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MINING PLAN AND MINE CLOSURE PLAN

FOR

KULDA EXPANSION OCP

(EXPANSION FROM 15.00 to 18.75 MTY)

IB VALLEY COALFIELD

MAHANADI COALFIELDS LIMITED

RQP: SHRI SIDDHARTHA SANKAR BASU, RQP REF.NO.-No. 34012/1/2015-CPAM, DTD. 05.10.2017

Under Rule 22(C) of Mineral Concession Rules 1960

JANUARY, 2020

CENTRAL MINE PLANNING & DESIGN INSTITUTE LIMITED

(A Subsidiary of Coal India Limited)

REGIONAL INSTITUTE-VII

BHUBANESWAR-751013

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MINING PLAN & MINE CLOSURE PLAN
OF
KULDA EXPANSION OCP (15 MTY TO 18.75 MTY)

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1	NAME AND ADDRESS OF THE APPLICANT	:	MAHANADI COALFIELDS LIMITED, JAGRUTI VIHAR, BURLA, SAMBALPUR-768020 (ORISSA)
2	STATUS OF THE APPLICANT	:	CENTRAL PUBLIC SECTOR UNDERTAKING (A SUBSIDIARY OF COAL INDIA LTD.) A GOVT. OF INDIA UNDERTAKING REGISTERED UNDER COMPANIES ACT, 1956
3	MINERAL WHICH THE APPLICANT INTENDS TO MINE	:	COAL
4	NAME, ADDRESS OF PERSON WHO PREPARED MINING PLAN	:	SHRI SIDDHARTHA SANKAR BASU CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED, REGIONAL INSTITUTE-VII, PLOT NO. E4 NEAR GANDHI PARK, SAMANTAPURI, BHUBANESWAR-751013 (ODISHA). RQP REF.NO.-No. 34012/1/2015-CPAM, DTD. 05.10.2017
5	NAME AND ADDRESS OF PROSPECTING AGENCY	:	CENTRAL MINE PLANNING & DESIGN INSTITUTE LIMITED, REGIONAL INSTITUTE-VII, PLOT NO. E4 NEAR GANDHI PARK, SAMANTAPURI, BHUBANESWAR-751013 (ODISHA).

DOCUMENTS ENCLOSED

Sl No	Description	Page
A.	Copy of the Allotment Order	The proposed Kulda OCP lies in the Kulda geological block which belongs to MCL and where opencast mine is being operated. Sanction letter of Project report enclosed in Annexure-I
B	**LIST OF ANNEXURE**	
1	Copy of Approval letter of Project report (Peak 18.75 Mty) (Annexure-II)	AN., page 4
2	Copy of approval of earlier Mining Plan/Mine Closure Plan (15 Mty) (Annexure-III)	AN., page 5
3	Copy of environment clearance (14 Mty) (Annexure-IV)	AN., page 6-16
4	Letter from MCL to CMPDI for preparation of Mining Plan (18.75 Mty) (Annexure-V)	AN., page 17
5	Re-diversion of 8.52 ha forest land (Annexure-VI)	AN., page 18
6	Copy of grant of recognition to executives of CMPDI as competent to prepare mining plan of coal/ lignite blocks (Annexure-VII)	AN., page 19
7	Certificate from Technically qualified person from CMPDI (Annexure-VIII)	AN., page 20
C	INDEX of chapters contained in MP&MCP	Enclosed in contents
D	List of plates contained in MP&MCP	Enclosed in contents
E	TEXT & PLATES	Page as mentioned in contents
F	Confirmation from RQP that he has verified the Block area with the relevant plans supplied by CMPDI/SCCL/NLC and area covered by the Mining Plan does not encroach on any other Coal/Lignite Block.	This is to confirm that the proposed area has been verified with the relevant plans available in CMPDI and the area under consideration is under jurisdiction of MCL.
G	Copy of the document to establish that the Geological Report has been duly purchased from CMPDI, GSI/MECL as the case may be.	The Geological Report was prepared by CMPDI.

H. **List of Abbreviations used:**

- MoC : Ministry of Coal
- MoEF : Ministry of Environment and Forest
- EC : Environmental Clearance
- FC: Forestry Clearance
- CMPDIL : Central Mine Planning and Design Institute Limited.
- MCL : Mahanadi Coalfields Limited.
- NCDC: National Coal Development Corporation.
- OC : Opencast
- IBM : Indian Bureau of Mines
- MECL: Mineral development Corporation Limited
- RH- Relative Humidity
- UHV- Useful Heat Value
- PR : Project Report
- CBA (A&D) Act- Coal Bearing Areas (Acquisition & Development) Act.
- Yr 1,2,- Production year 1,2
- Mt- Million tonnes
- Mty- Million tonnes per year
- OB- Overburden
- TPD- Tonnes per day
- kW- kilo watt
- kV-kilo volt
- FLP- Flame Proof
- lps-liters per second
- CO- Carbon Monoxide
- CH_4 Methane
- CHP- Coal Handling Plant
- MTK room- Mine Time Keeper Room
- RPM- Rounds per Minute
- SPM- Suspeded Particulate Matter
- NO_x Nitrogen Oxide/s
- EMP- Environmental Management Plan

SUMMARISED DATA

1.	General	
a)	Name and address of the Applicant Company	Mahanadi Coalfields Ltd. (MCL) Jagriti Vihar, Burla Dist: Sambalpur (Odisha) - 768020
b)	Name and address of the Block Allottee	Mahanadi Coalfields Ltd.(MCL)
c)	Relationship between the applicant and allottee company	MCL is a subsidiary of Coal India Ltd. which is a Govt. of India Undertaking
d)	Status of the Applicant Company : Central /Public Sector Undertaking/State Government Undertaking/JV Company/ Pvt. Company/Public Co/Others (Specify)	Central Public Sector Undertaking
e)	Name of the Coal Block together with name of Coalfield & State where located	KULDA Expansion OCP, Rev-II (Expn from 15 to 18.75 Mty) is located over Kulda Block in Basundhara area, Ib Valley Coalfield, Odisha.
f)	Date of allotment	Block is being worked by Mahanadi Coalfields Limited, A subsidiary of Coal India Limited (Govt. of India undertaking)
g)	End Use of Coal/Lignite as per Approval by the Competent Authority	Basket linkage.
h)	ROM Quantity proposed to be produced as per Mining Plan	18.75 Million Te
i)	Norms adopted for calculating ROM quantity requirement in case it differs from the quantity indicated in the Allotment Order.	Not Applicable
j)	Beneficiation required – Yes/No	Yes
k)	Requirement of Beneficiated Coal & expected availability thereof.	Washed coal yield around 70% (10 Mty ROM coal is washed out of 18.75 Mty)
l)	Period for which Mining Lease has been granted/is to be renewed/ is to be applied for.	Land acquired under CBA(A&D), Act, 1957
m)	Date of Expiry of earlier Mining Lease, if any	N/A
n)	RQP who has prepared the Mining Plan Name Address Phone No/Fax/Email ID Registration No & date till valid Date of grant/Renewal of RQP Status Validity	SIDDHARTHA SANKAR BASU Central Mine Planning and Design Institute limited, Plot No E4 (Near Gandhi Park), At: Samantapuri Bhubaneswar-751013 Phone No. 0674-2391962 E-Mail- ss.basu@coalindia.in RQP NO. 34012/1/2015-CPAM Dtd. 05.10.2017.

D. Information regarding earlier approved Mining Plans, if any.

a)	Approval Letter no. and Date	34012/(4)/2011-CPAM dtd 26th December 2016.
b)	Lease Area ----------	634.205 ha (Phase-I)
c)	Date of grant of Lease ----------	
d)	Date of Expiry of Lease ----------	
e)	Targetted Production ----------	18.75 Mty
f)	Proposed date of start of Production ----------	Already started.
g)	Proposed date of achieving the targeted production level -------	Yet to achieve.
h)	Envisaged life of the mine (in years) ----------	15 (w.e.f. 01.04.2019)
i)	Date of actual commencement of Mining Operations, if operations already started	2007-08
j)	Likely date of Mining Operations, if operations not yet started & reasons for non-commencement of operations	Not applicable.
k)	Planned production and actual levels achieved in last 3 years	
l)	Coal :- U/G O/Cast OB	

	COAL (Mt)	OB (Mcum)
2016-17	9.99	5.31
2017-18	10.07	8.22
2018-19	12.81	5.95

m)	Reasons for difference between the planned and actual production levels	Delay in land acquisition
n)	Reason for revision of the Mining Plan	To enhance production by expanding the area of operation.

o) Details of changes in the new mining plan compared to earlier approval

		Old Plan	New Plan
(i)	Lease Area (Ha) ----------	634.20	921.305
(ii)	Forest Area (Ha) ----------	227.89	354.06
(iii)	Excavation Area (Ha)	321.91 (phase-I)	539.98
(iv)	Production level (Mty) ----------		
(v)	Life (Years) ----------	15.0 10	18.75 15
(vi)	Reserves ----------	132.29 (phase-I)	266.49

E	LOCATION	
a)	Location of the Block Taluka/ Village/ Khasra/ Plot / Block Range / etc. District / State	Sundergarh district, Odisha
b)	Name of the Coalfield/ Coal belt	Ib Valley Coalfield
c)	Particulars of adjacent blocks: North, South, East, West	North- non coal bearing area South-Kulda dipside extension block. East- Garjanbahal block. West- Siarmal block
d)	Area of the Allotted Block (hectares) i Geological block area ii Excavation Area	 → 584.0 Ha → 539.98 Ha

e) Reference no. of plan of block boundary issued by CMPDI/ SCCL/ NLC (A copy of the Plan also to be annexed)	The Mining Plan is based on the Geological Report on Kulda Block, Ib valley Coalfield" Odisha, prepared by CMPDI, RI-VII in February 1994.
f) Whether the lease boundary/ required boundary is same as demarcated by CMPDI/ SCCL/ NLC for delineating block/sub- block	No
g) Existing mining Lease Area in case of existing mines, (hectares)	634.20 Ha (Phase-I) (excluding rehabilitation area of 22.90ha and colony area of 37.50ha)
h) Applied/ required Lease Area as per the Mining Plan under consideration (hectares)	Land acquired under CBA Act.
i) Whether the applied lease area falls within the allotted block	Yes
j) Area (hectares) of lease which falls outside the block/sub- block delineated by CMPDI/SCCL/NLC.	334.305 Ha
k) Details of outside area: - Whether forms part of any other coal block - Whether it contains any coal/lignite reserves - Purpose for which it is required, e.g. roads/ OB dumps/ service buildings/ colony/ safety zone/ others (specify)	Dump area falls under non coal bearing area towards rise side of Garjanbahal block which belongs to MCL. Infrastructure is on non coal bearing area towards rise side of the block. Colony & resettlement area is outside block area.
l) Whether some part(s) of the allotted block has not been applied for mining lease. - Total area in Ha. of such part(s). - Total reserves in such part(s). - Brief reasoning for leaving such part(s),	No. Not applicable.
m) Type of Land involved in Hectares - Forest Land - Non Forest Land	Forest land - 354.06 ha Non-forest land - 567.245 ha Total : 921.305 ha
n) Broad Land Use Pattern (Forest, Township, Industrial, Agricultural, Grazing, Barren etc.)	Agriculture and forest
o) Proximity of public road / railway line/major water body if any and approximate distance	Nearest rail head Himgir—36km by road Sundergarh town is at a distance of 40km by road.
p) latitude and longitude	**Kulda Block** Latitude : 22°01'02"and 22°03'03"N Longitude : 83°43'28"and 83°45'35"E

F	GEOLOGY AND EXPLORATION			
a)	Name of the Geological Block and area in hectares	Kulda- 584Ha		
b)	Name of the Geological Report (GR) with year of preparation	"Geological Report on Kulda Block, Ib river coalfield" Odisha, prepared by CMPDI, RI-VII in February,1994.		
c)	Name of the agency which conducted exploration and prepared GR	CMPDI		
d)	Period of conducting exploration			
e)	Details of drilling (by all agencies)	Block	Agency	No. of BHs
		Kulda	CMPDI NCDC	130
			Total	130
f)	No. of boreholes drilled within the block	130		
g)	Overall borehole density within the block (no./ sq. km)	22.3 BH/ Sq.Km		
h)	Area covered by 'detailed' exploration within the block (hectares)	Totally explored		
i)	Area covered by 'detailed' exploration outside the block (hectares) - No. of boreholes drilled outside the block. - Bore hole density for outside area (no./sq. km)	Not Applicable		
j)	Whether entire lease area has been covered by 'detailed' exploration.	Yes		
k)	Whether any further exploration is required or suggested and timeframe in which it is to be completed	No		
l)	Number of coal/lignite seams/horizons - thickness range of coal seams - Minimum & maximum depth of coal seams	3 major seams – Ib seam (3 sections) Rampur seam (5 sections) Lajkura. Seam (4 sections) Thickness Range (in metre) Lajkura IV - 12.42 - 14.47 Lajkura III - 3.10 - 4.89 Lajkura II - 30.05 - 34.07 Lajkura I - 11.56 - 14.55 Rampur-V - 1.94 - 7.42 Rampur-IV - 12.25 - 22.18 Rampur-III - 2.97 - 11.92 Rampur-II - 1.16 - 6.31 Rampur-I - 1.02 - 5.33 Ib top - 0.12 - 1.84 Ib middle - 1.16-4.28 Ib bottom - 1.00- 4.40 Ib bottom is the lowest coal seam. Minimum depth - 10m Maximum depth - 238m		

m)	Gross Calorific Value (GCV in K Cal/kg) and Useful Heat Value(UHV in K.Cal/Kg), of coal as per GR : Range	<table><tr><th>Coal Seam</th><th>UHV (K.cal/kg)</th></tr><tr><td>Lajkura-IV</td><td>2667-4222</td></tr><tr><td>Lajkura- III</td><td>3049-4691</td></tr><tr><td>Lajkura- II</td><td>3132-3973</td></tr><tr><td>Lajkura- I</td><td>2221-4180</td></tr><tr><td>Rampur-V</td><td>1683-4056</td></tr><tr><td>Rampur-IV</td><td>1448-3448</td></tr><tr><td>Rampur-III</td><td>2345-4705</td></tr><tr><td>Rampur-II</td><td>1517-4981</td></tr><tr><td>Rampur-I</td><td>2083-4277</td></tr><tr><td>Ib Top</td><td></td></tr><tr><td>Ib Middle</td><td>2621-5243</td></tr><tr><td>Ib Bottom</td><td>2662-5367</td></tr></table>
n)	Quality (Grade) of coal as per GR : Range Mean	D To G F
o)	Total geological reserves in the block	438.90 million tonnes
p)	Depletion of reserves (in case of running mine)	73.07 million tonne till 31.03.2019
q)	Additional reserves established (if any for running mine)	N/A
r)	Geological reserves considered for mining: by Opencast (without barrier & slope)	364.85 Mt
s)	Corresponding Extractable reserves: by Opencast mining	339.56 Mt incl depleted reserve Remaining reserve: 266.49 Mt
t)	Percentage of recovery w.r.t. geological reserves: by Opencast	93.07

G.	MINING	
a)	Existing and proposed method of mining (Opencast for OB & coal separately with dragline/ shovel/ surface miners/ manual/ etc.)	Shovel-Dumper in OB & surface miner/payloader/truck in coal.
b)	Targeted capacity in mtpa when the mine is fully developed and the year in which proposed to be achieved By Opencast : Year :	 18.75 Mty Year- 1
c)	Life of the mine	15 Years

d) Indicate quantum of production and expected grade as in table below:

Year	OC Production Mt	Grade	Washery rejects (Mt)
Yr-1 (2019-20)	18.75	D to G Grade (non-coking)	Not Applicable
Yr-2 (2020-21)	18.75		
Yr-3 (2021-22)	18.75		
Yr-4 (2022-23)	18.75		
Yr-5 (2023-24)	18.75		
Yr-6 (2024-25)	18.75		
Yr-7 (2025-26)	18.75		
Yr-8 (2026-27)	18.75		
Yr-9 (2027-28)	18.75		
Yr-10 (2028-29)	18.75		
Yr-11 (2029-30)	18.75		
Yr-12 (2030-31)	18.75		
Yr-13 (2031-32)	18.75		
Yr-14 (2032-33)	13.44		
Yr-15 (2033-34)	9.30		

Detailed calendar programme of coal production year wise and seam wise along with OB removal have been furnished in the relevant chapter.

e)	Whether the proposed external OB dump site is coal/ lignite bearing: - If so, whether coal/lignite below waste disposal area is extractable.	Not applicable
f)	Whether negative proving for coal / lignite in the proposed site for OB dump/ infrastructure has been done.	N/A
g)	Proposed configuration of HEMM for OC (Coal & OB) & Major Equipment for OC.	Suggested HEMM to be used by outsourcing agency: Elec. Rope Shovel 10.0 Cum. Elec. Hyd. Shovel 5.9-6.1 Cum Rear Dumper 100 T Rear Dumper 60 T

		Surface Miner (900-1100 HP) Elec. RBH Drill 250 mm Dozer 410 HP
h)	Mode of entry for underground mines (shaft, incline, adit,)	N/A
i)	Operations that are proposed to be outsourced	Total coal production & OB removal
j)	Proposed coal evacuation facilities Face to Surface Surface to end use plants	 Rear Dumpers/Tippers From surface to washery by truck/conveyor and then by rail

H.	**END USE OF COAL/ LIGNITE**	
a)	Capacity of the approved end use plants	Basket Linkage.
b)	Coal/ lignite requirement for end use plant with grade/quality	
c)	%age of end use requirement to be met from this mine	
d)	If washing / beneficiation of the coal/ lignite is planned to be conducted on site or adjacent to the extraction area, briefly describe the nature of the beneficiation and recovery rate.	N/A
e)	Proposed Use of Rejects/Middlings	N/A

I.	**ENVIRONMENTAL MANAGEMENT**	
a)	Existing land use pattern	**Existing : (Phase-I)** Forest land - 227.89 ha Non-forest land - 466.715 ha Total : 694.605 ha
b)	Land area indicating the area likely to be degraded due to mining, dumping, roads, workshop, washery, township etc.	Excavation: 539.98 Infrastructure including Safety zone (7.5m around mine boundary) and Embankment: 202.393 External OB dump: 178.932 **TOTAL MINE LEASE AREA: 921.305**
c)	Surface features over the block area	CHP, Workshop, etc.
d)	No. of villages/Houses to be shifted	Four villages will be affected due to this project.
e)	Additional Population to be affected by	NA
f)	Monitoring schedules for different environmental components after the commencement of mining and other related activities.	For air quality: Two days in a month at each station (once in a fortnight). For water and effluent quality: Once in a month for each station (for drinking water quality), once in a fortnight (for 4 parameters) and once in a year (23 parameters) (for effluent quality) For ground water level monitoring: 4 times in a year (i.e. April/May, August, November & January) For noise level: Once in a day-time and once in a night-time in fortnight from each station.

J.	PROGRESSIVE AND FINAL MINE CLOSURE PLAN (A separate chapter is also to be incorporated)	
a)	Estimated total capital expenditure for mine closure activities	
b)	Major closure Activities with proposed Capital expenditure	
i.		
	Preparation of survey and disposal reports	Approximately Rs.9636.59 lakhs (Cost base November 2019) compounded @5% annually will be required to be deposited in Escrow Account as per the guidelines for Mine Closure circulated by Ministry of Coal. Details of closure cost will be incorporated in the Mine Closure Report.
	Subsidence Area study	
	Disposal of P &M items	
	Subsided Area (Technical & biologically reclaimed)	
	Dismantling of Industrial Structure (Like substation / water treatment plant / / ETP / STP , etc.)	
	Leveling & gradient	
	Fencing of subsided area	
	Cleaning of coal stock and infrastructure area	
	Disposal / Dismantling of Residential colony	
	Plantation and landscaping on subsided/backfilled area	
	Plantation over cleaned land of infrastructure	
	Environmental monitoring	
	Permanent lighting arrangement in and around mine periphery	
	Total	

K.	OTHERS	
a)	Base date of Mining Plan.	**March 2019**
b)	Calendar year from which the production will start	The mine is already a running mine.
c)	Results of any investigation carried out for scientific mining, conservation of minerals and protection of environment; future proposals.	Not Applicable
d)	Signature of RQP Date Place	 Bhubaneswar

Chapter – 1
INTRODUCTION

1.1 PREAMBLE

MAHANADI COALFIELDS LIMITED is a subsidiary of COAL INDIA LIMITED formed in 03.04.1992. It is the one of the largest coal producing company in Coal India Limited which has been already awarded Mini Ratna, Cat-I status. It has ten areas in two coalfields of Odisha with 6 underground and 16 opencast mines. Total coal production of the company is 143.058 Mt in 2017-18 which was 23.14 Mt in 1992-93. There are 51 sanctioned mining projects (incl 3 exhausted projects) in MCL with a capacity of 224.41 Mty of coal. Out of total 51 Projects, 35 Projects are completed Projects and 16 Projects are On-going Projects. These 16 On-going projects have a capacity of 129.83 MTY with a capital investment of Rs.9184.91 Crs. Kulda opencast mine, 10 Mty, is an existing opencast mine in Basundhara area of Ib valley coalfield.

The Ib River coalfield lies in between latitude 21°31' to 22°14' North and longitude 83°32'00" to 84°10'00" East and falls mainly in Sundergarh, Jharsuguda and Sambalpur districts of Odisha. Coal reserves of this coalfield are about 28.07 billion tonnes (as on 1.4.2018) of which about 16.56 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 reserves of Ib-valley coalfield as per GSI as on 1.4.2018 are given below:

Table-1.1
Coal Reserves in Ib-valley coalfield as on 1.4.2018

(Reserves in million tonnes)

Depth (in meter)	Proved reserves	Indicated reserves	Inferred reserves	Total reserves
0-300	11433.26	5131.91	0.00	16565.17
300-600	1500.09	5136.47	3633.88	10270.44
600-1200	-	1235.83	2.69	1238.52
Total	**12933.35**	**11504.21**	**3636.57**	**28074.13**

Source GSI, as on 01.04.2018

Gopalpur tract in general and Kulda and Garjanbahal blocks in particular gained importance as M/s MAPL (Mirant Asia Pacific Ltd.), formerly M/s CEPA/SEAP were interested to install 6x660MW capacity power plant adjacent to Hirakud water reservoir near Jharsuguda township at Hirma in the fringe of the coalfield. Subsequently coal linkages granted to M/s MAPL were cancelled due to uncertainty and slow progress of their IPP. Subsequently M/s. NTPC (National Thermal Power Corporation) and M/s NLC (Neyveli Lignite Corporation) showed interest to install their thermal power plant in Ib-valley coalfield. However, during initial stages alternate customers based on the linkage granted by SLC (Long Term) were identified and the project is having basket linkages.

The Gopalpur tract in which Kulda OCP is located 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. Rail link from Jharsuguda to this area has already started it's operation.

This sector has been number of geological blocks (ref. Plate Gen-II) which are under different stages of exploration. All of them are virgin except Basundhara, Kulda & Garjanbahal blocks. At Basundhara coal production had commenced in 96-97 in Basundhara (East) OC project which was exhausted in 06-07. Mining operations in Basundhara (W) OC project have also started after the approval of the PR in October 2003. Mining operations in Kulda OC project have started it's coal production in 07-08 after approval of the PR in January 2005.

1.2 KULDA OCP & IT'S LINKAGE

Gopalpur sector of Ib-valley coalfield forms the north western part of Ib River coalfield which is a greenfield area with huge mining potential. Detailed exploration was undertaken by CMPDI to assess the quarriable potentiality of coal seams with primary view of opening up of new mining projects to the extent possible. This sector has high potential for opencast mining operations including the proposed project namely Kulda Opencast Project.

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.

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.

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. This project will help MCL to meet huge demand from Ib-valley coalfield.

1.3 STATUS OF KULDA OCP

The Advance Action Proposal (AAP) of the project was sanctioned by Govt. in October 1995 for a capital investment of Rs.8.624 crores.

PROJECT REPORT

Project Report (PR) was approved by MCL Board in March 1995 and subsequently by CIL Board in May 1995. The PR could not be processed further due to lack of forestry clearance and EMP clearance. Later project report was revised with different size of HEMM. This proposal was approved by MCL Board on 24.11.2001 and by CIL Board on 6.3.2002. Finally the proposal of Kulda OCP (UCE-August,2004 cost base) was sanctioned by CCEA in January,2005 for coal and OB outsourcing variant (enclosed as ANNEXURE-I).

The Project Report for Kulda Expansion OCP (Normative capacity 15.00 Mty; 5.00 Mty incremental) (Peak Capacity 18.75 Mty) was approved by MCL Board in its 159th meeting held on 25.06.2014 at an additional capital investment of Rs. 289.03 crore up to target year and Rs. 30.22 crore beyond target year to be implemented in incremental coal and incremental OB both by outsourcing (enclosed as ANNEXURE-II).

MINING PLAN

Mining Plan for Kulda OCP (10.0 Mty) was approved by MoC, Govt. of India vide letter no: 34012/(4)/2011-CPAM dated 1st July 2011. Mining Plan/Mine Closure Plan of Kulda Expansion OCP (Expansion from 10 Mty to 15 Mty) was approved by MoC, Govt. of India vide letter no: 34012/(4)/2011-CPAM dated 26th December 2016 (enclosed as ANNEXURE-III).

STATUS OF EMP

EMP clearance for Kulda OCP (10.00 Mty) has been received vide letter No.J/11015/10/95-IA.II(M) dated 24.12.2002 (Copy enclosed as Annexure-IV).Total mine lease area was 929.60 Ha inclusive of 279.20 Ha of forest land. But EMP clearance has been accorded for 878.29Ha inclusive of 227.89 Ha of forestland. EMP clearance for Expansion of Kulda OCP from 10 Mtpa to 14 Mtpa has been received vide letter No.J/11015/10/1995-IA.II(M) dated 22.03.2018 (Copy enclosed as Annexure-IV). EMP clearance has been accorded for 634.205 Ha including 227.89 Ha of forest land (excluding Lalma forest area).

STATUS OF FORESTRY CLEARANCE

Stage-I forestry clearance was received for land required for a period of 20 years from MOEF in two stages for 50.72ha on 25.07.2001 and 177.17ha on 22.01.2002 respectively. Stage-II clearance was obtained on 08.08.2007 for 227.89 ha of land for 20 years of mine workings.

1.4 MINE CLOSURE PLAN

MoC, Govt. of India has approved the Mine Closure Plan for Kulda Expn. OCP (15.00 Mty) vide letter 34012/(04)/2011CPAM dated 24.12.2016.

1.5 PRESENT STATUS

Kulda is a potential block having mineable reserves of about 266.49 million tonnes. Kulda Expansion OCP is a running project and has obtained all statutory clearances. Kulda OCP started it's mining operations in 2007-08. Coal extracted till 31.3.2019 is 73.07 Mt and OB removed till 31.3.2019 is 46.57 Mcum.

Actual production details:

YEAR	COAL (in Mt)	OB (in Mcum)
2007-08	0.15	0.29
2008-09	2.47	1.48
2009-10	3.43	0.90
2010-11	5.02	5.80
2011-12	5.54	5.33
2012-13	5.50	2.71
2013-14	5.27	2.08
2014-15	4.80	5.71
2015-16	8.02	2.79
2016-17	9.99	5.31
2017-18	10.07	8.22
2018-19	12.81	5.95
Total upto 31.03.2019	**73.07**	**46.57**

1.6 PRESENT REVISION OF MINING PLAN

In earlier approved Mining Plan of Kulda Expn. OCP (Revision-1) (10 Mty to 15 Mty), mining operation was carried out in two phases. In Phase-I, surface boundary was restricted within notified lease area for which forest clearance has been obtained by the

project authority i.e. excluding Lalma Forest. In Phase-II, remaining part of the block was to be worked after obtaining forest clearance for this area. With the increase in demand, MCL now wants to expand the mine in Lalma forest area so as to enhance the production capacity to 18.75 Mty from this mine.

1.7 DIFFICULTIES AND CONSTRAINTS IN MINING WITH ASSOCIATED RISK

Following constraints are envisaged and should be considered while implementation of the report:

a) Construction of new railway line from the proposed silo loading point to Jharsuguda on Howrah-Mumbai main line.

b) Land acquisition and rehabilitation of the villagers.

c) Diversion of Sundergarh-Raigarh road passing through the block.

Chapter – 2

DETAILS OF EARLIER APPROVAL OF MINING PLAN

2.1 STATUS

Mining Plan for Kulda OCP (10.0 Mty) was approved by MoC, Govt. of India vide letter no: 34012/(4)/2011-CPAM dated 1st July 2011. Mining Plan/Mine Closure Plan of Kulda Expansion OCP (Expansion from 10 Mty to 15 Mty) was approved by MoC, Govt. of India vide letter no: 34012/(4)/2011-CPAM dated 26th December 2016.

2.2 REASON FOR REVISION OF MINING PLAN

In earlier approved Mining Plan of Kulda Expn. OCP (Revision-1) (10 Mty to 15 Mty), mining operation was carried out in two phases. In Phase-I, surface boundary was restricted within notified lease area for which forest clearance has been obtained by the project authority i.e. excluding Lalma Forest. In Phase-II, remaining part of the block was to be worked after obtaining forest clearance for this area.

With the increase in demand, MCL now wants to expand the mine in Lalma forest area so as to enhance the production capacity to 18.75 Mty from this mine.

In this Mining Plan, total area including Lalma forest is considered with enhanced production of 18.75 Mty.

EMP clearance for Expansion of Kulda OCP from 10 Mtpa to 14 Mtpa has been received vide letter No.J/11015/10/1995-IA.II(M) dated 22.03.2018 (Copy enclosed as Annexure-IV). EMP clearance has been accorded for 634.205 Ha including 227.89 Ha of forest land (excluding Lalma forest area).

Sl. No.	Particulars	REVISION I (as on 31.03.2016) For Phase-I	PRESENT MINING PLAN (as on 31.03.2019)
1	RESERVE (in Mt)	132.29	266.49
2	OB (in Mcum)	115.49	283.32
3	Life (in years)	10	15
4	Capacity (in Mty)	15.0	18.75
5	Excavation area (Ha)	321.91	539.98
6	Mine lease area (Ha)	634.20	921.305
7	Forest Area (Ha)	227.89	354.06

Chapter - 3

LOCATION, COMMUNICATION, TOPOGRAPHY, DRAINAGE, CLIMATE AND RAINFALL

3.1 LOCATION

Kulda geological block is located in the north-western part of Ib valley coalfield in Sundergarh district in the state of Odisha. It is situated between latitudes 22°01'02" to 22°03'03" North and longitudes 83°43'28" to 83°45'35" East (refer plate no. Gen-I & Gen-II).

The block boundary is defined by the following :

North	-	Basundhara River
West	-	Chattajhor nallah, tributary of Basundhara River.
East	-	Metamorphic exposure.
South & South east	-	Line joining boreholes CMHG-103,129,123, 139 & 138 & adjacent Garjanbahal block.

The area of the block under consideration is 5.84 sq.km. out of which coal bearing area is 5.30 sq.km.

3.2 COMMUNICATION

District headquarter Sundergarh, on State Highway-10 (Sambalpur to Rourkela), is at a distance of about 40 km. from the blocks. The Sundergarh (Odisha) – Raigarh (Chattisgarh) all weather road passes through the blocks. The blocks are also connected by black top road with two important towns of Orissa namely Rourkela at 145 km and Jharsuguda at 75 km. The block comes under Himgir Tahsil and Balinga police station in the district of Sundergarh, Odisha.

The block is connected by road to the state capital Bhubaneswar through State Highway-10 and National Highway-42, with a total distance of around 450 km. The block is well connected with MCL HQ at Sambalpur situated at a distance of about 100 km.

Nearest railhead is Himgir on Mumbai-Howrah Broad Gauge of South Eastern Railway at a distance of about 36 km from the blocks. Jharsuguda railway station on Jharsuguda-Sambalpur-Bhubaneswar rail line of East Coast Railway is at a distance of about 75 km. The nearest port at Bay of Bengal is Paradip and situated at a distance of about 600 km. from the block.

3.3 TOPOGRAPHY

The topography of the block is rugged with steep rise and fall. The central and south eastern part lie at a comparatively higher elevation being dotted with hillocks.

The minimum and maximum elevations of the area are 254m and 320m respectively above the mean sea level.

3.4 DRAINAGE

The ground slopes generally towards west and north and ground water is collected by Chattajhor nallah being fed by streamlets, which in turn feeds to river Basundhara.

River Basundhara flows along northwest and northern boundary of the block.

3.5 CLIMATE & RAINFALL

The climate is sub-tropical. Temperature varies from 9.3°C (winter season) to 44.1°C (in pre-monsoon cyclone season).

The average annual rainfall is 1053 mm as measured at Himgir during last 15 years.

The general wind direction is NW and the average wind speed is 10.93km/hr. The relative humidity during April to July varies from 59% to 92%.

Chapter - 4

GEOLOGY

4.1 GENERAL

The geological information in this chapter has been compiled from "Geological Report on Kulda Block, Ib River Coalfield" prepared by CMPDI in Feb.'1994. A total of 130 boreholes, have been drilled with a total meterage of 14858.35m covering an area of 5.84 sq.km. Coal bearing area is 5.30 sq.km.

The borehole density is about 22.3 boreholes/sq.km.

4.2 GEOLOGICAL SUCCESSION OF THE IB RIVER COALFIELD

The geological succession of the coalfield as established by G.S.I. during regional exploration is given in table-4.1.

Table- 4.1

Age	Formation	Lithology
Recent to sub-recent	-	Alluvium, laterite, gravels and conglomerate.
Upper Permian	Kamthi(Upper)	Pebbly sandstone, ferruginous sandstone and red shales
	Kamthi (Middle) = Raniganj	Fine grained sandstone, silt stone and coal seams.
	Kamthi(Lower) = Barren Measures	Grey shale, carbonaceous shale, sandstone and clay ironstone nodules.
Lower Permian	Barakar	Grey sandstone, carbonaceous shale, siltstone with thick coal seams and fire clay.
	Karharbari	Black carbonaceous sandstone with pebble bed and coal seams.
Upper Carboni-ferous	Talchir	Diamictite, greenish sand stone, olive and chocolate shales, rhythmites.
---------- Unconformity ----------		
Pre-Cambrian	Metamorphics	Granite, gneisses, schists etc.

4.3 GEOLOGY OF THE AREA EXPLORED

Kulda block spreading over an area of 5.843 sq.km., forms the northern part of the coalfield. The topographical plan showing incrops of coal seams have been given in Plate No. G-I. The stratigraphic sequence as depicted on the basis of surface mapping and sub-surface data is furnished in table-4.2. Surface mapping has been given in the geological plan (Plate no. G-2).

Table- 4.2
Stratigraphic succession, Kulda Block

Age	Formation	Lithology	Thickness (m)
Recent/ sub-resent	-	Soil, Alluvium	0.00-17.00
Lower Permian	Barakar	Fine to coarse grained sandstone micaceous at places, burnt ferruginous sand-stone/shale, car-bonaceous shale grey shale, fine clay sandy-shale with thick coal seams.	0.77-236.55
	Karharbari	Carbonaceous medium grained sandstone with undecomposed feldspar, coarse grained to pebbly and gritty sand-stone with impersistent coal seam.	16.04-20.70
Upper Carboni-ferrous	Talchir	Fine to medium grained greenish sandstone & greenish shale.	2.30-54.10
---------- Unconformity ----------			
Precambrian		Granite, mica schists & gneisses	3.12-18.30

Pre-cambrians are exposed in the east of the block.

4.4 STRUCTURE

The geological structure of the area has been interpreted on the basis of surface and sub-surface data obtained from boreholes. Floor contours & geological cross sections are given in plate nos. VII,VIII,X,XI, XIV,XVI,XVII. Lithologs and seam structures of representative boreholes have been given in plate no. IV H to V.

4.5 BEDDING ATTITUDE

Strike of the strata is roughly NW-SE. The dip is generally 7^{0} towards southwest. Dip is slightly higher in southern part and near faults compared to rest of the area.

4.6 FAULTS

Existence of 3 no faults has been interpreted on the basis of borehole data. Details of faults are given in table-4.3.

Table-4.3
Description of faults

Fault No.	Location	Trend	Throw	Evidences
F1-F1	Central part of the block continues beyond the block boundary in the south.	NW-SE	0-8m with hade towards NE	1) Part of Rampur-IV seam missing in BH No. CMHG-324. Rampur-V and part of Rampur-IV seam is missing BH No.CMHG-310 2) Repetition of Lajkura-I seam.
F2-F2	Central part of the block	NW-SE	0-12m with hade towards NE	Parting between Rampur-I, II faulted in borehole CMHG-98 and Rampur-V and part of Rampur IV seam is missing in borehole CMHG-223.
F3-F3	Central part of the block abuts against fault F2-F2 in the north and dies out in the south within the block	NW-SE	01-15m with hade towards NE	Rampur-V and part of Rampur-IV seams are missing in BH No. CMHG-121&273.

4.7 COAL HORIZONS

Three coal seams viz. Ib, Rampur and Lajkura seams have been proved in this block under report. Ib seam is the bottom most coal seam and is splitted in to 3 sections viz. Ib Top, Ib Middle & Ib Bottom. Rampur seam is splitted into five sections

namely Rampur-I, Rampur-II, Rampur-III Top, Rampur-III bot., Rampur-IV and Rampur-V. Lajkura is also a thick seam and splitted into 4 sections viz; Lajkura-I, Lajkura-II, Lajkura-III and Lajkura-IV. Ib and Rampur seams occur covering almost entire block, whereas occurrence of Lajkura seam is restricted to the western half of the block.

Lajkura seam is extensively burnt in the incrop region as indicated in the geological plan. Burning may be responsible for hardening and making weathering resistant of the overlying ferruginous sandstone so as to stand out as a ridge. Incrop of Rampur seam has also been affected by burning at places to a small extent. The description of the coal seams in ascending order is mentioned in the paragraphs below:

It may be mentioned here that results of gross calorific value have been obtained for a few selected number of samples whereas results of UHV are available practically for all borehole samples. Hence, the two figures are not strictly comparable.

4.8 IB BOTTOM SEAM

It is the bottom most seam overlain by Ib middle seam with a parting of 0.13m to 5.10m. The parting between the two coal seams i.e. Ib-bottom and middle is less than 1m in the northern and southern part where the two coal seams have been considered as combined. The thickness of Ib-bottom seam varies from 0.22m to 3.28m. Average thickness ranges from 1.00m to 2.25m. Combined thickness of Ib-bottom & middle varies from 1.60m-7.13m. Quality parameters of Ib bottom seam/Ib combined seam are given in table-4.4.

