THE INDUSTRIAL DEVELOPMENT CORPORATION OF ODISHA LTD

MINING LESSEE

(A GOVT. OF ODISHA UNDERTAKING)

IDCOL House, Bhubaneswar, Odisha

MODIFICATION OF MINING PLAN

(Under Rule 22(6) of MCR, 1960)

AND

PROGRESSIVE MINE CLOSURE PLAN

(Under Rule 23B(2) of MCDR, 1988)

OF

TALANGI CHROMITE MINE

In the M.L. area of 65.683 hectares in villages Talangi & Ostapal, district Jajpur, Odisha

Mine Category	Date of Execution	Period	Forest Land	Non-Forest Land	Total
A (OTH)	16.09.2003	20 years	20.881 ha	44.802 ha	65.683 ha

Prepared by

S.C. NAYAK

Regn. No. RQP/CAL/211/99/A

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PREPARED FOR A PERIOD OF FIVE (5) YEARS FROM FY 2012-13 TO 2016-17

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INTRODUCTION

0.1 INTRODUCTION

Talangi chromite mine over an area of 65.583 hectares in village Talangi under Sukinda tahasil of Jajpur district, Odisha was executed on 15.09.2003 for the term of twenty (20) years in favour of The Industrial Development Corporation of Odisha Ltd., a Govt. of Odisha undertaking (hereinafter referred to as IDCOL). Hence, the tenure of lease expires on 15.09.2023.

Sukinda valley in Orissa, with an estimated reserve of about 147.04 million tonnes (as on 1995) of chromite, located within ultramafic bodies, is by far the most prominent chromite ore bearing area in the country. The total ore zone is found to have spread over an area of about 40 km², which has been explored by various agencies like Geological Survey of India, Mineral Exploration Corporation Limited, State Directorate of Mining & Geology, Orissa and The Odisha Mining Corporation Limited, M/s TISCO etc, of which the detailed investigation has been carried out mostly by Geological Survey of India. The exploration has so far delineated the presence of six number of ore bands. Present resource has been estimated up to a depth of [illegible] 200meters. Occurrence of Chromite in this belt was first reported in [illegible] and since then, a number of Mining Lessees have started exploiting the ores of the area.

Out of six bands, two bands namely Band-IV and Band-V [illegible] lease area under reference.

APPROVED
INDIAN BUREAU OF MINES
BHUBANESWAR

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Mining operation in the M.L area commenced in June, 1993. Till date, two (2) numbers of quarries have been developed in the lease area. As on date, 553,161 t mineable ore has been estimated by the present RQP (ref. Para-3.4.2) which has formed the basis for preparation of this Modification of Mining Plan to produce chrome ore @127,036 t to 58,278 t / annum (ref : Para-4.2).

The lease is operated by the IDCOL Ferro-Chrome and Alloys Ltd (a wholly owned subsidiary unit of IDCOL as a Category-A (Other Than Fully Mechanized) Mine.

The latest Scheme of Mining prepared by the RQP, Sri S.C. Nayak was approved by the Regional Controller of Mines, Indian Bureau of Mines, Govt. of India, Bhubaneswar vide letter No. MS/OTF-MECH/18-ORI/BHU/2008-09 dated 18.11.2008 for a period of 5 years from FY 2007-08 to 2011-12 and the validity of the scheme expires on 31st March, 2012. The status of Mining Plan/ Scheme are as follows :

Sl. No.	Name & Duration	Rule	Name of RQP with Regn. No.	Letter No.& Date	Purpose
1	Mining Plan (1992-93 to 1996-97)	22 of MCR 1960	The IDC of Orissa Ltd (Regn. No. RQP/CAL/[illegible])	[illegible] dated 04.11.1992	Approved [illegible] for [illegible]
2	Scheme of Mining (1997-98 to 2001-02)	15 of MCDR 1988	P.S. Nayak, Sr. Dy. Manager & Geology, IDCOL	CAL/[illegible]/MP-1/2 dated 30.07.1997	Approval for [illegible] mining operation
3	Scheme of Mining (2002-03 to 2006-07)	10 of MCDR 1988	P.C. Mishra, Dy. General Manager (Mines), IDCOL	[illegible] dated [illegible]	Approval for [illegible] to continue mining operation
4	Scheme of Mining (2007-08 to 2011-12)	12 of MCDR 1988	S.C. Nayak, Regn. No. RQP/CAL/211/95/A	MS/OTF-MECH/18-ORI/BHU/2008-09 dated 18.11.2008	-do-

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The IBC of Annexure-IV

Mining of chromite in the non-forest part of the lease area was commenced in June, 1993 on agency basis and continued for a period of 10 years 2 months 7 days from 07.06.1993 to 14.09.2003, as per sub-rule no. 22 (2) of M.C. Rules, 1960 on payment of agency fee as well as usual royalty. Mining lease over an area of 65.683 hectares was executed on 15.09.2003 for a period of 20 years in favour of IDCOL. Since then, IDCOL operates the mine as lessee.

Mining Plan was approved on 04.11.1991 for an area of 236.74 hectares as per the terms and conditions issued by the State Govt. for grant / execution of M.L. area. Subsequently, M.L area over 65.683 hectares was executed. After the execution of M.L area, Schemes of Mining have been prepared till date. There is no mining plan of 65.683 hectares M.L area. Therefore, this modification of mining plan has been prepared under rule-22(1) of MCR, 1960 which will remain valid for the remaining part of the lease period up to 14.09.2023. This modification of mining plan also includes review of the last scheme of mining and detailed year-to-year development, production etc. for five years from 2012-13 to 2016-17.

Mineable reserve, rate of production and market scenario has formed the basis for preparation of this modification of mining plan along with progressive mine closure plan.

Forest clearance is obtained from the Ministry of Environmental & Forest (MoEF) over an area of 17.483 hectares out of 20.861 hectares forest land on 18.09.2001 (ref : Annexure-3).

Environmental clearance is obtained from MoEF on 01.09.2010 to produce chromite @0.14 Mt or 140,000 t / annum (ref : Annexure-4).

Safety zone of 7.5m width in southern side of Quarry-1 is disturbed and included in Quarry-1 due to collapse of the edge of its southern side.

Safety zone of 7.5m width in northern side of Quarry-2 is disturbed due to washout of the corner of the top bench because of heavy rain.

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dumped area in western side of dump-2 in safety zone has been rehabilitated by way of plantation of various types of saplings after discontinuance of dumping.

0.2 REVIEW OF THE ACTUAL WORK DONE DURING LAST FOUR (4) YEARS FROM FY 2007-08 TO 2010-11

Scheme of Mining was prepared for 5 years from FY 2007-08 to 2011-12. At the time of approval, 2007-08 was completed and achievement was given for 2007-08 and planning was done for four (4) years from FY 2008-09 to 2011-12. Therefore, review in respect of exploration, development & waste management has been done for 3 years (2008-09 to 2010-11) whereas plantation is reviewed for 4 years (from 2008-09 to 2011-12) since plantation of 2011-12 has already been completed.

