1126

MCL

MAHANADI COALFIELDS LIMITED

MINING PLAN & MINE CLOSURE PLAN FOR LAKHANPUR-BELPAHAR-LILARI OCP

IB-VALLEY COALFIELD
JHARSUGUDA DIST., ODISHA STATE

(Block Area Allotted: 5406.586 ha)

(Consolidated Lease Area 4742.877 ha)

APPLICANT: **MAHANADI COALFIELDS LIMITED**
JAGRUTI VIHAR, BURLA, SAMBALPUR
ODISHA - 768017

REVISION NO. 0

TARGET CAPACITY: 40.0 MTY

ROP: DEBASHIS ROY, NO.3401/122/2005-CPAM Dtd.07.08.2018
Under Rule 22(C) of Mineral Concession Rules 1960

VOLUME - I (TEXT)

SEPTEMBER 2018

CONSULTANT
CENTRAL MINE PLANNING & DESIGN INSTITUTE LIMITED
(A Subsidiary of Coal India Ltd.)
REGIONAL INSTITUTE - VII
BHUBANESWAR- 751 013.

General Manager
MCL, Lakhanpur Area

देवाशिस राय
मुख्य प्रबंधक (खनिज)
सी. एम. पी. डी. आई., क्षे. सं.-VII

MCL

MAHANADI COALFIELDS LIMITED

MINING PLAN & MINE CLOSURE PLAN FOR LAKHANPUR-BELPAHAR-LILARI OCP

IB-VALLEY COALFIELD

JHARSUGUDA DIST., ODISHA STATE

(Block Area Allotted: 5406.586 ha)

(Required Lease Area: 4742.877 ha)

APPLICANT: MAHANADI COALFIELDS LIMITED
JAGRUTI VIHAR, BURLA, SAMBALPUR
ODISHA - 768017

REVISION NO. 0

TARGET CAPACITY: 40.0 MTY

RQP: DEBASHIS ROY, NO.34011/(22)/2005-CPAM Dtd.07.09.2010
Under Rule 22(C) of Mineral Concession Rules 1960

VOLUME - I (TEXT)

SEPTEMBER 2018

CONSULTANT
CENTRAL MINE PLANNING & DESIGN INSTITUTE LIMITED
(A Subsidiary of Coal India Ltd.)
REGIONAL INSTITUTE - VII
BHUBANESWAR- 751 013.

कृते खनिज (उपखनन)
भा. कृ. क. डी. सी., क्षे. भ.-7

Authorised Signatory
For M/s. Lakhanpur Area

GENERAL INFORMATION

1.	NAME AND ADDRESS OF THE APPLICANT	MAHANADI COALFIELDS LIMITED
2.	ADDRESS OF THE APPLICANT	JAGRUTI VIHAR, BURLA SAMBALPUR, DIST-JHARSUGUDA ODISHA - 768020
3.	STATUS OF THE COMPNAY	CENTRAL PUBLIC SECTOR UNDERTAKING
4.	NAME OF THE MINERAL WHICH THE APPLICANT INTENDS TO MINE	COAL
5.	NAME, ADDRESS AND REGISTRATION NUMBER OF THE ROP WHO PREPARED MINING PLAN	DEBASHIS ROY CENTRAL MINE PLANNING & DESIGN INSTITUTE LIMITED REGIONAL INSTITUTE-VII PLOT E-4, AT SAMANTAPUR P.O. R.R.L, BHUBANESWAR ODISHA - 751013 REG. NO. 340113(22)/2005-CPAM DT. 07-09-2010 FOR JOBS UNDERTAKEN BY CMPDI FOR OC MINES
6.	NAME AND ADDRESS OF PROSPECTING AGENCY	GSI, CMPDI, AND DIRECTORATE OF GEOLOGY (ODISHA)
7.	NAME & ADDRESS OF THE AGENCY WHO PREPARED THE GEOLOGICAL REPORT	CMPDIL R.I.-VII, BHUBANESWAR ODISHA
8.	PERIOD OF MINING LEASE	41 YEARS

CONTENTS

VOLUME – I

Sl. No.	Chapter Name		Page No. From	Page No. To
A.	General Information & Contents		(i)	(iv)
B.	Summarized Data		a	e
D.	CHAPTERS			
	CHAPTER-1	INTRODUCTION	1	9
	CHAPTER-2	MARKETING & JUSTIFICATION	1	2
	CHAPTER-3	PROJECT SITE INFORMATION	1	3
	CHAPTER-4	EXPLORATION, GEOLOGY, SEAM SEQUENCE, COAL QUALITY & RESERVES	1	26
	CHAPTER-5	MINE BOUNDARY AND RESEREVES	1	12
	CHAPTER-6	METHOD OF MINING	1	7
	CHAPTER-7	MINING & DUMPING STRATEGY	1	7
	CHAPTER-8	MINING SCHEDULE AND EQUIPMENT DEPLOYMENT SCHEDULE	1	9
	CHAPTER-9	COAL QUALITY	1	4
	CHAPTER-10	PUMPING & DRAINAGE	1	32
	CHAPTER-11	COAL HANDLING & DISPATCH	1	11
	CHAPTER-12	WORKSHOP	1	2
	CHAPTER-13	POWER SUPPLY AND ILLUMINATION	1	5
	CHAPTER-14	CIVIL CONSTRUCTION	1	4
	CHAPTER-15	SAFETY & CONSERVATION	1	9
	CHAPTER-16	ENVIRONMENT MANAGEMENT	1	13
	CHAPTER-17	LAND REQUIREMENT	1	9
	CHAPTER-18	MINE CLOSURE PLAN	1	28
	CHAPTER-19	MANPOWER	1	2
E.	DRAWINGS			

Sl.	SUBJECT	PLATE NO.
1.	Location map of Odisha coalfield	GEN-I
2.	Block location plan of Ib-valley coalfield	GEN-II
3.	Surface Layout Plan	GEN-III

4.	Topographical Map	GEO-I
5.	Geological Plan – Incrop Map	GEO-II
6.	Geological Cross-sections	GEO-III
7.	Graphic Litholoogs of Boreholes	GEO-IV
8.	Floor contour plan of Lajkura seam	GEO-V
9.	Floor contour plan of Rampur Top-II seam	GEO-VI
10.	Floor contour plan of Rampur Bottom-II seam	GEO-VII
11.	Floor contour plan of Ib seam	GEO-VIII
12.	Folio plan of Lajkura seam	GEO-IX
13.	Folio Plan of Local seam	GEO-X
14.	Folio plan of Rampur Top-II seam	GEO-XI
15.	Folio plan of Rampur Bottom-II seam	GEO-XII
16.	Folio plan of Ib seam	GEO-XIII
17.	Iso-parting plan above Ib seam	GEO-XIV
18.	Iso-parting plan above Ramour seam	GEO-XV
19.	Iso-parting plan above Local seam	GEO-XVI
20.	Iso-parting plan above Lajkura seam	GEO-XVII
21.	Iso-parting plan above Parkhani seam	GEO-XVIII
22.	Expected Mine Position on Base date 31-03-2020	MIN-I
23.	Excavation & Closure plan Yr-1	MIN-II
24.	Excavation & Closure plan Yr-3	MIN-III
25.	Excavation & Closure plan Yr-8	MIN-IV
26.	Excavation & Closure plan Yr-13	MIN-V
27.	Excavation & Closure plan Yr-18	MIN-VI
28.	Final Excavation plan	MIN-VII
29.	Final Closure Plan	MIN-VIII

Annexures:

Sl.	Description	Page No.
1	Approval of the Board of MCL for Mining Plan and Mine Closure Plan including Closure Cost	Annexure-I

SUMMARISED DATA

SUMMARISED DATA

Sl. No.	Particulars	Unit	Value
A.	GENERAL		
1	Name of Project		Integrated Lakhanpur-Belpahar-Lilari OCP
2	Name of Area /Company		Mahanadi Coalfields Ltd.
3	Nearest Railway Station from project	Name km	Belpahar 5
4	Nearest National / State Highway / Approach road	Name km	- Connected by the Belpahar-Jharsuguda all-weather road - Jharsuguda is connected with Sambalpur-Rourkela by state Highway No. 10
B.	GEOLOGICAL		
1	Name of geological blocks considered	Name	Belpahar I,II & III Combined Geological Block
2	Area of the geological blocks	Sq. km	42.81
3	Borehole Density within blocks	Bhs / sq.km	10
4	Description of all coal seams within block (Belpahar I,II & III Combined Geological block)		

Stratigraphic Sequence	Thickness (m)		No. of borehole intersections	Geological Reserves (Mt)	% of total geological Reserve
	Min.	Max.			
PARKHANI TOP	0.06	3.97	27	0.313	
P1D	8.16	25.69	38		
PARKHANI BOTTOM	0.08	8.22	38	3.816	
P2	78.14	106.67	37		
LAJKURA	19.25	36.92	120	89.887	49.5
P3	1.66	26.69	89		
LOCAL	0.10	8.34	100	53.44	3.9
P7	41.58	79.54	83		
RAMPUR TOP I	0.26	6.67	121	69.429	3.7
P5	0.45	11.59	120		
RAMPUR TOP II	0.10	5.61	130	99.524	5.2
P6	1.38	27.79	132		
RAMPUR MIDDLE	0.06	7.07	137	49.416	2.9
P4	0.72	25.49	142		
RAMPUR BOTTOM	3.08	7.97	145	161.214	8.2
P3	0.23	21.37	150		

Jobs No. 702192

Mining Plan and Mine Lay... Integrated Jobs, Part-II ... Lakhanpur-Belpahar-Lilari OCP (40 Mty) ... 2012

मुख्य प्रबंधक (उत्खनन)
भा. एल. सी. आई., बी. सं.-7

MCL Lakhanpur Area

RAMPUR BOTTOM II	0.15	10.62	151	369.135	11.8
P2	3.12	45.03	152		
IB TOP	0.07	8.06	102	68.485	5.2
P1	0.12	36.28	135		
IB BOTTOM	0.05	9.60	188	171.859	10.0
TOTAL				1720.356	100

C.	TECHNICAL		
1	Area of the proposed mine block (with break-up of different geolog cal blocks)	sq. km	36.28*
2	Borehole density within mine area	BHs/sq. km	10
3	Mine parameters (strih-wise) Extent along strike (min. – max.) Extent along dip (min.-max.)	km km	8.4 to 10.14 4.3 – 5.0

4.0 RANGE OF THICKNESS OF SEAMS AND PARTINGS

	Thickness Range		General Thickness	
Seam/Parting	Minimum(m)	Maximum(m)	Minimum(m)	Maximum(m)
Soil, WM, Top O.B.	11.34	86.36	16.15	74.0
Parkhani Top	0.08	2.37	0.2	1.3
PARTING	3.18	20.59	4.0	19.0
Parkhani Bottom	2.08	8.02	0.5	1.9
PARTING	78.14	106.52	80.7	101.3
Lajkura	18.25	36.02	25.2	32.7
PARTING	1.88	22.89	2.4	17.3
Local	0.10	8.54	0.1	2.1
PARTING	41.68	79.54	41.5	58.2
Rampur Top-I	0.26	5.67	0.7	2.5
PARTING	0.45	11.90	1.5	6.0
Rampur Top-II	0.10	5.81	0.5	4
PARTING	1.28	27.79	4.0	17.0
Rampur C	0.09	7.57	0.3	3.1
PARTING	0.72	23.40	1.9	12.0
Rampur Bottom-I	0.08	7.97	1.0	6.2
PARTING	0.33	21.37	1.1	10.0
Rampur Bottom-II	0.15	10.62	2.0	11.8
PARTING	3.12	45.03	12.4	27.9
IB Top	0.07	8.06	0.2	3.3
PARTING	0.12	36.28	2.1	10.2
IB Bottom	0.05	9.60	1.2	5.6

Thickness range is two to maximum & maximum thicknesses encountered in all boreholes; General thickness is the pre-dominant thickness in most of the working area.

	Total Coal	Mt	1202.35
	Total OB	Vol.m	With re-handling: 4334.33 In-situ O.B : 3561.78
5	Av. Stripping Ratio with re-handling 492.55Mcum	Cum/t	3.43
6	Method of Mining		Shovel-dumper, Surface miner

Coal & OB quantities are as on 1.4.2019

7	Target Output	Mt	40.00/My

Summarised Data, Page - b

Job No. 702192
Mining Plan u/s Mine Closure [illegible] Rajmahal-Ulan CCF (40 Mty), September 2019

[illegible]
मुख्य प्रबंधक (उत्पादन)
भा. कु. को. लि., कुं. मि.-I

Ref. No. 3401/(22)/265-CPM dt.07.08.2019

8	Year of achieving Target Production (from zero date 01-04-2022)		Year-5 (2023-24)
9	Year of start of Internal Dumping		Year-1

10. Production Build-up

Year--->	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6
Coal in mt	30.00	30.00	33.00	35.00	37.00	40.00
OB in Mcum	52.00	52.00	52.00	101.00	92.00	87.32

11	Total Mine Life		
	(@ Normal production capacity)	Years	41
	Construction period	Years	NIL
	Production build-up period	Years	5 years
	Full Production period	Years	Up to Year 20
	Tapering / mine closure period	Years	Year 22 to 41

12A. MAJOR HEMM REQUIREMENT (IF RUN DdepartmentALLY) – TOP OB AND PARTINGS

Sl No.	Machine type	Size	Required	Existing	Bal reqd.
1.	Dragline	168	1	1	
2.	Diesel Hyd. Shovel	34 cum	13		13
3.	Elec. Rope Shovel	5 cum	5	5	
4.	Diesel Hyd. Shovel	12 cum	3		3
5.	Diesel Hyd. Shovel	9.5 cum	1	1	
6.	Diesel Hyd. Shovel	8.3 cum	2	2	
7.	Electric Hyd. Shovel	8.1 cum	2	2	
8.	Diesel Hyd. Backhoe	4.3 cum	1	1	
9.	Hydraulic Backhoe	2.8/3.0 cum	2	2	
10.	Rear Dumper	344 T	144		144
11.	Rear Dumper	100 T	44	15	29
12.	Rear Dumper	50 T	88	55	33
13.	Electric Drill	250 mm	51	9	42
14.	Diesel Drill	160 mm	7	7	
15.	Crawler Dozer with ripper	850 HP	7	1	6
16.	Crawler Dozer	410 HP*	15	15	
17.	Crawler Dozer	401 HP*	2	2	
18.	Crawler Dozer	320 HP*	1	1	
19.	SW 32 A/W Dozer	400 HP*	2	2	
20.	Front Shovel Dozer	400 HP*	3	3	

* to be replaced with 850 HP ripper dozer after survey-all: 03 nos during 2018-19 and 2 nos during 2019-20

Job No: 733102

Summarized Data Page 4/5

Mining Plan (in Hindi) (Govt. Version)

सुरक्षा प्रबंधक (उत्खनन)
सी. एम. पी. आई., डे. मं.-I

एम.सी.एल., लखनपुर क्षेत्र
MCL, Lakhanpur Area

12B MAJOR HEMM REQUIREMENT (IF RUN DEPARTMENTALLY) – COAL

Sl No	Machine type	Size	Required	Existing	Bal reqt.
1	Surface Miner (~900 HP)	3.8m wide	12	2	10
2	Front End Loader	5.4 - 7.7 cum	12	1	11
3	Wheel Dozer	450 HP	1	1	
4	Wheel Dozer	300 HP	2	2	
5	Multi wheel Dump Truck	35 T	120		120

13	Addl. Manpower (for mine only) Existing Manpower 1740	Nos	4248
14	Overall Output per man shift (OMS) including Welfare Manpower	Tonnes	20.71
15	Presence of Major Surface Constraints (rail/ road, power line, etc.)	(type)	Presence of (i) 3550 PAPs in 17 nos. of villages (ii) Unit Nallah diversion (iii) Proposed nallah diversion (iv) Diversion of CPGC railway line between Belpahar and Lakhanpur OCP
16	Coal Transport within the mine (By Dumper/Truck)		35T Multi wheel Dump Truck
17	Surface Coal Transport to Siding/ Dispatch Point and Mode of Dispatch		By conveyor and through SILO (rapid loading system)
18	Any Railway Siding and distance		Existing and new rapid loading system proposed near the mine
19	Name of any Steel/ Coal/Power Industry		Basket Linkage

D.	ENVIRONMENTAL & OTHERS			
1	Civil Construction Residential houses	Unit	2951	
2	Water Demand	MLD	Potable	2.47
			Industrial	18.43
3	Land to be acquired - Total Forest land (type of forest)	Ha Ha	Addl land 608.544 Reserve Forest: 77.897 Revenue Forest: 39.746 Total Forest: 117.643	Total land 4742.817 Reserve Forest: 122.740 Revenue Forest: 673.648 Total Forest: 896.388
4	Additional land to be acquired for mine excavation Total Forest land	Ha Ha	322.042 75.558	
5	Additional land to be required outside mine area (beyond excavation area) Total Forest land	Ha Ha	287.502 42.085	

मुख्य प्रबन्धक (पर्यावरण)
सं. क्षे. पी. प्रो. लि., बेलपहाड़
Ref. No. 3481/232308-CPMI dt.07.08.2018

General Manager
Environment
MCL, Lakhanpur Area

6	Land to be acquired for external dumping Non-forest (pvt) Forest land	Ha Ha	Nil Nil
7	Habitation & Rehabilitation No. of villages within mine boundary No. of project affected persons No. of PAFs to be rehabilitated	Nos.	17 Nos.(Total) 22432(Total) 3850(Total)
8	Mean annual precipitation	mm	1514 mm
9	Total installed pumping capacity	lps	15000 lps
10	Drainage of the Area (Name of rivers/s)		Local nala
11	Any proposed diversion of road or power line		Likely and Proposed

Job No. 102102 Mining Plan and Mine Closure

Submitted by: [illegible]

[illegible] 2018

मुख्य प्रबंधक (उत्खनन)
सी. एल. पी. आई., झं. मं.-7

MCL-Lakhanpur Area

TEXT

General Manager
एल.पी.जी. (विपणन) अंचल
M/S Lubrizol India

देवाशिस राव
मुख्य प्रबंधक (प्रचालन)
सी. एल. पी. डी. आई., बी. पी.-7

Chapter- 1

INTRODUCTION

1.1 BACKGROUND OF THE PROJECT

The Project Report for Lakhanpur Opencast, 5.0 Mty capacity of b-valley coalfield was prepared in April 87 and approved in January 92 vide letter No.43011/ 43/ 87-CPA, dt.22.1.92. The mine started coal production from 1992-93. Expansion proposal for Lakhanpur OC mine for incremental production of 5.00 Mty (Total 10 Mty) was approved by CIL Board in February, 2004. (Phase-II) has also been sanctioned for 15 Mty (5 Mty Incremental) in September, 2008.

The PR of Belpahar OC was prepared in Oct 80 for a production of 2 Mty. The project was sanctioned by the Govt. in Dec'82. The project was started in 84-85. Expansion proposal of Belpahar mine for an incremental production of 1.50 Mty (3.50 Mty total capacity) was sanctioned by the MCL Board in August, 2004. Ph-II expansion of Belpahar OC has also been approved by MCL Board for rated capacity of 8.0 Mty (4.5 Mty incremental).

Project Report of Lilari OCP was sanctioned in Sept 1987 for a rated capacity of 0.50 Mty. An excension PR was formulated in March, 2002 within the same property by reducing the safety zone in the forest land from earlier 300m to 7.5 m as per guidelines. The extension PR was approved by FDs meeting of MCL.

Belpahar OCP was planned in Belpahar Block-I & II to exploit the lower seams (b and Rampur), whereas Lakhanpur OCP and Lilari OCP were planned further dip side in Belpahar block-III to exploit upper Lajkura seam. Both the mines were planned for open cast mining. The lower seams (b and Rampur) below Lakhanpur OC and Lilari OC were not planned due to thick parting between Lajkura and Rampur seam resulting in adverse economics.

देवाशिस सिंह
मुख्य प्रबंधक (खनन)
सी. एस. पी. डी. आई., बू. ब.-7

In the present proposal, all the three mines (Lakhanpur, Belpahar and Lilari OCs) have been proposed to be integrated into one mine to exploit all the three principal seams of the coalfield i.e. Ib, Rampur and Lajkura by open cast mining.

The Project Report for Integrated Mine was discussed at various levels of MCL and all observations were incorporated. The 164th MCL Board meeting held on 03.02.2015 recommended the proposal in Variant-II (partial outsourcing), to be put up before Empowered Sub-committee of CIL.

CMD, MCL made a presentation in the 85th ECS meeting of CIL held on 08.05.2015 and gave clarifications to all the queries.

After incorporating observations of ESC, the modified PR was put-up before 319th CIL Board held on 12.08.2015 at Kolkata. CIL Board accorded its "In-Principle" approval of the PR at an estimated capital investment of Rs.3017.57 crore on partial outsourcing variant (variant-II). Further, Board approved first year expenditure of Rs 635.00 crore for the project.

The PR was again discussed in the 330th CIL Board meeting held on 19th and 20th July 2016 and advised MCL to prepare Revised Project Report and submit to CIL through MCL Board.

Accordingly, the PR was revised in accordance with above directive of CIL Board, particularly scheme of mining has been changed avoiding OB re-handling at the initial years. Also Economics of the project has been worked out with and without washery.

With the above revision, the PR was placed before MCL Board held on 22.12.2017. The MCL Board approved the PR in-principle to be implemented in Variant-II (partial outsourcing) in Option-2 (with 10 Mty washery) and observed that the Mining Plan be prepared for a capacity of 40 Mty avoiding forest land.

The PR was discussed in the PAC (Project Appraisal Committee) meeting at CIL on 14.02.2018. After incorporating observations of the PAC, the Project Report was put up to ESC of CIL on 09-05-2018. The ESC of CIL approved the PR to be put up to CIL Board. The CIL Board in its 364th meeting held on 22-05-2018, approved the Project Report for Integrated Lakhanpur-Belpahar-Lilari OCP in Variant-II (partial outsourcing) and Option II (10 Mty washery).

हेमन्त सिंह
मुख्य प्रबंधक (उत्पादन)
सी. एम. पी. डी. आई., बी. पी.-7

General Manager
एम.सी.एल. लाखनपुर क्षेत्र
MCL, Lakhanpur Area

1.2 EXPLORATION STATUS

Detailed exploration by CMPDI in the eastern part of the Belpahar block was commenced in May '78. A total of 11,659.32 m of drilling in 135 boreholes (134 CMPDI + 4 GSI) had been carried out in an area of 16.4 sq. km. Similarly, as the detailed exploration continued in the dip side of western part of the Belpahar block, CMPDI drilled additional 178 boreholes (22611 m) besides 9 boreholes of GSI in an area of around 21.73 sq. km. Subsequently, during the course of MCL mining activities in three opencast projects viz. Belpahar, Lakhanpur & Lilari a total 121 no. of production support boreholes comprising 7251.10 m of drilling were drilled by CMPDI and DG (O) for strengthening geological structure, access trench alignment, assessment of quality etc. as per the requirement of MCL. Some other boreholes drilled in and around the area have also been considered in the present report.

The Belpahar I, II & III combined block covers an area of 42.81 sq. km with maximum extent of 8.56 km along strike direction and 5.0 km along dip direction.

Geological Reserve: Total Net Proved reserves of **1484.833** million tonnes and Indicated reserves of **235.433** million tonnes have been estimated vertically within Mining Lease up to seam IB BOTTOM. The volumes of less than 1.0 metre coal seams, Ungraded coal (Gr.IV less than 7300 Kcal/Kg) and in-seam dirt bands of more than 1 metre in thickness of these seams from PARKHANI TOP to IB BOTTOM have been deducted from MINEX and added to the volumes of respective overburden / parting above to arrive at total waste.

1.3 MINING ACTIVITIES – BRIEF DETAILS OF IB VALLEY COALFIELD

Ib-valley coalfield (also known as Ib-river coalfield) is located in Jharsuguda, Sambalpur and Sundargarh districts of Orissa between latitudes 21°31' to 22°14'N and longitudes 83°32' to 84°10'E (ref. **Plate No. Gen-I**). The coalfield is named after

the river Ib, a tributary of the river Mahanadi. The Howrah-Mumbai railway line passes through the coalfield. The nearest rail head is Brajrajnagar.

Mining in this coalfield in south-eastern part started with the support of available infrastructures around Brajrajnagar township in the first half of this century. The first UG mine to start was Hingir Rampur Colliery (1909) and subsequently Orient UG mine No.1 (1940).

Coal reserves of this coalfield are about 24.19 billion tonnes (as on 1.4.2014) of which about 14.95 billion tonnes lie within a depth range of 300m. Quality of coal varies from grade C to G (largely F), suitable for power generation.

The coal movement to western and southern India power houses is convenient from this coalfield by virtue of its locational advantage. Many private entrepreneurs are interested to build and operate power plants in this coalfield in the neighbourhood of Hirakud water reservoir due to ease of availability of coal and water. Thus the coalfield has gained importance in recent times.

1.3.1 DIVISION OF COALFIELD INTO SECTORS

The coalfield is broadly divided into three sectors as under:

- North-western sector/Gopalpur tract.
- West-central sector/Hingir tract.
- South-eastern sector/Rampur tract.

NORTH-WESTERN SECTOR/GOPALPUR TRACT

This sector has favourable geomining characteristics. However, due to its remoteness from the existing mine field and absence of rail link, the development of large scale mining activities in this sector is linked to establishment of pit head power stations in this region.

This sector has been divided into 23 nos. of geological blocks (ref. Plate Gen-II) which are under different stages of exploration. All of them are virgin except Basundhara & Kulda blocks. At Basundhara coal production had commenced in 96-97 in Basundhara (East) OC project which was exhausted in 06-07. Mining operations in

देवाशिष राय
मुख्य प्रबंधक (उपखनि)
सी. एम. पी. पी. आई., डब्लू. सी. एल.
Ref.No. 3411/32/2015-CMPI dt.07.05.2018

Basundhara (W) OC project have also started after the approval of the PR in October, 2003. Mining operations in Kulda OC project have started in 07-08 after approval of the PR in January, 2005.

WEST-CENTRAL SECTOR/HIMGIR TRACT

West-central unexplored region is covered by the exposures of Barren measures, Raniganj and Kamthi measures where coal seams are likely to be deep-seated, as indicated from regional drilling and needs to be proved by detailed exploration. As such, this sector does not offer any scope for mining activities in near future.

SOUTH-EASTERN SECTOR/RAMPUR TRACT

This sector of Ib valley coalfield is under maximum exploitation.

It has 10 exploration blocks and all of them are explored in detail. These are Delpahar-I & II, Belpahar-III, Talabira-I, Talabira-II& III, Kudopali, Rampur, Rampur Extension, Lajkura & its expansion, Orient group of blocks and Madhupur block.

Most of the blocks are under active mining operation except Talabira II & III blocks, which was a JV project where MCL has a share of 70%. The block has now been de-allocated.

1.3.2 STATUS OF SOUTH-EASTERN SECTOR (RAMPUR TRACT)

In this part of the coalfield, potential coal seams are Ib, Rampur and Lajkura which occur in ascending order. All the coal seams outcrop in this part with almost north-south strike with basal Ib seam in the eastern extremity followed by exposure of younger seams to the west in succession.

Due to nearness of Howrah-Mumbai railway line and availability of infrastructural facilities, this part of the coalfield has developed rapidly after nationalization.

Job No: 702152
Mining Plan and Mine Closure Plan for Lakhanpur Deposit in Lak OCP (upgn), Sundargarh (S), Odisha

Details of existing mines, completed & ongoing projects in Ib valley coalfield are given below:

Table 1.3
Existing Mines, Completed & Ongoing Projects

Sl. No.	Mine/Project	Annual capacity (Mt)	Seam worked
A.	**Existing Mines**		
1	Orient group UG mines (Orient-1,2,3&4)	0.79	Ib/Rampur & Lajkura
2	Rampur group UG mines (Hingir Rampur colliery & Hirakhand Bundia Incline)	0.06	Rampur and/or Ib
B	**Completed Projects**		
3	Lajkura OC	1.00	Lajkura
4	Belpahar OC & Expansion	8.0 (2.0+1.5+4.5)	Ib & Rampur
5	Liberi OC	3.00	Lajkura
6	Samaleswari OC & its expansions	12.0(3.00+1.00+1.00+2.00+5.0)	Lajkura
7	Lakhanpur OC & Expn.(Ph-II)	5.00+5.00+5.00	Lajkura
8	Basundhara West OC Expn./Extn.	2.+0+4.00	Ib & Rampur
C	**Ongoing Project**		
9,10	Kulda OC:PR Expn.	15.00	Ib, Rampur & Lajkura
11	Lajkura Expn OCP	1.50 (Incr.)	Lajkura
12	Hirakhand Bundia UG (Aug.)	2.42 (Incr.)	Rampur

Mine-wise production achieved in 2016-17 in Ib-valley coalfield is given below:

Sl. No.	Name of the Project	2016-17 Coal (Mt)
1	Belpahar OC	6.00
2	Lajkura OC	2.08
3	Lakhanpur OC	18.73
4	Liberi OC	0.33
5	Samaleswari OC	14.71
6	Basundhara (W) OC	3.50
7	Kulda	10.00
	Sub-total OC	**58.37**
	Sub-total UG	**0.84**
	TOTAL OF IB VALLEY	**59.21**

1.4 PRESENT STATUS OF THE MINE/PROJECT

In the project area, mining activities by opencast method by three mines namely Lakhanpur, Belpahar and Lilari OCPs are going on. The upper seam i.e. Lajkura seam is being mined in Lakhanpur and Lilari OCP and the lower seams (Ib and Rampur) are being worked out in Belpahar OCP. Opencast mining with Shovel-Dumper combination and dragline for OB and partings and Surface Miner and shovel-dumper for coal is adopted. Total Geological reserve estimated for the combined block is 1720.26 Mt, out of which 235.43 Mt are in Indicated category. The mineable reserves estimated within quarry configuration is 1202.80 Mt (as on 1.4.2018). It may be mentioned here that mineable reserve is arrived at after provision of safe quarry slope, statutory barriers, impossibility of extraction at acute corner etc. In view of detailed exploration an established coal occurrences, no geological loss has been considered, but about 5% coal has been deducted on account of mining loss due to multi seam, interbanded coal extraction.

At present coal from all the three mine is dispatched through the following sidings/UTLS as described below:

- Ubuda siding
- Belpahar siding 3, 6 and 7
- Siding no. 4 and 5 (Y- curve siding).

Total existing Manpower including three mines viz. Lakhanpur OCP, Belpahar OCP and Lilari OCP is 1740.

1.5 JUSTIFICATION OF THE INTEGRATED PROJECT

As explained earlier, both Ib and Rampur seams below Lakhanpur and Lilari OCP are virgin and were not planned earlier due to presence of thick parting between Lajkura and Rampur seam. In the present proposal, all the three mines have been proposed to be integrated into one mine and planned upto the lower most workable coal seam for better conservation, safety and enhancing the capacity of the mine to meet the growing coal demand of MCL.

देवाशीष राय
मुख्य प्रबंधक (उत्खनन)
मै. भू. वी. बी. आई., डे. फ.-I

1.5 SALIENT FEATURES OF INTEGRATED MINING PLAN

The present proposal has been prepared for 40.00 Mty capacity. The Washery of 10 Mty is already approved by MCL Board on 27.08.2016.

Presently out of production of about 18.75 Mty from Lakhanpur OCP, around 2.50 Mt of coal is linked to the Ib-TPS of M/s OPGC dispatched through Ubuda siding. The balance coal is dispatched from Belpahar siding 3,6 and 7 near Belpahar OCP and Y-Curve siding no. 4 and 5 located at a distance of about 12 km. Coal from Belpahar OCP is also dispatched from Y-curve siding. Some coal is dispatched through local sale from coal stock yard. In the present proposal, Belpahar OCP has been proposed to be extended in the dip side to integrate with Lakhanpur OCP which will necessitate dismantling of Ubuda siding.

Both washed and raw coal is proposed to be transported via rail from rapid loading systems fitted to the silos. Transport of coal on surface from pit-top receiving hoppers to silos/washery will be by conveyors. In the initial years till the conveyors and silos are commissioned, existing dispatch system will continue.

Proposed Integrated Lakhanpur-Belpahar-Lilari OCP has no consumer specific linkage. A basket of new consumers may be linked to the project who have been issued LOA (Letter of Assurances) by MCL under NCDP-2007.

1.7 PRE-REQUISITES AND ASSOCIATED RISKS

Following pre-requisites are envisaged and should be considered while implementation of the report:

a) Evacuation of villagers
b) Completion of R&R activities
c) Possession of land, diversion of road including villages roads
d) Forest Clearance and Environment Clearance
e) Diversion Nalla (Lilari and Pujhari)
f) Coal evacuation by rail

g) Construction of infrastructures like washery, sub-station, Rapid Loading System, railway line, office, HEMM workshop.

1.8 PROJECT OBJECTIVES AND TARGET BENEFICIARIES

Coal demand from Ib-valley coalfield has increased many fold due to its strategic location with Howrah-Mumbai railway line passing through the coalfield. Coal of this coalfield is suitable for thermal power plants.

Many pit head power plants and other coal based plants have come up due to easy availability of coal and water. The southern, western & central India power stations have to depend on Ib valley coalfield for their growth. The Howrah-Mumbai line passes through the coalfield. So coal can move from this coalfield to western India power houses via rail route. Coal to Tamil Nadu Electricity Board is also supplied via rail-cum-sea route through Vishakhapatnam and Haldia ports. Coal can easily move from this coalfield to Eastern India and Northern India as well. Necessary infrastructures like rail and port facilities are being developed/ augmented in the region.

The proximity of Ib-valley coalfield to Hirakud reservoir has generated a lot of opportunities for setting up super thermal power stations in the vicinity of the coalfield.

To meet the increasing demand of power in the country, more and more super thermal power stations are being planned in western, northern and eastern India, majority of which are coal based and may be linked from Ib-valley coalfield. Power Houses of Punjab State Electricity Board, Haryana State Electricity Board have also been linked to MCL and will be supplied coal from this coalfield. The New Power houses of TNEB, KPCL, WBPDCL, CESC and DVC are also linked to the coalfield.

मुख्य प्रबंधक (खनन)
सी. एम. पी. डी. आई., क्षे. का.-I
Ref. No. 3401/310806-CMPDI dt.07.06.2019

Chapter - 2
MARKETING AND JUSTIFICATION

2.1 DEMAND AND SUPPLY SCENARIO OF MCL

Long-term demand projection of coal is quite complex issue owing to rapid changes in the relative availability & fresh coal linkages or cancellation of linkages under New Coal Distribution Policy (NCDP) - 2007. However, as the position stands now, the overall coal balance of MCL is given below:

Table 2.1
Projected coal demand on MCL
(Both Talcher and Ib-valley coalfield)

Sl. No	Particulars	2021-22	2026-27
A.	**Existing Units**		
1	Total committed/under FSA & otherwise (based on last three years average) for Power (Utility)	67.240	67.240
2	Total committed under FSA & otherwise for Non-power (Utility)	28.565	28.565
Sub-Total(A)		95.804	95.804
B	**Future Units (LOA issued by MCL)**		
3	LOA Power (U)	130.085	158.085
4	LOA Power (captive)	16.148	19.448
5	LOA Cement	0.457	0.457
6	LOA Sponge	2.34	2.34
Sub-Total (B)		148.83	178.33
Total Demand on MCL (A+B)		244.634	274.134

The consumers of MCL are linked to the company and not to any specific coalfield. The actual supply from any coalfield of MCL will depend upon the production and transport logistics. Under the above circumstances coalfield wise demand has been assessed based on the production share of these two coalfield which is given in the next page.

Table 2.2
Projected coal demand on MCL from Ib-valley coalfield

(Fig. in Mt)

Sl No	Particulars	2021-22	2026-27
1	Total Demand on WCL	264.83	274.134
2	Projected coal demand for Ib-valley coalfield	97.90	120.55
3	Coal Availability	69.61	70.40
	Gap	(-)28.32	(-)50.15

2.2 UTILITY OR MARKET FOR THE COAL FROM MINE/PROJECT

It is proposed that the coal produced from the proposed project will be linked to various Thermal Power Stations for power generation, both within the state and outside the state.

2.3 AVAILABLE LINKAGE OR FIRM FUEL SUPPLY AGREEMENT (FSA)

The proposed integrated PR of Lakhanpur-Belpahar-Lilari OCP will be linked to the existing consumers of the respective OCPs. In addition a basket of new consumers may be linked to the project who have been issued LOA (Letter of Assurance) by MCL under NCDP-2007.However, the consumers wise quantity may be known after signing of FSA, which are to be executed after achieving the desired milestones as per the guidelines of NCDP-2007.

2.4 JUSTIFICATION OF OPENING THE PROJECT

The existing Lakhanpur OCP has been planned to mine upto the upper Lajkura seam only, below which both Rampur and Ib seam are left virgin. So from sound conservation point of view, in this project, it is proposed to work the left out virgin deposits of Rampur and Ib seam below Lakhanpur OCP. Also to add life to the project, additional property to the dip side has been annexed.

Further as explained in table 2.2, the projected gap between demand and availability by the end of year 2021-22 is projected to be 28.32 Mt from Ib-valley coalfield. Further new coal linkages have been given to MCL for which MCL has already issued LOA. The proposed integrated project will meet the coal demand from the coalfield, especially to the new consumers and reduce the gap between demand and availability.

Confirmed
सहायक महाप्रबंधक (तकनीकी)
भू. उ. वि. प्र. कार्या., डी. पी.-2
Ref. No. 345/1(2)2016-CPAM dt.07.04.2016

General Manager
Lakhanpur Area

Chapter - 3

PROJECT SITE INFORMATION

3.1 LOCATION, ACCESSIBILITY AND COMMUNICATION

Lakhanpur-Belpahar-Lilari integrated OCP (30.0 Mty) is proposed within Combined Belpahar I,II & III Geological block of Rampur tract of Ib-valley coalfield, in Jharsuguda dist. of Odisha. Lakhanpur OC, Belpahar UC and Lilari OC are running opencast projects of MCL, which are proposed to be integrated into one project.

Belpahar I, II & III combined block is situated between the latitude 21°42'12" – 21°47'20" N and longitude 83°45'00" – 83°52'41" E in the district of Jharsuguda, Odisha, covering an area of 42.81 sq. kms. The block falls under Survey of India toposheet no. 64O/13 & 64O/14 on R.F. 1:50,000 and Survey of India special toposheet nos. C-4, C-5, B-4, B-5 and D-4 on R.F. 1:10000.

The area under consideration is well connected by rail and road to all important business and industrial centres of the country. The Mumbai-Howrah main line of the SE railway passes close to the northern boundary of Belpahar I, II & III combined block. The Belpahar railway station is situated at a crow fly distance of about 5 km from the northern boundary of the block. Jharsuguda, the dist. Headquarter is 30 km from the area and is connected by the Belpahar-Jharsuguda all weather road (Odisha District Road-5). Jharsuguda is connected with Sambalpur-Rourkela and Bilaspur by a state Highway No.10. The district headquarter Raigarh of State Chhattisgarh is also around 70 km away from Belpahar and is well connected by the Belpahar-Kuraloi-Lakhanpur-Kalarcaga-Bhikampa-Raigarh all weather pitch road (NH-200).

The block is also connected with different working opencast coal mines of MCL viz. Lakhanpur OCP, Belpahar OCP and Lilari OCP (all within the block), Samaleswari OCP, Lajkura OCP, HR collieries, Orient colliries, Hirakud Bundia Incines etc. of MCL are all within 5 to 15 km away from the block. Tata Refractories Limited (TRL) is situated in the Gomodera small township, 2 to 3 km away in the north western corner of the block. Ib Thermal Power Station of OPGC (Odisha Power Generation

Corporation of Govt. of Odisha) is situated around 2 to 3 km away from the southern boundary in the south east corner of the block and is well connected with all weather pitch road.

3.1.1 AREA OF THE PROJECT IN SQ. KMS.

The Belpahar I, II & III combined block covers an area of 42.81 sq. km with maximum extent of 8.56 km along strike direction and 5.0 km along dip direction.

3.1.2 LIMITING BOUNDARIES OF THE PROJECTISED AREA

The limits of Belpahar I, II & III combined block are given below.

East: Floor of bottom most B Bottom seam Incline.

West: Notification boundary for 20 Mty PR formulation given by MCL and proved limit line of coal in GR on Belpahar Sector III.

North: Floor position of fault F1-F1 of bottom most seam, B Bottom.

South: Surface position of fault F7-F7.

The block shapes like a trapezium which extents maximum up to about 8.56 km along strike direction and about 5.0 km along dip direction.

3.2 CLIMATE AND RAINFALL DATA

The area falls in sub tropical climate. During summer (March-May) the temperature varies from 13.2°C to 40.0°C which even reaches up to 48.9°C during the extreme summer. In winter (December to February) the temperature varies from 7.0°C to 36.4°C (From January 1996 to February 2010). Most of the rainfall occurs during the end of June to September. December is the most of least rainfall. The average rainfall in the area is around 1519 mm recorded for the period of 1936 to 2007.

3.3 TOPOGRAPHY WITH DRAINAGE PATTERN OF AREA

The area is represented by gently rolling undulating topography with the softer formations like coal seams and shale, forming linear depressions and occupied by paddy fields and relatively harder sandstones forming the ridges and knolls. However, as the area has undergone to active opencast coal mining activities the natural/original topography of the block has undergone lots of change with the occurrence of opencast quarry pits, overburden dumps, coal stocks, haul roads, colliery infrastructures, running opencast projects office, residential establishments, ancillary townships, roads etc.

The lowest elevation is about 193.00 metres and lies near borehole no. DMB-057 (RL 192.90 m) in the north-western part and the highest elevation is about 252.00 metres and is located in southern part near borehole no. DMB-310 (RL 250.39 m).

The Ib River, after which the coalfield is named which flows southerly along the eastern boundary of the coalfield, constitutes the main drainage of the coalfield. The easterly flowing Lilari nala, a tributary of the Ib river, flows across the area in the northern part of the block controls the drainage pattern of the block. In addition to it few nalas flow into the Lilari nala. Besides, a number of artificial water logged depressions have been formed by fire clay quarries, which were mined by TISCO, in the northern part of the block, abandoned opencast coal mines / pits / benches mined by MCL in and around Belpahar OCP in the eastern, Lakhanpur OCP in the central and Lilari OCP in the northern parts of the block.

Chapter – 4

GEOLOGY AND DEPOSIT APPRAISAL

4.1 INTRODUCTION

4.1.1 BACKGROUND

The proposed Integrated PR of Lakhanpur-Belpahar-Lilari OCP has been formulated within Belpahar I, II & III Combined Geological block in the Rampur Sector of Ib-valley coalfield. The block namely, Belpahar I, II & III combined, is a combination of earlier blocks viz. Belpahar opencast I & II block and Belpahar Sector III. Geological report for both the aforesaid blocks, published in August 1994 and March 1986 respectively were available and on basis of which, three opencast projects viz. Belpahar opencast mine, Lakhanpur opencast mine and Lilari opencast mine are in operation within the blocks. In Belpahar OCP, lower coal horizons viz. Ib and Rampur seams in different sections/splits are being mined out and in Lakhanpur and Lilari OCP's upper seam horizon viz. Lajkura is being exploited by MCL. In Lakhanpur and Lilari OCPs lower seams namely Rampur and Ib seams were thought to be exploited by underground mining due to occurrence of parting to the tune of 70 to 80 m between Lajkura and Rampur seams.

In the meantime, due to high demand of coal for fulfilling the long term coal linkage commitment of MCL to its consumers, coupled with better economics with outsourcing, MCL has proposed to explore the possibilities of integrating existing Lakhanpur, Belpahar opencast projects to a single mine within the block under report, so that the virgin Rampur and Ib seam below Belpahar Sector III block can also be exploited by opencast method along with upper Lajkura seam. Accordingly it was felt to study the opencast potentiality of lower seams viz. Rampur and Ib seams below Lajkura seam in the Belpahar sector III block, so that the expansion projects for existing Belpahar, Lakhanpur and Lilari opencast mines can be formulated to increase the production capacity of mines of MCL within the block under report to meet the challenge of coal demand by the consumers. Hence a combined GR was prepared.

The Belpahar I, II & III combined block is located in Southern part of Ib Valley coalfield in the district of Jharsuguda, Odisha (Plate I & Figure 1). In this chapter Geology of the OCP has been described from the **GRs of Belpahar I, II & III combined block prepared by CMPDI, RI-VII in March, 2012.**

4.1.2 BLOCK BOUNDARY (Ref.Plate-G-2)

The limits of Belpahar I, II & III combined block are given below:

East	:	Floor of bottom most Ib Bottom seam (workable)
West	:	Notification boundary for 20 MTY PR formulation given by MCL and proved limit line of earlier GR on Belpahar Sector III
North	:	Floor position of fault F1-F1 of bottom most seam, Ib Bottom
South	:	Surface position of fault F7-F7

4.2 EXPLORATION STATUS

4.2.1 QUANTUM OF EXPLORATION

Detailed exploration by CMPDI in the eastern part of the Belpahar block was commenced in May'78. A total of 11,659.32 m of drilling in 138 boreholes (134 CMPDI + 4 GSI) had been carried out in an area of 15.4 sq. km. Similarly, as the detailed exploration continued in the dip side of western part of the Belpahar block, CMPDI drilled additional 176 boreholes (22911 m) besides 9 boreholes of GSI in an area of around 21.73 sq. km. Subsequently, during the course of MCL mining activities in three operational projects viz. Belpahar, Lakhanpur & Lilari, a total 121 no. of production support boreholes comprising 7251.10 m of drilling were drilled by CMPDI and DG (D) for strengthening geological structure, access trench alignment, assessment of quality etc. as per the requirement of MCL. Some other boreholes drilled in and around the area have also been considered in the present report.

The total quantum of exploratory drilling for coal carried out in Belpahar I, II & III combined block is provided in the following table

Table 4.1
Details of Exploration,
Belpahar I, II & III Combined Block, Ib Valley Coalfield

Agency	Period of Drilling	Nos. of BH intersections (BH series)	Meterage drilled (M)	Type of drilling	Status of Documentation
CMPDI	May 75 – May 1985	310 (CNB)	33958.80	Detailed drilling during exploration of Belpahar block	Documented in this report
GSI	Aug 77 – Nov 1984	15 (BR)	2791.20	Regional exploration in Belpahar block / Ajaswar area	
CMPDI	Dec 02 – Feb 2005	9 (CL)	1108.00	Production support drilling in Lilari OCP	
CMPDI	Jan 03 – May 2003	25 (CLK)	1510.00	Production support drilling in Lakhanpur OCP	
DG (D)	1997-98 (March 98 to April 98)	2 (CBOC)	163.00	Drilling for physico-mechanical studies of coals in Belpahar OCP	
DG (D)	Jan 2003 – May 2003	36 (CBB)	2907.00	Production support drilling for Belpahar OCP	Documented in this report
DG (D)	March 1998 – March 2002	9 (CLO)	1165.65	Production support drilling for Lilari OCP	
DG (D)	July 1999 – Oct 1999	49 (CBLK)	765.85	Production support drilling for Lakhanpur OCP	
Grand Total		444	45538.50		

4.2.2 DENSITY OF BOREHOLES IN BLOCK AREA

The Belpahar I, II & III combined block covers an area of 42.81 sq. km with maximum extent of 8.56 km along strike direction and 5.0 km along dip direction. Seam wise borehole density is given in the table below:

Table 4.2
Borehole Density,
Belpahar I, II & III Combined Block, Ib Valley Coalfield

Seam	Borehole Density (no. of Bh/sq. km)
PARKHANI TOP	1
PARKHANI BOTTOM	1
LAJKURA	4
LOCAL	3
RAMPUR TOP I	3
RAMPUR TOP II	3
RAMPUR MIDDLE	3
RAMPUR BOTTOM I	4
RAMPUR BOTTOM II	4
IB TOP	4
IB BOTTOM	3
ALL SEAMS/ALL Bhs	10

4.2.3 PROXIMATE ANALYSIS OF COAL SEAMS

Quality of coal in this block is generally of high moisture high ash power grade. The grade of coal is predominantly F to G. The details of quality of coal on 'as' basis in this block are tabulated below:

Rajkishore Nag
पुनर्वास अधिकारी (राजभाषा)
सी. एम. पी. डी. आई., बी. भ.-7.