Table- 4.4
Quality of Ib Bottom/Ib (Mid+Bot) seam

Thickness (m)	Type of sample	Proximate analysis on 60% RH and 40°C			G.CV in k.cal/kg.	UHV in K.cal/kg	Grade
		M%	Ash%	VM%			
A)	**Ib Bottom Seam**						
1.08-2.11	Bcs	4.6-7.2	19.4-27.4	20.0-29.0	-	4084-5367	C-E
1.00-2.25	I_{100}	4.6-7.7	18.9-40.1	24.4-29.0	4710-5519	2662-5367	C-F

B)	**Ib (Mid+Bot) seam**						
2.62-6.32	Bcs	2.8-7.6	23.9-40.5	22.0-30.4	4920-5307	2925-4691	D-F
1.60-7.13	I_{100}	3.0-7.6	20.4-46.0	18.3-30.4	4350-5218	1931-5105	C-G

Summary of results of ultimate analysis, HGI and AFT have been given in table-4.5.

Table-4.5

HGI, AFT and Ultimate analysis

Thickness (m)	Type of sample	HGI	Ash fusion temp.°C under MRA			Ultimate analysis on dmf basis %				
			IDT	HT	FT	C	H	N	S	O
A)	**Ib Bottom seam**									
1.00-2.25	Bcs	58	-	-	-	79.00-81.40	4.68-4.79	1.85-1.88	0.81-0.88	11.05-13.66
2.25	I_{100}	58	-	-	-	-	-	-	-	-
B)	**Ib (Mid+Bot) seam**									
2.62-5.24	Bcs	55-57	-	-	-	82.12-82.15	5.2	1.91-1.98	0.56-0.81	9.89-10.18
2.62-5.24	I_{100}	60	1250	1300	+1400	-	-	-	-	-

Ash analysis of Ib (Mid+Bot) seam is given below :

Table-4.6
Ash analysis Ib(Mid+Bot) seam

BH.No.	Type of sample	Constituents	Percentage
CMHG-246	I_{100}	SiO_2	63.47
		Al_2O_3	26.17
		Fe_2O_3	3.87
		TiO_2	1.79
		P_2O_5	0.57
		SO_3	0.49
		CaO	0.96
		MnO	Trace
		MgO	0.62
		K_2O	1.42
		Na_2O	0.64

4.9 IB MIDDLE SEAM

It is underlain by Ib bottom seam with a parting of 0.13m to 5.1m and is overlain by Ib top seam with a parting of 0.33m to 8.53m. It is occurring as a narrow strip in the central part and as combined with Ib bottom in the north and southern part of the block.

Thickness of the seam varies from 0.32m to 4.28m. The thickness of the seam gradually increases from 1m to 5m along the dipside.

The grade of the seam is mostly D-E and the various quality parameters have been given in the table-4.7.

Table-4.7
Quality of Ib Middle Seam

Thickness (m)	Type of sample	Proximate analysis on 60% RH and 40°C			G.CV in k.cal/kg.	UHV in K.cal/kg	Grade
		M%	Ash%	VM%			
1.32-2.67	Bcs	2.9-6.7	24.9-43.1	20.6-27.9	4800-5500	2455-4787	D-F
1.16-6.03	I_{100}	2.9-7.5	20.5-41.3	17.5-28.0	4750-5435	2621-5243	C-F

The HGI on I100 is 57 - 61 and the IDT, HT, FT on I100 sample are 1250-1260, 1320-1340 and >1400 ^{O}C respectively.

4.10 IB TOP SEAM

It is the uppermost split of Ib seam. The thickness varies from 0.12m to 1.84m. It has been encountered in 17 boreholes only and the workable thickness of 1m and above is restricted to dipside of the block and is encountered in few boreholes. In the dipside area in few boreholes it is merged with Ib middle seam with a parting of <1m. Wherever it is merged with Ib middle seam the section is considered as Ib middle seam and in the rest of the boreholes it is considered as OB. As the seam is not viable from mining point of view, no detailed exercise has been done for this seam.

4.11 RAMPUR-I SEAM

This is the bottom most split of Rampur seam overlain by Rampur-II seam with a parting of 0.12m to 10.75m. It has been encountered in 107 boreholes.

The thickness of the seam varies from 0.06m - 5.03m. Thickness is less than 1m in the eastern and northeastern part of the block and also along the E-W strip in the southern part of the block. It occurs as combined seam with the overlying Rampur-II seam in the northern part and in a small patch in the central part of the block.

The summarised quality parameters of Rampur-I/Rampur(I+II) seams are given below in tables 4.8, 4.9 and 4.10.

Table-4.8
Quality of Rampur-I/I+II seam

Thickness (m)	Type of sample	Proximate analysis on 60% RH and 40°C			G.CV in k.cal/kg.	UHV in K.cal/kg	Grade
		M%	Ash%	VM%			
A)	**Rampur-I seam**						
1.85-3.99	Bcs	3.0-5.8	26.2-37.3	25.8-28.2	4000-5315	3173-4484	D-F
1.02-5.03	I_{100}	3.3-4.9	28.6-45.8	17.7-26.3	2920-4407	2083-4277	D-G
B)	**Rampur(I+II) seam**						
6.16-7.59	Bcs	6.4-7.1	32.7-34.5	27.2-27.3	4330	3256-3408	E-F
5.65-9.12	I_{100}	4.4-5.6	35.2-49.0	22.3-25.9	3150	1489-3270	F-G

Table-4.9
HGI, AFT and Ultimate analysis of Rampur-I/(I+II) seam

Thickness (m)	Type of sample	HGI	Ash fusion tem.°C under MRA			Ultimate analysis on dmf basis %				
			IDT	HT	FT	C	H	N	S	O
A)	**Rampur-I seam**									
1.86-5.33	Bcs	-	-	-	-	78.12-79.01	4.66-4.68	0.64-1.01	1.78-1.85	13.82-14.43
3.99-5.33	I_{100}	61	1260-1290	1320 +1400	+1400	-	-	-	-	-
B)	**Rampur-I+II seam**									
7.59	Bcs	-	-	-	-	76.95	4.65	0.67	1.84	15.89
	I_{100}	60	1290	1340	+1400	-	-	-	-	-

Table-4.10
Ash analysis of Rampur-I Seam on I100 sample

Constituent	Percentage
SiO_2	61.12-63.74
Al_2O_3	25.84-28.74
Fe_2O_3	2.84
TiO_2	1.47- 1.85
P_2O_5	0.42- 0.49
SO_3	0.37- 0.47
CaO	1.81- 1.84
MnO	Trace
MgO	1.17- 1.22
K_2O	1.19- 1.24
Na_2O	0.62- 0.72

4.12 RAMPUR-II SEAM

The seam is underlain by Rampur-I with a parting of 0.12m to 10.75m and overlain by Rampur-III bot. seam with a parting of 0.17m to 8.21m. The seam is exposed in the northeastern part of the block along Basundhara river.

Although it is merged with Rampur III bot. seam in the south central part but has been treated as a separate seam.

Thickness of the coal seam varies from 0.91m to 6.31m.

Details of quality parameters have been furnished in tables below.

Table-4.11

Quality of Rampur-II seam

Thickness (m)	Type of sample	Proximate analysis on 60% RH and 40°C			G.CV in k.cal/kg.	UHV in K.cal/kg	Grade
		M%	Ash%	VM%			
1.19-5.56	Bcs	3.0-6.8	31.1-39.60	18.6-31.9	3810-4160	2028-3877	E-G
1.16-6.31	I_{100}	3.2-5.9	22.5-49.90	20.8-29.7	3230-4160	1517-4981	C-G

Table-4.12

HGI, AFT and Ultimate analysis of Rampur-II seam

Thickness (m)	Type of sample	HGI	Ash fusion tem.°C under MRA			Ultimate analysis on dmf basis %				
			IDT	HT	FT	C	H	N	S	O
2.71-4.08	Bcs	-	-	-	-	76.00-78.94	4.64-4.67	0.92-0.95	1.83-1.85	13.59-16.61
2.71-4.08	I_{100}	57	1280	1340	+1400	-	-	-	-	-

Table-4.13
Ash analysis of Rampur-II seam

Thickness(m)	Type of sample	Constituents	Percentage
4.08	1_{100}	SiO_2	61.21
		Al_2O_3	29.12
		Fe_2O_3	3.92
		TiO_2	1.59
		P_2O_5	0.47
		SO_3	0.43
		CaO	0.82
		MnO	Trace
		MgO	0.58
		K_2O	1.11
		Na_2O	0.84

4.13 RAMPUR-III BOTTOM SEAM

This is underlain by Rampur-II seam with a parting of 0.17m-8.21m and is overlain by Rampur-III Top with a parting of 0.30m-6.75m. The seam is not well developed in the northern part of the block and along southwestern boundary, where the thickness is <1m. In the southern part the seam is merged with Rampur-III Top seam where the parting is <1m in between Rampur-III Bot. & III Top seams. Thickness of the coal seam varies from 0.16m to 3.73m and in the southern part of the block, the combined thickness of Rampur-III Bot. + III Top varies from 6.33m to 11.98m.

Although, it has attained workable thickness in 2-3 boreholes in the northern part of the block because of the patchy occurrence, its reserve has not been estimated.

The quality parameters of the seam have been given in table below :

Table-4.14
Quality of Rampur-III Bot./III (Bot+Top) seam

Thickness (m)	Type of sample	Proximate analysis on 60% RH and 40°C			G.CV in k.cal/kg.	UHV in K.cal/kg	Grade
		M%	Ash%	VM%			
A)	**Rampur-III Bottom seam**						
1.18-3.60	I_{100}	4.3-6.8	17.7-44.9	-	-	2110-5519	C-G
B)	**Rampur-III (Bot+Top) seam**						
6.33-11.98	I_{100}	3.9-5.8	27.6-48.3	23.50-23.70	-	1696-4291	D-G

4.14 RAMPUR-III TOP SEAM

This seam underlies Rampur-IV seam with a parting of 0.89m to 7.27m. It is well developed over the area, however in the south central part it is merged with Rampur-III bottom seam. This seam is affected by surface burning at two places in the incrop region as localised patches.

Thickness of the coal seam varies from 2.97m to 11.92m. The general thickness is of the range in between 5m to 9m.

The quality parameters of the seam have been given in tables below :

Table-4.15
Quality of Rampur-III Top seam

Thickness (m)	Type of sample	Proximate analysis on 60% RH and 40°C			G.CV in k.cal/kg.	UHV in K.cal/kg	Grade
		M%	Ash%	VM%			
6.96-9.76	Bcs	4.6-6.8	27.0-31.3	26.5-29.0	4630-4870	3891-4277	D-E
2.97-11.92	I_{100}	4.0-6.2	24.2-43.5	23.8-28.2	3670-4670	2345-4705	D-G

Table-4.16
HGI, AFT and Ultimate analysis of Rampur-III Top seam

Thickness (m)	Type of sample	HGI	Ash fusion tem.°C under MRA			Ultimate analysis on dmf basis %				
			IDT	HT	FT	C	H	N	S	O
8.47-9.76	Bcs	56-58	-	-	-	79.00-79.06	4.69-5.01	0.65-0.74	1.80-1.85	13.50-13.77
	I_{100}	55-59	1270-1290	1320-1360	+1400	-	-	-	-	-

Table-4.17
Ash analysis of Rampur-III(T) seam

Thickness(m)	Type of sample	Constituents	Percentage
8.47-9.76	I_{100}	SiO_2	58.94-61.84
		Al_2O_3	27.07-28.94
		Fe_2O_3	4.01- 4.12
		TiO_2	1.74- 1.92
		P_2O_5	0.31- 0.52
		SO_3	0.42- 0.47
		CaO	1.27- 1.94
		MnO	Trace
		MgO	0.67- 1.59
		K_2O	1.17- 1.47
		Na_2O	0.74- 0.82

4.15 RAMPUR-IV SEAM

Rampur-IV seam is underlain by Rampur-III Top seam with a parting of 0.89m to 7.27m. It is overlain by Rampur-V seam with a parting of 0.39m to 5.10m. In southwestern part parting between Rampur-IV & Rampur-V seam reduces to <1m thickness. As such the coal seams have been considered as combined.

The stratigraphic thickness of the Rampur-IV seam ranges from 12.33m to 21.58m. In the southwestern part where Rampur-IV and Rampur-V seams have merged together, the effective thickness on exclusion of more than 1m dirt bands ranges from 20.42m to 27.13m.

The quality parameters of the seam have been mentioned in tables below :

Table-4.18
Quality of Rampur-IV & Rampur-(IV+V) seam

Thickness (m)	Type of sample	Proximate analysis on 60% RH and 40°C			G.CV in k.cal/kg.	UHV in K.cal/kg	Grade
		M%	Ash%	VM%			
A)	**Rampur-IV seam**						
17.31-20.44	Bcs	4.0-5.3	35.4-38.2	25.8-26.2	-	3118-3463	E-F
12.33-20.48	I_{100}	3.10-4.80	34.7-50.90	21.3-23.0	-	1448-3448	E-G
B)	**Rampur(IV+V) seam**						
19.77-25.20	Bcs	4.8-7.2	32.4-34.9	26.2-28.0	4320-4410	3380-3435	E
22.58-27.13	I_{100}	3.6-4.5	38.7-48.7	22.3-23.4	3270-3820	1683-2938	F-G

Table-4.19
HGI, AFT and Ultimate analysis of Rampur-(IV+V) seam

Thickness (m)	Type of sample	HGI	Ash fusion tem.°C under MRA			Ultimate analysis on dmf basis %				
			IDT	HT	FT	C	H	N	S	O
19.77-25.20	Bcs	56-59	-	-	-	78.55-79.00	4.70-5.00	0.78-0.92	1.80-1.88	13.41-14.04
22.58-27.13	I_{100}	58-60	1190-1250	1320-1330	+1400	-	-	-	-	-

Table-4.20
Ash analysis of Rampur-(IV+V) Seam

Thickness(m)	Type of sample	Constituents	Percentage
19.77-25.20	I100	SiO_2	58.79-63.00
		Al_2O_3	26.02-29.74
		Fe_2O_3	4.62- 5.60
		TiO_2	1.62- 1.87
		P_2O_5	0.37- 0.61
		SO_3	0.28- 0.39
		CaO	0.97- 2.40
		MnO	Trace
		MgO	0.44- 1.00
		K_2O	1.11- 1.21
		Na_2O	0.64- 0.84

4.16 RAMPUR-V SEAM

This is the top most seam of Rampur group of coal seams. It is overlain by Lajkura-I seam with a parting of 31.33m to 46.18m. Incrop of the coal seam is thinning down in the northern part and southern extremity in the incrop region.

The coal seam thickness ranges from 1.94m-6.40m. However, the seam thickness in general is 3m to 4m. It is free of dirt bands except in CMHG-336, where the thickness of dirt band is 1.09m.

The details of quality are given in table 4.21.

Table-4.21
Quality of Rampur-V seam

Thickness (m)	Type of sample	Proximate analysis on 60% RH and 40°C			G.CV in k.cal/kg.	UHV in K.cal/kg	Grade
		M%	Ash%	VM%			
1.94-6.40	Bcs	4.7-5.5	29.1-33.1	26.8-28.3	-	3642-4263	D-E
	I_{100}	3.6-5.4	29.7-48.7	23.1-25.8	-	1683-4056	E-G

4.17 LAJKURA-I SEAM

This is the bottom most seam of Lajkura group of coal seams. It is overlain by Lajkura-II seam with a parting of 1.25m to 2.79m. The coal seam is burnt almost entirely along the incrop zone excepting in the northern extremity.

Thickness of the coal seam varies from 12.09m - 14.43m. The effective thickness ranges from 11-13m.

The quality parameters of Lajkura-I seam have been given below :

Table-4.22
Quality of Lajkura-I Seam

Thickness (m)	Type of sample	Proximate analysis on 60% RH and 40°C			G.CV in k.cal/kg.	UHV in K.cal/kg	Grade
		M%	Ash%	VM%			
112.55-13.25	Bcs	4.7-6.0	28.5-33.7	26.5-28.4	3980-4780	3449-4236	D-E
12.09-14.43	I_{100}	3.9-5.20	29.00-44.50	23.60-26.40	3740-4180	2221-4180	E-G

Table-4.23
HGI, AFT and Ultimate analysis of Lajkura-I seam

Thickness (m)	Type of sample	HGI	Ash fusion tem.°C under MRA			Ultimate analysis on dmf basis %				
			IDT	HT	FT	C	H	N	S	O
12.78-12.98	Bcs	56-57	-	-	-	79.06-78.00	4.85-4.50	0.76-0.85	1.85-1.66	13.48-14.99
	I100	59	1270-1290	1340 +1400	+1400	-	-	-	-	-

Table-4.24
Ash analysis of Lajkura-I Seam

Thickness(m)	Type of sample	Constituents	Percentage
12.78-12.98	I100	SiO_2	61.32-61.87
		Al_2O_3	26.47-27.84
		Fe_2O_3	3.17- 5.32
		TiO_2	1.64- 1.74
		P_2O_5	0.44- 0.54
		MnO	Trace
		MgO	0.87- 1.08
		CaO	1.16- 1.55
		SO_3	0.37- 0.47
		K_2O	1.07- 1.41
		Na_2O	0.69- 0.98

4.18 LAJKURA-II SEAM

The seam is overlain by Lajkura-III seam with a parting of 0.95m to 2.21m. The coal seam is burnt along the incrop excepting at the northern end.

The thickness of the seam varies from 30.50m to 34.07m. The effective thickness in general ranges from 27m to 30m.

The quality parameters have been detailed in tables below:

Table-4.25
Quality of Lajkura-II seam

Thickness (m)	Type of sample	Proximate analysis on 60% RH and 40°C			G.CV in k.cal/kg.	UHV in K.cal/kg	Grade
		M%	Ash%	VM%			
31.30-33.90	Bcs	5.2-6.6	28.5-28.8	27.2-27.9	4770	4056-4208	D-E
30.05-34.07	I_{100}	4.6-5.7	30.00-36.80	25.90-26.30	4180-4210	3132-3973	E-F

Table-4.26
HGI, AFT and Ultimate analysis of Lajkura-II seam

Thickness (m)	Type of sample	HGI	Ash fusion tem.°C under MRA			Ultimate analysis on dmf basis %				
			IDT	HT	FT	C	H	N	S	O
31.60-32.09	Bcs	55-57	-	-	-	78.94-79.00	4.70-4.98	0.67-0.83	1.84-1.85	13.56-13.63
30.05-34.07	I_{100}	58-59	1250-1270	1320-1340	+1400	-	-	-	-	-

Table-4.27
Ash analysis of Lajkura-II Seam

Thickness(m)	Type of sample	Constituents	Percentage
31.60-32.09	I100	SiO_2	59.84-60.92
		Al_2O_3	26.84-28.34
		Fe_2O_3	4.17- 4.32
		TiO_2	1.74- 1.82
		P_2O_5	0.47- 0.64
		MnO	Trace
		Mgo	1.00- 1.17
		CaO	1.54- 2.35
		SO_3	0.42- 0.54
		K_2O	1.04- 1.14
		Na_2O	0.82- 0.88

4.19 LAJKURA-III SEAM

The seam is overlain by Lajkura-IV seam with a parting of 2.14m to 6.71m. Due to burning the depth of occurrence of the coal seam has been increased upto 36.95m.

Thickness of the seam ranges from 2.02m - 4.89m. The general thickness is mostly 3m.

Quality parameters of the seam have been furnished in tables below:

Table-4.28

Quality of Lajkura-III Seam

Thickness (m)	Type of sample	Proximate analysis on 60% RH and 40°C			G.CV in k.cal/kg.	UHV in K.cal/kg	Grade
		M%	Ash%	VM%			
4.57-4.89	Bcs	5.4-6.5	31.1-33.3	26.4-27.6	4380-4500	3449-3711	E
3.10-4.89	I_{100}	5.4-6.70	23.80-37.00	26.40-27.20	4380-4500	3049-4691	D-F

Table-4.29

HGI, AFT and Ultimate analysis of Lajkura-III seam

Thickness (m)	Type of sample	HGI	Ash fusion tem.°C under MRA			Ultimate analysis on dmf basis %				
			IDT	HT	FT	C	H	N	S	O
4.72-4.89	Bcs	57-58	-	-	-	78.94-79.04	4.65-4.85	0.73-0.78	1.85-1.86	13.53-13.77

4.20 LAJKURA-IV SEAM

This is the top most seam occurring within the area of Kulda block. This seam is burnt in the incrop region to a large extent.

Thickness of the seam varies from 12.42m to 14.39m. Thickness of <13m is however, restricted in a very limited area in the southern part besides the incrop.

The quality parameters have been mentioned in the tables 4.30, 4.31 and 4.32 below :

Table-4.30
Quality of Lajkura-IV Seam

Thickness (m)	Type of sample	Proximate analysis on 60% RH and 40°C			G.CV in k.cal/kg.	UHV in K.cal/kg	Grade
		M%	Ash%	VM%			
13.07-14.39	Bcs	6.4-8.2	27.8-33.0	26.2-29.2	4370-4510	3270-4015	E-F
13.07-14.39	I_{100}	6.1-8.2	26.20-39.07	25.80-28.90	4270-4510	2667-4222	D-F

Table-4.31
HGI, AFT and Ultimate analysis of Lajkura-IV seam

Thickness (m)	Type of sample	HGI	Ash fusion tem.°C under MRA			Ultimate analysis on dmf basis %				
			IDT	HT	FT	C	H	N	S	O
13.07-13.98	Bcs	-	-	-	-	78.50-76.53	4.60-4.85	0.63-0.71	1.80-1.85	14.17-16.36
13.07	I_{100}	56	1260	1320	+1400	-	-	-	-	-

Table-4.32
Ash analysis of Lajkura-IV Seam

Thickness(m)	Type of sample	Constituents	Percentage
13.07	1100	SiO_2	59.84
		Al_2O_3	28.81
		Fe_2O_3	5.12
		TiO_2	1.62
		P_2O_5	0.49
		MnO	Trace
		MgO	0.64
		CaO	1.46
		SO_3	0.37
		K_2O	1.01
		Na_2O	0.64

Succession and quality of coal seams are given in table 4.33.

4.21 COAL RESERVES

The coal bearing area in Kulda block is 5.306 sq.km. leaving 60m barrier zone within coal bearing area along Basundhara river and Chattajhore nallah. The block is bounded by metamorphics in the east, Basundhara river in the north and Chattajhore nallah in the west and boreholes CMHG-283,337,279 in south.

PROCEDURE OF RESERVE ESTIMATION

Isochores have been drawn for all the seams excluding 1m and above dirt bands. The quality calculated after excluding 1m and above dirt bands has been used for drawing isograd lines.

Areas enclosed by various intersections of isochores and isogrdes have been separately measured with planimeter. Measurement of area has been done excluding the barrier zone. Volume of coal has been obtained by multiplying the area with average thickness of two concerned isochores. The product obtained, in turn has yielded gross reserve on multiplication with the specific gravity assumed for that grade. Specific gravity taken for different grades is as follows :

Grade	Special gravity
C	1.50
D	1.55
E	1.61
F	1.68
G	1.75

A 10% deduction has been made from the gross reserve to arrive at the net geological reserve. Reserves in the incrop zone have been estimated separately.

All the reserves have been placed in proved category. In all 438.90 Mt coal has been estimated within the block, out of which 26.06 Mt is locked up within 60m barrier zone and 412.84Mt lies beyond barrier zone. Seamwise, gradewise reserves are given in tables 4.34 and 4.35.

4.22 OVERBURDEN

Area enclosed between two iso-overburden lines has been measured with planimeter with due regard to barrier zone. Average value of the two nearly iso-OB contours on multiplying with the area calculated has yielded the volume of overburden.

A total of 377.363 Mcum of overburden has been estimated for the entire block over Ib bottom seam. Out of this 21.690 Mcum lies in the barrier zone and 355.673 Mcum beyond the barrier zone. Seamwise, barrierwise coal:OB stripping ratio has been given in the table 4.36.

Table-4.33
Succession and Quality of Coal Seams

Coal seams	Parting (m)	Thickness (m)	M%	Ash%	VM%	UHV (K.cal/kg)	Grade
Lajkura-IV		12.42-14.39	6.1-8.2	26.2-39.07	25.8-28.9	2667-4222	D-F
	2.14-6.71						
Lajkura-III		2.02-4.89	5.4-6.7	23.8-37.0	26.4-27.2	3049-4691	D-F
	0.95-2.21						
Lajkura-II		30.05-34.07	4.6-5.7	30.0-36.8	25.9-26.3	3132-3973	E-F
	1.25-2.79						
Lajkura-I		12.09-14.43	3.9-5.2	29.0-44.5	23.6-26.4	2221-4180	E-G
	31.33-46.18						
Rampur-V		1.94-6.40	3.6-5.4	29.7-48.7	23.1-25.8	1683-4056	E-G
	0.39-5.10						
Rampur-IV		12.33-21.58	3.1-4.8	34.7-50.9	21.3-23.0	1448-3448	E-G
	0.89-7.27						
Rampur-III(Top)		2.97-11.92	4.0-6.2	24.2-43.5	23.8-28.2	2345-4705	D-G
	0.30-6.75						
Rampur-III(Bot.)		0.16-3.73	4.3-6.8	17.7-44.9	-	2110-5519	C-G
	0.17-8.21						
Rampur-II		0.91-6.31	3.2-5.9	22.5-49.9	20.8-29.7	1517-4981	C-G
	0.12-10.75						
Rampur-I		0.06-5.03	3.3-4.9	28.6-45.8	17.7-26.3	2083-4277	D-G
	1.53-11.39						

Coal seams	Parting (m)	Thickness (m)	M%	Ash%	VM%	UHV (K.cal/kg)	Grade
IB (Top)		0.12-1.84	-	-	-	-	-
	0.33-8.53						
IB(Middle)		0.30-4.28	2.9-7.5	20.5-41.3	17.5-28.0	2621-5243	C-F
	0.13-5.10						
IB(Bottom)		0.22-3.28	4.6-7.7	18.9-40.1	24.4-29.0	2862-5367	C-F

Table-4.34
Seamwise/Gradewise net proved geological reserve within Barrier zone, Kulda Block

(In Mt.)

Seam	Grade					
	C	D	E	F	G	Total
Lajkura-IV	-	-	1.9023	0.2105	-	2.1128
Lajkura-III	-	0.0040	0.8107	-	-	0.8147
Lajkura-II	-	-	3.2617	1.0012	-	4.2629
Lajkura-I	-	-	0.0584	3.5072	0.0412	3.6068
Total		0.0040	6.0331	4.7189	0.0412	10.7972
Rampur-V	-	-	-	0.2635	0.6710	0.9345
Rampur-IV	-	-	-	0.1508	3.2823	3.4331
Rampur(IV+V)	-	-	-	2.2283	1.8010	4.0293
Rampur-III Top	-	0.0946	2.0277	0.7033	-	2.8256
Rampur-III Bot	-	-	-	0.0370	0.1213	0.1583
Rampur(IIIT+IIIB)	-	-	-	0.0435	-	0.0435
Rampur-II	-	-	0.5067	0.3405	0.0246	0.8718
Rampur-I	-	-	0.5155	0.6436	-	1.1591
Rampur (I+II)	-	-	-	0.2988	-	0.2988
Total :		0.0946	3.0499	4.7093	5.9002	13.7540
IB (Mid)	-	-	0.3465	-	-	0.3465
IB (Bot)	-	0.0650	0.0487	-	-	0.1137
IB (Mid+Bot)	-	0.2247	0.3026	0.5189	-	1.0462
Total :	-	0.2897	0.6978	0.5189	-	1.5064
Grand Total :		0.3883	9.7808	9.9471	5.9414	26.0576

Table-4.35
Seamwise/Gradewise net proved geological reserve beyond Barrier zone, Kulda Block

(In Mt.)

Seam	Grade					
	C	D	E	F	G	Total
Lajkura-IV	-	-	18.7925	5.4283	-	24.2208
Lajkura-III	-	1.4538	6.7808	1.1530	-	9.3876
Lajkura-II	-	-	56.4565	23.3390	2.3310	82.1265
Lajkura-I	-	-	2.3432	42.9437	4.2471	49.5340
Total		1.4538	84.3730	72.8640	6.5781	165.2689
Rampur-V	-	-	0.4520	11.7141	5.1081	17.2742
Rampur-IV	-	-	-	9.5575	58.4829	68.0404
Rampur(IV+V)	-	-	-	14.0870	37.6963	51.7833
Rampur-III Top	-	2.1233	21.5841	16.7282	-	40.4356
Rampur-III Bot.	0.0281	0.2641	0.8646	1.1503	0.1202	2.4273
Rampur(IIIT+IIIB)	-	-	3.0290	10.0334	1.4667	14.5291
Rampur-II	0.0060	0.3792	5.6920	12.9605	1.6079	20.6456
Rampur-I	-	0.1509	1.5194	5.8218	0.5079	8.0000
Rampur (I+II)	-	-	-	2.2963	0.3112	2.6075
Total :	0.0341	2.9175	33.1411	84.3491	105.3012	225.7430
IB (Mid)	0.2885	2.2301	4.2693	0.2099	-	6.9978
IB (Bot.)	0.3650	2.6185	0.7581	0.1356	-	3.8772
IB (Mid+Bot.)	0.1220	5.1809	2.2859	3.1282	0.2413	10.9583
Total :	0.7755	10.0295	7.3133	3.4737	0.2413	21.8333
Grand Total :	0.8096	14.4008	124.8274	160.6868	112.1205	412.8452

Table-4.36
Seamwise/Barrierwise Coal:OB Stripping Ratio, Kulda Block
(For one seam and Immediate OB only)

Zone/Seam	Reserve in Million Tonnes	Immediate Overburden (In M.cum)	Stripping Ratio (Volume of OB in M^3 for 1t. of Coal)
Beyond Barrier			
Lajkura-IV	24.221	42.439	1.752
Lajkura-III	9.388	8.534	0.909
Lajkura-II	82.127	29.743	0.362
Lajkura-I	49.534	15.582	0.315
Sub-total :	165.269	96.298	0.583
Rampur-V	17.274	142.396	8.243
Rampur-IV (Inc. V+IV)	119.8232	19.882	0.166
Rampur-III Top	40.436	14.181	0.351
Rampur-III Bottom Inc. (III Top+III Bot.)	16.956	1.862	0.110
Rampur-II	20.646	21.785	1.055
Rampur-I Inc. (I+II)	10.608	6.063	0.572
Sub-total :	225.7432	206.169	0.913
IB Middle	6.998	45.831	6.831
IB Bot/IB (Mid+Bot.)	14.835	7.375	0.497
Sub-total :	21.833	53.206	2.437
Total :	412.8452	355.673	0.862
Within Barrier			
Lajkura-IV	2.113	3.186	1.508
Lajkura-III	0.814	0.828	1.016
Lajkura-II	4.263	0.944	0.221
Lajkura-I	3.607	0.537	0.149
Sub-total :	10.797	5.495	0.509
Rampur-V	0.934	10.248	10.960
Rampur-IV/Rampur (V+IV)	7.462	1.068	0.143
Rampur-III Top	2.826	0.796	0.282
Rampur-III Bot/ Rampur (III Top+III Bot.)	0.202	0.103	0.510
Rampur-II	0.872	1.311	1.503
Rampur-I/Rampur (I+II)	1.458	0.685	0.470
Sub-total :	13.755	14.211	1.033
IB Middle	0.347	1.803	5.200
IB Bot/IB (Mid.+Bot.)	1.160	0.181	0.156
Sub-total :	1.506	1.984	1.317
Total :	26.057	21.69	0.832
Grand Total :	438.902	377.363	0.860

Chapter - 5

MINING TECHNOLOGY

5.1 GENERAL

Kulda block is bounded by Basundhara River in the north, Chattajhor nallah in the west, Garjanbahal block on the east and south-east. Basundhara west Expn. and Basundhara east OCPs which are planned in Basundhara block are situated to the northwest of this block on the other side of Basundhara river.

5.2 DEPOSIT CHARACTERISTICS

Geological features of the block are explained in detail in Chapter-4. Three coal seams namely Ib seam, Rampur seam and Lajkura seam occur in this area. These three coal seams altogether occur in 12 split sections, leaving mergers & sub-splits.

Ib seam occurs in three sections. Ib bottom seam, which is the lowest coal section, is not workable in the northern part of the block. Ib middle section which overlies Ib bottom section is also not workable in the northern part. These two sections are combined over major part of the block. Ib top section is not workable over major part of the block and is not considered in quarriable reserves.

Rampur seam occurs in five sections. Rampur-I seam which overlies Ib middle section is not workable in the northern, southern & south eastern parts. It is combined with overlying Rampur-II seam over a long narrow strip in the western half of the block. The workable section of Rampur-I occurs at a minimum depth of about 34m in the region of borehole CMHG-118 while Rampur-II seam occurs in the entire block as workable coal section. Rampur-III bottom is not workable in the northern half of the block whereas other split sections overlying Rampur-III bottom are workable in the area of occurrence.

Lajkura horizon occurs in four sections and all coal sections are workable in the area of occurrence. Out of these four sections Lajkura-II seam is the thickest with a maximum thickness (including all bands) of 34.07m.

The parting between Ib middle seam and Rampur horizon varies from 3.79 to 13.62m. The parting is thicker where Rampur I is not workable. The parting between

Rampur horizon and Lajkura horizon is thickest with thickness ranging from 31m to 47m. Except these two partings other intervening partings between split sections are generally thin.

5.3 CHOICE OF TECHNOLOGY

The proposed mining block represents presence of moderately flat multiple coal seams with intermediate varying parting. Thick seams occur at shallow depth in wide area having power grade coal reserve. So this will make the project most viable by adopting opencast mining method.

5.4 MINE BOUNDARIES

Kulda geological block contains about 438.90 Mt of net geological reserves (vertical) with an overall vertical stripping ratio of 0.86 cum/t. The maximum depth upto floor of Ib bottom seam is about 238m. The entire reserves are quarriable.

As already mentioned, the geological block is bounded by Basundhara river, incrop of Rampur seam on the north/north eastern side and Chattajhor nallah on the western side. Chattajhor nallah has a meandering course giving rise to irregular block boundary. Therefore it is proposed to straighten nallah course at two places near boreholes CMHG-227 and CMHG-216. Surface boundary is arrived after leaving a surface barrier against nallah and the river.

In earlier approved Mining Plan of Kulda Expn. OCP (Revision-1) (15 Mty), mining operation was carried out in two phases. In Phase-I, surface boundary was restricted within notified lease area for which forest clearance has been obtained by the project authority i.e. excluding Lalma Forest. In Phase-II, remaining part of the block was to be worked after obtaining forest clearance for this area.

In this Mining Plan, total area of Phase-I and II are considered with enhanced production of 18.75 Mty.

As explained in Chapter-IV, Ib bottom, Ib middle and Rampur-I seams are not workable on northern side. Even after, Ib bottom seam attains workable thickness of 1m, incremental thickness ratio is adverse due to inconsistent development of Ib middle seam and Rampur-I seam. Hence, it is proposed to adopt Rampur-II floor as the mine floor upto

185m/190m floor contour of Rampur-II seam and thereafter deepen the mine floor to floor of Ib bottom seam floor.

Mine boundaries adopted in this mining plan are summarized below. (ref. plate Min-II).

North	:	Floor boundary is arrived after leaving surface barrier of about 60m against river. Quarry slope is about 37°.
East	:	Roof incrop of Rampur-II seam.
South	:	Geological boundary is adopted as surface boundary.
West	:	Floor boundary is marked after leaving a surface barrier of about 60m against Chattajhor nullah and its straightened part.

5.5 RESERVES AND STRIPPING RATIO

Kulda OCP is operating since 2007-08. About 73.07 Mt of coal and 46.57 M.cum of OB has been extracted till 31.03.2019. It is estimated that 266.49 Mt of mineable coal would be available for extraction within mine boundaries.

The total overburden to be removed is estimated as 283.32 Mcum. Thus overall stripping ratio works out to 1.06 cum/t.

Table 5.1 gives seamwise, gradewise details of mineable coal. Details of Parting/overburden are given in table 5.2.

Table - 5.1
Seamwise, Gradewise Mineable Coal

(Figs. in Mt.)

	Seam/Name/Grade	C	D	E	F	G	Grand Total
1	**Ib-bottom**	0.03	0.42	0.24	0.05	0	**0.74**
2	**Ib-middle**	0	0.57	1.32	0.03	0	**1.92**
3	**Ib-combined**	0.11	4.13	1.73	1.52	0.18	**7.67**
4	**Rampur-I**	0	0	0.37	2.56	0	**2.93**
5	**Rampur-II**	0	0.21	2.49	6.45	1.28	**10.43**
6	**Rampur-I+II**	0	0	0.01	0.99	0.26	**1.26**
7	**Rampur-III bottom**	0	0.04	0.91	0.45	0.38	**1.78**
8	**Rampur-III Top**	0	1.3	11.26	9.35	0	**21.91**
9	**Rampur-III Comb.**	0	0	0.47	7.37	0.55	**8.39**
10	**Rampur-IV**	0	0	0	7.36	26.2	**33.56**

11	**Rampur-IV+V**	0	0	0	5.04	25.23	**30.27**
12	**Rampur-V**	0	0	0.49	8.75	3.6	**12.84**
13	**Lajkura-I**	0	0	2.23	28.34	0.86	**31.43**
14	**Lajkura-II**	0	0	44.72	21.97	3.04	**69.73**
15	**Lajkura-III**	0	1.31	6.13	0.16	0	**7.6**
16	**Lajkura-IV**	0	0	20.09	3.94	0	**24.03**
		0.14	**7.98**	**91.52**	**104.33**	**61.58**	**266.49**

Table - 5.2
Details of overburden and partings

A.	**Partings**	**OB as on 01.04.2019**
1	PARTING BET. IB-BOT & IB-MID.	1.61
2	PARTING BET. IB-MID & RAMPUR-I	14.09
3	PARTING BET IB-MID & RAMPUR-II	10.92
4	PARTING BET RAMPUR-I & RAMPUR-II	3.17
5	PARTING BET RAMPUR-II & RAMPUR-III BOT	1.98
6	PARTING BET RAMPUR-II & RAMPUR-III TOP	13.49
7	PARTING BET RAMPUR-III BOT & RAMPUR-III TOP	2.45
8	PARTING BET RAMPUR-III TOP & RAMPUR-IV	16.38
9	PARTING BET RAMPUR-IV & RAMPUR-V	5.52
10	PARTING BET RAMPUR-V & LAJKURA-I	80.37
11	PARTING BET LAJKURA-I & LAJKURA-II	4.86
12	PARTING BET LAJKURA-II & LAJKURA-III	6.49
13	PARTING BET LAJKURA-III & LAJKURA-IV	5.05
	SUB-TOTAL (PARTINGS)	**166.38**
B.	**overburdens**	
14	OVERBURDEN ABOVE RAMPUR-II	0.71
15	OVERBURDEN ABOVE RAMPUR-III BOT	0.18
16	OVERBURDEN ABOVE RAMPUR-III TOP	1.2
17	OVERBURDEN ABOVE RAMPUR-IV	2.5
18	OVERBURDEN ABOVE RAMPUR-V	33.79
19	OVERBURDEN ABOVE LAJKURA-I	7.48
20	OVERBURDEN ABOVE LAJKURA-II	18.17
21	OVERBURDEN ABOVE LAJKURA-III	3.04
22	OVERBURDEN ABOVE LAJKURA-IV	49.87
	SUB-TOTAL (OVERBURDEN)	**116.94**
	TOTAL (OVERBURDEN & PARTING)	**283.32**

SPECIFIC GRAVITY

As already mentioned, gradewise specific gravities are adopted for calculation of coal quantity and are detailed in table 5.3.