0.2.1 PARTICULARS OF APPROVED MINING PLAN/SCHEME

Ref : Introduction of this Modification of Mining Plan.

0.2.2 EXPLORATION

Commitment : Eight boreholes were proposed to be put in western side of Band-V to establish the depth & strike extension of ore body and the exploration proposal was as follows :

Year of scheme	Financial Year	No. of Bore holes	Nature of holes	Drilling depth	Drilling length
2nd	2008-09	8	Inclined	70m-80m	600m

Compliance : A total of fifteen (15) boreholes have been drilled in 2011-12 of scheme period. Out of these, 12 boreholes have intersected Band-V. The exploration work is given in the table as follows :

Year of scheme	Financial Year	No. of Bore holes	Nature of holes	Average Inclined Drilling depth	Drilling length
5th	2011-12	15	Inclined	46.68m	700.25m

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Deviation & Reasons Thereof : As far as deviation in concerned, 8 boreholes has been put as against 8 boreholes. Because of the closed seam, boreholes has been increased by 7 numbers.

6.2.3 MINE DEVELOPMENT

Commitment: Quarry-1 & Quarry-2 were proposed to be developed for removal of 2,504,035m³ overburden during scheme period of 4 years (FY 2008-09 and 2011-12) as per the following table :

Year of scheme	Financial Year	Overburden planned for removal (m³)		
		Quarry-1	Quarry-2	Total
1st	2008-09	308,855	306,765	615,620
2nd	2009-10	---	582,050	582,050
3rd	2010-11	---	547,075	547,075
4th	2011-12	---	758,090	758,090
Total	---	308,855	2,195,180	2,504,035

Compliance : As per the proposal in scheme, Quarry-1 & Quarry-2 has been operated. During the scheme period, 2,157,543m³ waste has been removed as per the following table :

Year of scheme	Financial year	Overburden planned for removal (m³)	Overburden removed (m³)	Reasons
1st	2008-09	---	615,620	At the time of approval of scheme, this year was completed
2nd	2009-10	582,050	582,050	Work generation is comparatively less than proposed one
3rd	2010-11	547,075	452,853	-do-
4th	2011-12	758,090	342,820	-do-
5th	2012-13	758,090	364,020	-do-
Total	---	2,504,035	2,157,543	---

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0.2.4 EXPLOITATION

Commitment: Planning was done to develop Quarry-1 & Quarry-2 to produce chrome ore @135,000t/annum during the scheme period (FY 2007-08 to 2011-12) as per the following table :

Year of scheme	Financial Year	Production Planned (t)		
		Quarry-1	Quarry-2	Total
2nd	2008-09	106,650	28,560	135,210
3rd	2009-10	---	135,192	135,192
4th	2010-11	---	135,108	135,108
5th	2011-12	---	135,276	135,276
Total	---	106,650	434,136	540,786

Compliance : A total of 519,661 t chrome ore was produced from the mine during the scheme period of 5 years.

So far as marketable chrome ore production is concerned, the deviation observed between the planned production and actual production is observed to be (-) 27% as per the following table :

Year	Financial year	Planned (t)	Achieved (t)	Deviation	Reason
1st	2007-08	---	127,218	---	At the time of approval of scheme, this year was completed.
2nd	2008-09	135,210	174,788	(+) 29%	Production of chromite has been higher due to thickening of ore body while working towards depth.
3rd	2009-10	135,192	66,214	(-) 51%	Production of chromite has been lower due to thinning of ore body while working towards depth and non availability of ore along the strike in western side of the quarry.
4th	2010-11	135,108	95,059	(-) 29%	-do-
5th	2011-12	135,276	55,462	(-) 27%	-do-
Total	---	540,786	519,661	(-) 59%	---

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9.2.5 WASTE MANAGEMENT

Commitment: A total of 2,504,035m³ waste in form of soil, quartzite and weathered ultramafics was supposed to be generated during the last 4 years of scheme period. Moreover, overburden, ore and ore to waste ratio was as follows :

Year of scheme	Financial Year	Overburden Waste (m^3)	Production (t)	Ore : Waste ratio (t/m^3)
1st	2007-08	---	---	---
2nd	2008-09	615620	135210	1 : 4.6
3rd	2009-10	582650	135192	1 : 4.4
4th	2010-11	547675	135108	1 : 4.1
5th	2011-12	758090	135276	1 : 5.6
Total	---	2,504,035	540,786	1 : 4.6

Compliances: A total of 2,157,541 m³ waste has been generated in scheme period of 5 years. The year wise generation of waste has been recorded as follows :

Year of scheme	Financial Year	Sub-grade Ore (m^3)	Overburden (m^3)	Ore (t)	Ore : waste (t/m^3)
1st	2007-08	7200	596,345	127,216	
2nd	2008-09	9450	523,365	174,788	1 : 3.0
3rd	2009-10	11500	451,866	66,214	1 : 6.8
4th	2010-11	11200	342,852	95,959	1 : 3.6
5th	2011-12	6500	243,093	55,482	1 : 4.4
Total	---	45,850	2,157,541	519,661	1 : 4.2

Deviation and reasons thereof : Average ore to waste ratio has been 1 : 4.2 instead of 1 : 4.6 which is almost matching. Less amount of waste is generated which may be due to maintaining the quarry slope at higher ratio.

9.2.6 AFFORESTATION PROGRAMME

Commitment: A total of 10,272 saplings were proposed to be planted over an area of 6.44 hectares as per the following table :

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Year of scheme	Corresponding financial year	Planned area (ha.)	Estimated saplings	Name of species
2nd	2008-09	2.37	3792	Karanj, Dahanda, Jamun, Acacia, Chakunda, etc.
3rd	2009-10	1.26	2016	-do-
4th	2010-11	2.79	4464	-do-
5th	2011-12	---	---	---
Total	---	6.42	10,272	---

Compliance: During 5 years of Scheme of Mining period, 11 hectares waste dump area is planted by 26,960 saplings. Year wise plantation, however, is as follows :

Year of scheme	Corresponding Financial year	Planned area (ha.)	Planted saplings	Name of the saplings planted
1st	2007-08	0.39	650	Karanj, Jamun, Bamboo
2nd	2008-09	1.56	2,300	-do-
3rd	2009-10	2.00	5,350	Karanj, Sisame
4th	2010-11	2.88	7,486	Neem, Simarua, Sisha
5th	2011-12	5.49	13,500	Neem, Chakunda Simarua
Total	---	11	28,986	---

Deviation & Reasons : Plantation has been done in higher side as compared to the protocol due to availability of more area in matured waste dump.