Table 4.3: Qualitative Description Of Coal Seams, Belpahar I, II & III Combined Block, Ib Valley Coalfield

Seam Name	General Seam Thickness (m)		Range of Effective Thickness (m)		Range of Proximate Analysis on 60% RD & dry						Range of GCV in cal/gm		Range of UHV in kcal/kg		General Grade	
					M%		Ash%		VM%							
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
PARASEONI TOP	0.0	1.80	0.0	1.20	2.1	3.1	20.1	31.1			3936	5936	5962	7962		
PARASEONI BOTTOM	1.8	3.9	1.80	3.95	1.9	2.9	32.2	39.4			4845-911	5845-911	6845-911	7845-911	F	F
			3960-08	4960-911	1845-911	1845-911	1845-911	1845-911			3960	4960	4779	5771		
											3845-911	4845-911	5845-911	6845-911		
BELPAHAR I	20.2	32.5	2.50	15.00	5.8	8.1	31	46.1	22.3	36.9	3951	4951	5951	6951	F	G
			1845-911	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911						
				1.80							3960-911	4960-911	5960-911	6960-911		
BELPAHAR II	3.8	5.4	1.81	5.41	6.3	8.1	33.1	45.1							G	F
			1845-911	1845-911	1845-911	1845-911	1845-911	1845-911			3045	4045	5045	6045		
			1.00	4.00	3.3	8.0	29.8	47.8			3745-911	4745-911	5745-911	6745-911	F	G
BELPAHAR III	2.2	2.5	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911						
			1.00	3.01	4.7	5.9	25.2	34.1	20.1	23.7	3951	4951	5951	6951		
			1845-911	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911					G	F
BELPAHAR IV	1.7	4.9	1.00	5.01	4.7	5.9	25.2	34.1	20.1	23.7	3958	4958	5958	6958		
			1845-911	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911						
			1.00	6.74	5.5	8.6	34.8	49.2	22.9	28.9	3745-911	4745-911	5745-911	6745-911	F	F
BAMPUR MIDDLE	1.2	5.8	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911						
			1.00	7.93	5.5	7.5	29.7	39.7	20.1	25.1	3951	4951	5951	6951	G	F
BAMPUR BOTTOM	2.2	3.8	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911						
			1.00	3.95	4.2	6.0	25.2	35.4	18.5	25.4	3958	4958	5958	6958	F	F
BAMPUR BOTTOM II	2.1	2.1	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911						
			1.00	3.95	4.4	7.8	19.2	30.4	21.9	29.8	3951	4951	5951	6951	D	E
IB OUT	1.1	4	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911						
			1.00	4.00	3.3	4.7	23.2	34.6	21.2	24.1	3958	4958	5958	6958	F	D
IB BOTTOM	2.1	6.2	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911	1845-911						
			1.00	6.20	3.3	8.2	22.2	32.1	20.1	25.1	3951	4951	5951	6951	E	F

Agent
Mines (Orissa)

4.2.4 PHYSICO-MECHANICAL STUDIES

Physico-mechanical studies have been done for two coreholes DIBCC-1 & DIBCC-2 drilled by DGM) in Belpahar OCP area at the instance of MCL during the year 2000. Results are with MCL Lakhanpur area, IB valley CF.

4.3 GEOLOGY AND STRUCTURE OF BLOCK AREA

4.3.1 GENERAL GEOLOGY

The Belpahar I, II & III combined block is located between the latitude 21°42'12" – 21°47'20" N and longitude 83°48'06" – 83°52'41" E in southern part of the Ib Valley coalfield, in the district of Jharsuguda, Odisha. The block falls under Survey of India toposheet nos. 64D/13 & 64D/14 on R.F. 1:50000 and Survey of India special toposheet nos. C-4, C-5, B-4, B-5 and C-4 on R.F. 1:10000.

Geological succession of Belpahar I, II & III combined block is as follows:

Table 4.4
Stratigraphic Succession,
Belpahar I, II & III combined Block, Ib Valley Coalfield

Age	Formation	Lithology
Recent / Sub-Recent		Soil, alluvium, Lateritic soil and sub soil.
Lower Permian	Barakar	Fine to coarse grained sandstone, micaceous at places, carbonaceous shale, grey shale, fire clay, sandy shale, shaly sandstone, alternate shale and sandstone and thick coal seams.
	(300 – 350 Mt)	
Lower Permian	Karharbari	Coarse grained to pebbly and gritty sandstone, carbonaceous sandstone with undecomposed feldspar pieces with thin good quality coal seams.
	(3 – 35 Mt)	
Upper Carboniferous	Talchir	Fine to medium grained greenish sandstone and green shale. (+ 62m)
----------	----------Unconformity----------	----------
Pre-Cambrian	Archean	Granite, mica schist & gneisses

4.3.2 GEOLOGICAL STRUCTURE

Sub-surface boreholes data as well as floor contour and cross section across the block reveal that the block is bounded by major dip faults along the northern and southern boundaries as evidenced also by abrupt termination of coal seam incrops. Boundary faults in the north and south are associated with closely spaced sympathetic faults all heading towards north. Apart from the bounding faults, there are two more minor dip faults which affect the disposition of the top Lajkura seam. In total, Belpahar I, II & III combined block is traversed by 7 nos. of faults, generally E-W to NW-SE trending with mostly northerly and few southerly hade. Thus, in general, the block exhibits a simple structural disposition.

4.3.3 DIP AND STRIKE

The beds strike in a NE-SW direction in the northern part, assume an N-S trend in the central part and SSE-NNW in the southern part. The overall configuration is thus a broad antiform.

The strata dip towards NW in the northern part, towards west in the central part and towards WSW in the southern part at angles of 4 to 6° or at a gradient of 1 in 15 to 1 in 10.

4.3.4 FAULTS

The faults in Belpahar I, II & III block have been deciphered on the basis of direct evidence in the boreholes and discrepancies in the floor levels of seams between a set of boreholes. The trend, magnitude and evidences for the individual faults in the block are given in Table 4.5 below:

सहायक अभियंता (खनन)
भू. स. पी. पी. लि., ले. ब -2

General Manager

Table 4.5
Description of Faults,
Belpahar I, II & III combined Block, Ib Valley Coalfield

Sl. No.	Fault No.	Extent of Fault (m)	Location in the block	Trend	Throw		Evidence of Fault
					Direction	Amount (m)	
1	F1-F1	4200 (4.20 km)	North	E-W	North	50-70	1) Abrupt termination of outcrop of Lajkura, Rampur [illegible] seams. 2) Seams Rampur Top [illegible] MB [illegible] found in BH No. CMBM-018, Lajkura Local seams [illegible] in BH No. CIL-003, Lajkura Roof [illegible] above Lajkura [illegible] in BH No. CIL-[illegible] seam [illegible] in BH No. CMC-007, [illegible] Parting between Bottom and Lajkura [illegible] in BH No. [illegible] 307. 3) Differences of floor reduced levels of the seam between CMB-146, 108, 318, CIL-005 [illegible] falling on the down throw side and CMB-211, 158, 145, 201, 087 etc. falling on the up throw side.
2	F2-F2	3000 (3 km)	North	NW-SE	South-westerly	15-20	1) Parting between Rampur Seam IA [illegible] & Top not found in BH No. CMBR-[illegible] 2) Differences of floor reduced levels of the seams in [illegible] CMB-[illegible], CMB-021 on the down thrown side and CMB-195, 203, [illegible] on the upthrown side.
3	F3-F3	1800 (1.80 km)	South-east	WSW-ENE	Southerly	0-20	1. Difference of floor reduced levels of the [illegible] CMB-123, 142, 150, 147 on the down thrown side and CMB-121, 151 on the upthrown side.
4	F4-F4	2000 (2.00 km)	South-east	NW-SE	North-East	10-20	1) Difference of floor reduced levels of the seams in BHs CMB-307, 148, 130, 136, 139 [illegible] side and CMB-245, 244, 137 and 134 on the upthrown side.
5	F5-F5	4200 (4.20 km)	South	E-W with swing towards South at both ends	North	10-30	1) Abrupt termination and [illegible] of the [illegible] Lajkura, Rampur & [illegible] seams against the fault. 2) Difference of floor reduced levels of the seams in BHs CMB-091, BR-040, CMB-[illegible], [illegible] BR-[illegible], CMB-211, 243, BR-[illegible] on the down thrown side and CMB-273, 280, 272, [illegible] on the upthrown side. 3) Lajkura and Local seams [illegible] for [illegible] Chasing.

Sl. No	Fault No.	Extent of Fault (m)	Location in the block	Trend	Throw		Evidence of Fault
					Direction	Amount (m)	
5	F6-F5	1680 (1.63 km)	South	WN-SE	North-East	25-50	1) Difference of floor reduced levels of the seams in BHs DMB-220, 212, 241 in the down thrown side and DMB-073, 221 in the upthrown side.
7	F7-F7	3680 (3.60 km)	South	S-W with a swing towards SE	North	120-150	1) Absence of Lajkura seam in DMB-270, 304, 222, 223 on the upthrown side of fault. 2) Termination and subsequent strike of the traces of Lajkura seam against the fault.
8	F8-F8	1000 (4.30 km)	Fault Outside the block boundary	WNW-ESE	North-East	30	1) Pairing between Parbatpur Bottom and Lajkura Bottom Lajkura seam not available in the DMB-008.

4.3.5 COAL BEARING FORMATIONS AND THEIR GENERAL BEHAVIOR

Barakar and Karharbari are the two potential coal bearing formations in Ib Valley coalfield with Barakar being the store house of majority of coal seams. The coalfield occupies an area of 1460 Sq. km and with potential coal bearing area (excluding Kamthis, non coal bearing Lower Karharbari Formation) of about 200 sq km stretching along the south, east and northern periphery of the coalfield.

The coal seams have been explored in detail along the southern part of the coalfield as well as the eastern part and northern periphery trough basin. Thus occurrence of coal seams in these parts of the coalfield is well established. However there is a gap in detail exploration between south and east central part of the coalfield.

4.4 DESCRIPTION OF COAL SEAMS

4.4.1 GENERAL

The carbonaceous horizons occurring within Barakar and Karharbari Formations have been designated as coal seams (horizons) depending upon their

thicknesses, stratigraphic positions, quality and consistency in occurrence over considerable part of the coalfield. In Ib Valley coalfield, Karharbari Formation contains only one coal seam i.e. IB whereas, in Barakar Formation, there are 3 nos. of regionally correlatable consistent coal seams (Rampur, Lajkura and Parkhani). The Belpahar I, II & III Combined block contains regionally correlatable consistent coal seams as described above with numerous splits.

The coal and carbonaceous horizons have been differentiated from each other on the basis of moisture and ash contents as applicable in high moisture non-coking coal. Ash + moisture values considered for different categories of coal and other litho types are as follows:

Coal	–	Ash%+Moisture% upto 40%
Shaly coal	–	Ash%+Moisture% >40 upto 55%
Carbonaceous shale	–	Ash%+Moisture% >55 upto 75%
Greyshale, sandy shale and sandstone	–	Ash%+Moisture% exceeding 75%

4.4.2 SEQUENCE OF COAL SEAMS (REF PLATE G-XXX & G- XXXI)

In Belpahar I, II & III Combined block, the Karharbari Formation contains IB seam in 2 splits and Barakar Formations contain seams Rampur, Lajkura and Parkhani also in splits. Altogether, 9 nos. of seams / split seams are reported in Barakar Formation. Among these, seam LAJKURA, RAMPUR TOP I, RAMPUR TOP II, RAMPUR BOT I, RAMPUR BOT II and B BOTTOM are the most potential coal horizons in this block. As such, only 11 consistent splits of Parkhani, Lajkura, Rampur and Ib are dealt in details in this report (Figure 5). All of these seam occur within the block.

Belpahar I, II & III Combined block is covered by soil of thickness varies generally from 2 metres to 10 metres. It consists of sandy soil, clay and laterite soil.

The weathered mantle ranges upto 10 metres and consists of laterite, sandstone, sandy shale, intercalation of shale and sandstone, carbonaceous shale etc.

The sequence of coal seams and intervening partings found to occur within the block, as per borehole data, is given in Table 4.5 below.

Table 4.5
Succession of Coal Seams,
Belpahar I, II & III Combined Block, Ib Valley Coalfield

Seam / Parting between seams	ROOF DEPTH		FLOOR DEPTH		THICKNESS		RL		FL		GENERAL THICKNESS		Nos. of Bh
	MIN (M)	MAX (M)	MIN (M)	MAX (M)	MIN (M)	MAX (M)	MIN (M)	MAX (M)	MIN (M)	MAX (M)	MIN (M)	MAX (M)	
SO L	0.30	0.00	0.00	0.00	0.00	25.20					2.4	19	22
	CMBD-001	CMBD-200	CMBD-241	CMBD-219	CMBD-231	CMBD-210							
WM	0.30	20.00	0.00	97.00	0.20	30.80					1.0	13	321
	CMBD-001	CMBD-212	CMBD-030	CMBD-207	CMBD-003	BBR-304							
P1[a]	4.80	36.40	11.84	95.00	0.34	83.60					2.7	52	27
	CMBD-214	CMBD-215	CMBD-212	CMBD-209	CMBD-210	CMBD-264							
P1[b]/M1/M2 TOP	11.84	86.60	12.19	96.20	0.35	2.37	104.07	228.23	122.72	206.46	0.5	1.9	27
	CMBD-212	CMBD-263	CMBD-212	CMBD-209	BBR-040	CMBD-201	CMBD-307	CMBD-351	CMBD-287	CMBD-351			
P1[c]	11.30	96.33	17.24	107.37	3.18	29.46					4.9	18	32
	CMBD-208	CMBD-264	CMBD-211	CMBD-259	CMBD-190	BBR-031							
P1[c] Alt BOTTOM	11.00	127.37	11.30	97.75	0.30	3.00	104.69	218.02	122.17	210.02	0.5	1.9	38
	CMBD-112	CMBD-209	CMBD-116	CMBD-280	CMBD-208	CMBD-204	CMBD-287	CMBD-175	CMBD-237	CMBD-106			
P2	11.10	137.75	82.30	196.34	16.14	134.57					82.7	101	37
	CMBD-112	CMBD-280	CMBD-176	CMBD-198	CMBD-174	CMBD-205							
LA-BASIN	10.10	196.34	27.30	231.91	16.22	28.92	27.87	230.43	6.85	187.80	25.2	92.7	120
	CMBD-103	CMBD-202	BBR-031	CMBD-208	CMBD-113	CMBD-148	CMBD-216	CMBD-212	CMBD-218	CMBD-230			

General Manager

Seam / Parting between seams	ROOF DEPTH		FLOOR DEPTH		THICKNESS		ARL		FRL		GENERAL THICKNESS		Nos of bld
	MIN (M)	MAX (M)	MIN (M)	MAX (M)	MIN (M)	MAX (M)	MIN (M)	MAX (M)	MIN (M)	MAX (M)	MIN (M)	MAX (M)	
P3	0.70	209.06	20.81	214.63	1.08	25.95					0.4	1.1	11
	CMD-012	CMD-217	CMD-208	CMD-217	CM B-346	CMD-086							
LOCAL	0.80	218.08	19.15	229.07	0.15	8.54	15.31	211.84	4.54	213.14	0.5	2.7	100
	CMD-179	CMD-217	CM B-148	CMD-217	CMD-271	CMD-253	CMD-217	CMD-195	CMD-217	CMD-179			
P7	16.18	220.67	32.20	233.98	41.55	70.94					41.9	58	19
	CM B-019	CMD-217	CMD-211	CMD-217	CMD-208	CMD-208							
RAM-UP (O+I)	16.21	265.03	30.16	226.57	0.09	6.47	0.08	216.36	27.18	218.10	0.7	2.5	127
	CMD-350	CMD-217	CMD-204	CMD-217	CMD-177	CMD-108	CM B-217	CM B-209	CMD-217	CM D-060			
P6	0.40	265.57	9.20	272.61	0.19	11.46					1.6	8	124
	CMD-219	CMD-217	CMD-219	CMD-217	CM B-200	CMD-104							
RAMPUR (O+I)	0.10	217.79	11.67	219.03	0.10	5.91	42.74	216.10	45.41	212.09	0.5	4.1	126
	CMD-052	CMD-217	CM B-060	CMD-217	CMD-021	CMD-059	CMD-217	CMD-079	CMD-217	CMD-072			
P5	16.38	272.90	16.28	283.36	1.26	27.19					4.2	17	134
	CM B-126	CMD-211	CMD-200	CM B-217	CMD-212	CMD-200							
RAMPUR MIDDLE	17.16	265.03	15.87	190.40	0.09	7.47	43.01	208.46	34.01	208.79	0.3	3.3	127
	CMD-200	CMD-217	CMD-005	CMD-211	CM B-047	CM B-058	CMD-217	CM B-046	CMD-217	CM D-060			
P4	1.90	209.18	11.73	189.85	0.72	25.18					1.9	10	140
	CMD-001	CM B-217	CMD-032	CMD-217	CM B-013	CM B-217							
RAMPUR BOTTOM I	1.81	208.88	12.48	210.03	0.08	7.97	75.40	205.13	80.53	20.598	1.0	5.2	146
	CMD-033	CM B-217	CMD-085	CMD-217	CM B-291	CMD-086	CMD-217	CMD-054	CMD-217	CMD-004			
P2	3.66	210.80	5.42	220.44	0.22	21.37					7.1	30	146
	CM B-284	CMD-217	CMD-284	CMD-217	CMD-281	CMD-119							
	4.70	220.43	12.81	227.12	0.10	10.62	66.05	208.71	68.34	198.19	2.6	7.6	

Adj No: 102/17

Mining Plan for Hadibhe Extension Block for Lakhanpur-Belpahar Area of MCL (M/s. Expletech 2018

खंड. मुख. यो. अधि., कोयले, कं. स.-I

Seam / Parting between seams	ROOF DEPTH		FLOOR DEPTH		THICKNESS		RRL		RSL		GENERAL THICKNESS		Nos. of Bh
	MIN (M)	MAX (M)	MIN (M)	MAX (M)	MIN (M)	MAX (M)	MIN (M)	MAX (M)	MIN (M)	MAX (M)	MIN (M)	MAX (M)	
RAMPUR BOTTOM(I)	CMB-094	CMB-317	CMB-054	CMB-217	MR-040	CMB-038	CMB-277	CMB-376	CMB-277	CMB-377			
P2	B-90	293.05	15.30	308.90	0.10	40.80					12.4	27	182
	CMB-085	BR-031	CMB-068	BR-031	CMB-104	BR-039							
IN TOP	5.40	306.90	7.50	319.50	3.00	4.00	-99.45	304.10	-97.75	307.15	0.3	3.1	182
	CMB-361	BR-031	CMB-041	BR-031	CMB-104	CMB-823	BR-031	CMB-136	BR-031	CMB-119			
P1	7.00	289.70	8.62	330.46	0.10	36.45					2.1	10	186
	CMB-041	BR-031	CMB-361	BR-031	CMB-082	CMB-719							
B1 BOTTOM	8.90	303.65	13.07	337.75	0.05	7.80	115.05	264.10	115.05	269.61	1.0	9.0	138
	CMB-031	BR-031	CMB-851	BR-031	CMB-112	CMB-360	BR-031	CMB-139	BR-031	CMB-123			

4.4.5 DESCRIPTION OF INDIVIDUAL COAL SEAMS

SEAM NAME:PARKHANI TOP(PLATE NO. G-III AND GXIV, G-XXV)

Full seam intersection of seam PARKHANI TOP has been occurred in 27 boreholes. The maximum thickness of the seam PARKHANI TOP is 2.37 metres and its maximum depth of occurrence is 98.06 metres. The seam is devoid of dirt band of more than 1 metre thickness. The proximate analysis on 60% RH and 40°C of seam PARKHANI TOP on five sample shows moisture% and ash% as 7.1% and 38.1% respectively. The UHV value is 2662 kcal/kg. The grade is F. The available Mhc and unit calorific value indicate that the seam may fall in B1 group of long flame coals, subject to confirmation by generating more data.

SEAM NAME: PARKHANI BOTTOM (PLATE NO. G-IV & G-XV)

Full seam intersection of seam PARKHANI BOTTOM has been occurred in 38 boreholes. The maximum thickness of the seam PARKHANI BOTTOM is 3.02 metres and its maximum depth of occurrence is 107.37 metres. The seam is less interbanded and contains no inseam dirt band or above 1 metre in thickness. The proximate analysis on 60% RH and 40°C of the full seam PARKHANI BOTTOM on ten sample shows moisture% and ash% as 7.2% to 7.9% and 32.6% to 37.6 respectively. The UHV varies from 2718 kcal/kg to 3311 kcal/kg. The grade is F and the general grade of the seam is also F. The available Mvo, unit volatile matter and unit calorific value indicate that the part of the seam may fall in Bc group of long flame coals, subject to confirmation by generating more data.

The parting between seams PARKHANI BOTTOM and PARKHANI TOP varies from 3.16 metres to 25.59 metres. The parting thickness increases towards north-western and south-western parts of the block. The general parting thickness varies between 4 metres & 16 metres.

SEAM NAME: LAJKURA (PLATE NO. G-V , G-XVI, G-XXVI)

Full seam intersection of seam LAJKURA has been occurred in 120 boreholes. The maximum full seam thickness of seam LAJKURA is 38.62 metres and its maximum depth of occurrence is 138.34 metres. The seam is interbanded and contains inseam dirt bands of above 1 metre in thickness. The proximate analysis on 60% RH and 40°C of the full seam LAJKURA on ten sample shows moisture%, ash% and volatile matter% as 5.0% to 8.1%, 31.1% to 48.3% and 22.5% to 29.9%. The UHV varies from 1041 kcal/kg to 3490 kcal/kg. The grade varies from G to E and the general grade of the seam is G to F. The available Mvo, unit volatile matter and unit calorific value indicate that the seam may fall in Bc group of long flame coals, subject to confirmation by generating more data. The parting between seams LAJKURA and PARKHANI BOTTOM varies from 78.14 metre to 106.57 metres. The general parting thickness is 93.7 metre to 101 metres in the block.

SEAM NAME : LOCAL (PLATE NO. G-VI,G-XVII,G-XXVII)

Seam LOCAL has been encountered as full seam in 100 boreholes. The maximum thickness of seam LOCAL is 5.54 metres and its maximum depth of occurrence is 218.08 metres. The seam is less interbanded and contains 1 metre and above inseam dirt bands. The proximate analysis on 60% RH and 40°C of seam LOCAL on f.o. sample shows moisture% and ash% as 6.0% to 8.1% and 27.0% to 42.5%. The UHV varies from 2207 kcal/kg to 4056 kcal/kg. The grade varies from G to E and the general grade of the seam is F to E. The available Mois, unit volatile matter and unit calorific value indicate that the seam may fall in Bs group of long flame coals, subject to confirmation by generating more data. The parting between seams LOCAL and LAJKURA varies from 1.05 metre to 20.09 metres. The general parting thickness is between 6.4 metre to 17 metres.

SEAM NAME : RAMPUR TOP I (PLATE NO. G-VII,G-XVIII & G-XXVII)

Full seam intersection of seam RAMPUR TOP I has been occurred in 123 boreholes. The maximum full seam thickness of seam RAMPUR TOP I is 5.67 metres and its maximum depth of occurrence is 255.08 metres. The seam is devoid of inseam band of more than 1 metre in thickness . The proximate analysis on 60% RH and 40°C of seam RAMPUR TOP I on f.o. sample shows moisture%, ash% and volatile matter% as 5.3% to 9.0%, 19.8% to 57.0% and 17.5% to 27.5% respectively. The UHV varies from 192 kcal/kg to 4912 kcal/kg. The grade varies from UNGR to D. The general grade is G to E. The available Mois, unit volatile matter and unit calorific value indicate that the part of the seam may fall in Bs group of long flame coals, subject to confirmation by generating more data. The parting between seams RAMPUR TOP I and LOCAL varies from 41.56 metre to 78.54 metres. The parting thickness increases southerly. The general parting thickness varies between 48 metres to 58 metres.

SEAM NAME : RAMPUR TOP II (PLATE NO. G-VIII & G-XIX)

Full seam intersection of seam RAMPUR TOP II has been occurred in 100 boreholes. The maximum thickness of seam RAMPUR TOP II is 5.81 metres and its maximum depth of occurrence is 272.13 metres. The inseam dirt bands of 1 metre and

above have been developed in patches towards the northern parts of the block. The proximate analysis on 60% RH and 40°C of the seam on bore sample shows moisture%, ash% and volatile matter% as 4.7% to 5.0%, 27.8% to 53.7% and 20.5% to 23.8%. The UHV varies from 841 kcal/kg to 3990 kcal/kg. The grade varies from UNGR to E. The general grade is G to F. The available Mea. unit volatile matter and unit calorific value indicate that the seam may fall in B group of long flame coals, subject to confirmation by generating more data. The parting between seams RAMPUR TOP II and RAMPUR TOP I varies from 0.45 metres to 11.90 metres. The parting thickness increases in patches towards southern parts of the block. The general parting thickness varies between 1.5 metres to 6 metres.

SEAM NAME : RAMPUR MIDDLE (PLATE NO. G-IX & G-XXI)

Full seam intersection of seam RAMPUR MIDDLE has been occurred in 137 boreholes. The maximum thickness of seam RAMPUR MIDDLE is 7.57 metres and its maximum depth of occurrence is 282.00 metres. The seam is interbanded and contains both combustible and non combustible dirt bands of more than 1 metre thickness. The proximate analysis on 60% RH and 40°C of the seam on bore sample shows moisture%, ash% and volatile matter% as 3.7% to 6.6%, 34.8% to 53.7% and 22.9%. The UHV varies from 151 kcal/kg to 3187 kcal/kg. The grade varies from UNGR to F. The general grade is G to F. The available Mea. unit volatile matter and unit calorific value indicate that the seam may fall in B group of long flame coals, subject to confirmation by generating more data. The parting between seams RAMPUR MIDDLE and RAMPUR TOP II varies from 1.28 metres to 27.75 metres. The parting thickness increases in isolated patches towards southern and western parts of the block. The general parting thickness varies between 4 metres to 17 metres.

SEAM NAME : RAMPUR BOTTOM I (PLATE NO. G-X & G-XXII)

Full seam intersection of seam RAMPUR BOTTOM I has been occurred in 141 boreholes. The maximum thickness of seam RAMPUR BOTTOM I is 7.97 metres and its maximum depth of occurrence is 308.88 metres. The seam is interbanded and having dirt band of 1 metre and above in thickness. The proximate analysis on

RH and 40°C of the full seam RAMPUR BOTTOM I on five samples shows moisture%, ash% and volatile matter% as 4.4% to 7.8%, 28.0% to 53.2% and 19.5% to 23.0%. The UHV varies from 951 kcal/kg to 4263 kcal/kg. The grade varies from UNGR to D. The general grade of the seam is G to F. The available Max. unit volatile matter and unit calorific value indicate that the seam may fall in B$_1$ group of long flame coals, subject to confirmation by generating more data. The parting between seams RAMPUR BOTTOM I and RAMPUR MIDDLE varies from 0.72 metres to 25.48 metres. The parting thickness increases in isolated patches in southern, central, western and northern parts of the block. The general parting thickness varies between 1.9 metres and 10 metres.

SEAM NAME : RAMPUR BOTTOM II (PLATE NO. G-XI & G-XXI)

Full seam intersection of seam RAMPUR BOTTOM II has been occurred in 151 boreholes. The maximum full seam thickness of seam RAMPUR BOTTOM II is 10.62 metres and its maximum depth of occurrence is 329.44 metres. The seam is highly interbanded and contains both combustible and non-combustible dirt bands of less than 1 metre as well as more than 1 metre in thickness. The proximate analysis on 60% RH and 40°C of seam RAMPUR BOTTOM II on five samples shows moisture%, ash% and volatile matter% as 4.2% to 8.0%, 22.7% to 53.4% and 20.9% to 25.5%. The UHV varies from 924 kcal/kg to 4653 kcal/kg. The grade varies from UNGR to D. The general grade is G to E. The available Max. unit volatile matter and unit calorific value indicate that the seam may fall in B$_2$ group of long flame coals, subject to confirmation by generating more data. The parting between seams RAMPUR BOTTOM II and RAMPUR BOTTOM I varies from 0.23 metre to 21.37 metres. The parting thickness increases towards southern, western and north-western parts of the block. The general parting thickness varies between 1.1 metre and 10 metres. The parting thickness reduces to less than 1 metre towards southern most parts of the block.

SEAM NAME : III TOP(PLATE NO. G-XII & G-XXII)

Full seam intersection of seam IB TOP has been assumed in 152 boreholes. The maximum full seam thickness of seam IB TOP is 8.06 metres and its maximum depth of occurrence is 308.40 metres. The seam contains inseam dirt bands of more than 1 metre in thickness in 3 boreholes. The proximate analysis on 60% RH and 40°C of the seam IB TOP on 152 samples shows moisture%, ash% and volatile matter% as 4.4% to 7.8%, 19.5% to 50.4% and 25.0%. The UHV varies from 1338 kcal/kg to 5133 kcal/kg. The grade varies from G to C. The general grade is F to C. The available Max. unit volatile matter and unit calorific value indicate that the seam may fall in B5 groups of long flame coals, subject to confirmation by generating more data. The parting between seams IB TOP and RAMPUR BOTTOM II varies from 3.12 metre to 45.05 metres. The parting thickness increases towards south eastern, south-western and in two isolated patches in the northern parts of the block. The general parting thickness varies between 12.4 metre and 27 metres.

SEAM NAME : IB BOTTOM (PLATE NO. G-XIII, G-XXIV, G-XXIX)

Full seam intersection of seam IB BOTTOM has been assumed in 136 boreholes. The maximum full seam thickness of seam IB BOTTOM is 9.60 metres and its maximum depth of occurrence is 333.55 metres. The seam is devoid of dirt bands of more than 1 metre in thickness. The proximate analysis on 60% RH and 40°C of the seam IB BOTTOM on 136 samples shows moisture%, ash% and volatile matter% as 5.1% to 6.2%, 15.4% to 44.2% and 21.3% to 24.0%. The UHV varies from 3010 kcal/kg to 5695 kcal/kg. The grade varies from G to B. The general grade is E to C. The available Max. unit volatile matter and unit calorific value indicate that the part of the seam may fall in B5 groups of long flame coals, subject to confirmation by generating more data. The parting between seams IB BOTTOM and IB TOP varies from 0.15 metre to 38.25 metres. The parting thickness increases in isolated patches towards the southern and northern parts of the block. The general parting thickness varies between 2.1 metres and 10 metres. The parting thickness decreases to less than 1.0 m in the north central parts of the block.

Regional Manager
WCL, Lakhanpur

4.4.4 GENERAL OBSERVATION ON COAL SEAMS

From the meager analytical results available, it can be seen that the coal seams of Belpahar I, II & III Combined block, particularly Ib and Ramgur seams, exhibit low moisture 2.5% to 5%, unit VM 25% to 30%, unit carbon 60% to 65%, unit hydrogen 4% to 5%, unit sulphur 0.4% to 0.5% and unit CV 7700 kcal/kg to 8100 kcal/kg. Such analyses definitely encourage for further examining of these coal for its potential as semi-coking coals. However, high ash percentage, which is invariably over 25%, restrict its categorization as saleable unit as semi-coking coal. Yet quality of coal seams of Belpahar I, II & III Combined block needs to be evaluated further at least for CI, CT, SI, Reflectance, Reactivity, etc. for ascertaining them as high ash semi-coking insitu coal. Suitable washability characteristics also need to be carried out for assessing its economical viability as semi-coking coal, if established after desired analyses.

4.4.5 HYDRO-GEOLOGICAL DETAILS FOR BLOCK AREA

Available sub-surface hydro-geological data is meager to give precise information about sub surface hydro-geological regime. However, a brief description of the hydro-geological investigation carried out by the hydro-geology dept., CMPDI, Ranchi in and around air shaft of Orient colliery is given below:-

The study reveals that the sandstone strata overlying Lajkura horizon in the vicinity of the air shaft in Orient colliery is a potential aquifer and its hydraulic conductivity varies widely due to change in lithic units of the strata.

The sandstone strata constituting the intervening partings of the coal seams of IB Valley coalfield are more or less similar to the sandstone occurring above Lajkura horizon in Orient group of mines. This indicates that the intervening partings of the coal seams constituting sandstone may also be potential aquifer.

4.5 RESERVES

4.5.1 GENERAL

Belpahar I, II and III combined block covers an area of 42.51 sq. km. where three and one regionally correlatable potential coal seams are established in Barakar and Karharbari Formations respectively. While 9 no. of splits in three major seams in Barakar Formation are correlated, the IB seam in Karharbari Formation occurs in 2 correlatable splits.

Altogether 11 nos. of coal seams splits have been dealt in detail in the present report. All these 11 coal seams splits have been dealt qualitatively and quantitatively considering opencast mineability in view.

4.5.2 METHODOLOGY

Effective Reduced grids of 11 nos. of seams (Parkhani Top to IB Bottom) are prepared through Grid Compute menu operations of MINEX 6.0.5 software. Likewise, UHV grids are prepared for 11 nos. of seams for different categories of grade (A to Ungraded) through same operations. For different grades of coal, different inputs of sp. gr. are fed to database of MINEX. Limit of thickness of seam 1.0 meter and above, limit of polygon of block boundary and limit of UHV values for different grades of coal from UNGR to Grade A were fed to database of MINEX through Seam Model/ Detailed Resource Reporting operations menu of MINEX 6.0.5 software. Then by operating above menu of MINEX, grade-wise, seam wise, coal area, coal volume, Gross Useful resources, total volume of waste are determined on *.CSV format (Annexure-VIII A & VIIIB) by using 11 seams ET and UHV grids generated by MINEX. Thus, gross proved and indicated reserves of representative coal seams occurring within the polygon of block boundary have been obtained through MINEX 6.0.5 software.

Similarly, depth grids for 11 seams are generated through grid arithmetic menu of MINEX by deducing flattened floor grids of respective Coal seams from TOPS grid (surface contour grid). Then by operating Detailed Resource Reporting operations menu of MINEX 6.0.5 software Depth-wise, Seam-wise and Grade-wise Gross useful

Coal resources occurring within the block boundary have been estimated (Annexure-VIIIA & VIIIB) from MINEX generated depth, UHV and ET grids of respective seams.

A deduction of 10% has been made to obtain the Net reserves of the seam. This deduction of 10% is made to account for unforeseen geological disturbances / features within the block. However, no deduction has been made for obtaining Gross Indicated Reserves.

4.5.3 BARRIER

No barrier has been taken into consideration while estimating the reserves and overburden/ parting.

4.5.4 NET PROVED GEOLOGICAL RESERVE

Total quantity Net Proved reserves of 1484.833 million tonnes and Indicated reserves of 235.433 million tonnes have been estimated upto seam IB BOTTOM. The volumes of less than 1.0 metre coal seams, ungraded coal and in-seam dirt bands of more than 1 metre in thickness of those seams from PARKHANI TOP to IB BOTTOM have been deducted from MINEX and added to the volumes of respective overburden / parting above to arrive at total waste.

The seam-wise category wise Total Geological coal reserves are provided in Table-4.7:

Table 4.7: Seam-wise Category-wise Total Geological Reserves, Belpahar I, II and III combined Block, Ib Valley Coalfield

Seam	Net Proved Reserves (Mt.)	Gross Indicated Reserves (Mt.)	Total Reserves (Mt.)
PARKHANI TOP	0.312	0.000	0.312
PARKHANI BOTTOM	2.816	0.000	2.816
LAJKURA	717.914	132.903	850.817
LOCAL	38.470	10.974	49.444

Seam	Net Proved Reserves (Mt.)	Gross Indicated Reserves (Mt.)	Total Reserves (Mt.)
RAMPUR TOP I	55.045	8.381	63.426
RAMPUR TOP II	73.494	9.030	82.524
RAMPUR MIDDLE	49.638	2.888	52.526
RAMPUR BOTTOM I	128.448	12.766	141.214
RAMPUR BOTTOM II	183.224	13.911	205.135
IB TOP	78.187	11.266	89.453
IB BOTTOM	146.426	25.274	171.699
ALL SEAMS	1484.833	235.423	1720.256

The seam-wise grade-wise Net Proved Geological reserves are provided in Table–4.8.

Table–4.8: Seam-wise Grade-wise Net Proved Geological Reserves, Belpahar I, II and III combined Block, Ib Valley Coalfield

SEAM	Seam-wise, Grade-wise Net Proved Reserves								
	Grade-wise Net Proved Reserves in million tonnes							Net Proved Reserves (Mt.)	SEAM WISE PERCENTAGE
	A	B	C	D	E	F	G		
PARAHANI TOP	-	-	-	-	-	0.077	0.235	0.312	0.02%
PARAHANI BOTTOM	-	-	-	-	-	2.490	0.227	2.816	0.19%
LAJKURA	-	-	-	-	2.524	411.749	303.571	717.814	48.35%
LOCAL	-	-	-	3.268	19.561	15.040	0.585	38.470	2.60%
RAMPUR TOP I	-	-	-	0.455	12.867	37.448	4.273	55.045	3.71%
RAMPUR TOP II	-	-	-	-	2.606	38.170	38.552	79.494	5.36%
RAMPUR MIDDLE	-	-	-	0.013	0.363	0.264	36.383	46.528	3.13%

Ref. No. MCL/CGM(P)/2019/

General Manager

Seam-wise, Grade-wise Net Proved Reserves									
SEAM	Grade-wise Net Proved Reserves in million tonnes							Net Proved Reserves (Mt.)	SEAM-WISE PERCENTAGE
	A	B	C	D	E	F	G		
RAMPUR BOTTOM I	-	-	-	0.805	0.112	27.840	101.693	129.448	8.72%
RAMPUR BOTTOM II	-	-	-	2.498	23.698	137.404	26.564	189.224	12.74%
IB TOP	-	-	0.440	26.344	33.531	15.988	2.554	78.157	5.26%
IB BOTTOM	-	0.369	43.520	77.270	23.240	1.505	1.102	146.426	9.86%
ALL SEAMS	-	0.369	44.372	106.037	115.788	700.208	516.161	1484.833	100%
GRADE-WISE PERCENTAGE	-	0.02%	2.98%	7.35%	7.79%	47.18%	34.70%	100%	

The seam wise and depth-wise Net Proved Geological reserves are provided in Table–4.9.

Table–4.8: Seam-wise and Depth-wise Net Proved Geological Reserves, Belpahar I, II and III combined Block, Ib Valley Coalfield

Seam-wise, Depth-wise Net Proved Reserves						
SEAM	Depth-wise Net Proved Reserves in million tonnes				Net Proved Reserves (mt.)	SEAM-WISE PERCENTAGE
	UPTO 100M	101 - 200M	201 - 300M	301 - 400M		
PARKHANI TOP	8.312	-	-	-	8.312	0.56%
PARKHANI BOTTOM	2.818	-	-	-	2.818	0.19%
LAJKURA	327.494	379.484	30.836	-	737.814	48.35%
LOCAL	9.969	25.019	3.663	-	38.470	2.60%
RAMPUR TOP I	19.997	27.651	7.407	-	55.045	3.71%
RAMPUR TOP II	36.849	34.176	8.669	-	79.494	5.26%
RAMPUR MIDDLE	17.434	25.003	4.091	-	46.528	3.13%
RAMPUR BOTTOM I	80.838	84.781	22.826	0.807	129.448	8.72%
RAMPUR BOTTOM II	87.558	59.221	39.372	2.775	189.224	12.74%

केसरिया राय
मुख्य प्रबंधक (पर्यावरण)

Seam-wise, Depth-wise Net Proved Reserves						
SEAM	Depth-wise Net Proved Reserves in million tonnes				Net Proved Reserves (Mt.)	SEAM-WISE PERCENTAGE
	UP TO 100M	101 - 200M	201 - 300M	301 - 400M		
IB TOP	31.276	24.511	24.261	7.809	78.157	5.26%
IB BOTTOM	37.091	53.123	51.163	3.048	144.425	9.69%
ALL SEAMS	591.808	695.799	182.837	14.589	1484.833	100%
DEPTH-WISE PERCENTAGE	39.85%	46.19%	12.97%	0.98%	100%	

The seam-wise, seam Incrop-wise Total Geological reserves are provided in Table-4.10

Table-4.10: Seam-wise, Seam Incrop-wise Total Geological Reserves Belpahar I, II and III combined Block, Ib Valley Coalfield

Seam	Within Incrop Net Proved Reserves (Mt.)	Beyond Incrop Net Proved Reserves (Mt.)	Total Net Proved Reserves (Mt.)	Sinex Indicated Reserve (Mt.)	Total Geological Reserves (Mt.)
PARKHANI TOP	-	0.312	0.312	-	0.312
PARKHANI BOTTOM	0.691	2.815	2.816	-	2.816
LAJKURA	21.109	696.805	717.914	132.503	850.417
LOCAL	0.003	39.467	39.470	18.974	58.444
RAMPUR TOP I	0.004	53.041	53.045	9.381	62.426
RAMPUR TOP II	0.011	79.483	79.494	9.030	88.524
RAMPUR MIDDLE	0.004	46.524	46.528	2.888	49.416
RAMPUR BOTTOM	0.353	128.398	128.448	11.756	141.204
RAMPUR BOTTOM II	0.896	188.418	189.224	13.911	203.135
IB TOP	0.878	78.037	78.157	11.296	89.453
IB BOTTOM	0.895	145.330	146.425	25.274	171.699
ALL SEAMS	22.153	1462.680	1484.833	235.423	1720.256

4.6 WASTE

The total volume of waste (overburden/parting above) has been estimated in 4 categories, viz.

i) Volume of parting and overburden,

ii) Volume of coal seam less than 1 metre thickness,

iii) Volume of Ungraded coal and

iv) Volume of dirt bands of more than 1 meter in thickness within coal seams.

Total volume of waste of **5658.427** million cubic metres has been estimated upto IB BOTTOM. Details of waste is given in table 4.11.

Table 4.11: Detail of Total Waste Upto Seam IB BOTTOM, Belpahar I, II and III combined Block, Ib Valley Coalfield

WASTE ABOVE SEAM	VOLUME OF OB, PARTING & IN SEAM BAND > 1m (MCM)	VOLUME OF COAL SEAM < 1M (MCM)	VOLUME OF UNGRADED COAL (MCM)	TOTAL VOLUME OF WASTE (MCM)
PARKHANI TOP	182.284	2.329	0.398	190.926
PARKHANI BOTTOM	38.772	0.428	1.286	50.454
LAJKURA	1450.215	9.843	0.000	1460.258
LOGAL	257.335	4.270	0.000	261.513
RAMPUR TOP I	1458.951	6.950	1.045	1466.596
RAMPUR TOP II	130.913	6.975	0.996	138.794
RAMPUR MIDDLE	386.527	8.156	0.896	404.579
RAMPUR BOTTOM I	244.677	5.661	1.238	251.796
RAMPUR BOTTOM II	246.919	4.152	3.829	253.890
IB TOP	826.771	9.068	2.029	837.872
IB BOTTOM	211.473	7.739	0.001	219.293

दीपांकर गोष
मुख्य प्रबंधक (उत्खनन)
सी. एम. पी. डी. आई. (इं) लि.-7

General Manager
एम.सी.एल. लाजकुरा क्षेत्र
M/s. Lajkura Area

GRAND TOTAL	5637.854	63.870	6.703	5608.427

4.7 RECOMENDATIONS

Around 235 Mt of coal within the block is in indicated category. To prove this reserve it is estimated that around 30 to 35 number of boreholes involving approximately 12000 m of drilling is required. Necessary provision for the same has been kept in the PR.

Job No T02192
Mining Plan for Moira Colliery (Part) for Likely Increase in Rate of Coal Production from 2.0 Mty to 3.0 Mty

Chapter - 6

MINING METHOD

6.1 GEO-MINING CHARACTERISTICS

6.1.1 STRIKE AND DIP

The strike of the strata is northeast – southwest towards northern part and north-south towards southern part. The dip of strata is about 4-5° (1 in 15 to 1 in 12) towards west of northwest.

6.1.2 GEOLOGICAL DISTURBANCES

Fault F1-F1: This is the boundary fault of the block and working limit of Ib and Rampur seams towards north. Throw varies from 90m towards rise to 20m towards dip. Conveyor transport is proposed on either side of this fault.

Fault F2-F2: A minor fault with throw varying between 10 to 20m. It occurs in northern part of the quarry. It merges into fault F1-F1 towards dip.

Two minor faults named F5-F5 and F6-F6 will be encountered in Lakhanpur South Quarry towards southern boundary. There will not be any loss of coal as the throws are northerly dipping.

The description of all faults deciphered within the block in terms of their nomenclature, location, strike, direction of throw, amount of throw, borehole intersections, evidences, loss of column and intersection depth etc. is provided in Chapter-4 of this report.

वैभविम राव
मुख्य प्रबंधक (खनन)

General Manager
जन्नी एवं खनन क्षेत्र
MCL Lakhanpur Area

6 : 3 DETAILS OF SEQUENCE OF COAL SEAMS AND PARTING

Two distinct seams named IB and Rampur occur in this block. Depending upon thickness and consistency of shale bands within these major seams IB seams has been sub-divided into two sections named Bottom and Top, while Rampur seam has been sub-divided into four sections named Bottom II, Bottom I, Top II and Top-I from lower to upper direction. In IB seam, there are no bands of more than 1 m at places and the seam is proposed to work as combined seam. The parting between IB seam and Rampur seam is thick and comprising of mostly sandstone, while other partings are mostly shale and carbonaceous shale. For mining purpose, thicknesses of more than 1 m are considered. Coal thickness of less than 1 m is considered un-extractable and these volumes are added to waste. Seam sequence and range of thickness are given in the table below.

Table – 6.1(a)
Range of effective thickness of seams and partings

	Thickness Range		General Thickness	
Seam/Parting	Minimum(m)	Maximum(m)	Minimum(m)	Maximum(m)
Soil, WM, Top D.B.	11.84	36.06	8.10	74.2
Parkhani Top	0.06	2.37	0.2	1.3
PARTING	9.16	25.80	4.0	10.2
Parkhani Bottom	0.06	3.63	0.8	1.9
PARTING	76.14	108.37	83.7	101.0
Lajkura	16.24	36.10	25.2	32.7
PARTING	1.68	20.69	6.4	11.2
Local	2.10	8.54	2.1	3.7
PARTING	41.50	79.64	41.2	58.2
Rampur Top-I	3.28	5.67	3.7	2.6
PARTING	3.45	11.60	1.8	3.0
Rampur Top-II	2.10	5.81	3.8	4.1
PARTING	1.38	27.79	4.0	17.3
Rampur C	3.06	7.67	3.8	3.2
PARTING	3.72	25.48	1.9	10.3
Rampur Bottom-I	3.06	7.97	3.0	3.2
PARTING	3.33	24.37	1.1	10.3
Rampur Bottom-II	0.10	10.62	3.0	7.0
PARTING	3.12	46.65	12.4	27.0
IB Top	0.07	8.06	3.8	3.2
PARTING	0.12	36.25	2.1	10.0

Mining Plan for Lakhanpur Expansion Project of M/s MCL

Reference
Dist. Sundargarh (Odisha)
वि. सं. ओ. ओ. ओ. ओ. ओ.
Ref. No. [illegible]

General Manager
जी.एम. (ओ.ए.), लाखनपुर क्षेत्र
MCL, Lakhanpur Area

	Thickness Range		General Thickness	
Seam/Parting	Minimum(m)	Maximum(m)	Minimum(m)	Maximum(m)
IB Bottom	0.03	5.80	1.3	5.6

6.1.4 DETAILS OF INSEAM BANDS

Seams are already separated based on in-seam bands. In case of Lajkura seam, bands of more than 1 m thickness has been identified. No other seam contains any band of more than 1 m thickness. However, bands of less than 1 m thickness have been included in working and quality of seam has been estimated accordingly. Cumulative thickness of all bands for each seam has been given in Chapter-IV.

6.2 BASIC MINE PARAMETERS

Following table shows broad mining parameters of the proposed mine.

Table - 6.2
Mining Parameters

SL	Particulars	Unit	Value
1	Quarry floor area*	ha	3034.31
2	Quarry surface area*	ha	3928.56
3	Mineable reserve as on 01-04-2018	Mt	1262.86
4	Overburden* as on 01-04-2018	Mcum	4336.33
5	Stripping ratio	cum/t	3.43
6	No. of workable seams/ sections	No.	11
7	Annual peak capacity	Mt	40
8	Life from 01-04-2018	Years	41[5]
9	Average seam gradient	Degree	4-6
10	Strike length(along floor)	m	9427
11	Strike length(along surface)	m	10145
12	Quarry depth		
	Maximum	m	354
	Minimum	m	5
13	Quarry perimeter (from beginning)	m	33653
14	Dip-rise length		
	Along floor	m	4276
	Along surface	m	4994

General Manager
जनरल मैनेजर
MCL, Lakhanpur Area

[1] Including excavated floor and surface areas of Belpahar mine
[2] Includes 452.55 Mcum re-handling of OB from internal & external dumps of Lilari & Lakhanpur mines and for extraction of coal below Lilari nala after its diversion
[3] Including 2 years of construction period

MINING METHOD

Belpahar is an operating mine with two coal seams namely Ib and Rampur. Ib seam has two splits and Rampur seam has five splits. Coal seams are cut by Surface Miner by windrowing method. This coal is loaded by Front end loaders on to trucks. There is one departmental surface miner deployed in Ib seam. All coal loading activities and coal transportation is carried out contractually. Top overburden and partings are drilled, blasted and loaded by shovels. OB is transported partly by departmental dumpers of 60 T size. Contractors deploy 16 T trucks for OB transportation. Ib seam is the lowest seam in the total area. This mine will be advanced towards Lakhanpur mine and continue to extract lower seams till the final boundary is reached.

Lakhanpur is also an operating mine where only Lajkura seam is extracted. Coal is cut by one departmental and other contractual surface miners. Total coal loading and transportation is carried out contractually. Departmental excavators and dumpers work in one patch while separate patches are allocated for contractual OB loading and transport. Departmental excavators are shovels with varying sizes from 1.9 cum bucket to 2.5 cum and dumpers of sizes 90 T and 100 T. While Belpahar mine is advanced, it will extract coal below the present Lakhanpur mine. OB already backfilled in the Lakhanpur mine has to be re-handled. In order to avoid further re handling, Lakhanpur mine will be closed by end of 2023-24 in a phased manner and production will be enhanced from the Belpahar extension mine, here named as Central Quarry.