Table - 5.3
Gradewise specific gravity of coal

Grade	Specific Gravity (t/cum)
C	1.50
D	1.55
E	1.61
F	1.68
G	1.75

MINING LOSSES

Seamwise mining losses are calculated based on average thickness and presence of thick dirt bands. Based on these assessed losses, deduction has been made from net geological coal to arrive at mineable coal. Details of mining losses calculated for various seams are given in table 5.4.

Table - 5.4
Seamwise mining losses

Sl.No.	Seam Description	Mining Loss (%)
1.	Ib-bottom	21
2.	Ib-middle	13
3.	Ib-combined	9
4.	Rampur-I	17
5.	Rampur-II	12
6.	Rampur-III bottom	12
7.	Rampur-III top	7.5
8.	Rampur-III combined	4
9.	Rampur-IV	8
10.	Rampur-IV+V	4.5
11.	Lajkura-I	4.5
12.	Lajkura-II	5.5
13.	Lajkura-III	8
14.	Lajkura-IV	3

5.6 ANNUAL TARGET AND LIFE

An annual target of 18.75 Mt is proposed. Mine life at this target works out to 15 years.

5.7 GEO-MINING CHARACTERISTICS

Geo-mining characteristics of the proposed quarry are given in table 5.5.

Table - 5.5
Geo-mining Characteristics

Sl.No.	Particulars	Unit	Total
1.	Floor area	ha	397.95
2.	Surface area	ha	539.98
3.	Mineable reserves	Mt	266.49*
4.	Waste volume	Mcum	283.32*
5.	Stripping ratio	m^3/t	1.06
6.	No. of seams/sections		3/16**
7.	Capacity	Mty	18.75
8.	Life	Yrs	15
9.	Average gradient		
	R-II as floor	1 in 10.05	
	Ib-Bottom as floor	1 in 11.33	
10.	Strike length (along floor)		
	Maximum	m	2300
	Minimum	m	500
11.	Strike length (along surface)		
	Maximum	m	2430
	Minimum	m	820
12.	Depth		
	Maximum	m	200
	Minimum	m	10
13.	Perimeter	m	9630

* Balance as on 01.04.2019
** This includes split and combined sections.

5.8 OPENING OF DEPOSIT AND SEQUENCE OF WORKING

Rampur-II seam incrops at a shallow depth in the block, but due to the presence of Basundhara River, it was not be possible to approach the deposit from northern side. Thus

access trench has been located in eastern part of the block in the incrop zone of Rampur-II seam as proposed in approved Mining Plan of Kulda OCP (10 Mty).

This project is an operating mine. Present access trench is being used to reach the lowest workable seam as proposed in the original P.R. and is proposed to continue for balance project life.

Another exit is proposed at the south-east corner for carrying upper seam coal along southern batter.

At present, mining activities are confined to southern part of the strike length. The availability of land is restricted by Sundargarh-Raigarh road in the north and restricted limit of working as per forest approval on west and south.

The Sundergarh-Raigarh road is proposed to be diverted by north side of the property along Basunghara river over an embankment. This road should immediately be diverted for proper development of the mine. Once this road is diverted the present mine can extend upto north western limit of quarry with adequate strike length. Development of this mine to it's full strike also helps to align it's haul road on the mine floor and maximizes internal dump capacity. Process for clearance from forest department may be started early for taking possession of the dip side land.

Only after the above two constraints (road diversion and forestry clearance) are resolved, the mine can be expanded to its full strike width and haul road can be maintained in desired direction.

Barring three strike faults of up to 15m throw in the central part, the property is mostly undisturbed. There are hillocks in the south-central part for which additional capacity of OB removal is required. However, the rate of OB removal has been kept moderately uniform with little advance stripping.

After excavating mine floor for a width of about 550m, mine floor changes from Rampur-II to IB Bottom. A ramp has been provided along the line of different mine floors to reach the IB Bottom seam. Moreover, the faults die out before this ramp.

During the same period when mine floor is deepened to reach IB Bottom seam, Lajkura seam is encountered. Composite thickness is about 60m with thin intervening partings. All benches of mining operation are to be advanced as a single quarry towards dip.

5.9 MINING SYSTEM

The prevalent mining and geological conditions comprise of the followings:

i) Presence of 3 nos. thick coal horizons namely, (a) Ib (8 m), (b) Rampur (45 m), (c) Lajkura (50 m).

ii) The above coal horizons contain multiple coal sections with intervening partings. Thickest coal seams/sections are Rampur (IV+V) (25 m) and Lajkura II (31 m).

iii) Gradient of the seams (5° to 8°).

iv) Low average stripping ratio of 1.05 cum per tonne.

Considering the above prevalent mining and geological conditions, shovel dumper mining system in overburden and Surface Miner (windrowing), loader and tipper for coal extraction has been suggested.

The external overburden and the thick parting between Rampur and Lajkura seam horizons are proposed to be worked by horizontal slices, whereas all the coal seam sections and the intervening partings in Ib, Rampur and Lajkura seams are envisaged to be worked by inclined slices considering the moderate gradient.

5.10 EXCAVATION & TRANSPORT

The prevalent thickness of various coal seam sections and partings within the Kulda quarry area are given in table no.5.6.

Table - 5.6

Sl. No.	Particular	Maximum	Minimum	Average
1.	Top overburden	65.00	2.81	-
2.	Lajkura IV seam	14.47	12.42	13.63
3.	Ptg. bet. Lajkura IV & III	6.71	1.84	4.31
4.	Lajkura III seam	4.89	3.10	4.34
5.	Ptg.bet. Lajkura III & II	2.21	1.01	1.56

6.	Lajkura II seam	34.07	30.05	31.44
7.	Parting bet. Lajkura II & I	2.85	1.20	1.86
8.	Lajkura I seam	14.55	11.56	13.78
9.	Parting bet. Lajkura I & Rampur V	43.60	31.33	35.78
10.	Rampur V seam	7.42	1.94	4.03
11.	Parting bet. Rampur V & IV	4.40	1.04	2.33
12.	Rampur IV seam	22.18	12.25	17.14
13.	Ptg. bet. Rampur IV&III top	7.27	1.10	2.37
14.	Rampur III top seam	11.92	2.97	8.33
15.	Ptg. bet. Rampur III top & Rampur III bottom	2.58	1.18	1.73
16.	Rampur III bottom seam	3.73	1.03	1.97
17.	Ptg. bet. Rampur III bot. & Rampur II	5.28	1.13	2.68
18.	Rampur II seam	6.31	1.16	4.44
19.	Ptg. bet. Rampur II & I	5.12	1.11	2.29
20.	Rampur I seam	5.33	1.02	2.29
21.	Ptg. bet. Rampur II & Ib middle	17.83	8.66	14.15
22.	Ptg. bet. Rampur I & Ib middle	13.62	3.79	10.00
23.	Ib middle seam	4.28	1.16	2.45
24.	Ptg. bet. Ib middle & Ib bottom	4.52	1.03	2.29
25.	Ib bottom seam	4.40	1.00	1.47

Project report for the existing mine has been approved in both outsourcing variant for target production of 15 Mty. Accordingly coal extraction & overburden removal & transport are presently being done by outsourcing agencies. Same system of mining will be continued for mining operations.

For the above geomining conditions following is the optimum choice of equipment if the mine is operated departmentally.

i) The soil analysis data available for adjacent Basundhara block reveals that the thickness of top soil varies from 250 to 300 mm. As the major part of the area is covered with dense vegetation, the soil should be ripped, dozed and loaded after clearing vegetation.

ii) Elect. Rope shovels of 10 cum. working in conjunction with rear dumpers 85T / 100T are envisaged for the top overburden and the thick parting (35 m) between Rampur and Lajkura horizons.

iii) Moderately thick to thin partings are suggested to be removed by 5-7 cum hydraulic shovel/ backhoes with 85/100 T rear dumper.

iv) Thin inseam parting & bands can be removed by using high capacity ripper-dozer without blasting.

v) Surface miner, loader and rear dumper can be deployed for extraction of coal seams by blast free method. 5-7 cum. hydraulic shovels/ backhoe along with 85/100t dumper can be deployed in part coal production where surface miner cannot be deployed.

In the approved outsourcing variant similar size of HEMM are preferred to avoid excessive HEMM population.

At the full development stage of the mine, number of working overburden benches will be about 10 and total number of benches including parting and top overburden may be about 15. In addition to overburden benches, there are 11 nos. of coal horizons. Therefore, it is required to organize the transport system which will offer necessary connections to all horizons during mine development. Considering these requirements, it is envisaged to develop peripheral horizontal roads and a road at 6% gradient connecting these horizontal roads. There will be two such roads, one to serve northern & western side and another connecting eastern, south eastern flank roads (**ref. Plate MIN-I**).

Transport route for OB would be along working benches and to nearest flank level haul road through temporary ramps. From flank roads it will be hauled either to internal or external dumps. Coal from lower horizons would be transported through haul road on the mine floor whereas coal from upper horizons would be through flank haul roads.

5.11 DUMPING

It is estimated that about 73 Mcum of overburden is to be dumped outside the quarry. Due to surface constraints of Chattajhor nallah, adjoining Garjanbahal block and forest lands, there is acute shortage of land for external dumping. Area immediate rise side of incrop is not considered due to presence of forest land and also proposed location of mine infrastructure like CHP, workshop and substation. Therefore, the area on immediate rise side of adjoining Garjanbahal block is considered as one of the dump sites (External dump no 1 of original Mining plan). In the existing mine major quantity of the overburden is being

transported to this above mentioned external dump. About 33.83 Mcum has already been dumped in external dump no 1 located on the rise side of the Garjanbahal block. The proposed external dump no 2 is on the dip side of Kulda block. Dump no 2 (capacity 31.94 Mcum) has not been started. Additionally, 1.11 Mcum is dumped along Chattajhor nallah and Basundhara river to form embankment.

Backfilling has already been started in the existing mine. It is proposed to increase the internal dumping when sufficient advance is made on lower most seam floor. MIN-VI shows the position of external and internal dumps at final stage of mining operations.

Table - 5.10
External and Internal Dumping

YEAR	EXTERNAL DUMP-1	EXTERNAL DUMP-2	EMBANKMENT	INTERNAL DUMP	TOTAL OB REMOVED
TILL 31.3.2019	33.83		1.1	11.63	46.57
Yr-1 (2019-20)	4.11	6.15		16.3	26.56
Yr-2 (2020-21)	3.12	6.51		16.84	26.47
Yr-3 (2021-22)		7.23		22.47	29.7
Yr-4 (2022-23)		5.67		14.48	20.15
Yr-5 (2023-24)		6.38		11.77	18.15
Yr-6 (2024-25)				18.46	18.46
Yr-7 (2025-26)				18.19	18.19
Yr-8 (2026-27)				18.05	18.05
Yr-9 (2027-28)				18.28	18.28
Yr-10 (2028-29)				18.39	18.39
Yr-11 (2029-30)				18.44	18.44
Yr-12 (2030-31)				18.52	17.52
Yr-13 (2031-32)				18.41	17.41
Yr-14 (2032-33)				10.53	9.48
Yr-15 (2033-34)				5.02	4.02
TOTAL	**41.06**	**31.94**	**1.1**	**255.79**	**329.89**

Quantity of external duping has been more due to delay in diversion of Sundragargarh- Raigarh road.

South-eastern slope of the mine adjacent to Lalma forest is being partially filled by overburden generated by Phase-I mining operation. This overburden will have to be rehandled while advancing this area towards south during Phase-II mining operation. Alternatively this overburden can be dumped in area of external dump-2 as per earlier approved mining plan. This external dump area is on coal bearing area

towards dip side property. The non-forest area has already been notified by project authority.

5.12 DRILLING AND BLASTING

Overburden is mostly required to be loosened by drilling and blasting before excavation. There is wide variation in thickness of coal sections being worked. Blasting will be mostly avoided in coal seams due to deployment of surface miner. Ripping and dozing may be adopted in coal sections of thickness less than 2 m, depending upon situation.

It is envisaged to deploy 250 mm dia electric blasthole drills in top overburden and thick partings. 160 mm dia drills are provided to deal with other partings. As per standardization adopted in MCL only two types of drills are adopted. Powder factor of 0.35 kg/cum and 0.2 kg/cum have been adopted for overburden and coal respectively for estimating explosive requirement.

Blasting pattern will have to be established after conducting a series of field trials. Considering that the mine infrastructure and bridge across Basundhara River is located close to the quarry, it is important to determine charge per delay and other blasting parameters. However following tentative blasting pattern is suggested:

Table - 5.10
Proposed Blasting Pattern

Description	Overburden			Coal	
Bench height (m)	15	10	5	10	5
Blast hole diameter (mm)	250	250	115	160	115
Spacing x burden (m x m)	9.5x8	9x7.5	5x4	7.5x6	5.5x4.5

5.13 CALENDAR PROGRAMME OF EXCAVATION

Calendar programme of seamwise yearly coal production is given in Table 5.11. Yearwise quantities of coal, volume of overburden and corresponding stripping ratio is given in Table 5.12. Final Stage Excavation Plan is shown in plate MIN-I.

Table 5.11

SEAMWISE YEARLY COAL PRODUCTION SCHEDULE

KULDA EXPANSION OC PROJECT

YEAR	Ib-bot	Ib-mid	Ib-comb	Ram-I	Ram-II	Ram-I+II	Ram-III bottom	Ram-III Top	Ram-III Comb.	Ram-IV	Ram-IV+V	Ram-V	Laj-I	Laj-II	Laj-III	Laj-IV	TOTAL
Yr-1 (2019-20)	0.05	0.14	0.54	0.21	0.74	0.09	0.13	1.55	0.59	2.37	2.14	0.91	2.22	4.92	0.54	1.61	18.75
Yr-2 (2020-21)	0.05	0.13	0.54	0.2	0.73	0.09	0.12	1.54	0.59	2.37	2.13	0.9	2.22	4.93	0.53	1.68	18.75
Yr-3 (2021-22)	0.06	0.14	0.54	0.21	0.74	0.09	0.13	1.55	0.6	2.37	2.14	0.91	2.22	4.92	0.54	1.59	18.75
Yr-4 (2022-23)	0.05	0.13	0.55	0.21	0.74	0.09	0.12	1.55	0.59	2.37	2.14	0.91	2.22	4.92	0.54	1.62	18.75
Yr-5 (2023-24)	0.05	0.14	0.54	0.2	0.73	0.08	0.13	1.55	0.59	2.37	2.14	0.9	2.22	4.93	0.53	1.65	18.75
Yr-6 (2024-25)	0.05	0.13	0.54	0.21	0.74	0.09	0.12	1.54	0.59	2.37	2.13	0.91	2.22	4.92	0.54	1.65	18.75
Yr-7(2025-26)	0.06	0.14	0.54	0.21	0.74	0.09	0.13	1.55	0.6	2.37	2.14	0.91	2.21	4.92	0.54	1.6	18.75
Yr-8 (2026-27)	0.05	0.13	0.54	0.21	0.73	0.09	0.13	1.55	0.59	2.37	2.14	0.9	2.22	4.93	0.53	1.64	18.75
Yr-9 (2027-28)	0.05	0.14	0.54	0.2	0.74	0.09	0.12	1.54	0.59	2.37	2.14	0.91	2.22	4.92	0.54	1.64	18.75
Yr-10 (2028-29)	0.05	0.14	0.55	0.21	0.73	0.09	0.13	1.55	0.59	2.37	2.13	0.91	2.22	4.93	0.54	1.61	18.75
Yr-11 (2029-30)	0.05	0.13	0.54	0.21	0.74	0.09	0.12	1.55	0.6	2.37	2.14	0.9	2.22	4.92	0.53	1.64	18.75
Yr-12 (2030-31)	0.06	0.14	0.54	0.2	0.74	0.09	0.13	1.54	0.59	2.37	2.14	0.91	2.22	4.92	0.54	1.62	18.75
Yr-13 (2031-32)	0.05	0.13	0.54	0.21	0.73	0.09	0.12	1.55	0.59	2.36	2.14	0.91	2.22	4.93	0.54	1.64	18.75
Yr-14 (2032-33)	0.03	0.09	0.36	0.14	0.49	0.06	0.09	1.03	0.4	1.58	1.42	0.6	1.48	3.28	0.35	2.04	13.44
Yr-15 (2033-34)	0.03	0.07	0.27	0.1	0.37	0.04	0.06	0.77	0.29	1.18	1.06	0.45	1.1	2.44	0.27	0.8	9.30
TOTAL	0.74	1.92	7.67	2.93	10.43	1.26	1.78	21.91	8.39	33.56	30.27	12.84	31.43	69.73	7.60	23.09	266.49

Table 5.12

PROGRAMME OF COAL EXTRACTION AND OB REMOVAL

KULDA EXPANSION OC PROJECT

YEAR	COAL	OB	Stripping Ratio
Yr-1 (2019-20)	18.75	26.56	1.42
Yr-2 (2020-21)	18.75	26.47	1.41
Yr-3 (2021-22)	18.75	29.70	1.58
Yr-4 (2022-23)	18.75	20.15	1.07
Yr-5 (2023-24)	18.75	18.15	0.97
Yr-6 (2024-25)	18.75	18.46	0.98
Yr-7 (2025-26)	18.75	18.19	0.97
Yr-8 (2026-27)	18.75	18.05	0.96
Yr-9 (2027-28)	18.75	18.28	0.97
Yr-10 (2028-29)	18.75	18.39	0.98
Yr-11 (2029-30)	18.75	18.44	0.98
Yr-12 (2030-31)	18.75	18.52	0.99
Yr-13 (2031-32)	18.75	18.41	0.98
Yr-14 (2032-33)	13.44	10.53	0.78
Yr-15 (2033-34)	9.30	5.02	0.54
TOTAL	266.49	283.32	1.06

5.14 REQUIREMENT OF HEMM

Project report of Kulda OCP (10 Mty) was approved for both coal & OB outsourcing variant. Kulda OCP (15 Mty; 5 Mty incremental) has been approved for incremental coal & incremental OB both by outsourcing. In sanctioned outsourcing variant equipment requirement and its phasing will depend on the outsourcing agency. But the optimum choice of equipment as per departmental variant has also been assessed, total requirement and its phasing have been calculated based on the calendar plan of operations, revised productivity of HEMM and possible physical deployment of equipment in various horizons.

Requirement of HEMM (in case the mine is operated departmentally) is given in Table 5.13.

Table 5.13
Requirement of HEMM

			Total
A.	***OVERBURDEN***		**NO.**
1.	HYDRAULIC BACKHOE [660-760 HP]	5.9-6.1 cum.	9
2.	ELECTRIC ROPE SHOVEL [6.6 kv]	10 Cum.	4
3.	REAR DUMPER	100 T	30
4.	REAR DUMPER	60 T	70
5.	ELEC. R.B.H. DRILL TALL MAST	250 mm	6
6.	R.B.H. DRILL	160 mm	6
7.	DOZER	410 H.P.	10
8.	RIPPER DOZER	850 HP	3
B.	***COAL***		
1.	SURFACE MINER (WINDROW)	900-1100 HP	6
2.	HYDRAULIC BACKHOE [660-760 HP]	5.9-6.1 cum.	1
3.	FRONT END LOADER [~500 HP]	5.5-6.0 cum	7
4.	REAR DUMPER	60 T	57
5.	DOZER	410 H.P.	5
C.	***COMMON***		
1	LATTICE BOOM CRAWLER MOUNTED CRANE	75 tonne	1
2	ROUGH TERRAIN CRANE	40 tonne	2
3	HYDRAULIC MOBILE CRANE	10 tonne	2
4	SERVICE CRANE	8 tonne	3
5	HYDRAULIC BACKHOE	1.5-1.6 cum	3
6	FRONT END LOADER	3.0 cum	4
7	TYRE HANDLER	FOR 60T TRUCK	3
8	MULTIPURPOSE HANDLING EQUIPMENT		1
9	GRADER	280 HP	4
10	WATER SPRINKLER	28 KL	8
11	MAINTENANCE VAN		3
12	FUEL BOWSER	20 KL	3
13	FIRE TRUCK		2
14	VIBRATORY COMPACTOR		2

Chapter - 6

MANPOWER, SAFETY AND SUPERVISION

6.1 REQUIREMENT OF MANPOWER

COAL & OB OUTSOURCING (APPROVED VARIANT)

Manpower for OB removal, coal extraction together with common services and land reclamation considering 330 working days and 16.5% absenteeism in a year as per approved Mining Plan is given belowin table 6.1.

6.1.1 REQUIREMENT ON VARIOUS WORKING HEADS AS PER APPROVED MINING PLAN FOR COAL & OB OUTSOURCING VARIANT

The group wise manpower requirement as per approved Mining Plan is given in table no.6.1 below:

Table - 6.1
Groupwise manpower requirement

Sl. No.	Particulars	No. of persons (upto target year)	No. of persons (beyond target year)
1	Executives	77	-
2	Monthly rated	248	-
3	Daily rated (Category)	332	3
4	Daily rated (Excavation)	153	3
	Total	**810**	**6**

Manpower requirement as per approved Mining Plan for various activities is given in table no. 6.2 below:

Table No. 6.2

Sl. No.	Particulars	No. of persons (upto target year)	No. of persons (beyond target year)
1	Coal	44	-
2	OBR	167	6
3	Common	571	-
4	Environment & land	28	28
	Total	**810**	**6**

6.1.2 ADDITIONAL REQUIREMENT (FOR 5 MTY INCREMENTAL PRODUCTION) ON VARIOUS WORKING HEADS FOR COAL & OB OUTSOURCING VARIANT

The group wise additional manpower requirement is given in table no.6.3 below:

Table - 6.3
Groupwise additional manpower requirement

Sl. No.	Particulars	No. of persons (upto target year)	No. of persons (beyond target year)
1	Executives	-	-
2	Monthly rated	7	-
3	Daily rated (Category)	3	-
4	Daily rated (Excavation)	81	-
	Total	**91**	-

Additional manpower requirement for various activities is given in table no. 6.4 below:

Table No. 6.4

Sl. No.	Particulars	No. of persons (upto target year)	No. of persons (beyond target year)
1	Coal	68	-
2	OBR	-	-
3	Common	-	-
4	Environment & land	23	-
	Total	**91**	-

6.2 SAFETY AND SUPERVISION

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

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 unruly 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.
- Accumulation of noxious gases/fumes in deep pits.

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.

6.3 SAFETY MANAGEMENT

6.3.1 SLOPE STABILITY

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.

All the working benches shall be under the direct supervision of overman /mining sirdar and all necessary precautions shall be taken to make the workings safe. Any rehandling to expose coal should be done with all safety measures and norms. Width and height of working coal benches will depend on machinery /HEMM deployed by the outsourcing agency and safety should be properly ensured by the competent authority as per provisions of existing safety norms by DGMS or other agencies.

Considering the gradient of coal seam about 5°-6° 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.

FOR COAL SEAMS

	5.5Cum EHS
Max. bench height	10m
Working bench width	32m/37m
Bench slope	70°

FOR OB

	5.5Cum EHS/10Cum. ERS
Bench height (max.)	10m (for 5.5 cum EHS)
Bench height (max.)	15m (for 10 cum ERS)
Working bench width	37m/50m
Bench slope	70°

OB DUMP

Due to presence of Basundhara River on north & presence of reserve forest on east, there is acute shortage of external dumping area. The southern side is also constrained because of presence of coal bearing areas of Garjanbahal & Meenakshi blocks.

It is estimated that about 74.11 Mcum of overburden is to be dumped outside the quarry. Therefore, the area on immediate rise side of adjoining Garjanbahal block is considered as one of the dump sites (External dump no 1 of original Mining plan). In the existing mine major quantity of the overburden is being transported to this above mentioned external dump. About 33.83 Mcum has already been dumped in external dump no 1 located on the rise side of the Garjanbahal block. The proposed external dump no 2 is on the dip side of Kulda block. Dump no 2 (capacity 31.94 Mcum) has not been started. Additionally, 1.11 Mcum is dumped along Chattajhor nallah and basundhara river to form embankment.

At present major overburden from the mine is being dumped externally. Internal backfilling has just started and will be continued in future. Both internal & external dumps will be formed in 30m tiers with an overall slope of about 26°, angle of individual dump tier will be around 37° depending on angle of repose of material and there should be horizontal berm of width 30m in between the individual 30 m dump tiers. Height of each dump may even be kept at a lesser height where the dump is near any road or locality. Berm between each dump tier should be properly graded and drains should be provided at toe with proper gradient. Fencing may be done near bottommost tier to stop unauthorized entry near the dump,

adequate safety distance on surface from dump toe should be maintained to avoid any accident due to slope failure.

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.

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 separately, 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. The natural angle of repose shall be maintained.
7. A suitable fence shall be erected at the toe of every OB dump to prevent unauthorized person from approaching the OB dump.
8. The backfilled area shall be kept benched and the distance of active mine workings (faces) from the toe of the bottom most backfilled face (bench) shall not be less than 100m.
9. Garland drain to be made around OB dump area to avoid water flow during monsoon below the OB dump.
10. Ground water table is generally 3-5m below ground level hence may have no adverse impact.
11. Leveling, grading and drainage arrangement for top of OB dumps will be done.
12. Technical & Biological reclamation will be done.

13. Sufficient clearance as per DGMS regulations or any other statutory law should be maintained between toe of the dump and nearby road/village/infrastructure to avoid any accident or slope failure.

6.3.2 SAFE USE OF EXPLOSIVES

Site mixed slurry (SMS) has been proposed to be used for good fragmentation and obviate storage of bulk quantum of explosives. However, for storage of explosives meant for priming, detonating fuse and detonators, two explosive magazines of 20 tonnes each have been provided in this report.

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

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 are suggested to be used, after field trials. A tentative drilling and blasting pattern is given in Mining Technology chapter (Chapter-V).

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.

A safety zone of 300m radius 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.

6.3.3 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/posts 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. 6 nos. of Electrical Supervisors have

been provided in the manpower requirement to fulfill the statutory needs as per the rules, regulations pertaining to mining industry.

6.3.4 USE OF HEMM

Based on the excavation requirement of the mine and envisaged calendar programme, adequate number of HEMM has been envisaged in the PR with due regard to stand-bye provisions for proper maintenance ofthe same.

A well equipped workshop is suggested in the PR to cater to the maintenance needs of HEMM and other equipments besides provision of necessary 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 crewware provided in the PR with due consideration of leave/sick provisions.

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.

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-VII.

6.3.5 DUST

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 examine objectively the status of compliance with the statutory standards and for making a real assessment of ambient air quality.

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

- All the drills are provided with well designed dust extraction/suppression system ;
- Blasting operations are designed in such a way so that these 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 installed 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 tankers/sprinklers to reduce dust generation from haul roads.

6.3.6 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 a thin layer of inert rock so as to form a impervious layer.

b) treatment of exposed coal seams & outdoor coal stocks with antipyrogenic substances.

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

6.3.7 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 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.

6.3.8 INUNDATION

Due care has been taken while formulating the PR to prevent water ingress during mining operations from the higher ground through local streams.

a) It has been proposed to straighten Chatta jhor nallah for convenience of mine operation. Adequate precaution shall however, be taken at the four diversion points so that water in-rush through old river-course to the mine workings does not take place.

b) In rainy season, water from the mining area flows down to Chattajhor nallah and Basundhara river by means of small streams. Mining operation will disrupt the existing drainage system. Garland drains around the periphery have therefore been provided.

c) Possible overflow of water during rainy season, from Chattajhor nallah and Basundhara river to mine workings will be guarded against by formation of embankment alongside the water courses.

Height of embankment shall be kept above HFL. The width at top of the embankment will be 20m with slopes on both sides. The slope facing nallah will be stone pitched. Provision has been made for this in the PR. During implementation, design of the embankment should be properly done considering actual site conditions.

d) A careful assessment is to be made against the danger from surface water before on the onset of rainy seasons. The necessary precautions should be clearly laid down and implemented. A garland drain needs to be provided to drain away the surface rainwater from coming into the mine.

e) Inspections for any accumulation of rainwater, obstruction in normal drainage and weakening in embankment.

f) Standing order; for withdrawal of working persons in case of apprehended danger.

g) During heavy rain inspection of vulnerable points is essential. In case of any danger persons are to be withdrawn to safer places.

h) Nallah or water inlets may be diverted or isolated by embankments/if so required.

6.3.9 VENTILATION OF DEEP BENCHES

The ventilation units like truck mounted auxiliary fans will be provided towards the end of mine life to improve the working environment when the maximum depth of quarry reaches more than 200m depending upon existing conditions.

6.4 CONSERVATION

Opencast method provides maximum conservation.

Chapter - 7

COAL HANDLING PLANT, WASHING AND MODE OF DESPATCH

7.1 INTRODUCTION

The proposed PR of Kulda Expansion OCP is planned to handle the total production of 15.0 Mty and the same will be enhanced up to 18.75 Mty. Presently, the CHP is having 2 nos. feeder breakers of 200 to 300 tph (approx.) capacity and dispatch the coal through the existing truck loading hoppers to nearby siding. Out of 18.75 Mty of production, blast free raw coal of 10 Mty will feed to proposed Basundhara Washery and rest coal is to be dispatched to Kanika and Sardega sidings as well as road sale also.

7.2 COAL HANDLING ARRANGEMENTS

The coal handling arrangement feeding the raw coal to 10 Mty Basundhara washery and dispatch of washed coal through wagons shall have the following provisions:

- Four numbers of reclaim feeders located at a suitable position near the mine access trench to receive the blast free raw coal to handle 10 Mty capacity.
- The entire 10 Mty raw coal reclaimed by the reclaim feeders and transported up to the proposed Basundhara washery (10 Mty) by sets of belt conveyor C1&C1A, C2&C2A and C3&C3A and feed to Washery complex at a height of 10-15 mtr.
- Out of balance 8.75 mty of coal, 2 mty conventionally produced coal will be collected by existing feeder breakers and after crushing the same will be dispatched to Kanika and sardega sidings by trucks. Rest 6.75 Mty blast free coal will also be dispatched to Kanika and sardega sidings as well as road sale.

In future, if the capacity of washery will be enhanced, modification of raw coal feeding will be done accordingly to handle 18.75 Mty raw coal.

7.3 BASIC PARAMETERS

The basic parameters considered for the planning of the coal handling plant will be as under:

Capacity (Max.)	18.75 Mty
No. of working days	330
No. of shifts/day	3
No. of hours/shift	8
No. of effective hours of work of CHP/shift	5

7.4 DESCRIPTION OF COAL TRANSPORTATION UPTO WASHERY

(Refer Dwg No. Plate no **Engg.-I**)

FOR 15 MTY WITH INCREMENTAL 3.75 MTY COAL

Conventionally produced around 2 Mty coal brought by dumpers from the quarry shall be unloaded into the existing Feeder breakers circuits and dispatch through the truck loading hoppers to nearby Kanika and sardega sidings.

The blast free coal (by surface miner) brought to the reclaim feeder complex from quarry and stacked on ground. Dozers or Pay loaders are used to channelizing the coal from ground to four numbers of reclaim feeders (0-1000 tph variable capacity each) and the reclaim feeders reclaims the coal and feed into conveyor C1/C1A. The coal reclaimed by the reclaim feeders collected and transported up to the proposed Basundhara washery (10 Mty) and feed at a height of 10-15 meter within the washery premises by the sets of belt conveyors C1&C1A, C2&C2A and C3&C3A of 1500 tph each design capacity.

To dispatch the balance blast free coal of approximately 6.75 mty, present system of despatch arrangement shall be adopted. The entire 6.75 Mty coal shall be despatched by trucks to Kanika and sardega sidings using the existing road corridor.

Misc. items like dust suppression, firefighting, chutes with liners, tools and tackles etc. will be provided for the proposed coal handling system.

7.5 WASHED COAL TRANSPOTATION THROUGH SILO

The total washed coal from the Basundhara washery (10 Mty) shall be transported upto Silo by conveyors is under the scope of BOMO.

The washed coal from Basundhara washery (10 Mty), shall be loaded into wagons by Rapid loading system (i.e. SILO located on MGR loop near Barpali yard) at the capacity of 5500 tph.

However, the Silo for Basundhara Washery (10 Mty) will be within the Barpali Bulb consisting of 7 loading points. Due to land acquisition issues, the commissioning of the same loading bulb will be delayed.

Recently, 2 number of Silos with RLS near Sardega siding is being designed along with coal transportation system by conveyor. The truck receiving hoppers has been proposed to receive surface miner coal. It is proposed that the coal from Kulda mine will be transported up to truck loading hopper (TRH) by trucks and dispatch through the Silo located at Sardega siding.

7.6 ELECTRICALS

7.6.1 POWER SUPPLY ARRANGEMENT

Power at 6.6 kV for CHP is proposed to be received from the existing feeders of 2X5 MVA, 33/6.6 kV project substation at Kulda OCP through double circuit overhead line. One of the two incoming feeders will normally be kept as stand bye. It is proposed to establish two numbers of 6.6 kV substations in a suitable location near CHP and SILO to cater to the power requirement for different equipment of CHP & SILO.

7.6.2 CHP SUBSTATION

For supplying power to different equipment at CHP, two numbers of 6.6 kV substations are required to be installed (one near TH-1 and other substation will be installed near SILO). The 6.6 kV substations -1 & 2 will receive power at 6.6 kV through Double Circuit O.H line such that one feeder is capable of catering to the entire load of the CHP and SILO.

Power shall be fed to 6.6 kV switch panel at substation-1 comprising of 10 nos. of Circuit Breakers (10 nos. of VCB) having 2 nos. of incomer, 1 no. of sectionaliser, 2 nos. of VCB for feeding power to MCC through 6.6/0.415 kV distribution transformers, 1 no. of VCB for feeding power to 63 kVA, 6.6/0.230 kV (L-L) lighting transformer, 2 nos. of outgoing VCB for feeding power to capacitor banks and 2 nos. spare VCB. The similar arrangement has been provided at 6.6 kV substation-2 also.

The reclaim feeders, feeder breakers, firefighting system, dust suppression system, sampling system and other LT loads will receive power at 415 V from MCC of 6.6 kV CHP substation.

All motors above 110 kW shall get power at 6.6 kV. All motors of 110 kW & below shall get power at 415 V. All the lighting loads shall get power at 230V.

All the incoming 6.6 kV panels will be provided with over load, short circuit, and earth fault and earth leakage protection.

All the outgoing panels supplying power to HT motors will be provided with motor protection relay (MPR) and all the panels supplying power to transformer or to any substation or capacitor bank will be provided with over load and short circuit protection

(i) All the 415V incoming panels will be provided with over load, short circuit and earth leakage protection.

(ii) All the 415 V outgoing panels supplying power to motors will have over load protection along with single phasing protection and short circuit protection.

(iii) All the 415 V outgoing panels supplying power to motors above 45 KW in sequence control will be provided with motor protection relay.

The power factor of the plant has improved to a level above 0.98 lagging at the 6600 volts switch board of 6.6 kV substations. The sufficient capacity of capacitor bank with automatic power factor correction relay have been provided at existing 6.6 kV substations.

The area covered along the conveyors, substation yard, substation building and other areas will be illuminated by light fittings, which will get power from the secondary of 63 kVA, 6.6/0.230 (L-L) kV lighting transformer installed at each 6.6 kV substation.

Proper earthing arrangement for the plant has to be provided as per I.E Rules. As per amended CMR, restricted earthed neutral system has been envisaged for the said installations. An earthing grid shall have to be developed around the periphery of CHP substation as well as along the CHP. In addition all the motors will be earthed through the armoring of the connecting cable.

The control scheme of the CHP along with sequencing shall be done through microprocessor based programmable logic controller (PLC) suitable for industrial control system.

Chapter - 8

INFRASTRUCTURE FACILITIES PROPOSAL AND THEIR LOCATION

8.1 INTRODUCTION

The proposed PR of Kulda Expansion OCP is planned to handle the total production of 15.0 Mty and the same will be enhanced up to 18.75 Mty.

Presently coal and OB are being extracted by outsourcing agencies as per approved project report. No departmental HEMM will be deployed as per approved report except some auxiliary equipment. Hence, the HEMM workshop has not been envisaged for this variant. There is a provision of small E&M workshop and store.

HEMM workshop will be constructed & maintained by outsourcing agency as per their requirement.

8.2 POWER SUPPLY

Main power supply is from 220KV Main sub-station at Garjanbahal which was charged in October 2012. Power is transmitted to 2x5 MVA, 33/6.6 KV substation near existing mine.

8.3 EXISTING INFRASTRUCTURE

- Construction of several residential quarters are under progress
- Office buildings at Kulda are existing.
- Two feeder breakers are existing
- Road diversion are has started.
- Nala diversion are yet be started.