6.3.7 RECLAMATION & REHABILITATION

Commitment : Q-1 pit proposed to be back-filled from 2009-10 onwards up to 2011-12 by the waste of Q-2 while eastern part of Q-2 was proposed to be back filled by the waste of dep-II in 2012-13.

Compliance: Backfilling has been carried over an area of 16,000m² or 1.600 hectare in 2009-10 to till date. Plantation could not be done since back-filling continues sequentially at two sides and tippers move on the back filled area. There will be no back-filling of Q-2 since there is scope of amalgamation of this lease with adjacent lease under execution.

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0.2.8 CONTROL OF DUST, NOISE & VIBRATION

Commitment: A vegetative cover had been suggested to plant 2000 saplings over an area of 0.020 hectares in virgin (un-worked) slope to control and prevent the dust pollution. Water sprinkling was proposed for dust suppression. Maintenance of machines was proposed to be properly undertaken. Delay detonators was proposed to be used.

Compliance: A total of 28,330 saplings have been planted on the waste dump over an area of 15.7 hectares to arrest dust particles. Water sprinkling was done on the haul road to control the dust pollution. Machines were properly maintained for reduction of noise level. Human settlements are not found near the work zone. Therefore, vibration due to blasting has not been complained.

0.2.9 REVIEW OF THE COMPLIANCE POSITION OF CONDITIONS AND STIPULATIONS IMPOSED IF ANY, WHILE APPROVED THE SCHEME.

Conditions and stipulations were not imposed in the approved scheme.

0.2.10 REVIEW OF COMPLIANCES OF VIOLATIONS POINTED OUT AFTER INSPECTIONS MADE UNDER MCDR-1988 DURING LAST 5 YEARS.

As far as the mine site office record is available, violation pointed out by IBM and compliance made by the lessee has been reviewed as follows :

Year	Nature of Violation	Compliance
2008-09	Dy. Controller of Mines (DCOM, IBM, Mining Engineer of Directorate of Mines and Agent of Lessee inspected the mine on 07.04.2008. On the basis of above inspection, DCOM, IBM, Bhubaneswar issued letter on 26.05.2008 indicating the violation of Rule 38 of MCDR, 1988 (ref : Annexure-6).	Lessee furnished the clarification of the violation to IBM on 20.06.2008 (ref: Annexure-6).
2009-10	Asst. Controller of Mines, IBM inspected the mine on 09.10.2009 and issued letter on 19.10.2009 indicating the violation of Rule 23B(2) and 42(1)(b)(i) of MCDR, 1988 (ref - Annexure-7).	Lessee furnished the clarification of the violation to IBM Mines on 27.11.2009 (ref : Annexure-7).

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2010-11	Junior Mining Geologist (JMG), IBM inspected the mine on 15.07.2010 and issued letter on 19.07.2010 indicating the violation of Rule 13(1) of MCDR,1988 (ref : Annexure-8)	Lessee furnished the clarification on the violation to IBM on 02.09.2010 (ref Annexure-9)
	Task Force Team members of IBM, State Govt. and Lessee inspected the mine on 23.11.2010. On the basis of above inspection, ACOM, IBM, Bhubaneswar issued letter on 10.12.2010 indicating the violation of Rule 13(2), 16(1), 20(3), 35, 42(1), 5(1) and 45(1)(b) of MCDR, 1988 as observed in the mine (ref : Annexure-9).	Lessee furnished the clarification of the violation to IBM on 10.01.2011 (ref: Annexure-9).
2011-12	Asst. Controller of Mines (ACOM), IBM, Bhubaneswar inspected the mine on 07.01.2012 and issued violation indicating the Rule 13(1) and 42(1)b(i) (ref Annexure-10).	Lessee furnished the clarification of the violation to IBM on 30.03.2012 (ref Annexure-10)

9.2.11 ANY OTHER POINTS REQUIRING IN THE INTEREST OF PROPER MINE DESIGN DEVELOPMENT & CONSERVATION ETC

Gradewise reserves have been re-estimated based in the recently drilled boreholes. According to the position of ore bodies, mine design is aligned and development proposal is projected. Grade-I (+40% Cr_2O_3) ore from the mine will be directly used in ferro-chrome plant of IFCAL, a subsidiary unit of Lessee. Grade-II (+30% -40% Cr_2O_3) will be fed to the CSP plant for up-gradation and the concentrate obtained from beneficiation will be used in the ferrochrome plant of the lessee. Grade-III (-10% -30% Cr_2O_3) will be stacked as sub-grade ore and sold depending upon the demand.

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CHAPTER-1

1.0 GENERAL

1.1 Name and Address of the Lessee

The Industrial Development Corporation Ltd. (A Govt. of Odisha undertaking).

Corporate Office	Regional Head Office	Mine Site Office
IDCOL House, Ashok Nagar, Unit-II Bhubaneswar-751009 Post Box No : 76 Phone: 0674-2530099 Fax : 0674-2530530	IDCOL Ferrochrome & Alloys Limited, At/ Ferrochrome Project Jajpur Road Dist : Jajpur, Odisha. PIN : 755020 Phone : 06726 - 230211, 220605, Fax : 06726 - 220524, 220318 E-mail : fcp@sify.com	Tafangi Chromite Mine Dist IDCOL of Odisha Ltd. (A Govt. of Odisha Undertaking) At : Tafangi PO : Kaniha Dist : Jajpur, Odisha PIN : 755038

1.2 Status of the Lessee

The Industrial Development Corporation of Odisha Ltd (hereinafter referred to as IDCOL or Lessee) rests with Board of Directors consisting of senior bureaucrats from the State & Central Govt. professionals on different disciplines. Name, designation & address of the Board of Directors of IDCOL are as follows :-

Sl. No.	Name	Designation	Address
1	Sri T. Ramachandra iah	Chairman-cum-Managing Director	IDC of Odisha Ltd. IDCOL House, Unit-II, Ashok Nagar, Bhubaneswar-751009
2	Sri Saurabh Garg IAS	Commissioner-cum-Secretary to Government, Director	Public Enterprises Department, Govt. of Odisha, Bhubaneswar-751001

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3.	Sri Manoj Ahuja IAS	Commissioner-cum-Secretary to Government, Director	Odisha Mining Corporation Ltd, Bhubaneswar
4.	Sri Vijay Arora IAS	Ex-Special Secretary to Govt., Director	Planning and Co-ordination Department, Bhubaneswar-751001
5.	Sri P.K. Biswal	Joint Secretary to Govt., Director	Finance Department, Govt. of Odisha, Bhubaneswar
6.	Sri Sudhakar Padhi	Director	206, Dibya Prabha Apartment, Vivekananda Marg, Bhubaneswar
7.	Sri T. K. Rath	Director	Regional Controller of Mines, Indian Bureau of Mines, Nandini Complex, 302, District Centre, Chandrasekarpur, Bhubaneswar-751016
8.	Sri P.C. Sahu	Director	Managing Director, Nilachal Ispat Nigam Limited
9.	Dr. D.V. Ramana	Director	Professor of Finance, Xavier Institute of Management, Bhubaneswar

3.3 Mineral(S) which is Occurring in the area and the Lessee Intends to Mine

Lessee intends to continue the mining of chrome ore which is the only ore established & produced economically as yet.