Lilari mine is a small quarry where only Lajkura seam has been extracted on other side of Lilari nala flowing between Lakhanpur and Lilari mines. Its coal reserve of Lajkura

General Manager
MCL, Lakhanpur Area

Machine Name	Model	Size/Specs	Existing
Dragline	10/70	10/70	1
Rope shovel	EKG 8A	5 cum	2
Hydraulic shovel	BE 1300	6.1-6.3 cum	1
Loader	WA 200	3.8 cum	1
Surface Miner	SM 2200/3500	3.5m wide	1
Hydraulic shovel	DEMAG H40	2.8 cum	1
Hydraulic backhoe	Hitachi Ex3-LCH	1.7 cum	1

Lakhanpur:

Machine Name	Model	Size/Specs	Existing
Rope shovel	EKG 8A	5 cum	3
Hydraulic shovel	BE 1500	9.5 cum	1
Hydraulic shovel	Ex 1200 D	6.3 cum	2
Hydraulic shovel	BE 1300	6.1 cum	2
Hydraulic backhoe	BE 1300	4.3 cum	1
Hydraulic backhoe	CK 300 E	2.3 cum	1
Hydraulic backhoe	BE 300 D	1.57 cum	1
Surface Miner	SM 2200/3500	3.5m wide	1
Pay loader	CAT 988 H	7.7 cum	1

Lilari:

Machine Name	Model	Size/Specs	Existing
Hydraulic shovel	L&T CK 300	2.3 cum	1
Hydraulic backhoe	TATA Hitachi	?	Not considered
Pay loader	Liebherr PR751	Old and Not considered	

For additional waste removal it worked only departmentally hydraulic face shovels of 24 cum bucket (around 3800 HP) equivalent to Terex O&K Model RH 3400 or Liechher R 996 Litronics and hydraulic face shovels of 11-12 cum (around 1600 HP) equivalent to TEREX O&K RH90C or PC 2000-8 have been proposed.

General Manager
MCL, Lakhanpur Area

seam is exhausted. The lower Ib and Rampur seams will be extracted in the proposed North Quarry.

The Dragline, deployed in Belpahar mine will be surveyed off after 2019-20. To match with production and advance, much larger dragline will be required. The capital cost and financial parameters will not be comparable with contractual mining. So replacement of dragline is not proposed.

Total coal will be extracted by mechanized open cast mining method. Dumpers are proposed for coal transportation from face to surface (3-4 km) and conveyor system has been proposed for all surface transports (3-4 km).

5.3 CHOICE OF TECHNOLOGY

Being a working mine with SHOVEL-DUMPER as predominant technology, no other technology is proposed. Reclaim feeders will be installed near quarry mouths for receiving coal from surface miner and feeder breakers are proposed for small amount of coal extracted by drilling-blasting method. Surface transport is proposed by conveyors.

5.4 EQUIPMENT SELECTION

As per approved Project Report of the Integrated Project, existing equipment will continue and additional load of both coal & OB will be outsourced. Given below is the list of existing HEMM in the three mines which are proposed to be integrated to a single mine. Contractors usually deploy hydraulic shovels of 3-4 cum bucket in OB, 3-3.5 cum bucket loaders in coal and 15 T trucks in both. As an ideal proposal, the additional HEMMs proposed are of higher capacities to reduce fleet size, manage efficiently and reduce pollution, as has been proposed in Departmental Variant of the Project Report.

List of Existing HEMMs

Belpahar:

General Manager

For departmental variant, surface miners of same specification as existing and loaders of 6.4 cum bucket (around 550 HP) are proposed.

For OB transportation, 80 T dumpers are proposed with excavators with less than 6.5 cum buckets in OB. 100 T dumpers are proposed with excavators having 8.5 cum and 12 cum buckets. 244 T dumpers are proposed with 34 cum excavator. For coal transportation, 35T multi-wheel trucks are proposed with 6.4 cum Front end loaders. 50 T dumpers will be replaced by 80 T dumpers.

Additional drills and dozers are of same specifications as existing and approved in Project Reports. 850 HP dozers are proposed to replace existing 400 HP dozers in OB while 450 HP wheel dozers are proposed to replace existing 300 HP dozers in coal.

6.6 MINING SYSTEM & SYSTEM PARAMETERS

Benches will be aligned along general strike. Bench floor should follow own seam floor/roof or that of adjacent seam. Main bench parameters for shovel benches are given below:

Maximum bench height:	: 15m for 34 cum hydraulic shovel : 12m for 5 cum rope shovel : 13m for 9.5/12 cum hydraulic shovel : 10m for 6.3/8.1/4.3 cum hydraulic shovel and backhoe : 7m for 1.7 to 2.5 cum hydraulic backhoe : 15m for surface miner
Bench width (working):	: 40m for dragline cut : 50m for surface miner : 42m for 34 cum hydraulic shovel : 36m for 5 cum rope shovel : 38m for 9.5/12 cum hydraulic shovel : 34m for 6.3/8.1/4.3 cum hydraulic shovel and others
Working angle	: 70° with horizontal for shovel working benches : 60° with horizontal for surface miner bench

Bench dimensions may vary with different sizes of equipment deployed.

मुख्य प्रबंधक (खनन)
भा. एल. के. टी. आई., खं. स.-7
Ref. No. Jakhanpur-Kotabahal-OCP-MCL-Rev-2019

General Manager

General Manager
MCL-Lakhanpur Area

Chapter – 5

MINE BOUNDARIES, RESERVES & LIFE

5.1 INTRODUCTION

This report has been prepared for mining coal from Geological Blocks named 'Sector-I&II, Belpahar Block' and 'Sector-III, Belpahar Block' in the Lakhanpur Area of Ib-valley coalfield under jurisdiction of Mahanadi Coalfields Limited. All drawings, estimates and calculations are based on 'GEOLOGICAL REPORT ON BELPAHAR I, II & III COMB., IB VALLEY C.F.', completed in October 2011 by CMPDI Ltd (RI-VII). Coal deposit details, coal characteristics and estimates of coal and overburden quantities vertically within block boundary have been given in Chapter-4 of this report.

Within area of mineral, three open cast coal mines are presently under operation namely, Belpahar Opencast Mine, Lakhanpur Opencast Mine and Lilari Opencast Mine. Brief history:

Project	Start year	Capacity	Basis
Belpahar	1954-55	2.0 Mt	Project Report approved by the Government of India in December, 1962
Belpahar	Expansion	3.5 Mt	Project Report approved by MCL in August 2004
Belpahar	Expansion	8.0 Mt	Project Report approved by MCL Board
Lakhanpur	1962-63	5.0 Mt	Project Report approved in January, 1992
Lakhanpur	Expansion	10.0 Mt	Project Report approved in January, 2004
Lakhanpur	Expansion	15.0 Mt	Project Report approved in September, 2008
Lilari	1988-89	0.8 Mt	Project Report approved in September 1987
Lilari	Extension	0.8 Mt	Project Report formulated in March 2002

During preparation of original Geological Reports (1984 & 1986), IB and Rampur seams were conceived to be extracted by open cast mining in Belpahar mine and by underground method in Lakhanpur mine. With increase in coal price, better efficiency and

देवाशिस गरे
मुख्य प्रबंधक (खनन)
सी. एम. पी. डी. आई. - बी. सं.-I

Dy. General Manager
एम.सी.एल., लखनपुर क्षेत्र
MCL, Lakhanpur Area

demand for high coal output, all coal seams are now planned to be extracted by open cast mining method. The best option to extract all coal seams by open cast mine with minimum coal loss is to integrate all three mines into one. This option will also reduce requirement of external OB dumping by utilizing space available in de-coaled area.

5.2 GEOLOGICAL DISPOSITION AND MINING APPROACH

The lowest coal seam – IB, starts occurring sub-surface along eastern boundary of Sectors I & II of Belpahar Block. Strike of the block is mostly north of north-east to south of south-west with dip towards west of north west.

Workings of the three mines were also started from incrop of respective lowest seams. As the coal seams are thinning down towards south, some areas towards south are not workable for Ib and Rampur seams and was not planned earlier. In this report all of Lajkura seam and most of Ib and Rampur seams are covered in the proposed quarries.

For Ib and Rampur seams to be extracted below Lakhanpur and Lajkura mines, internal and external dumps of these mines are to be re-handled. There are other surface constraints explained in the next paragraph. In order to produce 40 Mt annually with partial backfilling in running Lakhanpur mine, total area has been planned with several quarries initially and merged later. As of geological, structural and seam deposit characteristics, there is no constraint in mine development.

5.3 SURFACE CONSTRAINTS AND MINING APPROACH

5.3.1 The rail line of CPGC passing in-between Belpahar and Lakhanpur mines is the physical limit of Belpahar mine, up to which the Belpahar mine was planned. The rail line will soon be dismantled but to mine coal from area lying in-between Belpahar and Lakhanpur quarries, Mining Plan and Environment Clearance is required for re-diversion of land from earlier non-mining purposes to mining purpose. Coal remaining at Belpahar will last another two years. Lakhanpur mine needs to be closed in phased manner to avoid

3/2/20

re-handling of OB as coal lying below Lakhanpur mine is now planned to be extracted by open cast mining. Lilari mine is exhausted.

There are large forest lands in the additional area within Integrated Mining Lease boundary. Environment clearance for total area including Forestry Clearance will take long time and coal production will stop from Belpahar mine.

Thus, it is proposed to apply for E.C. in two Phases. In Phase-I, E.C. will be applied for the land already approved under the three running mines, without involvement of any F.C., only for re-diversion of land from non-mining to mining purpose. E.C. for Phase-I is expected by end of 2019-20.

In Phase-II, E.C. will be applied for total lease area, including F.C. for forest land not yet diverted and in additional land. Time line kept for clearance of Phase-II is end of 2032-24.

5.3.2 Lilari nala, a perennial stream, flows through the property between Lakhanpur and Lilari mines. It also bifurcates Belpahar mine downstream. Surface width is not sufficient between excavated Lilari mine and mining lease boundary to divert the stream along northern boundary.

The densely populated Jurabaga Basti is partly in the quarry area on the northern side of Lilari nala. It will take considerable time to rehabilitate land oustees and take possession. So, all future mining activities up to 20 years will be carried out on the southern side of Lilari Nala. Northern part of Lilari nala will be taken up from 21st year.

5.3.3 Phuljor nala, a seasonal stream, originating within the integrated mine lease, passes through Lakhanpur mine property and joins Lilari nala within Belpahar property. Its catchment area is small and already reduced due to advance of Lakhanpur mine. This stream is proposed for diversion in phases along western boundary of present Lakhanpur

केशरिया राय
कुशल प्रबंधक (उत्खनन)

General Manager
एम.सी.एल., लखनपुर क्षेत्र
MCL, Lakhanpur Area

mine to Lilari nala. The diversion channel will also work as gallant dam for the integrated mine.

5.4 MINE BOUNDARIES

Geological block boundary of the combined block has been extended towards northern half of earlier western boundary, which is about 200m from the last series of exploratory boreholes.

Based on new borehole information of developmental drilling, the alignments of northern (F1) and southern (F7) boundary faults have been modified a little compared to previous Geological Report. The northern boundary fault is downthrown towards north, as a result of which, Lajkura seam occurs at sub-surface (incrop) towards north. Thus Lajkura seam on northern side of boundary fault can easily be extended along with its seam on southern side of the fault. Another northerly dipping fault (F 8) with estimated throw of 30m occurs after a distance of around 250m, for which only a strip of Lajkura is available for extraction. Though this area is not included in Geological Report, it has been included in the Mining Project. Structural model of this area is available in Geological Report.

With due considerations to all surface constraints and geological uncertainties within the block, quarry boundaries have been derived as below:

SURFACE BOUNDARIES

North : Considering fault F6-F8 as mine floor boundary on Lajkura seam, surface boundary has been drawn with an angle of slope of 21 degrees.

West : Notified boundary.

Authorised Signatory
General Manager
Talabira Area
M/s. Mahanadi Coalfields Ltd.
Ref. No. Talabira/Geology/Mining Plan/16-2019

Director
Geomine Consultants
Bhubaneswar

South : Considering fault F7-F7 as floor boundary on Lajkura seam and workable limits of Ib and Rampur seam sections, surface boundary has been drawn with an ultimate pit slope of 37 degrees.

East : Roof incrop of IB seam in virgin area or excavated quarry boundary.

FLOOR BOUNDARIES

Based on surface boundaries on west and south floor boundaries have been arrived after provisioning of sufficient number of ramp roads with safety berms. Average slope on all sides is about 35°-40° with horizontal.

In general to Dobari seam is the floor of the quarry. Towards south, many of the sections of Ib and Rampur seams are workable in patches only. It will not be possible to accurately identify the workable patches and also, access to seams at lower levels compared to surrounding area in small patches is not feasible. After careful study of workability, different seams have been finalized as quarry floor at different places. Towards south-west, only Lajkura seam is workable while towards north between F1 and F8 faults, Lajkura seam is quarry floor due to depth consideration.

In view of increasing depth of the quarry slope stability studies are recommended to be carried out all along the final quarry boundary. Mine floor and surface boundary, access trench and main haul road are shown in Final Stage Excavation plan.

5.5 MINEABLE RESERVE

Only balance coal and overburden quantities have been estimated, as available on 01.04.2018 based on Surface Plan obtained from Belpahar, Lakhanpur and Lilari Mine Authorities.

मुख्य प्रबंधक (खनन)
भा. कृ. कौ. अनु., केंद्रीय खनन अनुसंधान संस्थान

महाप्रबंधक
General Manager
एम.सी.एल. लखनपुर क्षेत्र
MCL, Lakhanpur Area

As Rampur seam is worked as composite seam, its different coal sections and partings are not marked by separate benches. Some assumptions were made to interpret positions of different splits within the composite benches of Rampur seam. Within the balance property detailed above, extractable coal quantity as on 01-04-2018 is estimated as **1282.86 Mt** with corresponding overburden of **3881.78** Mcum of in-situ OB. Additionally, 462.55 Mcum OB is to be rehandled, 277.78 Mcum from present Lakhanpur mine, 20.02 from present Lilari mine and 154.77 Mcum from "Central Quarry" while extracting coal below Lilari nala after its diversion. The project area being intensively explored and faults well demarcated, no geological loss has been considered. Extractable coal quantity is arrived after provisioning for "mining loss" over Gross Geological Reserves, including all re-handlings. Total OB handling is 4334.33 Mcum resultant stripping ratio is 3.43 cum/t.

Following procedure is adopted for assessing minable coal, overburden and partings:

i) To the extent possible, three-dimensional model was created for worked out quarries. Ultimate quarry and mining stage plans were prepared in MINEX software using standard parameters. Coal and waste volumes for ultimate quarry and mining stages were calculated by using MINEX software.

ii) Coal volume is multiplied by grade wise specific gravity to arrive at Gross Geological Reserve. Volume of coal seams having thickness less than 1 m has been added to overburden volume. Band volume for III seam has also been added to overburden. Grade wise specific gravity considered is shown in following table 5.01.

Table - 5.21
Gradewise Specific Gravity of Coal

Coal Seam Name	Specific Gravity
Grade-C	1.50
Grade-D	1.55
Grade-E	1.60
Grade-F	1.67
Grade-G	1.74

ii) Due to multiple seams of different thicknesses and in-seam bands of more than 1 m thickness, **Mining Loss** has been estimated for each seam separately to arrive at **Mineable Coal Reserve**. Mining loss depends on:

a) Loss of coal in roof and floor of seam
b) Loss of seam while cleaning roof of bench
c) Loss of coal during selective mining for > 1m bands
d) Loss of coal during transportation

Seam wise mining losses are given in table 5.02 below:

Table-5.02
Mining losses of coal seams

IB BOT	IB TOP	RB-I	RB-II	RU	RT-II	RT-I	LOCAL	LAJKURA	PKB	PKT
0%	12%	5%	7%	5%	7%	12%	8%	3%	10%	10%

Table - 5.03 (A)
Table showing seam wise minsable coal reserve and overburden as on 01-04-2018

Quantity in Mt

Name of horizon	Grade-C	Grade-D	Grade-E	Grade-F	Grade-G	TOTAL	Percent
Parkhani Top	0.00	0.00	0.00	0.00	0.02	0.02	0.00
Parkhani Bottom	0.00	0.00	0.00	1.36	0.00	1.36	0.11
Lajkura seam	0.00	0.00	8.87	331.64	234.61	575.12	45.38
Local seam	0.00	3.84	20.66	16.92	0.32	43.94	3.46
Rampur Top-I seam	0.00	0.32	11.37	35.72	3.88	52.30	4.13
Rampur Top-II seam	0.00	0.00	3.34	37.20	30.77	71.37	5.65
Rampur Middle seam	0.00	0.01	0.14	7.89	36.08	44.12	3.49
Rampur Bottom-I seam	0.00	0.00	0.04	29.21	59.71	118.96	9.42
Rampur Bottom-II seam	0.00	1.29	14.58	121.81	17.35	155.13	12.28
IB Top seam	0.47	24.96	28.55	11.02	0.07	64.56	5.11
IB Bottom seam	45.78	75.36	14.17	2.33	0.43	137.96	10.93
Total coal	46.26	105.80	97.81	598.95	414.05	1262.86	100.00
Percent	3.66	8.38	7.75	47.43	32.79	100.00	

Table - 5.03 (B)

Waste quantities (Top OB, Parting Bands, UG Coal and less than 1m Coal)	Quantity in Mcum	Percent
Above Parkhani Top	37.75	0.67
Above Parkhani Bottom	471.53	10.59
Above Lajkura	157.24	3.63
Above Local	134.07	3.19
Above Rampur Top-I	232.21	5.36
Above Rampur Top-II	91.84	2.12

वैशाखिया राव
मुख्य प्रबंधक (अन्वेषण)
सी. एम. पी. डी. आई., बेलपहाड़ क्षेत्र-2

एस. सी. एस. प्रसाद
एस. सी. एस. प्रसाद
Manager (Survey)

Above Rampur Middle	934.36	20.83
Above Rampur Bottom-I	221.21	6.73
Above Rampur Bottom II	1466.42	34.37
Above to Top	8.09	0.19
Above to Bottom	85.07	1.90
TOTAL WASTE – In-situ	**3881.78**	
Re-handling	**452.55**	**10.31**
TOTAL WASTE	**4334.33**	
Stripping Ratio (cum/t)	**3.43**	

Note: Out of total re-handling of 448.35 Mcum, 273.06 Mcum will be done during 7th to 16th year, 22.02 Mcum from 22nd to 35th year and 104.77 Mcum from 31st to 35th year.

5.5 SECTOR & SECTION WISE MINEABLE RESERVES:

In order to sustain present level of production and to prepare the mine for integration producing 40 Mt coal per year, it is required to extract coal at along eastern side of Belpahar and taper down production from Lakhanpur in addition to opening a new quarry towards south of Lakhanpur mine. Few mining stages were drawn to reflect changes in coal and overburden quantities with progress of mine, so that, production programme and excavator scheduling can be done properly.

Table - 5.04(A)
MINEABLE RESERVE AND O.B. IN LAKHANPUR MINE (Figures in Mt)

Seam name	Lakhanpur Stage-1			Lakhanpur Stage-2			Total		
(From 01-04-18)	Coal	O.B.	S.R.	Coal	O.B.	S.R.	Coal	O.B.	S.R.
Lajkura	44.22	46.78	1.06	55.00	92.54	1.68	100.22	139.32	1.39
Parkhira Bottom	-	-	-	-	-	-	-	-	-
Parkhira Top	-	-	-	-	-	-	-	-	-
Total	44.22	46.78	1.06	55.00	92.54	1.68	100.22	139.32	1.39

Table - 5.04(B)
MINEABLE RESERVE OF STAGES IN CENTRAL QUARRY (Excluding Lakhanpur Mine)
Figures in Mt (From 01-04-18)

Seam name	Stage-1	Stage-2	Stage-3	Stage-4	Stage-5	Stage-6	Stage-7	Total
IB Bottom	5.31	16.02	27.31	24.14	21.45	12.37	5.23	111.85
IB Top	2.27	4.93	10.56	12.16	7.78	5.15	10.41	52.24
R.S.-II	6.13	32.47	39.01	21.47	14.08	6.44	23.14	133.84
R.S.-I	3.28	15.08	25.24	32.88	13.38	5.76	12.42	85.88

General Manager

Seam name	Stage-1	Stage-2	Stage-3	Stage-4	Stage-5	Stage-6	Stage-7	Total
R.C.	0.12	4.35	11.01	12.47	5.69	1.43	0.34	35.51
R.T.-II	6.17	12.44	16.24	14.63	8.81	4.26	3.40	50.15
R.T.-I	0.03	6.82	10.04	12.08	7.47	3.66	5.93	45.96
LOCAL		0.06	6.08	12.34	10.48	5.02	6.97	41.95
LAJKURA			3.29	21.09	94.93	37.68	199.40	356.44
PARKH. BOT.								
PARKH TOP								
Total	17.37	92.45	137.76	154.41	183.85	88.77	267.21	933.84

R.B.-Rampur Bottom; R.T.-Rampur Top; R.C.-Rampur Middle

Table - 5.04(C)

O.B. QUANTITIES IN STAGES OF CENTRAL QUARRY (Excluding Lakhanpur Mine)

Figures in Mcum (From 01-04-19)

Seam name	Stage-1	Stage-2	Stage-3	Stage-4	Stage-5	Stage-6	Stage-7	Total
Abv. IB Bottom	1.10	3.41	4.30	4.50	2.67	0.87	6.31	23.06
Abv. IB Top	1.80	55.64	88.53	87.02	67.87	33.52	67.23	402.51
Abv. R.B.-II	5.43	10.37	15.16	17.77	19.49	12.16	48.05	128.42
Abv. R.B.-I	4.09	16.27	16.58	18.18	13.78	7.27	38.20	114.27
Abv. R.Middle	3.00	34.07	33.57	26.20	17.62	7.47	82.04	207.23
Abv. R.T.-II	1.77	12.97	16.26	13.19	8.63	3.43	23.62	79.87
Abv. R.T.-I	17.58	42.70	170.30	174.07	101.11	45.06	228.82	788.64
Abv. Local		86.81	42.42	42.12	26.25	12.01	56.55	274.26
Abv. Lajkura			11.75	82.58	331.52	60.59	594.30	1081.03
Abv. Parkh. Bot.								
Abv. Parkh. Top								
Re-handling			160.10	117.66				277.76
Total	35.37	278.34	570.77	584.90	589.02	182.81	1144.73	3877.93
Stripping Ratio	2.04	2.92	4.14	3.73	3.33	2.06	4.28	3.62

Table - 5.04(D)

MINEABLE COAL AND O.B. IN SOUTH QUARRY (Coal Mt, OB Mcum)

Seam name	South Qry Stage-I		South Qry Stage-II		Total	
	COAL	O.B	COAL	O.B	COAL	O.B
Lajkura	32.73	84.82	68.47	191.65	91.20	196.47
Parkhani Bottom			1.55	8.28	1.55	8.06
Parkhani Top			9.02	33.92	9.02	33.92
Total	32.73	84.82	69.84	176.65	92.57	234.47
S.R. (cum/t)	1.67		3.01		2.53	

Table - 5.04(E)

MINEABLE COAL AND O.B. IN SOUTH EAST QUARRY

Seam	South East Quarry	
	Coal (Mt)	O.B. (Mcum)
IB Bottom	1.72	2.19

प्रबंधक (खनन)
महा. प्रा. खं. अर्क., सं. सी.ल.

General Manager
जन.सी.एल.,लखनपुर क्षेत्र
MCL, Lakhanpur Area

Seam	South East Quarry	
IB Top	1.08	10.36
R.B.-II	5.10	15.52
R.B.-I	0.67	5.45
R Middle	0.30	16.82
R.T.-II	1.08	2.62
R.T.-I	0.70	41.66
Local		
Lajkura		
Parkh. Bot		
Parkh. Top		
Total	13.06	88.43
Stripping Ratio	6.83 cum/t	

Table - 5.04(F)
MINEABLE COAL AND O.B. IN NORTH QUARRY

Seam name	North of Lilari Nala		Below Lilari Nala		Total	
	COAL (Mt)	OB (Mcum)	COAL (Mt)	OB (Mcum)	COAL (Mt)	OB (Mcum)
IB Bottom	11.07	0.45	9.68	2.00	20.85	12.65
IB Top	7.53	38.75	3.30	14.81	10.83	53.56
R.B.-II	9.55	10.62	6.18	4.63	15.73	15.25
R.B. I	10.64	9.90	6.34	4.70	16.78	14.54
R.C	5.08	5.98	3.38	2.16	8.46	8.14
R.T.-II	6.53	5.98	3.90	2.36	10.43	8.04
R.T.-I	3.78	50.14	2.12	23.62	5.83	73.76
LOCAL	0.85	10.33	1.30	5.02	2.15	16.85
LAJKURA	12.30	80.39	14.01	16.22	27.31	108.69
PARKH. BOT.	-	-	-	-	-	-
PARKH TOP	-	-	-	-	-	-
Re-handling		20.02		154.77		174.79
Total	73.43	261.43	53.26	227.26	122.68	488.67
S.R. (cum/t)	3.47				3.98	

5.5 TARGET OUTPUT & MINE LIFE

The mine is proposed for peak rated capacity of 40.0 Mty. Existing Belpahar (9.0 Mty), Lilari (0.8 Mty) and Lakhanpur (21.00 Mty) projects will be merged to form one single project. No further production is expected from Lilari mine.

ZERO DATE

The Project Report has been approved by the Board of Coal India Limited starting from 2018-19. So, the Zero Date is also kept as start of 2018-19.

Starting from 2018-19 with construction works and processing for land acquisition. It is anticipated that all statutory clearances including Forest Clearance for the total Mining Lease mandate can be obtained not before March 2024. As this is a long period and it is urgently required to advance present Belpahar mine towards west beyond approved boundary, Mining Lease is proposed to be obtained in two Phases, Phase-I will consist of no new forest land, within acquired land but only with change in use for mining purpose and Phase-II will consist of total mining lease including forest lands not yet diverted.

Time line for obtaining all approvals of Phase-I is March 2020. As per approvals obtained by MCL, production capacity for two years from 2018-19 has been kept as 30.00 Mt with 21.00 Mt coming from Lakhanpur mine and 9.0 Mt coming from Belpahar mine.

The mine life for expansion project is 41 years. During construction years production will be of approved capacity. From 25th year, working area is constrained by narrow width and high depth. Caution is also required while removing OB dump of 'Central Quarry' while extracting coal from below Lilari Nala after its diversion. So, production has been tapered down to 5 Mty from Year 33 to the end of mine while working below Lilari Nala after its diversion, with very high re-handling from previously dumped Central Quarry slope.

5.6 FUTURE EXPANSION POTENTIAL

Capacity expansion: Infrastructure of Belpahar mine and Lakhanpur Area towards east are very near to mine boundary. In addition, MCL has agreed to provide a rail corridor to OPGC through this infrastructure area. Free space is barely available for coal off-take arrangement. So, production level cannot be raised to very high level. Peak capacity has been fixed at 40.00 Mt per year.

Area expansion: Few boreholes towards north and south indicate possibility of coal seams occurring nearby. Dip side is free from surface constraints. But geological

देवाशिस राय
मुख्य प्रबंधक (खनन)

Project Manager
खान प्रबंधक
MCL, Lakhanpur Area

information is insufficient for making proper investment proposal. As on date, dip side will be reached not before 18 years. It is expected that surrounding area will be probed sufficiently in future for area expansion.

Chapter - 7

MINING AND DUMPING STRATEGY

7.1 CONSTRAINTS ON MINE DEVELOPMENT

Diversion of Lilari stream is a major constraint. This stream is met with another stream called Phuljor coming from Lakhanpur (Belpahar Sector-II) block. The strip of land available between dip side boundary of Lilari OCP and the Notified boundary of the project is not sufficient for diversion of Lilari nala. Lower seams Ib and Rampur are extractable below Lilari OCP. So, Lilari OCP is not proposed for filling up. Northern part of Lilari nala will be taken up at later stage (from 21st year).

Village Jurabaga is large habitation on the northern side of Lilari stream and could not be vacated yet.

There are patches of forest land on west-central part of present Lakhanpur mine and south-west part of Belpahar mine pending forest clearance. Large area of South Quarry and lowance dip side of Central Quarry are covered by Forest land, for which process of forest diversion proposal will soon be initiated. Non-availability of these fresh forest lands will cause delay in Environment Clearance and intended sequence of operation of the Integrated Project.

OPGC rail line connecting their power plant with Bombay-Howrah main line which also carries coal from Lakhanpur mine to the power plant is lain very near to the dip-side boundary of present Belpahar mine. Without removing this line, it is not possible to advance Belpahar and extract lower seams below in the Lakhanpur mine area. Its removal is depended on establishment of new line of OPGC presently under construction.

All infrastructures of Lakhanpur and Lilari mines are to be re-located for integrated mine to advance. The external and internal dumps already formed in these two mines are to be re-handled. Production from Lakhanpur mine now producing around 21.00 Mt annually will be tapered down slowly and will be closed by 2023-24.

General Manager
जी.एम. (खनन)
MCL, Lakhanpur Area

सहायक महाप्रबंधक (खनन)
एम. सी. एल. लाकपुर

In anticipation of considerable time required for clearances of forest lands to be diverted which were not part of any of the three projects, it is proposed to obtain Environmental Clearance in two phases.

In Phase-I, area is confined within approved boundaries only requiring re-diversion of lands from non-mining purposes earlier to Mining purposes now. Clearances are expected by end of 2019-20.

In Phase-II, total lease area for the Integrated Project will be applied for including all forest lands. Time line considered for Phase-II clearance is end of 2023-24.

7.2 MINING STRATEGY / MINING SEQUENCE

Through years of past experience it has been learnt that it takes considerable time to take possession land belonging to forest and villages. Also it is a long process to get all clearances required for diversion of a natural stream. So, a time span of two years has been kept in Phase-I and six years in Phase-II for overcoming the above constraints. Sequencing of work areas are explained below.

Belpahar operating Quarry: After clearing whatever coal is left out in the operating area, mine will advance up to southern branch of Lilari nala. Within approved boundary, it has enough coal to sustain up to 2019-20. Departmental HEMM of Lilari mine is proposed to be transferred to Belpahar mine.

Lakhanpur operating Quarry: This quarry is proposed to be stopped by 2023-24. In order to minimize re-handling of dump for extraction of lower seams, OB of running Lakhanpur mine is proposed to be carried and dumped into void of Belpahar mine with immediate effect. It is estimated that about 51 Mcum OB from Lakhanpur mine can be transported to void of Belpahar mine during two years of construction period (2018-19 & 2019-20). From 1st year of integrated project (2020-21), total OB from Lakhanpur mine can be put into void of Belpahar mine till end of Lakhanpur mine, subject to advance of Belpahar mine in the form of Central Quarry, as has been

General Manager
MCL, Lakhanpur Area

proposed here. Pruljor nala is proposed to be diverted to Jiari nala in phases along north-western boundary of Lakhanpur mine.

South Quarry: With phased closure of operating Lakhanpur mine, this quarry will be developed as a part substitute. Initial OB about 41 Mcum will be dumped in void of Belpahar mine. This quarry is proposed to start on Yr.7 (2024-25), immediately after Phase-II clearance and to continue till Yr.15 (2033-34). Only Lajkura seam is extractable here. So, dumps formed need not be re-handled later.

Central Quarry: As Belpahar mine advances beyond its present approved boundary, it will enter into Lakhanpur mine area and is called Central Quarry. Re-handling will start slowly from Yr.7 and will peak between 11th to 15th year. From 7th to 16th year, it will work along with South Quarry. From 17th to 21st year, only this quarry will be worked to produce total requirement. Afterwards, it will be worked along with North Quarry till its end on 33rd year.

As the proposed working areas are far apart, deployment of HEMM and its proper utilization is a challenging task. It has been attempted to deploy existing equipment in best possible way. The factors those were considered for allocating production from different patches are:

1) Mix of production is such that combined waste removal requirement varies within narrow range from year to year.
2) Excavators are utilized to maximum possible by deploying them exclusively either in southern part or northern part.
3) Sufficient face length is available for working of dragline and its movement is restricted within Belpahar Central Quarry.

7.2.1 ACCESS TRENCH/MINE ENTRY

The access trench catering to Belpahar operating Quarry will be continued as central haul road till 2019-20. As this quarry advances, with renamed Central Quarry, a haul road will be developed along southern slope of Central Quarry and the central

उप मुख्य प्रबंधक (खनन)
MCL, Lakhanpur Area

उप महाप्रबंधक (खनन)
मै. को. लि. लाजरी

road will be backfilled. This haul road will cater to coal evacuation till end of Central Quarry and will be kept open for future expansion.

The entries to Lakhanpur mine are to be continued till its closure. Top of Central Quarry will not reach the existing road system of Lakhanpur mine till its end though all structures are to be dismantled. An additional coal transport road is proposed between northern boundary of Central Quarry and Lilari nala for feeding coal to receiving hoppers linked to 10 Mty washery.

A small access trench will be required for South Quarry. Coal from South Quarry will be unloaded at receiving hoppers of 20 Mty combined capacity. Though South Quarry will be exhausted by 16th year, this entry and haul road is proposed to be kept open for transport of coal from Lajkura seam in Central Quarry.

For Central Quarry at later stage, there are two entries. One is by south on the southern slope and the other will be driven at mid level on northern slope. It is required to evacuate 10 Mt coal annually from Lajkura seam by north for feeding to receiving hoppers towards north.

In 17th year, the North Quarry will be opened independently by a small access trench. Before that, the northern branch of Lilari nala has to be closed. It may require to widen and deepen the southern branch to carry the total flow. A bridge will be required to cross Lilari nala.

After Lilari nala is diverted over backfill of North Quarry, the remaining part below Lilari nala course can be approached with an independent small access trench.

The small part towards south of access trench of Central Quarry can be worked from the same access trench lain on southern slope of Central Quarry.

7.2.2 MINE DEVELOPMENT

The objective is to advance the mine without any hindrances for long period. Area already under possession for the three operating mines can be worked by advancing Belpahar mine into Lakhanpur property and extracting the lower seams

General Manager
MCL, Lakhanpur Area

The constraints described above need to be overcome for which sufficient time has been allocated. Surface developmental activities are briefly stated below

a. Construction of embankment along southern side of Lilari Nala.
b. Construction of road from Lakhanpur mine to Belpahar along Lilari nala
c. Acquisition of forest lands in approved mine area
d. Acquisition of forest lands in South Quarry
e. Rehabilitation of villages Jurabaga, Chharia, Daripali, Ubda, Kusuralai
f. Construction of workshops, stores and electrical sub-stations at designated places
g. Construction of CHP, conveyors, rail yard, ground bunker, silo as shown
h. Laying of rail link of OPGC by western side
i. Diversion of Lilari Nala

Positions of all three mines at beginning of Yr.-1 is shown in Plate MIN-I. Stage plans of 2nd, 5th, 10th, 15th and 25th years are given as Plate MIN-II, MIN-III, MIN-IV, MIN-V and MIN-VI respectively. Final Stage Excavation Plan and Final Stage Closure Plan are given in MIN-VII and MIN-VIII respectively. Surface Plan showing nala diversion, rail alignment, material handling facilities, surface and mine roads and other surface infrastructures are given in GEN-III.

7.3 DUMPING STRATEGY

The objective is to accommodate all OB removed inside the excavated mine void. About 18 Mcum OB has been dumped externally by the three operating mines long back. In this project proposal, no additional external dumping is proposed. But to keep the entire OB internally, it is absolutely necessary to raise the dump top level to 90 m above surrounding ground level. The area already planted at the dump tops are also proposed for raising dump height.

In order to avoid further external dumping, OB needs to be transported for long distances far from working area to places where void is available for low OB removal in early years.

It was found that internal dump capacity just matches with OB removal of the whole mine at the end of 25th year. In subsequent years, when final slope of the Central

General Manager
(Planning)
MCL, Lakhanpur Area

Quarry is approached, part of the slope is proposed to be filled up. As there is possibility of extension towards dip side, total slope will not be filled up.

The haul roads on mine face to reach the deep most part of the mine and Lajkura seam in South Quarry are also kept open for advancing the mine in future expansion project.

While calculating OB accommodation in the dumps, swell factor of 1.15 has been applied on in-situ volume to arrive at dump volume. These dumps do not include washery rejects or any other material.

The dumps have been designed with multiple tiers. Levels of these tiers are matched with horizontal road levels on quarry slope, for easy transportation from working benches to dump benches. Maximum height of each tier is 30m and slope of each individual tier is 37 degrees. Overall slope of full dump face is about 26 degrees.

Slope stability studies have been carried out as a model at CMPDI for external OB dump at its deep most location. The factor of safety is found to be within acceptable limit. However, slope stability studies need to be carried out at regular intervals with field data. Laser assisted slope movement monitoring radars have been proposed for installation at suitable location for early warning.

Top level of internal dumps proposed in Belpahar Combined Quarry is 280m above mean sea level, which is 75-80m above surrounding ground level. Part of present internal dump has already been reclaimed and vegetated at around 280m AMSL. Necessary permission is to be obtained from concerned departments to raise the reclaimed dump top for backfilling by raising level of dump and to fulfill net void significant.

7.3.1 RE-HANDLING OF OB

During operation of Central Quarry where extraction of lower seams in S. Rampur are attempted, OB above Lajkura seam in Lakhanpur OCP is required to be

General Manager

removed. This is re-handling of OB. Total re-handling proposed is 277.76 Mcum which is the anticipated quantity of internal & external dumps at the end of 2023-24.

Similar is the situation for Lilari OCP where 20.02 Mcum OB has been dumped in external and internal OB dumps which is to be re-handled during coal extraction of lower seams from North Quarry.

Due to space constraint, northern slope of Central Quarry has been filled up and internal dump is raised to 293m AMSL to accommodate all OB. This is the boundary against Lilari Nala. After Lilari nala is diverted through backfill of North Quarry, extraction of total coal blocked below original course of Lilari nala will be attempted. For this extraction, the OB on northern slope of Central Quarry is to be re-handled. Estimated volume of this re-handling is 154.77 Mcum. In view of this high volume of re-handling, it is suggested to review planning of future mine operation after 25 years of this project to find suitable alternatives to avoid huge re-handling. Technological improvement in high-wall mining for higher percentage of extraction may be adopted if found suitable.

Re-handling schedule of OB from Central Quarry

Year	Quantity (Mcum)
2024-25 (Yr-7)	20.00
2025-26 (Yr-8)	28.00
2026-27 (Yr-9)	36.00
2027-28 (Yr-10)	40.00
2028-29 (Yr-11)	48.00
2029-30 (Yr-12)	40.00
2030-31 (Yr-13)	30.00
2031-32 (Yr-14)	20.00
2032-33 (Yr-15)	10.00
2033-34 (Yr-16)	5.76
Total	277.76

Re-handling schedule of OB from North Quarry

Year	Quantity Mcum
2040-41 (Yr-23)	3.00
2041-42 (Yr-24)	5.00
2042-43 (Yr-25)	7.00

General Manager
पुरुषा क्षेत्रालय (उड़ीसा)

Chapter – 8

MINING SCHEDULE & EQIPMENT PHASING

8.1 DESIGN CRITERIA

The following design criteria has been adopted for mining operations as per prevalent norms of mine design considered in CIL mine.

- No of annual working days : 300 days
- No of daily shifts : 3
- Duration of shift hours : 8

Excavation category
- COAL : CAT-III
- OVERBURDEN : 50% CAT-III+50% CAT-IV

Insitu volume weight
- For coal : 1.67 t/cum (average)
- For overburden : 2.40 t/cum

8.2 EQUIPMENT PRODUCTIVITY

Design parameters are same as approved standards of CMPDI.

8.3 CALENDER PROGRAMME OF EXCAVTION

Total remaining quarry area has been divided into number of mining stages. Coal and waste were calculated in a mine planning software. Quarries and mining stages are shown in Plates MIN-I to MIN-VIII.

34 cum hydraulic shovels are exclusively deployed in thick parting and top overburden. Surface miners, front end loaders and 2.3 cum hydraulic shovels are deployed exclusively in coal benches. All other shovels are to work in overburden/interburden. Dragline and 50T dumpers are phased off with their respective end of present life. Hydraulic shovels of 6.1 and 6.3 cum buckets are deployed in thin partings. Hydraulic shovels of 12.0 and 9.5 cum buckets are predominantly deployed in thick partings.

Coal will mostly be cut by surface miner. Coal cut by surface miner will be loaded by front end loaders on to dumpers and brought to reclaim feeders installed at the quarry mouth. Small amount of coal from blasting will be brought to feeder breaker also installed at quarry mouth. Sized coal will be transported on surface by conveyors to washeries or silos as per final choice of alternative. Detailed specifications are given in Chapter-11.

As already stated, 7engine and 50T rear dumpers will be phased out. Other smaller shovels will be used in miscellaneous jobs. 38 numbers of 50T dumpers will be replaced with 23 numbers 90T dumpers. In view of existing loader of size 6.4 cum bucket, required dumpers of 35 T have been provided for transportation of departmental coal extraction.

After closure of Lajkura mine, the HEMM are proposed to be shifted to Belpahar mine. It is also proposed to shift departmental HEMM of Lakhanpur mine to Belpahar mine from 4th year. It is proposed to deploy all departmental excavators in the lower seams named IB Bottom, Ib Top, Rampur Bottom and partings in between of Central Quarry. At all other places, contractual working is proposed.

The waste removal schedule has been modified with same level of OB removal for a three year period. Owner should encourage contractors for engagement of machines not lesser in size proposed in this Mining Plan in order to keep fuel management and pollution level under control.

Table 8.0
PRODUCTION PROGRAMME – LAKHANPUR RUNNING QUARRY
(Figures in Million Cubic Meter)

Year	Lajkura	OB Abv. Lajkura	S.R.
2018-19 (Yr-1)	21.00	22.22	1.06
2019-20 (Yr-2)	21.00	22.22	1.06
2020-21 (Yr-3)	21.00	34.87	1.66
2021-22 (Yr-4)	16.00	27.84	1.75
2022-23 (Yr-5)	11.20	18.18	1.66
2023-24 (Yr-6)	10.22	15.59	1.36
Total	100.22	138.32	1.38

- Production during initial two years is from presently approved Mining Plans for Lajkura (6.0 Mty) and Lakhanpur (21.0 Mty) mines. Infrastructure for integrated project will be established during this period.

Approved
General Manager
MCL, Lakhanpur Area

cmpd

MCL

Table-8.4
PRODUCTION PROGRAMME – Belpahar & Central Quarry

(Coal in Million metric tonnes, O.B. in Million cubic meters)

	Rampur Belt	Rampur Mid	Rampur Top	Local	Lajkura	Pan-i-Hard	Total Coal	Min. O.B.	Min. Rampur	Min. Local	Top O.B.	Re-handling	Total O.B.	S.R.
2016-17 (Act.)	3.05	4.85	0.05	0.11	3.00	3.00	0.00	3.00	1.45	19.55		6.05	0.00	35.00	2.78
2017-18 (Act.)	3.82	4.87	0.05	0.00	3.00	3.00	0.00	3.00	1.00	13.97		9.43	0.00	35.00	2.78
Yr-1	2.72	5.13	0.50	3.50	0.07	0.00	3.00	12.00	7.65	15.00		2.34	0.00	85.00	2.08
Yr-2	4.30	3.76	0.34	3.00	0.01	0.00	3.00	16.00	12.13	23.15		26.72	3.00	74.00	3.74
Yr-3	5.85	17.15	1.00	5.41	0.03	0.00	0.00	20.00	15.65	32.45		24.68	3.00	74.00	2.85
Yr-4	6.19	15.31	1.47	6.20	0.03	0.00	0.00	28.70	18.94	41.36		17.00	0.00	74.00	2.45
Yr-5	0.00	14.70	2.70	7.05	1.25	3.75	0.00	35.50	24.45	68.25	9.70	2.00	20.00	120.00	3.37
Yr-6	6.70	12.37	2.00	6.10	1.41	3.77	0.00	32.00	21.06	67.15	9.86	2.41	20.00	120.00	3.84
Yr-7	7.30	12.65	2.36	5.34	1.26	3.09	0.00	28.00	13.97	63.06	8.95	5.86	38.00	132.00	4.29
Yr-8	7.70	13.65	2.34	5.34	1.26	0.66	0.00	28.00	15.97	63.06	8.95	5.86	42.00	137.00	4.64
Yr-9	7.31	3.65	2.24	5.19	1.57	1.77	0.00	28.00	16.15	60.65	8.21	1.79	48.00	137.00	4.64
Yr-10	6.77	5.04	2.20	4.69	2.24	3.83	0.00	28.00	18.72	60.45	7.65	17.18	43.00	137.00	4.64
Yr-11	6.77	6.63	2.20	4.69	2.24	3.83	0.00	28.00	18.72	45.45	7.65	32.18	53.00	118.00	3.93
Yr-12	6.75	6.63	2.20	4.69	2.24	3.84	0.00	28.00	15.08	45.44	7.65	20.55	30.00	110.00	3.36
Yr-13	7.57	8.10	2.61	5.72	2.08	4.67	0.00	33.00	13.67	53.28	9.01	18.04	10.00	110.00	3.33
Yr-14	8.33	9.10	2.54	5.72	2.73	3.04	0.00	37.00	20.45	53.08	8.96	35.82	5.70	126.00	3.39
Yr-15	8.34	5.91	1.21	3.54	2.28	20.98	0.00	48.30	16.35	34.65	5.71	19.35	3.00	126.30	3.15
Yr-16	8.34	5.95	1.20	3.54	2.28	20.91	0.00	48.30	16.35	35.01	5.71	68.85	3.00	126.30	3.15
Yr-17	8.04	5.94	1.22	3.55	2.28	20.91	0.00	48.30	16.35	35.01	5.71	69.03	3.00	126.30	3.15
Yr-18	0.04	5.95	1.23	8.65	2.28	20.96	0.00	40.00	15.35	35.33	5.71	69.55	0.00	126.00	3.15
Yr-19	0.21	5.24	0.63	8.56	2.37	15.66	0.00	35.00	14.06	37.34	5.12	40.63	0.00	92.00	2.62
Yr-20	4.43	4.06	0.37	2.81	1.39	13.00	3.00	30.00	11.32	33.12	5.24	41.51	0.00	92.00	3.07
Yr-21	4.81	4.88	0.35	2.73	1.81	17.00	0.00	30.00	10.78	31.93	5.24	38.90	0.00	90.00	3.00
Yr-22	3.48	4.39	0.25	1.87	1.41	18.75	0.00	30.00	10.20	30.67	5.45	59.06	0.00	114.00	3.80
Yr-23	3.00	4.16	3.22	1.61	1.24	15.73	0.00	30.00	9.75	41.99	5.12	58.58	0.00	114.00	3.80
Yr-24	1.79	3.89	3.04	1.65	0.19	22.30	0.00	30.00	8.32	47.34	5.22	51.53	0.00	114.00	3.80
Yr-25	1.78	3.96	3.04	1.64	0.19	22.38	0.00	30.00	8.24	47.07	5.23	85.79	0.00	128.00	4.27
Yr-26	1.78	3.96	0.34	1.64	0.19	22.38	0.00	30.00	8.24	47.07	5.23	85.79	0.00	128.00	4.27
Yr-27	1.78	3.96	0.34	1.64	0.19	22.38	0.00	30.00	8.24	47.07	5.23	85.79	0.00	128.00	4.27
Yr-28	1.78	3.96	3.04	1.64	0.19	22.38	0.00	30.00	8.24	45.18	5.21	86.27	0.00	128.00	4.27
Yr-29	1.78	3.96	3.04	1.64	0.19	22.38	0.00	30.00	8.24	47.65	5.22	52.91	0.00	100.00	4.00
Yr-30	1.78	3.96	3.04	1.64	0.19	22.38	0.00	30.00	8.25	48.40	0.04	53.51	0.00	123.00	4.10
Yr-31	1.78	3.96	3.04	1.64	0.19	21.96	0.00	30.00	8.21	38.85	5.16	84.08	0.00	120.00	4.80
Yr-32	1.48	3.32	3.03	0.87	0.06	16.61	0.00	25.00	0.78	3.41	0.54	4.23	0.00	8.50	3.40
Yr-33	0.15	0.36	0.00	0.09	0.01	1.50	0.00	2.63	486.30	1316.78	178.85	1177.65	217.70	3977.55	3.62
TOTAL	104.00	209.72	38.01	106.15	41.08	280.49	6.00	903.54							

Production during initial two years is from previously approved Mining Plans for Belpahar (3.0 Mty) and Lakhanpur (21.0 Mty) mines. Infrastructure for integrated project will be established during this period.