Chapter - 9

LAND REQUIREMENT AND SURFACE REORGANISATION

9.1 LAND REQUIREMENT

9.1.1 EXISTING APPROVAL OF LAND

Existing approved land requirement for Kulda OCP 15 Mty under various heads are as given below:

APPROVED LAND OF KULDA OCP 15 MTY

Sl. No.	Particulars	Land in ha		
		Forest	Non-forest	Total
A.	**MINE LEASE AREA**			
1	Quarry excavation area	187.16	134.755	321.91
2	Infrastructure including Safety zone (7.5m around mine boundary) and Embankment	36.615	115.178	151.793
3	External OB dump	4.12	156.382	160.502
	Total mine lease area required	**227.89**	**406.315**	**634.205**
B.	**OUTSIDE MINE LEASE AREA**			
1	Residential colony	0	37.5	37.5
2	Rehabilitation site	0	22.9	22.9
	Total Outside Mine Lease Area	**0**	**60.4**	**60.4**
	Total Project area	**227.89**	**466.715**	**694.605**

9.1.2 INCREMENTAL LAND REQUIREMENT

Incremental land requirement over land requirement of existing approved mining plan is given below:

INCREMENTAL LAND REQUIRED FOR KULDA EXPN OCP 15 TO 18.75 MTY

Particulars	Land in ha		
	Forest	Non-forest	Total
MINE LEASE AREA			
Quarry excavation area	110.92	107.15	218.07
Infrastructure including Safety zone (7.5m around mine boundary) and Embankment	9.84	49.28	59.12
External OB dump	13.93	4.5	18.43
Total mine lease area required	**134.69**	**160.93**	**295.62**
OUTSIDE MINE LEASE AREA			
Residential colony	0	0	0
Rehabilitation site	0	0	0
Total Outside Mine Lease Area	**0**	**0**	**0**
Total Project area	**134.69**	**160.93**	**295.62**

9.1.3 TOTAL LAND REQUIREMENT

Total land requirement is summation of approved land of Kulda OCP 15 Mty and incremental land requirement for Kulda Expansion OCP 15 Mty to 18.75 Mty. An area of 8.52 ha of forest land is being re-diverted from already diverted forest area of 227.89 ha for Kulda OCP for construction of Basundhara Coal washery (10 Mty). Hence, 8.52 ha has been subtracted from infrastructure area of this mining plan.

As per present mining plan of the block, total mine lease area is 921.305 Ha which excludes 60.4 Ha for colony and R&R. OB dumps will require about 178.932 ha of land. Land required for Infrastructures, Safety zone (7.5m around mine boundary) and embankments against water courses is 202.393 ha and for Rehabilitation site will be about 22.90 ha. Tentative infrastructures and other complexes have been located avoiding as far as possible forest land. Total land requirement is 981.705 ha.

TOTAL LAND REQUIRED FOR KULDA EXPN OCP 18.75 MTY

Particulars	Forest	Non-forest	Total
MINE LEASE AREA			
Quarry excavation area	298.075	241.905	539.98
Infrastructure including Safety zone (7.5m around mine boundary) and Embankment **	37.935	164.458	202.393
External OB dump	18.05	160.882	178.932
Total mine lease area required	**354.06**	**567.245**	**921.305**
OUTSIDE MINE LEASE AREA			
Residential colony	0	37.5	37.5
Rehabilitation site	0	22.9	22.9
Total Outside Mine Lease Area	0	60.4	**60.4**
Total Project area	**354.06**	**627.645**	**981.705**

** **8.52 ha forest land re-diverted from existing Kulda OCP to Basundhara washery. Hence, 8.52 ha has been subtracted from infrastructure area of this Mining Plan.**

9.2 VILLAGES AFFECTED

The incremental land (295.62 ha) comprises of six villages namely Kulda, Bankibahal, Balinga, Tumulia, Siarmal, and Lalma RF. Out of these only habitats of Kulda, Bankibaahal, Balinga, and Siarmal(Partly) falls in core zone. Tenancy land under village Balinga and Bankibahal area mostly under possession.

9.3 PROPOSED SURFACE REORGANISATION

a) Infrastructural facility and dumps have been located as far as possible within the 300 m safety zone of the mining excavation.

Surface master plan is given in Plates No. Gen-III.

b) A proper resettlement and rehabilitation (R&R) plan is to be drawn up in consultation with the state govt. and project affected persons (PAPs) taking into consideration the existing norms of State/Central Govt.

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.

d) It has been proposed to straighten Chattajhor nallah for convenience of mine operation (ref. surface master plan, plate Gen-VI). Adequate precaution shall however, be taken at the four diversion points so that water in-rush through old river-course to the mine workings does not take place.

e) In rainy season, water from the mining area flows down to Chattajhor nallah and Basundhara river by means of small streams. Mining operation will disrupt the existing drainage system. Garland drains around the periphery have therefore been provided.

f) Possible overflow of water during rainy season, from Chattajhor nallah and Basundhara river to mine workings will be guarded against by formation of embankment alongside the water courses.

Height of embankment shall be kept at least 1.5 meter above HFL. The width at top of the embankment will be 20m with slopes on both sides. The slope facing nallah will be stone pitched. Provision has been made for this in the PR.

g) Diversion of Raigarh-Sundergarh state highway crossing through the mining area is under process. Alternative diversion road has been provided on the top of the embankment provided against Basundhara river and Chattajhor nallah.

h) Besides above, road and power supply lines adjoining villages will also undergo reorganization.

Chapter - 10

ENVIRONMENTAL MANAGEMENT

10.1 GENERAL

Kulda geological block is located in the north-western part of Ib valley coalfield in Sundergarh district in the state of Odisha. It is situated between latitudes 22°01'02" to 22°03'03" North and longitudes 83°43'28" to 83°45'35" East (refer plate no. Gen-I & Gen-II).

The block boundary is defined by the following:

North	-	Basundhara River
West	-	Chattajhor nallah, tributary of Basundhara River.
East	-	Metamorphic exposure.
South & South east	-	Line joining boreholes CMHG-103,129,123, 139 & 138 & adjacent Garjanbahal block.

The area of the block under consideration is 5.84 sq.km., out of which coal bearing area is 5.30 sq.km.

10.2 PROJECT PROFILE

The mineable reserve is 266.49 Mt with corresponding overburden of 283.32 Mcum. The production capacity is 18.75 Mty total. The balance life of the mine is 15 years.

10.3 CLIMATE

The area experiences a sub-tropical warm temperature. About 70% of rainfall occurs during rainy season i.e. June to Sept. As per IMD data of Jharuguda 2016 the highest 24 hourly rainfall occurs in the month of August 63.20 mm. The temperature varies from 7.4^{0}C to 45.3^{0}C for the year 2016. The predominant wind direction is SW to NE.

10.4 EXISTING ENVIRONMENTAL QUALITY

10.4.1 AIR QUALITY

The brief statistics of Routine Environmental Monitoring data of the existing Kulda OCP for SPM, PM_{10}, $PM_{2.5}$, SO_2, and NO_X during the period Dec-18 to Feb-19 are given in table 1. It has been observed that sometimes values exceeds the limit for SPM and PM_{10} but average value for given period is well within the permissible limit. Since there is no standard limit for the $PM_{2.5}$, so it is compared with NAAQS, 2009 and is found that average values for $PM_{2.5}$ is also well within the permissible limit.

Table:1 Brief Statistics of Air Pollutants for Kulda OCP (Values in $\mu g/m^3$)

Monitoring Station	Brief Statistics	Period of Sampling	SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_x
A1/KUL 1 South of External OB Dump	Maximum	Dec-18 to Feb-19	559.00	438.00	91.00	27.83	48.53
	Minimum		150.00	93.00	17.00	10.63	11.37
	Mean		274.33	184.83	49.83	14.69	27.94
	98 Percentile		532.70	415.50	89.60	26.49	47.86
A2/KUL 2 External CT Road	Maximum	Dec-18 to Feb-19	452.00	373.00	39.00	21.76	36.86
	Minimum		139.00	89.00	14.00	10.06	12.34
	Mean		220.17	157.00	26.50	15.95	22.71
	98 Percentile		427.80	351.80	38.70	21.54	35.97
A3/KUL3 West of Working Face/Near Tumulia	Maximum	Dec-18 to Feb-19	483.00	375.00	114.00	22.45	47.63
	Minimum		158.00	83.00	21.00	12.71	14.40
	Mean		299.00	190.40	48.80	17.27	27.10
	98 Percentile		479.64	367.32	108.16	22.11	45.80
A4/KUL 4 South of Working Face/Near Karlikachhar	Maximum	Dec-18 to Feb-19	664.00	449.00	170.00	19.21	30.84
	Minimum		193.00	109.00	18.00	10.92	11.60
	Mean		309.00	194.67	59.17	14.68	21.11
	98 Percentile		629.30	423.40	160.50	19.13	30.37
A5/KUL 5 North of CHP/Kushra	Maximum	Dec-18 to Feb-19	441.00	320.00	84.00	22.58	58.94
	Minimum		119.00	72.00	30.00	10.81	16.24
	Mean		274.67	188.33	50.00	14.90	31.60
	98 Percentile		430.50	316.50	81.00	21.99	57.47
Standard as per MoEF, GSR 22(E)			600	300		120	120
NAAQS, 2009					60		

10.4.2 WATER QUALITY

DRINKING WATER QUALITY

The drinking water quality of Routine Environmental monitoring data for Tumulia well water for December-18 to February-19 is given in following table:

Table:2 Drinking Water Quality of Tumulia Village

Project / OCP	Kulda OCP			Indian Drinking Standards (IS-10500):2012	
Monitoring Station	Well at Tumulia	Well at Tumulia	Well at Tumulia		
Date of sampling	05-12-2018	15-01-2019	08-02-2019	Acceptable	Permissible
Colour(Hazen)	6	19	3	5	15
Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
Turbidity(NTU)	4	2	2	1	5
pH	7.79	8.24	7.09	6.5-8.5	No relaxation
Total Alkalinity(mg/L)	224	192	188	200	600
Total Hardness(mg/L)	304	248	208	200	600
Iron(mg/L)	0.06	<0.06	<0.06	0.3	No relaxation
Chloride(mg/L)	128	112	80	250	1000
Total Dissolve Solid(mg/L)	756	630	412	500	2000
Calcium(mg/L)	78.4	62.4	33.6	75	200
Copper(mg/L)	0.04	<0.03	<0.03	0.05	1.5
Manganese(mg/L)	0.04	<0.02	<0.02	0.1	0.3
Sulphate(mg/L)	70.7	50.7	1.21	200	400
Nitrate(mg/L)	7.52	24.15	2.2	45	No relaxation
Fluoride(mg/L)	0.41	0.49	0.64	1	1.5
Arsenic(mg/L)	<0.002	<0.002	<0.002	0.01	0.05
Lead(mg/L)	<0.005	<0.005	<0.005	0.01	No relaxation
Zinc(mg/L)	0.03	0.69	0.02	5	15
Total Chromium (mg/L)	<0.05	<0.05	<0.05	0.05	No relaxation
Boron(mg/L)	<0.02	<0.2	<0.2	0.5	1.0
Cadmium(mg/L)	<0.0005	<0.0005	<0.0005	0.003	No relaxation

All the parameters are well within permissible limit.

MINE EFFLUENT DATA

Mine effluent data of Final Discharge Point of Mine for the period Dec-18 to Feb-19 is given in following table:

Table:3 Effluent Water Quality of Kulda OCP

Sampling Station	Date of Sampling	pH	Oil & Grease (mg/l)	TSS (mg/l)	COD (mg/l)
Outlet of Settling Pond	26-Feb-19	8.3	<4	37	12
Outlet of Settling Pond	08-Feb-19	7.79	<4	44	68
Outlet of Settling Pond	30-Jan-19	8.2	<4	44	12
Final Discharge Point of Mine	15-Jan-19	7.53	<4	32	12
Outlet of Settling Pond	15-Jan-19	8.14	<4	28	12
Outlet of Settling Pond	28-Dec-18	7.29	5.4	94	120
Outlet of Settling Pond	05-Dec-18	7.86	<4.0	42	24

All the parameters are well within permissible limit.

10.4.3 NOISE QUALITY

Noise is considered as a source for annoyance and health hazard. The high noise level disturbs the ambient environmental quality. The noise level has been monitored during day time (6:00 AM to 10:00 PM) and night time (10:00 PM to 6:00 AM) on fortnightly basis.

Table 4: Noise Level Data of Kulda OCP

Project	STATION	DATE OF SAMPLING	DAY (dBA)	NIGHT (dBA)
Kulda OCP	N1 Near Farakbahal village	16-Feb-19	63.6	58.4
		02-Feb-19	66.8	64.7
		22-Jan-19	64.8	60.5
		07-Jan-19	64.7	61.3
		19-Dec-18	68.3	66.7
		03-Dec-18	66.4	60.7
Kulda OCP	N2 Near sardega railway siding	19-Dec-18	64.7	62.5
		03-Dec-18	68.4	65.8
		16-Feb-19	68.8	66.2
		02-Feb-19	68.9	66.4
		22-Jan-19	69.2	66.4
		07-Jan-19	67.9	66.7
Standard			**75**	**70**

The noise quality data are within the permissible limits of the Standards prescribed by the CPCB.

10.4.4 FLORA & FAUNA

The Flora and Fauna data are taken from the EIA/EMP report of Existing Kulda Expn. OCP (14 Mty). The survey was conducted by VRDS Consultant, Chennai in Oct-2016 to Dec-2016.

FLORA

List of Flora Found in Core-zone found in Kulda Project is given below:

Type	Common Name	Family name	Botanical Name
Trees	Safed babul,	*Leguminosae*	*Acacia leucophloea* (Roxb.) Willd.
	Kadam	*Rubiaceae*	*Adina cordifolia*Willd ex Roxb.)Benth &Hook f ex Brandis
	Ankola	*Alangiaceae*	*Alangium salvifolium* (L.f.) Wangerin
	Sirish	*Leguminosae*	*Albizia lebbeck* (L.) Benth
	Shakunda	*Leguminosae*	*Albizia saman* (Jacq.) Merr.
	Daura	*Combretaceae*	*Anogeissus latifolia (Roxb. ex DC.) Wall. ex Guillem. & Perr.*
	Kathal, Jackfruit	*Moraceae*	*Artocarpus heterophyllus* Lam.
	Bamboo	*Poaceae*	*Bambusa arundinaceae* L.
	Kanchanar	*Leguminosae*	*Bauhinia purpurea* L.
	Palmyrah Palm	*Arecaceae*	*Borassus flabellifer* L.
	kaji,	*Phyllanthaceae*	*Bridelia retusa* (L.) A.Juss.
	Polash	*Leguminosae*	*Butea monosperma*(Lam.) Taub.
		Leguminosae	*Dalbergia lanceolaria subsp. paniculata (Roxb.) Thoth..*
	Tendu	*Ebenaceae*	*Diospyros melanoxylon* Roxb.
	Udumbara, Fig	*Moraceae*	*Ficus racemosa* L.
	Banyan	*Moraceae*	*Ficus benghalensis* L.
	Peepal Tree	*Moraceae*	*Ficus religiosa* L.
	Dhaman tree	*Tiliaceae*	*Grewia tiliafolia* Vahl.
	Avli, Tapasi	*Ulmaceae*	*Holoptelia integrifolia*(Roxb.) Planch
	Indian ash tree	*Anacardiaceae*	*Lannea coromandelica*(Houtt.) Merr.
	Dhaura, sanah	*Lythraceae*	*Lagerstroemia parviflora* Roxb.
	Mahua	*Sapotaceae*	*Madhuca indica* J F Gmel
	Aam, Mango	*Anacardiaceae*	*Mangifera indica* L.

	Persian Lilac	*Meliaceae*	*Melia azedirach* L.
	Bakul	*Sapotaceae*	*Mimusops elengi* L.
	Indian mulbery	*Rubiaceae*	*Morinda pubescens* Sm
	Maha bael	*Rutaceae*	Narengi crenulata(Roxb.) Nicolson
	Wild Date	*Arecaceae*	*Phoenix sylvestris*(L.) Roxb.
	Amla	*Phyllanthaceae*	*Phyllanthus emblica* L.
	Jivaputrak	*Putranjivaceae*	*Putranjiva roxburghii* Wall.
	Salmale, Silk cotton	*Bombacaceae*	*Salmalia malabarica*(DC) Schott &Endl.
	Sal dhoop	*Dipterocarpaceae*	*Shorea robusta* Gaertn.
	Jamun	*Myrtaceae*	*Syzygium cumini*(L.) Skeels
	River jamun	*Myrtaceae*	*Syzygium salicifolium* (Wight) J.Graham
	Teak	*Lamiaceae*	*Tectona grandis* L.
	Arjun	*Combretaceae*	*Terminalia arjuna*(Roxb.) Wt&Arn.
	Indian laurel	*Combretaceae*	*Terminalia tomentosa* Wight & Arn.
Herbs	Chir chita	*Amaranthaceae*	*Achyranthus aspera* L.
	billygoat-weed	*Asteraceae*	*Ageratum conzoides* L.
	smooth joyweed	*Amaranthaceae*	*Alternanthera paronychioides* A.St.-Hil.
	Prostrate herb	*Leguminosae*	*Alysicarpus moniliformis* (L.) DC.
	Slender amaranth	*Amaranthaceae*	*Amaranthus viridis* L.
	Kalmeg	*Acanthaceae*	*Andrographis paniculata* Wall ex Nees
	False water willow	*Acanthaceae*	*Andrographis echioides* (L.) Nees
	Vajradanti	*Acanthaceae*	*Barleria prionitis* L.
	Broad leaved herb	*Asteraceae*	*Blumea mollis* DC
	Broad leaved herb	*Asteraceae*	*Blumea axillaris* (Lam.) DC
	Indian madder	*Apocynaceae*	*Calotropis gigantea*(L.) Dryand.
	Silver cocks comb	*Amaranthaceae*	*Celosia argentea* L.
	Hairy crotalaria	*Leguminosae*	*Crotalaria prostrata* Willd.
	Smooth evolvulus	*Convolvulaceae*	*Evolvulus nummularifolius*(L.)L.
	Kokilaksha	*Acanthaceae*	*Hygrophila auriculata* (Schumach.) Heine
	Chan	*Lamiaceae*	*Hyptis suaveolens* (L.)Poit
	Giliri	*Leguminosae*	*Indigofera cassioides* DC.
	Spreading hedyotis	*Rubiaceae*	*Hedyotis diffusa* (Willd.) Roxb
	Dronapushpi	*Lamiaceae*	*Leucas lavandulifolia* Sm.
	Kali angedi	*Acanthaceae*	*Peristrophe bicalyculata*(Retz.) Nees
	Bhumiamala	*Phyllanthaceae*	*Phyllanthus amarus* Schum &Thonn.
		Acanthaceae	*Rungia repens* (L.) Nees
	Bala	*Malvaceae*	*Sida acuta* L.
	Kateli	*Solanaceae*	*Solanum virginianum* L.
	Mundi	*Asteraceae*	*Sphaeranthus indicus* L.
	Sharpunka	*Leguminosae*	*Tephrosia purpurea*(L.) Pers
	coatbuttons	*Asteraceae*	*Tridax procumbens* L.
	diamond burbark	*Tiliaceae*	*Triumphetta rhomboideae* Jacq.

	Cogon grass	*Poaceae*	*Imperata cylindrical*(L.) Raeusch
	Durva	*Poaceae*	*Cyanodon dactylon* L.
	Tangle head	*Poaceae*	*Hetropogon contortus*(L.) Beauv ex Roem &Schult
	wild sugarcane	*Poaceae*	*Saccharum spontaneum* L.
	Polynesian arrowroot,	*Dioscoreaceae*	*Tacca leontopetaloides* (L.) Kuntze.
	Epiphytic orchid	*Orchidaceae*	*Vanda tessellata (Roxb.) Hook. ex G.Don*
Climbers	Shatavari	*Asparagaceae*	*Asparagus racemosus* Willd.
	climbing wattle	*Leguminosae*	*Acacia pennata* (L.) Willd.
	Aradanda	*Capparaceae*	*Capparis zeylanica* L.
	Wild morning glory	*Covolvulaceae*	*Argyreia cymosa Roxb. ex Sweet*
	Malkangni	*Celastraceae*	*Celastrus paniculatus Willd.*
	Atundi	*Combretaceae*	*Combretum decandrum* Jacq.
	Kanta alu	*Dioscoreaceae*	*Dioscorea pentaphylla* L.
	Kali dhoodi	*Apocynaceae*	*Ichnocarpus frutescens*(L.) R.Br.
	Spongy guard	*Cucurbitaceae*	*Luffa cylindrica (L.) M.Roem.*
	Amar bel	*Apocynaceae*	*Wattakaka volubilis* (L.f) Stap f
	Rangoon creeper	*Combretaceae*	*Quisqualia indica* L.
	Jackle jujube	*Rhamnaceae*	*Ziziphus oenoplia*(L.) Mill.

FAUNA

List of Fauna found in Core-zone found in Kulda Project is given below:

Mammals			
Zoological Name	**Common Name**	**Status in wildlife (Protection)Act**	**ICUN RDB**
Mus booduga	Indian Field Mouse	Schedule-V, Section, 5	LC
Herpestes edwardsi	Indian Grey mongoose	Schedule-IV, Section, 6A	LC
Funambulus palmarum	Indian Ground Squirrel	Schedule-IV	LC
Macaca mullata	Bandar	Schedule-IV	LC
Bird			
Zoological Name	**Common Name**	**Status in wildlife (Protection) Act**	**ICUN RDB**
Columbia livia	Pigeon	Schedule-IV, Section,11	LC
Bubulcus ibis	Cattle egret	Schedule-IV, Section,11	LC
Ardeola grayii	Indian pond heron	Schedule-IV, Section,11	LC
Milvus migrans	Black kite	Schedule-IV, Section,11	LC
Streptopelia chinensis	Spotted dove	Schedule-IV, Section,11	LC
Alcedo atthis	Small blue kingfisher	Schedule-IV, Section,11	LC
Halcyon smyrensis	White-breasted kingfisher	Schedule-IV, Section,11	LC

Reptiles			
Zoological Name	**Common Name**	**Status in wildlife (Protection) Act**	**ICUN RDB**
Zamenis mucosus	Rat snake	II	LC
XEnochrophis piscator	Dhanda	II	LC
Calotes versicolar	Garden lizard	IV	LC
Naja tripudians	Common cobra	IV	LC
Natrix piscator	Water snake	IV	LC
Amphibians			
Zoological Name	**Common Name**	**Status in Wildlife (Protection) Act**	**ICUN RDB**
Bufo melanostictus	Common toad	IV	LC
Euphlyctis hexadactyla	Common frog	IV	LC
Rana hexadactyla	Green pond frog	IV	LC
Rana tigrina	Indian bull frog	IV	LC

10.4.5 SOCIO-ECONOMIC PROFILE

The incremental land (295.62 ha) comprises of six villages namely Kulda, Bankibahal, Balinga, Tumulia, Siarmal, and Lalma RF. The socio-economic profile of the core zone of Kulda OC Project whose habitats falls in core zone are given below as per 2011 Census:

A) **Social profile**

- Population 2058
- Sex structure (females/1000 males) 878
- SC population (%) 16.38
- ST population (%) 45.64
- Literacy level (%) 75.83

B) **Economic profile**

- Occupational structure
  - * Main & marginal workers 46.20%
  - * Non-workers 53.80%

  Total: 100.00
- Dependency ratio = about 1.16

10.5 ENVIRONMENTAL IMPACT & MANAGEMENT

10.5.1 IMPACT ON AIR QUALITY AND ITS MANAGEMENT

The mining and its related activities will cause ambient air pollution. The ambient air will be polluted due to presence of SPM, PM_{10}, $PM_{2.5}$, SO_2 & NO_x which will be generated due to various activities related to the project. The concentration of pollutants will vary depending upon micro-meteorological parameters of area.

Appropriate air pollution control measures have been taken so that the ambient air quality is maintained within stipulated standards. Both preventive and suppressive measures which have been taken are elaborated below:

➢ **DRILLING OPERATION**

- Presently All the drills have wet-drilling arrangements along with the NVE extractors. The same arrangement will continue.
- Coal production has been done by Surface Miners and the same will continue.
- Proper maintenance and handlings of drilling units are getting done.

➢ **BLASTING OPERATION**

Blasting is to be done in a proper way to minimize the generation of fugitive dust. Proper burden/spacing of blast holes are to be maintained.

➢ **LOADING AND TRANSPORT**

* The haul roads are to be sprayed regularly with water.
* All service roads are to be blacktopped.
* Provision of greenbelts around the quarry, industrial area, service building area and colony site are to be made.

➢ **COAL HANDLING PLANT (CHP)**

* Provision of covers on the conveyor belts, unloading/transfer points to prevent access of wind.

* Existing CHP has been provided with dust suppression system, 48 numbers of Fixed water sprinklers (Foggers) have been installed in 400T CHP Circuit and an additional of six fixed sprinklers (Rain Gun) in CHP ramp & 8 Nos. in CHP site have been installed.
* Suppression of coal dust at transfer points and at other points in the coal flow circuit by provision of water jets and mist formation system.
* At railway siding coal will be loaded to wagons by SILO and proper dust control measures has been provided at all transfer points.
* Minimization of the height of coal-fall at transfer points to reduce the dust generation and if necessary, provision of dust suppression measures.
* Improved maintenance of plant and machinery including provision of condition monitoring instruments like vibration meter, etc.

➢ **FIRE AT COAL FACES & COAL STOCKYARDS**

* Provision of adequate firefighting arrangements including storage of sufficient quantity of water at all critical points.
* Semi-consolidated coal stack of height not more than 8m with strict supervision.
* Careful removal of all loose coal from the abandoned coal faces.

10.5.2 IMPACT ON WATER QUALITY AND ITS MANAGEMENT

The likely sources of water pollution from this project are as follows:

* Sanitary (Domestic) wastewater.
* Industrial wastewater from workshop.
* Mine discharge water.
* Surface run-off passing through coal stockpiles and OB dump.
* Storm water from leasehold and built-up areas.

The impact of mining at this project on both surface water source and ground water resource has been assessed as follows:

➢ **SURFACE WATER SOURCES**

* Disruption of natural drainage pattern in the core zone.
* Deterioration of water quality & pollution of water bodies.
* Siltation and choking of water courses causing scarcity of surface water and flooding problem in the area.

➢ **GROUND WATER RESOURCE**

* Due to excavation, ground water aquifers are disrupted.
* Due to pumping of mine water, the water table of the region may get lowered.

Effective water pollution control measures will be taken for this project. The water pollution control measures to be adopted are:

* A sedimentation pond constructed near CHP and is being maintained as per standards. An ETP has also been constructed during 2014-15 and is in working condition.
* Oil and grease traps construction work is completed which is then channeled to settling pond for further treatment.
* The domestic wastewater will be treated for bio-chemical oxygen demand (BOD) and total suspended solids (TSS) through STP.
* Garland drains with settling tanks for surface run-off.

10.5.3 NOISE ABATEMENT AND BLASTING VIBRATION CONTROL

(a) NOISE POLLUTION ABATEMENT MEASURES

The adverse effect of high noise level like health effect (both auditory and non- auditory), masking effect, sleep interference, change in personal behaviour, etc. are well known.

The following abatement measures (suppressive and preventive) are to be adopted:

* Proper designing of plant & machinery by providing inbuilt mechanism like silencers, mufflers and enclosures for noise generating parts and shock absorbing pads at the foundation of vibrating equipment.
* Greenbelts around infrastructure site, service building area and township.
* Adoption of personal protective devices like earplugs, etc.

(b) **BLASTING VIBRATION CONTROL MEASURES**

* Proper quantity of explosive, suitable stemming materials and appropriate delay system are to be adopted for safe blasting.
* A safe blasting zone are kept around the periphery of the quarry.

10.5.4 FLORA & FAUNA

Safety zone plantation is already completed. Arboriculture and avenue plantation is being done along haul road and Coal transportation road. Further plantation will be carried out in the infrastructure and colony area.

10.5.5 SOCIO-ECONOMIC IMPACTS

The mine will have beneficial impact on socio-economic front by providing direct employment to the local people. The project will further boost the economy of the area and provide secondary and tertiary employment to the local people. There will be a positive change in the social infrastructure facilities of the area also.

10.5.6 LAND RESOURCE MANAGEMENT

The most significant adverse impact of opencast coal mining is the change in land use pattern. So reclamation of mined out land will be given due importance as a step for sound land resource management.

For backfilling and technical reclamation, required number of dozers and graders has been provided. After technical reclamation, the area will be further biologically reclaimed.

10.5.7 **RESETTLEMENT AND REHABILITATION**

This is a running mine and the R&R is already in advance stage. The R&R is being carried out under the direction of "Claims Commission" set up by Hon'ble Supreme Court for the purpose. Resettlement colony has been provided in Barapalli-I with all infrastructure facilities like roads, dug wells, tube wells, playground, schools, community center, dispensary, shopping center, etc. Details of rehabilitation & resettlement are given below:

Table 5: R& R Details of Existing Kulda Mines

Sl.No.	Name of village	No. of PAFs	Project affected persons	No. of PAFs eligible for plot at R&R site/Cash compensations	PAFs opted for plot at R&R site/Cash compensations	Balance	No. of persons eligible for employment	Provided employment/Person opted for cash compensation in lieu of employment	Balance
1.	Balinga	286	1028	280	219	61	191	180	11
2.	Bankibahal	161	566	134	126	8	96	83	13
3.	Kulda	94	293	83	35	48	67	38	29
4.	Siarmal (Partly)	31	85	-	-	-	31	19	12
	Total	**572**	**1972**	**497**	**380**	**117**	**385**	**320**	**65**

However, the exact no. of families and PAF can be known after due survey.

10.6 **ENVIRONMENTAL MANAGEMENT SYSTEM**

The success of environmental management depends on deep involvement of personnel at all levels and also on the creation of an effective implementation organisation. To carry out various pollution control measures and compliance of statutory regulations of existing project, project level environmental organisation has already been established. The manpower required for the project for environmental management has been provided.

Chapter – 11

MINE CLOSURE PLANNING

11.1 INTRODUCTION

Mine closure plan for Kulda OCP has been approved in MCL Board & the same has been approved by Ministry Of Coal vide letter no 34012/(04)/2011-CPAM dated 26.12.2016.

- 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.55011-01-2009-CPAM, Govt. of India, Ministry of Coal, dated 27th August, 2009 and subsequent updation latest dated 07.01.2013.
- 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.

❖ **OBLIGATION/LEGISLATION**

Environmental clearance of development projects including mining is done by government with the following objective:

"Optimal utilization of finite natural resources through use of better technology & management package and increasing suitable remedial measures".

The policy statement of pollution issued by MoEF, Govt. of India in 1992, provides an instrument in the form of legislation and regulation, fiscal incentives, educational programme, etc. The establishment and functioning of any industry including mining will be governed by the following environmental acts/regulation:

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 relating to the mine management are as follows:

(a) **Health & Safety**: Regulation Nos. 6, 61, 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, 2000;

(iv) DGMS Directives on Noise & Ground Vibration;

(v) Water (Prevention & Control of Pollution) ; cess Act 1977 as amended (watr cess Act)

(vi) Wild life protection Act, 1972

(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.

11.1.1 TYPES OF MINE CLOSURE PLAN

There are two types of mine closure plan :

- Progressive mine closure plan
- Final mine closure plan

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.

11.1.2 TECHNICAL ASPECT

- **REASON FOR CLOSURE**

i) Coal will be exhausted during the mine life (mine life 15 years).
ii) All overburden removed will either be backfilled or will be dumped externally.

- **MINING METHOD**

- Shovel dumper system for overburden removal & coal extraction.
- Surface miner will also be used for coal extraction.

11.1.3 STATUTORY OBLIGATIONS

	Subject	Status	Enclosed as
1.	Mining Plan/Mine Closure Plan (15 Mty)	MoC has approved the mining plan vide letter no 34012/(4)/2011-CPAM dated 26th December 2016	Annexure-III
2.	Environmental clearance (14 Mty)	MoEF vide letter J/11015/10/1995-IA.II(M) dated 22.03.2018	Annexure-IV

11.1.4 CLOSURE PLAN PREPARATION

Closure planning is a life time of mine exercise that begins with the commencement of mining operations and continues till post closure. The dynamic nature of closure planning requires regular and critical review to reflect changing cicumstances as a result of any operational change, new regulation, new technology and remain flexible enough to cope with unexpected events.

The final mine closure plan will be submitted to Ministry of Coal for approval at least five years before the intended final closure of the mine The final mine closure plan consists of cost estimates and time bound schedules for various mine closure activities and details of the escrow account.

11.2 MINE DESCRIPTION

11.2.1 PHYSIOGRAPHY & DRAINAGE OF THE AREA

Details are furnished in chapter-3

11.2.2 GEIOLOGY

The geological details of the block are based on 14858.35 metres of drilling in 130 boreholes over 5.84 Sq.km. The borehole density is 22.3 boreholes/sq.km.
Details are furnished in Chapter-4.

11.2.3 MINING

Details are furnished in chapter-5

11.2.4 COAL HANDLING & DESPATCH

Details are furnished in Chapter-7.

11.3 PROGRESSIVE MINE CLOSURE

Mine closure operation is a continuous series of activities starting from day one of the initiation of mining project. Therefore, progressive mine closure plan will be a continuous process throughout the life of mine which will be reviewed periodically. This includes various land reclamation activities to be done continuously and sequentially during the entire life of the mine. This is a life time of mine process which starts from of commencement of mining operations and leads to the final closure of the mine.

11.3.1 ACTIVITIES OF PROGRESSIVE MINE CLOSURE PLAN

- **OB DUMP RECLAMATION**
  - **Handling & dozing of OB dumps & backfilling**
  - **Technical and Bio-reclamation including plantation**
- **Landscaping of the open space in leasehold area for improving its esthetics an eco value**
- **Grass carpeting/ Plantation around the quarry area and in safety zone**
- **Grass carpeting/ Plantation over the external OB Dump**
- **Entrepreneurship Development (Vocational/skill development training for sustainable income of affected people**
- **Miscellaneous and other mitigative measures**

Progressively mine will be advanced with increase in depth and excavation area. Mine stage plans are included in this report showing status of excavation and backfilling. Part of this excavation area will be backfilled and grass carpeted. Similarly all the activities associated with this backfilling like levelling, compaction, spreading of top soil and grass carpeting and maintaining the same throughout the mine life should be properly monitored. A suitable action plan and activity implementation schedule should be formed by company to implement and monitor the same. Provision of fund can be utilized from mine closure fund which will be returned to company from time to time. Rehabilitation of displaced manpower, training for them who are eligible for employment should also be carried out as per schedule.

Total mine lease area is 921.305 Ha (Total Project area is 981.705 Ha inclusive of 60.4 Ha of land for R&R site and colony). Presently internal dumping has been started, external dumping is also continued. In future years more internal dumping space will be

generated and major part of overburden will be backfilled. The bacfilled area of the quarry & external dump will be technically and biologically reclaimed and grass plantation will be done on this reclaimed area.

11.3.2 MANAGEMENT OF WASTES

- **NON-TOXIC SOLID WASTE**

Kulda OCP will have a life of 15 years. The total overburden generated at the end of mine is 329.89 Mcum.

Backfilled area will be technically & biologically reclaimed. Backfilled area will be reclaimed with endemic species and mixed culture.

- **TOXIC WASTE**

Toxic wastes like used oil, used batteries, oily sludge, besides filter and filter materials containing oil during maintenance of vehicles will be generated from this project.

Used oil will be stored in drums safely in store either for disposal through auction to the authorized reprocessors or for use as lubricant in UG mines. Used batteries will be stored safely for auction to the authorized reprocessors. As regards oily sludge besides filter and filter materials, the same will be disposed off in impervious layer lined pits without causing environmental hazards.

11.3.3 TOP SOIL MANAGEMENT

Top soil from unbroken area will be scrapped for progressive & concurrent utilization during technical & biological reclamation, thus obviating the necessity of storage of top soil.

11.3.4 MANAGEMENT OF AIR QUALITY

The average values of Routine Environmental Monitoring data of the existing Kulda OCP project for SPM, RPM, SO_2, NO_X and $PM_{2.5}$ are given in Chapter-10. It has been observed that all the value are well within permissible limit except $PM_{2.5}$.

Details of existing air quality controls measures are described in chapter-10 which are summarized below:

DETAILS OF CONTROL MEASURES

- Dust extraction in drill machines
- Fixed water sprinklers at CHP, haul road
- Mist spraying in feeder breakers at CHP.
- Mobile water sprinkler for haul roads, transportation roads
- Black topping roads, colony roads, approach road to service buildings and to projects
- Greenbelt cover development

11.3.5 WATER QUALITY MANAGEMENT

Detailed water quality data & it's management are described in chapter-10.

DRAINAGE ARRANGEMENT FOR EXTERNAL OB DUMP

- **CATCH DRAIN**

An open drain of appropriate size is provided on all terraces at the foot of next bench to receive the storm water from upper benches. This is then discharge to the lower benches through masonry chute, thus minimizing gully formation in the slope of external dump.

- **FOOT DRAIN**

A foot drain of proper size is provided around the external OB dump (portion exposed to outside only). This drain collects run-off from dump and direct it to settling tank/sedimentation pond before discharge to nearby natural watercourses.

DRAINAGE ARRANGEMENT FOR INTERNAL OB DUMP

- During working stage, the run-off is collected from internal dump by foot drain for diverting to mine sump for pumping.
- 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 as a measure for water harvesting.

MEASURES FOR CONTROL OF POLLUTION (DETAILS FOR POLLUTION CONTROL ARRANGEMENT)

The details of water pollution control measures are described in chapter-10.

11.3.6 DIFFERENT ACTIVITIES TO BE MONITORED DURING PROGRESSIVE MINE CLOSURE

Major activities for the project during mine closure should be decided in detail by project auyhority, some of these activities are described below.

- Backfilling
- Levelling
- Land scaping
- Spreading of top soil
- Biological reclamation
- Grass carpeting/ tree plantation (if the dumps are rehandled during mine closure the same should be grass carpetted instead of bigger size tree plantation)
- Fencing, supervision of the reclaimed area
- Rehabilitation of displaced families, skill development programme for elligible persons.

11.4 FINAL MINE CLOSURE

11.4.1 MANAGEMENT OF WASTE

At the end of mine life, major part of the excavation area will be backfilled and biologically reclaimed. Post mining land use pattern is given below.

Post-mining land use (at the end of mining activity)

Sl. No.	Category	Land use (in ha)					
		Plantation/ grass carpeting	Water body	Dip side slope & haul road	Undis-turbed	Built-up area	Total
1	Excavation	393.94	15.76	130.28			539.98
2	Infrastructure including Safety zone (7.5m around mine boundary) and Embankment	60.718			16.191	125.484	202.393
3	External OB dump	178.932					178.932
Total		**633.59**	**15.76**	**130.28**	**16.191**	**125.484**	**921.305**

After end of mining activity there can be two situations.

Option 1: Mine will be further extended towards dip side which is coal bearing, so internal dumping will be continued.

Option 2: Mine will be closed at this stage, so all the external dumps and the internal dumps of the proposed mine which are above ground level will be rehandled back to the available voids of the mine. There will be no external dump after mine closure.

11.4.2 UNDERGROUND WATER/QUARRY WATER MANAGEMENT AFTER CLOSURE (SPECIFY ITS USAGE LIKE DOMESTIC WATER SUPPLY, IRRIGATION, PISCICULTURE OR STABILIZING THE GROUND WATER REGIME)

Maximum effort are being made and will be made to recycle or reuse the treated effluents totally to the extent possible by keeping the make of water in different sumps or low lying areas of the mine. The final voids of the quarries will be left as a water reservoir for **water harvesting** and also recharging the aquifer in the surrounding area which will serve following purposes :

- Source of supply of water for industrial and fire fighting purposes of near by mines.
- Source of supply of potable water after necessary treatment.
- Pisciculture.
- For recharging the aquifer in the area.