3.4 Period for Which the Mining Lease is Granted/Renewed

Tailangi mining lease area over 65.683 hectares was granted in favour of the Industrial Development of Odisha Ltd. vide letter No.5970 dated 4.06.2003 of department of Steel & Mines, Govt. of Odisha. The lease was executed on 15.09.2003 for a period of twenty (20) years and the tenure of lease will expire on 15.09.2023.

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1.5 Name, Address and Registration Number of the Recognized Person Who Prepared the Mining Plan

Name	:	Mr. S.C. Nayak
Address	:	M/s MINESKETCH Consultants (P) Ltd. A/185, Saheed Nagar, Bhubaneswar-751007 Phone: 0674-2564707, Fax : 0674-2564708 e-mail : mineskotch_2005@rediffmail.com website : www.mineskotch.com
Registration Number	:	RQP/CAL/211/95/A
Date of Registration	:	2nd February, 1995
Renewed upto	:	1st February, 2021
No. of renewals	:	Four (4)

1.6 Name and Address of the Prospecting Agency

The Industrial Development Corporation Ltd
(A Govt. of Odisha undertaking)
IDCOL House, Ashok Nagar, Unit-II
Bhubaneswar-751001, Post Box No 178
Phone: 0674-2530098, Fax : 0674-2520518

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CHAPTER-2

2.0. LOCATION AND ACCESSIBILITY

2.1 Location

- ML area : 65.683 hectares (Ref: Plate – I)
- Village (nearest) : Telangi & Chhatpal
- PS /Tahasil : Sukinda
- District : Jajpur
- State : Odisha

2.2 Khasra No/Plot No/Block/Range etc

ML area over 65.683 hectares comes within forest as well as non forest land under Sukinda block and Sukinda forest range, Lease Schedule is attached with the Lease Deed (ref. Annexure-16).

2.3 Whether the area is Recorded to be as Forest

A part of the area over 20.681 hectares comes under forest land.

2.4 Ownership/ Occupancy

Some of the land belongs to State Govt. as well as private individuals.

2.5 Existence of Public Road/Railway Line

There is neither State/national Highway nor Railway Line within the lease area. Village road exists in the ML area. New roads have been developed in the same area for transportation of ore and waste.

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CHAPTER-3

3.0 GEOLOGY AND EXPLORATION

3.1 TOPOGRAPHY, DRAINAGE, GENERAL GEOLOGY AND LOCAL/MINE GEOLOGY OF THE MINERAL DEPOSIT

3.1.1 TOPOGRAPHY

The area has more or less flat topography with elevations about 100m above Mean Sea Level (MSL). The area consists of forest Land (part of Dalsan P.F. and village forests), quarries and dumps, agricultural land and perennial nullahs.

Wasteland has developed in the area where the soil conditions are poor and due to mining and allied activities. The rocky outcrops and adjacent areas where soil depth is not appropriate to support plant growth are also commonly seen in the area. All such areas are either without any vegetation or are covered with species shrubs and herbs.

The forest in the core zone is classified as Northern Tropical Dry Deciduous Forests. The core zone is a part of Dalsan P.F. In these part of the forest area the average tree density is very low (about 20 – 35 trees/ha) due to development of grasslands. Most of the trees are mature with height ranging from 1.5 to 15m and girth class ranging from 0.6 m to 1.1m. Sal (Shorea robusta) and Asan (Terminalia tomentosa) are the most dominant species with Diospyros melanoxylon, Mango (Mangifera indica), Semala (Terminalia bellirica), Mahul (Madhuca indica), Kusum (Schleichera oleosa), Neem (Azadirachta indica), Dhawi (Anogeissus latifolia), etc. as common associates.

The study area can roughly be divided into hilly, plains (in the Subarnarekha valley) and waste lands. The former is either covered with Northern Tropical Dry Deciduous forests or barren (where the slope is extremely steep). Mining and allied activities and other anthropogenic activities have converted some of the Northern Tropical Dry Deciduous forests into Dry Deciduous Scrub Forests.

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CHAPTER-4

4.0 MINING

4.1 PROPOSED METHOD OF DEVELOPING OR WORKING WITH ALL DESIGN PARAMETERS

4.1.1 Method of Mining & Mechanization

The mine belongs to Category-A (other than fully mechanized). Overburden is removed by the small excavators and mining & loading of ore, dressing, sizing & sorting, and separation of ore in to different grades is done manually to avoid dilution of ore with waste.

4.1.2 Bench Geometry

Height & width of the benches have been maintained at 1.5 m to 6 m and 6 m to 15 m respectively. The individual benches have been developed nearly vertically while the overall quarry slope angle (the angle between the line joining the toe of the bottom bench and the crest of top bench with the horizontal) has been maintained within 30° to 45° with the horizontal.

9. Road Development

Eight (8) meter wide haul road will be maintained for transportation of man & materials. Gradient of the road will be flat or 1 in 16.

* Working Hours

The mine is under working in general shift from 7 AM to Noon and 2 PM to 5PM in day light. Weekly one day is declared as holiday excluding National holidays.

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4.1.3 The Details of the Existing Quarries

Quarry-1 is under backfilling and Quarry-2 will period. The existing extent and size of the pits will

Name of quarry	Length (m)	Width (m)	Maximum depth (m)	Ultim.		Remarks
				in m^3	in ha.	
Quarry-1	410	245	22	100,450	10.045	Under back-filling
Quarry-2	450	265	40	129,850	12.985	Under working
Total	---	---	---	230,300	23.030	---

4.1.4 Details of the Existing Dumps

There exist two (2) dumps in the lease area which are detailed as follows:

Name of the Dump	Dimension (m)	Present capacity (m^3)	Maximum height (m)	Area Occupied (m^2)	Status
Dump-1	260 x 98 x 10	150,800	12	15,080	Fully rehabilitated
Dump-2	480 x 240 x 40	4,608,000	50	115,200	Recently rehabilitated
Total	---	4,758,800	---	130,280	---

4.1.5 Status of Reclamation or Rehabilitation

Quarry-1 is exhausted and under back-filling. Quarry-2 is under working and its waste is utilized for back-filling of Quarry-1. Dump-1 is fully rehabilitated while Dump-2 is rehabilitated recently by way of plantation and casualty replacement of saplings of Dump-2 is under progress.

