidic material is present in the mining area.

8.3.5 Surface subsidence mitigation measures:

Not applicable as the proposal is for opencast mining in a stable area.

Table-8.5: Summary of year wise proposal for item Table No. 8.3

Items	Details	Year-wise Proposed measures					Remarks
		Ist	IInd	IIIrd	IVth	Vth	
Dump Management	Area afforested in (Ha)	-	-	-	7.48	7.48	The AD-1 is saturated at the end of third plan period.
	No. of saplings planted	-	-	-	11250	11250	N.A.
	Cumulative no. of plants planted	-	-	-	-	-	N.A.
	Cost including watch and ward care during the year	-	-	-	-	-	N.A.
Management of worked out benches	Area available for rehabilitation (Ha)	-	-	-	-	-	Mining operations are yet to resume. No worked out abandoned benches. Rehabilitation not proposed.
	Afforestation done	-	-	-	-	-	N.A.
	No. of saplings planted in the year	-	-	-	-	-	N.A.
	Cumulative no. of plants	-	-	-	-	-	N.A.
	Cost including watch & care	-	-	-	-	-	N.A.

R&R by backfilling	Void available for backfilling	-	-	-	-	-	-	
	Void Filled by waste/ tailing (Area in Ha.)	-	-	-	-	-	N.A.	
	Afforestation on the backfilled area	-	-	-	-	-	N.A.	
	Rehabilitation by making water reservoir	-	-	-	-	-	N.A.	
Rehabilitation of waste land within lease	Area available (Ha)	-	-	-	-	-	-	
	Area rehabilitated	-	-	-	-	-	Afforestation work will be taken up simultaneously with mining operation.	
	Method of rehabilitation	-	-	-	-	-	Local species, as suggested by ICFRE will be planted to restore the natural flora.	
Others	Area for Greenbelt Development (Ha)	1.1	1.3	0.92	0.40	0.50	Greenbelt development in for first plan period 4.4 Ha remaining 3.1 Ha will be developed in next plan period	
	Afforestation for area under encroachment (Ha)	16.63	16.63	16.63	16.63	16.63	Mining Pit	7.35 Ha
							Overburden Dumps	49.38
							Others	26.46

*It is fresh auctioned block mine operation are not yet be resumed

To prevent further degradation of land and stabilization of dumps, engineering measures i.e. toe walls, garland drains etc. are proposed inside the lease area. The details are given below:

8.4 Disaster Management and Risk Assessment:

The aim of disaster management is to identify potential dangers associated with the mining operations. An important element of mitigation is emergency planning i.e., recognizing that accidents are Possible, assessing the consequences of such possible accidents and deciding on the emergency procedures, in advance, both on-site and off-site, that would need to be implemented in the event of an emergency, systematically and without delays and confusion.

The risk and disasters that could be foreseen in opencast mines may arise from:

i. Failure of external overburden dumps

ii. Failure of mine bench slopes

iii. Fly-rock from blasting operations

iv. Chemical spills

v. Fire in the bulk fuel storage ore forest fire

vi. Plying of trucks and other vehicles on public roads

Maintenance of proper bench geometry, observing safety precautions for transport, proper storage, safe handling and use of explosives and fuel etc., good maintenance of roads and transport units, fire prevention measures, good dump management, shall go a long way in preventing accidents/disasters. No chemicals are used in mining operations or beneficiation process. Hence, there is no risk involved due to chemical spills.

Mining will be carried-out strictly as per MMR 1961 and all other rules and regulations. Project proponent is having mobile communication system for quick passing of information if need arises. Proper training will also be given to the work persons periodically, as per DGMS rules.

The management is committed to identify possible causes for the potential disasters and draw a code of emergency measures and procedures to deal with such disasters, which is otherwise also advised by DGMS through their periodic circulars.

Safety and Security

Around the ultimate pit limit, a fencing will be constructed as per the norms prescribed by the DGMS, to fence off the entry of stray animals and persons to the mine area. Where such effective blocking is not possible, watch & ward Posts will be established. Periodical inspection of all such arrangements will be carried out. The visitors will be allowed to enter the mine area only with permission.

Risk Management

In case of any emergency, evacuation of affected people will be undertaken immediately. Injured person(s) will be shifted to the hospital by departmental ambulance to Sanjeevani Hospital and Government. Hospital located at 25 km. & 5 Km. from mine head respectively. Using cellphone service, monitoring of relief services will be carried out.

No high-risk accidents are anticipated, as the project is an open cast mining operation in a stable area free from land subsidence, earthquake etc. However, in case of any eventuality, the designated Mines Manager will be managing of the situation. He will be having communication facility and a Jeep at his disposal which will help in evacuating persons involved in any accidents.

Details of the Person to be contacted in case of emergency situation:

Name: Sri Nishant Kumar Sharma, Mines Manager

Cell: 9480694249

Nearest Hospital (102), Fire station (101) and Police Station (08395-260249) are in Sandur which is about 9 km away.

8.5 Care and maintenance during temporary discontinuance:

An emergency plan to deal with the situation of temporary discontinuance or incomplete programme due to Court order/due to statutory requirements or any other unforeseen circumstances will be drawn by the technical & managerial personnel to suit the specific situation of this mine.

This will be reviewed & modified to suit the varying conditions. This would involve preventing access to dangerous places, pits and preventing accidental fall into the pit of animals & men. Safety measures, such as firefighting equipment, switchgear etc., will be placed at readily accessible locations.

The following measures will be implemented:

(i) Proper and adequate security at the entrance/exit to the mine to prevent entry of unauthorized person.

(ii) Top edges of the quarry will be fenced off.

(iii) Entrance to the toe of dumps will be blocked.

(iv) Special security and fire preventing measures will be taken at dangerous places/explosive magazine etc.,

(v) All the above will be examined by mines manager once in a week to ensure that they are in order.

8.6 Financial Assurance:

Details of land use proposed for mining and allied activities regarding calculation of Financial Assurance as per COM's Circular no. 4, 2006 are given below.

Sl. No.	Particulars	Area put on use at start of MP (Ha)	Additional requirement during plan period (Ha)	Total Area (Ha) A+B=C	Area considered as fully reclaimed and rehabilitated (Ha)	Net area considered for calculation (Ha) C-D=E
		A	**B**	**C**	**D**	**E**
1	Area under mining	34.39	10.29	44.68 Ha	0.00	44.68
2	Storage for topsoil	-	-	-	-	-
3	Waste dump site	39.93	6.85*	46.78	26.28	20.50
4	Mineral storage	0.85	0.65	1.50	0.00	1.50
5	Infrastructure-Workshop, Admin. Building etc.	0.30	0.20	0.50	0.00	0.50
5A	crushing and Screening plant with stock yard	0.20	0.65	0.85	0.00	0.85
6	Roads	1.50	--	1.50	0.00	1.50
7	Railways	-	-	-	-	-
8	Tailing pond	-	-	-	-	-
9	Effluent treatment plant	-	-	-	-	-
10	Mineral separation plant	-	-	-	-	-
11	Township area	-	-	-	-	-
12	Green belt/Afforestation	7.38	0.00	7.38	0.00	7.38
12A	Engineering measures (retention wall, Garland drain, Settling tank etc.)	-	0.30	0.30	0.00	0.30
13	Others -*Un used*	45.98	0.00	27.04	0.00	0.00
	Grand Total	130.53	18.94	130.53	26.28	77.21

*3.07 ha area is considered for temporary dumping in Block-II

Financial area assurance plan is enclosed in 1:2000 **(Plate No.11)**

B P Pandey

Qualified Person