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.

All these activities will have to be continued till the area will be mined again for extraction of lower seams.

11.4.3 WATER QUALITY MONITORING FOR THREE YEARS AFTER CLOSURE THE SAMPLING STATIONS SHALL BE ONE NO. MINE WATER WITH FORTNIGHTLY FREQUENCY AND TWO NUMBERS GROUND WATER SAMPLES IN CORE AND BUFFER ZONE WITH MONTHLY FREQUENCY

At present water samples covering surface water, ground water and effluent are being analysed in the core and buffer zones of the project. Out of the above, three sample points will be utilized for Water quality monitoring for three years after closure of the mine.

11.4.4 DETAILS OF SURFACE STRUCTURES PROPOSED FOR DISMANTLING

All equipment and buildings erected on site for the mining operation should be dismantled and removed as part of the reclamation process, unless they form part of the future land use infrastructure

BUILDINGS/ ADMINISTRATION OFFICES

Buildings shall be constructed to last depending on the anticipated life of the mine operation. Buildings for short term use should preferably be prefabricated structures that can

be easily dismantled at the time of closure and reclamation. Such structures should be totally removed from the site and may be disposed of at an approved facility or reused elsewhere. Foundations comprised of concrete should be broken up, buried or removed in accordance with applicable waste management regulations.

WEIGHBRIDGE

Fixed equipment and structures such as weigh scales may also have concrete pads or footings and these should be broken up, buried on site or removed in accordance with applicable waste management regulations.

SUB STATIONS/POWER LINES

All power lines, cables, towers and guy wires should be removed as well as any concrete footings or slabs where appropriate. If access roads were necessary for construction or decommissioning of power lines, they should be ripped and revegetated.

ROADS

Access and on-site roads should be properly designed and constructed as part of the initial operating plan to minimize adverse environmental effects and facilitate reclamation. In the operating plan, roads should fit the topography to minimize unnecessary earth moving for road cuttings and embankments. All culverts and drains should be removed and original drainage restored as much as possible in accordance with future land use planning.

11.4.5 DISPOSAL OF PLANTS & MACHINERIES

All the P&M will be reused in dipside mine or other projects of the company after the mine closure , in case not useful for company then Possibility shall be explored for handing over to state Govt. (including residential & non-residential buildings) for the benefit of local villagers and strengthening the area infrastructures. The end use of these facilities shall be decided by State Govt. with the help of local Govt. and village Panchayat.

a) DISPOSAL OR REUSE OF EXISTING HEMM, CHP AND WORKSHOP

HEMMs which will have balance life may be deployed in dipside mine or some other project of the company if possible, or otherwise will be disposed off. CHP, workshop at the end of mine life will be dismantled and disposed off. Every effort will be made to restore the area to economic utilisation value as per the mine closure plan.

b) DISPOSAL OR REUSE OF TRANSMISSION AND SUBSTATION

The transmission line and substation will be used by neighbouring mines or local community. The transmission line and transformers will be dismantled and removed from the site if not required for purposeful use by the local community or nearby mines.

11.4.6 CONTROL MEASURES TO RESTORE LAND USE & LANDSCAPE

- The face slopes of the dump will be maintained at the natural angle of repose of the material and at overall slope angle of 26°.
- The newly backfilled area may be covered with suitable grass plants, plantation for bigger trees should be avoided as all these dumps will be rehandled while extraction of lower seams.
- Suitable drainage arrangement for smooth disposal of storm water.
- Appropriate garland drain is to be provided to collect run-off.
- Topsoil shall be progressively and concurrently utilized during physical/ technical reclamation of external OB dumps and backfilled area, thus obviating the necessity of storage of topsoil separately.
- Arboriculture carried out in the vacant areas which will not be mined in future.
- Proper grass carpeting/afforestation/plantation is carried out for greenbelt development.

11.4.7 SAFETY AND SECURITY ARRANGEMENT

a) DETAILS OF FENCING AROUND ABANDONED QUARRY INDICATING THE LENGTH OF THE FENCING

Fencing around abandoned quarry will be done as per details given in D.G.M.S Circulars.

b) MINE ENTRY SEALING ARRANGEMENTS AND SUBSIDENCE MANAGEMENT FOR UG MINES

Not Applicable.

c) PROVIDING ONE TIME LIGHTING ARRANGEMENT

Sufficient lighting as per standard will be provided at all the required places, i.e. working faces, OB dump area, haul road, coal transfer points, loading points, CHP, workshop, etc., to avoid accidents and to create efficient working conditions.

After closure of the mine, the lighting arrangements will be kept maintained at all locations which are not required to be demolished or dismantled like sub-stations, transformers, community services, pump-houses, water-treatment/ filtration plants, waterlines, power lines, roads etc. to be utilized for the neighbouring projects and at critical places for safety point of view.

The guidelines/instructions from DGMS will be followed in case of discontinuance of mine operation, if any.

d) SLOPE STABILITY ARRANGEMENT FOR HIGH WALL AND BACKFILLED DUMPS

During the process, the geometrical shape of the dumps is altered to make it amenable to effective biological reclamation and also to provide safety and stability & high wall will be maintained and stabilized as per norms.

The details of the final Mine Closure plan alongwith 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.

11.5 ECONOMIC REPERCUSSIONS OF CLOSURE OF MINE

Many infrastructures like roads, power line etc have been developed and the local people have gained out of it. Educational institutes owned by MCL are accessible to local population. Healthcare facilities (dispensaries/hospitals) have been provided in this project. The coal company has a number of healthcare centres including a specialised **"referral"** hospital in the coalfield area at Brajrajnagar. The local people can also avail these healthcare facilities. As part of peripheral development, MCL has widened and strenghened the existing roads with better connectivity with district HQ (Sundargarh) and Brajrajnagar and Jharsuguda.

Overall there has been positive impact in socio-economic area due to increased economic activities, creation of new employment opportunities, infrastructural development and better educational and healthcare facilties. Even after closure of the mine , these facilities will continue.

There has been creation of direct and indirect employment opportunities due to working of this mine. After closure, these people will be engaged in upcoming any oyher mines of MCL.

IMPLEMENTATION SCHEDULE FOR MINE CLOSURE OF KULDA EXPN. OCP

(LIFE OF THE MINE : 15 YRS)

Sl. No	Activity	Time Frame	Year-1 to year-5	Year-6 to year-10	Year-11 to year-15	Post Closure		
						PC 1	PC2	PC 3
A	Dismantling of Structures							
	Service Buildings	2 years						
	Residential Buildings	2 & ½ years						
	Industrial structures like CHP, Workshop, field sub-station, etc.	2 & ½ years						
B	Permanent Fencing of mine void and other dangerous area							
	Random rubble masonry of height 1.2 metre including leveling up in cement concrete 1:6:12 in mud mortar	2 years						
C	Grading of highwall slopes							
	Levelling and grading of highwall slopes	2 years						
D	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 Bio-reclamation including plantation and post care	Throughout the life of the mine including 3 years after cessation of mining operation						
E	Landscaping							
	Landscaping of the open space in the leasehold area to improve esthetics and eco value	Throughout the life of the mine including 3 years after cessation of mining operation						
F	Plantation							
	Plantation over cleared area obtained after dismantling	2 years						
	Plantation around the quarry area and in safety zone	Throughout the life of the mine including 3 years after cessation of mining operation						

Sl. No	Activity	Time Frame	Year-1 to year-5	Year-6 to year-10	Year-11 to year-15	Post Closure		
						PC 1	PC2	PC 3
	Plantation over the external OB Dump	Throughout the life of the mine						
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						
J	Post Closure Manpower cost for supervision	3 years						

PC1 : Post Closure Year 1
PC2 : Post Closure Year 2
PC3 : Post Closure Year 3

Progressive and Final Mine Closure cost distribution of OC Coal & Lignite mines for reimbursement against progressive/final mine closure activities is given in table below.

Table 11.7

Sl. No.	Activity	Mine Closure Cost (Percentage weightage)	Remarks	Equivalent % converting to 100% for Progressive claims of eligible amount	Equivalent % converting 100% for Final claims of eligible amount
A	Dismantling of Structures (Future utilization should be evaluated on case to case basis as per para 3.7 of the annexure of mine closure plan guidelines dated 07th Jan.,2013)		To be included in final mine closure plan		
	Service Buildings	0.2			0.69
	Residential Buildings	2.67			9.21
	Industrial structures like CHP, Workshop, field substation etc.	0.3			1.03
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 meter including levelling up in cement concrete 1:6:12 in mud mortar or any other approved design	1.5			5.17
C	Grading of high wall slopes		To be included in final mine closure plan		
	Levelling and grading of high wall slopes	1.77			6.10
D	OB Dump Reclamation		71% for progressive and 17.66% for final mine closure		
	Backfilling and Technical Reclamation (50%) + Handling/Dozing of OB Dump (50%). (Note: Drilling & Blasting cost shall be excluded. For backfilling with dragline, bucket wheel excavator and spreader etc. separate calculation sheet is to be maintained)	88.66		95.71	60.90
E	Landscaping		Equal weightage throughout the life of the mine		
	Landscaping of the open space in leasehold area for improving its esthetics and eco value	0.3		0.40	1.03
F	Plantation & Bio-Reclamation				
	Plantation over cleared area obtained after dismantling	0.5	To be included in final mine closure plan		1.72
	Plantation around the quarry area and in safety zone and over external OB dump	0.22	Equal weightage throughout the life of the mine	0.30	0.76
	Bio-reclamation including plantation and post care	0.4	Equal weightage throughout the life of the mine	0.54	1.38
G	Post closure Env. Monitoring/testing of parameters for three years		For three years after mine closure		
	Air Quality	0.22			0.76
	Water Quality	0.2			0.69
H	Entrepreneurship Development (Vocational/skill development training	0.26	Equal weightage throughout the life of	0.35	0.90

Sl. No.	Activity	Mine Closure Cost (Percentage weightage)	Remarks	Equivalent % converting to 100% for Progressive claims of eligible amount	Equivalent % converting 100% for Final claims of eligible amount
	for sustainable income of affected people). It should not be covered in CSR activities. It is also to be clarified that vocational/skill development is given to PAP and cost of training is not recovered.		the mine		
I	Miscellaneous and other mitigative measures. (Including progressive environment monitoring and other activities as decided by Third Party government institution while auditing	2.0	Equal weightage throughout the life of the mine	2.70	6.90
J	Manpower cost for supervision	0.8	To be included in final mine closure plan		2.76
	TOTAL	**100.00**		**100.00**	**100.00**

Manpower requirement depends up on the method and machinery engaged for progressive and final closure activities.

(iii) Mine closure cost

As per estimate and guidelines of Ministry of Coal the closure cost of open cast Mine has been calculated at Rs.9 Lakhs per hectare at the declared price level (as on 01.04.2019) for the whole project area (which includes Mining Lease area, area covered by external overburden dumps, Pit head Mine Infrastructures). The April 2019 wholesale price index for all commodities was 121.1 based on base year of 2011-12. Present WPI for month of November 2019 is 122.3 with base year 2011-12. The base price of Rs.9 Lakhs per hectare is updated as per guidelines provided in above circular.

Updated cost of mine closure on November 2019 cost base (WPI: 122.3) is estimated to be Rs. 9.08918 Lakh/Ha.

Total Project area involved	: 981.705 Ha
Mine closure cost/Ha (November 2019 cost base)	: Rs. 9.08918 lakh
Total Mine closure cost (November 2019 cost base)	: Rs 8922.8959 lakh
Fund already deposited in Escrow Account	: Rs 2224.17 lakh
Balance mine Closure Cost	: Rs 6698.7259 lakh

PHASING OF MINE CLOSURE COST

The annual closure cost is to be computed considering the total leasehold area (Total project area) and dividing the same by the life of the mine. An amount equal to the annual cost is to be deposited each year throughout the mine life compounded @5% annually.

Balance mine closure cost estimated : Rs. 6698.7259 lakhs
Balance life of the project as on 1.4.2019 : 15 years

Out of the balance 15 years last 5 years are for final implementation of mine closure activities, for annual cost calculations 15 years period has been considered:
Annual mine closure amount to be deposited with Coal Controller :

6698.7259 lakhs/15 years = 446.58 lakhs for 1st year.
Yearly phasing of mine closure cost is as below:

(Yr-1 is considered as 2019-20)

Year	Mine closure cost (Rs. in lakh)
Yr-1	446.58
Yr-2	468.91
Yr-3	492.36
Yr-4	516.97
Yr-5	542.82
Yr-6	569.96
Yr-7	598.46
Yr-8	628.39
Yr-9	659.80
Yr-10	692.79
Yr-11	727.43
Yr-12	763.81
Yr-13	802.00
Yr-14	842.10
Yr-15	884.20
TOTAL	**9636.59**

Balance estimated mine closure cost compounded @5% annually for 15 years is : Rs. 9636.59 lakhs.

The mine closure cost deposited and amount released to mine owner/lease holder will be as per guidelines issued by Ministry of Coal vide letter no.55011-01-2009-CPAM, Dt.7/1/2013.

11.6 RISK ASSESSMENT AND MANAGEMENT

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 :

- Identification and assessment of risks.
- Recommendation of measures to prevent damage to life and property against such risks.

◈ IDENTIFICATION OF RISK

- Slope failure in mine pit
- Slope failure in OB dumps (internal and external).
- Blasting
- Explosive handling
- Mine inundation
- Fire
- Road accident

❖ RECOMMENDATION OF MEASURES

- Follow statutory mine safety rules administered by the DGMS and Chief Controller of Explosives.
- Creating safety awareness.
- Proper illumination and communication.
- Proper maintenance for avoiding accidents for heavy vehicles.
- Proper training to workers.

Annexure-I

PROJECT REPORT APPROVAL (10 MTY)

Mahanadi Coalfields Limited
(A Subsidiary of Coal India Limited)
OFFICE OF THE CHIEF GENERAL MANAGER (CP&P)
AT/PO : JAGRITI VIHAR, BURLA
Dist. SAMBALPUR - 768 020 (ORISSA)
Tel – 0663 – 2542808 (O) 2542767 (Fax)

Ref. No.: MCL/SAMB/CGM (CP&P)/ 2005 / 1297   Date : 20.01.2005

SANCTION ORDER

Sub: Approval of the Project Report of Kulda Open Cast Project (10.00 Mty) at a capital investment of Rs. 302.96 crores

The Project Report of Kulda Opencast Project for an annual coal production of 10.00 Mty, at a capital investment of Rs.302.96 Crores (Rs. Three hundred and two crores and ninety six lakh only) [including APR and initial exploration] and a completion cost of Rs. 354.47 Crores has been approved by the Government of India in pursuance of Article 38 of the Articles of Association of Coal India Limited, as communicated by Shri Shyam Sunder, Under Secretary to the Govt. of India, (for & on behalf of the President of India), Ministry of Coal, New Delhi vide Sanction Order No. 43011/12/2002-CPAM dated 12th January 2005. The project will be funded entirely from the internal resources of the company.

The break-up of the estimated capital investment of the project and other parameters have been given in the sanction order of Ministry of Coal. (Copy enclosed)

The zero date of monitoring of the project will be from the date of issue of the letter. The monthly monitoring report should be sent to this office by 10th of every month for onward submission to CIL & Ministry. This is for kind information and necessary action.

Chief General Manager (CP&P)

Distribution:

1. CMD, MCL
2. D(T)/ D(F)/ D(P), MCL
3. CVO, MCL
4. Adviser (Projects), GOI, MOC, New Delhi
5. CGM (CP&PMD), CIL, Kolkata
6. CME (CP) / CME (PMD), CIL, Kolkata
7. Company Secretary, MCL
8. All HODs, MCL Hq
9. CGM (S&R), MCL Hq
10. All CGMs/GMs of Area
11. CGM, Ib Valley Area (with a copy of Sanction Letter (UCE already sent)
12. CM (Env), MCL Hq
13. Conservator of Forests, MCL Hq
14. RD, CMPDI, RI-VII, Bhubaneswar (with a copy of Sanction Letter)
15. Project Officer, Kulda OCP
16. Sri P.K. Sahu, SOM, CP&P Deptt.
17. Sri B.K. Mishra, Suptt. Geologist, CP&P Deptt.
18. Sri S. Mazumdar, SOM (BG), CP&P Deptt.
19. Kulda OCP File
20. Project Sanction file

[illegible]

No. 43011/12/2002-CPAM
Government of India
Ministry of Coal
CPAM - Section

New Delhi, the 12th January, 2005

To

The Chairman
Coal India Limited
10 Netaji Subhas Road
KOLKATA - 700 001.

(with 10 spare copies)

Subject:- Kulda Opencast Project of MCL – Sanction for.

Sir,

In pursuance of Article 38 of the Articles of Association of Coal India Limited, the President is pleased to approve the Kulda Opencast Project, Mahanadi Coalfields Limited (a subsidiary of Coal India Limited) for a targeted production of 10.00 million tonnes of coal per annum and a capital investment of Rs. 302.96 crores [(Rupees three hundred and two crores and ninety six lakh only) (including AAP and initial exploration)] and a completion cost of Rs. [illegible] crores (Rupees [illegible] hundred and fifty [illegible] crores and forty seven lakh only). The project will be funded entirely from the internal resources of the company.

The break up of the estimated capital investment of the project is given as under:-

S.No	Particular	Capital Estimates (August, 2004 price level) (Rs. in lakhs)
1	Land	408.50
2	Buildings	
	(a) Residential	1493.40
	(b) Service	1063.85
3	Plant & Machinery	
	(a) HEMM	[illegible]
	(b) Others	[illegible]
4	Furniture & Fittings	63.23
5	Railway Sidings	345.00
6	Vehicles	234.19
7	Exploration	208.30
8	Development	
	8.1 Capital outlay	4742.23
	8.2 Roads & Culverts	2375.17
	8.3 Water supply & Sewerage	702.75
	8.4 Scientific research	25.00
	8.5 PR preparation cost	146.02

MAHANADI COALFIELDS LTD
2354
Dt. 13/1/05
HQ. SECTT. SAMBALPUR

9	Revenue Expenditure capitalised (Coal & OBR-DRE)	1390.00
10	Less depreciation capitalised in development period	2613.00
11	[illegible] for land reclamation	486.78
	Total	30296.39

2. [illegible] of Kulda OCP are as under:-

Target Output	:	10.00 mtpa
Man power (Nos.)	:	610
O.M.S. (tonnes)	:	48.78 tonnes
Year of achieving target output	:	7 th year

3. As regards the housing component of the project cost estimate, instructions contained in this Ministry's letter No.[illegible]/76 dated 26.07.1977 and CPD-430 1/33/76 dated 31.01.1978 are to be strictly adhered to.

4. Commencing from the next month, this project should be included in the progress reports to be submitted by the company to the Ministry and other agencies as part of the Management Information System.

5. The present approval is based on the Cost Estimates submitted by the Coal Company for consideration, to the Ministry and as per the decision taken by the Public Investment Board in its meeting held on 30.9.2004. The guidelines contained in Ministry of Finance O.M. No.1(2)/PF-I/2003 dated 7.5.2003 circulated vide this Ministry's letter No.43011/13/2003-CPAM dated 29.9.2003 are to be strictly adhered to.

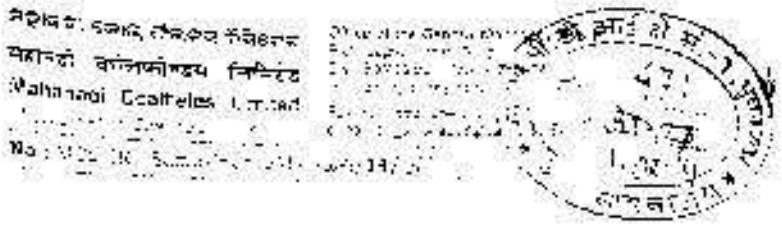
6. When 50% of the capital investment sanctioned is incurred, Mandatory review of the project is to be done to examine if proposal of RCE need to be submitted.

7. This issues with the concurrence of I.F. Wing vide their U.O. No 9/DS(F)/05 dated 11.1.2005.

Yours faithfully,

(Shyam Sunder)
Under secretary to the Govt. of India
(for & on behalf of the President of India)

Annexure-II



Subject: **Approval of Project Report for Kulda Expansion Opencast Project (Normative Capacity 15.00Mty; 5.00Mty incremental) (Peak Capacity 18.75Mty)**

The Project Report for Kulda Expansion Opencast Project (Normative capacity 15.00Mty; 5.00 Mty incremental; Peak Capacity 18.75 Mty) of Basundhara-Garjanbahal Area has been approved by MCL Board in its 359th meeting held on 25.06.2024 at an additional capital investment of ₹ 299.03 crore up to target year and ₹ 30.22 crore beyond target year to be implemented in incremental coal and incremental OB both by outsourcing.

The Board further approved the proposal for getting EMP clearance for peak coal production level of 18.75 Mty.

The zero date of monitoring of the project will be from the date of issue of this letter. The monthly monitoring report should be sent to this office by 10th of every month for onward transmission to CIL/Ministry. This is for kind information and necessary action.

(B. N. Shukla)
General Manager (CP&P)

Distribution:
1. CMD, MCL
2. Advisor (Project(s), GoI, MoC, New Delhi-with a copy of MCL Board Resolution.

Annexure-III

No. 34012/(04)/2011-CPAM
Government of India
Ministry of Coal

New Delhi, the 26th December, 2016

To

Shri S.K. Kundu,
General Manager (Projects & Planning),
Mahanadi Coalfields Limited,
P.O. Jagruti Vihar, Burla,
Dist. SAMBALPUR-768020(ODISHA)(e-mail:mlprojapat5@gmail.com)

Subject	**Mining Plan/Mine Closure Plan of Kulda Expansion OCP (Revision 1) (Expansion from 10 MTY to 15 MTY) Dated September, 2016.**

Sir,

I am directed to refer to MCL's letter No MCL/HQ/Sambalpur/General Manager (Projects & Planning)/16/1495 dated 08.11.2016 on the above cited subject and to forward herewith 04 copies of Mining Plan/Mine Closure Plan of Kulda Expansion OCP (Revision 1) (Expansion from 10 MTY to 15 MTY) Dated September, 2016 of Mahanadi Coalfields Limited duly approved and signed on all pages by Adviser (Projects), Ministry of Coal.

Yours faithfully,

26/12/16

(A.K. Mandal)
Under Secretary to the Govt. of India

Encl: As above.

No.J-11015/10/1995-IA.II(M)
Government of India
Ministry of Environment, Forest & Climate Change
IA-II (Coal Mining) Division

Indira Paryavaran Bhawan,
Jorbagh Road, N Delhi - 3
Dated: 22nd March, 2018

To,

The Chief General Manager (CP&P)
M/s Mahanadi Coalfields Limited
PO - Jagruti Vihar, Burla,
Sambalpur - 768 020 **(Odisha)**
E-mail: cgmenvt2014@gmail.com; gmenvt_mcl@yahoo.co.in

Sub: Expansion of Kulda OCP from 10 MTPA to 14 MTPA of M/s Mahanadi Coalfields Limited in ML area of 634.205 ha located in Tehsil Himgir, District Sundergarh (Odisha) - Environmental Clearance reg.

Sir,

This has reference to your letter No.MCL/HQ/(ENVT)/Kulda OCP/17-18/2832 dated 2nd February, 2018 along with online proposal No.IA/OR/CMIN/61822/2017 dated 15th February, 2018 and subsequent letters dated 05.02.2018, 13.02.2018, 15.02.2018, 19.02.2018 and 27.02.2018 on the above mentioned subject.

2. The Ministry of Environment, Forest and Climate Change has considered the proposal for grant of environmental clearance to the project for expansion of Kulda OCP from 10 MTPA to 15 MTPA of M/s Mahanadi Coalfields Limited in a total area of 694.605 ha (mine lease area of 634.205 ha) located in Tehsil Hemgir, District Sundargarh (Odisha).

3. The proposal was considered by the Expert Appraisal Committee (EAC) in the Ministry for Thermal & Coal Mining Sector in its 27th meeting held on 27th February, 2018. The details of the project, as per the documents submitted by the project proponent, and also as informed during the meeting, are reported to be as under:-

(i) The project was accorded EC vide letter no. J-11015/10/95-IA.II(M) dated 24-12-2002 for 10.0 MTPA in an ML area of 878.29 ha [(929.60 – 51.31 = 878.29 ha) i.e. EC is only granted for 878.29 as out of 279.20 ha total Forest Land, FC is available only for 227.89 ha (FC is not available for 279.20 – 227.89 = 51.31 ha)].
(ii) ToR for the project was granted vide letter dated 18th May,2017.
(iii) The latitudes and longitudes of the project are 21°42'00" to 21° 44'30" N and 83°43'00" to 83°46'30" E respectively.
(iv) Coal Linkage: Thermal Power Plant & Basket Linkage
(v) Employment generated / to be generated: 385 numbers (direct employment)
(vi) Benefits of the project: (a) Improvement in physical infrastructure, (b) Improvement in social infrastructure, (c) Increase in employment potential. (d) Contribution to the exchequer (both State and Central Govt.), (e) Post-mining enhancement of green cover, (f) Improvement of electrical power generation and availability of electricity for 24x7 in rural areas, (j) overall economic growth of the country.
(vii) There is no additional land involved in the Project. The total land area is 694.605 ha. Mining lease area as per the approved Mining Plan is 634.205 ha.

(viii) The land usage of the project will be as follows:

Pre-Mining:

Sl.	Type of Land	Within ML area (ha)		Outside ML area (ha)		Total Area (ha)	
		Existing	Proposed	Existing	Proposed	Existing	Proposed
1.	Agricultural/Tenancy	455.790	259.794	37.500	37.500	493.290	297.294
2.	Waste land	194.610	146.521	22.900	22.900	217.510	169.421
3.	Forest Land	279.200*	227.890	0.000	0.000	279.200	227.890
4.	Grazing	0.000	0.000	0.000	0.000	0.000	0.000
5.	Surface water bodies	0.000	0.000	0.000	0.000	0.000	0.000
	Total:	**929.600**	**634.205**	**60.400**	**60.400**	**990.000**	**694.605**

Note: Instead of 929.60 ha, EC is only granted for 878.29 ha; as out of *279.20 ha Forest Land, FC is available only for 227.89 ha (FC not available for 279.20 – 227.89 = 51.31 ha).

Post- Mining:

Sl.	Land Use during Mining (Core Zone)	Land-Use (ha)					
		Plantation/ grass carpeting	Water Body	Dip side slope & haul road	Un-disturbed	Built-up area	Total
1.	Excavation Area	211.470	17.64	92.80	--	--	321.910
2.	OB dump Area	160.502	--	--	--	--	160.502
3.	Infrastructure	25.230	--	--	--	100.927	126.157
4.	Embankment	3.510	--	--	--	14.049	17.559
5.	Other Area including Safety Zone & Road/ Nullah Diversion	8.077	--	--	--	--	8.077
	Total	**408.789**	**17.64**	**92.80**	**--**	**114.976**	**634.205**

Core Area:

Particulars	Existing (ha)			Proposed (ha)		
	Forest	Non-Forest	Total	Forest	Non-Forest	Total
Excavation Area	241.700	294.300	536.000	187.155	134.755	321.910
Infrastructure/Embankment and Other Area including Safety Zone	32.900	189.930	222.830	36.615	115.178	151.793
External OB Dumps	4.600	166.170	170.770	4.120	156.382	160.502
Mine Lease Area	**279.200***	**660.400**	**929.600**	**227.890**	**406.315**	**634.205**
Residential Colony	0.000	37.500	37.500	0.000	37.500	37.500
Rehabilitation Site	0.000	22.900	22.900	0.000	22.900	22.900
Outside Lease Area	**0.000**	**60.400**	**60.400**	**0.000**	**60.400**	**60.400**
Total	**279.200**	**710.800**	**990.000**	**227.890**	**466.715**	**694.605**

Note: Instead of 929.60 ha, EC is only granted for 878.29 ha; as out of *279.20 ha Forest Land, FC is available only for 227.89 ha (FC not available for 279.20 – 227.89 = 51.31 ha).

(ix) The total geological reserve is 438.90 MT. The mineable reserve 245.71 MT, extractable reserve is 122.29 MT. The percent of extraction would be 70.20%.
(x) The coal grade is G-11 (average). The stripping ratio is 0.90 Cum/tonne. The gradient varies from 5° to 8°. There are three major seams with thickness ranging upto 34.07 m.
(xi) The total estimated water requirement is 4083 m3/day. The level of ground water ranges from 0.30 m to 8.42 m below ground level.
(xii) The method of mining would be Opencast.
(xiii) There are two external OB dumps with quantity of 30.26 Mm3 in an area of 160.502 ha with the height of 90 meter above the surface level and two internal dump with quantity of 112.32 Mm3 in an area of 211.47 ha.
(xiv) The final mine void would be in 34.05 ha with depth varying from 30 m to 40 m and the total quarry area is 469.80 ha. Backfilled quarry area of 435.75 ha shall be reclaimed with plantation. A void of 17.64 ha with depth upto 200 m (max.) which is proposed to be converted into a water body.
(xv) The seasonal data for ambient air quality has been documented and all results at all stations are within the prescribed limits.
(xvi) The life of mine is 9 Years.
(xvii) Transportation: In pit: by trucks. Surface to Siding: Present:- Kanika siding (31 km) by truck, JSPL Raigarh by truck & Road Sale by tarpaulin-covered truck. Proposed:- Sardega Siding (6.0 Km) by truck, JSPL Raigarh by Pipe Conveyor & Road Sale by tarpaulin-covered truck.Siding to Loading: by pay loader into wagons.
(xviii) There is no additional R&R involved.
(xix) Cost: Total capital cost of the project is Rs.622.21 Crores. CSR Cost is 2% of the average net profit of the company for the three immediate preceding financial years. Environmental Management Cost Rs.87.28 Crores.
(xx) Water body: Chattajor nallah passing through the mine lease area, Basundhara river flows at a distance of 70 m, Bhaina Jor is at a distance of 0.5 km.
(xxi) Approvals: Board's approval obtained in the 182nd Board Meeting held on 22-10-2016. Mining plan has been approved by MoC vide letter no. 34012/(04)/2011-CPAM dated 26-12-2016. Mine closure plan is an integral part of mining plan.
(xxii) Wildlife issues: There are no National Parks, Wildlife Sanctuary, Biosphere Reserves found in the 10 km buffer zone.
(xxiii) Forestry issues: Total forest land is 227.89 ha in ML area of 634.205 ha, Forest clearance hass been obtained vide letter no. F.No 8-176/1997-FC dated 8th August, 2007.
(xxiv) Total afforestation plan shall be implemented covering an area of 211.47 ha at the end of mining and green belt over an area of 8.077 ha has also been proposed having density of tree plantation 2500 trees/ha..
(xxv) There are no court cases/violation pending with the project proponent for the proposed expansion.
(xxvi) The public hearing was held on 10th January, 2018 for expanded capacity of 15 MTPA. The issues raised during the public hearing included control of air pollution, water pollution, supply of drinking water, employment, etc.
(xxvii) Base line data was generated during the pre-monsoon season, March to June, 2017.
(xxviii) The Cumulative Impact Assessment Study has been done considering nearby running and upcoming mines namely, Kulda Expansion OCP, Garjanbahal OCP, Basundhara OCP and Basundhara (W) Extn. OCP for incremental capacity of 23.25 MTPA, and it has been observed that after replacement of road transportation by rail and conveyors, the absolute predicted values of PM_{10} will be within the permissible limit at all the locations.
(xxix) The monitoring report on compliance status of EC conditions has been forwarded by the Eastern Regional Office of the Ministry at Bhubaneswar vide letter dated 25th September, 2017.

The action taken report on observations of the Regional Office was submitted vide letter dated 24th October, 2017 & 1st February, 2018.

(xxx) Kulda OC is catering to most of the critical and super critical thermal power plants and at the present level of production it has already achieved its production capacity of 10 MTPA and is under non-producing state for the want of EC for higher production capacity.

4. The Expert Appraisal Committee in its 27th meeting held on 27th February, 2018 has recommended the project for grant of environmental clearance for a period of one year. Based on recommendations of the EAC, the Ministry of Environment, Forest and Climate Change hereby accords environmental clearance to the project for **expansion of Kulda Opencast Coal Mine from 10 MTPA to 14 MTPA of M/s Mahanadi Coalfields Ltd in a total area of 694.605 ha (mine lease area 634.205 ha) located in Tehsil Hemgir, District Sundargarh (Odisha), for a period of one year only** i.e. up to 31st March, 2019, under the provisions of the Environment Impact Assessment Notification, 2006 and subsequent amendments/circulars thereto subject to the compliance of the terms & conditions and environmental safeguards mentioned below:

(i) The project proponent shall collect and analyze one season base line data for environmental parameters, preferably during April-June, 2018, and submit for consideration of the EAC before 31st December, 2018.

(ii) The project proponent shall submit the details regarding action taken on different observations of the Regional Office before 31st December, 2018, for the Committee to examine adequacy and efficacy of the pollution control measures and its impact on ambient air quality and to make recommendations for continuance of the project thereafter.

(iii) To control the production of dust at source, the crusher and in-pit belt conveyors shall be provided with mist type sprinklers.

(iv) Mitigative measures shall be undertaken to control dust and other fugitive emissions all along the roads by providing sufficient numbers of water sprinklers. Adequate corrective measures shall be undertaken to control dust emissions as presented before the Committee, which would include mechanized sweeping, water sprinkling/mist spraying on haul roads and loading sites, long range misting/fogging arrangement, wind barrier wall and vertical greenery system, green belt, dust suppression arrangement at railway siding, etc.

(v) Persons of nearby villages shall be given training on livelihood and skill development to make them employable.

(vi) To ensure health and welfare of nearby villages, regular medical camps shall be organized at least once in six months.

(vii) Thick green belt of 75 m width at the final boundary in the down wind direction of the project site shall be developed to mitigate/check the dust pollution.

(viii) A third party assessment of EC compliance shall be undertaken once in 03 year through agency like ICFRI /NEERI/IIT or any other expert agency identified by the Ministry.

4.1 The grant of EC is further subject to compliance of the generic conditions as under:

(a) Mining

(i) Mining shall be carried out under strict adherence to provisions of the Mines Act 1952 and subordinate legislations made there-under as applicable.

(ii) No change in mining method i.e OC to UG, calendar programme and scope of work shall be made without obtaining prior approval of the Ministry of Environment, Forest and Climate Change (MoEFCC).

(iii) Mining shall be carried out as per the approved mining plan(including Mine Closure Plan) abiding by mining laws related to coal mining and the relevant circulars issued by Directorate General Mines Safety (DGMS).

(iv) No mining shall be carried out in forest land without obtaining Forestry Clearance as per Forest (Conservation) Act, 1980 and also adhering to The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 read with provisions of Indian Forest Act, 1927.

(b) Land reclamation and water conservation

(i) Digital Survey of entire lease hold area/core zone using Satellite Remote Sensing survey shall be carried out at least once in three years for monitoring land use pattern and report in 1:50,000 scale shall be submitted to Ministry of Environment, Forest and Climate Change/Regional Office (RO).

(ii) The surface drainage plan including surface water conservation plan for the area of influence affected by the said mining operations, considering the presence of river/rivulet/pond/lake etc, shall be prepared and implemented by the project proponent. The surface drainage plan and/or any diversion of natural water courses shall be as per the approved Mining Plan/EIA/EMP report and with due approval of the concerned State/GoI Authority. The construction of embankment to prevent any danger against inrush of surface water into the mine should be as per the approved Mining Plan and as per the permission of DGMS.

(iii) The final mine void depth should preferably be as per the approved Mine Closure Plan, and in case it exceeds 40 m, adequate engineering interventions shall be provided for sustenance of aquatic life therein. The remaining area shall be backfilled and covered with thick and alive top soil. Post-mining land be rendered usable for agricultural/forestry purposes and shall be handed over to the respective state government as specified in the guidelines for Preparation of Mine Closure Plan issued by the Ministry of Coal dated 27th August, 2009 and subsequent amendments.

(iv) The entire excavated area, backfilling, external OB dumping (including top soil) and afforestation plan shall be in conformity with the "during mining"/"post mining" land-use pattern, which is an integral part of the approved Mining Plan and the EIA/EMP submitted to this Ministry. Progressive compliance status vis-a-vis the post mining land use pattern shall be submitted to the Ministry of Environment, Forest and Climate Change/Regional Office on six monthly basis.

(v) The top soil shall temporarily be stored at earmarked site(s) only and shall not be kept unutilized for long. The top soil shall be used for land reclamation and plantation purposes. Active OB dumps shall be stabilised with native grass species to prevent erosion and surface run off. The other overburden dumps shall be vegetated with native flora species. The excavated area shall be backfilled and afforested in line with the approved Mine Closure Plan. Monitoring and management of rehabilitated areas shall continue until the vegetation becomes self-sustaining. Compliance status shall be submitted to the Ministry of Environment, Forest and Climate Change/ Regional Office on six monthly basis.

(c) Emissions, effluents, and waste disposal

(i) Transportation of coal, to the extent permitted by road, shall be carried out by covered trucks/conveyors. Effective control measures such as regular water/mist sprinkling/rain gun etc shall be carried out in critical areas prone to air pollution (with higher values of PM_{10}/$PM_{2.5}$) such as haul road, loading/unloading and transfer points. Fugitive dust emissions from all sources shall be controlled regularly. It shall be ensured that the Ambient Air Quality parameters conform to the norms prescribed by the Central/State Pollution Control Board.

(ii) Greenbelt consisting of 3-tier plantation of width not less than 7.5 m shall be developed all along the mine lease area in a phased manner. The green belt comprising a mix of native species shall be developed all along the major approach/ coal transportation roads.

(iii) The transportation of coal shall be carried out as per the provisions and route proposed in the approved Mining Plan. Transportation of the coal through the existing road passing through any village shall be avoided. In case, it is proposed to construct a 'bypass' road, it should be so constructed so that the impact of sound, dust and accidents could be appropriately mitigated.

(iv) Vehicular emissions shall be kept under control and regularly monitored. All the vehicles engaged in mining and allied activities shall operate only after obtaining 'PUC' certificate from the authorized pollution testing centres.

(v) Coal stock pile/crusher/feeder and breaker material transfer points shall invariably be provided with dust suppression system. Belt-conveyors shall be fully covered to avoid air borne dust. Side cladding all along the conveyor gantry should be made to avoid air borne dust. Drills shall be wet operated or fitted with dust extractors.