4.1.6 Yearly Development for the Plan Period

Quarry-1 is exhausted. Quarry-2 will be developed towards depth up to 70m RL in 5th year of modification period to produce chrome ore from 1st year to 5th year.

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4.1.6.1 First year (2012-13)

During the year, Quarry-2 will be developed / worked between 3200N to 3080N and 1993W to 1500W grids in a top downward manner up to 52m depth by the erection of 6m (height)/14m (width) benches. However, the development to be done in first year is tabulated as follows:

Sl. No.	Particulars		Quarry-2
1	Level	Highest adjoining ground level	180mRL
		Lowest adjoining ground level	172mRL
		Quarry Bottom level	128mRL
2	Bench Geometry	Height	6m
		Width	14m
		Bench slope angle	Nearly vertical (85°)
3	Pit / quarry development	Direction of advancement	Mainly towards depth
		Size of the quarry	405m x 205m x 52m
		No. of benches to be developed	10
		Overall quarry slope angle	< 30°
4	Nature of excavation	Overburden	447,495m³
		Sub-grade Ore (+10%-20% Cr_2O_3)	11,340m³
		Usable Ore (+20%-40% Cr_2O_3)	14,445m³
		Usable Ore (+40%-52% Cr_2O_3)	2,586 m³
		Total Excavation	498,000m³

4.1.6.2 Second year (2013-14)

In this year, Quarry-2 will also be developed / worked between 3200N to 3080N and 1993W to 1500W grids towards depth to finish proved ore above 58m depth. However, the development to be done in second year is [illegible] as follows:

Sl. No.	Particulars		Quarry-2
1	Level	Highest adjoining ground level	180mRL
		Lowest adjoining ground level	172mRL
		Quarry Bottom level	122mRL
2	Bench Geometry	Height	6m
		Width	14m
		Bench slope angle	Nearly vertical (85°)

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3	Pit / quarry development	Direction of advancement	Mainly towards depth
		Size of the quarry	495m x 305m x 58m
		No. of benches to be developed	11
		Overall quarry slope angle	< 30°
4	Nature of excavation	Overburden	52,940m³
		Sub grade ore (>10%-20% Cr_2O_3)	30,480m³
		Usable Ore (>20%-40% Cr_2O_3)	14,335m³
		Usable Ore (>40%-52% Cr_2O_3)	2,375m³
		Total Excavation	570,220m³

4.1.6.3: Third year (2014-15)

In this year, Quarry-3 will also be developed / worked between 3285N to 3750N and 1993W to 1500W grids up to 64m depth. However, the development to be done in 3rd year is tabulated as follows:

Sl. No.	Particulars		Quarry-3
1	Level	Highest adjoining ground level	180mRL
		Lowest adjoining ground level	122mRL
		Quarry Bottom level	116mRL
2	Bench Geometry	Height	6m
		Width	14m
		Bench slope angle	Nearly vertical (65°)
3	Pit / quarry development	Direction of advancement	Mainly towards depth.
		Size of the quarry	495m x 325m x 64m
		No. of benches to be developed	12
		Overall quarry slope angle	< 30°
4	Nature of excavation	Overburden	562,155m³
		Sub grade ore (>10%-20% Cr_2O_3)	28,370m³
		Usable Ore (>20%-40% Cr_2O_3)	13,485m³
		Usable Ore (>40%-52% Cr_2O_3)	2,285m³
		Total Excavation	606,215m³

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Sl. No.	Particulars		Quarry-2
1	Level	Highest adjoining ground level	160mRL
		Lowest adjoining ground level	172mRL
		Quarry Bottom level	110mRL
2	Bench Geometry	Height	6m
		Width	14m
		Bench slope angle	Nearly vertical (80°)
3	Pit / quarry development	Direction of advancement	Mainly towards depth
		Size of the quarry	409m x 345m x 20m
		No. of benches to be developed	12
		Overall quarry slope angle	< 30°
4	Nature of excavation	Overburden	187,410m³
		Sub-grade ore (+10%-20% Cr_2O_3)	15,400m³
		Usable Ore (+20%-40% Cr_2O_3)	5,510m³
		Usable Ore (+40%-52% Cr_2O_3)	1,456m³
---	---	Total Excavation	209,779m³

4.1.6.6 Ultimate Extent and Size of the Pit at the end of modification period.

Name of the Pit	Length (m)	Breadth (m)	Area	
			(m²)	(ha)
Quarry-1	410	245	100,450	10.045
Quarry-2	409	345	170,775	17.078
Total	---	---	271,225	27.123

4.2 QUANTUM OF DEVELOPMENT AND PRODUCTION FOR THE MODIFICATION PERIOD

Based on the past experience, geo-mining parameters taken into consideration for mine planning are as follows:-

Geo-Mining Parameters	Quantitative Description
Type of ore	Chromite
Usable ore incidence (+20% to – 52% Cr_2O_3)	37%
Sub-grade ore generation (+10% to – 20% Cr_2O_3)	63%
Bulk density of +10% to – 20% Cr_2O_3	2.5 t/m³
Bulk density of +20% to – 40% Cr_2O_3	2.8 t/m³
Bulk density of +40% to – 52% Cr_2O_3	3 t/m³
Bench height	6 m
Bench width	14 m

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Length of Influence of each section	45m to 50m
Cut-off Grade of Captive Plant	20% Cr_2O_3
Threshold value	10% Cr_2O_3

Keeping in view the market demand and resource availability in respect of reserve & grade, the mine is planned to obtain the production @ 127,036 t to 58,278 t / annum. However, year wise quantum of development and production of ROM ore, as is planned, will be as follows :

Year	Name of Quarry	Topsoil (m^3)	Volume of Overburden (m^3)	ROM Ore (t)			
				Sub-grade (+10% to 20% Cr_2O_3)	Beneficiable (+20% to 40% Cr_2O_3)	Usable (+40% to 52% Cr_2O_3)	Total (t)
FY 2012-13	Quarry-I	3[illegible]	449,405	73,850	46,436	7,700	127,036
FY 2013-14	-do-	2820	523,030	76,200	40,138	7,125	123,463
FY 2014-15	-do-	25[illegible]	362,175	71,525	37,758	6,255	115,538
FY 2015-16	-do-	25[illegible]	328,440	49,500	27,440	5,100	82,040
FY 2016-17	-do-	—	387,410	38,500	15,425	4,353	58,278
Total	-	12,270	2,050,485	313,075	161,210	31,170	506,355