Job No.702/02

Mining Plan for Lakhanpur-Belpahar Jo... Page - 9

Chief Manager (CMPDI)
SECL, Lakhanpur Area

Asstt. Manager (CMPDI)

Table-6.5
PRODUCTION PROGRAMME – SOUTH QUARRY
Coal Qty. in Mt; O.B. volume in million cubic meter

Year	Lignite	Pakri-Barwadih	Pakri-Barwadih (OC)	Total Coal	Total OB	S.R.
2024-25	3.50	0.00	0.00	3.50	6.00	1.71
Yr-II	8.00	0.00	0.00	8.00	14.00	1.75
Yr-III	12.00	0.00	0.00	12.00	20.00	1.67
Yr-IV	12.00	0.00	0.00	12.00	24.00	2.00
Yr-V	12.00	0.00	0.00	12.00	36.00	3.00
Yr-VI	12.00	0.00	0.00	12.00	36.00	3.00
Yr-VII	12.00	0.00	0.00	12.00	36.00	3.00
Yr-VIII	12.00	0.00	0.00	12.00	36.00	3.00
Yr-IX	7.00	0.00	0.00	7.00	21.00	3.00
Yr-X	2.00	0.00	0.00	2.00	5.87	2.94
Total	91.50	1.95	0.02	92.57	236.87	2.55

Table-6.6
PRODUCTION PROGRAMME-NORTH QUARRY

Year	COAL	In-situ OB	Re-handling (Mcum)	OB incl. Re-handling	Stripping ratio
2038-39	5.00	16.00		16.00	3.20
Yr-II	10.00	35.00		35.00	3.50
Yr-III	10.00	32.00	3.00	35.00	3.50
Yr-IV	10.00	30.00	5.00	35.00	3.50
Yr-V	10.00	29.00	7.00	36.00	3.60
Yr-VI	10.00	30.98	5.02	36.00	3.60
Yr-VII	10.00	35.00		35.00	3.50
Yr-VIII	7.42	23.42		23.42	3.02
Total	72.42	231.40	20.02	351.42	3.47

Table-6.7
PRODUCTION PROGRAMME-SOUTH-EAST QUARRY

Year	COAL	In-situ OB	Stripping Ratio Cum't
2045-46	2.85	20.00	7.02
Yr-29	5.00	35.00	7.00
Yr-30	5.00	35.00	7.00
Yr-31	0.70	3.94	5.63
Total	13.55	93.94	6.93

Table-6.8
PRODUCTION PROGRAMME-BELOW DIVERTED UILARI NALA

Year	COAL	In-situ OB	Re-handling (Mcum)	OB incl. Re-handling	Stripping Ratio Cum't
2053-54	10.00	17.21	15.79	33.00	3.30
Yr-34	8.03	14.42	18.58	33.00	3.82
Yr-35	5.00	8.00	24.00	33.00	3.93
Yr-36	5.00	8.00	24.00	33.00	3.60
Yr-37	5.00	8.00	24.00	33.00	3.60
Yr-38	5.00	8.00	24.00	33.00	3.60
Yr-39	5.00	5.20	22.80	28.00	3.89
Yr-40	5.00	8.00	0.00	8.00	1.60

General Manager
(P.P.)
MCL, Lakhanpur Area

Yr-41	1.62	2.25	0.00	2.25	1.39
Total	80.39	82.48	184.77	337.35	4.73

Table-8.8
PRODUCTION PROGRAMME-TOTAL QUARRY

Calendar Year	Progressive Year	Coal (Qty in mt for 000)						OB (Mbcm cubic m)			SR
		RI	Kanpur	Local	Lajkura	Parkman	Total	Inside OB	Rehandling	Total OB	cum/t
2018-19	Year-1	3.65	5.05	0.02	21.62	0.00	30.35	52.00	0.00	52.00	1.71
2019-20	Year-2	3.81	5.35	0.00	21.04	0.00	30.20	52.00	0.00	52.00	1.73
2020-21	Year-3	2.72	9.27	0.01	22.00	0.00	33.00	52.00	0.00	52.00	1.58
2021-22	Year-4	4.30	14.69	0.01	16.00	0.00	35.00	101.00	0.00	101.00	2.89
2022-23	Year-5	5.89	20.09	0.02	11.00	0.00	37.00	92.00	0.00	92.00	2.49
2023-24	Year-6	6.25	23.01	0.02	10.72	0.00	40.00	87.33	0.00	87.33	2.18
2024-25	Year-7	6.60	28.56	1.19	4.25	0.00	40.00	100.00	29.00	129.00	3.23
2025-26	Year-8	8.29	21.05	1.41	8.27	0.00	40.00	109.00	28.00	137.00	3.43
2026-27	Year-9	7.70	18.40	1.24	12.66	0.00	40.00	107.00	36.00	143.00	3.58
2027-28	Year-10	7.70	18.40	1.24	12.66	0.00	40.00	111.00	40.00	151.00	3.78
2028-29	Year-11	7.47	17.35	1.57	13.50	0.21	40.00	115.00	48.00	163.00	4.08
2029-30	Year-12	6.73	15.08	2.24	15.92	0.27	40.00	123.00	40.00	163.00	4.08
2030-31	Year-13	6.77	15.16	2.24	15.56	0.26	40.00	116.00	30.00	146.00	3.65
2031-32	Year-14	6.73	15.12	2.24	15.67	0.23	40.00	126.00	20.00	146.00	3.65
2032-33	Year-15	7.97	17.88	2.64	11.35	0.16	40.00	128.00	20.00	148.00	3.70
2033-34	Year-16	8.33	12.77	2.79	16.05	0.06	40.00	125.72	5.70	131.42	3.29
2034-35	Year-17	6.34	10.69	2.24	20.69	0.00	40.00	126.00	0.00	126.00	3.15
2035-36	Year-18	6.34	10.73	2.23	20.67	0.00	40.00	126.00	0.00	126.00	3.15
2036-37	Year-19	6.34	10.72	2.23	20.67	0.00	40.00	126.00	0.00	126.00	3.15
2037-38	Year-20	6.34	10.72	2.23	20.66	0.00	40.00	126.00	0.00	126.00	3.15
2038-39	Year-21	7.63	12.03	2.46	17.91	0.00	40.00	108.00	0.00	108.00	2.70
2039-40	Year-22	7.12	12.38	1.84	18.64	0.00	40.00	127.00	0.00	127.00	3.18
2040-41	Year-23	6.69	12.10	1.79	19.48	0.00	40.00	126.00	1.00	127.00	3.18
2041-42	Year-24	5.17	11.71	1.53	20.59	0.00	40.00	144.00	5.00	149.00	3.73
2042-43	Year-25	5.71	11.28	1.30	21.67	0.00	40.00	143.00	7.00	150.00	3.75
2043-44	Year-26	6.43	10.44	0.92	24.23	0.00	40.00	244.00	5.00	150.00	3.75
2044-45	Year-27	6.44	10.43	0.91	24.22	0.00	40.00	364.00	0.00	364.00	9.10
2045-46	Year-28	6.26	11.36	0.85	23.72	0.00	40.00	168.42	0.00	168.42	4.21
2046-47	Year-29	2.79	9.04	0.78	22.39	0.00	35.00	193.00	0.00	193.00	4.83
2047-48	Year-30	4.79	9.04	0.78	22.39	0.00	35.00	156.00	0.00	176.00	4.40
2048-49	Year-31	3.98	5.68	0.76	21.68	0.00	30.00	125.54	0.00	125.54	4.20
2049-50	Year-32	2.46	4.22	0.65	18.67	0.00	26.00	120.00	0.00	120.00	4.60
2050-51	Year-33	2.80	4.76	0.73	4.71	0.00	12.60	26.14	15.29	41.43	3.33
2051-52	Year-34	2.23	3.72	0.32	2.42	0.00	8.68	24.32	18.68	43.00	3.82
2052-53	Year-35	1.32	2.13	0.13	1.40	0.00	5.00	8.00	24.40	33.00	6.60
2053-54	Year-36	1.32	2.13	0.13	1.40	0.00	5.00	8.60	24.40	33.00	6.60
2054-55	Year-37	1.32	2.13	0.13	1.40	0.00	5.00	8.60	24.40	33.00	6.60
2055-56	Year-38	1.32	2.16	0.13	1.39	0.00	5.00	8.60	24.40	33.00	6.60
2056-57	Year-39	1.32	2.15	0.13	1.40	0.00	5.00	6.20	22.80	29.00	5.80
2057-58	Year-40	1.32	2.16	0.13	1.39	0.00	5.00	8.00	0.00	8.00	1.60
2058-59	Year-41	0.65	0.93	0.08	0.48	0.00	1.63	2.25	0.00	2.25	1.38
	TOTAL	199.84	442.88	44.11	575.16	1.37	1263.36	3881.78	452.55	4334.33	3.43

*Production during initial two years is from previously approved Mining Plans for Belbaha (9.0 Mty) and Lakhanpur (24.0 Mty) mines. Infrastructure for integrated project will be established during this period.

Authorised Signatory

8.4 EQUIPMENT SCHEDULE

All existing equipment of the three projects will continue to work and get replaced by machine of same specification except for dragline. Due to increase in planned coal production, depth, re-handling and consequent increase in stripping ratio compared to present situation, additional coal and OB are to be handled. This additional load of both coal and OB is proposed to be outsourced.

As per assessment of CMPDI, excavation capacity of the three mines to be integrated including one dragline and two surface miners in 2017-18 was 22.24 Mcum. Dragline capacity is mentioned as 0.85 Mcum/yr. Annual capacity of surface miner was derived as 1.52 Mcum. So, annual capacity of all excavators of the three mines is 18.35 Mcum.

Lilari mine is already exhausted and its machines are proposed to work in Belpahar mine. Annual capacity of Belpahar mine is taken as 10.27 Mcum. Annual capacity of running Lakhanpur mine is 8.08 Mcum. Excavators will work in respective mines till 2023-24. Afterwards, Lakhanpur mine is closed and machines will be transferred to Central Quarry with annual departmental capacity of 18.35 mcum.

Departmental equipment will work in Central Quarry up to 2049-50 (Yr-32) and then move to quarry below crossed Lilari nala. Departmental excavators will be deployed in lower sections, surface miners in Ib seam and shovels in partings in-between Ib and Rampur split sections. Where ever the required quantities of coal and OB removal do not match exactly with available capacity, deployment will be spatially separated for complete extraction of any section within a specified boundary. Details are to be worked out by the project authority at the time of preparing tenders for outsourcing on three years interval basis.

There is considerable increase in lead distances in both coal and OB due to wider working area, far away from unloading points of RoM coal or OB to internal dumps. Necessary additional transport equipment have been provided to be procured

General Manager

departmentally. Following table shows year wise average lead distances for coal and overburden.

Table – 8.9
Average Lead Distances for departmental dumpers (km)

Bolpalsa & Central Quarry

Particulars	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6
Overburden	2.00	3.00	2.00	2.50	2.25	2.25
Coal	2.00	2.50	3.00	3.50	4.25	4.50

Lakhanpur Operating Quarry

Particulars	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6
Overburden	5.00	5.25	5.25	5.50	5.50	5.50
Coal	5.00	5.25	5.25	5.00	5.50	5.50

Coal will mostly be cut by surface miner. Coal cut by surface miner will be loaded by front end loaders on to dumpers and brought to reclaim feeders installed at the quarry mouth. Small amount of coal from blasting will be brought to feeder breaker also installed at quarry mouth. 10 Mty of sized coal will be transported on surface by conveyors to the washery and finally dispatched through silo. 20 Mty will be dispatched ROM through ground bunker and two silos. 3.5 Mty will be dispatched to OPGC through dedicated MGR rail. 9.5 Mty will be sold locally. Detailed specifications are given in Chapter-11.

List of major HEMM as existing on given section 8.4 of Chapter-5

The project has been approved in *Partial Outsourcing Variant* where existing major departmental machines will continue to work with its existing strength throughout mine life while additional load of coal and waste will be outsourced through contractual method. Though contractors are given freedom to bring in machine size of their choice, it is recommended to adopt long term contract in view of long mine life, large volume and lower cost of outsourcing. Changes in the contractual terms from above configuration may be informed to appropriate authority.

Life of the project is 41 years from 2018-19. Depth and stripping ratio increases with time. Also, diversion of Lilari nala over backfilled North Quarry and winning coal below diverted Lilari nala area by open cast method are challenging and needs detailed designing. Economic viability of extracting coal at stripping ratio of 4.00 cum/t or more

General Manager
MCL, Lakhanpur Area

from a depth of more than 300m will be reviewed after 20th year considering ground realities. Alternatives of Lilari nala diversion will also be studied.

6.5 DRILLING AND BLASTING

Hard overburden requires drilling and blasting before excavation. Soil and weathered mantle has not been considered for estimation of drilling load and requirement of explosives. Very old OB dumps are also proposed to be loaded without drilling and blasting. Drilling and blasting in unconsolidated OB dump is not advised because drill rods may get stuck in boulders, there may be fly rocks, too much dust may be generated etc. So, a few rock breakers may be procured/hired if required. It is proposed to deploy 250mm dia electric RBH drills in top overburden, parting between IB and Rampur, parting between Rampur Bottom and Top, parting between Rampur and Local and between Local and Lajkura. Parkhani seam is workable only in southern part. So, for most part of the quarry, parting between Lajkura and Parkhani seams is considered as top O.B. Other partings are generally thin and may be drilled by using 160mm drills. In coal for conventional extraction, 160mm dia elect. RBH drills are envisaged.

Total requirement of drills is assessed on 2 shift operation, physical deployment and productivity of drills. The annual productivity of drills adopted is given below.

250mm drills	-	35,000m
160mm drills in O.B.	-	32,000m

The tentative blasting pattern in coal and overburden is given below.

Table-6.12

Description	Unit	Overburden		Coal
Bench height	m	10-15	Upto 10	Upto 10
Blasthole dia	mm	250	160	160
Staking & burden	m	9.0 x 8.0	6.5 x 5	7 x 6

For best fragmentation result with minimum fly rock, inclined holes are recommended.

General Manager
MCL, Lakhanpur Area

Chapter – 9

COAL QUALITY

9.1 GENERAL

In the proposed integrated Lakhanpur-Belpahar-Ulari all the three principal seams of Ib-valley coalfield i.e. Lajkura, Rampur and Ib seams have been proposed to be mined by opencast method. In addition, a local seam and Parkhani seam has also been proposed to be exploited wherever available and mineable.

All the coal seams of Belpahar I, II & III Combined block are highly interbanded. Due to occurrence of dirt band in large numbers, there was difficulty in assigning roof and floor and also the inseam dirt band of above 1 metre in thickness. Normal 1:1 dirt band and coal ratio yielded coal seams at places beyond reasonable limit of overall quality of coal. Some deviation from the prevailing norms were attempted to bring the coal horizons within reasonable quality limit. Thus, few coal bands were left along with the dirt band either on roof, floor or along with inseam dirt band of above 1 meter in thickness.

9.2 DIRT BANDS AND INSITU COAL QUALITY

Dilution and admixture of bands with coal is the main reason for deterioration and slippage of coal quality. So utmost planning is required to deal with the bands occurring within coal seams. Details of dirt bands and their thickness seam wise is given below.

PARKHANI TOP

The maximum thickness of the seam including dirt band is 1.03 meters. The seam is devoid of 1 meter and above thickness of dirt band. The total dirt bands constitute upto 34% of the total seam thickness.

Operation Manager

PARKHANI BOTTOM

The maximum thickness of the seam including dirt band is 1.88 meters. The seam is devoid of more than 1 meter dirt band. The seam is practically devoid of inseam dirt bands which constitute maximum upto 27% of total seam thickness.

LAJKURA

The maximum thickness of the seam including dirt bands is 35.92 meters. The seam is interbanded and contains both combustible and non-combustible dirt bands of less than 1 metre as well as above 1 meter in thickness. The seam is interbanded and contains both combustible and non-combustible dirt bands upto 32% of the total seam thickness.

LOCAL

The maximum thickness of the seam including dirt bands is 6.50 meters. The seam is less interbanded and contains both combustible and non-combustible dirt bands of both less and more than 1 meter thickness. The total dirt bands constitute upto 36% of the total seam thickness.

RAMPUR TOP I

The maximum thickness of the seam including dirt bands is 4.05 meters. The seam is interbanded and contains both combustible and non-combustible dirt bands of less than 1 meter. The seam is devoid of dirt band of more than 1 metre in thickness. The total dirt bands constitute upto 31% of the total seam thickness.

RAMPUR TOP II

The maximum thickness of the seam including dirt band is 5.01 meters. The seam is interbanded and contains both combustible and non-combustible dirt bands of more than 1 meter and less than 1 meter thickness also. The inseam dirt bands of

Authorised
General Manager
(Ex.Mi.Inf. Planning) &
M/s. Lakhanpur Area

more than 1 meter have been developed in patches towards northern parts of the block. The total dirt bands constitute upto 58% of the total seam thickness.

RAMPUR MIDDLE

The maximum thickness of the seam including dirt band is 7.57 meters. The seam is interbanded and contains both combustible and non-combustible dirt bands of more than 1 meter in thickness. The total dirt bands constitute upto 64% of the total seam thickness.

RAMPUR BOTTOM - I

The maximum thickness of the seam including dirt band is 7.97 meters. The seam has more than 1 meter dirt band in isolated patches towards northern and south central parts of the block. The total dirt bands constitute upto 78% of the total seam thickness.

RAMPUR BOTTOM - II

The maximum thickness of the seam including dirt band is 10.32 meters. The seam is highly interbanded and contains both combustible and non-combustible dirt bands of less than 1 meter as well as more than 1 meter in thickness. More than 1 meter inseam dirt bands occur towards northern most and in few isolated patches in the eastern and southern parts of the block. The total dirt bands constitute upto 58% of the total seam thickness.

IB-TOP

The maximum thickness of the seam including dirt band is 8.06 meters. The seam contains inseam dirt bands of more than 1 meter in thickness in 3 boreholes. The total dirt bands constitute upto 63% of the total seam thickness.

IB-BOTTOM

The maximum thickness of the seam including dirt band is 8.60 meters. The seam is devoid of dirt bands of more than 1 meter in thickness. The total dirt bands constitute upto 28% of the total seam thickness.

9.3 COAL QUALITY IMPROVEMENT

For selective mining and to segregate the bands, Surface Miner has been proposed for coal extraction in both the varieties. To maintain and improve the coal quality, following steps are required to be done:

i) The coal seam is thick and has to be worked in a number of benches.

ii) The presence of separable bands in the seam makes the system rigid and complicated. Further, if the bands are not separated and bulk mining is adopted, there will be deterioration in the coal quality.

iii) The OB benches should be kept sufficiently in advance of the coal benches in operation.

iv) Coal top should be kept clean before blasting is done in coal benches.

v) Dirt bands, particularly over 1m thickness shall be mined separately. Auxiliary equipment for this have been provided.

9.4 WASHERY

It has been proposed to wash 10 Mt per annum out of 40 Mty ROM coal before selling. The washed coal will have ash% of around 34% with a washery yield of 74%.

General Manager
M/s. Lakhanpur Area

Chapter – 10

PUMPING & DRAINAGE

10.1 GENERAL

Integrated Belpahar, Lilari, and Lakhanpur mine is being planned for a targeted production of 30 Mty.There are three existing separate mines namely Lakhanpur OCP, Lilari OCP and Belpahar OCP. Out of which Lilari OCP has been exhausted and working continues in rest of the two mines i.e. Lakhanpur OCP and Belpahar OCP. This integrated mine is being planned by combining the three mines to one mine for a production of 40 Mty. There are very few faults having 10-15m throw within the property. The seams and mine workings are so located and being planned that maximal OB disposal can be made with the development lower to seam duly backfilled.

Five faces have been planned for working at a time – South Lajkura seam working, South Rampur seam working, North Lajkura seam working, North Rampur seam working and Central IB seam working. Hence there are five entry points to the mine.

The depth and total exposed area of the mine is increasing gradually. The maximum depth occurs after 32nd year. The life of the mine is 41 years.

10.2 TOPOGRAPHY & DRAINAGE

The area is represented by gently rolling undulating topography with the softer formations like coal seams and shale forming linear depressions and occupied by paddy fields and relatively harder sandstones forming the ridges and knolls. However, as the area has undergone to active opencast coal mining activities the natural original topography of the block has undergone lots of change with the occurrence of opencast quarry pits, overburden dumps, coal stocks, haul roads, colliery infrastructures, running opencast projects office, residential establishments, ancillary townships, roads etc.

Senior Manager
(Env.)
MCL, Lakhanpur Area

The lowest elevation is about 190.00 meters and lies near borehole no. CMIB-067 (RL 192.90 m) in the north-eastern part and the highest elevation is about 252.00 meters and is located in southern part near borehole no. CMIB-310 (RL 250.36 m) (Plate No. IIS Figure No.2).

The Ib River after which the coalfield is named which flows southerly along the western boundary of the coalfield, constitutes the main drainage of the coalfield. The easterly flowing Lilari nala, a tributary of the Ib river, flows across the area in the northern part of the block controls the drainage pattern of the block. In addition to it, a few nalas flow into the Lilari nala. Besides, a number of artificial water logged depressions have been formed by the clay quarries, which were mined by TISCO, in the northern part of the block, abandoned opencast coal mines/pits/benches mined by MCL in and around Belpahar OCP in the eastern, Lakhanpur OCP in the central and Lilari OCP in the northern parts of the block.

10.3 PLANNING OF PUMPING AND DRAINAGE SYSTEM TO BE FOLLOWED DURING EXCAVATION

There exists three separate mine named as Lakhanpur OCP, Lilari OCP and Belpahar OCP. Out of which Lilari OCP has been exhausted and working continues in rest of the two mine i.e. Lakhanpur OCP and Belpahar OCP. This integrated mine is being planned by combining the three mines to one mine for a production of 30 Mty. During initial period when the area of excavation and depth of the mine is less, the existing pumps shall be utilised for pumping at the proposed area of excavation. With further development of the mine the higher capacity of pumps with higher head have been considered. Finally main sump has been planned at suitable two locations one at 0.00 level in IB seam for discharging water at northern end of the mine where as another location shall be at dip most point in Lajkura seam working at southern end of the mine. Also stage pumping is being planned for optimum utilization of the pumps at later stage which were procured earlier. Laying of delivery pipe line is being planned along the border of the mine for discharging water into the garland drains at the surface

General Manager
OC, Jharsuguda
MCL, Lakhanpur Area

10.4 RAINFALL CHARACTERISTICS

Normally the rainfall has been observed in the locality for four months only i.e. from June to September every year. However in other months also rains were observed occasionally. With these observations the mine pumping is being planned for possibility of maximum rainfall in a day during peak period.

The area falls in sub tropical climate. During summer (March–May) the temperature varies from 13.2°C to 40.6°C which even reaches up to 46.9°C during the extreme summer. In winter (December to February) the temperature varies from 7.0°C to 26.4°C (From January 1990 to February 2010).

10.5 HYDROGEOLOGICAL STUDIES

The drainage of the northern part of Belpahar block is controlled by Lilari nullah through a tributary seasonal stream. Whereas in the southern part is drained by directly to Hirakud reservoir. The Lilari stream is a perennial in nature. It is traversing the present and proposed mining area. The Lilari stream needs diversion for proposed incremental production of the projects. This stream is mainly acting as drainage for rainfall run-off of that area.

Lilari stream originates from Chhengapahar reserved forest at an elevation of 397 m above mean sea level near Himgiri railway station towards north west of the project. Another 4th order stream originates near Tangarbhi village at an elevation of 408 m above mean seam level in the Girpahar reserved forest. Both the streams join before Gondola village and elevates the Lilari stream as 5th order magnitude which ultimately joining to river flowing from north to south in the northern part of the block.

The Hydrogeological Unit of CMPDI, Ranchi had conducted the hydrogeological studies in Orient colliery, Ib Valley Coalfield. Further, hydrogeological investigation has been carried out by the Central Ground Water Board (CGWB) for estimation of 'Ground Water Resources and Development Potential' of Jharsuguda district. The salient features of the study are given below to give an idea about the

पर्यावरण एवं
मुख्य प्रबंधक (पर्यावरण)
भा. एल. पं. ली. लि., पं. प. क्षे.

General Manager
ENVT. DEPT., Jagruti Bhawan
MCL, Lakhanpur Area

hydrogeological regime of the sedimentary deposit as the sedimentary deposits are of contemporaneous in origin.

- Sandstone between Lajkura and Parkhani seams form an aquifer with depth ranges between 38 to 150 mbgl. The aquifer is semi-confined to confined in nature.
- Disintegrated formation above Parkhani seam or sandstone formation above Lajkura seam upto the land surface with a semi-pervious layer of limited thickness at a depth of 25 to 30 mbgl is encountered. The nature of aquifer is unconfined.
- The general movement of ground water in the ground water table aquifer is from north-west to south-east direction.
- The ground water level in this area ranges from less than 1.30 m bgl to about 4.12 m bgl in post-monsoon and less than 2.80 to about 7.62 m bgl in pre-monsoon period.
- The water level fluctuation annually varies from 1.04 to 12.05 m in this area.
- The specific yield of the phreatic aquifer is 0.05 or 5%.
- The aquifer characteristics of shallow (unconfined) aquifers are calculated by conducting pumping tests on representative open wells tapping different litho units. The litho unit-wise aquifer characteristics is given below.

Sl. No.	Hydrogeological unit	Specific capacity (lpm/m)	Permeability (m/day)	Yield (m³/day)
1	Talcher sandstone	7.149	0.983	20.56
2.	Barakar sandstone	0.720 - 39.850	0.250 - 8.040	24.20 259.84
3	Kamthi sandstone	3.136 - 6.336	0.517 - 1.165	24.29 934.56

- The hydrogeological data of test wells are summarized in next page.

General Manager
GM, CMPDI, Regional Institute
MCL, Lakhanpur Area

Hydrogeological Data of Test Wells in Rampur Tract of Jhilimili Valley Coalfield

Sl. No.	Location	Well depth (m bgl)	Dia (mm)	Zones tapped	SWL (m bgl)	Discharge (LPS)	Draw down (m)	Duration of pumping (Min)	Transmissivity (m²/day)	Storage coefficient	Remarks
1.	Lajkura Test Well Orient Colliery Field-1	147	365/152	36-53, 66-76, 83-92, 93-103, 115-118, 123-125, 126-136	13.41	9.5	27.250	1800	60	–	Dr. ad b CMPDIL a Valley Coalfield Conductor conducted
2.	Lajkura Dia Well (84.58 m away from Test Well)	142	150	73-77, 85-88, 102-108, 113-116, 130-138	10.56	–	6.375	–	69	–	
3.	Abandoned Air Shaft-1 Test Well	78	5300	30-75	35.50	38.0	22.695	2500	86.79	5.3×10^{-3}	
4.	Abandoned Air Shaft-1 Test Well (2 Nos)	78	5300	30-76	26.51	–	4.700	–	35.96	5.46×10^{-3}	
5.	Lajkura Test Well, Orient Colliery Field-2	60	203/152	45-50, 54-58	32.50	3.3	10.985	4300	–	–	
6.	Lajkura Dia Well (DW-1) 30 m. away from Test Well	66	150	41.5-46, 53.63	32.33	–	1.070	–	61.93	5.0×10^{-3}	
7.	Lajkura Dia Well (DW-2) 80m away from Test Well	68	150	52.0-62, 65.0	32.38	–	0.831	–	114.65	6.0×10^{-4}	
8.	Piezom Test Well	38.3	203	19-24, 26-35	3.69	1.9	25.427	15	0.4	–	

Water balance & management for operating Belpahar OC Expansion Project

(Figures in Mm³/annum)

Inflow			Outflow		
Source	In rainy season	In lean season	Purpose	In rainy season	In lean season
Avg. make-up water in the quarry due to:			Avg. treated mine discharge water for:		
Direct	7.62	0.855	Industrial use and fire fighting	0.178	0.354

Section – 10, Page – 5

Job No: 702192

Mining Plan and Water Balance Plan for Lajkura Belpahar (ex) OCP (Jhilimili Valley), September 2016

General Manager, MCL, Lakhanpur Area

precipitation and seepage from strata and surrounding, etc.			Effort is made to keep the balance water in the lower benches of mine or Lodh tank as rain water harvesting measures. In unusual situations during monsoon, mine discharge water will be allowed to go as recharge/runoff in the same basin of the area.	2.492	3.601
Total:	2.82	0.965		2.82	3.965

Table : Water Balance & Management for operating Lakhanpur OCP Expansion

(Figures in Mn3/annum)

Inflow			Outflow		
Source	In rainy Season	In lean season	Purpose	In rainy season	In lean season
Avg. make-up water in the quarry due to			Avg. treated mine discharge water for		
Direct precipitation and seepage from strata and surrounding, etc.	6.22	2.25	Industrial use and fire fighting	0.305	0.000
			Balance water for watering of plants and recharging the ground water by discharging to the natural drain	5.915	2.250
Total	6.22	2.25		6.22	2.25

10.6 SOURCE OF WATER

The sources of water accumulation inside the quarry area are as under:

i) Rain water falling directly within the excavated area

ii) Inflow of rain water from back filled area

iii) Inflow of rain water from area beyond excavation

iv) Seepage of water from Strata/ Ground water.

10.7 GENERAL CONSIDERATIONS

General criteria for determining the number of pumps, layout and design of the pumping installation are as under:

General Manager
MCL, Lakhanpur Area

- Geographical location of the project.-Belpahari, II & III combined block is situated between the latitude 21°42'12" – 21°47'20" N and longitude 83°46'30" – 83°52'41" E in the district of Jharsuguda, Odisha, covering an area of 42.61 sq. kms.
- The General climatic conditions, surface features of the terrain beyond the boundary of the mine are such as:

i. The topography of the block is represented by small hillocks & flat ground.
ii. The Litari river flows at the northern part of the block where the water shall be discharged.
iii. The minimum and maximum elevations of the area are 220m in east and 234m in north western part respectively above the mean sea level.
iv. Except the short spell of winter, the climate is warm for the most part of the year.
v. Humid conditions prevail for the most part of the year.
vi. Some of the monsoon depressions in July and August cause gusty winds and heavy rains. Dust storms or thundershowers occur during March to June even in monsoon months.

- Life of the mine – 41 years.
- Calendar plan of excavation of quarry – The Calendar plan of the excavation of the quarry are furnished in detail at Chapter VIII of this report.
- Geological characteristics of OB and coal seams – The geological characteristics of OB and coal are furnished in detail at Chapter IV of this report.
- METEOROLOGICAL DATA

Except the short spell of winter, the climate is warm for the most part of the year.

10.5 TEMPERATURE

According to the short term data collected for the period of 1999-2001 (Data Source - DISTRICT STATISTICAL HANDBOOK, JHARSUGUDA) the maximum summer temperature was recorded at 46.40° C in May of 2001 whereas the minimum temperature was recorded at 6.5° C in January of 2000 & 2001.

Also the average maximum and minimum temperature for the same period has been taken to be 38.53° and 15.48° respectively.

Thus it is observed that winter is mild and the climate remains warm for the most part of the year as temperature normally hovers between 35 to 40 degrees. Given below are the tables showing temperature data related to Jharsuguda.

MONTH WISE METEOROLOGICAL DATA (1991)
(Data from Census Atlas, Series-19, Orissa)

Sl. No.	Year	Month	Jharsuguda District
1.	1991	January	19.95
2.		February	24.09
3.		March	28.62
4.		April	32.15
5.		May	35.85
6.		June	31.55
7.		July	29.30
8.		August	27.05
9.		September	28.09
10.		October	26.45
11.		November	22.25
12.		December	19.05
		ANNUAL (Average)	27.17

Also given is the data related to month wise highest and lowest temperature in Jharsuguda district during the years 1999 to 2001.

MONTH WISE HIGHEST AND LOWEST TEMPERATURE (°C)
IN JHARSUGUDA DISTRICT, ORISSA

Sl.No.	Month	JHARSUGUDA CENTRE, ORISSA					
		1999		2000		2001	
		Max.	Min.	Max.	Min.	Max.	Min.
1.	January	31.0	6.5	31.8	6.5	31.0	6.5

2	February	35.2	12.9	36.2	11.8	37.6	9.2
3	March	42.2	15.5	38.8	13.1	39.2	13.2
4	April	45.3	18.6	45.4	21.0	45.6	19.2
5	May	45.4	19.9	44.4	20.4	45.4	20.1
6	June	41.1	19.8	40.4	22.6	41.6	22.2
7	July	36.0	19.8	35.0	23.2	35.7	22.4
8	August	33.7	21.7	34.0	23.9	35.5	23.8
9	September	34.2	21.0	34.7	21.8	37.1	23.5
10	October	34.0	19.0	36.2	17.4	35.7	18.8
11	November	33.4	10.4	33.5	13.5	35.6	14.0
12	December	29.1	8.5	31.7	9.0	33.8	9.0

Source: DISTRICT STATISTICAL HANDBOOK, JHARSUGUDA, ORISSA

10.9 **HUMIDITY**

According to the data collected from Jharsuguda Observatory the humid conditions are found to prevail for the most part of the year. It is as high as 81-85% in the months of July to September at 8.30 hours. Similarly data collected at 17.30 hours show high level of humidity from June to October every year.

10.10 **CLOUDS**

During monsoon period i.e. June to September the skies are generally heavily clouded. Skies are generally clear or lightly clouded during the rest of the year.

10.11 **SPECIAL WEATHER FEATURES**

Some of the monsoon depressions in July and August cause gusty winds and heavy rains. Dust storms or thunderstorms occur during March to June even in monsoon months.

- **CATCHMENTS AREAS**

For computation of catchment area, the following parameters have been considered:

- Total excavated area of the mine
- Area beyond excavation - (Considered as 5% of the total excavated area)
- Interna! Dump area which has the level above the surface level

- **DEPTH OF THE QUARRY**

General Manager

For computation of pump capacity and subsequently power requirement for pumping operation, the depths considered are elaborated in subsequent paragraphs.

- **RUN-OFF CHARACTERISTICS OF THE AREA**

The contour plan of the area shows the hill area toward the North West direction and thus the run off characteristics will trend towards north direction of the block i.e. towards Lilari river.

- **INFLOW/SEEPAGE FROM UNDERGROUND WATER INTO THE MINE**

The Inflow/seepage from underground has been considered 20% of the water accumulated within the quarry on the day of maximum rainfall.

- **SUMP LOCATION AND ITS CAPACITY**

The capacity of the temporary sump location from year-1 to year-5 is 15000 to 30000 m^3 and from year-10 to 15 it has been proposed to 50000 m^3. Again 15th year onwards it shall be 100000 cum. The temporary sump location has been proposed at dip side of the then quarry as far as possible. The sump location will permanently be fixed in 33rd year with 100000 m^3 capacity.

- The Maximum number of days to pump out the accumulated water in the quarry due to maximum rainfall in a day is considered at 5 and the number of pumping operation is considered at 16 hours per day.
- Stand-by capacity required-The stand-by capacity is 20% of total pumping requirement.
- Size of pipes, piping layout, etc. – Size of pipes has been selected depending upon the capacity of pump. The layout of pipes has been planned along the border of the mine.
- pH value of water-The water is neither acidic nor basic. pH value of water in the locality has been considered as neutral. Detail of the has been narrated in Chapter XVI of this report.
- Desired location of surface where quarry water can be discharged considering the surface drainage system- The desired location is

General Manager
जी.एम. (खदान)
चां. एरिया
Dy. G.M. (Mines)
Chapdi Area

discharging the water to surface has been considered towards North of the quarry. The dip of the quarry shall be from East to West. Also another discharged location shall be at south west side to finally discharged at Ltari river through garland drains. But the most suitable discharging point of pumped water is the northern part of the quarry.

- Protective Embankment against Floods

An Embankment of 3m height will be needed for flood protection & inflow of surface water into the mine. It will have batters of 1:1 on mine side and 1:3 on other side. It will be 3 meters wide at top. The embankment will protect the mine from backflow flooding. It does not need be constructed in the development phase of the mine. Rather it should be viewed as an additional out of pit dump area to be constructed from mine waste.

10.12 BASIC DATA

The basic data considered for calculating make of water and pumping capacity are as under:

i. Life of the quarry – 41 years

ii. Maximum rainfall in a day – The maximum rainfall in a day has been derived from the probability curves.

iii. Depth of operation – Existing working -existing mine-wise

YEAR	Existing Status			3rd Year		
	Ltari	Lakhanpur	Belpahar	Ltari	Lakhanpur	Belpahar
Mine depth (m)	90	150	110	90	180	120

Mine depth (m)	S.Lajkura Seam	S. Rampur Seam	N. Lajkura Seam	N. Rampur Seam	Central IB Seam
5th yr.	105	155	85	105	130
10th yr.	160	225	125	160	180
15th yr.	160	300	140	180	205
20th yr.	160	300	160	200	300

iv) Catchment areas – stage wise

	Total excavation area (Hec.)	Internal dump area (Hec.)	Area beyond excav. (Hec.)	Total catchment area (Hec.)
Existing				
Lakhanpur	610.37	153.00	30.52	457.89
Belpahar	305.81	92.50	15.29	229.10
Lilari	53.58	10.00	03.18	46.76
5th yr.				
Lakhanpur	667.00	200.00	33.35	500.35
Belpahar	775.15	232.50	19.00	561.65
Lilari	63.08	19.00	03.59	48.16
10th yr.				
S. Lajkura	506.65	230.00	25.33	301.98
S. Rampur	132.52	53.05	6.63	85.20
N. Lajkura	57.02	-	2.85	59.87
N. Rampur	57.02	-	2.85	59.87
Central IB	1396.30	418.59	69.77	1046.48
15th yr.				
S. Lajkura	506.65	152.00	25.33	379.98
S. Rampur	212.54	63.76	10.63	159.41
N. Lajkura	57.02		2.85	59.87
N. Rampur	57.02		2.85	59.87
Central IB	1644.79	563.44	82.24	1363.99
20th yr.				
S. Lajkura	506.65	152.00	25.33	379.98
S. Rampur	254.87	76.46	12.73	191.14
N. Lajkura	57.02	-	2.85	59.87
N. Rampur	57.02	-	2.85	59.87
Central IB	2124.12	637.24	106.21	1592.13
25th yr.				
S. Lajkura	506.65	152.00	25.33	379.98
S. Rampur	324.32	97.30	16.22	243.24
N. Lajkura	57.02	-	2.85	59.87
N. Rampur	57.02	-	2.85	59.87
Central IB	2872.16	861.65	143.61	2154.12

v. Run off coefficients considered are as follows:

a. For total excavated area 0.9

b. For area beyond excavation 0.7

c. For internal dump area 0.4

vi. Seepage/inflow of water into the mine

Seepage or inflow of water into the mine has been taken as 20% of the total accumulated water due to rainfall in a day. It is to be added to the total make of water due to direct rainfall.

vii. Time required to dewater the accumulated water etc.

The Maximum number of days to pump out the accumulated water in the quarry due to maximum rainfall in a day is considered at 5 and the number of pumping operation is considered at 16 hours per day.

10.13 ASSESSMENT OF MAXIMUM RAINFALL IN A DAY

RAINFALL

The rainfal data in Jharsuguda district are available for fairly long period (1968-2006). A study of this data shows high inconsistency in the pattern of rainfall. Years of excess rainfall or severe draught keep on occurring between years with normal rainfall. At times the disparity between rains in consecutive years is so great that they may easily lead us to erroneous conclusions when taking average values.

The annual and month wise average rainfall for the entire area of Jharsuguda and Sundargarh have been derived based on data supplied by IMD Jharsuguda (Refer Tables 1&2)

MONTHLY TOTAL RAINFALL (MM) AT JHARSUGUDA (TABLE-1)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1966	0	0	0	29.7	60.2	137.7	459.2	414	177.3	72.2	4.7	0.6	1356
1970	5.6	11	23.6	3.7	12.6	320.1	380.2	226.3	220.5	0.8			1205.9
1971				69.5	42	308.6	397.8	646.2	62.1	39.6	0	0	1662.3
1972	0	4.3	5.6	29.7	4.1	152.6	325.1	260.6	149.8	38.3	25.6	0	1035.5
1973	6.3	6.2	14.3	1.4	31	288.6	376.3	666.6	470.4	37.1	16	0	1960.8
1974								215	23.9	25.5	0	0.2	257.3
1975	15.6	2	12.3	—	5.6	97.1	256.7	626.2	149.4	108.1	0	0	1175.1
1976	0	7.6	0	3.1	21.9	46.7	183.4	276.7	175.2	2	3.3	4.5	827.3
1977							376	320.1			0.6	1.2	706.9
1978	0				4.1	148	217.1	166	0	0.2		15.1	574.1
1982	15.6	8.2	13.6	0	53.2	468.2	326.5	268.6					1151.8
1981		0	19.6	40.4	73.4	118.2	249.6	162	133	1.2	0	0.4	806.3
1982	28	28.6	58.7	26	11	178	196.7	628.2	115.2	25.7	0	1.8	1280.6
1983	0	12.6	8.7	31.8	37.5	96.4	182.7	346.2	472.7	19	0	25.4	1169.2
1984	32.6	12.6	0	4.8	34.3	258.7	244.4	268.6	30.7	101	0	0	970.5
1985	25.1	18.6	0	0	54.8	123.2	177.7	316.1	142.7	29.1	0	0	786.6
1986	0	72.6	38.7	4.6	56.5	438.6	436.6	326.3	79	126.2	11	33.6	1636.9
1987	14.1	19.4	13.3	10	51.9	116.6	504.7	135	176.6	48.3	21.6	8.3	1158.8
1988	0	92.7	18	32.5	53.9	247.6	180.6	466.7	151.6	9.7	0	0	1257.7
1989	0	0	0	0	5.4	210	274.5	451.5	286.8	17.8	0	15.6	1244.6
1990	0	9.6	15.6	26.6	162.6	299.1	326.1	114.7	199.5	103.3	31	66.7	1284.3
1991	43.7	0	0	6.2	17.5	69.3	252.1	630.7	223	70.6	32.6	12.3	1371.2
1992	0	0	0	0.6	2.2	0.6	5.3	7.7	11	0	0	0	22.6

MONTHLY TOTAL RAINFALL (MM) AT JHARSUGUDA (TABLE-I)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1993	0	7.1	5.6	16.0	60.4	223.2	432.6	216.5	290.3	79.3	0	0	1330.5
1994	12	2.6	0	0	72.5	305.9	361.5	466.7	231.1	74.3	28.1	0	2041.6
1995	46.1	16	16.1	17.1	49.4	66.6	461.9	361.2	268.8	100.4	77.9	0.2	1824.7
1996	6.3	11.8	11	4.5	33.4	337.1	461.2	224.5	139.9	14.8	0	0	1143.9
1997	0	0	0	0	0	156	307	553	435	-	82	126	1661
1998	118	0	20	7	51	330	339	196	621	44	37	-	1563
1999	0	0	0	0	52	136	280	630	270	14	-	-	1430
2000	0	20	0	0	64	132	136	147	130	11	-	-	659
2001	0	0	37	32	19	197	783	533	141	75	-	-	1796
2002	32	0	13	11	27	215	386	372	184	78	-	-	1172
2003	0	20	7	10	19	223	313	390	360	234	-	23	1676
2004	11	7	0	0	9	154	342	428	54	102	0.03	-	1105.03
2005	44	4	7	0	16	112	422	271	161	64	2	53	1156
2006	0	0	31	15	70	125	248	305	53	12	2	-	884
2007	0	75.1	0.3	28.7	39.2	309	460.9	454.2	328.7	89.6	51.8	0	1736.8
2008	36.4	16	12	19.3	28.1	332.2	525.4	360.5	435	64.4	0	0	3866.3
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2009	0	0	0.2	6	35.2	87.2	612.9	251.1	90	157.6	7	0	1238.4
2010	1.8	3.5	0	0.1	11.2	216.6	365.8	269.3	97.6	20	7.2	35.5	972.6
AVG	12.6	10.3	10.6	10.8	38.0	190.6	342.3	340.5	195.5	56.9	12.8	13.6	1351.4

Note : Average annual is based on average monthly rainfall.

A study of table-1 reveals that it can be observed that in the year 1992 annual total rainfall was 97.5% less than normal rains leading to severe drought conditions, whereas in the year 1994, rainfall was 90% more than normal rainfall.

Thus, we see that rainfall pattern shows diversity not only over a period of time but also within close proximity of area. For example, if 1991 is a year of excess rains in Jharsuguda.

However attempt has been made to integrate the analysis of the whole as well as specific areas to arrive at a reasonably accurate climatological assessment necessary to undertake Water Management for the project.

Some other salient features of the rainfall data at Jharsuguda Observatory are:

i. The main rainy months are June to September when about 88.5% of the annual rainfall occurs. During the post monsoon period from October to November, about 4.7% of the annual rainfall occurs due to depressions over the Bay of Bengal.

ii. The average annual rainfall (1951 – 1980) is 1490.9 mm and the average number of rainy days in a year is 68.7.

iii. The variation of rainfall from year to year basis is very large. The highest annual rainfall amounting to 181.56 percent (2656.6 mm) of the normal was recorded in 1961. The lowest annual rainfall of 991.8 mm (61.62% of normal) was recorded in the year 1979.

iv. The heaviest rainfall in 24 hours amounting to 257.8 mm occurred on 20th August 1975.

v. The highest monthly rainfall (wettest month) amounting to 770.7 mm was recorded in the month of 05th July 1961.

vi. Season-wise rainfall distribution pattern is as below.

Season (month)	Mean R.F (mm)	%of Total R.F.	Mean Rainy days	%of Total Rainy days
Winter (Nov – Feb)	38.2	2.6	3.3	4.8
Pre-monsoon (March – May)	84.7	4.1	5.4	7.9
Monsoon (June –Sep)	1293.0	86.8	56.0	81.5
Post monsoon (Oct)	69.0	4.6	4.0	5.8
Annual Total	1490.9	100.0	68.7	100.0

General Manager
M/S. Laxmanpur Area

Based on these observed climatic conditions, 30% of the monthly rainfall has been assumed as the maximum rainfall in a day of 24 hours.

On this basis probability of maximum rainfall in a day has been derived for the purpose of calculating the mine pumping requirement.

Based on this, a probability curve has been derived to determine probability (P) of precipitation of maximum daily rainfall over the years for calculating the pumping requirement for smooth mine operation.

10.14 PROBABILITY CURVE

Based on the data available, the resultant rainfall frequency curve signifies only a segment of curve required for covering the project life. This curve is theoretically extended by calculations.

The probability of occurrence of daily maximum rainfall has been calculated by an expression: $P\% = [(N-0.3) / (M+0.4)]*100$

The probability for the entire series has been calculated in the similar way and tabulated for Jharsuguda and Sundargarh regions (Ref. Table-3 & table-4).

The following steps are involved.

The arithmetic mean (h_{av}) of the daily maximum rainfall has been calculated by dividing the summation of maximum daily rainfall to no of observations and has been worked out to 128.75mm for Jharsuguda area & 135.93 mm for Sundargarh area.

The Modal co-efficient (K) for each year has been calculated on the basis of assumptions made above and the values of K & $(K-1)^2$ are tabulated accordingly.

SAME ALL PROBABILITY OR ACTUAL OBSERVATION for JHARSUGUDA TABLE 2.1

Sl. NO OF OBSER-VATIONS	YEAR	MONTH	MAX MONTHLY RF in mm	MAX DAILY RF IN mm in	PROBABILITY(P) =(M-0.33)/(N+0.6)	MODAL COEFF (Cm) k_m	K_m	$(K_m)^2$
1	1984	July	861.6	291.42	1.69	1.08	0.99	0.98
2	2001	July	733	234.6	4.11	1.0	0.91	0.83
3	1981	Aug	625.7	186.21	6.82	1.43	0.86	0.73
4	1988	Aug	609.2	186.38	9.54	1.43	0.85	0.72
5	2009	July	610.8	182.21	11.26	1.41	0.84	0.71
6	1998	Aug	608	180	13.77	1.39	0.83	0.69
7	1987	July	594.7	178.41	16.18	1.38	0.82	0.68
8	1977	Aug	556.8	176.34	18.83	1.37	0.8	0.64
9	1997	Aug	554	169.8	21.51	1.33	0.78	0.61
10	1971	Aug	548.2	163.56	23.43	1.26	0.75	0.57
11	1978	Aug	528.2	157.86	26.89	1.22	0.72	0.52
12	2008	July	525.8	157.62	28.28	1.21	0.71	0.51
13	1998	Sep	521	156.3	30.89	1.20	0.69	0.48
14	1993	Dec	472.1	151.61	33.33	1.09	0.64	0.41
15	1988	Aug	468.7	143.99	35.51	1.08	0.63	0.4
16	1996	July	467.2	138.96	37.93	1.01	0.61	0.38
17	1989	July	458.2	137.46	40.34	1.06	0.59	0.35
18	1983	June	448.2	134.46	42.75	1.03	0.59	0.35
19	1982	July	441.2	132.36	45.17	1.04	0.54	0.29
20	1993	Aug	437.2	131.16	47.58	1.04	0.53	0.28
21	1980	June	434.4	130.32	50.32	1.01	0.51	0.26
22	1994	July	432.6	129.78	52.32	1.08	0.52	0.27
23	2001	Aug	426	127.8	54.53	3.56	0.51	0.26
24	2001	July	420	126.6	57.25	3.68	0.52	0.27
25	2001	July	414.2	124.26	58.68	3.76	-0.54	0.29
26	1990	July	383.2	115.296	62.08	3.08	0.12	0.01
27	2002	Aug	380	114	64.49	1.68	-0.12	0.01
28	1976	Aug	379.2	113.81	66.87	0.68	-0.12	0.01
29	1977	June	376	112.8	69.22	0.67	-0.13	0.02
30	1972	July	366.1	97.83	71.34	0.75	-0.25	0.06
31	1996	July	354.1	97.33	74.15	0.75	-0.25	0.06
32	2002	Aug	312	93.6	76.47	0.72	-0.28	0.08
33	2009	Aug	308	92.4	79.09	0.71	-0.29	0.08
34	2015	July	306.8	92.04	81.49	0.70	-0.3	0.09
35	1981	July	299.8	89.94	83.82	0.69	-0.31	0.09
36	1991	July	298.8	89.64	86.23	0.69	-0.31	0.09
37	1978	July	277.7	83.13	88.65	0.70	-0.3	0.09
38	1998	Aug	218.1	64.23	91.06	0.50	-0.50	0.25
39	1994	Aug	214	64.2	93.46	0.50	-0.50	0.25
40	2000	Sep	113	61	95.88	0.50	-0.51	0.26
41	1992	Dec	11	3.3	98.31	0.53	-0.47	0.22
Average Daily rainfall in mm				126.70				

based on modal co-efficient, a variation ratio (C_v) and asymmetrical ratio (C_s) are calculated by expression:

$C_v = [(K-1)^2/(N-1)]^{1/2}$ and $C_s = 3C_v$

The values of C_v and C_s have been calculated to be 0.908 and 2.7 for Jharsuguda and 0.586 and 1.8 for Sundargarh.