(vi) Coal handling plant shall be operated with effective control measures viz. bag filters/water or mist sprinkling system etc to check fugitive emissions from crushing operations, conveyor system, transfer points, etc.

(vii) Ground water, excluding mine water, shall not be used for mining operations. Rainwater harvesting shall be implemented for conservation and augmentation of ground water resources.

(viii) Catch/garland drains and siltation ponds of appropriate size shall be constructed around the mine working, coal heaps & OB dumps to prevent run off of water and flow of sediments directly into the river and water bodies. Further, dump material shall be properly consolidated/ compacted and accumulation of water over dumps shall be avoided by providing adequate channels for flow of silt into the drains. The drains/ ponds so constructed shall be regularly de-silted particularly before onset of monsoon and maintained properly. Sump capacity should provide adequate retention period to allow proper settling of silt material. The water so collected in the sump shall be utilised for dust suppression measures and green belt development. Dimension of the retaining wall constructed, if any, at the toe of the OB dumps within the mine to check run-off and siltation should be based on the rainfall data. The plantation of native species to be made between toe of the dump and adjacent field/habitation/water bodies.

(ix) Industrial waste water generated from CHP, workshop and other waste water, shall be properly collected and treated so as to conform to the standards prescribed under the Environment (Protection) Act, 1986 and the Rules made there under, and as amended from time to time. Oil and grease trap shall be installed and maintained fully functional with effluents

discharge adhering to the norms. Sewage treatment plant of adequate capacity shall be installed for treatment of domestic waste.

(x) Adequate groundwater recharge measures shall be taken up for augmentation of ground water. The project authorities shall meet water requirement of nearby village(s) in case the village wells go dry due to dewatering of mine.

(d) Illumination, noise & vibration

(i) Adequate illumination shall be ensured in all mine locations (as per DGMS standards) and monitored weekly. The report on the same shall be submitted to this ministry & its RO on six-monthly basis.

(ii) Adequate measures shall be taken for control of noise levels below 85 dB(A) in the work environment. Workers engaged in blasting and drilling operations, operation of HEMM, etc shall be provided with personal protective equipments (PPE) like ear plugs/muffs in conformity with the prescribed norms and guidelines in this regard. Adequate awareness programme for users to be conducted. Progress in usage of such accessories to be monitored.

(iii) Controlled blasting techniques shall be practiced in order to mitigate ground vibrations and fly rocks as per the guidelines prescribed by the DGMS.

(iv) The noise level survey shall be carried out as per the prescribed guidelines to assess noise exposure of the workmen at vulnerable points in the mine premises, and report in this regard shall be submitted to the Ministry/RO on six-monthly basis.

(e) Occupational health & safety

(i) The project proponent shall undertake occupational health survey for initial and periodical medical examination of the workers engaged in the project and maintain records accordingly as per the provisions of the Mines Rules, 1955 and DGMS circulars. Besides regular periodic health check-up, 20% of the workers identified from workforce engaged in active mining operations shall be subjected to health check-up for occupational diseases and hearing impairment, if any.

(ii) Personnel (including outsourcing employees) working in dusty areas shall wear protective respiratory devices and shall also be provided with adequate training and information on safety and health aspects.

(iii) Skill training as per safety norms specified by DGMS shall be provided to all workmen including the outsourcing employees to ensure high safety standards in mines.

(f) Ecosystem and biodiversity conservation

(i) The project proponent shall take all precautionary measures during mining operation for conservation and protection of endangered flora/fauna, if any, spotted/reported in the study area. The Action plan in this regard, if any, shall be prepared and implemented in consultation with the State Forest and Wildlife Department.

(g) Public hearing, R&R and CSR

(i) Implementation of the action plan on the issues raised during the public hearing shall be ensured. The project proponent shall undertake all the tasks/measures as per the action plan submitted with budgetary provisions during the public hearing. Land oustees shall be compensated as per the norms laid down in the R&R policy of the company/State Government/Central Government, as applicable.

(ii) The project proponent shall ensure the expenditure towards socio-economic development in and around the mine, in every financial year in pursuance of the Corporate Social Responsibility Policy as per the provisions under Section 135 of the Companies Act, 2013

(iii) The project proponent shall follow the mitigation measures provided in this Ministry's OM No.Z-11013/5712014-IA.II (M) dated 29th October, 2014, titled 'Impact of mining activities on habitations-issues related to the mining projects wherein habitations and villages are the part of mine lease areas or habitations and villages are surrounded by the mine lease area'.

(iv) The project proponent shall make necessary alternative arrangements, if grazing land is involved in core zone, in consultation with the State government to provide alternate areas for livestock grazing, if any. In this context, the project proponent shall implement the directions of Hon'ble Supreme Court with regard to acquiring grazing land.

(h) Corporate environment responsibility

(i) The Company shall have a well laid down environment policy duly approved by Board of Directors. The environment policy should prescribe for standard operating procedures to have proper checks and balances and to bring into focus any infringements/deviation/violation of the environmental or forest norms/conditions. Also, the company shall have a defined system of reporting of non-compliances/violations of environmental norms to the Board of Directors and/or shareholders/stakeholders.

(ii) The hierarchical system or Administrative Order of the company to deal with environmental issues and for ensuring compliance with the environmental clearance conditions should be displayed on website of the Company.

(iii) A separate environmental management cell both at the project and company headquarter level, with suitable qualified personnel shall be set-up under the control of a Senior Executive, who will report directly to the Head of the Organization.

(iv) Action plan for implementing EMP and environmental conditions shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose. Year wise progress of implementation of action plan shall be reported to the Ministry/Regional Office along with the Six Monthly Compliance Report.

(v) Self environmental audit shall be conducted annually. Every three years third party environmental audit shall be carried out.

(i) Statutory Obligations

(i) The environmental clearance shall be subject to orders of Hon'ble Supreme Court of India, Hon'ble High Court, NGT and any other Court of Law from time to time, and as applicable to the project.

(ii) This environmental clearance shall be subject to obtaining wildlife clearance, if applicable, from the Standing Committee of National Board for Wildlife.

(iii) The project proponent shall obtain Consent to Establish/Operate under the Air Act, 1981 and the Water Act, 1974 from the concerned State Pollution Control Board.

(iv) The project proponent shall obtain the necessary permission from the Central Ground Water Authority (CGWA).

(j) Monitoring of project

(i) Adequate ambient air quality monitoring stations shall be established in the core zone as well as in the buffer zone for monitoring of pollutants, namely PM_{10}, $PM_{2.5}$, SO_2 and NO_x. Location of the stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board. Online ambient air quality monitoring stations may also be installed in addition to the regular monitoring stations as per the requirement and/or in consultation with the SPCB. Monitoring of heavy metals such as Hg, As, Ni, Cd. Cr, etc to be carried out at least once in six months.

(ii) The Ambient Air Quality monitoring in the core zone shall be carried out to ensure the Coal Industry Standards notified vide GSR 742 (E) dated 25.9.2000 and as amended from time to time by the Central Pollution Control Board. Data on ambient air quality and heavy metals such as Hg, As, Ni, Cd, Cr and other monitoring data shall be regularly reported to the Ministry/Regional Office and to the CPCB/SPCB.

(iii) The effluent discharge (mine waste water, workshop effluent) shall be monitored in terms of the parameters notified under the Coal Industry Standards vide GSR 742 (E) dated 25.9.2000 and as amended from time to time by the Central Pollution Control Board.

(iv) The monitoring data shall be uploaded on the company's website and displayed at the project site at a suitable location. The circular No. J-20012/1/2006-IA.11 (M) dated 27.05.2009 issued by Ministry of Environment, Forest and Climate Change shall also be referred in this regard for its compliance.

(v) Regular monitoring of ground water level and quality shall be carried out in and around the mine lease area by establishing a network of existing wells and constructing new piezometers during the mining operations. The monitoring of ground water levels shall be carried out four times a year i.e. pre-monsoon, monsoon, post-monsoon and winter. The ground water quality shall be monitored once a year, and the data thus collected shall be sent regularly to Ministry of Environment, Forest and Climate Change/Regional Office.

(vi) Monitoring of water quality upstream and downstream of water bodies shall be carried out once in six months and record of monitoring data shall be maintained and submitted to the Ministry of Environment, Forest and Climate Change/Regional Office.

(vii) The project proponent shall submit six monthly reports on the status of the implementation of the stipulated environmental conditions to the Ministry of Environment, Forest and Climate Change/Regional Office. For half yearly monitoring reports, the data should be monitored for the period of April to September and October to March of the financial years.

(viii) The Regional Office of this Ministry shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data / information/monitoring reports.

(k) Miscellaneous

(i) Efforts should be made to reduce energy consumption by conservation, efficiency improvements and use of renewable energy.

(ii) The project authorities shall inform to the Regional Office regarding commencement of mining operations.

(iii) A copy of the environmental clearance shall be marked to concerned Panchayat. A copy of the same shall also be sent to the concerned State Pollution Control Board, Regional Office. District Industry Sector and Collector's Office/Tehsildar Office for information in public domain within 30 days.

(iv) The EC shall be uploaded on the company's website. The compliance status of the stipulated EC conditions shall also be uploaded by the project authorities on their website and updated at least once every six months so as to bring the same in public domain.

(v) The project authorities shall advertise at least in two local newspapers widely circulated, one of which shall be in the vernacular language of the locality concerned, within 7 days of the issue of this clearance, informing that the project has been accorded environmental clearance and a copy of the same is available with the State Pollution Control Board and also at website of the Ministry.

(vi) The environmental statement for each financial year ending 31 March in Form-V is mandated to be submitted by the project proponent for the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be uploaded on the Company's website along with the status of compliance of EC conditions and shall be sent to the respective Regional Offices of the MoEF&CC by e-mail. Concerns raised during public hearing.

(vii) The above conditions will be enforced inter-alia, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and Rules and any other orders passed by the Hon'ble Supreme Court of India/High Courts and any other Court of Law relating to the subject matter.

5. The proponent shall abide by all the commitments and recommendations made in the EIA/EMP report and also that during presentation to the EAC. All the commitments made on the issues raised during public hearing shall also be implemented in letter and spirit.

6. The proponent shall obtain all necessary clearances/approvals that may be required before the start of the project. The Ministry or any other competent authority may stipulate any further condition for environmental protection. The Ministry or any other competent authority may stipulate any further condition for environmental protection.

7. Any appeal against this environmental clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.

8 The coal company/project proponent shall be liable to pay the compensation against the illegal mining, if any, and as raised by the respective State Governments at any point of time, in terms of the orders dated 2nd August, 2017 of Hon'ble Supreme Court in WP (Civil) No.114/2014 in the matter of 'Common Cause Vs Union of India & othrs'.

9. The project proponent, without prejudice to this environmental clearance, shall be bound to comply with any other interpretation of the orders of Hon'ble Supreme Court also, in due course of time.

10. This environmental clearance supersedes the earlier one granted vide letter No.J-11015/10/1995-IA II(M) dated 24th December, 2002 for a capacity 10 MTPA.

22/3/2018

(S. K. Srivastava)
Scientist E

Copy to:

1. The Secretary, Ministry of Coal, Shastri Bhawan, New Delhi
2. The APPCF, Regional office (EZ), Ministry of Environment Forests and Climate Change, A-31, Chandrashekarpur, Bhubaneswar - 751023
3. The Secretary, Department of Environment & Forest, Government of Odisha, Secretariat, Bhubaneswar
4. The Member Secretary, Central Ground Water Authority, Ministry of Water Resources, Curzon Road Barracks, A-2, W-3 Kasturba Gandhi Marg, New Delhi
5. The Member Secretary, CPCB, CBD-cum-Office Complex, East Arjun Nagar, Delhi -110032
6. The Member Secretary, Odisha State Pollution Control Board, Neelakanth Nagar, Unit-VIII, Bhubaneswar
7. The District Collector, Sundargarh, Government of Odisha
8. Monitoring File 9. Guard File 10. Record File 11. Notice Board

22/3/2018

(S. K. Srivastava)
Scientist E

Annexure-V

ମହାନଦୀ କୋଲ୍ ଫିଲ୍ଡସ୍ ଲିମିଟେଡ୍
महानदी कोलफील्डस लिमिटेड
Mahanadi Coalfields Limited
(A subsidiary of Coal India Limited)

महाप्रबंधक (परियोजना एवं योजना) का कार्यालय
Office of the General Manager (P&P)
At/Po : Jagruti Vihar, Burla, MCL
Dist: Sambalpur – 768 020 (Odisha)
CIN: U10102OR1992GOI003038
Ph: +91 (663) 254 2808 / Fax: +91 (663) 254 2767,
e-mail : cpnp.mcl@gmail.com/ gmprojectsmcl@gmail.com
cgm-cpnp.mcl@coalindia.in
Website : www.mahanadicoal.in

MCL

क्रमांक : एम.सी.एल / मुख्यालय /सम्बलपुर/ महाप्रबंधक (परियोजना एवं योजना)/18/ 357-H. दिनांक: 25-Jul-18

सेवा में

क्षेत्रीय निदेशक,

क्षेत्रीय संस्थान- 7,

सेंट्रल माईन प्लानिंग एंड डिजाइन इंस्टिट्यूट लिमिटेड (सी.एम.पी.डी.आई.एल),

सामंतपुरी (गान्धी पार्क के नजदिक), आर. आर. एल. भुबनेश्वर - 751 013 (ओडिशा)

विषय: **Approval of additional items in the Annual Work Programme of CMPDIL, RI-VII, Bhubaneswar for the year 2018-19**

महोदय,

This is to convey the approval of Competent Authority for additional items in the Annual Work Program of CMPDIL, RI-VII, Bhubaneswar for the year 2018-19 and the same has been enclosed.

भवदीय

संलग्न:
1. Land Schedule of Kulda Exp Phase-II (18.75 MTY)
2. Land details of Chhendipada OCP
3. Additional jobs with time schedule

महाप्रबंधक(परियोजना एवं योजना)

सूचनार्थ:
निदेशक-(तकनीकी/ परियोजना एवं योजना), एम.सी.एल.

प्रतिलिपि:
1. महाप्रबंधक, वित्त (लागत और बजट)
2. महाप्रबंधक, वित्त (कॉर्पोरेट अकाउंट्स)
3. महाप्रबंधक, सिविल
4. महाप्रबंधक, विद्युत एवं यांत्रिकी
5. कार्यालय कापी

क्षेत्रीय निदेशक,

Job No: 702231 MP&MCP OF Kulda Expn OCP

Annexure-VI

महानदी कोलफील्डस लिमिटेड
Mahanadi Coalfields Limited
(A subsidiary of Coal India Limited)

Office of the General Manager
Basundhara Area
At/PO-Basundhara 770078
Dist. Sundargarh (Orissa)

MCL

REF NO. MCL/GM/BA/KOCP/2019/ ES-8E /363 Date:14.11.19

To,
The General Manager (P&P)
HQ Sambalpur

Sub: Inclusion of re-diversion of Forest Land of Kulda OCP in Mining Plan.

Dear Sir,

As per Stage-I approval for Forest Diversion in respect Basundhara Coal Washery obtained vide 8-176/1997-FC(Vo.) dt. 11.03.2019, a diversion of 29.41 Ha forest land has been approved out of which 20.89 Ha is for fresh forest land and 8.52 Ha has been approved for re-diversion out of the already diverted forest area of 227.89 Ha for Kulda OCP.

As per condition no. XI of the Stage-I approval

> (XI) Since an area of 8.52 ha of forest land is being re-diverted from already diverted forest area of 227.89 ha for Kulda OCP of Mahanandi Coalfields Ltd.) in Sundargarh Forest Division of Sundargarh District, Odisha for construction of Basundhara Coal Washery (10 MTY) by M/s Mahanadi Coalfields Limited, therefore, the land use plan and mining plan shall be got approved before Stage-II Clearance and a copy of the same be submitted to this Ministry for record.

As of now, the compliance of Stage-I conditions have been submitted to MoEF&CC New Delhi with an undertaking that the approved Mining Plan will be submitted as soon as it is approved by MCL Board.

Hence, it is requested that the necessary changes may please be incorporated in the Mining plan being prepared for Kulda Expansion 18.75 MTY so that the same may be submitted to MoEF&CC, New Delhi after competent approval.

This is for necessary action from your end.

Yours faithfully,

14/11

General Manager
Basundhara Area, MCL

Copy to:
- GM(Envt&Forest), MCL
- Project Officer, KOCP

खनिज कार्यालय रिसीव्ड
योजना एवं परियोजना विभाग
प्राप्ति/Rec...1484.....
दिनांक/Date.18.11.19

Annexure-VII

No. No.34012/(01)/2015
Government of India
Ministry of Coal

New Delhi, the 05th October, 2017

To

Shri Shekhar Saran,
Chairman-cum-Managing Director,
Central Mine Planning & Design Institute Limited,
Gondwana Place, Kanke Road,
Ranchi (Jharkhand) /FAX:0651-2230003 /
E-mail:cmd.cmpdi@coalindia.in

Subject	**Application from CMPDI for seeking recognition to their 42 Officers as** Recognized Qualified Person (**RQP) to prepare Mining Plans/Mine Closure Plans under Rule 22© of Mineral Concession Rule, 1960.**

Sir,

I am directed to refer to CMPDI Ref. No. CMPDI:TS:2017/41.01/I/1043 dated 25.02.2017 and CMPDI:TS:2017:41:01:I/1042 dated 25.02.2017 on the above cited subject and to convey approval of the Central Government to the grant of recognition in favor of the following persons as competent person to prepare Mining Plan/ Mine Closure Plan for Coal/Lignite block(s) under Rule 22(c) of Mineral Concession Rule, 1960 **for the assignment/ jobs undertaken by CMPDI up to 10 years** from the date of issue of this letter or duly perform to the Company.

(1) Anandji Prasad (2) Chiranjib Patra (3) Arvind Kumar Sharma (4) Shambhu Sharan (5)Pramod Kumar (6) Vivek Singh (7) Devendra Pratap Singh (8) Pankaj Pandey (9) Ashish Verma (10) Irshad Ahmad (11) Subrata Kundu (12) Partha Das (13) Saikat Chatterjee (14) Uma Shankar Singh (15) Manoj Kumar (16) P.R. Suresh (17) Ghanshyam Singh Gahlot (18) G.Y. Padmanabha Reddy (19) Sudhanshu Mishra (20) Rajesh Ahuja (21) S.Jayakumar (22) Sanjeev Murlidhar Singh (23) Birendra Kumar Thakur (24) Sadanan Mahapatra (25) Badal Manna (26) Siddhartha Shankar Basu (27) Guntur Srinivas (28) Shri Rajesh Ralhan (29) Shri Arun Kr. Bal.

(2) Shri G.Y.Padmanabha Reddy has been recognized as RQP for making Mining Plans/Mine Closure Plan for Opencast Coal Mines only.

(3) RQP is required to comply with the provisions of all the concerned statutes and guidelines/circulars of the Govt. issued from time to time in regard to preparation of Mining Plans.

Yours Faithfully

(A.K. Mandal)
Under Secretary to the Govt. of India
Tel: 011-23073937

Copy to TD, NIC, Ministry of Coal for including in the list of RQP in Ministry of Coal's Web Site.

Annexure-VIII

CERTIFICATE

1. *Certified that M/s Mahanadi Coalfield Limited has requested M/s Central Mine planning and Design Institute Limited to prepare the Mining Plan and Mine Closure Plan of KULDA EXPN OCP (Expn: 18.75 Mty). It is also certified that the undersigned has a valid recognition from Ministry of Coal under MCR,1960 to prepare the mining plan.*

2. *Certified that the provisions of Mineral Conservation and Development Rules, 1988 and MCR, 1960 have been observed in the preparation of "**Mining Plan and Mine Closure Plan for KULDA EXPN OCP** (Expn: 18.75 Mty) **of MCL**" and wherever specific permissions are required, the applicant will approach the concerned authorities.*

3. *Certified that provisions of Mines Act, 1952 and of the Rules and Regulations made there under have been observed in the preparation of this Mining Plan & Mine Closure Plan and that wherever specific permission is required the applicant will approach Director General of Mines Safety in the matter.*

4. *Certified further that the information furnished in this Mining Plan & Mine Closure Plan is true and correct to the best of my knowledge.*

SIDDHARTHA SANKAR BASU
RQP NO. 34012/1/2015-CPAM Dtd. 05.10.2017.
Place : Bhubaneswar
Date :

MADHYA PRADESH

JHARKHAND

WEST BENGAL

CHHATTISGARH

ANDHRA PRADESH

BAY OF BENGAL

SUNDARGARH

IB-VALLEY COALFIELD

JHARSUGUDA

DEOGARH

SAMBALPUR

KENDUJHARGARH

MAYURBHANJ

BALESHWAR

HALDIA PORT

TALCHER COALFIELD

BHADRAK

JAJPUR

DHENKANAL

ANGUL

BARGARH

SONAPUR

BAUDA

BALANGIR

NUAPARHA

KENDRAPARA

CUTTACK

BHUBANESWAR

JAGATSINGHPUR

PARADIP PORT

KHORDHA

NAYAGARH

PURI

KANDHAMAL

BRAHMAPATNA

KALAHANDI

NABARANGPUR

RAYAGADA

GANJAM

GAJAPATI

BRAHMAPUR

GOPALPUR PORT

KORAPUT

MALKANGIRI

PLATE NO. - GEN I

MAHANADI COALFIELDS LIMITED

MINING PLAN & MINE CLOSURE PLAN OF BULDA EXP. OCP - 10.75 MTY

LOCATION MAP OF ODISHA COALFIELDS

CMPDI

IB-VALLEY COALFIELD

TALCHER COALFIELD

KULDA OCP.

CHHATTISGARH STATE

ORISSA STATE

SUNDARGARH DISTRICT

JHARSUGUDA DISTRICT

SURAPAHAR

DHARAMJAIGARH AND DIP EXTENTION

CHHATABAR WEST

CHHATABAR EAST

RAMPIA

DIP EXTENTION OF RAMPIA

PRAJAPARA AND DIP EXTENTION

LEENAKSHI

MEENAKSHI AND DIP EXTENTION

HEMAGIRI

TANGARDIHI

ROHINI

SOUTH EAST CENTRAL RAILWAY

LEGEND

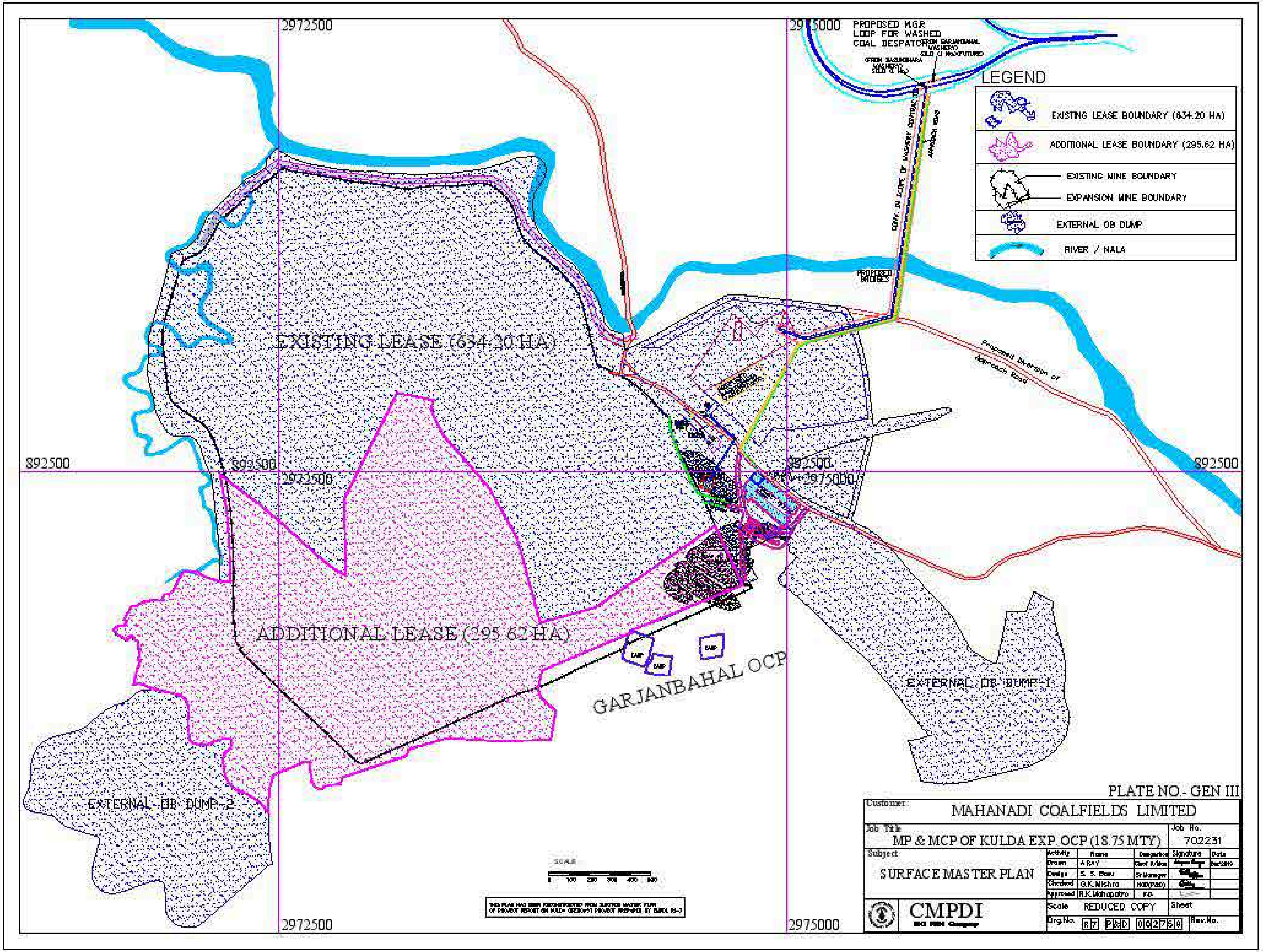
Sl.	SYMBOL	PARTICULARS
1		GEOLOGICAL BLOCK BOUNDARY
2 3		EXAMINED BLOCK BOUNDARY OF KULDA AND DHARAMJAIGARH AND THEIR EXTENSION
4		RIVER / JHORE / NALLAH
5		RIVER
6		DISTRICT BOUNDARY
7		SURFACE WATER BODY / DAM

Scale

PLATE NO.-GEN II

MAHANADI COALFIELDS LTD.

CMPDI



2972500
2975000
PROPOSED M.G.R. LOOP FOR WASHED COAL DESPATCH
LEGEND
EXISTING LEASE BOUNDARY (634.20 HA)
ADDITIONAL LEASE BOUNDARY (295.62 HA)
EXISTING MINE BOUNDARY
EXPANSION MINE BOUNDARY
EXTERNAL OB DUMP
RIVER / NALA
PROPOSED BRIDGES
Proposed Diversion of Approach Road
EXISTING LEASE (634.20 HA)
892500
ADDITIONAL LEASE (295.62 HA)
GARJANBAHAL OCP
EXTERNAL OB DUMP-1
EXTERNAL OB DUMP-2
SCALE
PLATE NO.- GEN III
Customer:
MAHANADI COALFIELDS LIMITED
Job Title
MP & MCP OF KULDA EXP. OCP (18.75 MTY)
Job No.
702231
Subject
SURFACE MASTER PLAN
Activity
Name
Signature
Drawn
A RAY
Design
S. S. Basu
Checked
G.K. Mishra
Approved
R.K. Mahapatro
Scale
REDUCED COPY
Sheet
CMPDI
Drg. No.
Rev. No.

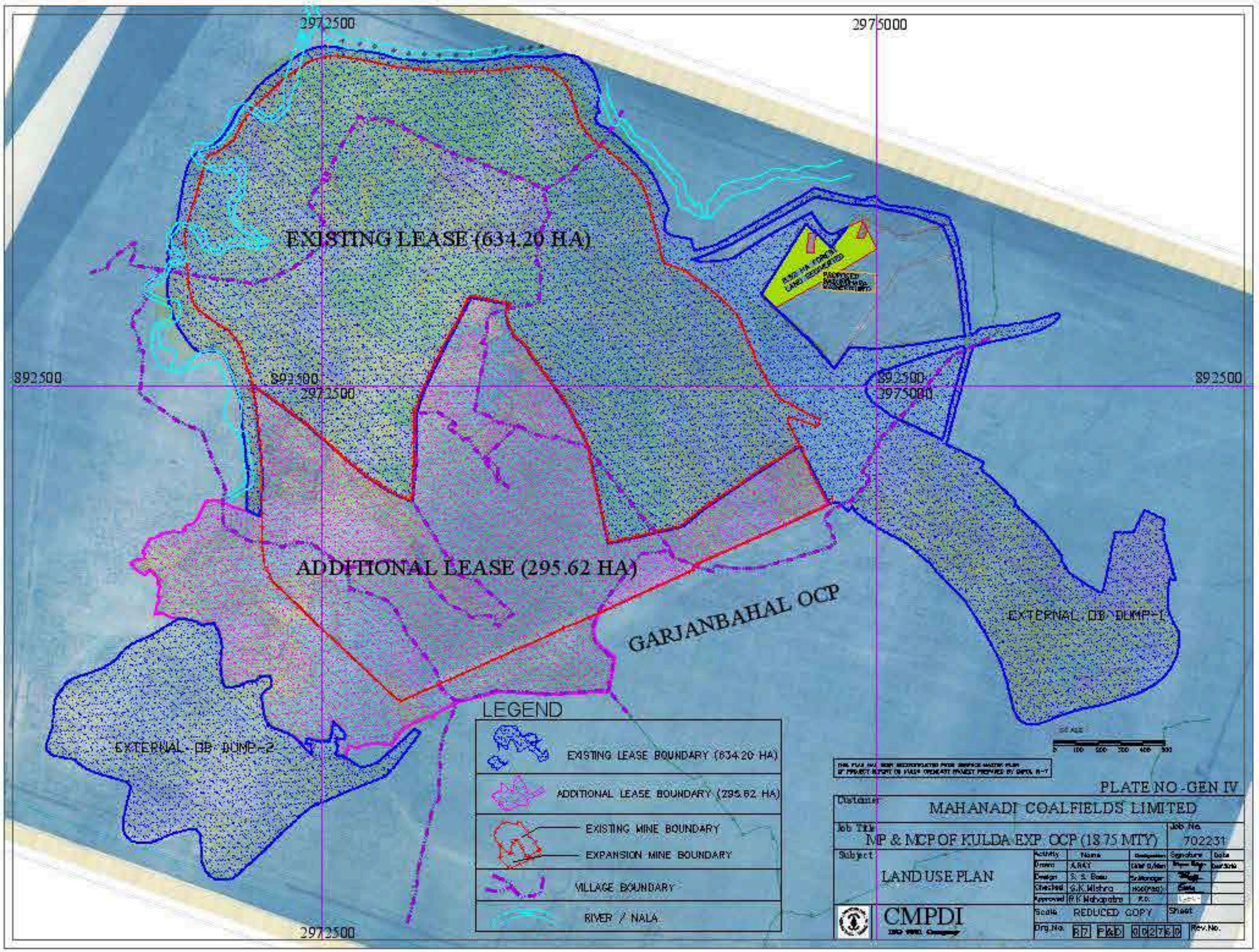
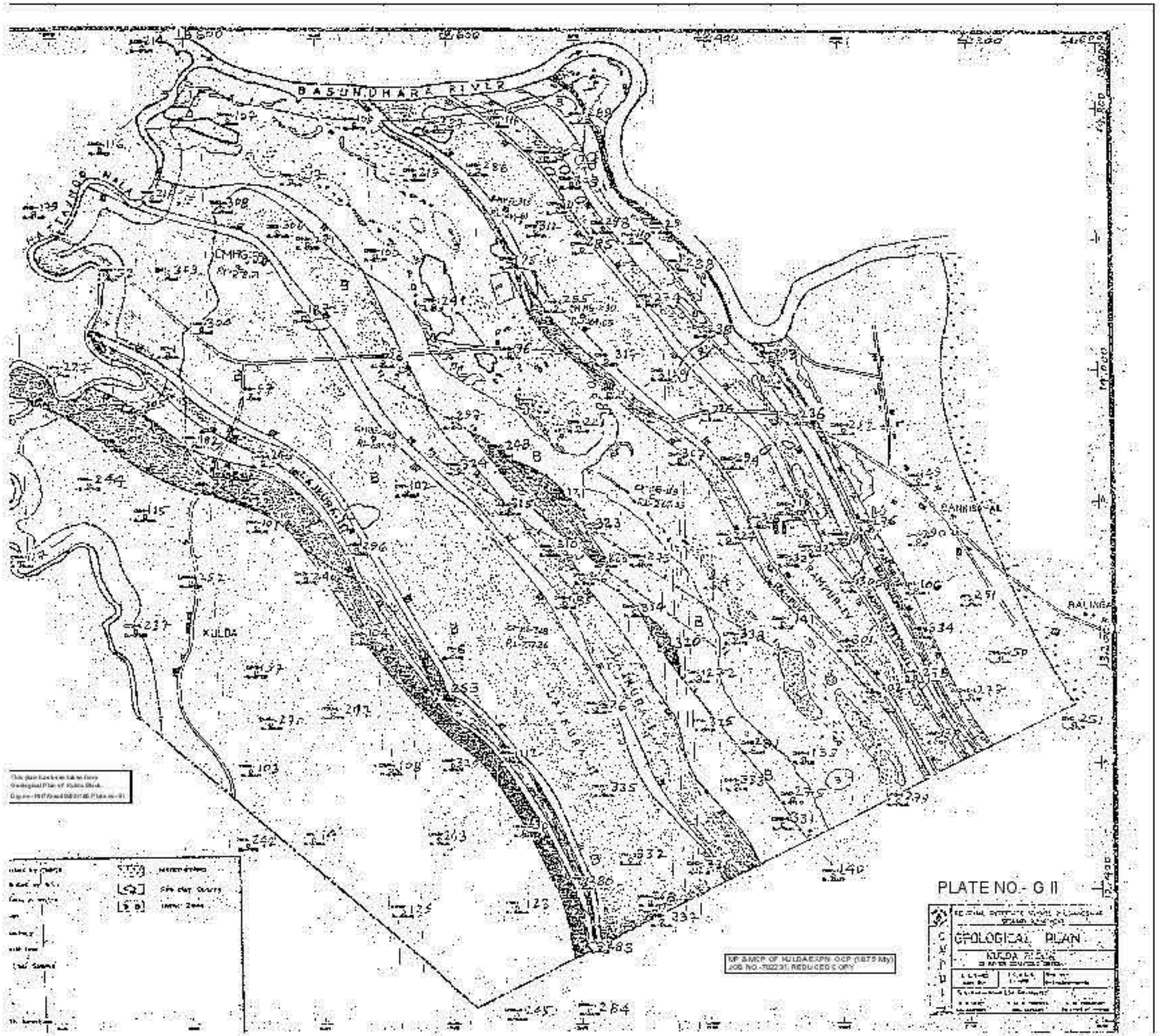

2972500
2975000
892500
892500
892500
892500
2972500
2975000
EXISTING LEASE (634.20 HA)
ADDITIONAL LEASE (295.62 HA)
GARJANBAHAL OCP
EXTERNAL OB DUMP-1
EXTERNAL OB DUMP-2
LEGEND
EXISTING LEASE BOUNDARY (634.20 HA)
ADDITIONAL LEASE BOUNDARY (295.62 HA)
EXISTING MINE BOUNDARY
EXPANSION MINE BOUNDARY
VILLAGE BOUNDARY
RIVER / NALA
PLATE NO-GEN IV
Customer
MAHANADI COALFIELDS LIMITED
Job Title
MP & MCP OF KULDA EXP OCP (18.75 MTY)
Job No.
702231
Subject
LAND USE PLAN
CMPDI
Scale
REDUCED COPY
Sheet
Rev.No.