ORE TO OB RATIO

Year	Overburden (m^3)	ROM Ore (t) (+10% to 52% Cr_2O_3)	Ore : OB ratio (t/m^3)	Beneficiable / Usable Ore (t) (+20% to 52% Cr_2O_3)	Ore : OB ratio (t/m^3)
FY 2012-13	449,405	127,036	1 : 3.5	48,156	1 : 9
FY 2013-14	523,030	123,463	1 : 4.2	47,263	1 : 11
FY 2014-15	362,175	115,538	1 : 4.9	44,013	1 : 12
FY 2015-16	328,440	82,040	1 : 4.0	32,540	1 : 10
FY 2016-17	387,410	58,278	1 : 3.2	19,778	1 : 9
Total	2,050,485	506,355	1 : 4.0	192,380	1 : 10

अनुमोदित
APPROVED

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

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4.3 COMPOSITE YEARWISE PLAN & SECTIONS

4.3.1 Excavation

Quarry-2 will be developed to obtain chrome ore @ 12,036 t to 58,278 t / annum. Year wise development plan on 1:2000 scale and sections on 1:1000 scale have been prepared and coloured distinctly to represent excavation limits.

4.3.2 Dumping

Waste generated in Quarry-2 will be disposed of in Quarry-1 to continue back filling. Year wise back-filling has been shown in Plate-IV.

4.4 PROPOSED RATE OF PRODUCTION WHEN THE MINE IS FULLY DEVELOPED

The mine is fully developed and life of the mine is only 5 years. Since the reserve is less, rate of production of chrome ore will be reduced from 12,036 t in 1st year to 58,278 t in 5th year.

4.5 CONCEPTUAL PLAN (Ref : Plate-IX)

An estimated, mineable reserve of chrome ore is of the order of 553,161t (ref Para 3.4). During the modification period (2012-13 to 2016-17), 106,355 t chrome ore will be exploited and remaining reserve of 553,161 – 106,355 = 46,806t will be extracted only in one (1) year (2017-18). Hence, life of the mine is 6 years which consists of 5 years of scheme period and one year beyond the Modification period.

Rate of production may likely be affected in future due to the existence of mine boundaries all around the quarry and lower side demand of low grade ores.

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4.5.1 The Ultimate Extent and Size of the Pit

Till date, adjacent area applied for mining lease has not been executed. Mineable reserve and ultimate extent and size of the pit will increase once the adjacent applied mining lease is executed and amalgamated with this lease subject to approval of concerned Govt. authorities. At present status, ultimate extent of the quarries will be confined to the area of 27.370 hectares as per the following table :

Name of quarry	Name of ore band	Size (m)	Ultimate extent		
			Area (m^2)	Area (ha)	Depth (m)
Quarry-1	Band- IV	410 x 245	100,450	10.045	72
Quarry-2	Band-V	495 x 350	173,250	17.325	70
Total	---	---	273,700	27.370	---

4.5.2 Final Slope Angle at the Close of the Mine

To keep the ultimate pit slope safe & stable and to mine out the optimum amount of chrome ore from the quarries, height & width of the benches will be kept at 6m and 14m respectively at the time of abandonment. The [illegible] benching will result the ultimate pit slope angle at around 25° with the horizontal.

4.5.3 Ultimate Capacity of the Dump & Stack

Ore bodies of Band-V are planned to be extracted up to the optimum depth of [illegible] surface level. Ore to waste ratio in Modification period will be 1 : 4 (ref : Para-5.3). On the basis of above ratio, 46,806 x 4 = 187,224 m^3 waste is likely to be generated beyond the Modification period. [illegible] conceptual generation of the waste will be as follows :

Period	Years available	Ore (t)	Waste (m^3)	Referance
Modification period	2012-13 to 2016-17	506,355	2,050,480	Para-5.3.2
Beyond	2017-18	46,806	187,224	As above
Total	---	553,161	2,237,704	---

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Waste dumps are already rehabilitated by the local saplings and there will be no external dumping in the ML area henceforth till the end of life of the mine.

4.5.5 Land Degradation / Utilization, Reclamation & Afforestation

4.5.5.1 Land Degradation / Utilization

An area of 49.315 hectares land is already degraded/ utilized for mining, dumping, office, road etc. Cumulatively, an area of 57.135 hectares is anticipated to be degraded/ utilized at the end of the conceptual planning period as per the following table :

Sl. No.	Type of land use	As at present (ha)	As at the end of Modification period (ha)	As at the life of the mine (ha)
1.	Area under excavation	23.030	27.123	27.370
2.	Storage for Topsoil	0.230	0.250	0.250
3.	Overburden dump	12.985	12.995	12.985
4.	Mineral storage	7.980	7.980	7.980
5.	Infrastructure (workshop, administrative building etc.)	1.000	1.000	1.000
6.	Road	1.500	1.500	1.500
7.	Railways	---	---	---
8.	Green belt	1.520	3.02	5.000
9.	Tailing Pond	0.100	0.100	0.100
10.	Effluent Treatment Plant	0.060	0.050	0.060
11.	Mineral Separation Plant (COB Plant)	0.650	0.050	0.650
12.	Township area	---	---	---
13.	Others (Magazine)	0.230	0.230	0.230
	Sub-Total	49.315	54.908	57.135
14.	Area which remains untouched	12.212	10.775	8.548
	Total lease area	61.527	65.683	65.683

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Waste generated from the adjacent M.L area (under execution) will be utilized for back-filling of Quarry-2.

4.6 OPEN CAST MINES

4.6.1 Method of Mining

Chromite mining in the M.L area is/will be done by open cast method with the help of drilling machine (wagon drill), associated compatible size compressor, hydraulic excavators, tipper / truck and other auxiliary equipments for development, production as well as safety. Benches will be formed and worked in a top downward manner. Drilling and blasting will be performed depending upon the hardness of the strata.

4.6.2 Layout

Layout of mine workings has been shown separately in plan & sections on 1:2000 & 1 : 1000 scale respectively and distinctly through coloured lines.

4.7 UNDERGROUND MINES

Not Applicable

4.8 EXTENT OF MECHANIZATION

Loosening of the hard rock mass will be effected by the blasting of wagon drilled holes. Shovels of 0.9m³ to 1.7m³ capacity will be utilized for excavation & loading of blasted rocks. Rear dump trucks of 10t capacity will be used for transportation of ore and waste.

4.8.1 Drilling

Blast hole Parameters	Magnitude
Burden	2.0m
Spacing	3.0m
Height of the bench	6.0m
Sub grade drilling (10%)	0.6m
Depth of the hole	6 + 0.6= 6.6 m

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4.5.5.2 Reclamation/Rehabilitation/Progressive Mine Closure

There exist 2 dumps in the M.L. area. Dump-1 is fully reclaimed / rehabilitated, Dump-2 is rehabilitated by way plantation in last scheme period from 2007-08 to 2011-12.