Chief Manager
(Mining)
MCL, Lakhanpur Area

a. Function asymmetrical ratio for calculated Cs and different probabilities has been taken from the Ribkin Chart.

b. Mean standard Ms is calculated by multiplying variation co-efficient (C_v) by function of asymmetrical ratio

$Ms = \phi \times C_v = f(C_s) \times C_v$

c. Theoretical max. daily rainfall at different probabilities is calculated by the expression (Refer Table-5 & 6):

$r = r_{av} (Ms+1)$

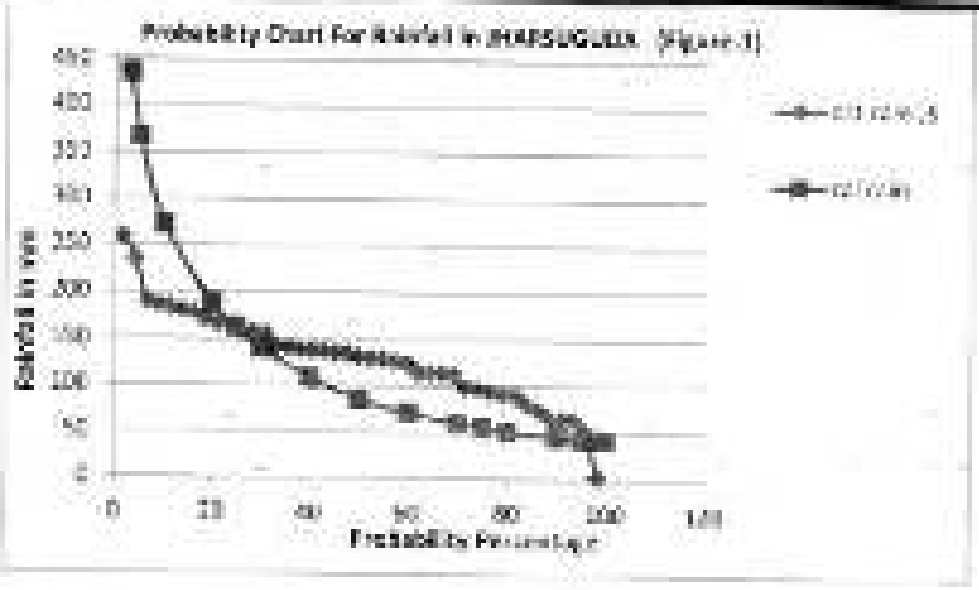
CACULATED RAINFALL (r) for JHARSUGUDA (TABLE-5)

PROBABILITY %	f(CS)	Ms=f(Cs)xCv	Ka=Ms+1	r=Kaxrav
0.01				
0.05				
0.1	6.68	6.23	7.23	926.35
1	3.91	3.69	4.69	600.82
2	2.8	2.35	3.35	429.21
5	2.01	1.83	2.83	365.67
10	1.21	1.10	2.10	272.37
20	0.49	0.45	1.45	187.90
25	0.28	0.25	1.25	162.75
30	0.08	0.07	1.07	139.18
40	-0.16	-0.16	0.84	108.53
50	-0.36	-0.35	0.65	84.56
60	-0.5	-0.47	0.53	70.61
70	-0.6	-0.55	0.45	58.69
75	-0.63	-0.57	0.43	55.49
80	-0.67	-0.61	0.39	50.77
90	-0.72	-0.65	0.35	44.88
95	-0.74	-0.67	0.33	42.52
97	-0.73	-0.66	0.34	43.70
99	-0.74	-0.67	0.33	42.52
99.9	-0.74	-0.67	0.33	42.52

The data of theoretical rainfall are plotted against probability on a probability graph to obtain theoretical frequency curve.

d. On the same probability graph the frequency curve obtained from actual observation of rain pattern is also plotted. (Refer Figures 1).

General Manager
MCL, Lajkura Belpahar Area



Depending upon the life of the project, rainfall is calculated by the expression % Probability = (1/life of project) x 100, which comes to 2.04% as the life of project is 49 years.

The maximum daily rainfall to occur for this probability is determined from the probability curves and comes to 436.21mm approx. for Jharsuguda.

A look at the probability curves for the two places shows us that the max. daily rainfalls thus determined are purely hypothetical as they are quite out of range from the actual observed rainfall data. Also as stated earlier the heaviest rainfall in 24 hours has amounting to 257.8 mm occurred on 26th August 1975.

So for calculating pumping requirements, a reasonable max daily rainfall has been arrived at by studying the probability curves.

We find that in Figure 1, the actual rainfall is 170.04mm at 19% probability and is more or less matched by hypothetical rainfall figure of 187.58 mm at 20% probability.

Thus based on study of rainfall data and observation of inconsistencies prevailing, rainfall calculated at 20% probability has been decided to be taken as parameter to base calculation of pumping requirement.

General Manager

Maximum daily rainfall for 25% probability has been worked out 162.75mm for Jharsuguda in a day (Refer Table-5).

Hence170 mm has been taken as the maximum likely rainfall to occur in a period of 24 hours.

10.15 ASSESSMENT OF VOLUME OF WATER TO BE PUMPED

Based on continuous rainfall of 170mm (As obtained from Probability Chart) covered in 24 hours, the make of water has been assessed. A sump capacity of 15000 m^3 during initial mining operation and 50000 m^3 in the intermediate stage and one lakh cum at advanced stage has been considered for storage of water for calculation of pumping requirement. Backfilling has been considered for reducing the exposed surface area as well as reducing pumping capacity described in Table-II above. Five days with 15 hrs in a day pumping time has been envisaged to dewater the backlog due to heavy downpour as stipulated above keeping the sump full.

The make of water, pumping capacity and main pumps requirement for different stages of mine operation is given in Table 7.

The external dump area has not been considered in the area beyond excavation because gradient of dump should be opposite of the quarry. Mined out area will include areas of working benches also.

cmpdi

MCL

TABLE-7

PARTICULARS	10th year	15th year	20th year	25th year	30th year
Surface Area of the mine (Ha)	2,003.68	2,626.55	2,878.39	3,253.10	3,625.71
Internal dumped area (Ha)	467.29	1,120.08	1,236.21	1,410.64	1,606.54
Area beyond lease (Ha)	101.19	121.43	142.32	162.66	181.20
Mine depth (m)	165	190	215	240	262
Maximum daily rainfall (m)	0.17	0.17	0.17	0.17	0.17
Max.water accumulated in catchment area (in m^3)					
Q = ((A1-A3) x h x . 9) +A2xhx 7+ A3xh x.25 =	2306092	2943425	3309078	3812043	3999016
Considering 20% seepage from strata Q1 = 1.2Q	2771186	3532614	3970894	4334456	4787131
Sump capacity planned for water storage	10000	15000	15000	19000	19000
Make of water for pumping	2756186	3517614	3955894	4315456	4772131
Qty. of water to be pumped / day = Q1/W = Considering water accumulated in one day shall be pumped in 5 days	551237	703523	791179	863091	954426
Qty. of water to be pumped / min (m^3/min) = pump running as 18 hours a day	510.40	650.55	710.35	799.93	883.73
Qty of water to be pumped in LPS =	8508.45	10846.35	11841.55	13334.22	14731.78
W= no. of pumping days to dry the sump					
(For monsoon period (W = 5)	510.40	650.55	710.35	799.93	883.73
Working hours per day =18					

10.16 PUMPING CAPACITY

Based on the above calculations, the pumping capacity has been assessed with maximum rainfall in a day to be dewatered in 5 days with 18 working hours in a day. The year wise requirement of pumping capacity is also given in the above table.

10.17 SELECTION OF PUMPS

This integrated project report is being formulated by combining three existing opencast mines, say; Lakhanpur OCP, Belpahar OCP, and Liban OCP. Hence there exist a formidable no of pumps that shall be utilized for this Imagrated OCP. The detail of existing pumps are listed as under:

S N	PUMP PARTICULARS	UNIT	QTY
1	Centrifugal pump cap-180 lps , head-120 m , power-295 kw with 3.3 KV electricals	No	10
2	Centrifugal pump cap-150lps, head-150 m , power-370 kw with electricals , 3.3 KV	No	12
3	Centrifugal pump cap-120lps, head-60 m , power- 90 kw with electricals , 415 V	No	8
4	Centrifugal pump cap-80lps, head-90 m , power- 110 kw with electricals , 415V	No	8
5	Centrifugal pump cap-35lps, head-130 m , power-90 kw with 415V electricals	No	10
6	Centrifugal pump cap-30 lps, head-35 m , power-18.5 kw with 415V electricals	No	2
7	Centrifugal pump cap-70 lps, head-27 m , power-26 kw with 415V electricals	No	4
8	Centrifugal face pump cap-20 lps, head-40 m, power-15kw with electricals 415 V	No	20

In addition to the above the pumps provided for the Integrated Project are detailed as under:

General Manager
जी.एम. (लाखनपुर क्षेत्र)
MCL, Lakhanpur Area

FACE PUMPS

Water stagnated on the haul roads, near the working faces and from undesirable water pockets, will be handled by face pumps to discharge into the main sumps. The specification of the face pumps is as follows:

Discharge	20lps (1.17 m3 /minute)
Head	40 m
Power	15 kW
Voltage	415 V
Population	4

- **INITIAL STAGE PUMPS**

Since this is expansion of the existing mines, the existing pumps shall be utilised for initial stage pumping. Hence no new provision for such pumps has been envisaged.

- **INTERMEDIATE STAGE PUMPS**

After a few years of integrated mine operation when depth has been increased considerably, the pumps of the following specification will be required. These pumps shall also be used to dewater the unexpected water pockets in different stage of working in later stage. Also they shall be utilized in late stage from dip side of the mine to main sump which shall be developed on 20th year of working. Thus the optimum utilization of these intermediate pumps can be achieved.

Their specification is as follows:

Discharge	180 lps (10.80 m^3 /minute)
Head	200 m
Power	500 kW
Voltage	6.6 V
Population	30 (25+5)

- **MAIN PUMPS**

Main pumps have been envisaged to discharge water directly to the surface from the main sump located at dip most point of the mine. The peak pumping requirement for the quarry has been assessed based upon the calculation at different level of mine operation indicated in Table above.

For the entire project, 2 no of main pumping stations have been envisaged. One is located at South Lajkura seam at dip most point whereas the other is located at Central B seam at zero level.

In the 2nd case, the dip most level for B seam is (-)40m from where the stage pumping from earlier envisaged pumps shall be utilized.

For the Southern part pumping station, the specification of pumps (Vertical Turbine) deployed are as under

Discharge	500lps (28.30 cum/min)
Head	200 m
Power	2000 kW
Voltage	6.6 kV
Population	(5+2)6 working, 2 standby

Further for the B seam to discharge water at the Northern part of the quarry, the specification of the main pumps (Vertical Turbine) deployed are as under

Discharge	2000lps (120.00 cum/min)
Head	350 m
Power	8500 kW
Voltage	6.6 kV
Population	(6+1) 6working, 1 standby

General Manager
MCL, Lajkura Area

The quarry shall have a main sump which will be located at suitable location at a depth of approximately 300m for Central IB seam whereas 150 m for South Lajkura seam. This shall be achieved on 10th year for South Lajkura seam and on 30th year for Central IB seam at suitable place. The installed main pumps shall discharge water to the surface for the entire life of the mine. The auxiliary pumps as well as low head pumps envisaged earlier will be utilized to collect water from the temporary sumps/ water pockets at lower/higher levels, to be discharged to the main sump/ directly to surface.

- **OTHER PUMPS**

During rainfall, the water inflow into the sump contains clay & silt as well. To handle slurry water for sump clearing and dewatering of other undesirable pockets, the slurry water pumps have been provided.

The specification of the slurry pump is as under:

Discharge	70lps (4.20 m³/minute)
Head	84 m
Power	75 kW
Voltage	415 V
Population	5 (as and when required)
And	
Discharge	2.5lps
Head	40 m
Power	37 kW
Voltage	415 V
Population	6 (as and when required)

In addition to above mentioned pumps, adequate number of diesel pumps have also been envisaged. The specification of diesel pump shall be as under:

Discharge	40lps
Head	100 m
Population	4 (as and when required)

General Manager
MCL, Lakhanpur Area

10.18 PUMP-MOTOR SPECIFICATION

The main pump shall be of vertical turbine type of required discharge capacity and discharge head.

Its bowl shall be made of close- grained cast iron. It shall house bronze bowl bearing, S.S.impeller shaft and impeller and hydraulically profiled guide vanes for higher efficiency.

The impeller shall be close-grained cast iron or bronze, single suction, enclosed or semi-enclosed type. They shall be dynamically balanced, clamped by draw-out type collet and locknut to stainless steel shaft.

The discharge case shall be made of close-grained cast iron. It shall house bronze bearing. Guided water shall flow into column assembly. The discharge case in oil lubricated turbine pumps has intermediate bearing, lantern ring, asbestos- plated yarn steel (gland packing) and discharge case bearing for line shaft tube. This prevents water from entering the line shaft tube as the high pressure water is bypassed through relief ports in the lantern ring.

The suction case is made of closed-grained cast iron and houses bronze bearing and sand collar which prevents sand into suction case bearing. Water is guided into the eye of the lowest impeller.

Casing pipe line shaft tube is made of steel concentrically threaded for line shaft bronze bearings provided at intervals of 1.5 m.

Column pipe is made of steel and concentrically threaded as per Indian IS.

The auxiliary pump shall be of multistage, centrifugal type of required discharge capacity and discharge head.

General Manager
एल.जी.एम. (तकनीकी) सेवा
MCL, Lakhanpur Area

The impeller shall be made from close grained CI iron of Grade 20 conforming BIS 210 (current). The impeller shall be of enclosed type. The rotating elements shall be statically and dynamically balanced. Hydraulic balance shall be achieved by balancing ring and balancing disc depending upon the required discharge and head.

The casing shall be free from blow holes, and shall be of diffuser type. The delivery flanges shall be vertical whereas the suction flange shall be oriented left, right or vertical viewed from driving end. There shall be smooth hydraulic passages to ensure better efficiency.

The bearing housing shall be provided with effective sealing arrangement against the entrance of water or dust. A drain plug shall be provided below the housing. Grease cups shall be provided for lubrication. Proper sealing arrangement comprising of stuffing boxes fitted with suitable packing material shall be provided to prevent leakage within the casing. The sealing arrangement shall be such that replacement of packing material does not require dismantling of any other parts except glands. Suitable antifriction bearings with proper lubrication arrangement shall be provided for support of impeller shaft. The high tensile steel shaft shall be provided with accurately machined and ground shaft be supported on journal bearing on both side of the impeller. Shaft in stuffing box areas shall be protected by shaft sleeves.

Required flanges for connecting the inlet/outlet pipe, priming funnel shall be provided. Suitable arrangement shall be provided for balancing of hydraulic thrust. The pump shall be of energy efficient and suitable to operate at maximum efficiency at the head variation of ± 20% of rated head.

The motor shall be suitably rated to meet the requirements and shall conform to IS 325 (current). The motor shall be horizontal, foot mounted, squirrel cage induction type, TEFC, non-flame proof, IP54 protection, S1-continues duty, class 'F' insulation suitable for DOL starting, continuously rated, 1500 RPM (synchronous speed), suitable for operation on 415 V, 3 phase, 50 Hz supply for the pumps below 160 kW (with star-

General Manager
(P), Lucknow

3 phase, 50 Hz supply for the pumps above 100 kW. The cable end boxes shall be suitable for 3 core PVCSWA cables of copper conductors of suitable size.

The motor shall be capable to deliver rated output with

The terminal voltage differing from its rated value by not more than ±5% or
The frequency differing from its rated value by not more than ±3% or

Provision for earthing of motor shall be as per IS 3043 (current) and relevant IE rules. Minimum 2 points shall be provided. The limit of vibrations shall be as per IS 4729 (current).

COUPLING

The motor and pump shall be coupled by means of a bush type flexible coupling having transmitting capacity of 1.25 times the motor rating. The coupling shall absorb the misalignments due to parallel, angular and axial loads. A coupling guard made of expanded metal shall be provided. Coupling by V belts is not acceptable.

STARTER

Push button type start / stop switch shall be provided at pump for starting and stopping in case of emergency. Normally the pump will receive power from MCC.

BED FRAME

The base frame shall be fabricated form MS structural steel. The pump and motor shall be properly aligned in the works and proper erection marks and dowel pins shall be provided. Proper lifting lugs shall be provided.

i. The motor shall stop if the level of water in the sump falls below a predetermined level for which floats may be used.

10.19 DELIVERY RANGE

The delivery ranges of the pumps have been based on the capacity of the pumps.

- **AUXILIARY & DIESEL PUMPS& SLURRY PUMPS**

For low capacity pumps of capacity 5lps and diesel pumps of capacity 20lpsand slurry pumps of capacity 16lps 150mm dia GI pipe has been considered. Adequate length of 150mm GI pipe has been provided.

For medium capacity pumps of capacity 180lps 324mm dia ERW pipe has been considered. Adequate length of such pipe has been provided.

- **FACE PUMPS**

For face pump of capacity 20 lps, 100mmdia GI pipe has been envisaged.

- **MAIN PUMPS**

Pipe sizes has been envisaged with respect to the capacity of the pumps to ensure the energy conservation as well as maximum pumping efficiency of pump operation.

For main pumps of capacity 500lps, ERW pipes of outside dia 630mm and minimum 60 mm wall thickness has been considered. For main pumps of capacity 2000lps, ERW pipes of outside dia 1400mm and minimum 140 mm wall thickness has been considered. In addition for intermediate existing pumps the existence of pipes has been considered. For lower capacity pumps of capacity up to 50lps, GI pipes of 150dia have been considered. Pipe length has been assessed to be laid through bunker during the life of the mine thus reducing the length of the pipe considerably.

10.20 DELIVERY RANGE SPECIFICATION

The GI pipes of 100mm dia and 150mm dia shall be of Galvanized M.S. conforming to IS 1239 (current) and ERW Pipes of 324mm / 219mm /630mm / 1400mm outside dia shall be conforming to IS 3589 (current). The dia. of the pipe shall be suitable for carrying the required quantity of water with a velocity within the limits of laminar flow (1.5 to 2 m/sec) and the pipe frictional losses shall be as low as possible. The inside wall of the pipes shall be well finished to reduce the frictional losses.

The pipes shall have suitable threads at the ends for joining the pipes with couplers. However, in case of necessity flanges shall be welded at site for joining. The flange dia. shall be as per IS and shall have required holes for connection. Proper gaskets will be provided at flange connection to avoid any leakage. Pressure filters may be provided in the out let of the pump discharge. The pipes shall be ISI marked.

The bends/elbows, flanges, couplers, tees, diffusers, enlargers shall be suitably galvanized. These shall be of medium duty and MS galvanized steel. These shall conform to relevant Indian Standards. The pipes, bends/elbows and other pipe fittings shall be ISI marked.

All pipe lines shall be hydrostatically tested to 2 times the working pressure after erection. Location and types of pipe supports are to be decided at site.

The piping system shall have the requisite quantities of the following:

1. 120° bends
2. 90° bends
3. 45° bends
4. Other angle bends as per system requirement
5. Gate valve

Dy. Chief Manager
Dy. Gen. Manager
M/s. Lakhanpur Area

6. Sluice valve
7. Air valves etc.

10.21 SLUICE VALVES, GATE VALVE, NON RETURN VALVES

The valves shall be manufactured conforming to latest Indian Standards. These shall be suitable for use with the GI / ERW pipes of required diameter. The dimensions, wall thickness, material of the other parts shall conform to IS 780 (current). The valves shall be operated by hand wheels. On the Upper side of the rim the words open and shut with direction arrows shall be shown. The castings shall be free of blowholes and manufactured to withstand required water pressure in the pipe. The valves shall be provided with flanges for connecting to the pipe line.

Required number of holes shall be provided in the flanges. The valves shall be opened by operating in anti-clock wise direction and closed by operating in clock wise direction.

10.22 INSTALLATION OF PUMPS

During initial period when the mine is under development, pumps of smaller capacity shall be installed at temporary sumps for de-watering purposes. Once the sump/permain sumps shall be developed, higher capacity and higher head pumps shall be installed at appropriate depths as envisaged. Main pumps shall be installed on wooden plinths, i.e., pontoons which will connect the delivery range by the suitable flexible pipes.

Chapter – 11

COAL HANDLING & DESPATCH ARRANGEMENTS

11.0 INTRODUCTION

The proposed Coal Handling Plant envisages surface coal collection, conveying of the coal from the mine access trenches to the proposed washeries and loading the washed coal to the silos located at different points.

In Ib-Valley coalfields, three seperate mine namely Lakhanpur OCP, Lilari OCP and Belpahar OCP are working side-by side. Out of which Lilari OCP is going to be exhausted. Rest of the two mines i.e. Lakhanpur OCP and Belpahar OCP will be in working condition. An integrated mine has been conceptualised by combining the three mines to one mine for a production of 40 Mty. There are two entry points to the mine and thus two outlets at northern and southern side.

It has been decided to construct one coal washery of 10 Mty capacity (named Ib-Valley washery) under BOM concept. Coal from receiving hoppers towards north will be transported by conveyors to the washery. After washing, washed coal will be transported by conveyors to silo for final dispatch by rail. To handle the blast free coal, Reclaim feeders has been proposed near the northern mine entry of Central Quarry. Necessary feeder breaker circuits with secondary crushers has also been proposed for small amount of overburden coal through drilling-blasting.

For 20 Mty ROM coal, receiving hoppers are proposed near southern entry of Central Quarry, which are also near to South Quarry exit. Coal will be transported by conveyors through over-ground bunker to two silos for rapid loading on rail. Balance 3.5 Mty coal will be dispatched to OPGC by rail from sidings and 6.5 Mty will be sold locally to nearby customers.

11.1 EXISTING STATUS

As per transportation system matrix, presently the entire coal is being extracted by surface miners from Belpahar as well as from Lakhanpur OCP. The surface miners,

coal i.e blast free coal is being dispatched through Y-curve siding, Ubda MGR siding, newly constructed no-5,6,7 siding and by road sale.

The detailed description of coal handling system for departmental variant has been elaborated here under.

11.2 DESIGN PARAMETERS

The design parameters considered for the proposed Coal Handling Plant are as under:

11.2.1 BASIC DATA

(A) GENERAL

(a) Location	:	Ib-valley coalfield of Mahanadi Coalfields, Odisha
(b) Annual mine target	:	40.0 Mt of coal
(c) Communication	:	Jharsuguda on Howrah-Mumbai main line of south eastern railway zone is around 2 km away from the block.
(d) Ambient temperature	:	Max 47° centigrade in summer, minimum 7° degree centigrade in winter.
(e) Relative humidity	:	31% to 86% in September
(f) Main consumer	:	Thermal Power houses
(g) Life of the mine	:	41 yrs.

(B) COAL HANDLING PLANT

- Handling capacity : 40.00 Mty
- No. of working days/year : 330 days
- No. of working shifts/day : 3
- Effective working hrs/shift : 5
- Bulk density of ROM coal
  - For capacity calculation : 0.8 tonne/cu.m
  - For load calculation : 1.2 tonne/cu.m.
- Product size : (-)100 mm

(C) COAL RECEIPT AND DISPATCH ARRANGEMENT

a. ROM coal size : (-) 300 mm

महाप्रबंधक
General Manager
एम.सी.एल.,लाखनपुर क्षेत्र
MCL,Lakhanpur Area

मुख्य प्रबंधक (पर्यावरण)
सी. एम. पी. डी. आई., के. शा.-7
Ref. No.3409/(2)/2015-CPM&I/07.09.2018

b. Coal Receipt : By reclaim feeder at access tunnels of northern side and southern side as well as by feeder breaker circuits.

c. Coal Transport : By Pipe conveyors/conventional belt conveyors for surface transportation to feed the raw coal to proposed washeries. From washeries the transportation of coal shall be scope under BOMO. Three number of Silos has been envisages at two different places to dispatch coal.

d. Proposed washed coal Dispatch: 7.40 Mty (Through proposed washery by Silo loading arrangement).

e. Proposed reject disposal : 2.60 Mty (as per extant rule after washery construction)

(D) RAPID LOADING SYSTEM FOR 7.4 Mt WASHED COAL and 20 Mty ROM COAL

• Silo capacity	4000 t
• No of Silo	3
• No. of Outlets	2 pockets for each silo
• Type of loading	Pre-weigh hopper
• Loading rate	Av. 3500 tph
• Type of Chute	Traversing Telescopic chute
• Rake size	58 Box N / Equvt. wagons
• Wagon pay load	62 tonnes
• Rake capacity	3600 t
• Annual capacity	22 Mty

(E) WEIGHMENT

वेंकटेश्वर राव
मुख्य प्रबंधक (पर्यावरण)
सी. एम. पी. पी. आई., के. ख.-7

• Type of weigh bridge	:	Pre weigh hopper system of loading and in motion rail weigh bridges
• Wagon Marshalling	:	By locomotive of Railways @ 0.8 Km/hr
(F) DUST SUPPRESSION	:	For the whole proposed CHP
(G) FIRE FIGHTING & PLANT CLEANING SYSTEM	:	For the whole proposed CHP

11.2.2 SALIENT FEATURES OF CHP

For smooth operation, reclaim feeders has been envisaged near both the mine entries. Coal transportation by Pipe conveyor has been proposed from northern access trench to 10 Mty washery for pollution free transportation system.

11.2.3 SYSTEM DESCRIPTION

Integrated Lakhanpur, Belpahar, Lilari OCP is being planned to produce 40.0 Mty coal. The ROM coal shall be produced from the mine by blast free techniques i.e. by surface miners. However some coal shall be produced by conventional technique. For crushing of coal produced by conventional technique, feeder breaker with secondary crusher has been proposed at southern side of quarry.

Location of silos are shown in Coal flow diagram (**Plate No. ENGG-IIIA, IIIB, IIIC & ENGG-IVA, IVB, IVC**). The reject coal from washery will be dispatched as per extant rule after washery operation starts. Coal samples shall be collected by automatic sampler installed suitably onto the conveyors at pre-determined intervals of time and shall be sent to laboratory for analysis. Similarly, Electronic metal detectors and Magnetic separators shall also be installed on south quarry and north quarry at suitable locations for tramp metal removal.

महाप्रबंधक
General Manager
एम.सी.एल., लखनपुर क्षेत्र

देवाशीष दत्त
मुख्य प्रबंधक (खनन)
सी. पी. सी. आई., डी. सं.-7

From southern entry, entire 20 My coal will be fed in to the reclaim feeder (0-1000 tph variable capacity, 8 nos.) near access trench. A set of belt conveyor system C3A/B, C4A/B (tripper conv.) will be fed to an over ground bunker of 30000 t capacity. The coal will be reclaimed from the bunker by the conveyors C5A/B and subsequently fed to silos (2 nos. 4000t cap.) by the conveyors C6A/B and C7A/B.

The blast free and drilling bleeding coal will be transported by contractual trucks/dumpers up to access trenches for Northern and Southern quarry. Near both the access trenches, 12 numbers of reclaim feeders (0-1000 tph variable capacity) has been envisaged to receive the blast free coal.

From northern entry, entire 10 My coal will be fed in to the reclaim feeder (0-1000 tph variable capacity, 4 nos.) near access trench. A set of belt conveyor system C1A/B, C2A/B, C3A/B (tripper conv.) will be fed to an over ground bunker of 10000 t capacity. The coal will be reclaimed from the bunker by the conveyors C4A/B and subsequently fed to silo (1no. 4000t cap.) by the conveyors C5A/B.

11.3 EQUIPMENT DESCRIPTION

• RECLAIM FEEDERS

Coal of (-) 100 mm size produced by surface miner in the mine shall be transported by tipping trucks/ dumpers and discharged at a suitable location at northern side and southern side where the Reclaim feeders are installed. The quantity, capacity and location of reclaim feeders deployment has been given below. Also one no of dozers has been envisaged for channelizing of coal to the reclaim feeders at each faces. The reclaim feeders shall discharge the coal into the belt conveyors.

The technical parameters for design of reclaim feeders are as under

A. FOR SOUTHERN SIDE

Quantity	:	8
Location	:	Near access trench
Capacity avg.	:	0-1000 tph, variable capacity
Material to be handled	:	As per rated capacity
Bulk Density	:	0.8 to 1.2 t/m3

General Manager

Material size	:	(-) 100mm
Maximum inherent	:	8% moisture content
Approx. Power	:	110 kW

B. FOR NORTHERN SIDE

Quantity	:	4
Location	:	Near access trench
Capacity avg.	:	0-1000 tph, variable capacity
Material to be handled	:	As per rated capacity
Bulk Density	:	0.8 to 1.2 t/m3
Material size	:	(-) 100mm
Maximum inherent	:	8% moisture content
Approx. Power	:	110 kW

- **FEEDER BREAKER**

The feeder breaker circuit has been envisaged for crushing of coal extracted by drilling & blasting. Two nos. feeder breaker of 400 tph capacity has been proposed in southern side.

- **LOAD OUT SYSTEM**

The coal carried by the conveyors will be discharged into three numbers of silos of 4000 t capacity. There will be two outlets at the bottom of the each silo. These outlets / pockets at the silo bottom are fitted with pre weigh hoppers along with traversing telescopic chutes. The loading from the silo into wagons will be through pre weigh hoppers and the loading rate will be 6500 tph (Av.) from each of these outlets.

The silos will be designed in such a way that rakes can be loaded into it to the system railway tracks. The rake capacity will be around 3000 t (58 no. of box N or equivalent type of wagons of 62 t capacity each).

The silos shall be of R.C.C. construction and designed to take all the loads as expected in the system. Arch breakers, necessary silo discharge and maintenance gates, two numbers of pre-weigh hoppers, load cells for two numbers of pre-weigh hopper system of loading, traversing telescopic chutes, shear and crushable sections, hydraulic power pack, accumulator, cooling system, air compressors, hydraulic cylinders and valves, control desk with computer and color monitors to operate the

महाप्रबंधक
General Manager

मुख्य प्रबंधक (पर्यावरण)
सी. पू. प. डी. आई., क्षे. म.-7

RLS through relay logic and all other miscellaneous items for the operation of two numbers of pre-weigh hopper system of loading, freight cum passenger lift, staircases etc. shall also form the part of the silo loading system. In addition to the above, calibrating test weight blocks, level sensors, temperature detector, air blasters etc are also envisaged.

11.3.3 DUST SUPPRESSION SYSTEM

The objective of this system is to reduce air pollution due to dust. Adequate number of nozzles will be installed at pre-determined transfer points along the conventional conveyors for suppression of dust by spraying plain water in atomized condition and high pressure DS system. The dust suppression system shall be inter locked with the conveyor system so that it will be in operation only when conveyors are running.

11.3.4 NOISE CONTROL SYSTEM

It is an accepted fact that noise is very uncomfortable to operating personnel. Provision is made to keep down the noise level to the recommended levels. All drive heads requiring heavy foundations will be fitted with energy absorbing anti vibration pads / sheets for reducing the vibration and there by noise.

11.3.5 FIRE FIGHTING SYSTEM

A suitably designed fire-fighting system has been envisaged for the plant. This includes fire hydrant system at locations vulnerable for fire. The system consists of high pressure pumps, supply pipe lines with necessary valves for operation. Hoses in hose boxes will be maintained at vulnerable locations as per standard practice. Suitable fire extinguishers will be provided to deal with electrical / oil / ordinary fires at all the required points in the plant like control room, sub-station buildings, drive houses, Silos etc. In addition to the above required nos. of sand buckets shall also be provided at key locations.

11.3.6 PLANT CLEANING SYSTEM

Provision for plant cleaning system has also been provided. Effluents discharged from the system shall also be collected and an effluent treatment plant is also envisaged.

11.3.7 PLANT MAINTENANCE

For effective maintenance of all the equipment, sufficient working space is provided around the drive heads, tail pulleys, and takes ups of each conveyor. All the conveyors shall be installed inside closed gantries. All the drive houses and transfer houses shall be covered and will be complete with hand rails, ladders, cross-overs etc. as per the requirement. Necessary electrical hoists and chain pulley blocks of adequate capacity are also provided at required locations where heavy components of conveyors are to be dealt.

11.3.8 WEIGHMENT SYSTEM

Two numbers of pre-weigh hoppers shall be fitted underneath each silo for accurate weighment of the wagons loaded. These shall load coal of pre determined quantities into one number of wagon of the rakes placed on two separate number of railway tracks laid as per in the system drawing. The accuracy level of loading is ±0.05 % (weighing accuracy) and ±0.02 % (for complete rake) of the desired quantity of coal to be loaded in each wagon.

In addition to motion rail Weigh Bridges has also been envisaged for weighing purpose.

11.3.9 ELECTRONIC METAL DETECTORS

Metal detectors shall be installed on conveyor at a location of southern quarry and northern quarry. This shall be electronic type, suitable to be installed over 1600mm wide belt conveyor and 1400mm wide belt conveyor. This shall give an audio visual signal whenever non magnetic materials mixed with coal are passing along with the coal on the conveyor. The conveyor will be stopped for its removal as and when

महाप्रबंधक
General Manager
एम.सी.एल.,लखनपुर क्षेत्र
M/s Lakhanpur Area

मुख्य प्रबंधक (पर्यावरण)
सी. एम. पी. सी. कार्य., बी. सी.-7
Ref.No.3401/MP/2019 Dated 07.03.2019

required and the metallic pieces shall be removed manually and stored at a suitable location over a platform for further disposal.

11.3.10 IN LINE MAGNETIC SEPARATORS

Four nos. of magnetic separator or ILMS shall be suspended across the conveyors is envisaged in the system. This suspended magnet shall lift any magnetic metallic items passing along with the coal stream. The suspended magnet will be moved sideways and all the tramped magnetic items lifted by it will be discharged into a bin for further disposal.

The magnetic separator shall attract any tramp magnetic materials up to a weight of 50 kg.

11.3.11 COAL SAMPLING

It is proposed to incorporate over automatic sampler for raw coal section feeding to washeries. Coal samples will be collected by the primary sampler only at pre-decermined intervals to assess the quality of the coal being dispatched. The samples will be collected and carried by a small feeder conveyor and stored in a bin and sent to the laboratory for analysis purposes. Sampling of washed coal shall be done by washery.

11.3.12 MATERIAL HANDLING

Necessary provision has been made like hoist blocks, electric hoists, chain pulley block etc. for lifting heavy materials.

11.4 PROPOSED POWER SUPPLY

11.4.1 POWER SUPPLY ARRANGEMENT

The surface conveyors SILO loading arrangement are proposed to feed power from the proposed 3X12.5 MVA, 33/6.6 kV project substation – I (North Quarry) and 3X12.5 MVA, 33/6.6 kV project substation – II (South Quarry).

General Manager
मुख्य प्रबंधक (खनन)
सी. एम. पी. डी. आई., के. सी.-7

The tail end of pipe conveyors (P1), surface conveyors C1A/B and other associated loads proposed to be installed in north quarry for transportation of 10 Mty coal from north quarry to 10 Mty washery & 20 Mty washery will feed power at 6.6 KV from project substation – I.

The surface conveyors C3A/B, discharge end of conveyors and other associated loads proposed to be installed in southern quarry for transportation of 20 Mty coal to 20 Mty washery and three numbers of SILO loading arrangement proposed to dispatch washed coal from 10 Mty washery & 20 Mty washery will feed power at 6.6 KV from project substation – II.

The LT loads proposed in north quarry will receive power at 415V from 33/6.6 KV project substation-I and LT loads proposed in south quarry will receive power at 415V from 33/6.6 kV project substation-II.

Provision for six numbers (two feeders at SS-1 & four feeders at SS-2) outgoing feeders have been kept for pipe conveyor, surface conveyor system and three nos. of SILOs at 6.6 kV switch boards at project substation – I & II.

महाप्रबंधक
General Manager
एम.सी.एल.,लखनपुर क्षेत्र

सहायक प्रबंधक (पर्यावरण)
सी. एस. पी. टी. ए.ई., बेलपहाड़ी

Chapter - 12

WORKSHOP & STORE

12.0 GENERAL

The capital outlay in the mining equipment & infrastructure provided in the mine can be appreciated greatly through systematic organization of repair and maintenance needs of HEMM and there by achieving their optimum utilization. For this, a schematic layout with facilities for efficient and better utilization of the equipment is being described in this chapter. The layout design and facilities for workshop have been prepared to cater to needs of pithead workshop.

12.1 INTRODUCTION

The integrated Lakhanpur-Belpahar-Lilari OCP mine project envisages 40 Mty of production per annum. The life of the mine is 41 years as per the calendar programme of the mine. The overall availability of the mining equipment & other infrastructure provided in the mine can be greatly improved through systematic organization of repair and maintenance. The layout of the workshop has been designed to achieve this very objective. All necessary facilities have been provided in the workshop to cater to the needs of the entire project. One shift working for workshop has been envisaged.

The daily and scheduled maintenance including lubrication and minor repair of Dumpers, Dozers, Excavators and other E & M deployed in the mine shall be performed in the workshop to be located at pit-head. However two nos. of field workshop have been envisaged in view of reducing the movement of dumpers for daily and schedule maintenance. The services provided shall be preventive in nature as the workshop is being planned mainly to look after the job of minor repairs only.

For this layout, facilities for efficient working have been designed on modern lines. Due consideration has been given to proper environmental conditions including

Deputy Manager
MCL, Lakhanpur Area

cleanliness of shops; dust free and conducive working conditions will greatly help in achieving higher productivity.

12.2 MAINTENANCE FACILITIES

In Partial Outsourcing Variant, all the additional HEMM equipment shall be on contractual basis. All the existing HEMM equipment will be repaired and maintained through existing HEMM workshop.

The E&M workshop has been proposed for repair and maintenance of Coal and pumping equipment. (Since the Coal Handling Plant shall be operating departmentally but mining operation shall be contractual, pumping of the mine shall be under departmental jurisdiction).

Chapter – 13

POWER SUPPLY, ILLUMINATION & COMMUNICATION

13.1 POWER SUPPLY

13.1.1 SOURCE OF POWER

Presently Lakhanpur, Belpahar & Lilari opencast projects existing substations are receiving power at 33 KV, through four numbers single circuit 33 KV overhead line, drawn from 132/33 kV Jorabaga substation of MCL. All the three projects are having separate 33 kV substation. Belpahar OCP substation is having total five numbers of transformers (1x5 MVA, 33/6.6 kV transformer to cater the load of dragline, 6.6kV shovel and drill + 2x2 MVA, 33/3.3 kV transformers to cater the loads of UTLS & colony - 1x2.5 MVA & 1x1 MVA, 33/3.3 kV transformers to cater the loads of HEMM, Pump, Workshop etc.). Lakhanpur OCP substation is having 2x5 MVA, 33/6.6kV to cater loads of the total project. Lilari OCP substation is having 1x1 MVA, 33/6.6kV to cater loads of the project. In addition to existing substations two numbers of additional 33/6.6kV substations will be installed to cater the additional HEMM, pumping, surface conveyor, pipe conveyor with SILO loads for integrated PR. The proposed substations will receive power from 33 kV feeders presently feeding power to Lakhanpur, Belpahar & Lilari OCP projects. As 132/33 kV Jorabaga substation will not be able to cater the peak demand of this project, hence provision of capital investment for augmentation of 132/33KV Jorabaga substation has been made in this report. Provision for new 33 kV overhead line has also been made in this report.

13.2 MAIN SUBSTATION

It is proposed to establish two numbers separate 33 kV substations at suitable locations in non-coal bearing area to cater the additional loads of HEMM, pumping, surface conveyors and pipe conveyor with silo for this integrated project for both the variant. The substation-1 will be installed in the northern side of the quarry and substation-2 will be installed in the southern side of the quarry. Three numbers of transformers each of 33/6.6 kV, 12500 kVA capacity will be installed in substation no-1 and three numbers of transformers each of 33/6.6 kV, 12500 kVA capacity will be

installed substation no-2 to cater the loads of additional drills, shovels, pumps, surface conveyors, pipe conveyors and other service facilities. Schematic single line diagram of the proposed 33/6.6 kV project substations has been shown in drawing no 300924 & 300925. The major functional components at the proposed substations are as follows.

I) OUTDOOR INSTALLATIONS

- 33 kV Bus section
- 33 kV Isolators
- 33 kV Vacuum Circuit breakers
- 33 kV /6.6 kV, 12500 KVA Transformers
- 33 kV Current Transformers and Potential transformers
- 33 kV lightning arresters
- 33kV/415V, 250 KVA Station transformer

II) INDOOR INSTALLATIONS

- Remote Control panel for 33 kV Circuit Breakers.
- 6.6 kV Switch Board.
- 415 V Switch Board.
- Capacitor Banks.
- Battery and Battery charger with DCDB.

III) 6.6 KV INDOOR TYPE SWITCH BOARD (FOR PROJECT SIS-1)

A 28 - panel, 6.6 KV indoor type switch board has been proposed for secondary control of the 12500 kVA transformers feeding power to mine and control of power supply to different load centers of the Project. The switch board comprises 28 numbers of Vacuum Circuit Breakers for the following functions:

- Incoming feeders controller	3 Nos.
- Bus Coupler (sectionaliser)	2 No.
- Capacitor Bank feeder controller	3 Nos.
- Quarry Power supply to HEMM	7 Nos.
- Quarry Lighting	2 Nos.
- Pumping	6 Nos.
- Power supply to surface pipe conveyors	2 Nos.
- Reserve	3Nos.
Total	28 Nos.

The incoming Panels shall be provided with Digital type microprocessor based Power meter and outgoing feeder control panels shall be provided with Digital type ammeter & energy meters.

General Manager

iv) 6.6 KV INDOOR TYPE SWITCH BOARD (FOR PROJECT S/S-2)

A 26 panel, 6.6 kV indoor type switch board has been proposed for secondary control of the 12500 KVA transformers feeding power to mine and control of power supply to different load centers of this Project. The switch board comprises 26 numbers of Vacuum Circuit Breakers for the following functions:

- Incoming feeders controller	3 Nos.
- Bus Coupler (sectionalizer)	2 Nos
- Capacitor Bank feeder controller	3 Nos.
- Quarry Power supply to HEMM	4 Nos.
- Quarry Lighting	2 Nos.
- Pumping	5 Nos.
- Power supply to surface/pipe conveyors with silos	4 Nos.
- Reserve	3Nos.
Total	26 Nos.

The incoming Panels shall be provided with Digital type microprocessor based Power meter and outgoing feeder control panels shall be provided with Digital type ammeter & energy meters.

v) 33 KV/ 415V, 250 KVA STATION TRANSFORMER

It is proposed to install one number of 33 kV / 415V, 250 kVA station transformer at the main substations outdoor yard for meeting the requirements of lighting and other LT loads in substations.

Suitable provision has been made for external electrification and illumination of residential colony. This includes HT and LT overhead lines, transformers, street light fittings etc required for external electrification of township.

1.1.3 ENERGY CONSUMPTION

The energy consumption has been calculated considering active power, annual number of working hours of equipments' installation wise and total coal & OB to be removed for this project. For 10 Mty washery, the specific energy consumption will be maximum 1.68 kWh per ton of coal produced for production of coal for outsourcing washing for this option.

General Manager
Lakhanpur Area

13.4 POWER FACTOR IMPROVEMENT

In order to maintain a high system power factor of around 0.98, even during the maximum demand hours, three sets of 6.6 kV capacitor banks each having a capacity of 4650 KVAR in substation-1 and 4000 KVAR in substation-2 will be provided in the 6.6 kV switch boards. The capacitor banks installed with 6.6 kV switch boards will have the facility to connect and disconnect required number of units automatically depending upon the loading pattern of substations. The capacitor banks will be provided with automatic control facility.

13.5 QUARRY POWER SUPPLY DISTRIBUTION

The quarry power supply distribution shall be provided only for quarry lighting and haul road illumination. Sufficient quantity of 6.6 kV Overhead transmission lines, 1.1 kV overhead transmission lines, 6.6kV/1.1 kV grade cables, 6.6 kV isolators, 6 kV lightning arresters and other accessories have been envisaged for feeding power to electrical units proposed.

13.6 ILLUMINATION

Provision has been made for general illumination in the area of substation building, workshop, rest shelter, pumping stations and others strategic locations of mine with LED light fittings of suitable size. The permanent type of illumination in haul road and inside the quarry will also be done by LED streetlights those lights are to be supplied from 230 V (L-L) systems. LED light fittings shall be provided for street lighting and flood lighting. Haul roads will be illuminated by LED street light fittings. All outdoor light fitting shall be flood light type, dust and moisture proof with proper gaskets.

The illumination along the quarry will be provided by LED flood light fitting of 120 W mounted on suitable supports fixed. The permanent type of illumination inside the quarry will also be done by 120 W LED flood light fittings. These lights are to be supplied from 230 V (L-L) systems.

The haul roads for trucks and dumpers will be illuminated by 70 - 85 W LED street light fittings. Sufficient numbers of 70 - 85 W LED street light fittings have been proposed for maintaining the illumination as per standard for small & large width haul

General Manager

roads. In case of larger width haul roads, the lighting arrangements shall be made by centrally erected mast.

Provision of mobile lighting masts/towers has also been made in this report for illumination in the working zones of quarry. High mast along with 120 W LED flood light fittings will be provided at strategic locations for illumination of sounding area. Required number of 6.6 kV/ 230 V (L-L), 25 kVA lighting transformers will be provided for supplying power to luminaries used for quarry lighting and over burden dumps.

Trolley based telescopic tilting towers of required quantity with 120 W LED flood light fittings along with sufficient capacity DG sets have been proposed in the work places of heavy machinery and drilling areas where permanent lighting is not possible.

13.7 COMMUNICATION SYSTEM

The existing communication system will continue for proposed expansion project. However some capital have been provided in this report for communication. For mobile communication along the road and quarry, TETRA mobile sets are being proposed.

Chapter - 14

CIVIL CONSTRUCTION

14.1 GENERAL

Civil works for this project consists of mainly residential buildings, service buildings, HEMM workshop, colony road, 33 kV substation, colony road, domestic as well as industrial water supply, garbage disposal and sewage treatment.

14.1.1 LIFE AND TYPE OF SPECIFICATION

The life of the project is thirty six (36) years. The infrastructures are of pirmanent type. All the residential quarters and service buildings like workshop etc. are of standard specification.

14.1.2 NATURE OF SOIL

Soil investigation is a prior requisite before construction of other service or residential building and road.

14.1.3 EXTERNAL SERVICES

Since this is an expansion project there is no requirement for any external services.

14.2 COST INDEX AND SPECIFICATIONS OF BUILDING

The rates for all civil works are based on cost index 3909 with respect to 100 base at Delhi as on 1.10.78. The cost index has been arrived on the basis of the rates of the basic materials as given in MCL Updated SOR Oct 2017.

14.3 SERVICE BUILDINGS

14.3.1 PROVISION OF SERVICE /WELFARE BUILDINGS

Provision has been made for HEMM workshop complex, 33 kV substation, store complex etc. along with other related facilities to cater the need for the project.

14.3.2 SITE FOR SERVICE BUILDING

The site for the workshop is proposed taking care of incremental load.

14.3.3 SALIENT FEATURES OF IMPORTANT SERVICE BUILDINGS

The HEMM workshop complex will have sheds for maintenance and repair of dumpers and dozers with required washing facilities.

14.3.3.1 WORKSHOP

Provision has been made for HEMM workshop to cater the need for the project.

14.3.3.2 STORE

Provision has been made for store complex to cater the need for the project.

14.3.3.3 SUBSTATION

Provision has been made for 33 kV Substation to cater the need for the project.

14.4 RESIDENTIAL BUILDING

14.4.1 PROVISION OF HOUSES

Provision of 791 nos. quarters has been made for 1134 nos. manpower.

14.4.2 TYPE OF CONSTRUCTION

All the residential quarters will be permanent type and of standard specification with G+3 storied RCC frame structure. Area of these standard quarters have been considered as per CPWD plinth area norm as accepted by MCL. A, B, C & D type standard quarters have been taken for cost estimate.

14.4.3 SITE FOR TOWNSHIP

Proposed site of the township will be selected by the project officials at the time of execution of buildings.

14.5 ROADS CULVERTS

14.5.1 COLONY ROADS AND CULVERTS

Provision has been done for 3.650 m Colony roads. Estimate has been provided for one 700 m flyover near Bajrangbali Chowk.

14.5.2 SERVICE ROADS AND CULVERTS

There is no provision for haul road.

14.5.3 DIVERSION OF NON-CIL ROAD

There is no such diversion of Non-CIL road

14.6 WATER SUPPLY AND SEWAGE DISPOSAL ARRANGEMENT

The water supply arrangement would basically include potable and industrial water demand of the project.

Following provisions have been envisaged:

The total water requirement is estimated to be 10.9 MLD

WATER DEMAND

The total requirement of water for potable and industrial purposes including firefighting, washery etc. and has been assessed as under:

a)	Potable water demand	0.66 MLD
b)	Industrial water demand (including firefighting)	10.24 MLD
	Total water demand	**10.9 MLD**

General Manager
एम.सी.एल., लखनपुर क्षेत्र
MCL, Lakhanpur Area

Details of computation of water demand for various purposes and norms adopted are given above.

14.6.1 COLONY WATER SUPPLY AND SEWAGE

Water supply scheme is being taken into consideration to cater the need for domestic water supply. Potable water from existing RWSS (Integrated water supply scheme) has been proposed to be supplied to the tune of 0.95 MLD. Sewerage treatment plant will be provided for treatment of sewage from residential and service/welfare buildings.

14.6.2 INDUSTRIAL WATER SUPPLY AND SEWAGE

Existing mine water is to be used for industrial purpose. So cost for laying pipe line for industrial supply has been considered in the estimate. Industrial water demand is 10.24 M.D. Industrial effluent treatment plant is provided for treatment of industrial sewage.

14.7 SURFACE REORGANISATION AND REHABILITATION

An amount of Rs.4515.80 lakhs has been provided for development of rehabilitation site.