PLATE NO.- G I


BASUNDHARA RIVER
KULDA
PLATE NO.- G II
GEOLOGICAL PLAN
KULDA PLAIN

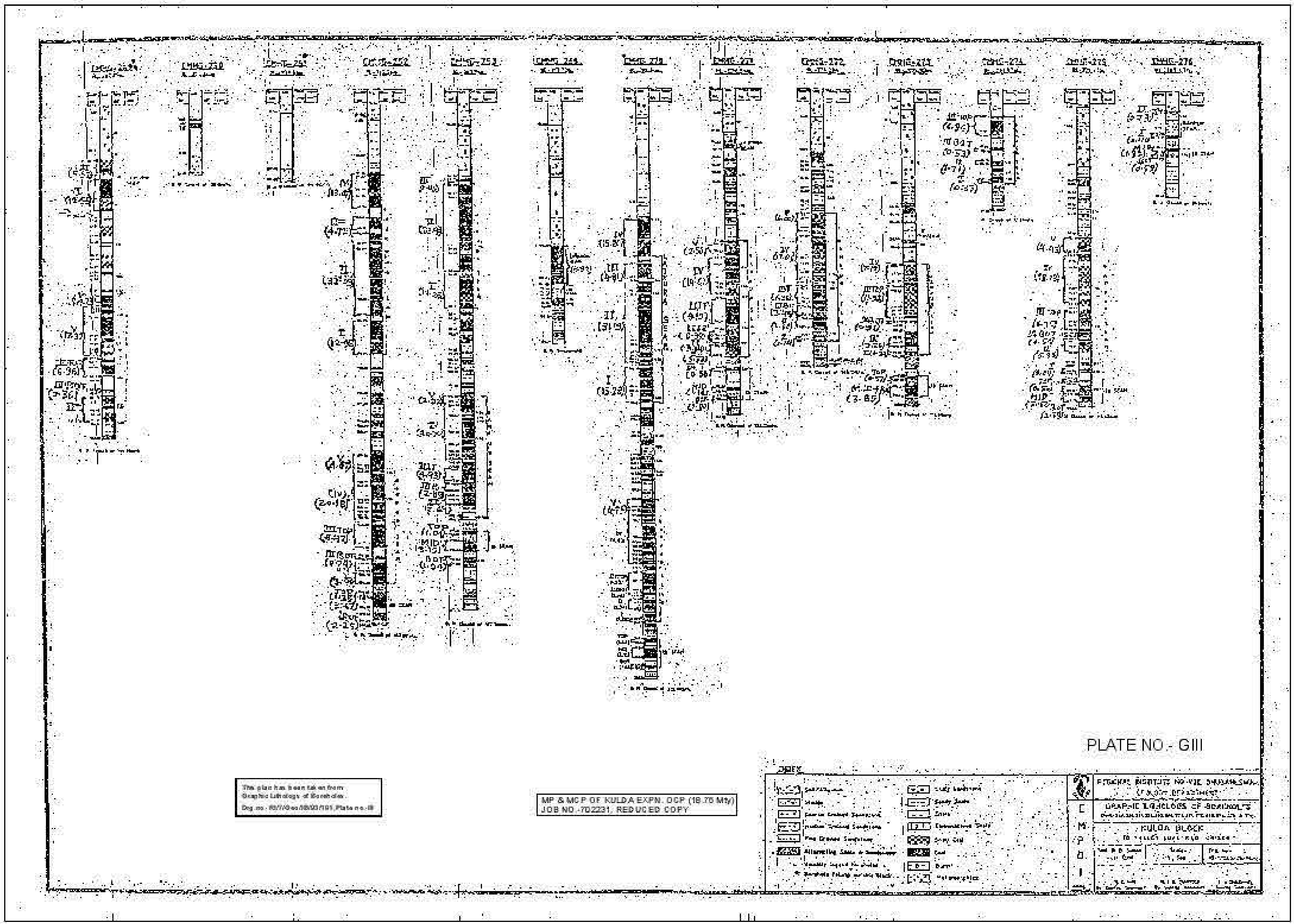
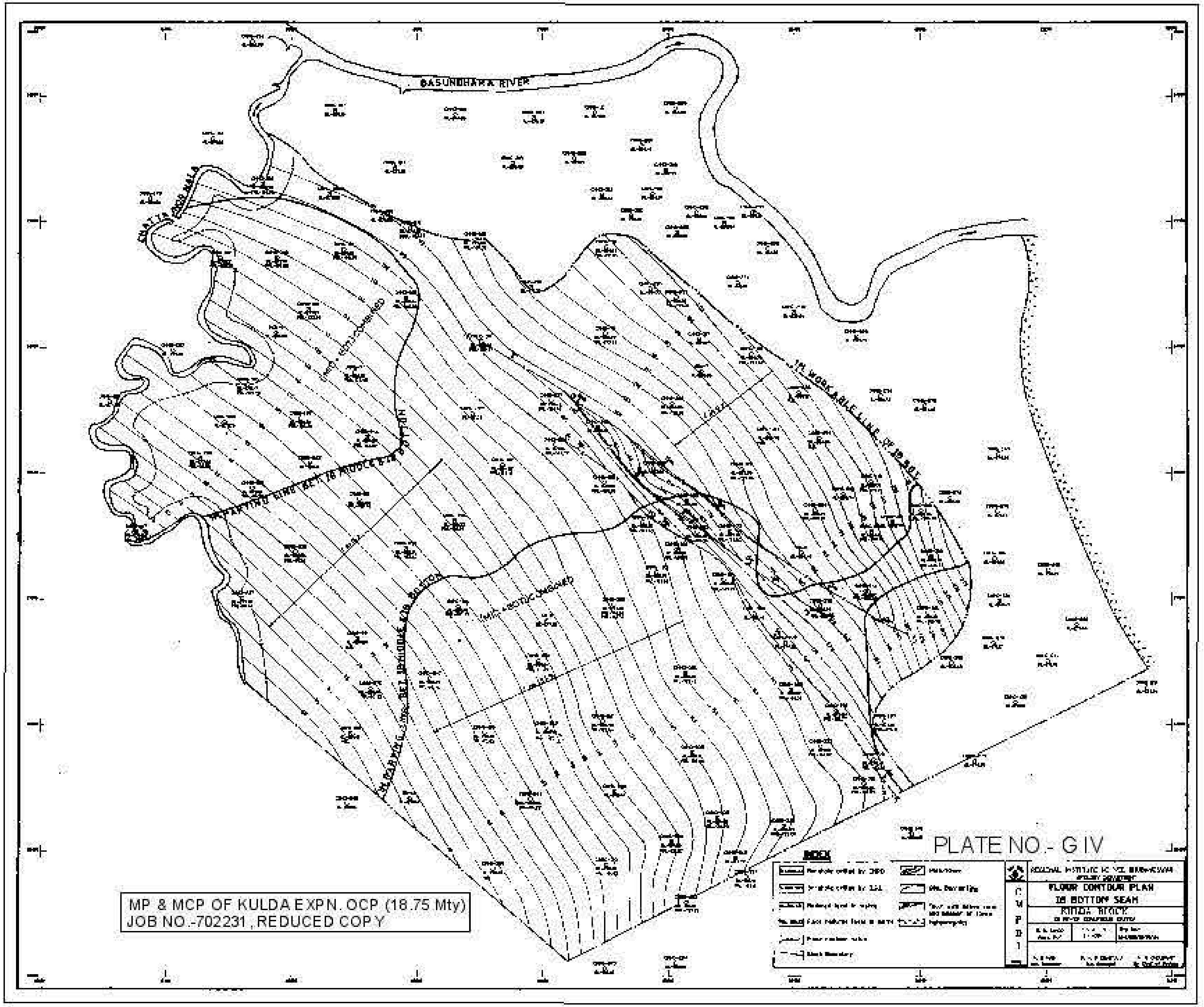
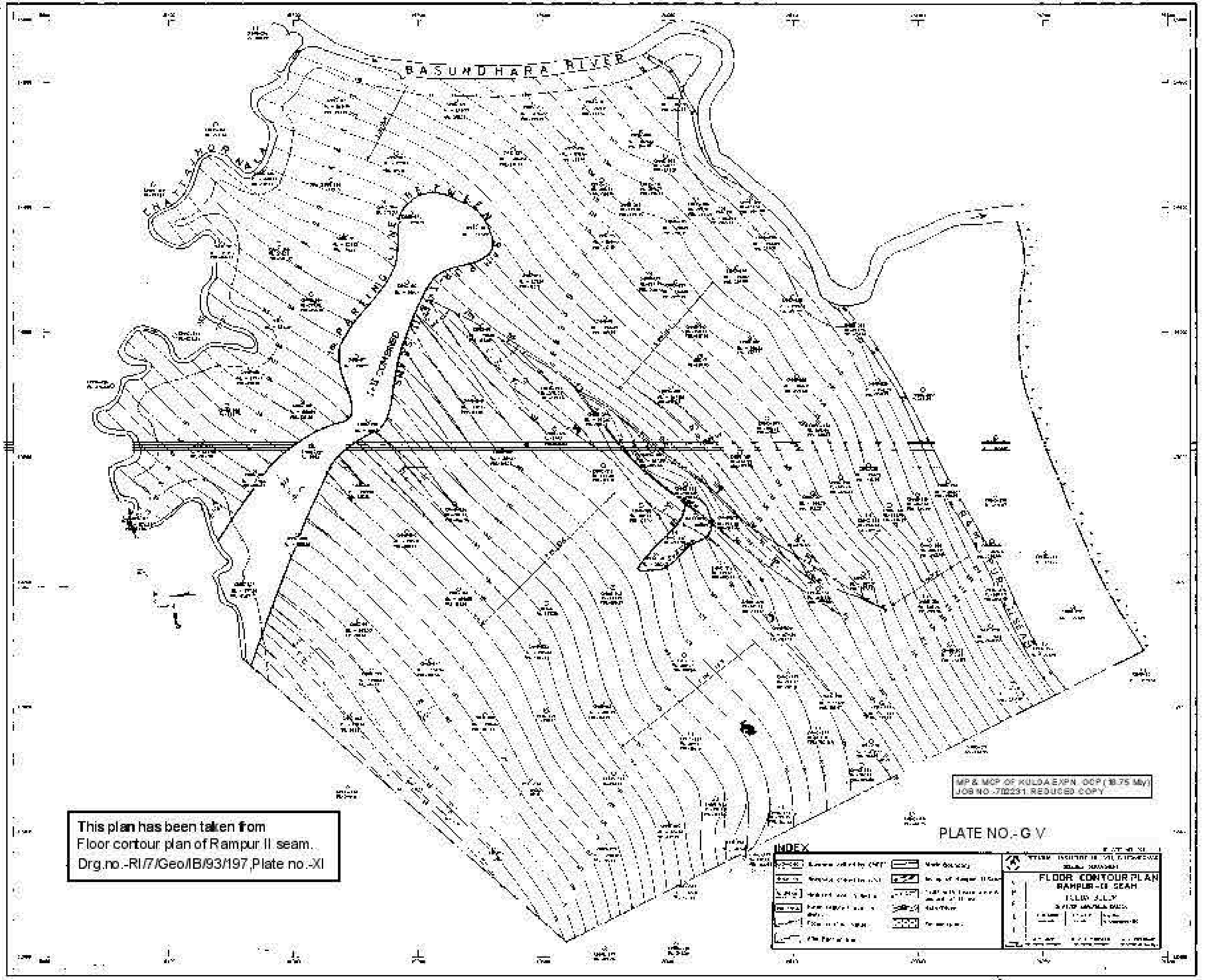
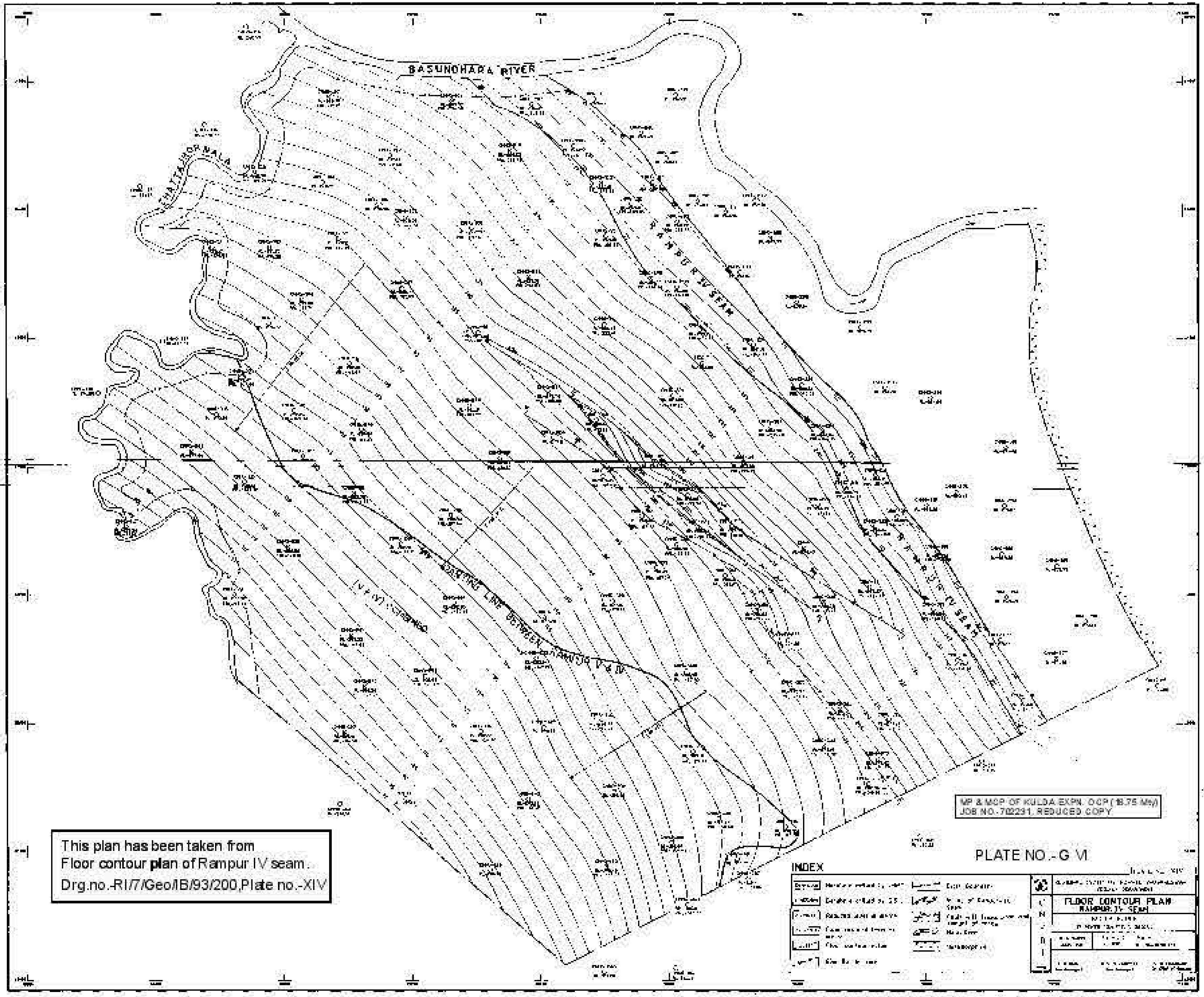
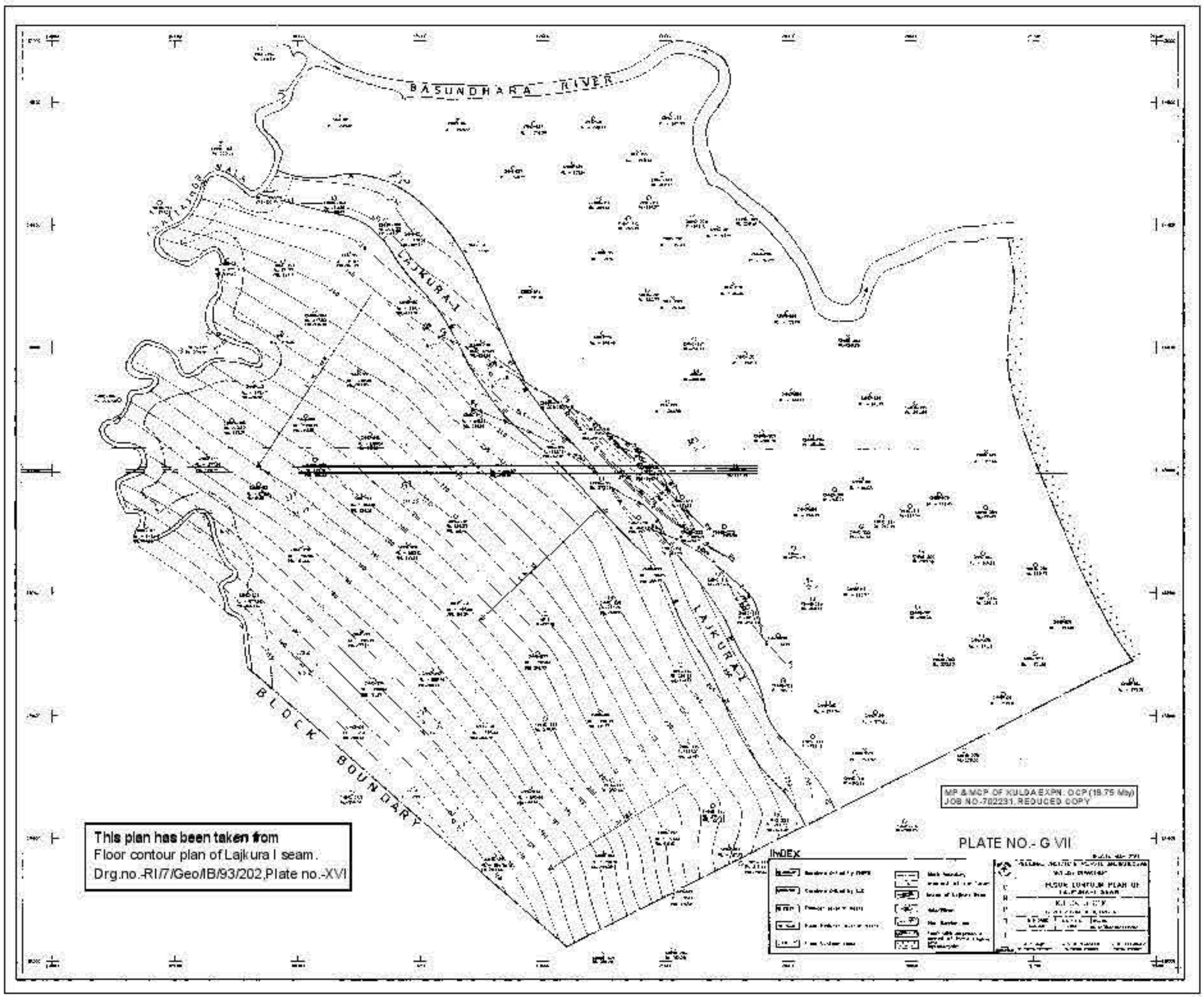


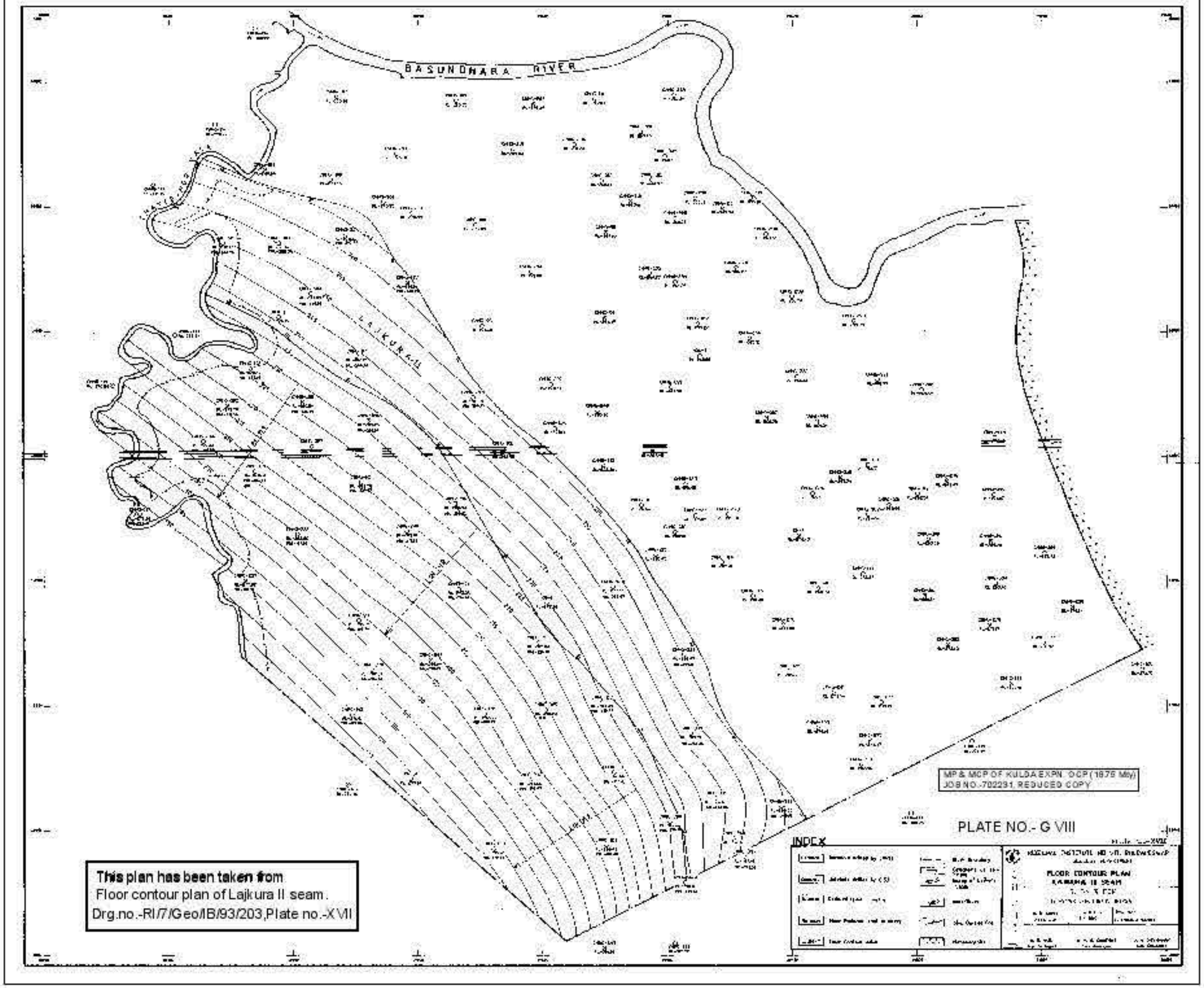
PLATE NO.- GIII
This plan has been taken from
Graphic Lithologs of Boreholes.
MP & MCP OF KULDA EXPN. OCP (18.75 Mty)
JOB NO.-702231, REDUCED COPY
KULDA BLOCK
GRAPHIC LITHOLOGS OF BOREHOLES

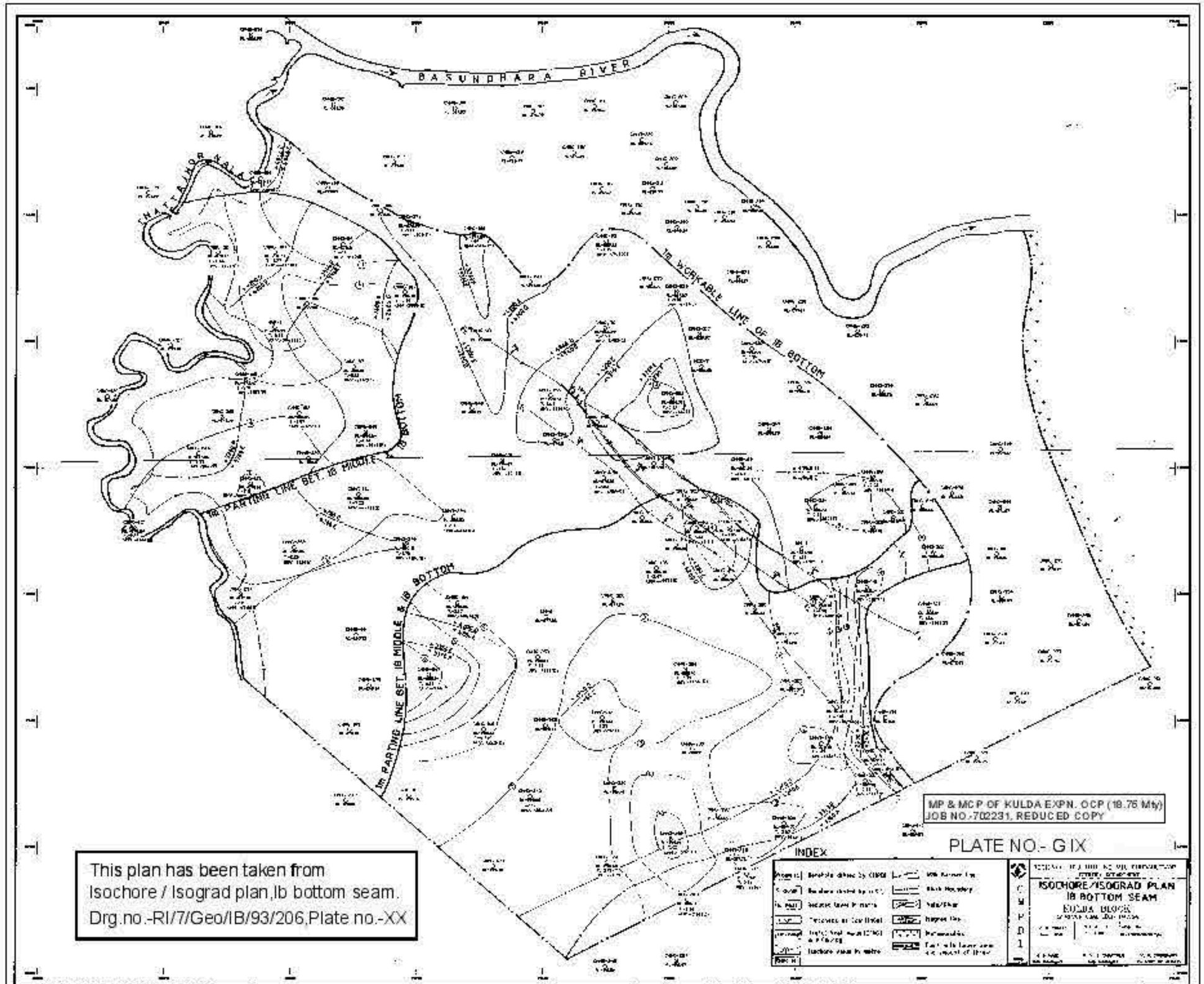

BASUNDHARA RIVER
INDEX
FLOOR CONTOUR PLAN
IB BOTTOM SEAM
KULDA BLOCK
PLATE NO.- G IV
MP & MCP OF KULDA EXPN. OCP (18.75 Mty)
JOB NO.-702231, REDUCED COPY

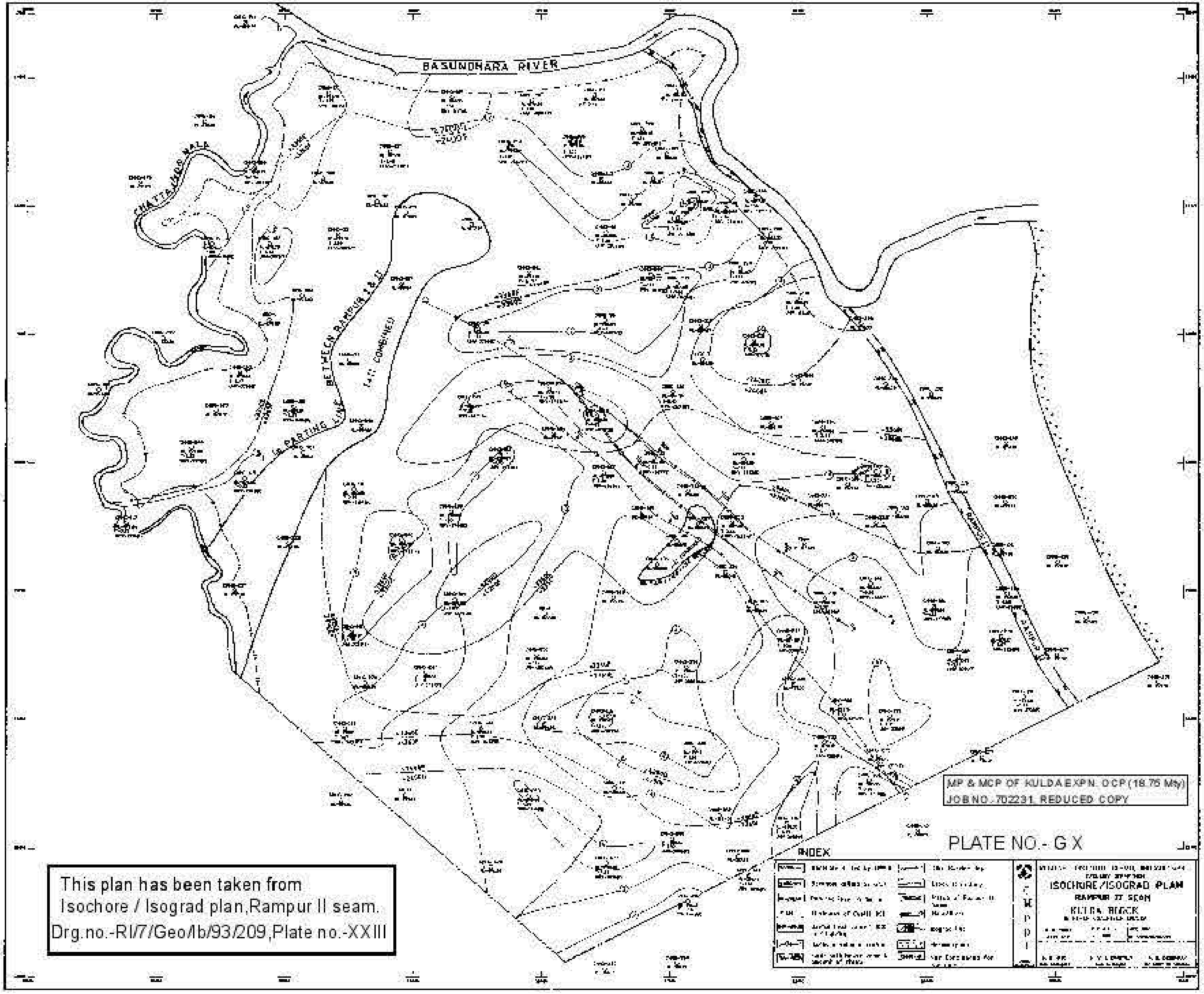

BASUNDHARA RIVER
CHATTAIMORNALA
PARTING LINE BETWEEN
COMBINED
MP & MCP OF KULDA EXPN. OCP (18.75 Mty)
JOB NO.-702231, REDUCED COPY
This plan has been taken from
Floor contour plan of Rampur II seam.
Drg.no.-RI/7/Geo/IB/93/197,Plate no.-XI
PLATE NO.- G V
INDEX
FLOOR CONTOUR PLAN
RAMPUR-II SEAM


BASUNDHARA RIVER
RAMPUR IV SEAM
This plan has been taken from
Floor contour plan of Rampur IV seam.
Drg.no.-RI/7/Geo/IB/93/200,Plate no.-XIV
MP & MCP OF KULDA EXPN. OCP (18.75 Mty)
JOB NO.-702231, REDUCED COPY
PLATE NO.- G VI
INDEX
FLOOR CONTOUR PLAN
RAMPUR IV SEAM

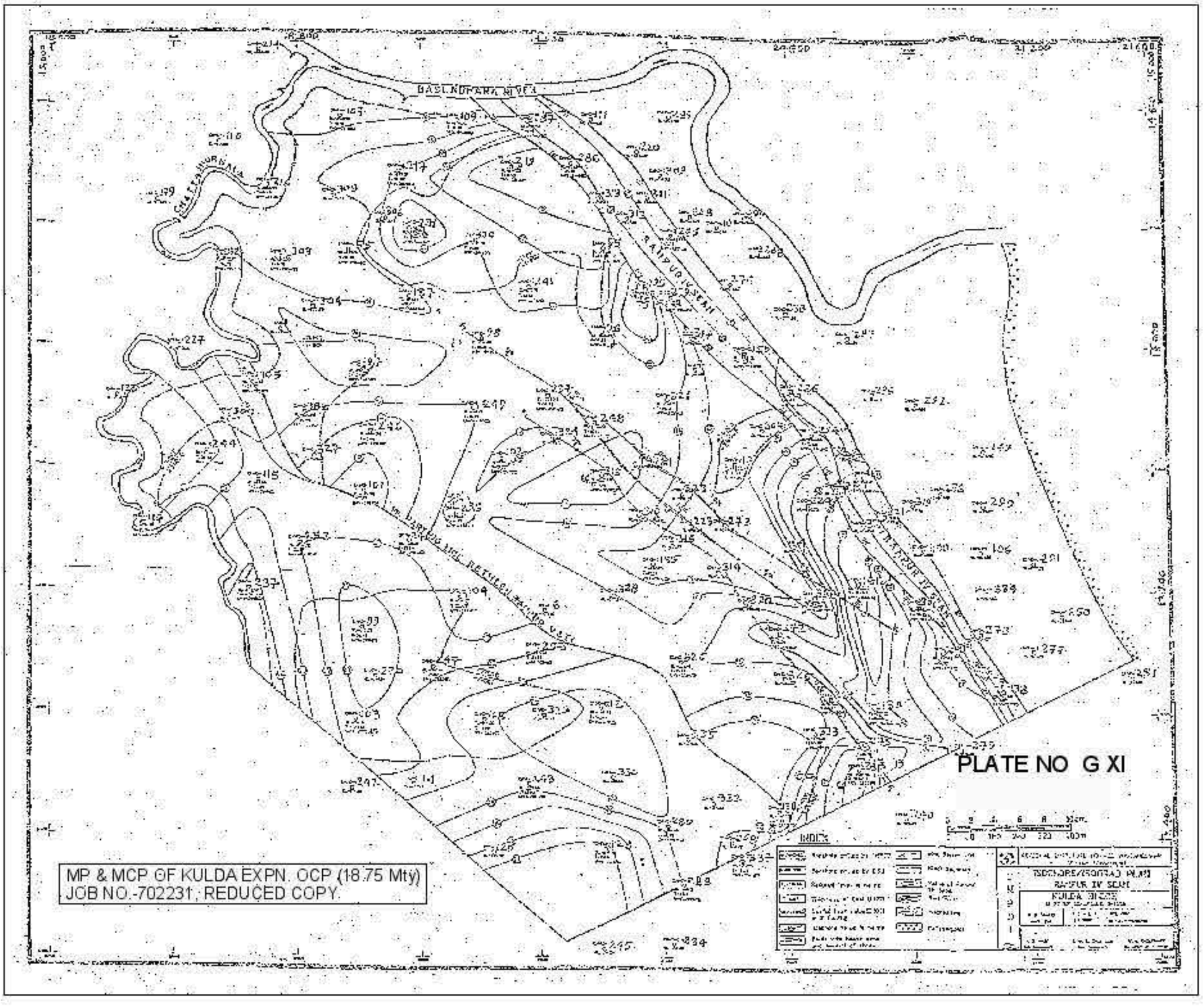

BASUNDHARA RIVER
LAJKURAJ
LAJKURAJ
BLOCK BOUNDARY
MP & MCP OF KULDA EXPN. OCP (18.75 Mty)
JOB NO-702231, REDUCED COPY
This plan has been taken from
Floor contour plan of Lajkura I seam.
Drg.no.-RI/7/Geo/IB/93/202,Plate no.-XVI
PLATE NO.- G VII
INDEX


BASUNDHARA RIVER
LAJKURA-II
MP & MCP OF KULDA EXPN. OCP (1675 Mty)
JOB NO.-702291, REDUCED COPY
PLATE NO.- G VIII
INDEX
FLOOR CONTOUR PLAN
This plan has been taken from
Floor contour plan of Lajkura II seam.
Drg.no.-RI/7/Geo/IB/93/203,Plate no.-XVII


BASUNDHARA RIVER
JHANJRA NALA
IB WORKABLE LINE OF IB BOTTOM
IB PARTING LINE SET IB MIDDLE
IB PARTING LINE SET IB BOTTOM
IB MIDDLE & IB BOTTOM
This plan has been taken from
Isochore / Isograd plan,Ib bottom seam.
Drg.no.-RI/7/Geo/IB/93/206,Plate no.-XX
MP & MCP OF KULDA EXPN. OCP (18.75 Mty)
JOB NO.-702231, REDUCED COPY
PLATE NO.- G IX
INDEX
ISOCHORE/ISOGRAD PLAN
IB BOTTOM SEAM
KULDA BLOCK



This plan has been taken from
Isochore / Isograd plan,Rampur II seam.
Drg.no.-RI/7/Geo/Ib/93/209,Plate no.-XXIII