Back filling of Quarry-1 is under progress and will continue till the end of lease period. There is no proposal of back-filling in Quarry-2 till exhaust of ore.

4.5.5.3 Afforestation

Year wise plantation for the Modification period has been given in Table-4.1. Cumulatively, there will be plantation of 56,881 saplings over an area of 31.915 hectares on behalf of the Lessee in the lease area due to this ongoing mining project as per the following table:

Period	Type of plantation	Area under plantation (ha)	Spacing (m)	No. of saplings	Name of saplings
As on date (up to 2011-12)	Dump-1 rehabilitation	1.500	2.6	2250	Neem, Bahada, Chakunda, Mahua etc.
	Dump-2 rehabilitation	11.467	2.5	18,379	-do-
	Virgin area plantation near Tailing nala	1.520	2.5	2,432	-do-
	Back filled area of Q-1	4.000	2.5	6,400	-do-
Modification period (2012-13 to 2016-17)	Virgin area plantation near Tailing nala	1.500	2.5	2,400	-do-
Beyond (2017-18)	Virgin area plantation	1.980	2.5	3,168	-do-
	Back filled area plantation of Q-1 & 2	9.920	2.5	15872	-do-
Total	---	31.915	---	50,081	---

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Drilling parameters	
Drill diameter	300mm
Drilling speed	7.5m /hr.
Expected utilization	85%
Operating efficiency	70%
Working hours in a shift	8
Number of shifts per day	2
Annual working days	300
Meters to be drilled/ drill / annum	7.5x85%x70%x8x2x300 =21420m
Output / hole	2 x 2 x 5 = 20 m³

- Drilling machines required

Item	Magnitude
Excavation of rock mass	= 606,245 m³
Volume to be loosened through drilling and blasting (assuming 40% of total excavation)	= 606,245 x 40% = 242,498 m³
Actual requirement of holes	= 242,498 / 36 = 6,736
Meterage of drilling required	= 6,736 x 6.6 = 44,458 m
No. of drills required to be in operation	= 44,458 / 22420 = 2.07, say 2

4.5.2 EXCAVATION AND LOADING

Run-of-mine ore and overburden will be excavated & loaded in the ripper by 2 Cum to 1.7 m³ capacity excavator. The detailed calculation is as follows:

- Excavation parameters

Bucket Capacity	= 0.8 m³	= 1.5 m³	= 1.7 m³
Bucket fill factor	= 0.8	= 0.9	= 0.9
Swell factor	= 0.75	= 0.75	= 0.75
Digging efficiency	= 80%	= 80%	= 80%
Operating efficiency	= 70%	= 70%	= 70%
Bucket cycle time	= 30 sec.	= 30 sec.	= 30 sec.
Swing factor	= 1	= 1	= 1
No. of shifts/day	= 1	= 1	= 1
No. of working hours/shift	= 8	= 8	= 8
No. of working days	= 300	= 300	= 300
Seconds/hour	= 3600	= 3600	= 3600

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❖ Number of shovels required

Volume to be handled / shovel	= (0.9 x 0.9 x 0.75 x 80% x 70% x 3600 x 8 x 1 x 300) / (30x1) = 97,977 m³	= (1.5 x 0.9 x 0.75 x 80% x 70% x 3600 x 8 x 1 x 300) / (30x1) = 163,295 m³	= (1.7 x 0.9 x 0.75 x 80% x 70% x 3600 x 8 x 1 x 300) / (30x1) = 185,064 m³
Number of shovels available	1	2	1
Volume can be handled / type	97,977 x 1 = 97,977 m³	163,295 x 2 = 326,590m³	185,064 x 1 = 185,064 m³
Volume can be handled in all total	= 97,977 + 326,590 + 185,064 = 609,631 m³		
Volume required to be handled / annum	= 606,245 m³		
Remark	Requirement is almost matching with the available machinery.		

8.4.3 HAULAGE & TRANSPORT EQUIPMENT FOR ORE & WASTE

Waste of Q-2 will be disposed-off in Q-1 for back-filling. R.O.M chrome ore will be transported to the stack yard. Average distance / lead are assumed to be 2 km between the quarries and ore stack. However, excavator and tipper matching calculation is made as follows :

❖ Tipper Parameters

Parameters	Magnitude
Tipper Capacity	10t or 4.5 m³
Swell factor	0.75
Bucket capacity	1.4 m³
Tonnage factor of overburden	2.0 t/m³
Tonnes per pass	1.4 x 0.9 x 0.75 x 2 = 1.89 t
No. of passes	10 t / tonnes per pass = 10 / 1.89 = 5.29, say 5 to 6 passes

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CHAPTER-5

5.0 BLASTING

Talaugi mine is enriched with chromite and ultrabasic rocks which are hard in nature. Therefore, drilling & blasting is done for loosening & fragmentation of almost all type of rocks for ease in production. Since a part of the ore / waste is excavated directly by the machine, about 60% of excavation is obtained through drilling & blasting.

5.1 BROAD BLASTING PARAMETERS

Drill holes are drilled in single rows as well as in multi row on staggered pattern by wagon drills. However, drilling & blasting parameters are chosen as follows:

Sl. No.	Parameters		Drilling Details
1	Dia of the hole		102mm
2	Drilling pattern	Burden	3 cm
		Spacing	3.0m
		Bench height	60°
3	Depth	Sub-grade drilling	0.5m
		Hole depth	9.5m
4	Nature of hole	Type	Vertical
		Angle	90°-00°
5	Type of Main explosive	Name	Nova prime, Emulsion etc
		Dia of cartridge	80-85 mm
6	Powder factor		0.7 kg/t
7	Requirement of explosive	Quantity / hole	10kg
		Quantity / single blast	Upto 500kg
8	Detonative applicable	Detonator	OD ED
		Fuse	Safety fuse (pneumatic) fuse
9	Type of blasting		Primary
10	Yield / hole		30 m³

5.2 TYPE OF EXPLOSIVES TO BE USED

Ammonium nitrate cartridges such as Nova prime, emoprime etc are used directly to blast the wagon drilled holes.

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CHAPTER-6

6.0 MINE DRAINAGE

6.1 LIKELY DEPTH OF WATER TABLE

[illegible] at a depth of 5m in rainy season and 8m in dry season from general surface level (RL 170m). Therefore, water table in rainy season and dry season are at RL 165m and RL 162m respectively.

6.2 EXPECTED WORKING DEPTH

Maximum expected depth of working is up to 70m depth from general surface level in Quarry-2, however, the expected depth of working in each quarry has been given in Para-2.3.3.1.