14.8 CONSTRUCTION MANPOWER

There is no provision for construction manpower. The existing manpower is sufficient to cater the need for the proposed construction envisaged in the project report.

General Manager
MCL, Lakhanpur Area

Chapter – 15

SAFETY AND CONSERVATION

15.1 PREAMBLE

Opencast mining operation in general is associated with a number of hazards/risks.

Some of the various anticipated sources of danger are enumerated as under:

- Slope failure.
- Dangers due to handling and use of explosives and accidents due to fly-rocks and air-blasts following a faulty heavy blast.
- Hazards associated with use of electricity.
- Accidents due to unsafe operation of HEMM.
- Dust hazards.
- Fire hazards due to spontaneous heating of coal in stock piles and exposed benches.
- Fire hazards in stores & workshops where inflammable & highly inflammable materials are stored or used.
- Danger of inundation from surface and/or ground water.

Adequate provisions have been made for safe working of the mine in form of design of operational systems, provision of safety measures for safe use of explosives, electricity and HEMM etc. Sufficient financial provisions have been made under different heads for procurement of necessary safety equipments.

Adequate skilled & trained manpower has also been provided for compliance of safety provisions. Regular training/refresher courses, "on job" training shall be conducted & mock rehearsals shall be made to make the manpower conversant with various rules, regulations, methods of prevention & combat with hazards.

General Manager
MCL, Lakhanpur Area

15.2 INUNDATION

Due care has been taken while formulating the PR to prevent water ingress during mining operations from the higher ground local rivers/reservoir. Due to mining operation, the existing drainage pattern will be disrupted. Hence, it is suggested in the PR for re-coursing of surface run-off from the catchments area of the nullah through suitable water course. Lilari nullah has been proposed to be suitably channelized to join the original course in the downstream and Pulpur nullah has been proposed to be diverted to join Lilari nullah at suitable point.

15.3 DUST SUPPRESSION

INVENTORY OF DUST GENERATION SOURCES

The likely dust generation sources due to various mining operations in the project are envisaged as under:

- Drilling, blasting, excavation and transportation of overburden material;
- Drilling, blasting, excavation, crushing and transportation of run-of-mine (ROM) coal;
- Construction and demolition activities like land clearing, material/debris storage and handling, etc;
- Loading of coal at stockpile, reclaiming from pile and movement of vehicle and loading equipment;
- Wind erosion;
- Movement of vehicles on haul roads (black topped and non-black topped) for transportation of coal and overburden.

DUST POLLUTION CONTROL MEASURES

Systematic and regular air quality monitoring is necessary to determine objectively the status of compliance with the statutory standards and for making a real assessment of ambient air quality.

General Manager

The following measures are suggested in the PR to contain the pollution arising out of dust emission within limits:

- All the units are provided with well designed dust extraction/suppression system.
- Blasting operations are designed in such a way so that those produce minimum dust.
- Effective use of sprinklers and dust suppression units during loading, transportation and handling of ROM/processed coal and overburden.
- Dust extraction/suppression system is proposed in coal handling plant.
- Provision of greenbelt around quarry, industrial and residential areas and avenue plantation along the haul roads on surface.
- Black topping of permanent service roads besides proper maintenance, wetting of the surface by deploying water tanker/sprinklers to reduce dust generation from haul roads.

15.4 FIRE AND SPONTANEOUS HEATING

FIRE DUE TO SPONTANEOUS HEATING IN COAL BENCHES & GROUND STOCKS

The following measures will be taken to avoid spontaneous heating:

a) Coal bench slopes and seam outcrops will be overlain with an impervious layer of soil/clay.

b) Treatment of exposed coal seams & outdoor coal stocks with anti-pyrogenic substances.

c) Exposure of coal benches for long time shall be avoided.

FIRE IN PROJECT STORES & WORKSHOPS

Sufficient provision has been made in the PR for the prevention & control of fire in the project store, both E&M & HEMM workshops & sub-stations by way of

General Manager
Mahanadi Coalfields Ltd.
Lakhanpur Area

installing fire extinguishers of right type & size. Timely inspection & refilling of fire extinguishers will be done.

Systematic layout of both stores & workshops has been made so that inflammable & highly inflammable materials do not come in contact with any spark or flame. Adequate number of cautions in the form of hoardings will be displayed near such places.

15.5 SLOPE STABILITY

A) COAL/OB BENCHES

The exposed ends of the coal seams and OB shall be left with a safe slope to avoid slope failure and collapse of benches. Similarly, at the end of mining operation safe terminal pit slope is provided to avoid pit failure. Detailed site specific tests for slope stability shall be carried out and site specific parameters determined. Present provision is a broad guideline.

Considering the gradient of coal seam (3°-15.5°) in this project area, it is proposed to excavate top OB/ thick parting between Rampur and Lajkura seams and thick coal seam sections by horizontal slices. All other partings and coal sections are proposed to be worked by inclined slices. Based on the above consideration, the following pit design parameters have been adopted in the PR.

Coal bench width will be kept at a minimum width of 50m for surface mining operations.

OB DUMP

Major part of O.B has been proposed to be dumped internally. Dumping is optimized by suitably matching OB removal and void created by de-coaling. Individual tiers of 30m and an ultimate slope of about 28° have been proposed as a safety measure.

General Manager

For better stability of internal dumps it is suggested to rip the mine floor in strips before backfilling. It is suggested to level the dumps and grade them outward properly to obviate water accumulation.

B) HAZARD AND RISK ASSESSMENT OF OB DUMPS

Hazard of OB dump failure is mainly governed by following factors:

1. Height of benches.
2. Slope of benches.
3. Nature of material.
4. Slope of foundation rock.
5. Nature of foundation rock.
6. Drainage of foundation.
7. Depth of ground water table.

The following precautions will be taken to reduce the risk of dump failure.

1. OB benches will be made of <30m ht in each tier.
2. The angle of repose of OB benches will be around 37°.
3. Soil should be scraped seperately so that it is not mixed in OB rock.
4. The slope of ground is kept mild so that it will not have any adverse effect.
5. The soil from the foundation ground should be scrapped before starting of OB dumping.
6. Garland drain to be made around OB dump area to avoid water flow during monsoon below the OB dump.
7. Ground water table is generally 3-6m below ground level hence may have no adverse impact.
8. Leveling, grading and drainage arrangement for top of OB dumps will be done.
9. Technical & Biological reclamation will be done.

15.6 HAUL ROAD MAINTENANCE

For proper haul road maintenance, following aspects have to be considered and implemented:

General Manager (T)
MCL, Lakhanpur Area

i) Proper design and maintenance of the haul roads

ii) Formulation, approval and enforcement of traffic rules regarding :

a) Speed limit

b) Parking and standing

c) Overtaking

iii) One way traffic, otherwise width should not be less than 3 times the width of the largest vehicle.

iv) Gradient should not be greater than 1 in 16.

v) Berm width should not less than height of bench above it.

vi) Separate machines and personnel for maintenance of haul road.

During rainy season soil erosion will take place and it will deteriorate the haul road corridor and therefore

i) Proper drainage arrangement shall be made along the haul road

ii) Cross slopes (1 in 50 to 1 in 25) shall be provided on the haul road so that water flows into the drain.

iii) Water barrier, cross drains, relief drains etc. should be constructed and maintained properly.

iv) Culverts shall be designed, installed and maintained to withstand the vertical soil pressure, weight of the vehicles plying over the road etc.

15.7 BLASTING

SAFE USE OF EXPLOSIVES

Site Mixed Slurry (SMS)/Bulk explosive has been proposed to be used for good fragmentation and to obviate storage of bulk quantum of explosives. However, for storage of explosives meant for priming, detonating fuse and detonators, two explosive magazines have been provided in the report.

For transportation of explosives, explosive van of approved type is also envisaged.

General Manager

For proper blasting and minimizing the adverse side effects due to blasting viz. noise, ground vibration, back-breaks, air blast and fly rocks etc., the optimal blast design parameters will be suggested during the mine operation after conducting a study for determining the blasting parameters.

Provision has been made in the PR for qualified blasting-in-charge with requisite number of assistants. Adherence to relevant statutory safety provisions as stipulated by DGMS, Chief Controller of Explosives and others shall be made.

Blasting danger zone of 300m for blasting has been taken in non-forest area. In forest area this demarcation will be done on the ground as only 7.5m has been considered as safety zone for permissive possession in case of forest area. Accordingly, land beyond the quarry limit is envisaged to be acquired for the project from safety considerations. It is suggested to resort to controlled blasting near built-up areas and surface features, if any, within the safety zone.

15.8 CONSERVATION OF COAL

Opencast method provides maximum conservation.

15.9 SCIENTIFIC STUDIES

It is proposed that scientific studies in respect of effects of vibration and flying fragments on surface buildings/ structures due to blasting is carried out. Studies regarding slope stability should also be carried out.

15.10 ADDITIONAL PERMISSION/RELAXATIONS REQUIRED FROM DGMS

For the purpose of usage of bulk explosive, following permission from the competent authority will be required.

i) Permission for will be required for under CMR 161 clause (1) and CMR 168(5) for usage of explosive in other than cartridge form and other type of explosive.

ii) Permission for sleeping of holes shall be obtained.

General Manager
MCL, Lakhanpur Area

15.11 USE OF ELECTRICITY

To prevent shock hazards in use of electricity proper earthing system has been envisaged. It has been proposed to use restricted earthed neutral system of power supply and adoption of fail-safe electronic relays to minimise shock hazards.

Moving towers/pole shall be provided for mine illumination in addition to fixed towers.

It is suggested to strictly comply with the relevant provisions of Indian Electricity Rules, 1956 to obviate hazards due to use of electricity. Provision of Electrical Supervisors has been provided in the manpower requirement to fulfil the statutory needs as per the rules, regulations pertaining to mining industry.

Provision for proper illumination of quarry faces, haul roads and other working places have also been made as per the statutory guidelines. The details are given in Chapter-13.

15.12 USE OF HEMM

Based on the excavation requirement of the mine and envisaged production programme, adequate number of HEMM has been envisaged in the PR.

A well equipped workshop has been suggested in the PR to cater to the maintenance needs of HEMM and other equipments besides provision of mechanical maintenance crew. A project store is provided for storage of slow and fast moving spares and other necessary spares of vital importance.

Adequate number of trained/skilled operators and maintenance crew are provided in the PR with due consideration of leave/sick provisions.

Reference Only
General Manager
खान एवं प्रबन्धक
MCL, Lakhanpur Area

Properly designed haul roads are envisaged in the PR, away from the general and traffic congestion. The traffic rules as enforced by the DGMS shall be strictly followed by the operators of mobile equipments like rear dumpers, water sprinklers, tippers and other light motor vehicles. All mobile equipments shall be provided with audio visual alarms.

Safety devices like fire alarm and control operated by sensors should be inbuilt in the equipment/HEMM. Flashers should be fitted in relevant HEMM. The haul roads should be sufficiently wide to prevent accidents.

Inter locking of starting with normal positioning of dumper body should be provided, so that dumper cannot be started when the body is in lifted position beyond a certain limit.

Chapter - 17

LAND REQUIREMENT AND SURFACE REORGANISATION

17.1 GENERAL

This Mining Plan has been prepared based Geological Report for Belpahar-I, II & III Combined Block where three operating mines named Lakhanpur, Belpahar and Lilari exist. Lease boundary has been contained within Notified Boundary for IB BLOCK-II and IB BLOCK-IV (PART-I & PART-II). The reason for integration of the three mines have been elaborated in Chapter-5. The three mines are adjacent to each other and have common lease boundaries. Excavation by open cast mining method has been proposed wherever economic coal occurs within the Notified Boundary. Areas have been added for mining mainly towards south and a little towards north. Area has been added for laying rail lines to load coal from silos by rapid loading system, and for infrastructure. Minimum forest land which is essential for infrastructure has been included in the Mining Lease. The whole village has been proposed for acquisition where most of the village land needs to be acquired for mining purposes.

The infrastructure facilities have been proposed avoiding forest land as far as possible (refer Plate GEN-III, Surface Layout Plan). Most of the existing infrastructural facilities like workshops, stores, offices, substations, magazine etc. have been proposed to be used in the integrated project.

17.2 LAND REQUIREMENT

There are forest lands falling in the Mining Lease to be applied for. In anticipation of long time required for clearance of forest lands (ultimately related to Environment Clearance to work in new areas) and the urgency of maintaining production from the three mines, it is proposed to apply Environment Clearance in two Phases.

In Phase-I, E.C. will be applied for the land already approved under the three running mines, without involvement of any F.C. only for re-diversion of non forest land

from non mining to mining purpose and change of land use pattern of 41.709 ha Forest Land of Lakhanpur mine. F.C. for Phase-I is expected by end of 2019-20.

In Phase-II, F.C. will be applied for total lease area including F.C. for forest land not yet diverted and in additional land. Time line kept for clearance of Phase-II is end of 2023-24.

Land approved for the three mines namely Lakhanpur, Belpahar and Lilari mines is 4133.333 ha and total land was considered as Mining Lease.

Out of approved Mining Lease, Forest land measures to 878.745 ha. Out of 878.745 ha, forest diversion has been made for 541.622 ha and 337.123 ha of Forest land has not been diverted yet for the three approved projects.

Within diverted Forest land, re-diversion of use pattern for 41.709 ha Forest land is required in Phase-I and 130.685 ha Forest land is required in Phase-II.

Additional land required for Integrated Project is 609.544 ha in which, Forest land involved is 117.843 ha, out of which, 37.893 ha Forest land lies far away and falls outside Mining Lease, which need not be diverted. Additional Forest land required to be diverted in Phase-II is 79.950 ha. Total Forest diversion is required for 417.073 ha. Processing and approval for this huge area of Forest land will require considerable time. This is why Mining Lease is proposed to be applied in two phases.

Table 17.1 shows break-up of approved land of the three projects separately under the heads of Forest, Government non-forest and Tenancy.

Table 17.2 shows break-up of land of the Integrated Project with additional area required, under the heads of Forest, Government non-forest and Tenancy.

Table 17.3 shows break-up of land to be applied under Phase-I under the heads of Forest, Government non-forest and Tenancy with purpose wise break-up.

Table 17.1

Land requirement as per approved projects of Lakhanpur OCP Expansion (Ph-II) 15.00 Mty, Belpahar OCP Expansion (Ph-II) 8.00 Mty and Lilari OCP 0.8 Mty

Sl. No.	Particulars	Approved Lakhanpur OCP Expansion (Ph-II) 15.00 Mty (ha)				Approved Belpahar OCP Expansion (Ph-II) 8.00 Mty (ha)				Approved Lilari OCP 0.8 Mty (ha)				Total approved Land for Lakhanpur, Belpahar & Lilari mines (ha)			
		Forest	Govt.	Tenancy	Total	Forest	Govt.	Tenancy	Total	Forest	Govt.	Tenancy	Total	Forest	Govt.	Tenancy	Total
1	Excavation Area	343.100	821.700	575.331	1741.043	71.153	196.190	265.647	532.990	33.500	8.193	21.340	63.033	596.753	826.194	862.308	3340.967
2	Safety Zone 7.5m	3.045	4.345	3.675	13.067	2.000	4.340	1.140	7.480					0.436	8.685	4.815	19.247
3	OB Dump	3.675	9.170	25.855	38.400		37.300	16.130	53.430		1.540	3.080	0.000	5.215	48.010	47.065	98.770
4	Temp. Topsoil storage																
5	Temp. Rejects/Reject storage																
6	Infrastructure	6.230	87.660	99.040	193.930	46.230	58.700	87.373	192.303	4.400			4.400	57.030	193.360	186.320	306.700
7	300/500m blasting zone & Others*	592.525	125.630	403.814	715.370	154.614	272.867	102.268	529.629	124.240	6.630	0.710	131.580	871.814	404.663	537.112	1603.709
8	Residential Colony/ Rehab Complex**		93.822		93.822		71.150	8.143	80.235				0.000	3.000	164.813	9.119	173.932
A	Mining Lease/Project Area	428.575	347.105	1362.223	3465.806	277.814	672.155	484.035	1444.652	162.230	16.723	25.208	204.230	575.745	1635.879	1616.636	4133.533

* Much larger area was acquired earlier, falling in '300/500m Blasting Safety Zone'. Whan larger part of a village falls in essentially required area for mining & allied activities, the remaining part is also acquired to be acquired. Forest land falling in-between various infrastructure were acquired as non-mining lands to be developed & maintained as green belts. Much of this land is now required as 'Recreation Area' and 'Infrastructure'

** Residential colony and Rehabilitation sites were considered inside M.ning Lease in previous reports. These have been excluded from Mining Lease in the Combined Mining Plan for Lakhanpur-Belpahar-Lilari open cast mine, but are included in 'Project Area' for calculation of Closure Cost

Table 17.2

Land requirement for Integrated Lakhanpur-Belpahar-Lilari OCP 40.0 Mty

Sl No	Particulars	Total Approved for Lakhanpur, Belpahar & Lilari mines (Ha)				Proposed Integrated Lakhanpur-Belpahar-Lilari mine (Ha)				Additional for Proposed Integrated Lakhanpur-Belpahar-Lilari mine (Ha)			
		Forest	Govt.	Tenancy	Total	Forest	Govt.	Tenancy	Total	Forest	Govt.	Tenancy	Total
1	Excavation Area	350.730	670.164	663.366	2040.902	779.654	1330.673	1448.355	3555.484	428.974	660.321	696.387	1524.582
2	Safety Zone 7.5m	5.746	8.882	4.919	19.547	8.725	9.107	3.967	21.799	2.980	0.421	-0.947	2.452
3	Tunnel (Existing)	3.978	46.918	47.075	98.770		15.220	7.420	22.640	-3.978	-33.698	-39.655	-77.130
4	Temp. Top soil storage					4.837	0.702	36.355	41.894	4.837	0.702	36.355	41.894
5	Temp. Washery Reject storage						95.336	28.664	124.022		95.336	28.664	124.022
6	Infrastructure	87.030	183.353	38.320	308.703	97.705	223.306	175.107	496.018	40.675	39.953	17.787	95.315
7A	300/500m Blasting Safety Zone & Others*	424.121	390.668	114.941	875.035	63.273	48.591	14.139	126.003	-360.848	-266.852	-100.802	-748.032
7B	Outside Blasting Zone but in Quasi Mining Lease	37.693	68.670	422.971	529.734	Partly Translocated to (1), (2), (4) above and Outside Mining Lease (9) below				-37.693	-68.670	422.971	-529.734
8	Residential Colony, Resettlement site		184.813	9.149	173.962	Translocated to 'Outside Lease' (10) below				0.000	-184.813	-9.149	-173.962
A	Mining Lease	875.745	1535.379	1618.689	4133.333	956.555	1723.648	1715.933	4396.246	79.956	87.670	86.393	366.913
9	Outside Blasting Zone, now Outside Mining Lease					37.693	62.939	59.037	160.669	37.693	62.939	59.037	160.669
10	Non-dential Colony, Rehabilitation site						184.813	9.149	173.962	0.000	184.813	9.149	173.962
B	Outside Lease					37.693	227.752	78.186	343.631	37.693	227.752	78.186	343.631
C	PROJECT AREA	875.745	1535.379	1618.689	4133.333	996.388	1951.401	1795.068	4743.877	117.649	315.422	176.579	889.544

* Much larger area was acquired earlier, falling in '300/500m Blasting Safety Zone', part of which is now required for the Lilari mine project. Also, when larger part of a large city is essentially required area for mining & allied activities, remaining part is also acquired as per company's policy.

Forest land falling in-between existing infrastructure were acquired as non-mining lands to be developed & maintained as green belts.

Negative values indicate change of purpose to 'Excavation Area', 'Temp. Top soil storage' and 'Temp. Washery Reject storage'.

Table 17.3
Land requirement under Phase-I of
Lakhanpur-Belpahar-Lilari OCP Expansion 40.00 Mty
Based on Actual Acquisition made till date

Sl. No.	Particulars	Acquired for Lakhanpur OCP (Ha)				Acquired for Belpahar OCP (Ha)				LKP-BBL-LIL Combined OCP Phase-I (Ha)			
		Forest	Govt. (NF)	Tenancy	Total	Forest	Govt. (NF)	Tenancy	Total	Forest	Govt. (NF)	Tenancy	Total
1	Excavated Area	227.913	922.497	570.451	3825.761	70.037	324.700	203.703	598.440	300.020	1047.200	1228.163	3575.203
2	Safety Zone-1.5m	3.080	7.797	5.750	14.835	1.113	7.494	4.598	13.253	1.193	15.043	10.448	37.288
3	OB Dump	3.575	9.170	25.856	38.408		31.200	18.138	55.338		15.250	7.420	22.668
4	Temp. Top soil storage									4.997	3.919	24.282	32.897
5	Temp. Working Road storage												
6	Infrastructure	1.362	36.709	39.016	65.364	46.200	131.731	67.752	225.333	46.200	101.781	87.752	215.833
7	Barrier against Lilari Nala and curved areas		3.735	3.122	6.857								
8	Area to be used in Phase-I for Mining		72.597	6.549	19.318		23.21	37.364	29.575		80.914	39.468	159.382
A	Mining Lease	253.430	680.130	1036.206	3768.768	120.430	373.639	390.304	864.433	353.950	1263.788	1436.354	3054.183
9	Residential Colony/ Rehabilitation site		33.625		53.523		71.100	8.148	89.358		164.613	3.140	173.962
10	Outside Blasting Zone, now Outside Mining Lease						62.539	69.297	131.976		62.309	69.037	131.976
B	Outside Lease		33.625		53.523		134.129	78.156	212.315		227.702	72.169	305.938
C	PROJECT AREA	253.430	693.755	1036.206	3963.363	120.430	737.768	468.540	1868.748	353.950	1491.541	1514.142	3360.131

Sl. No.	Particulars	Acquired out of Approved Lakhanpur & Belpahar OCP (Ha)				Land Required for Integrated OCP Phase-I (Ha)				Additional required for Phase-I (Ha)			
		Forest	Govt. (NF)	Tenancy	Total	Forest	Govt. (NF)	Tenancy	Total	Forest	Govt. (NF)	Tenancy	Total
	Mining Lease	353.950	1263.788	1436.354	3054.183	353.950	1263.788	1436.354	3054.183	-	-	-	-
	Outside Mining Lease		227.702	72.169	305.938		227.702	72.169	305.938	-	-	-	-
	Project Area	353.950	1491.541	1514.140	3360.131	353.950	1491.541	1514.140	3360.131	-	-	-	-

17.3 RE-DIVERSION PROPOSAL FROM DIVERTED FOREST LAND AND FOREST LAND TO BE DIVERTED

TABLE – 17.4

S. No.	Particulars	Previous "Forest Land"	Net area change of various [1]	Additional Forest Land to be diverted [2]	Proposed Lease area Sought in Mining Lease Conversion [1+2]
1	Excavation Area	258.72	-904.559	315.055	729.864
2	Safety Zone 7.5m	3.708	2.731	5.385	8.128
3	OB Dump				
4	Temp. Top soil storage		4.937		8.937
5	Temp. Washery Reject storage				
6	Infrastructure	79.501	64.936	36.636	97.235
7	300/500m blasting zone (Area reclaimed for afforestation)	155.585			
8	Residential Colony Rehabilitation site				
9	Area to be reclaimed as Green patches		0.286	37.987	68.273
A	Diverted Forest Area in Mining Lease	541.672	541.672	413.073	913.936
B	Diverted Forest Area Outside Mining Lease				37.82
C	PROJECT AREA				951.756

* Calculated areas of Lakhanpur, Bejahar & Lisan are not

17.4 RE-DIVERSION PROPOSAL OF DIVERTED FOREST LAND

TABLE – 17.5

Name of Mine	Mining Phase	Previous use	Proposed use	Area	Total
Bejahar	Phase-I			Nil	
	Phase-I	7.5m safety zone	Mining	0.744	0.744
Lakhanpur	Phase-I	Infrastructure	Mining	6.082	41.711
		7.5m Safety Zone	Mining	0.284	
		300m blasting zone	Mining	30.401	
		500m blasting zone	Top Soil Dump	4.960	
	Phase-II	7.5m Safety Zone	Mining	0.679	0.679
Lisan	Phase-I			Nil	
	Phase-II	Infrastructure	Mining	4.400	128.640
		300m blasting zone	Mining	123.281	
		500m blasting zone	7.5m safety zone	0.959	
Total					171.774

General Manager

17.5 VILLAGES AFFECTED

The core zone of the project comprising of excavation zone, infrastructure area, OB dump sites, safety zone for blasting, etc., covers partly and/or fully the land from 17 villages as given below for the active property of the project. There are no additional villages/PAFs involved. About 3650 families will be affected by the project due to mining and other associated activities of this project. Number of displaced families is 2554. These displaced families will be resettled and rehabilitated socially, culturally and economically as per latest R&R policy (2005 and subsequent amendments) of Govt. of Odisha. Details of project affected families and project affected persons are given below.

Sl.No	Name of village	Project affected families	Displaced Families	Families Resettled
1	Chhatia	313	191	191
2	Bandamal	31	0	0
3	Balgut	5	0	0
4	Banjipali	45	30	30
5	Khuntmahul	63	20	20
6	Thigamal	355	290	206
7	Kharikuni	495	379	337
8	Ubuda	416	379	301
9	Dartipali	243	164	109
10	Kharlama	70	5	1
11	Jurabaga	443	356	59
12	Kudrala	380	300	0
13	Kartajori	300	200	0
14	Khaliapali	300	200	0
15	Kudaloi	100	30	0
16	Lakhanpur	20	0	0
17	Sadia	100	0	0
	TOTAL	3650	2554	1313

However, the exact number of project affected families will be known after due enumeration by the Project Authority.

General Manager
Dy.GM, Opn.Manager Adv
MCL, Lakhanpur Area

17.4 DIVERSION OF NALLAH

At present, Lilari nallah flowing in between Lakhanpur OCP and Lilari OCP cannot be diverted through narrow patch between Notified boundary and Lilari mine excavation. After extraction of coal from North Quarry and filling up to surface level, diversion will be carried out over backfilled quarry. This is proposed to commence from 28th year and finished in two years. Details of its diversion and alignment will be worked out separately based on ground reality and availability of land.

Pulijhor nallah (a small seasonal nalah) is flowing through the mine property, the catchment area of which lies near the south-western limit of the quarry boundary. Due to mining operation the existing drainage pattern will be disrupted. Hence, it is suggested for re-coursing of surface run-off from the catchment area of the nalah through suitable diversion along the western boundary of the project directed towards Lilari nalah.

17.5 PROPOSED SURFACE REORGANISATION

a) Most of the existing infrastructural facilities like workshop, store, offices, substations, magazine etc. have been proposed to be used in the integrated project to minimize the land requirement. Additional infrastructures have been located as far as possible to avoid forest land.

b) Most of the overburden generated is dumped internally. Proposed external dumps are located in non-forest land. Surface Layout Plan is given in Plates No. Gen-III.

c) Suitable provision for compensatory afforestation, arboriculture and technical as well as biological reclamation have been made as per latest guidelines of EAC. Govt. land shall be chosen for compensatory afforestation and resettlement of PAPs. These shall be finalized during implementation.

17.6 PROPOSED ROAD DIVERSION

Suitable provision for diversion of road from Bajrajnagar to the project has been made in the investment for development activities.

General Manager
Mip, M.M. Jharsuguda dist
MCL, Lakhanpur Area

Chapter – 18

MINE CLOSURE PLANNING

18.1 LEGISLATIVE REQUIREMENTS

- All coal mines shall adopt Mine Closure Plan comprising progressive closure plan and final closure plan duly approved by the competent authority as per circular No 55011-01-2008-CPAM, Govt. of India, Ministry of Coal, dated 27th August, 2009 and as per subsequent updation dated 07.01.2013. This plan provides an indication of the cost and guideline to the process that will be implemented to close the Mine.

- Coal projects who has been accorded approval of Mining Plan / Project Report without mine closure plan are required to prepare and obtained the approval of Mine closure plan within a period of 1 year as per the circular.

OBJECTIVES OF MINE CLOSURE PLANNING

- To allow a productive and sustainable after use of the site which is acceptable to the mine owner and the regulatory authority.
- To protect public health and safety.
- To alleviate or eliminate environmental damage and thereby encourage environmental sustainability.
- To minimize adverse socio-economic impacts.

VARIOUS ASPECTS OF MINE CLOSURE PLANNING

The mine closure planning broadly involves the following aspects:

(a) Technical aspects.
(b) Environmental aspects.
(c) Social aspects.
(d) Safety aspects.
(e) Financial aspects.

MINE CLOSURE OBLIGATION

There is a need to define the liabilities, responsibilities and authorities of the mine management, other regulatory bodies, Central and State Governments after mine closure. Some obligations resting to the mine management are as follows:

(a) **Health & Safety:** Regulation Nos. 8, 81, 106, 112 of Coal Mines Regulations, 1957 and its related DGMS Circulars.

(b) **Environment**

(i) Water (Prevention & Control of Pollution) Act, 1974;

(ii) Air (Prevention & Control of Pollution) Act, 1981;

(iii) Environmental (Protection) Act, 1986 and Environmental Protection (Amendment) Rule, 2006;

(iv) DGMS Directives on Noise & Ground Vibration;

(c) **Forest**

Forest (Conservation) Act, 1980.

(d) **Rehabilitation**

CIL's Policy and Orissa State Govt. Policy, Latest Policy / Norms of Govt of Orissa is followed for this project.

(e) **Decommissioning/asset disposal, etc.**

Decommissioning of infrastructure is done, the land occupied by the infrastructure will be restored to some useful purpose. The salvaging and shifting operation of mining machinery and other equipment will be done considering the ground realities existing during the period 1 year advance of final closure of the mine.

TYPES OF MINE CLOSURE PLAN

There are two types of mine closure plan:

- Progressive mine closure plan
- Final mine closure plan

General Manager

PROGRESSIVE MINE CLOSURE PLAN

This is a progressive plan for the purpose of providing protective reclamation and rehabilitation measures in a mine or part there of.

FINAL MINE CLOSURE PLAN

This plan means for the purpose of decommissioning rehabilitation and reclamation in the mine or part there of after cessation of mining and its related activities that has been prepared in the manner to address all environmental aspects taking into consideration.

The final mine closure activities would start towards the end of mine life, and may continue even after the reserves are exhausted and / or mining is discontinued till the mining area is restored to an acceptable level to create a self sustained ecosystem.

ASPECTS FOR PREPARATION OF MINE CLOSURE PLAN

The following points will be incorporated while preparing mine closure plan.

TECHNICAL ASPECTS

1. Mine description
2. Reason for closure
3. Management of mined out land
   a. Present land use
   b. Final stage and post operation stage
4. Management of top soil
5. Management of wastes
6. Management / decommissioning of infrastructure.
7. Management of disposal of mining machinery.

ENVIRONMENTAL ASPECTS

1. Management of hydrology & hydrogeology during mine period and post mining closure period
2. Drainage arrangement for external OB dump.

General Manager
MCL Lakhanpur Area

3. Reclamation of dump(s) & adjoining areas
4. Rehabilitation & resettlement
5. Management of air quality

SOCIAL ASPECTS

1. Redeployment of workforce
2. Management of community facilities
3. Management of association and consultation with stake holders.

SAFETY AND SECURITY ASPECTS

1. Disaster management
2. Care and maintenance during temporary discontinuance
3. Management of fire

FINANCIAL ASPECTS

COST OF MINE CLOSURE INVOLVED

1. Cost of reclamation of mined out area.
2. Cost of air quality protection measure.
3. Decommissioning cost of infrastructure
4. Cost of safety & security
5. Socio-economic cost
6. Cost of organization for executing the closure activities
7. Cost of post project monitoring for five years.

18.2 TECHNICAL ASPECTS

18.2.1 SAFETY HAZARDS INCLUDING MANAGEMENT OF FIRE

Keeping in view the three basic principles i.e. prevention, preparedness (both pro-active and reactive) and mitigation of effect through rescue, recovery relief and rehabilitation, a comprehensive blue print for risk assessment and management has been drawn up for the project incorporating the following:

- dentification and assessment of risks

- Recommendation of measures to prevent damage to life and property against such risks.

MINE SLOPE FAILURE MANAGEMENT

While mining operations are in progress, the working slope where drills, excavators, loaders and dumpers are deployed, are designed with multiple benches, minimum dimensions of which are given in Chapter-5. Overall working slope will vary from 22° to 18°. In absence of any major fault, chance of failure of working slope is negligible.

The side slopes are designed for coal and OB transportation by dumpers. Overall side slopes will vary from 37° to 40°. Part of slope lower than the lowest transport berm will be filled with OB, reducing chance of slope failure.

On recommendation of CIL Board, CMPDI has conducted theoretical study to ascertain safety factor of final slope at the deepmost part. Factor of safety found was satisfactory. However, field study will be carried out prior to final mining operation to ascertain factor of safety of final slope.

Laser based slope monitoring equipment has been proposed for round-the-clock monitoring of undesired movement of pit slopes.

BLASTING

For proper blasting and minimizing the adverse side effects due to blasting, viz noise, ground vibration, back-breaks, air blast, fly rocks, etc., the following precautions have been suggested to avoid dangerous situations:

- A safety zone for blasting has been provided around the quarry.
- Before blasting is done, warning sound will be given so that people can move to safe places.
- Controlled blasting with site mixed slurry. Use of millisecond delay detonators that are initiated by shock tube initiation system, between rows and between holes in same row.
- Optimisation of quantity of explosive in a blast hole.
- Blasting shall be carried out in conformity of extant laws with closer control of blasting parameters including blasting results like desire fragmentation, permitted ground vibration, etc.

General Manager

EXPLOSIVE HANDLING

The present day technology of blasting with site mixed slurry (SMS) explosive shall be used with milli second delay detonators that are initiated by shock tube initiation system. SMS is stored by the supplier as per DDI Notification. Further, transport and charging are also done by the supplier on the spot. Only priming will be done by the project authority. For storage of explosives meant for priming, detonating fuse and detonators, one service magazine have been provided.

SAFETY RULES

Mining operations follow statutory mine safety rules administered by the Directorate General of Mine Safety (DGMS), Chief Controller of Explosives and others. Planning and design of electrical installations will take into account the existing electricity rules to obviate the hazards due to use of electricity.

For creating safety awareness and imparting education on safe practices, the following steps shall be taken.

- Holding annual safety weeks.
- Imparting basic and refresher training to new and old employees respectively as per Vocational Training Rules.

MINE INUNDATION

Provisions in Coal Mine Regulations shall be followed. The mine pit would receive water from three sources namely, direct precipitation over excavated area, surface run off from the surrounding area and seepage from the strata. During heavy rainstorms, there may be a situation when mine may get flooded. This may cause loss of human life and equipment, etc. All the necessary precautions will be taken against such eventuality through out the life of the project.

FIRE

Adequate fire fighting arrangement has been provided. Adequate number of fire extinguishers will be provided for stores and other service buildings. While calculating total water demand for the project, provision for fire fighting has also been made.

ROAD ACCIDENTS

Sufficient arrangements for illumination of roads including haul roads will be made. Road crossings has been properly planned and designed to prevent vehicular accidents.

MANAGEMENT OF FIRE

The measures for management of fire at coal faces in the mine and coal stockyard will be adopted / to be adopted and there will be no safety hazards for the neighbouring community after the mine closure.

18.2.2 MANAGEMENT OF WASTE DUMPS

EXTERNAL OB DUMPS

All three mines have small external dumps near their quarry mouths. Those of Lakhanpur and Lilari mines will be liquidated for extraction of lower coal horizons as the mine progresses. Those of Belpahar mine will remain undisturbed. OB dumps of Belpahar mine are very old, well stabilized and heavily planted.

INTERNAL DUMP

Major part of the quarry will be backfilled with overburden. The backfilling will be carried out in a phased manner. Once the backfilling has reached a certain predetermined reduced level, the plots will be levelled, graded and cleared of large stone pieces lying on the surface. The slope of the ground will be made very gentle as far as possible (preferably less than 2%). The graded and levelled area will be divided into small sectors and small check bunds will be constructed to retain moisture and humus in the soil. The outer slope of each bench will be kept at the natural angle of repose of the spoil material and at overall slope angle of 28° considering all benches.

Table 6.1.1

Mining Lease Area & Progressive Reclamation

AREA USED (in Ha)

Year/Stage	Excavation area for OC			Rail/Road	Tank & Others	Total
	Total	Backfilling	Void			
At the end of 31st March 2015	1152.01	760.39	210.77	3.978	823.706	2216.774
Yr-5	1370.03	905.18	791.05	3.978	823.706	2494.264
Yr-10	1830.71	208.84	624.97	4.078	826.706	2568.476
Yr-15	1983.71	1965.68	419.99	4.078	826.706	3017.492
Yr-20	2476.56	1951.82	523.96	4.078	826.706	3309.269
Yr-25	2826.72	2208.05	458.97	4.078	826.706	3709.406
Yr-30	3135.95	2718.68	207.39	4.078	826.706	3944.709
Yr-31 (Final)	3152.48	3136.00	460.00	3.978	826.706	4389.244

PLANTATION AREA (in Ha)

Year/Stage	Dump Top & Slope	Safety Belt Zone	Green Belt	Plantation on Dump / Void	Total
At the end of 31st March 2015	248	3.978	6.931	274.369	343.212
Yr-5	330	3.978	13.622	386.293	192.233
Yr-10	369	4.078	41.488	382.939	896.447
Yr-15	412	4.078	80.110	317.463	1065.04
Yr-20	381	4.078	69.110	317.463	1181.241
Yr-25	468	4.078	69.110	317.463	1378.524
Yr-30	165	3.978	69.110	317.463	1549.224
Yr-31 (Final)	418	3.978	69.110	317.463	1808.847

Without Plantation

Final Quarry	Quarry void & Dumps/Voids	Road side	Rail Dump Top & Slope	External Dump	Water body	Plantation on Dump / Void	Township & Misc. Activities	Temporary Soil & Rejects Dumps in Forest Land	Total
	439.04	22.87	3135.000	3.978	60.11	317.463	216.864	276.217	4329.244
	Sub-total: 439.04					Sub-total: 3953.408			

Note: Residential colony, Recreational area, Other roads/footpaths, Dump slopes etc. will be plantation by respective owners. 343.212

❋ DRAINAGE ARRANGEMENT FOR INTERNAL OB DUMPS

Large part of the quarry will be backfilled with overburden. The backfilling will be carried out in a phased manner. Once the backfilling has reached a certain predetermined level, the tops will be levelled graded and cleared of large stone pieces lying on the surface. Top soil preserved and freshly extracted will be spread uniformly over the dump tops. The slope of the ground will be made very gentle as far as possible (preferably less than 2%). The graded and leveled area will be divided into small sections and small check bunds will be constructed to retain moisture and humus in the soil. The drainage arrangements for precipitation run-off are as follows:

- During working stage, the run-off will be collected from internal dump by kacha drain for diverting to mine sump for pumping.

General Manager

- In the post-mining period, the drainage pattern of the reclaimed area will be such that the run-off will be diverted to final void of the quarry which will be developed as a water reservoir for water harvesting and also recharging the aquifer in the surrounding area.

There is an intricate relationship between surface water and ground water. In the monsoon period, till the aquifer attains its original ground water level, surface water bodies like stream, ponds & lakes recharge the aquifer. As soon as ground water recoups and attains its level, it contributes again to surface water bodies. After post-monsoon period, this process is reversed again as ground water level gets lowered from the original level.

The mine dewatering brings down ground water level in the immediate vicinity of the mine. Maximum effort will be made to recycle or reuse the treated mine discharge water totally to the extent possible by keeping the make up water in different sumps or low lying areas of the project. In unusual situations during monsoon, mine discharge water will be allowed to go as recharge/run-off in the same basin of the area.

As such, this area is having an average annual rainfall of 1241mm. This rainfall replenishes the annual ground water draft every year. This will enhance the recharge of the aquifer in the area for mitigating the lowering of ground water level in the area surrounding the mine.

18.2.3 MANAGEMENT OF HYDROLOGY AND HYDRO-GEOLOGY

- Assessment of hydrology and hydro-geology of the area

Investigations have been carried out in and around the area comprising of core and buffer zones of this project. The matter has been dealt.

- Estimation of ground water availability of the area

Ground water availability of the area comprising of core and buffer zones of this project has been assessed.

- Water demand, dewatering of the mine and waste water management

The above details have been given in this report.

General Manager
Project for Drainage etc.
MCL, Lakhanpur Area

- Impact of the mine on ground water and surface water

18.2.4 DETAILS OF DE-COMMISSIONING OF THE INFRASTRUCTURES AND PLANT AND MACHINERY

MANAGEMENT / DECOMMISSIONING OF INFRASTRUCTURE

The infrastructure like workshop, office buildings, residential colony, roads and transmission lines, etc., will be provided for the project. Considering the ground realities existing during the period just 1 year before mine closure, plan for rectification in neighbouring mines or decommissioning will be made. If decommissioning of infrastructure is done, the land occupied by the infrastructure will be restored for some useful purpose.

MANAGEMENT OF DISPOSAL OF MINING MACHINERY

The salvaging and shifting operation of mining machinery and other equipment will be planned considering the ground realities existing during the period 1 year advance of final closure of the mine.

18.2.5 FENCING AROUND MINED OUT AREAS

Fencing will be provided through out the periphery of the proposed mine for safety and security.

18.3 ENVIRONMENTAL ASPECTS

18.3.1 LAND MANAGEMENT

The proposed mining plan area comprises mostly of land already acquired for the three operating mines. Area expansion is mostly towards south. The area of different types of land and their present and proposed usage is given in the table below:

Project Manager

Table-18.2

Sl. No.	Particulars	Total approved Land for Lakhanpur, Belpahar & Lilari mines (ha)				Proposed Lakhanpur-Belpahar-Lilari mine (ha)			
		Forest	Govt.	Tenancy	Total	Forest	Govt.	Tenancy	Total
1	Excavation Area	350.750	926.164	840.998	2040.912	716.654	1232.475	1442.355	3391.484
2	Safety Zone 7.5m	5.149	6.098	6.010	18.247	5.125	5.137	6.992	24.534
3	OB Dump	119.72 ha fall in standing safety zone				55.33 ha fall in standing safety zone			
4	Temp. Top soil dump					4.927	0.774	40.316	46.017
5	Temp. Washery Reject dump						126.757	41.751	168.508
6	Infrastructure	97.057	153.868	168.300	396.103	85.763	72.012	59.319	216.894
7	300/600m blasting zone & Others*	427.466	334.800	181.366	973.761	81.215	180.484	118.757	380.456
8	Residential Colony, Retail Station etc		194.813	5.149	173.962	Transferred to 'Outside Lease' as below			
9	Outside Blasting Zone, soil or Inside Mining Lease	37.926	68.570	129.671	326.734	Partly in 'Mining Lease' and partly 'Outside Lease' as below			
A	Mining Lease	875.748	1635.879	1518.868	4135.333	869.906	1733.540	1716.502	4319.948
10	Residential Colony, Retail Station etc						154.812	9.184	163.962
11	Outside Blasting Zone, now 0.3/0.6 Mining Lease					37.830	52.839	69.037	159.069
B	Outside Lease					37.830	207.752	78.189	323.031
C	PROJECT AREA	875.748	1635.879	1518.868	4135.333	869.906	1941.491	1795.088	4742.977

* Much larger area was acquired earlier, falling in '300/600m Blasting Safety Zone', part of which is now required for the combined project. Also, which larger part of a village falls in essentially required area for mining & allied activities, remaining part is also required to be acquired.

Forest and falling in between various infrastructure were acquired as non-mining lands to be developed & maintained as green belts.

18.3.2 MANAGEMENT OF FINAL VOIDS

The objective is to accommodate all OB removed inside the excavated mine void. About 16 Mcum OB has dumped externally by the three operating mines long back. In this project proposal no additional external dumping is proposed. But to keep the entire OB internally, it is absolutely necessary to raise the dump top level to 90 m above surrounding ground level. The area already planted at the dump tops are also proposed for raising dump height.

In order to avoid further external dumping, OB needs to be transported for long distances far from working area to places where void is available for low OB removal in early years.

It was found that internal dump capacity just matches with OB removal of the whole mine at the end of 2037-38 which is in the 21st year. In subsequent years, when final slope of the Central Quarry is approached, part of the slope will be filled up. As there is possibility of expansion towards dip side, total slope has not been filled up

The haul roads on mine floor to reach the deep coal part of the mine and Kajora seam in South Quarry are also kept open for advancing the mine in future expansion project.

While calculating OB accommodation in the dumps, swell factor of 1.15 has been applied on in situ volume to arrive at dump volume. These dumps do not include washery rejects or ash from E.B.C. power plant.

The dumps have been designed with multiple tiers. Levels of these tiers are matched with horizontal road levels on quarry slope, for easy transportation from working benches to dump benches. Maximum height of each tier is 30m and slope of each individual tier is 37 degrees. Overall slope of full dump face is about 26 degrees.

Top level of internal dumps proposed in Belpahar Combined Quarry is 280m above mean sea level, which is 75-90m above surrounding ground level. Part of present internal dump has already been reclaimed and vegetated at around 260m AMSL. Necessary permission is to be obtained from concerned departments to re-use the reclaimed dump top for backfilling by raising level of dump and for felling of trees if significant.

After exhaustion of designated quantity of coal from mining lease area, final reclamation activities will start. Final reclamation plan will be prepared 5 years prior to end of mine life. The post reclamation land use is given in the following table-

Table-18.3

Proposed details Post-Reclamation Land use

O.B. Dump Top Plantation (ha)	170.360
O.B. Dump Slope Plantation area (ha)	337.494
Quarry Bottom & Flank Roads Re-graded (ha)	435.020
Water Body Area inside mine void (ha)	23.870
Infrastructure Areas Reclaimed for Farmland (ha)	216.994
Temporary Top soil & Washery Rejects Storage area Reclaimed for Farmland (ha)	220.117
Nala Divers on and Green Belt Area (ha)	69.110
Resettlement colony & Rehabilitation sites (ha)*	173.962
Undisturbed area developed with plantation (ha)	482.854
Total surface area reclaimed	474.107

* Rights of land for Rehabilitation site will be vested with the displaced persons. Residential colony will be returned by the The Company.

Table-18.4
Information on Dump & Water Body Dimensions

Average Height of external dump above surrounding surface (in meter)	25-30
Volume of external dump (in Mcum)	1.10
Average Height of internal dump above surrounding surface (in meter)	75-80
Volume of internal dump-II (in Mcum)	4284.29
Maximum depth of Water Body (in m)	30

18.3.3 MANAGEMENT OF TOP SOIL

Vast area inside mining lease is not yet disturbed. A location measuring 45.788 ha has been proposed for temporary storage of top soil. To preserve fertility of the stored top soil, height will be restricted to 5m and rolling system of first-in first-out will be adopted for use of stored top soil over OB dumps where final height and slope has been reached. Care will be taken to use stored top soil within 6 months.

Phase wise quantities of top soil extracted, stored and re-used are given in table below:

Table-18.5
TOP SOIL GENERATION, STORAGE & REUSE

(volume in Mcum)

	Extracted	Stored	Re-used
Yr-1 to Yr-5	1.05	1.03	0.02
Yr-6 to Yr-10	0.34	1.03	0.64
Yr-11 to Yr-15	0.42	1.03	0.42
Yr-16 to Yr-20	1.25	1.03	1.06
Yr-20 to Yr-25	1.26	1.03	1.00
Yr-25 to Yr-30	0.59	1.03	0.99
Yr-30 to Yr-36	-	0.65	0.40
Post Mining	-	-	0.05
Total /d	5.35		5.35

18.3.4 RE-HANDLING OF OB

During operation of Central Quarry where extraction of lower seams Ib & Rampur are attempted, OB dumps in Lakhanpur OCP is required to be removed. This is re-handling of OB. Total re-handling proposed is 277.76 Mcum, which is the anticipated volume of internal & external dumps at the end of 2023-24. In order to

minimize re-handling of dump for extraction of lower seams. OB of running Lakhanpur mine is proposed to be carried and dumped into void of Belpahar mine with immediate effect. It is estimated that about 51 Mcum OB from Lakhanpur mine can be transported to void of Belpahar mine during two years of construction period (2018-19 & 2019-20). From 1st year of integrated project (2020-21), total OB from Lakhanpur mine can be put into void of Belpahar mine till end of Lakhanpur mine, subject to advance of Belpahar mine in the form of Central Quarry, as has been proposed here.

Similar is the situation for Lilari OCP where 20.02 Mcum OB has been dumped in external and internal OB dumps which is to be re handled during coal extraction of lower seams from North Quarry.

Due to space constraint, northern slope of Central Quarry has been kept up and internal dump is raised to 290m AMSL to accommodate all OB. This is the boundary against Lilari Nala. After Lilari nala is diverted through backfill of North Quarry, extraction of coal blocked below original course of Lilari nala will be attempted. For this extraction the OB on northern slope of Central Quarry is to be re handled. Estimated volume of this re-handling is 154.77 Mcum. In view of this high volume of re-handling, it is suggested to review planning of future mine operation after 20 years of this project to find suitable alternatives to avoid huge re handling. Technological improvement in high wall mining for higher percentage of extraction may be adopted if found suitable.

18.3.3 MANAGEMENT OF RECHARGE AREAS

Mining operation of this project will create voids or depressions, which will reduce / accelerate rainfall recharge and decrease run-off in the mining area. Maximum effort will be made to recycle or reuse the treated mine discharge water locally to the extent possible by keeping the intake of water in different sumps or low lying areas of the mine. The remaining water will be discharged to the natural drainage for ground water recharge in the same basin. The final voids of the quarry will be left as a water reservoir for water harvesting and also recharging the aquifer in the surrounding area.

Chief General Manager
HQ, MCL, Lakhanpur Area

18.3.4 ACCEPTABLE SURFACE AND GROUND WATER FLOWS

The drainage arrangement for smooth disposal of storm water from OB dump will be made to avoid gully formation on the dump body and also siltation problem of the nearby natural drains.

18.3.5 ALTERNATIVE USE OF LAND

There are several options available for land use pattern of the reclaimed land. The following factors have been considered for selection of appropriate land use pattern:

- Pre-mining land use pattern
- Topsoil/sub-soil quality
- Socio-economic parameters of the area
- Availability of technology for land reclamation
- Climatic conditions of the area
- Local flora.

The alternatives available for utilising the reclaimed land are :

- Agricultural use
- Afforestation

The option for using the reclaimed backfilled area for agricultural purpose immediately is ruled out due to the following reasons :

- The reclaimed land is very different from its pre-mining conditions. It cannot sustain crops as the soil has poor fertility status. So the agriculture may prove uneconomic venture compared to afforestation.
- The development of soil regime for agriculture will take a considerable time.
- Reclamation is proposed to be done progressively and concurrently with mining operation. Carrying out agriculture within mining activity area by releasing reclaimed area in a phase-wise manner, may not be advisable from safety point of view.

In view of the above, it is suggested to utilise the reclaimed land for afforestation purpose which will help improve the soil status i.e texture and nutrient levels, etc.

18.4 SOCIAL ASPECT

18.4.1 RE-DEPLOYMENT OF WORK FORCE

The peak workforce required for mine operations is in the first few years of the mine when construction activities as well as operational activities achieve their peak. This workforce slowly goes down with completion of development and when only the operational work remains. Again, near the end of mine life say, 5 years advance of closure, the activity of the mine starts getting reduced and therefore, management will get opportunity to taper the operational manpower. After closure, skeleton service people will be left for continuing the actual closer operations. The reduction of manpower will be effected by following options:

- Retraining and redeployment of younger group upto 40 years of age.
- Transfer of experienced middle aged groups between 40-50 years to the other projects.
- Implementation of VRS for age group of above 50.
- Retrenchment with suitable compensation after exhausting the above.

18.4.2 MANAGEMENT OF COMMUNITY FACILITIES

The peripheral village community facilities developed by the Mine Authority will be left to the Local Body / State Govt. for management.

18.4.3 CHANNELISATION OF AVAILABLE WATER

18.4.4 EMANCIPATION FROM PAPs

- The resettlement site shall be named suitably.
- If any place of worship like temple, church, etc. are acquired, the same shall be provided on the replacement basis.
- A community of a particular caste, creed and religion shall be allowed to reside in a particular area in the resettlement colony to foster the communal harmony.
- Training facilities shall be extended to the women folk to give equitable access to income generating opportunities for raising their social status.

18.5 FINANCIAL ASPECT

18.5.1 COST OF CLOSURE ACTIVITIES

1. Cost of reclamation of mined out area.
2. Cost of air quality protection measure.
3. Decommissioning cost of infrastructure
4. Cost of safety & security
5. Socio-economic cost
6. Cost of organization for executing the closure activities.
7. Cost of post project monitoring for five years.

Table 18.6

Activity wise Progressive & Final Mine Closure cost distribution is given in table below:

S.No	ACTIVITY	Closure Cost (percentage weightage)	Remarks
A	**Dismantling of Structures**		To be included in final mine closure plan
	Service Buildings	0.20	
	Residential Buildings	2.67	
	Industrial structures like CHP, Workshop, field sub-station, etc.	3.20	
B	**Permanent Fencing of mine void and other dangerous area**		To be included in final mine closure plan
	Random rubble masonry of height 1.2 metre including levelling up in cement concrete 1:6:12 in rod mortar	1.50	
C	**Grading of highwall slopes**		To be included in final mine closure plan
	Levelling and grading of highwall slopes	1.77	
D	**OB Dump Reclamation**		
	Handling/Dozing of OB Dump and backfilling	88.88	71% for progressive and 17.88% for final mine closure.
	Technical and Bio-reclamation including plantation and post care	3.40	Equal weightage throughout the life of the mine.
E	**Landscaping**		
	Landscaping of the open space in leasehold area for improving its aesthetics and use value	3.30	Equal weightage throughout the life of the mine.
F	**Plantation**		
	Plantation over cleared area obtained after dismantling	3.00	To be included in final mine closure plan
	Plantation around the quarry and and in safety zone	3.20	Equal weightage throughout the life of the mine.
	Plantation over the external OB Dump	3.00	Equal weightage throughout the life of the mine.
G	**Post Closure Env. Monitoring / testing of parameters for three years**		For three years after mine closure
	Air Quality	3.22	
	Water Quality	3.20	

S.No	ACTIVITY	Closure Cost (Percentage weightage)	Remarks
H	Entrepreneurship Development (Vocational skill development training for sustainable income of affected people	0.25	Equal weightage throughout the life of the mine
I	Miscellaneous and other mitigative measures	2.00	Equal weightage throughout the life of the mine
J	Post Closure Manpower cost for supervision	0.80	To be included in Final mine closure plan
	TOTAL	100.00	

10.5.2 COST OF ORGANIZATION FOR EXECUTING THE CLOSURE ACTIVITIES

An organization with necessary manpower and vehicle support will be needed. The manpower required for the closure activities and then post-project monitoring are given below.

Table-10.7
Manpower for closer activities and post-project monitoring

Sl.No.	Designation	No.
1.	Asst.Colliery Manager	1
2.	Overman	1
3.	Mining Sirdar	1
4.	Watchman	2
	Total	5

TIME SCHEDULE FOR DIFFERENT ACTIVITIES FOR MINE CLOSURE

The closure of mines involve environmental, technical, social aspect and financial assurance for implementing activities will run for three years. The following activities will be implemented as per bar chart. The details of time schedule for all these operation which are applicable for both Progressive and Final Mine Closure Plan has been described with bar chart.

	Activity	Time frame	Yr-1 to yr-5	Yr-6 to yr-10	Yr-11 to yr-15	Yr-16 to yr-20	Yr-21 to yr-25	Yr-26 to yr-30	Yr-31 to yr-43	Post Closure Phase PCI	PCII	PCIII
A.	**Permanent fencing of mine area and other dangerous area**											
	Random rubble masonry of height 1.2 metre including leveling up in cement concrete 1:3:12 in mud mortar	Execute wherever not done yet. To complete in 25 years										
B	**OB Dump Reclamation**											
	Handling/Dozing of OB Dump and backfilling	Throughout the life of the mine including 3 years after cessation of mining operation										
	Technical and biological reclamation including plantation and post care	Throughout the life of the mine including 3 years after cessation of mining operation										
C	**Landscaping**											
D	**Plantation**											
	Plantation around the quarry and infrastructure	During initial 10 years										
	Plantation over cleared area followed after dismantling	3 years post mining										
	Dismantling of Structures											
	Service Buildings & Other Buildings	2 years										
	Industrial structures like CHP, Workshop, field sub station, etc.	2 & ½ years										
	Grading of highwall slopes											
	Leveling and grading of highwall slopes	2 years										

G	Post Closure Env Monitoring / testing of parameters for three years		
	Air Quality	3 years	
	Water Quality	3 years	
H	Entrepreneurship Development /Vocational/skill development training for sustainable income of affected people	Throughout the life of the mine	
I	Miscellaneous and other mitigative measures	Throughout the life of the mine including 3 years after cessation of mining operation	

PCL : Post Closure Year 1 PC2 : Post Closure Year 2 PC3 : Post Closure Year 3

10.5.3 MINE CLOSURE COST

The cost of the mine closure of the project has been estimated comprising of cost of reclamation of mined out area, cost of air quality protection measure, decommissioning cost of infrastructure, cost of safety & security, socio-economic cost, cost of organization for executing the closure activities, cost of post project monitoring for three years, rehabilitation of mining machinery (disposal of mining machinery), arboriculture and land scaping including biological reclamation and cost of barbed wire fencing all around working area. Annual closure cost has been computed considering the total project area as per guide line. The Money to be levied per hector of mining lease is to be deposited every year after commencement of any activity on the land for the mine after opening an Escrow Account. Mining Company/owner including all Public Sector Undertakings will deposite the yearly amount in a Scheduled Bank. The details of the final mine Closure Plan along with the details of the cost estimate for various mine closure activites and Escrow Account already set up shall be submitted to the Ministry of Coal for approval atleast five years before the intended final closure of the mine. Up to 90% of the total deposited amount including interest accrued in the ESCROW account may be released after every five years in line with the periodic examination of the Closure Plan as per Clause 3.1 of the Annexure of the Guidelines. The amount released shall be equal to expenditure incurred on the progressive mine closure in past five years or 90% whichever is less. The balance amount at the end of the final Mine Closure shall be released to mine owner/leaseholder at the end of final Mine Closure on compliance of all provisions of Closure Plan duly signed by the lessee and certify that the said closure of mine complied all statutory rules, regulations, orders made by the Central or State Government, statutory organisations, court etc. and duly certified by the Coal Controller.

The cost involved barbed wire fencing all and around the working area, dismantling of the structure / demolition and cleaning of sites, rehabilitation of mining machinery, plantation, physical / biological reclamation, landscaping, post-environmental monitoring, supervision for 3 years, power cost, etc. The closure cost will be updated with respect to WPI

As per the guidelines, the closure cost for opencast mine will be six lakhs per hectare (at WPI of August 2009) of total project area and this rate will stand modified based on the whole sale price index as notified by Government of India from time to time.

Monthly Wholesale Price Index on August 2009	: 129.6
Monthly Wholesale Price Index on March 2012 (Index=100 at Base 2011-12)	: 158.1
Mine Closure cost on August 2009 as per MoC	: Rs.6.00 lacs/ha
Mine Closure cost on March 2012	: Rs.7.227 lacs/ha

Transformed to 2011-12 base (6x158.1/129.6)

Monthly Wholesale Price Index on August 2018	: 120.0
Monthly Wholesale Price Index on September 2018	: 120.1

(WPI has been taken in same months of previous year)

(WPI has been obtained from the official website of Office of the Economic Adviser to the Government of India, ministry of Commerce and Industry for 'All Commodities'. Website address: http://eaindustry.nic.in/display_data.asp)

Mine closure cost/ha (September 2018, 2011-12 Base) = **Rs.8.679627 lakhs/ha** [7.227 X (120.1/100)]

Total Project area involved	: **4742.877 Ha**
Total Mine Closure Cost (as on September 2018)	: **Rs.41,166.40 lakhs**

Amounts of Escrow Account of the three mines (till 01.04.2018)

Lakhanpur OCP:	Rs.10,117.38 Lakhs
Belpahar OCP:	Rs.11,595.14 Lakhs
Lilari OCP:	Rs. 2,048.29 Lakhs
Total:	Rs.23,760.81 Lakhs

Balance amount of Mine Closure Cost: 17,405.59 Lakhs

PHASING OF MINE CLOSURE COST

As per the guidelines, the annual closure cost has been computed considering the total project area at the above mentioned rate and dividing the same by the entire life of the mine in years. An amount equal to the annual cost is to be deposited each year throughout the mine life compounded @8% annually.

Estimated Balance Mine closure cost (September 2018) : **Rs. 17,405.59 lakhs**

Life of the mine : 41 years

Annual amount to be deposited with the Cost Controller in the 1st year: Rs.424.53 lakhs

Annual deposit amounts for balance life @ 8% compounding rate is given below:

General Manager

Table 18.8
(2018-19 is considered as Yr-1)

Year	Mine closure cost (Rs. in lakh)
Yr-1	424.6300
Yr-2	445.7365
Yr-3	468.0643
Yr-4	491.4465
Yr-5	516.0188
Yr-6	541.8197
Yr-7	568.9107
Yr-8	597.3062
Yr-9	627.224
Yr-10	658.5852
Yr-11	691.5145
Yr-12	726.0902
Yr-13	762.3947
Yr-14	800.5144
Yr-15	840.5401
Yr-16	882.5671
Yr-17	926.6955
Yr-18	973.0303
Yr-19	1021.6818
Yr-20	1072.7659
Yr-21	1126.4042
Yr-22	1182.7244
Yr-23	1241.8606
Yr-24	1303.9536
Yr-25	1369.1513
Yr-26	1437.5089
Yr-27	1509.4893
Yr-28	1584.9838
Yr-29	1664.212
Yr-30	1747.4335
Yr-31	1834.7937
Yr-32	1926.5334
Yr-33	2022.8601
Yr-34	2124.3031
Yr-35	2230.2033
Yr-36	2341.7135
Yr-37	2458.7992
Yr-38	2551.7332
Yr-39	2710.8709
Yr-40	2846.3975
Yr-41	2988.6839
TOTAL	64271.8603

The present payment schedule towards Escrow Account of the three mines individually will be discontinued and new payment schedule will be achieved to from F.Y. 2018-19, subject to approval of the Board of MCL and other statutory requirements. The

General Manager
(E.M.), Lakhanpur Area
MCL, Lakhanpur Area

mine closure cost will be deposited as per guidelines issued by Ministry of Coal vide letter No. 55011-01-2009-CPAM. Dt.7/1/2013.

18.6 FINANCIAL ASSURANCE

1. MCL will open an Escrow Account with the Coal Controller Organization (on behalf of the Central Government) as exclusive beneficiary.
2. MCL shall cause payments to be deposited in the Escrow Account per year as per the table 18.6. The amount being deposited will be reviewed with such periodicity as deemed fit by the Coal Controller. A copy Board Resolution regarding approval of Mining Plan including Closure cost is attached as Annexure-I.
3. Mining will be carried out in a phased manner initiating afforestation/reclamation work in the mined out area of the first phase while commencing the mining in the second phase i.e. continuation of mining activities from one phase to the next indicating the sequence of operations depending on the geo-mining conditions of the mine. Up to 80% of the total deposited amount including interest accrued in the ESCROW account may be released after every five years in line with the periodic examination of the Closure Plan as per Clause 3.1 of the Amendment of the Guidelines. The amount released may be equal to expenditure incurred on the progressive mine closure in past five years or 80% whichever is less. The balance amount at the end of the final Mine Closure may be released to MCL on compliance of all provisions of Closure Plan duly agreed by MCL to the effect that said closure of mine complied all statutory rules, regulations, orders made by the Central or State Government, statutory organizations, courts etc. and duly certified by the Coal Controller.
4. An Agreement outlining detailed terms and conditions of operating the Escrow Account shall be executed amongst MCL, Coal Controller and the concerned bank in order to give effect to this.

18.7 RESPONSIBILITIES OF THE MINE OWNERS

1. It is the responsibility of MCL to ensure that the protective measures outlined in the mine closure plan including reclamation and rehabilitation works have been

Project Manager

carried out in accordance with the approved mine closure plan and final mine closure plan.

2. MCL shall submit to the Coal Controller a yearly report before 1st July of every year setting forth the extent of protective and rehabilitative works carried out as envisaged in the mine closure plans.

3. The details of the final Mine Closure plan along with the details of the updated cost estimates for various mine closure activities and the Escrow account already set up shall be submitted to the Ministry of Coal for final approval at least five years before the intended final closure of the mine.

18.6 PROVISIONS OF MINE CLOSURE

1. MCL shall be required to obtain a mine closure certificate from Coal Controller to the effect that the protective, reclamation and rehabilitation works in accordance with the approved mine closure plan/final mine closure plan have been carried out by the mine owner for surrendering the reclaimed land to the State Government concerned.

2. The balance amount at the end of the final Mine Closure may be released to MCL on compliance of all provisions of Closure Plan duly signed by MCL to the effect that said closure of mine complied with all statutory rules, regulations, orders made by the Central or State Government, statutory organizations, court etc. and duly certified by the Coal Controller. This will also indicate the estimated extractable coal reserves and coal actually mined out.

If the Coal Controller has reasonable grounds for believing that the protective, reclamation and rehabilitation measures as envisaged in the approved mine closure plan in respect of which financial assurance was given has not been or will not be carried out in accordance with mine closure plan, either fully or partially, the Coal Controller shall give MCL a written notice of his intention to issue the orders for forfeiting the sum assured at least thirty days prior to the date of the order to be issued after giving an opportunity to be heard.

MCL will open an Escrow Account with the Coal Controller Organization on behalf of the Central Government as exclusive beneficiary.

MCL shall cause payments to be deposited in the Escrow Account per year as per the table-18.8. The amount being deposited will be reviewed with such periodicity as deemed fit by the Coal Controller. A copy Board Resolution against the approval of Mine Closure cost is attached as **Annexure-I**.

Mining will be carried out in a phased manner initiating afforestation/reclamation work in the mined out area of the first phase while commencing the mining in the second phase i.e. continuation of mining activities from one phase to other indicating the sequence of operations depending on the geo-mining conditions of the mine. Up to 90% of the total deposited amount including interest accrued in the ESCROW account may be released after every five years in line with the periodic examination of the Closure Plan as per Clause 3.1 of the Annexure of the Guidelines. The amount released may be equal to expenditure incurred on the progressive mine closure in past five years or 90% whichever is less. The balance amount at the end of the final Mine Closure may be released to MCL on compliance of all provisions of Closure Plan duly signed by MCL to the effect that said closure of mine complied all statutory rules, regulations, orders made by the Central or State Government, statutory organizations, court etc. and duly certified by the Coal Controller.

An Agreement outlining detailed terms and conditions of operating the Escrow Account shall be executed amongst MCL, Coal Controller and the concerned bank in order to give effect to this.

18.8 RESPONSIBILITIES OF THE MINE OWNERS

It is the responsibility of MCL to ensure that the protective measures contained in the mine closure plan including reclamation and rehabilitation works have been carried out in accordance with the approved mine closure plan and final mine closure plan.

Dy. Manager
Env. & Safety
MCL, Lakhanpur

MCL shall submit to the Coal Controller a yearly report before 1st July of every year setting forth the extent of protective and rehabilitative works carried out as envisaged in the mine closure plans.

The details of the final Mine Closure plan along with the details of the updated cost estimates for various mine closure activities and the Escrow account already set up shall be submitted to the Ministry of Coal for final approval at least five years before the intended final closure of the mine.

18.10 PROVISIONS OF MINE CLOSURE

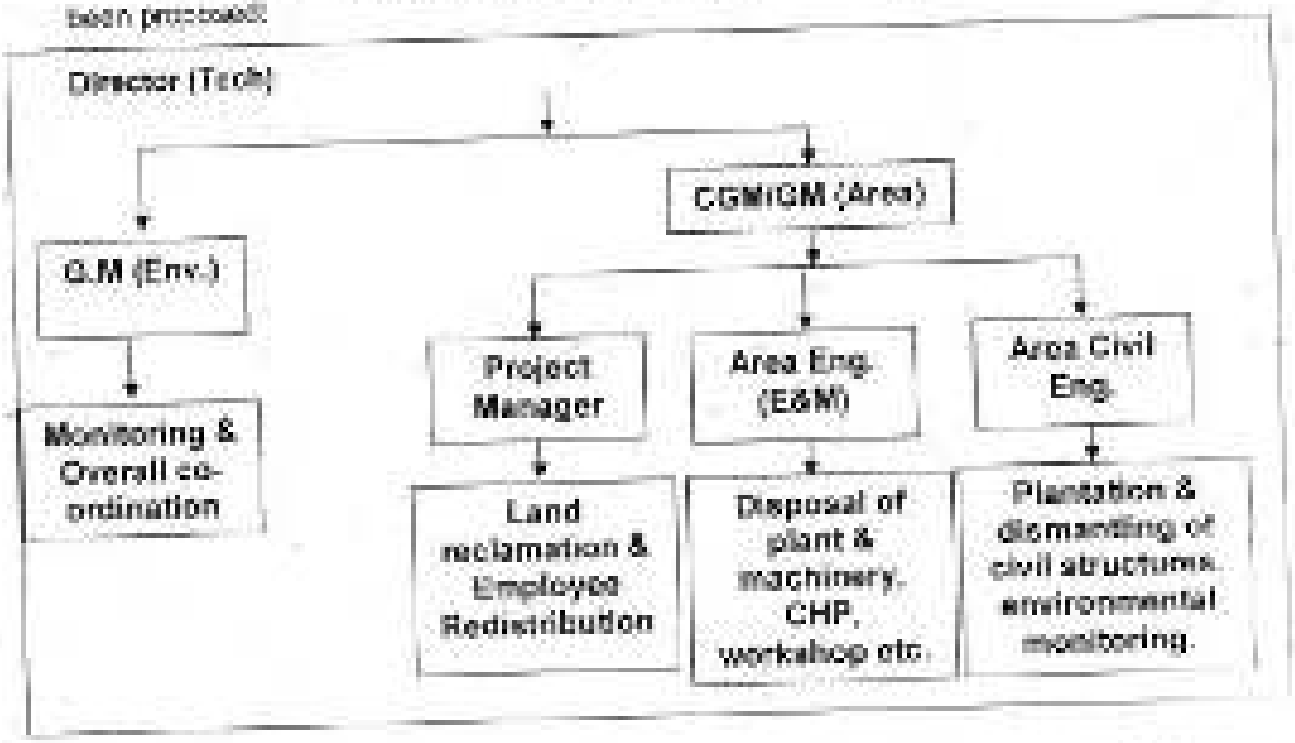
MCL shall be required to obtain a mine closure certificate from Coal Controller to the effect that the protective, reclamation and rehabilitation works in accordance with the approved mine closure plan/final mine closure plan have been carried out by the mine owner for surrendering the reclaimed land to the State Government concerned.

The balance amount at the end of the final Mine Closure may be released to MCL on compliance of all provisions of Closure Plan duly signed by MCL to the effect that said closure of mine complied with all statutory rules, regulations, orders made by the Central or State Government, statutory organizations, court etc. and duly certified by the Coal Controller. This will also indicate the estimated extractable coal reserves and coal actually mined out.

If the Coal Controller has reasonable grounds for believing that the protective, reclamation and rehabilitation measures as envisaged in the approved mine closure plan in respect of which financial assurance was given has not been or will not be carried out in accordance with mine closure plan either fully or partially, the Coal Controller shall give MCL a written notice of his intention to issue the orders for forfeiting the sum assured at least thirty days prior to the date of the order to be issued after giving an opportunity to be heard.

18.11 IMPLEMENTATION PROTOCOL

For implementing the mine closure activities, the following organizational structure has been proposed:



Environmental monitoring for three years after closure of mine will be carried out to evaluate the environmental quality of the area. If need be proper mitigation measures will be taken up after evaluating the environmental quality. The funds for this have been provided in the cost estimate. Before closure of the mine, final CA will prepare survey and disposal report and the same will be submitted to DGMS for acceptance.

General Manager
जन.प्रबं.,लखनपुर क्षेत्र
MCL, Lakhanpur Area

Chapter - 19

MANPOWER

19.0 INTRODUCTION

Manpower for OB removal, coal extraction together with common services and land reclamation considering 330 working days and 16.5% absenteeism in a year has been estimated for all the variants. Office and allied functions shall be computerized. Security, canteen and some other services are proposed to be hired, as decided by MCL. Modern communication facilities shall be adopted.

Total existing manpower as on 01.04.2017 of the three mines, viz. Lakhanpur OCP, Belpahar OCP and Lilari OCP is 1740. Additional manpower requirement has been assessed based on the balance workload.

Details of existing manpower as on 01.04.2017 is given below:

Sl.No	Name of Mine	Exco	Monthly Rated	Daily Rated	Total
1	Lakhanpur OC	56	228	621	905
2	Belpahar OC	46	192	407	645
3	Lilari OC	21	51	118	190
Total		123	471	1146	1740

19.1 ADDITIONAL MANPOWER

The company has decided to engage contractual mining for additional load of coal and OB. Except for CHP, Washery and Security, departmental manpower for the integrated project will be same as above. However, an estimate has been prepared assuming deployment of large size new equipment for production of 40 Mty. Additional Manpower assessment is given below in table 19.1.

REQUIREMENT ON VARIOUS WORKING HEADS

Table - 19.1

Additional Manpower requirement

Sl. No.	Particulars	TOTAL
1	OB	820
2	Coal	842
3	Common	2368
4	Land reclamation	19
	Total	**4249**

General Manager

ANNEXURE

ANNEXURE-I

Shri [illegible]
Project Officer
Mahanadi Coalfields Limited
[illegible]

Ref. No. MCL/[illegible]/[illegible]/[illegible]

Date: 31.10.2018

[illegible] CONFIDENTIAL

To,
[illegible]
[illegible]

Sub: Minutes of the meeting of the 208th Board meeting of MCL held at 7:00 PM on Tuesday the 23rd October, 2018 at MCL Office, Plot No. S-3, Sambalpur, Maharashtra-768002.

Sir/Madam,

[illegible]

Sir/ Madam,

Sub: Approval for corridor of Mahanadi road of Talcher and Jagannath for Construction of Internal Mine road Infrastructure roads for Talcher coalfields of MCL under NCDP, Talcher, OCP, Nandira OCP, Jagannath OCP, Kaniha OCP, Hingula OCP and Lingaraj OCP of MCL.

1.1 With regard deliberation on the proposal in subject, it is DTI/ PEP submitted that in 2018-19, Analyst was asked to provide an alignment for connecting a coal handling plant with external main connecting to the Mahanadi. During on site communications analyst was asked for and work orders were placed. But the Agencies did not submit the bids based on which the contracts were finalized. Subsequently, the Board approved awarding of Rail work orders for constructing the Coal Corridor on a fresh alignment and the job is progressing and work almost 50% completed so far. However, the external roads also need to be aligned and constructed for which the present proposal has been initiated.

During deliberation, the following queries were raised:-

i) What action possibilities if at all there will not be any further change in the alignment of the proposed external roads?

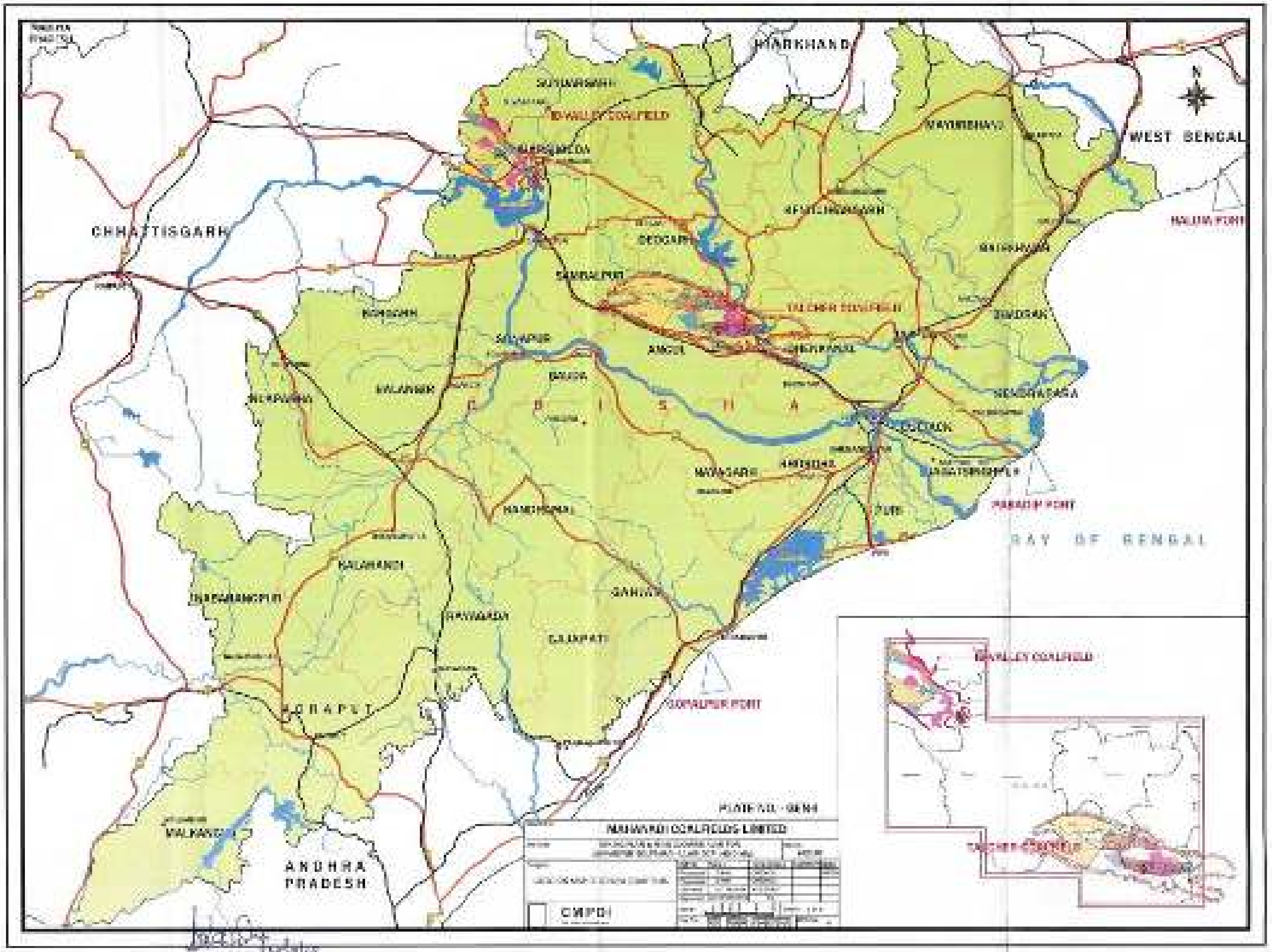
ii) Has any External Organization studied the current alignment?

iii) If work is carried out in this line in near future, will it lead to future demolition or disturbance in operation plan of Coal.

1.2 Replying to the queries, Director (T)/ CMPDI assured the Board that the external MCL Team has studied the alignment of the external roads and confirmed that there will not be any change in the alignment.

[illegible]
General Manager
[illegible]
MCL, Lakhanpur Area

PLATES



ORISSA STATE

ORISSA STATE

JOBM BLOCK AS RECEIVED FROM OBM DEPTT.

BELPAHAR I, II & III
COMBINED BLOCK

EXCAVATION BOUNDARY
SAMALESWARI EXPN. OCP

LILARI NALA

FINAL EXCAVATION SURFACE BOUNDARY

FINAL EXCAVATION FLOOR BOUNDARY

TEMPORARY
TOP SOIL
STORAGE

SITE FOR TEMPORARY
STORAGE OF
WASHERY REJECTS

Central Workshop
Colony

Project
Office

ECO TANK

SERVICE MAGAZINE

WORKSHOP

PROJECT STORE

MINE ENTRY

FINAL EXCAVATION SURFACE

LEGENDS

SYMBOL	PARTICULARS
	FINAL EXCAVATION BOUNDARY
	REQUIRED LEASE BOUNDARY TOTAL
	REQUIRED LEASE BOUNDARY FOR PHASE-I
	EXISTING RAIL LINE-MCL
	EXISTING RAIL LINE-OPCC
	PROPOSED RAIL LINE-MCL
	PROPOSED RAIL LINE-OCPL
	FLOOR BOUNDARY OF FINAL QUARRY
	FOREST LAND DIVERTED
	FOREST LAND TO BE DIVERTED

SCALE
0 100 200 300 400 500 600 700 800 900 1000 M

PLATE NO.- GEN III

Customer: MAHANADI COALFIELDS LIMITED

Job Title: MINING PLAN AND MINE CLOSURE PLAN FOR LAKHANPUR-BELPAHAR-LILARI OCP (40.0 Mty)

Job No. 702192

Subject: SURFACE LAYOUT PLAN

Activity	Name	Designation	Signature	Date
Designed	D. ROY	CM(EXCV.)		30-09-18
Drawn	D. ROY	CM(EXCV.)		30-09-18
Checked	G. K. MISHRA	HoD (P&D)		
Approved	S.K.SRIVASTAVA	R.D.		

CMPDI
ISO 9001 Company

Scale 1 : 10,000 Sheet

Drg.No. R/7/P&D/0020/3 REV.No. 0

DIP SIDE OF SAMALESWARI OCP BLOCK

DIP SIDE OF LAKHANPUR OCP BLOCK

LIMIT OF INDICATED RESERVE

LIMIT OF PROVED RESERVE

BELPAHAR-I,II & III COMBINED BLOCK

KUSARALOI R F

KUSARALOI R F

-2000 -1000 0 1000 2000 3000 4000 5000 6000 7000

7000 6000 5000 4000 3000 2000 1000 0 -1000 -2000

N

W E

S

INDEX

- Boreholes drilled by CMPDI
- Boreholes drilled by DMCO
- Boreholes drilled by GSI
- Village Road
- Dam with Embankment
- Village
- Surface contour with value (225)
- Block Boundary
- Nala
- Ponds/Water bodies
- Trees
- BLOCK BOUNDARY COMB.

All values are in metre

MINING PLAN & MINE CLOSURE PLAN FOR LAKHANPUR-BELPAHAR-LILARI OCP (40.0 Mty), JOB NO - 702192, SCALE - 1 : 10,000

PLATE NO.-GEO-I

Client: MAHANADI COALFIELDS LIMITED

Job Title: GEOLOGICAL REPORT ON BELPAHAR I, II & III COMB. IB VALLEY C.F. RI-VII BHUBANESWAR, ODISHA

Job No. 702121

Subject: TOPOGRAPHICAL PLAN

Activity	Name	Designation	Signature	Date
G/P/Design	S. K. Sahoo	Sr. G/P		28/10/2021
Processed	J. Nath	G/P(Gr. Chief) Manager (Geol.)		28/10/2021
Checked	Dr. S. Samanta	GM (Geology)		28/10/2021
Approved	A. Sharma	HOD (Geo. Chief)		28/10/2021

Scale: 1:10000 (0 100 500m) Original Size: A0

Drg.No. E7 GEO 002002 R/V. No.

CMPDI (ISO 9001 Company)

S/W DEVELOPED BY MODELLING UNIT, EXPLORATION DIVISION, CMPDI(HQ), RANCHI.

DIP SIDE OF SAMALESWARI OCP BLOCK

DIP SIDE OF LAKHANPUR OCP BLOCK

MINE BOUNDARY (30MTY)

MINE BOUNDARY (30 MTY)

MINE BOUNDARY (30 MTY)

MINE BOUNDARY (30 MTY)

PROPOSED MINE BOUNDARY (30 MTY)

LIMIT OF INDICATED RESERVE

LIMIT OF PROVED RESERVE

BELPAHAR-LILARI COMBINED BLOCK

BELPAHAR OCP

LA MURA

F1 F2 F3 F4 F5 F6 F7 F8

A A' B B' C C' D D' E E'

N W E S

-1000X 0X 1000X 2000X 3000X 4000X 5000X 6000X

6000Y 5000Y 4000Y 3000Y 2000Y 1000Y 0Y -1000Y -2000Y -3000Y

INDEX

- Boreholes drilled by CMPDI (CMB-065, CBLK-065, CBLK-029)
- Boreholes drilled by DMG (DBB-038, DBLL-008, DBCC-2)
- Boreholes drilled by GSI (GSB-029)
- Fault with direction and amount of throw (F1, 40)
- Outcrop
- Block Boundary
- A — A' Geological cross section line
- 210.20 Reduced level
- Mine Boundary of Integrated PR (30 Mty)

All values are in metre

MINING PLAN & MINING PLAN FOR
LAKHANPUR-BELPAHAR-LILARI OCP(43.0 Mty)
JOB NO - 702192, SCALE - 1 : 10,000

PLATE NO.-GEO-II

Customer: MAHANADI COALFIELDS LIMITED

Job Title: GEOLOGICAL REPORT ON BELPAHAR I, II & III COMB. IB VALLEY OF RI-VII BHUBANESWAR, ODISHA — Job No. 702121

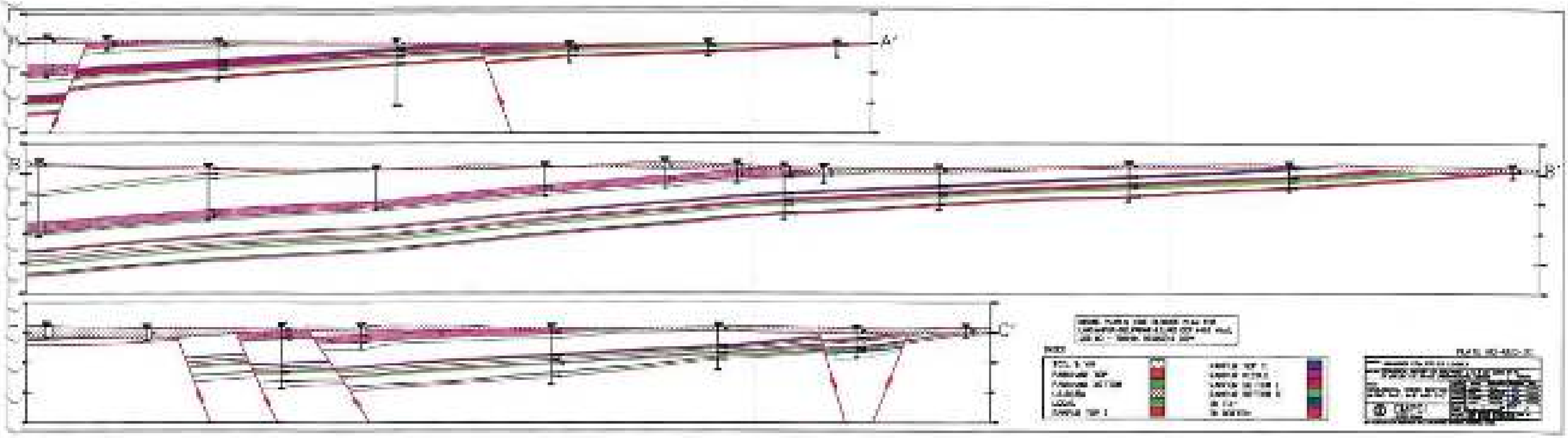
Subject: GEOLOGICAL PLAN OF BELPAHAR I, II & III COMBINED BLOCK

Activity	Name	Designation	Signature	Date
D/F/Design				
Prepared				
Checked				
Approved				

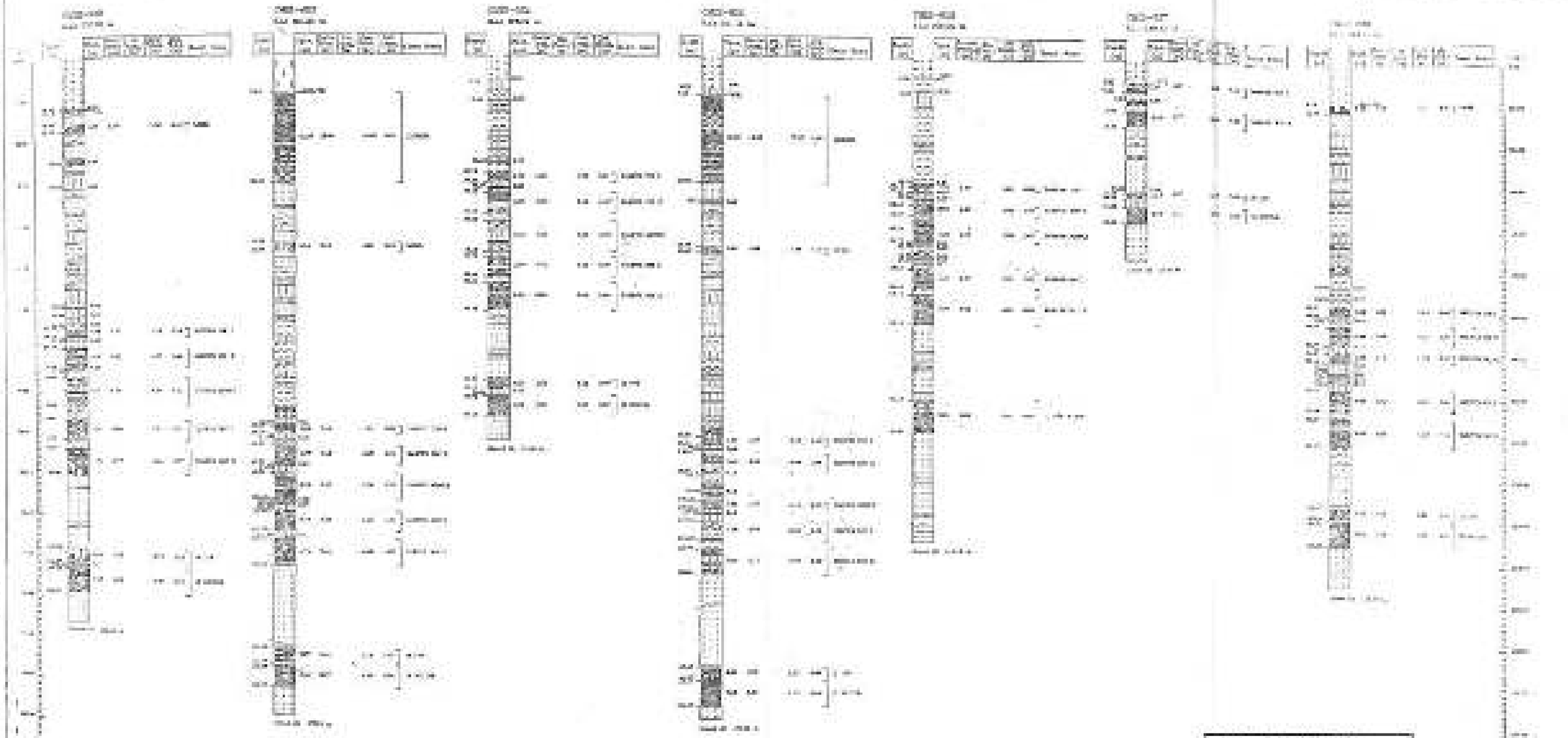
CMPDI (ISO 9001 Company)

Scale@A3 1:10000 — Drg No. — Sheet of — REV. No.

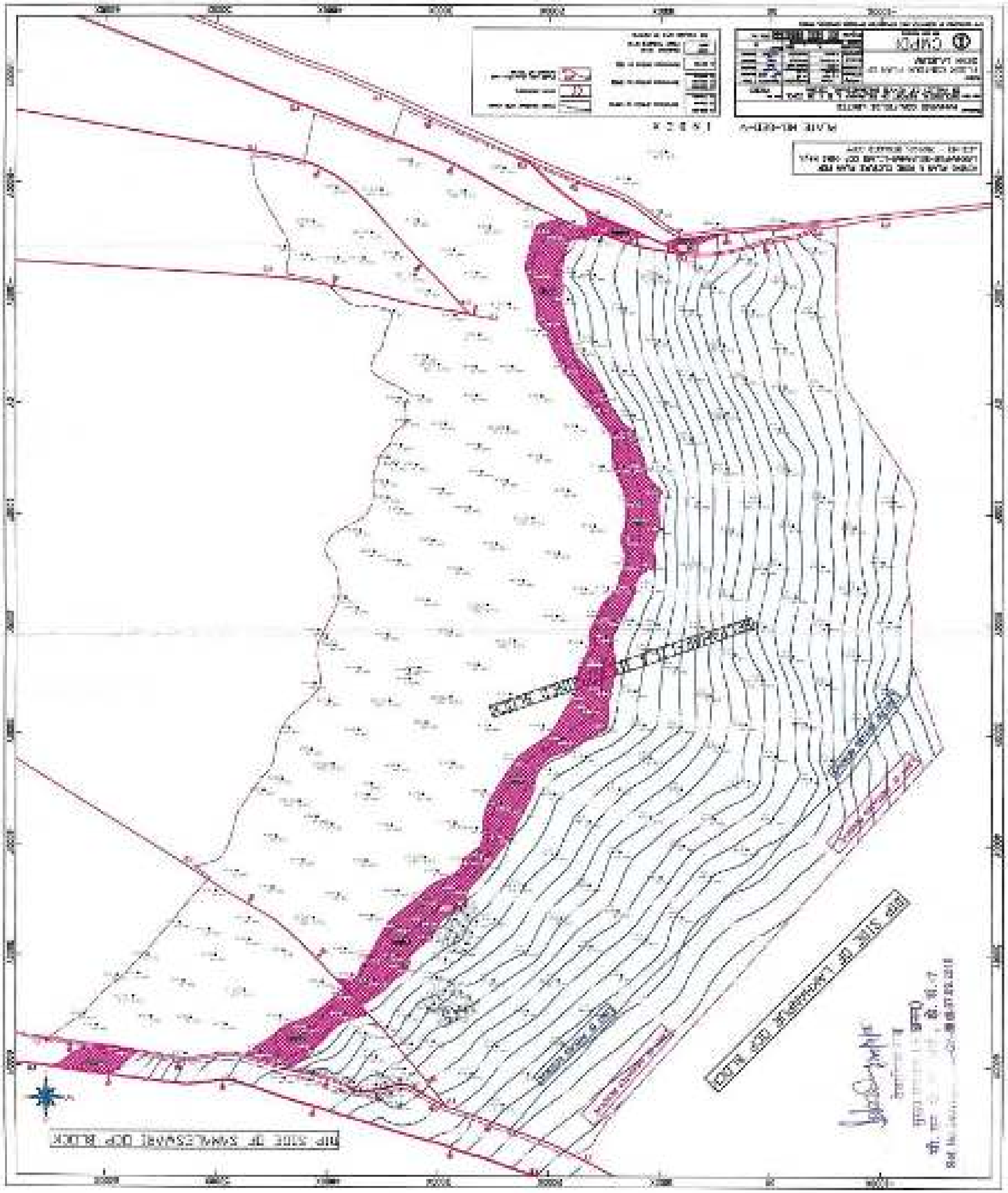
S/W DEVELOPED BY GEOSYSTEM UNIT EXPLORATION DIVISION, CMPDI(HQ), RANCHI.