6.3 QUANTITY AND QUALITY OF WATER LIKELY TO BE ENCOUNTERED AND DISCHARGE / DRAINAGE SYSTEM

6.3.1 QUANTITY OF WATER LIKELY TO BE ENCOUNTERED

Source of influx water in the mine are (a) Rainfall/direct precipitated water in the quarry (b) surface run-off water from the adjacent area around the quarry and (c) Seepage /subsurface water which will be pumped out as per the following example.

	Quarry-2
Dimension of the quarry	195m x 345m
Area Computed	175,775m²
Maximum rainfall expected in a rainiest month	560mm = 0.6m
Total precipitated water	175,775 x 0.6 = 102,465 m³
Surface run-off water assuming 10% of direct precipitated water	102,465 x 10 % = 10,246 m³
Seepage / sub-surface water (assuming 20% of direct precipitated water)	102,465 x 20% = 20,493 m³
Total accumulation of water/month	102,465 + 10,246 + 20,493 = 133,204 m³
Maximum discharge of water/day of 25 days	133,204/25 = 5,328 m³
Average rate of water as experienced in	1,300 m³ / day

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CHAPTER-7

7.0 STACKING OF SUB-GRADE ORE & DISPOSAL OF WASTE

7.1 NATURE OF WASTE & IT'S RATE OF YEARLY GENERATION

Overburden / waste to be generated from the mine is soil, quartzite and weathered ultramafics. However, yearwise generation of waste will be as follows:

Year of Modification	Financial Year	Volume of Waste (m^3) (Quarry-2)
1st	2012-13	449,485
2nd	2013-14	521,000
3rd	2014-15	502,305
4th	2015-16	328,000
5th	2016-17	187,410
Total	—	2,050,480

7.2 LAND CHOSEN FOR DISPOSAL OF WASTE

Selection of dumping site mostly depends upon the factors like topography, drainage, land use, mineral inventory, pit configuration, mine waste characteristics, its volume of generation and economy in transportation. Keeping in view the above physical as well as techno- economic factors, these 2,050,480m^3 waste materials generated in Modification period will be utilized for back-filling of Quarry-1.

7.3 MANNER OF DISPOSAL

The manner of disposal/back-filling of waste in Quarry-1 will be as per the following table.

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CHAPTER-8

8.0 USE OF MINERALS

8.1 End Use Of The Mineral

Chromite is the only source of chromium which is used widely in metallurgical, chemical and refractory industries. The specification of chrome ore for various industries is tabulated as follows:

Sl. No.	Parameters	Ferrochrome	Charge chrome	Refractory	Chemical
1	Cr_2O_3	48% (min)	44%(min)	40%(min)	48% (min)
2	Cr : Fe	2.8:1 (min)	1.5 : 1(min)	---	---
3	FeO	---	---	20%(max)	20% (max)
4	CaO	---	---	1%(max)	3% (max)
5	MgO	---	---	---	14% (max)
6	Al_2O_3	---	---	14%(max)	14% (max)
7	SiO_2	---	---	(Less than 10%	3% (max)

8.2 Physical and Chemical Specifications Stipulated by Buyers

As far as chromite at Tulunga Mine is concerned, there will be no change in the ore which is mostly consumed by its own Ferro-Chrome Plant. The specification of the ore was as follows :

Cr_2O_3	Fe_2O_3	SiO_2	Cr : Fe
+ 47%	(+) 15%	4-7%	+ 2.6:

Now it is contracted due to scarcity of high grade chromite on Quarry-2, specification of chrome ore will be changed as follows :

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CHAPTER-9

9.0 OTHERS (SITE SERVICES)

Site office, Vocational Training Centre, General office (records), time keeping & cash counters etc) have been provided for administrative, maintenance and servicing facilities in the Taking M.L area.

All the statutory facilities such as crèche ("A" type crèche for nursing up to 30 children below the 6 years of age) has been provided. First-aid facilities equipped with sterilized dressing materials such as cotton wool, bandages, iodine and antiseptic solution etc has been provided for treatment of the workers before hospitalization, if any accident occurs in the mine.

To take care of the drinking water needs at different working areas, water coolers have been envisaged. The rest shed-cum-lunch rooms have been provided near quarry site under mines rules-55 to take food & water and to rest during lunch time. A canteen is provided to take tiffin & meals as per need of the mine people.

First-aid facilities and toilet are attached to the office locating in the M.L area. Portable blasting sheds of one end open type have been provided at the mine site for giving protection to the workers during blasting. These blasting sheds are made up of steel and are shifted in accordance with the drilling of blast hole locations.

During night, lighting arrangement is made sufficiently as per the Metal Mines

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10.0 MINERAL PROCESSING :

The chief impurities associated with chrome ore are siliceous as well as ferruginous in nature. The siliceous impurities include serpentine & talc which are with silicates of magnesium while ferruginous impurities include goethite & limonite with traces of chert, magnesite, magnetite etc. High percentage of iron is detrimental for refractoriness because the bricks exhibit on heating. Presence of silicates of magnesium lowers the melting point.

Chrome ore of +40% Cr_2O_3 – 47%Cr_2O_3 will be used directly in the captive ferro chrome plant of Lessee and chrome ore of +20%Cr_2O_3 – 40%Cr_2O_3 will be used in the plant after beneficiation. Yearwise feed, concentrate and tailings generation were as follows :

Year	Feed Quantity (t)	Concentrate production (t)	Tailings (t)
2007-08	87040	45001	42039
2008-09	68853	34883	34070
2009-10	51175	24502	26783
2010-11	93654	39759	53896
2011-12	9376	4121	5255
Total	309,798	147,956	161,842

After processing of run of mine, generation of tailings and production of concentrate in scheme period will be of the order of 161,310 t, 96,726t (at 60% liberation), 64,484 t (at 40% recovery) respectively.

10.1 Nature of Processing / Washing

The ROM ore produced from the mine is stacked in the ore plot.

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11.0 ENVIRONMENT MANAGEMENT PLAN

11.1 BASELINE INFORMATION

11.1.1 Existing Land Use Pattern

An area of 49.315 hectares land is already engraged/ utilized for mining, dumping, office, road etc. as per the following table :

Sl. No.	Type of land use	Area (ha)
1.	Area under excavation	33.030
2.	Storage for Topsoil	0.250
3.	Overburden dump	12.995
4.	Mineral dump	2.060
5.	Infrastructure (workshop, administrative building etc.)	1.000
6.	Road	1.500
7.	Railways	—
8.	Green belt	1.520
9.	Tailing Pond	0.100
10.	Effluent Treatment Plant	0.060
11.	Mineral Separation Plant (Ore Dump)	0.620
12.	Township area	—
13.	Others (Magazine)	0.230
—	Sub-Total	49.315
14.	Area which remains untouched	12.212
—	Total lease area	61.527

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