वैज्ञानिक सहायक
मुख्य प्रयोगशाला (उत्तरी)
भू. एव. पी. डी. आई., डी. स.-I
Ref. No. 3401/1/2019/DS-CPL(N)-CLOT-05/2018



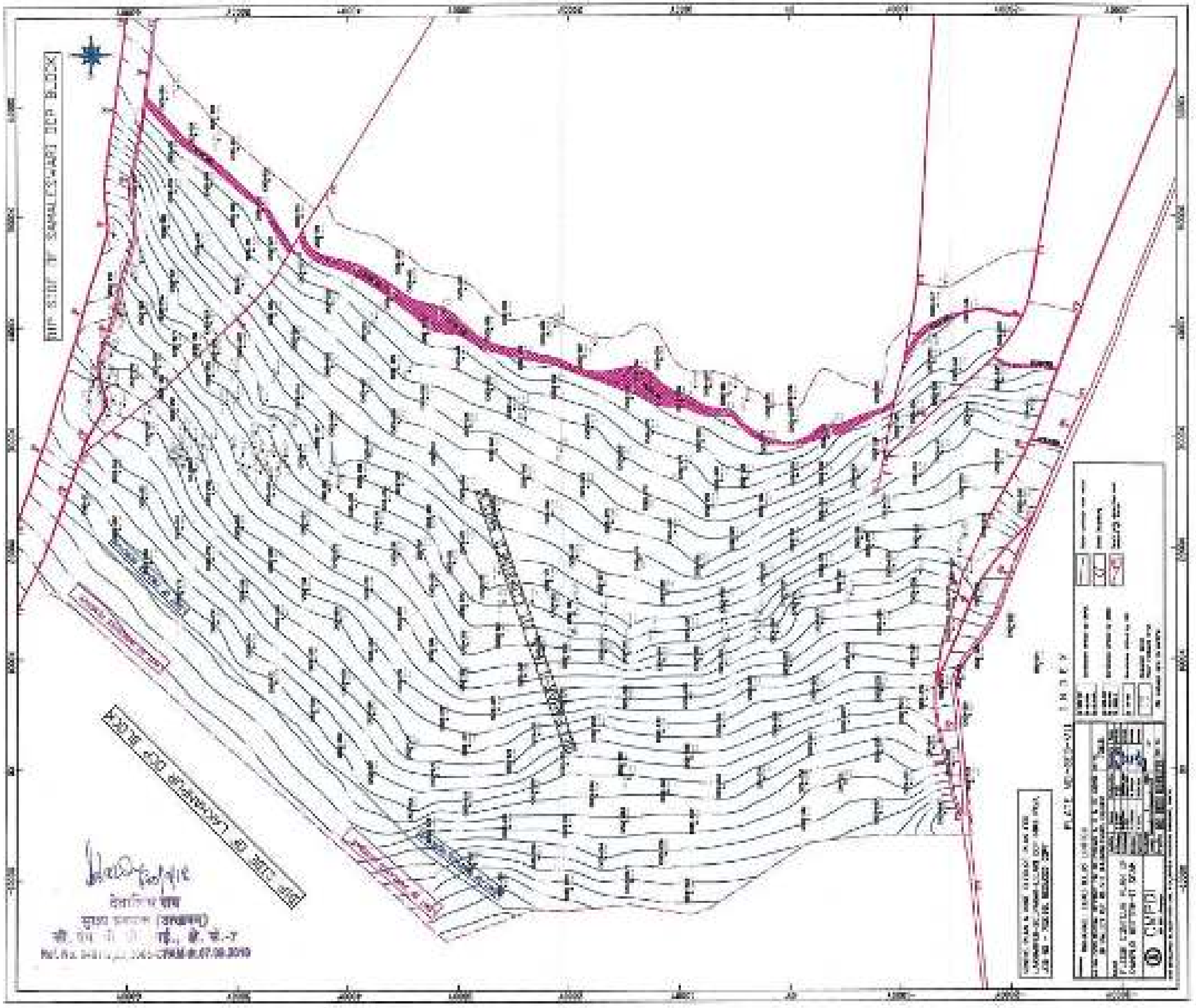
केतकिम राठ
मुख्य प्रबंधक (उत्पादन)
सी. एल. सी. डी. आई., के
Ref No. 3401/[illegible]/2015-CDA/[illegible]

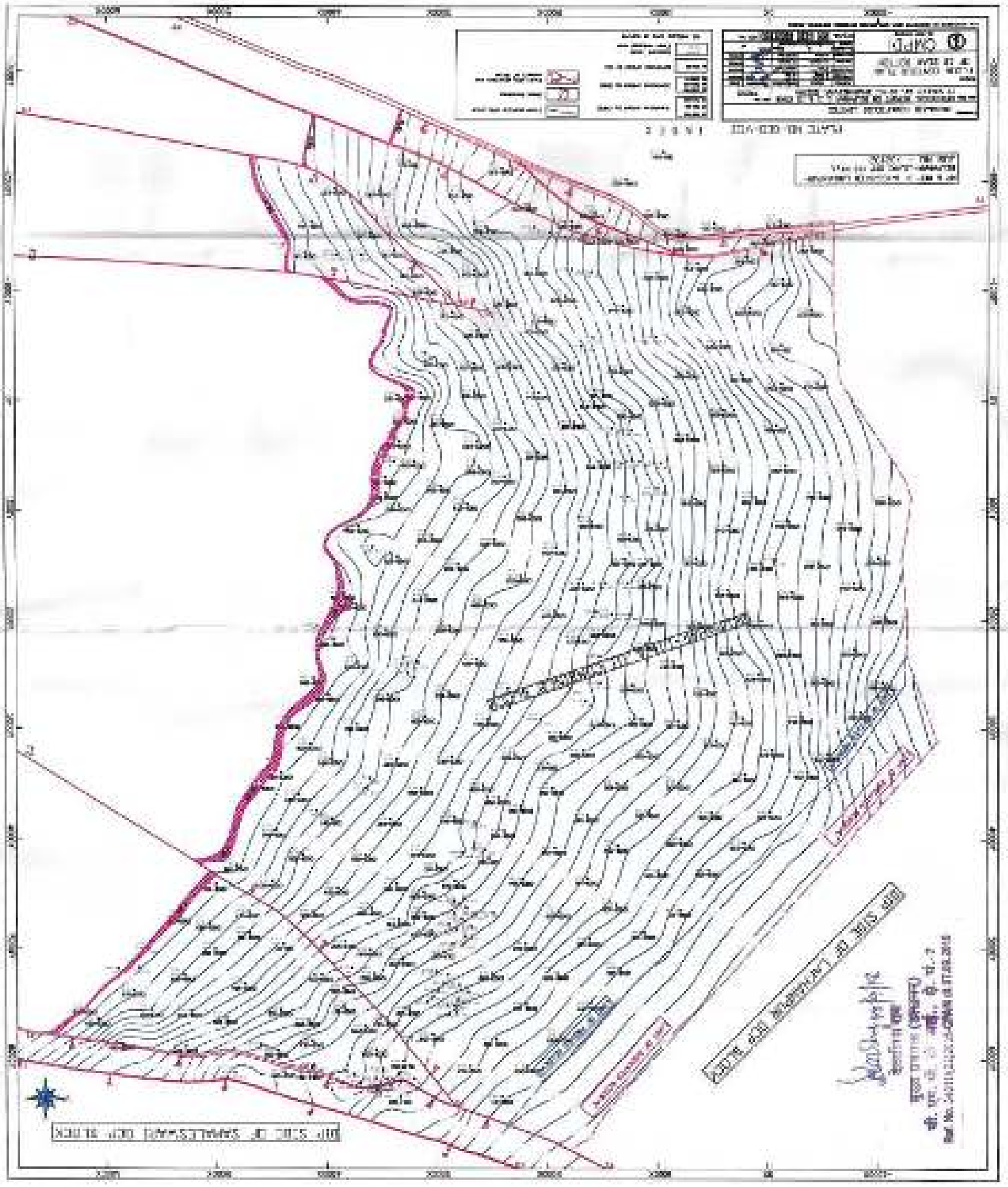


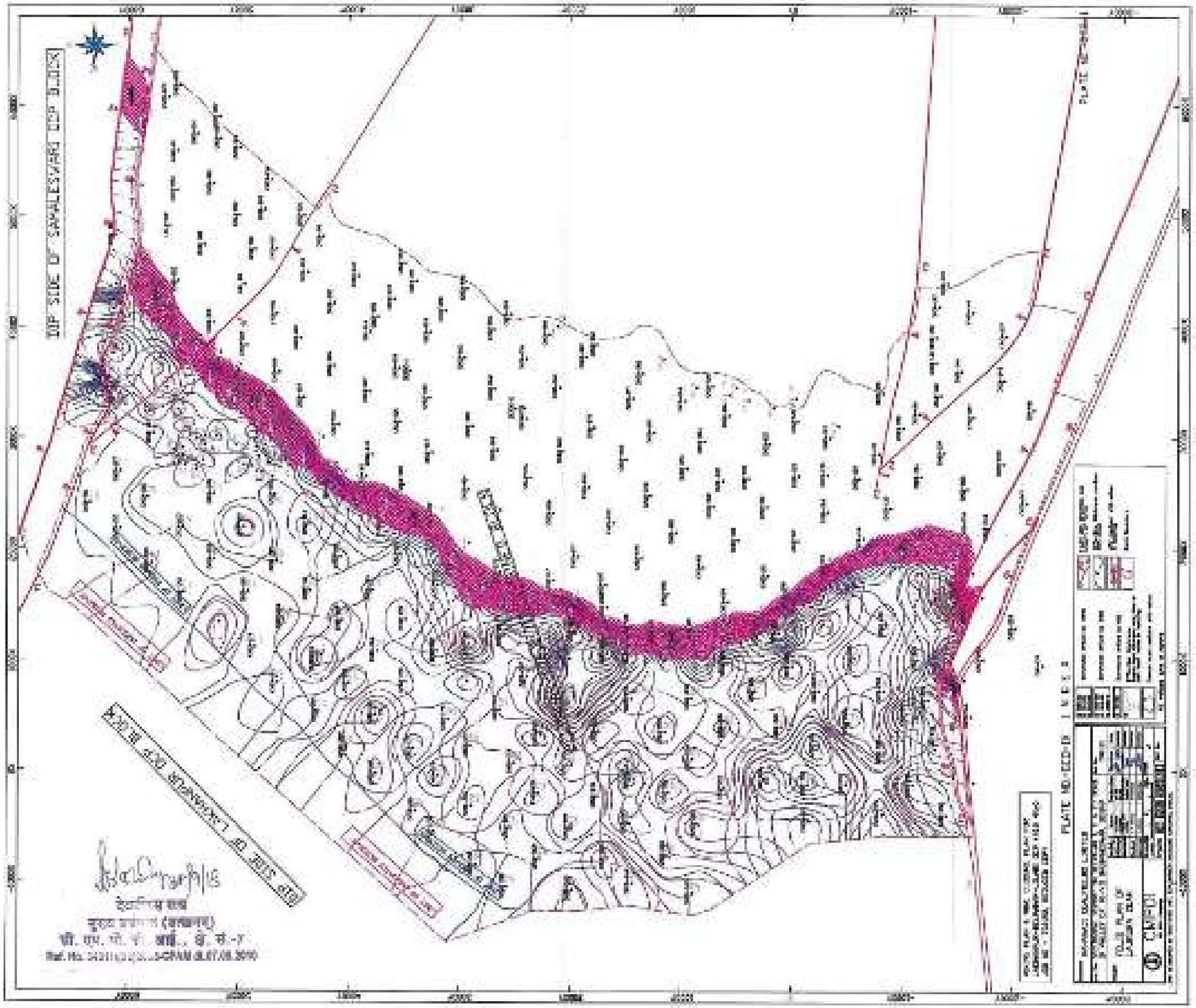
DIP SIDE OF SWANLESWARI DEEP BLOCK

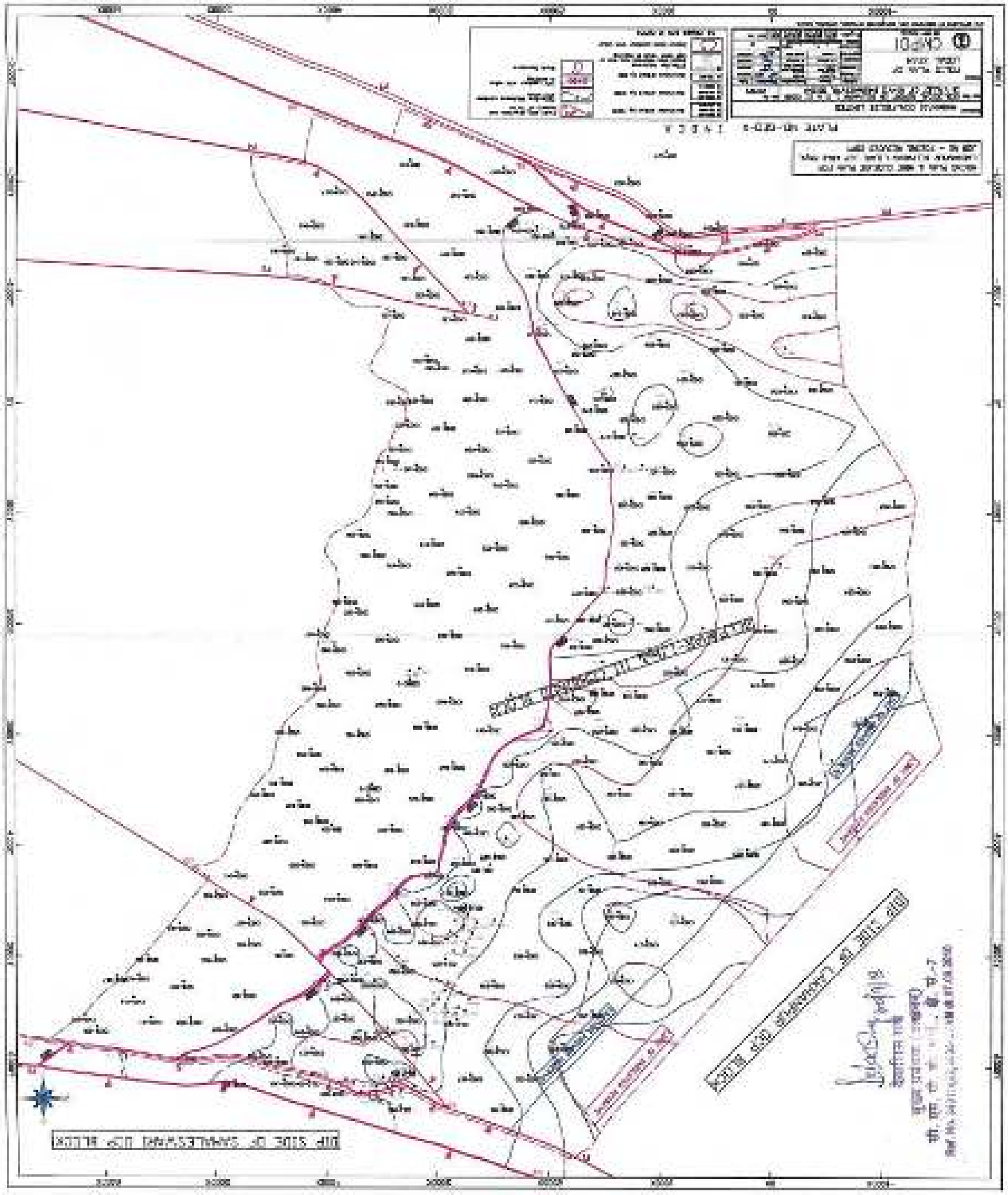
DIP SIDE OF LAKWAPUR DEEP BLOCK

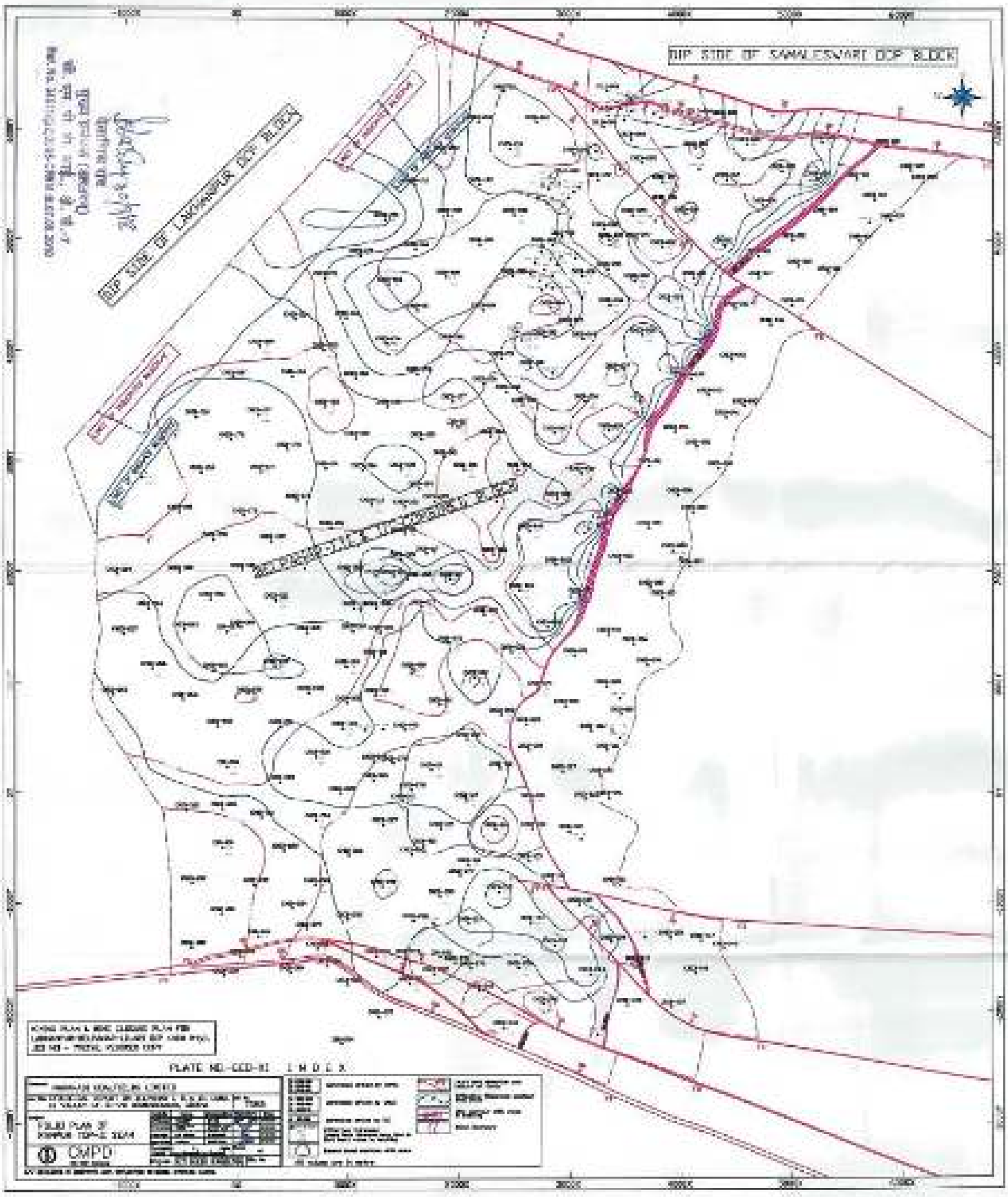
PLATE NO.-GEO-VI INDEX

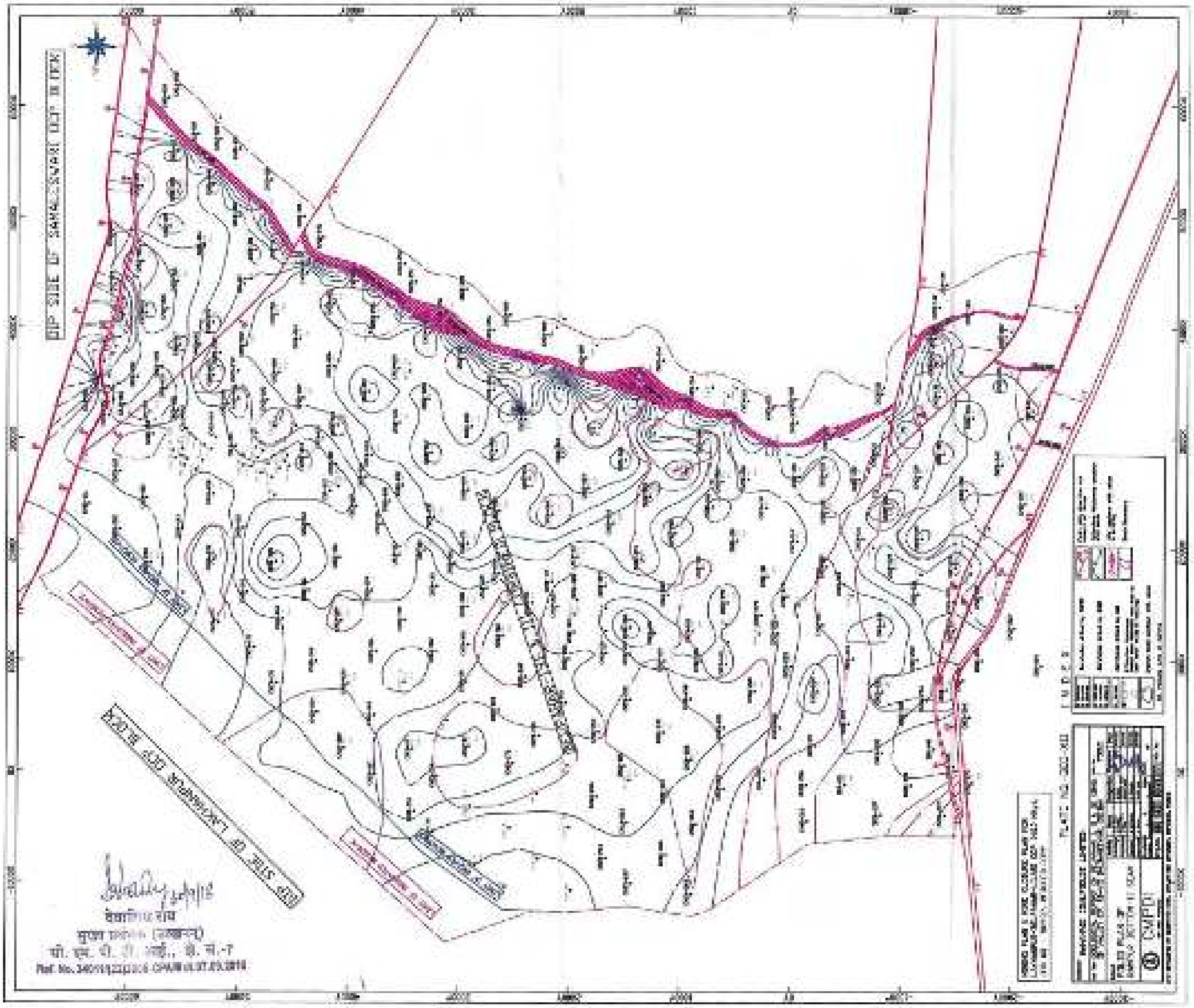


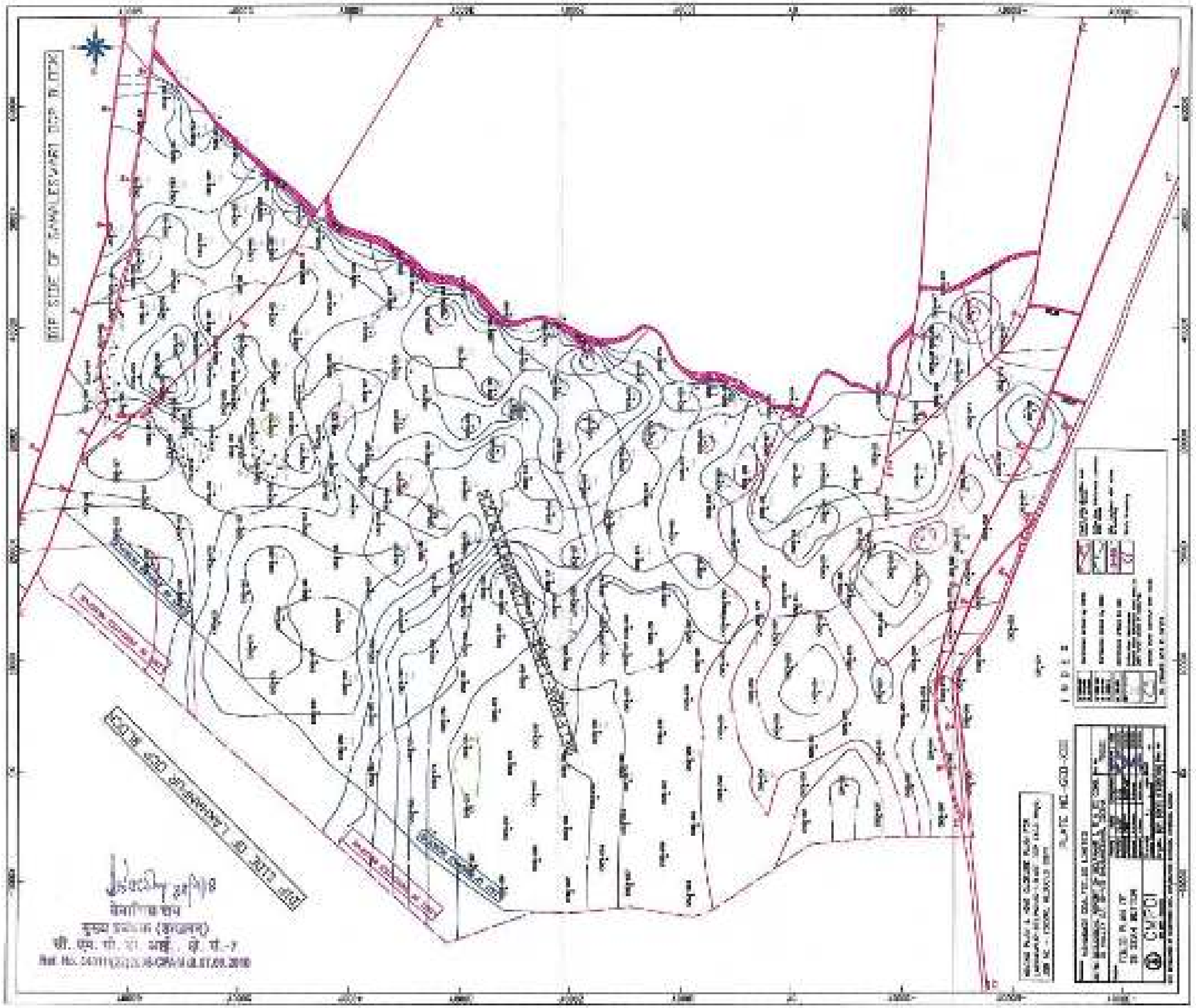


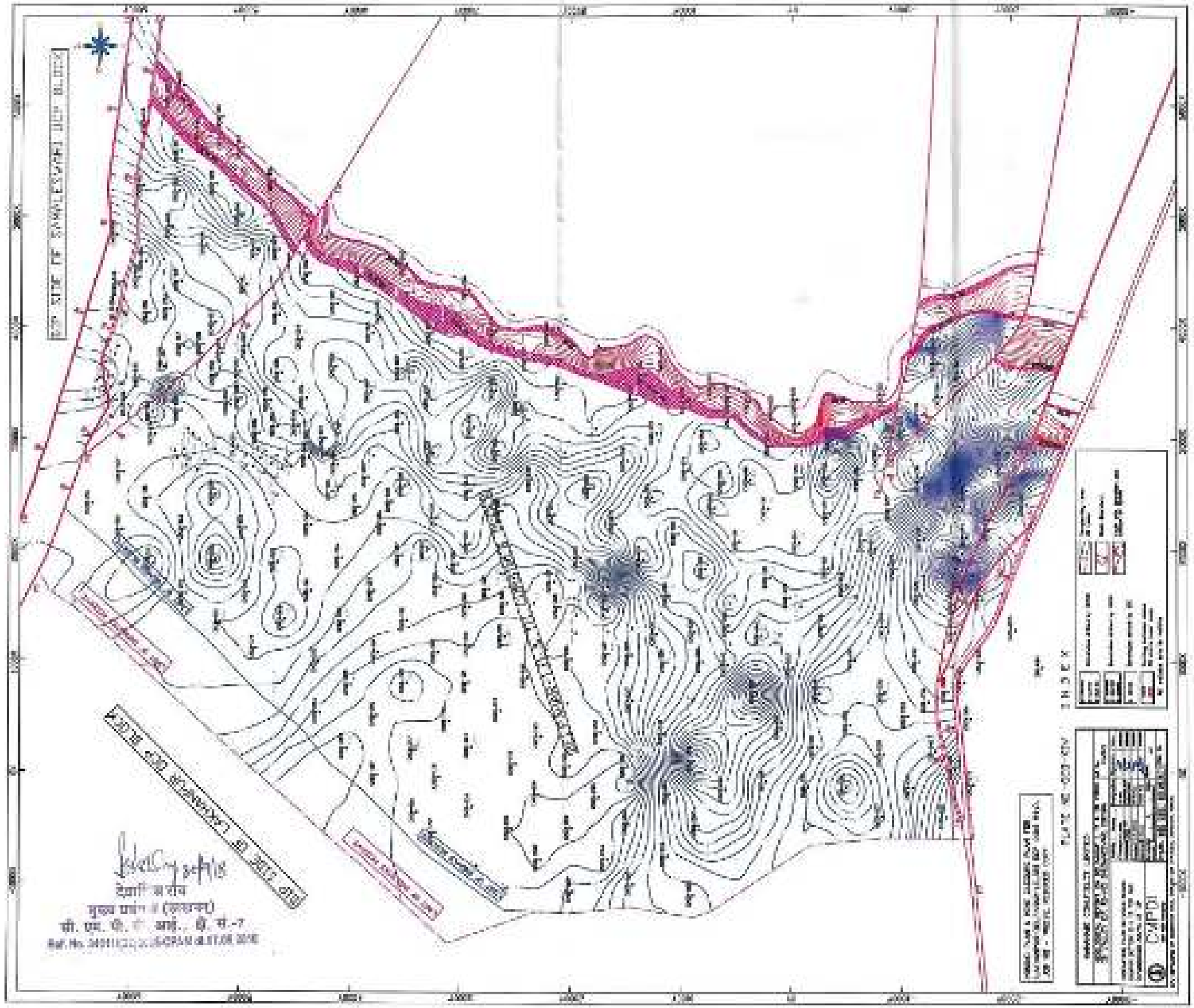

TOP SIDE OF SPARKLESPRO BLOCKS
PLATE NO. ECD-15




DIP SIDE OF SAMALESWARI DCP BLOCK
DIP SIDE OF LAKHANPUR DCP BLOCK
PLATE NO.-CCD-01 I N D E X


SITE OF SUBSTATION (DEP)
PROPOSED 400 KV D/C TRANSMISSION LINE
EXISTING 400 KV D/C TRANSMISSION LINE
EXISTING 220 KV D/C TRANSMISSION LINE
PROPOSED 400 KV D/C TRANSMISSION LINE

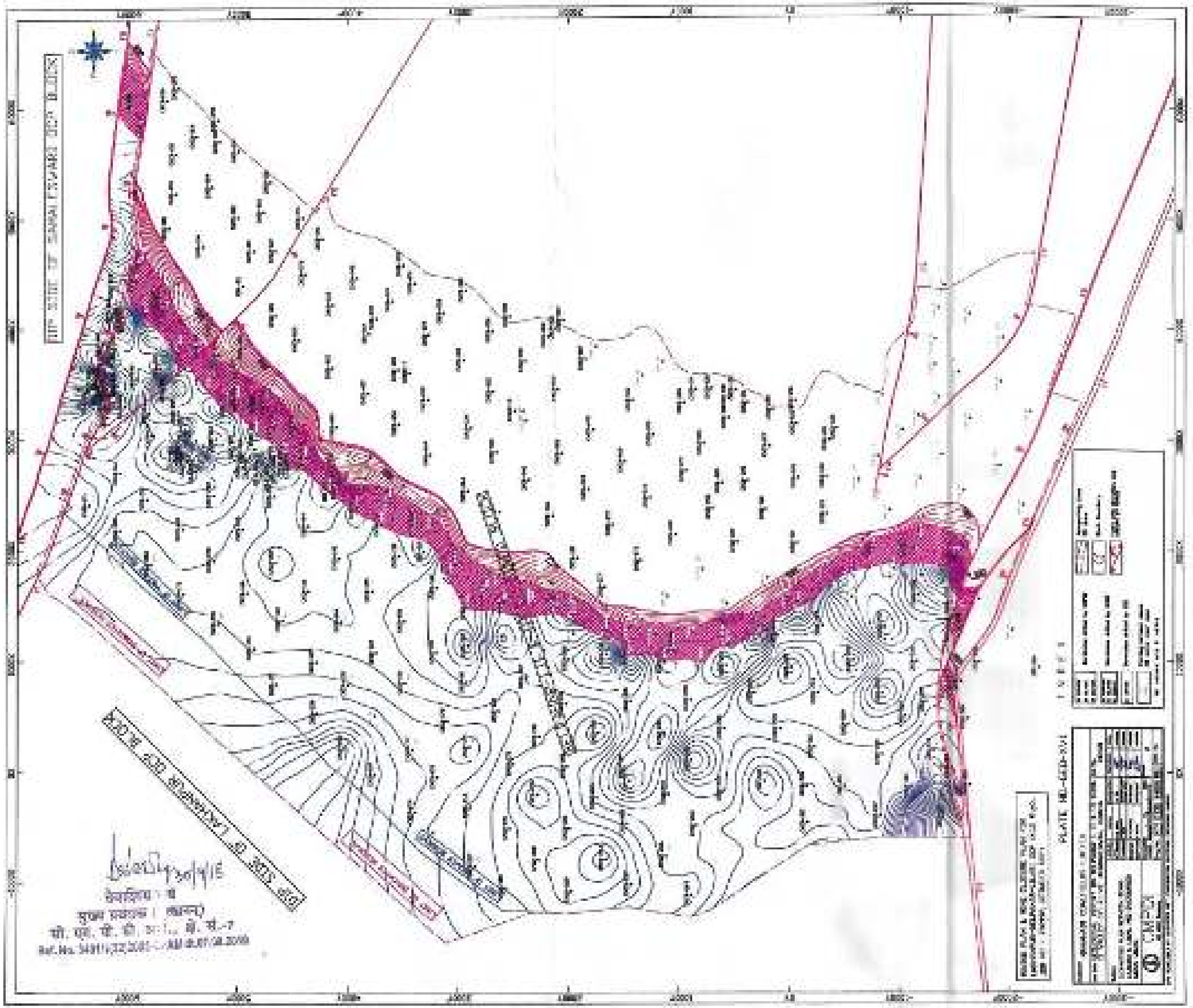



INDEX
PLOT NO. 223-07
(SPD)

DIP SIDE OF SAMALESWARI DEEP BLOCK

DIP SIDE OF LAKSHMIPUR DEEP BLOCK

PLATE NO-SEC-RV INDEX



DIP SIDE OF SAMALESWARI DEEP BLOCK

DIP SIDE OF LAKHAMPUR DEEP BLOCK

PLATE NO. G-(V-C)

I N D E X

CMPD

DIP SIDE OF SAMALESWARI EOP BLOCK

DIP SIDE OF LAKHANPUR EOP BLOCK

PLATE NO.-E-XVIII

INDEX

CMPDI

LILARI MINE

LAKHANPUR MINE

BELPAHAR MINE

QUARRY NO-1

QUARRY NO-2

QUARRY NO-3

QUARRY NO-4

OB BACKFILLED AREA

15 MTY QUARRY LIMIT LINE

MINE BOUNDARY

NOTIFICATION LINE IB BLOCK-VI PART-II

SC ALE-R/F 10000

FUEL OIL LINE

ECO TANK

Q3N

Q3S

BELPAHAR OPENCAST MINE
LAKHANPUR AREA
M. C. L.
SCALE 1:10000

LEGENDS

SYMBOL	PARTICULARS
	PROPOSED LEASE BOUNDARY FOR PHASE-I
	REQUIRED FINAL LEASE BOUNDARY
	INTERNAL AND EXTERNAL OB DUMPS
	RIVER, POND, STREAM, WATER BODY

PLATE NO.- MIN I

SCALE

0 100 200 300 400 500 600 700 800 900 1000 M

Customer: MAHANADI COALFIELDS LIMITED

Job Title: MINING PLAN AND MINE CLOSURE PLAN FOR LAKHANPUR-BELPAHAR-LILARI OCP (40.0 Mty)

Job No. 702192

Subject: EXISTING MINE POSITION AS ON 01-04-2018

Activity	Name	Designation	Signature	Date
Designed	D. ROY	CM(EXCV.)		Sept'2018
Drawn	D. ROY	CM(EXCV.)		
Checked	G. K. MISHRA	HoD (P&D)		
Approved	S.K.SRIVASTAVA	R.D.		

CMPDI
ISO 9001 Company

Scale 1 : 10,000

Sheet

Drg.No. R | P&D | 0 0 2 0 5 5 | REV No. 0

N

JURABAGA

EXCAVATION BOUNDARY
SAMALESWARI EXPN. OCP

LILARI NALA

LILARI EXTERNAL O.B. DUMP

L I L A R I O C P

EMBANKMENT

EXT. DUMP

LAKHANPUR MINE 2019-20

PHULIJOR NALA

OB DUMP TOP LEVEL +230 AMSL

L A K H A N P U R Q U A R R Y

EXCAVATED LAKHANPUR QUARRY

NALA DIVERSION

BELPAHAR MINE 2019-20

UBDA

UBDA VILLAGE

KUSURALOI

EXCAVATED BELPAHAR QUARRY

ECO TANKS

SERVICE MAGAZINE

Central Workshop

Colony

LILARI NALA

FINAL EXCAVATION BOUNDARY

DRY. BND. BELPAHAR'S MTY.

SCALE

0 100 200 300 400 500 600 700 800 900 1000 M

LEGENDS

SYMBOL	PARTICULARS
	REQUIRED LEASE BOUNDARY of PHASE-I
	REQUIRED LEASE BOUNDARY of PHASE-I (FINAL)
	FINAL EXCAVATION BOUNDARY
	SURFACE BOUNDARIES OF EXISTING MINES
	FLOOR BOUNDARIES OF EXISTING MINES
	VILLAGE HABITATION
	EXISTING RAIL LINE-MCL
	EXISTING RAIL LINE-OPCC
	PROPOSED RAIL LINE-MCL
	PROPOSED RAIL LINE-OCPL
	INTERNAL AND EXTERNAL O.B. DUMP

देवाशिस राय
मुख्य प्रबंधक (खनन)
सी. एम. पी. डी. लि., बी. बी.-7
Ref. No. 340/(12)/2008-CPM dt.07.08.2019

PLATE NO.- MIN II

Customer: MAHANADI COALFIELDS LIMITED

Job Title: MINING PLAN AND MINE CLOSURE PLAN FOR LAKHANPUR-BELPAHAR-LILARI OCP (40.0 Mty)

Job No. 702192

Subject: ASSESSED MINE POSITION END OF 2019-20 (YEAR-2)

Activity	Name	Designation	Signature	Date
Designed	D. ROY	CM(EXCV.)		Sept'2018
Drawn	D. ROY	CM(EXCV.)		
Checked	G. K. MISHRA	Hod (P&D)		
Approved	S.K.SHIVASTAVA	R.D.		

Scale: 1 : 10,000

Sheet

CMPDI
ISO 9001 Company

Drg.No. R 7 P & D 0 0 2 0 5 6

REV.No. 0

N

JURABAGA

EXCAVATION BOUNDARY
SAMALESWARI EXPN. OCP

LILARI NALA

LILARI EXTERNAL O.B. DUMP

L I L A R I O C P

EMBANKMENT

EXT. DUMP

GARLAND DRAIN

OB DUMP TOP LEVEL +230 AMSL

L A K H A N P U R Q U A R R Y

EXCAVATED

LAKHANPUR YEAR-6 (2023-24)

CENTRAL QRY YEAR-6 (2023-24)

INTERNAL OB DUMP
TOP LEVEL +230 AMSL

ECO TANK

Project Office

Central Workshop

Colony

Training Institute

Workshop Stores

Pay Loader Operators Cabin

SERVICE MAGAZINE

INTEGRATED MINE BOUNDARY

TEMPORARY
TOP SOIL
STORAGE

PROJECT OFFICE

WORKSHOP

PROJECT STORE

SITE FOR TEMPORARY
STORAGE OF
WASHERY REJECTS

LEGENDS

SYMBOL	PARTICULARS
	REQUIRED LEASE BOUNDARY of PHASE-I
	REQUIRED LEASE BOUNDARY of PHASE-II (FINAL)
	FINAL EXCAVATION BOUNDARY
	SURFACE BOUNDARIES OF QUARRIES
	FLOOR BOUNDARIES OF QUARRIES
	VILLAGE HABITATION
	EXISTING RAIL LINE-MCL
	EXISTING RAIL LINE-OPGC
	PROPOSED RAIL LINE-MCL
	PROPOSED RAIL LINE-OCPL
	INTERNAL AND EXTERNAL O.B. DUMP

SCALE
0 100 200 300 400 500 600 700 800 900 1000 M

PLATE NO.- MIN III

Customer:	MAHANADI COALFIELDS LIMITED				
Job Title	MINING PLAN AND MINE CLOSURE PLAN FOR LAKHANPUR-BELPAHAR-LILARI OCP (40.0 Mty)			Job No.	702192
Subject	EXCAVATION & CLOSURE PLAN 6TH YEAR (2023-24)	Activity	Name	Designation	Signature	Date
		Designed	D. ROY	CM(EXCV.)		Sept'2018
		Drawn	D. ROY	CM(EXCV.)		
		Checked	G. K. MISHRA	HoD (P&D)		
		Approved	S.K.SRIVASTAVA	R.D.		
CMPDI ISO 9001 Company		Scale	1 : 10,000		Sheet:	
		Drg.No.	RT P&D 0 0 2 0 5 7		REV.No.	0

N

JURABAGA

EXCAVATION BOUNDARY
SAMALESWARI EXPN. OCP

LILARI NALA

LILARI NALA EMBANKMENT

LILARI EXTERNAL O.B. DUMP

L I L A R I O C P

EXT. DUMP

GARLAND DRAIN

STOPPED LAKHANPUR QUARRY

INTERNAL DUMP OF LAKHANPUR REHANDLING

CENTRAL QURRY

INTERNAL OB DUMP
TOP LEVEL +280 AMSL

PROPOSED OVER BURDEN DUMP

ECO TANK

SERVICE MAGAZINE

Central Workshop

Central Workshop Colony

Project Office

INTEGRATED MINE BOUNDARY

TEMPORARY TOP SOIL STORAGE

RECLAIM FEEDER COMPLEX (EW-01)

FEEDER BREAKER (400 TPH CAPACITY EACH)

CHAIN CONVEYOR (Tripper)

PROJECT OFFICE

WORKSHOP

PROJECT STORE

MINE ENTRY

SOUTH QUARRY

SITE FOR TEMPORARY STORAGE OF WASHERY REJECTS

LEGENDS

SYMBOL	PARTICULARS
	REQUIRED LEASE BOUNDARY of PHASE–I
	REQUIRED LEASE BOUNDARY of PHASE–II (FINAL)
	FINAL EXCAVATION BOUNDARY
	SURFACE BOUNDARIES OF QUARRIES
	FLOOR BOUNDARIES OF QUARRIES
	VILLAGE HABITATION
	EXISTING RAIL LINE–MCL
	EXISTING RAIL LINE–OPGC
	PROPOSED RAIL LINE–MCL
	PROPOSED RAIL LINE–OCPL
	INTERNAL AND EXTERNAL O.B. DUMP

SCALE
0 100 200 300 400 500 600 700 800 900 1000 M

PLATE NO.- MIN IV

Customer: MAHANADI COALFIELDS LIMITED

Job Title: MINING PLAN AND MINE CLOSURE PLAN FOR LAKHANPUR-BELPAHAR-LILARI OCP (40.0 Mty)

Job No. 702192

Subject: EXCAVATION & CLOSURE PLAN 10TH YEAR (2027-28)

Activity	Name	Designation	Signature	Date
Designed	D. ROY	CM(EXCV.)		Sept'2018
Drawn	D. ROY	CM(EXCV.)		
Checked	G. K. MISHRA	HoD (P&D)		
Approved	S.K.SRIVASTAVA	E.D.		

CMPDI
ISO 9001 Company

Scale: 1 : 10,000

Sheet

Drg.No. RT P&D 0 0 2 0 5 8 REV.No. 0

N

JURABAGA

EXCAVATION BOUNDARY
SAMALESWARI EXPN. OCP

LILARI NALA

LILARI NALA EMBANKMENT

LILARI EXTERNAL O.B. DUMP

L I L A R I O C P

EXT. DUMP

GARLAND DRAIN

GARLAND DRAIN

CENTRAL QUARRY

INTERNAL OB DUMP
TOP LEVEL +290 AMSL

PROPOSED DIVERSION

LILARI NALA

Central Workshop

Central Workshop Colony

Training Institute

Area Manager's House Old Office

Regional Stores

Workshop Stores

Project Office

ECO TANK

SERVICE MAGAZINE

INTEGRATED MINE BOUNDARY

TEMPORARY TOP SOIL STORAGE

SOUTH QUARRY

INTERNAL O.B. DUMP
CAPACITY 234.47 Mcum

SITE FOR TEMPORARY STORAGE OF WASHERY REJECTS

MINE ENTRY

PROJECT OFFICE

WORKSHOP

PROJECT STORE

LEGENDS

SYMBOL	PARTICULARS
	REQUIRED LEASE BOUNDARY of PHASE-I
	REQUIRED LEASE BOUNDARY of PHASE-II (FINAL)
	FINAL EXCAVATION BOUNDARY
	SURFACE BOUNDARIES OF QUARRIES
	FLOOR BOUNDARIES OF QUARRIES
	VILLAGE HABITATION
	EXISTING RAIL LINE-MCL
	EXISTING RAIL LINE-OPGC
	PROPOSED RAIL LINE-MCL
	PROPOSED RAIL LINE-OCPL
	INTERNAL AND EXTERNAL O.B. DUMP

SCALE
0 100 200 300 400 500 600 700 800 900 1000 M

PLATE NO.- MIN V

Customer: MAHANADI COALFIELDS LIMITED

Job Title: MINING PLAN AND MINE CLOSURE PLAN FOR LAKHANPUR-BELPAHAR-LILARI OCP (40.0 Mty)

Job No. 702192

Subject: EXCAVATION & CLOSURE PLAN 15TH YEAR (2032-33)

Activity	Name	Designation	Signature	Date
Designed	D. ROY	CM(EXCV.)		Sept'2018
Drawn	D. ROY	CM(EXCV.)		
Checked	G. K. MISHRA	HoD (P&D)		
Approved	S.K.SRIVASTAVA	R.D.		

CMPDI
ISO 9001 Company

Scale 1 : 10,000

Sheet

Drg.No. R7 P&D 0020359 REV.No. 0

JURABAGA

EXCAVATION BOUNDARY
SAMALESWARI EXPN. OCP

LILARI NALA

LILARI EXTERNAL O.B. DUMP

L I L A R I O C P

EMBANKMENT

EXT. DUMP

CENTRAL QUARRY

INTERNAL OB DUMP
TOP LEVEL +290 AMSL

INTEGRATED MINE BOUNDARY

TEMPORARY
TOP SOIL
STORAGE

SOUTH QUARRY

INTERNAL O.B. DUMP
CAPACITY 232.00 Mcum

SITE FOR TEMPORARY
STORAGE OF
WASHERY REJECTS

MINE ENTRY

PROJECT OFFICE

WORKSHOP

PROJECT STORE

ECO TANK

SERVICE MAGAZINE

Central Workshop

Central Workshop
Colony

Project Office

Regional Store

Workshop Store

LEGENDS

SYMBOL	PARTICULARS
	REQUIRED LEASE BOUNDARY of PHASE-I
	REQUIRED LEASE BOUNDARY of PHASE-II (FINAL)
	FINAL EXCAVATION BOUNDARY
	SURFACE BOUNDARIES OF QUARRIES
	FLOOR BOUNDARIES OF QUARRIES
	VILLAGE HABITATION
	EXISTING RAIL LINE-MCL
	EXISTING RAIL LINE-OPGC
	PROPOSED RAIL LINE-MCL
	PROPOSED RAIL LINE-OCPL
	INTERNAL AND EXTERNAL O.B. DUMP

SCALE

0 100 200 300 400 500 600 700 800 900 1000 M

PLATE NO.- MIN VI

Customer: MAHANADI COALFIELDS LIMITED

Job Title: MINING PLAN AND MINE CLOSURE PLAN FOR LAKHANPUR-BELPAHAR-LILARI OCP (40.0 Mty)

Job No. 702192

Subject: EXCAVATION & CLOSURE PLAN 20TH YEAR (2037-38)

Activity	Name	Designation	Signature	Date
Designed	D. ROY	CM(EXCV.)		Sept'2018
Drawn	D. ROY	CM(EXCV.)		
Checked	G. K. MISHRA	HoD (P&D)		
Approved	S.K.SRIVASTAVA	R.D.		

CMPDI (ISO 9001 Company)

Scale 1 : 10,000

Sheet

Drg.No. R 7 P&D 0 0 2 0 6 0 REV.No. 0

EXCAVATION BOUNDARY
SAMALESWARI EXPN. OCP

CENTRAL SUB-STATION

LILARI NALA

NORTH QUARRY

CENTRAL QUARRY

SOUTH QUARRY

TEMPORARY
TOP SOIL
STORAGE

SITE FOR TEMPORARY
STORAGE OF
WASHERY REJECTS

Central Workshop

CENTRAL
WORKSHOP
COLONY

ECO TANK

WORKSHOP

PROJECT OFFICE

PROJECT STORE

MINE ENTRY

MINE ENTRY

देवाशिस राय
मुख्य प्रबंधक (एकात्मी)
खो. मृ. नि. लि., ला. ओ. सी. -I

LEGENDS

SYMBOL	PARTICULARS
	FINAL EXCAVATION BOUNDARY
	REQUIRED LEASE BOUNDARY
	EXISTING RAIL LINE-MCL
	EXISTING RAIL LINE-OPGC
	PROPOSED RAIL LINE-MCL
	PROPOSED RAIL LINE-OCP
	FLOOR CONTOURS OF IB BOTTOM SEAM
	FLOOR CONTOURS OF IB TOP SEAM
	FLOOR CONTOURS OF LAJKURA SEAM
	FLOOR CONTOURS OF RAMPUR BOTTOM-II SEAM

SCALE
0 100 200 300 400 500 600 700 800 900 1000 M

PLATE NO.- MIN VII

Customer:	MAHANADI COALFIELDS LIMITED				
Job Title	MINING PLAN AND MINE CLOSURE PLAN FOR LAKHANPUR-BELPAHAR-LILARI OCP (40.0 Mty)			Job No.	702192
Subject		Activity	Name	Designation	Signature	Date
		Designed	D. ROY	CM(EXCV.)		Sept/2018
EXCAVATION PLAN FINAL YEAR (2058-59)		Drawn	D. ROY	CM(EXCV.)		
		Checked	G. K. MISHRA	HoD (P&D)		
		Approved	S.K.SRIVASTAVA	R.D.		
CMPDI ISO 9001 Company		Scale	1 : 10,000		Sheet	
		Drg.No.	R/7 P&D 0 0 2 0 6 1		REV.No.	0

N

EXCAVATION BOUNDARY
SAMALESWARI EXPN. OCP

LILARI NALA

LEVEL +230m AMSL

LEVEL +230m AMSL

NORTH QUARRY

CENTRAL QUARRY

Central Workshop

Central Workshop Colony

Training Institute

Lakhanpur Area GM Office

Regional Store

Workshop Store

Project Office

ECO TANK

SERVICE MAGAZINE

TEMPORARY TOP SOIL STORAGE

MINE ENTRY

CHP

CHP (Tripper)

PROJECT OFFICE

WORKSHOP

PROJECT STORE

MINE ENTRY

SOUTH QUARRY

INTERNAL O.B. DUMP
CAPACITY 424.43 Mcum

SITE FOR TEMPORARY STORAGE OF WASHERY REJECTS

6000N
5000N
4000N
3000N
2000N
1000N
0
1000S
2000S

1000W 0 1000E 2000E 3000E 4000E 5000E 6000E 7000E

LEGENDS

SYMBOL	PARTICULARS
	FINAL EXCAVATION BOUNDARY
	REQUIRED LEASE BOUNDARY
	EXISTING RAIL LINE-MCL
	EXISTING RAIL LINE-OPGC
	PROPOSED RAIL LINE-MCL
	PROPOSED RAIL LINE-OCPL

SCALE
0 100 200 300 400 500 600 700 800 900 1000 M

PLATE NO.- MIN VIII

Customer: MAHANADI COALFIELDS LIMITED

Job Title: MINING PLAN AND MINE CLOSURE PLAN FOR LAKHANPUR-BELPAHAR-LILARI OCP (40.0 Mty) — Job No. 702192

Subject: CLOSURE PLAN FINAL YEAR (2058-59)

Activity	Name	Designation	Signature	Date
Designed	D. ROY	CM(EXCV.)		Sept'2018
Drawn	D. ROY	CM(EXCV.)		
Checked	G. K. MISHRA	HoD (P&D)		
Approved	S.K.SRIVASTAVA	R.D.		

CMPDI
ISO 9001 Company

Scale 1 : 10,000 — Sheet

Drg.No. R7 P&D 0 0 2 0 6 2 — REV.No. 0