MP & MCP OF KULDA EXPN. OCP (18.75 Mty)
JOB NO.-702231, REDUCED COPY.
PLATE NO G XI

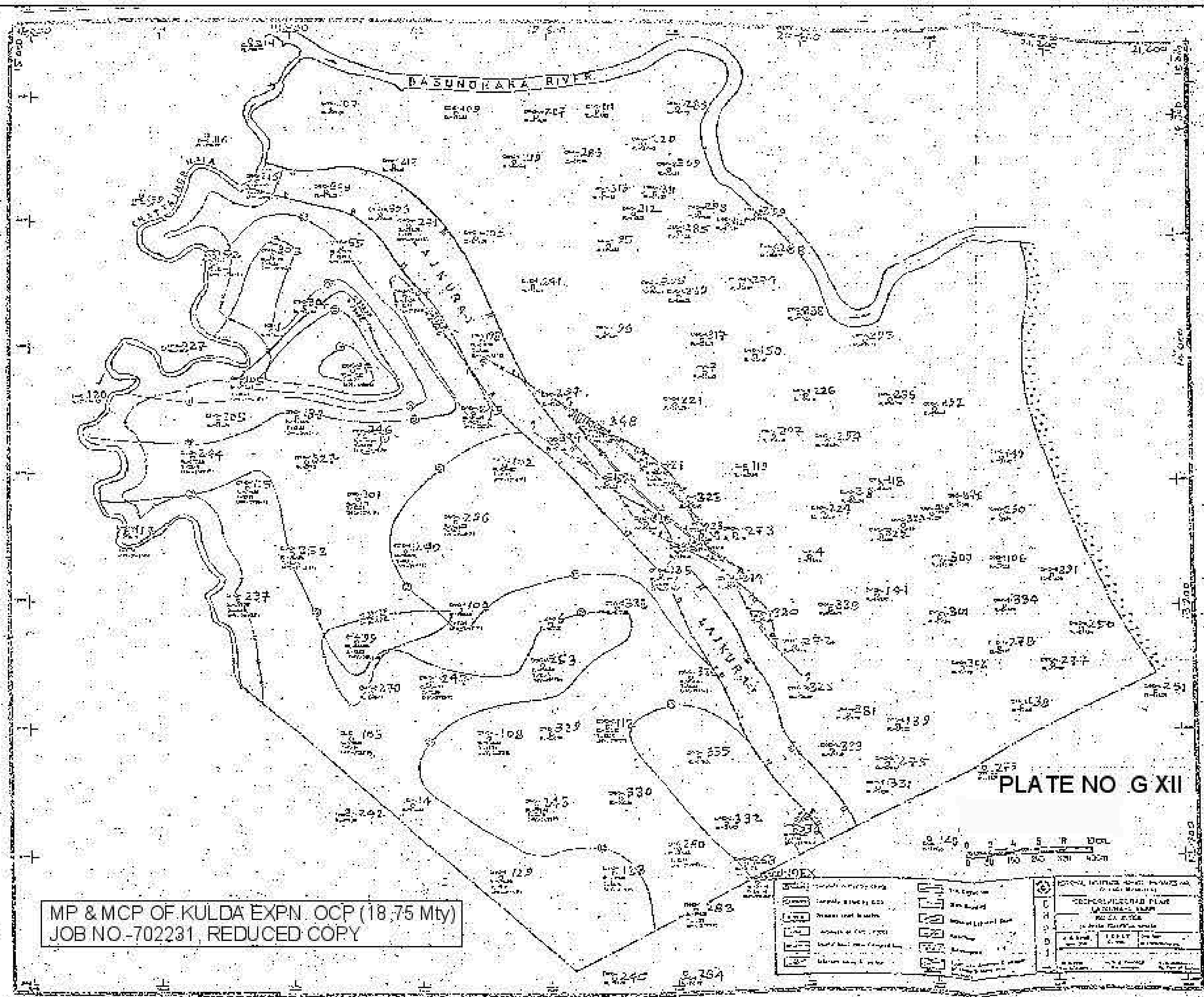
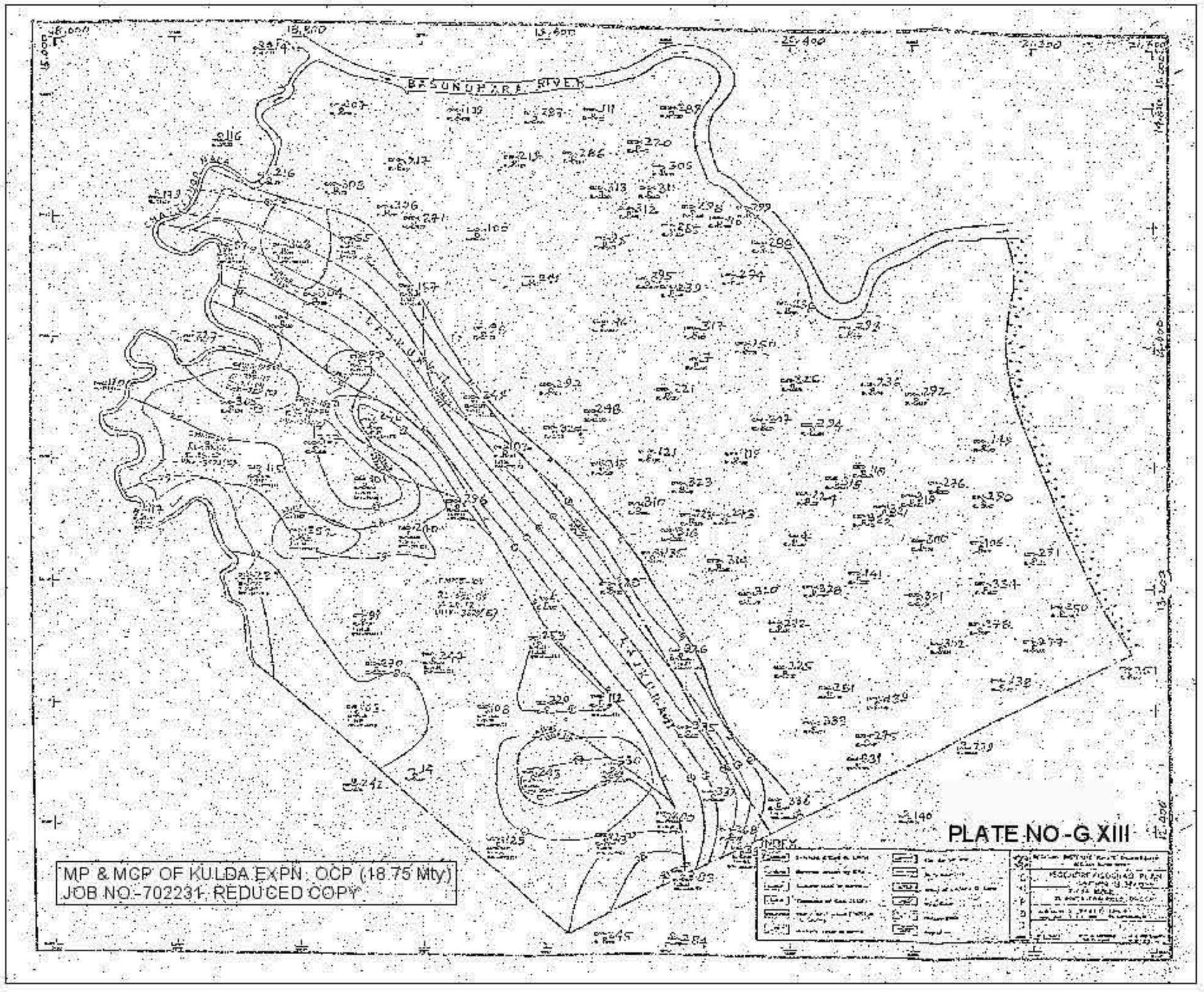
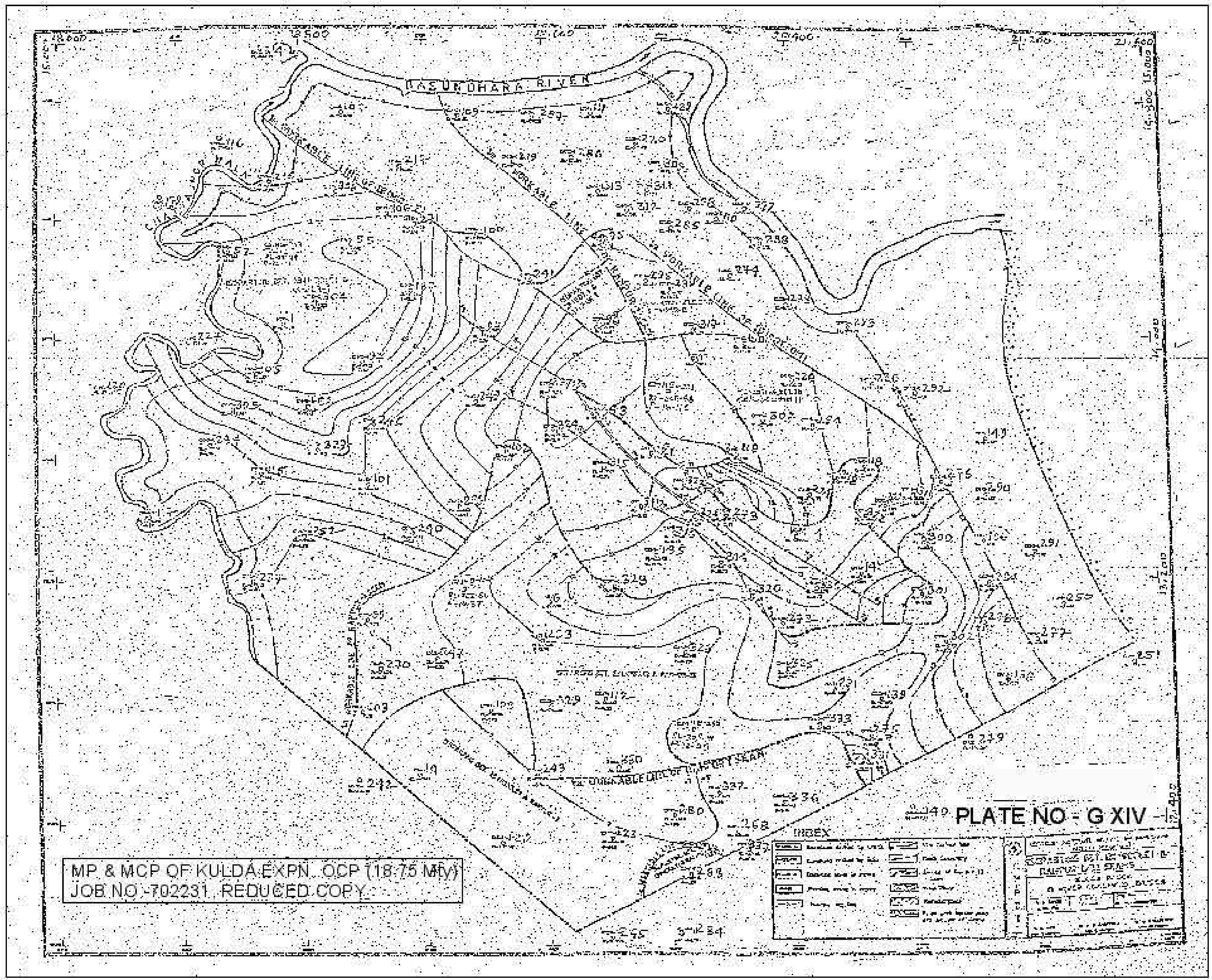
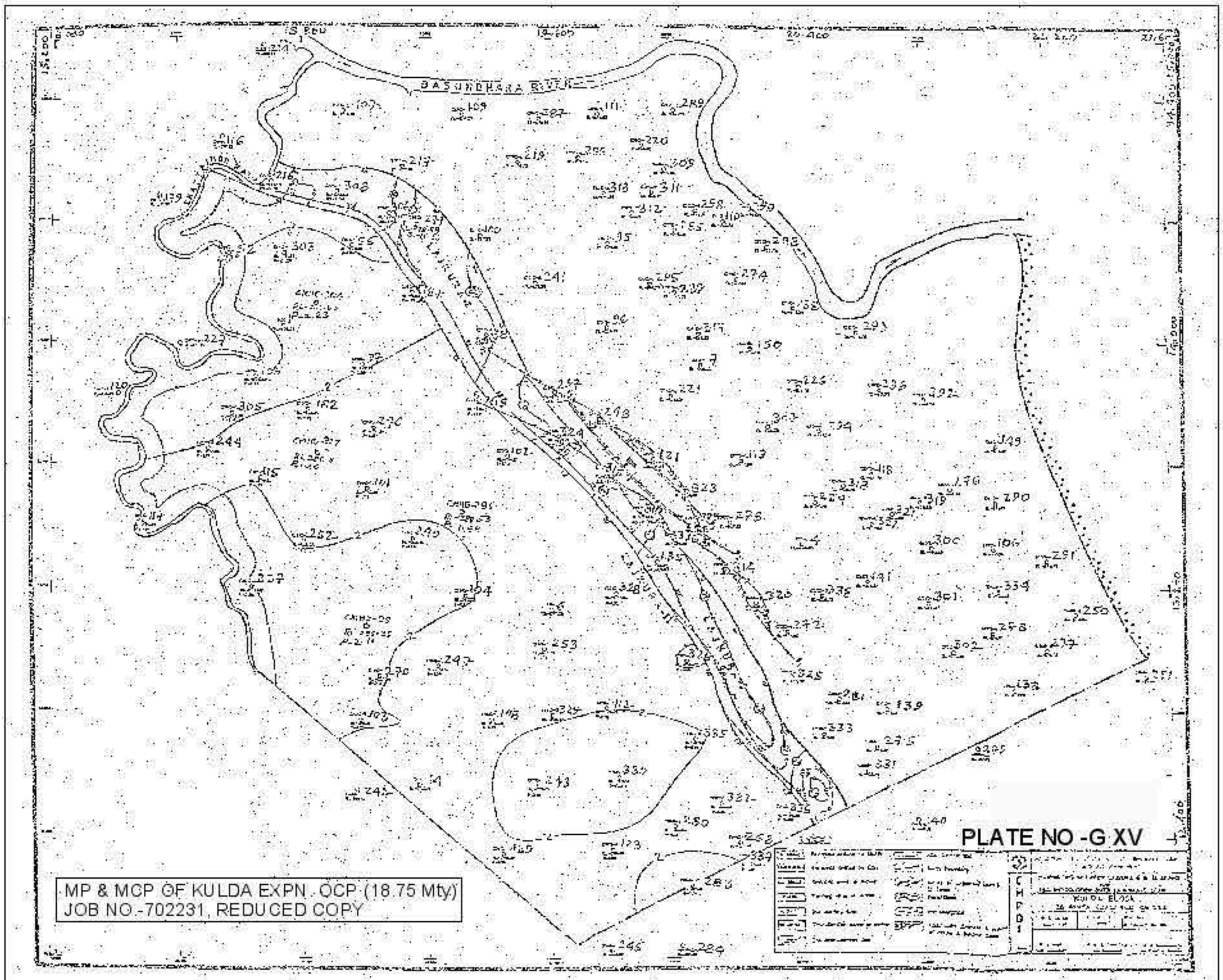


PLATE NO .G XII

MP & MCP OF KULDA EXPN. OCP (18.75 Mty)
JOB NO.-702231, REDUCED COPY


BASUNDHARA RIVER
MP & MCP OF KULDA EXPN. OCP (18.75 Mty)
JOB NO.-702231, REDUCED COPY
PLATE NO-G XIII


BASUNDHARA RIVER
PLATE NO - G XIV
MP. & MCP OF KULDA EXPN. OCP (18.75 Mty)
JOB NO -702231, REDUCED COPY
INDEX


BASUNDHARA RIVER
MP & MCP OF KULDA EXPN. OCP (18.75 Mty)
JOB NO.-702231, REDUCED COPY
PLATE NO -G XV

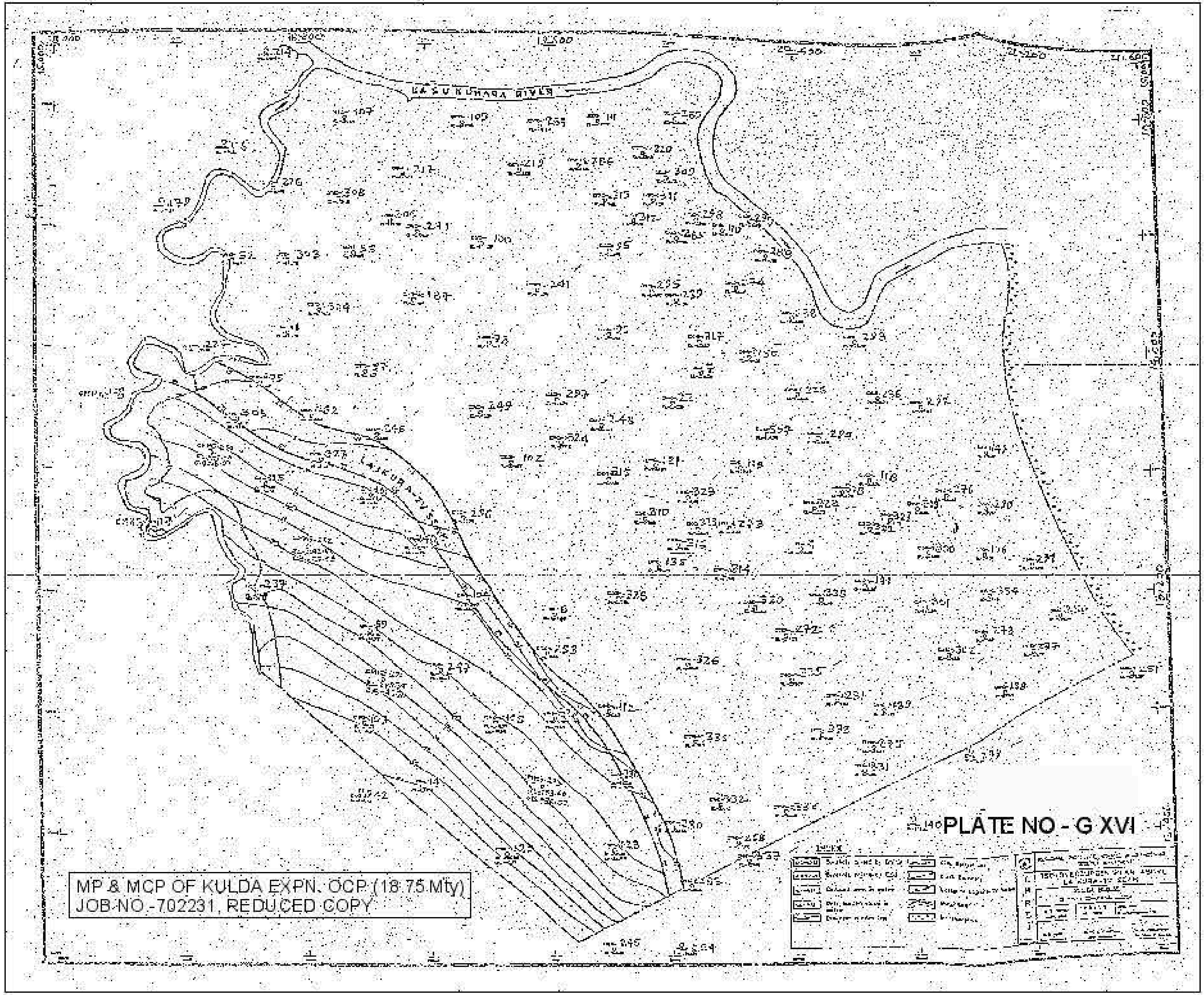
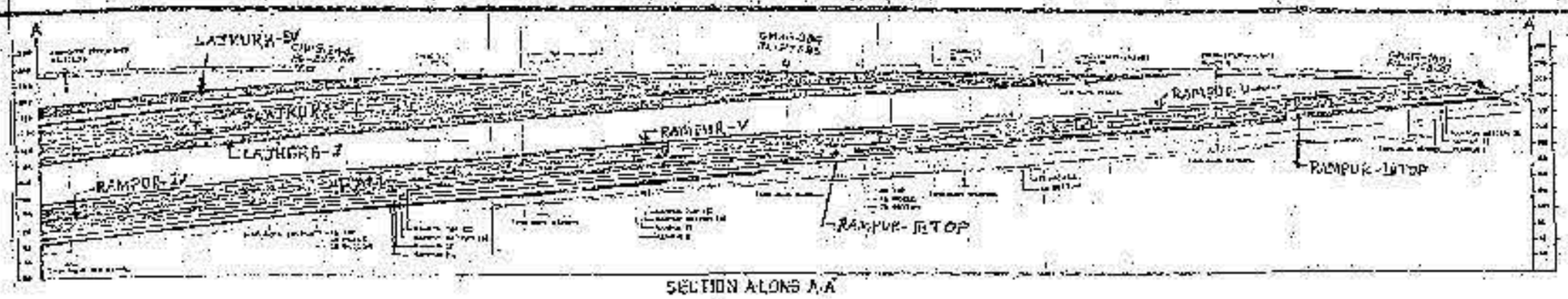
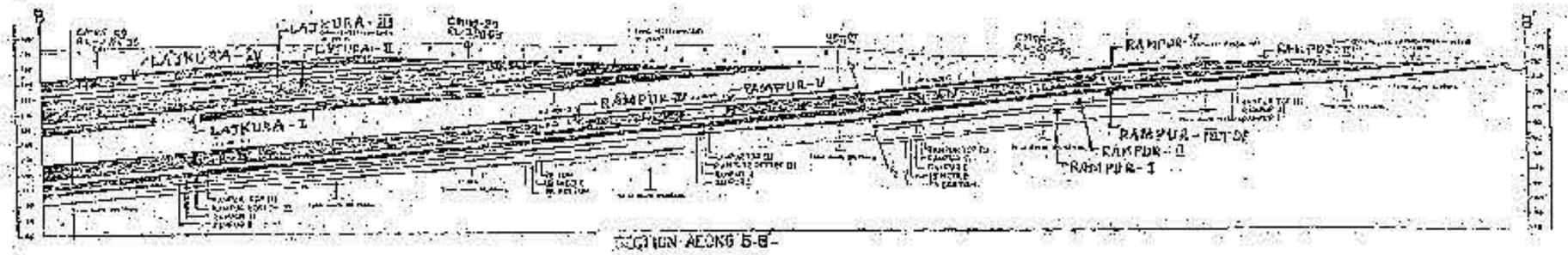


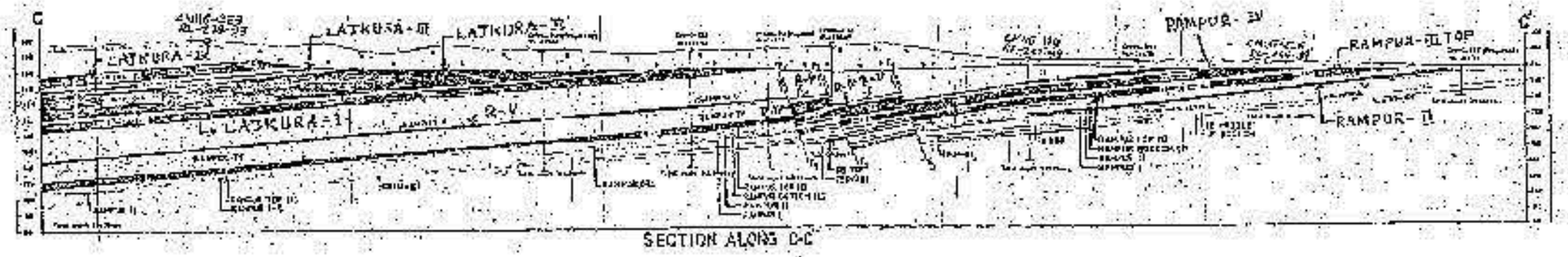
PLATE NO - G XVI
MP & MCP OF KULDA EXPN. OCP (18.75 Mty)
JOB NO.-702231, REDUCED COPY



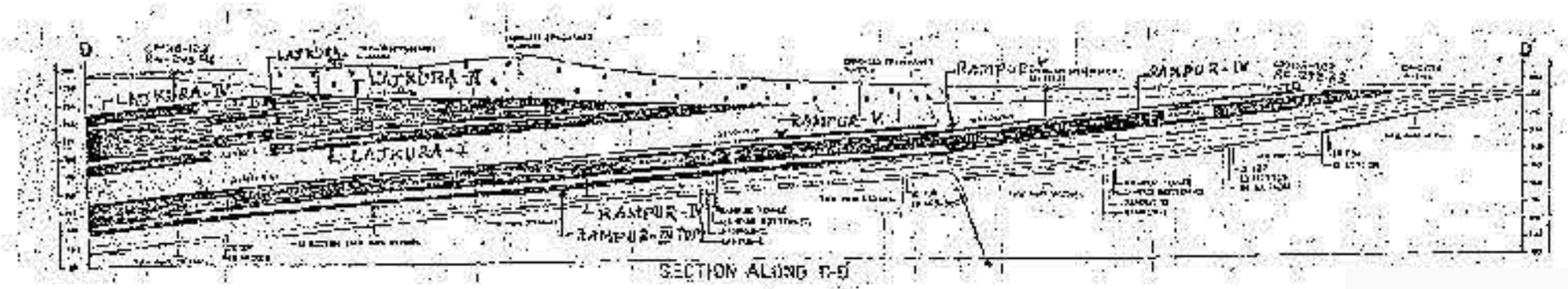
SECTION ALONG A-A'



SECTION ALONG B-B'



SECTION ALONG C-C'



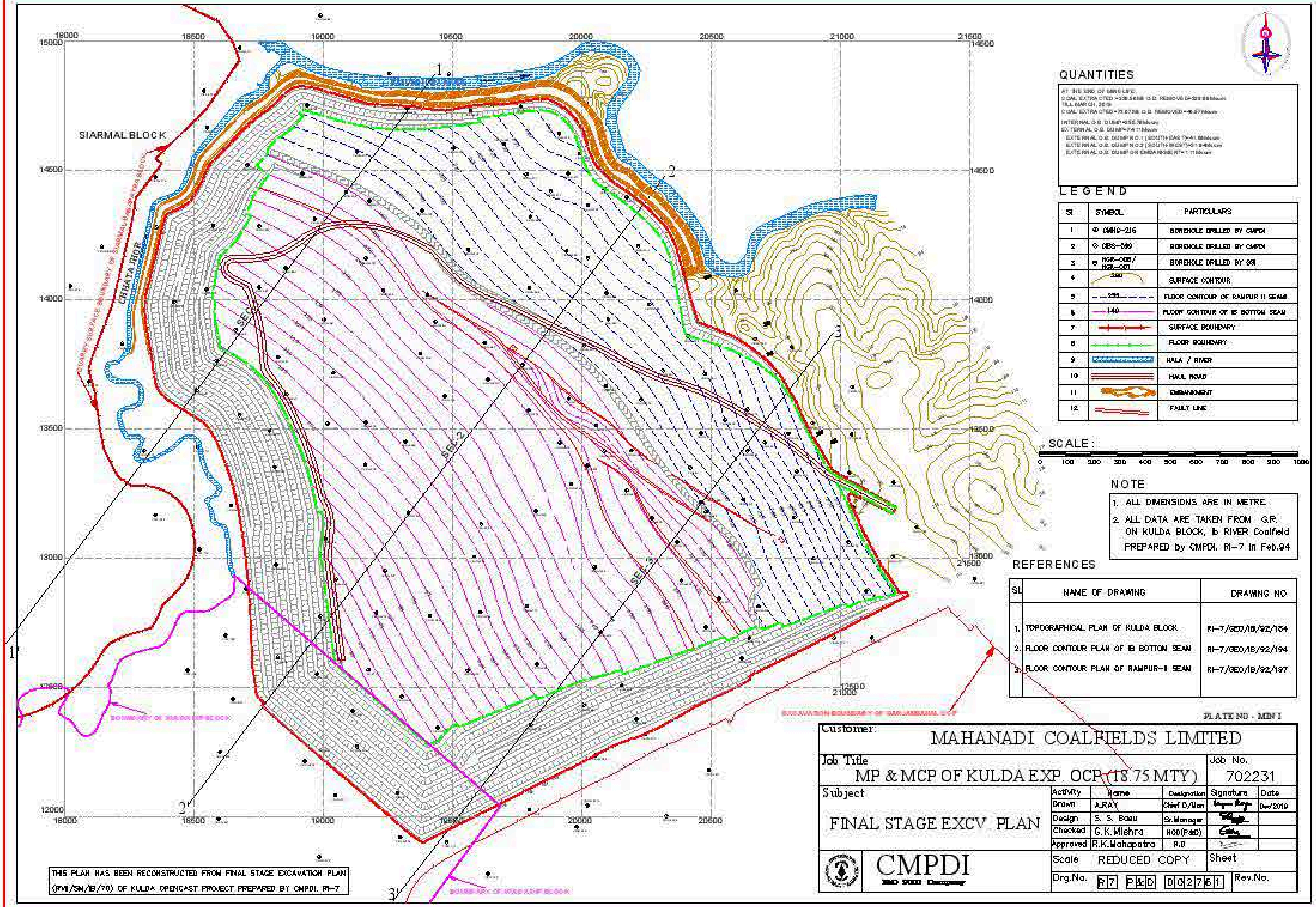
SECTION ALONG D-D'

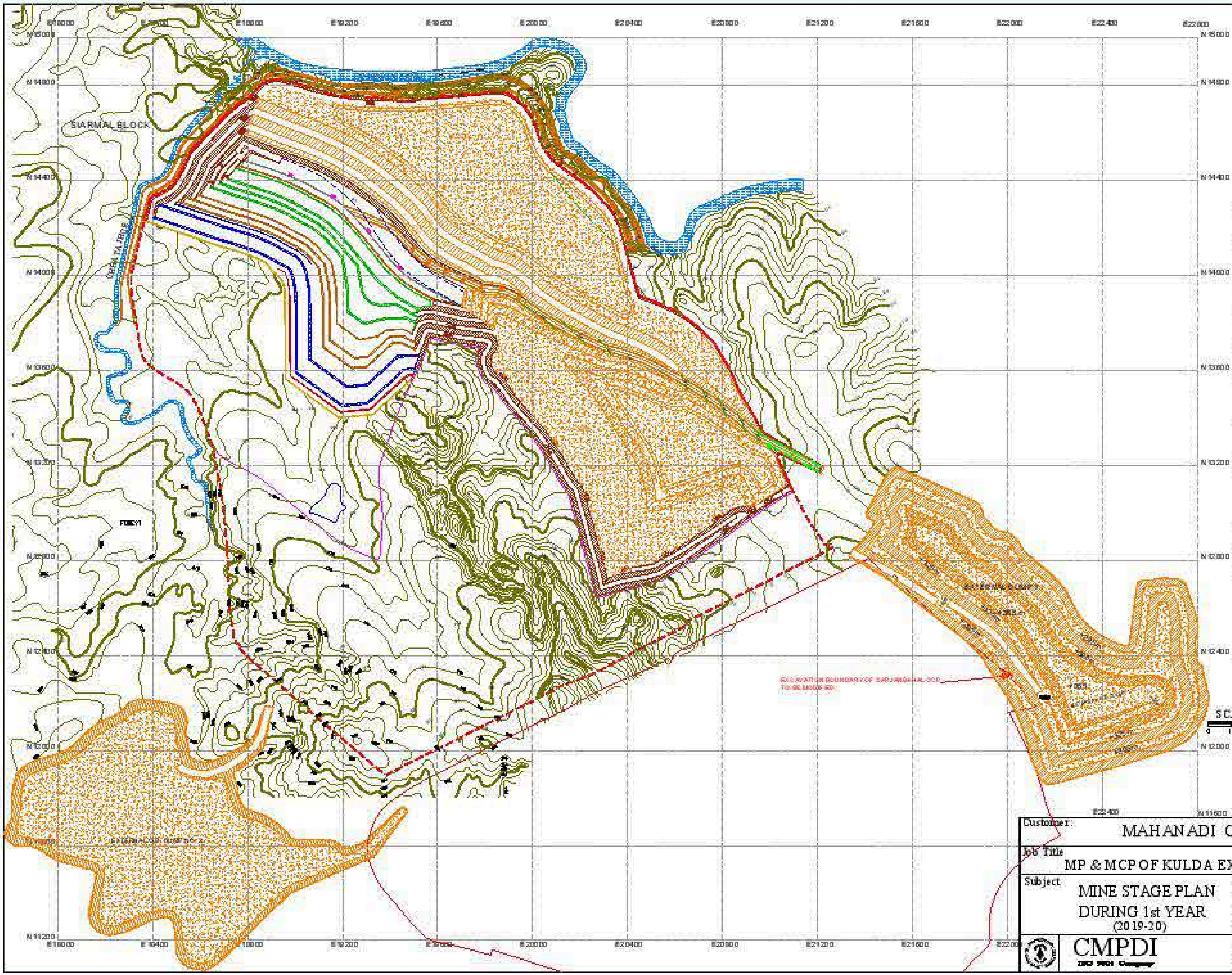
PLATE NO.- G.XVII

MP & MCP OF KULDA EXPN. OCP (18.75 MTy)
JOB NO.-702231 REDUCED COPY

GEOLOGICAL CROSS-SECTION ALONG A-A', B-B', C-C' & D-D'

KULDA BLOCK


SIARMAL BLOCK
QUANTITIES
LEGEND
Sl | SYMBOL | PARTICULARS
1 | CMKC-216 | BOREHOLE DRILLED BY CMPDI
2 | CBS-399 | BOREHOLE DRILLED BY CMPDI
3 | NGK-008/NGK-001 | BOREHOLE DRILLED BY GSI
4 | 280 | SURFACE CONTOUR
5 | 250 | FLOOR CONTOUR OF RAMPUR II SEAM
6 | 140 | FLOOR CONTOUR OF IB BOTTOM SEAM
7 | SURFACE BOUNDARY
8 | FLOOR BOUNDARY
9 | NALA / RIVER
10 | HAUL ROAD
11 | EMBANKMENT
12 | FAULT LINE
SCALE :
0 100 200 300 400 500 600 700 800 900 1000
NOTE
1. ALL DIMENSIONS ARE IN METRE.
2. ALL DATA ARE TAKEN FROM G.R. ON KULDA BLOCK, Ib RIVER Coalfield PREPARED by CMPDI, RI-7 in Feb.94
REFERENCES
SL | NAME OF DRAWING | DRAWING NO
1. TOPOGRAPHICAL PLAN OF KULDA BLOCK | RI-7/GEO/IB/92/184
2. FLOOR CONTOUR PLAN OF IB BOTTOM SEAM | RI-7/GEO/IB/92/194
3. FLOOR CONTOUR PLAN OF RAMPUR-II SEAM | RI-7/GEO/IB/92/197
PLATE NO - MIN I
Customer: MAHANADI COALFIELDS LIMITED
Job Title: MP & MCP OF KULDA EXP. OCP (18.75 MTY)
Job No. 702231
Subject: FINAL STAGE EXCV. PLAN
Activity | Name | Designation | Signature | Date
Drawn | A.RAY | Chief D/Man | | Dec/2019
Design | S. S. Basu | Sr.Manager
Checked | G.K.Mishra | HOD(P&D)
Approved | R.K.Mohapatra | R.D
CMPDI
Scale REDUCED COPY
Sheet
Drg.No. R7 P&D 002761
Rev.No.
THIS PLAN HAS BEEN RECONSTRUCTED FROM FINAL STAGE EXCAVATION PLAN (FMI/SM/IB/70) OF KULDA OPENCAST PROJECT PREPARED BY CMPDI, RI-7



LEGEND

SL	SYMBOL	PARTICULARS
1	[illegible]	BOREHOLE DRILLED BY CMPDI
2	[illegible]	BOREHOLE DRILLED BY CMPDI
3	[illegible]	BOREHOLE DRILLED BY GSI
4		SURFACE CONTOUR
5		FLOOR CONTOUR OF RAMPUR II SEAM
6		FLOOR CONTOUR OF IB BOTTOM SEAM
7		NALA / RIVER
8		HAUL ROAD
9		SURFACE BOUNDARY
10		FLOOR BOUNDARY
11		EMBANKMENT
12		OB DUMP

NOTE

1. ALL DIMENSIONS ARE IN METRE.
2. ALL DATA ARE TAKEN FROM GR ON KULDA BLOCK, IB RIVER COALFIELD PREPARED BY CMPDI RI-7 in Feb.94.

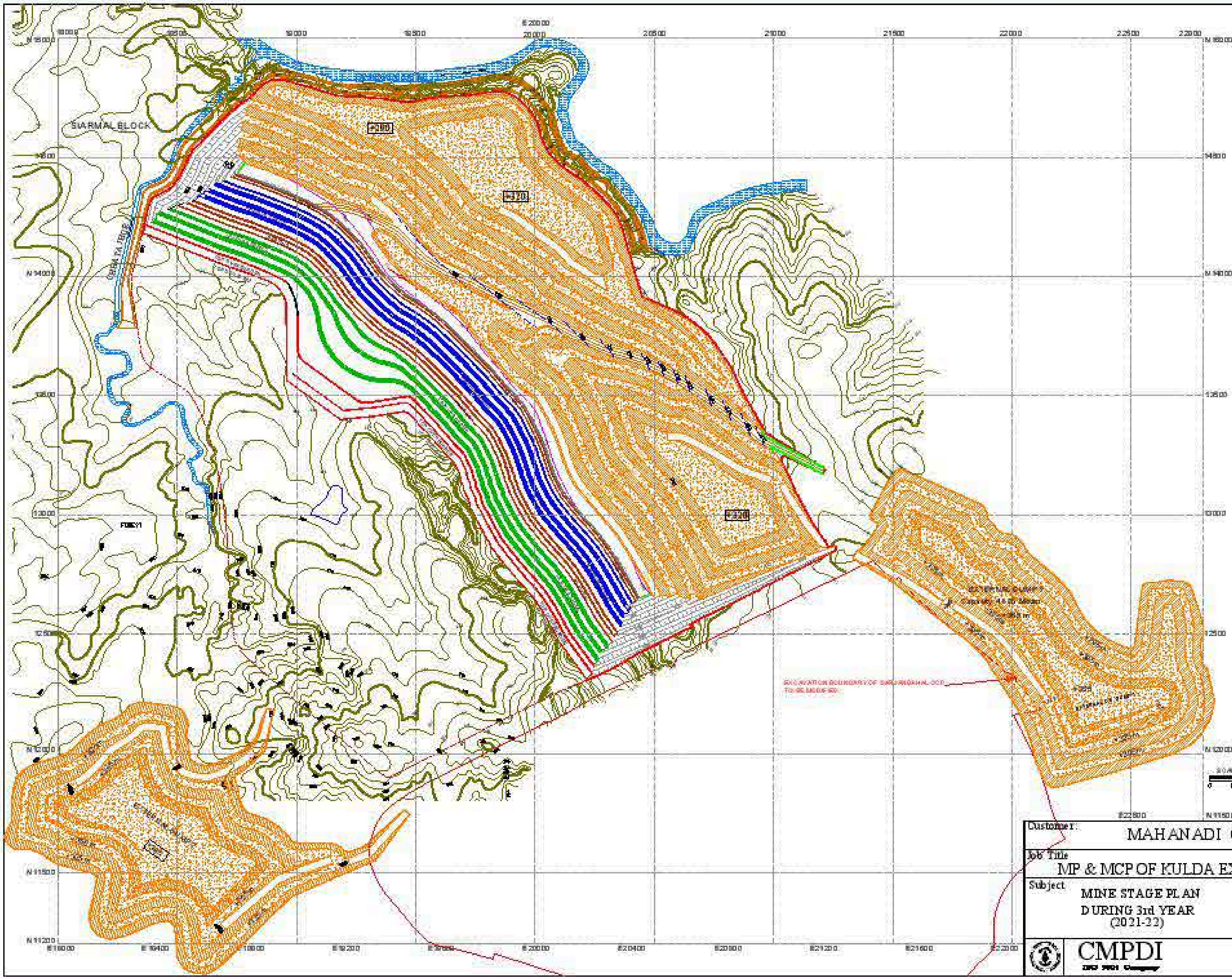
REFERENCES

Sl.	NAME OF DRAWING	DRAWING NO
1.	TOPOGRAPHICAL PLAN OF KULDA BLOCK	RI-7/GEO/IB/[illegible]
2.	FLOOR CONTOUR PLAN OF IB BOTTOM SEAM	RI-7/GEO/IB/[illegible]
3.	FLOOR CONTOUR PLAN OF RAMPUR-II SEAM	RI-7/GEO/IB/[illegible]

SCALE : 0 100 200 300 400 500 600 700 800 900 1000

PLATE NO -MIN II

Customer:	MAHANADI COALFIELDS LIMITED				
Job Title	MP & MCP OF KULDA EXP. OCP (18.75 MTY)			Job No. 702231	
Subject	Activity	Name	Designation	Signature	Date
MINE STAGE PLAN DURING 1st YEAR (2019-20)	Drawn	A.RAY	Chief D/Man		
	Design	S. K. BASU	Sr.Manager		
	Checked	G.K.MISHRA	HOD(P&D)		
	Approved	[illegible]	R.D.		
CMPDI ISO 9001 Company	Scale — REDUCED COPY			Sheet	
	Drg.No R7 P&D 002782			Rev.No.	



LEGEND

SL	SYMBOL	PARTICULARS
1	CMHR-215	BOREHOLE DRILLED BY CMPDI
2	DBS-239	BOREHOLE DRILLED BY CMPDI
3	HGP-005/ HGE-001	BOREHOLE DRILLED BY GSI
4	290	SURFACE CONTOUR
5	290	FLOOR CONTOUR OF RAMPUR II SEAM
6	140	FLOOR CONTOUR OF IB BOTTOM SEAM
7		SURFACE BOUNDARY
8		FLOOR BOUNDARY
9		NALA / RIVER
10		HAUL ROAD
11		EMBANKMENT
12		OB DUMP

NOTE

1. ALL DIMENSIONS ARE IN METRE.
2. ALL DATA ARE TAKEN FROM G.R. ON KULDA BLOCK, IB RIVER Coalfield PREPARED by CMPDI RI-7 in Feb/94.

REFERENCES

SL.	NAME OF DRAWING	DRAWING NO
1.	TOPOGRAPHICAL PLAN OF KULDA BLOCK	RI-7/GEO/IB/88/184
2.	FLOOR CONTOUR PLAN OF IB BOTTOM SEAM	RI-7/GEO/IB/88/184
3.	FLOOR CONTOUR PLAN OF RAMPUR-II SEAM	RI-7/GEO/IB/82/187

SCALE
0 100 200 300 400 500 600 700 800 900 1000

PLATE NO - MIN III

Customer: MAHANADI COALFIELDS LIMITED

Job Title: MP & MCP OF KULDA EXP. OCP (18.75 MTY)

Job No. 702231

Subject: MINE STAGE PLAN DURING 3rd YEAR (2021-22)

Activity	Name	Designation	Signature	Date
Drawn	A.RAY	Chief D/Man		
Design	S. S. Basu	Sr.Manager		
Checked	G.K.Mishra	HOD(P&D)		
Approved	R.K.Mohapatra	R.D.		

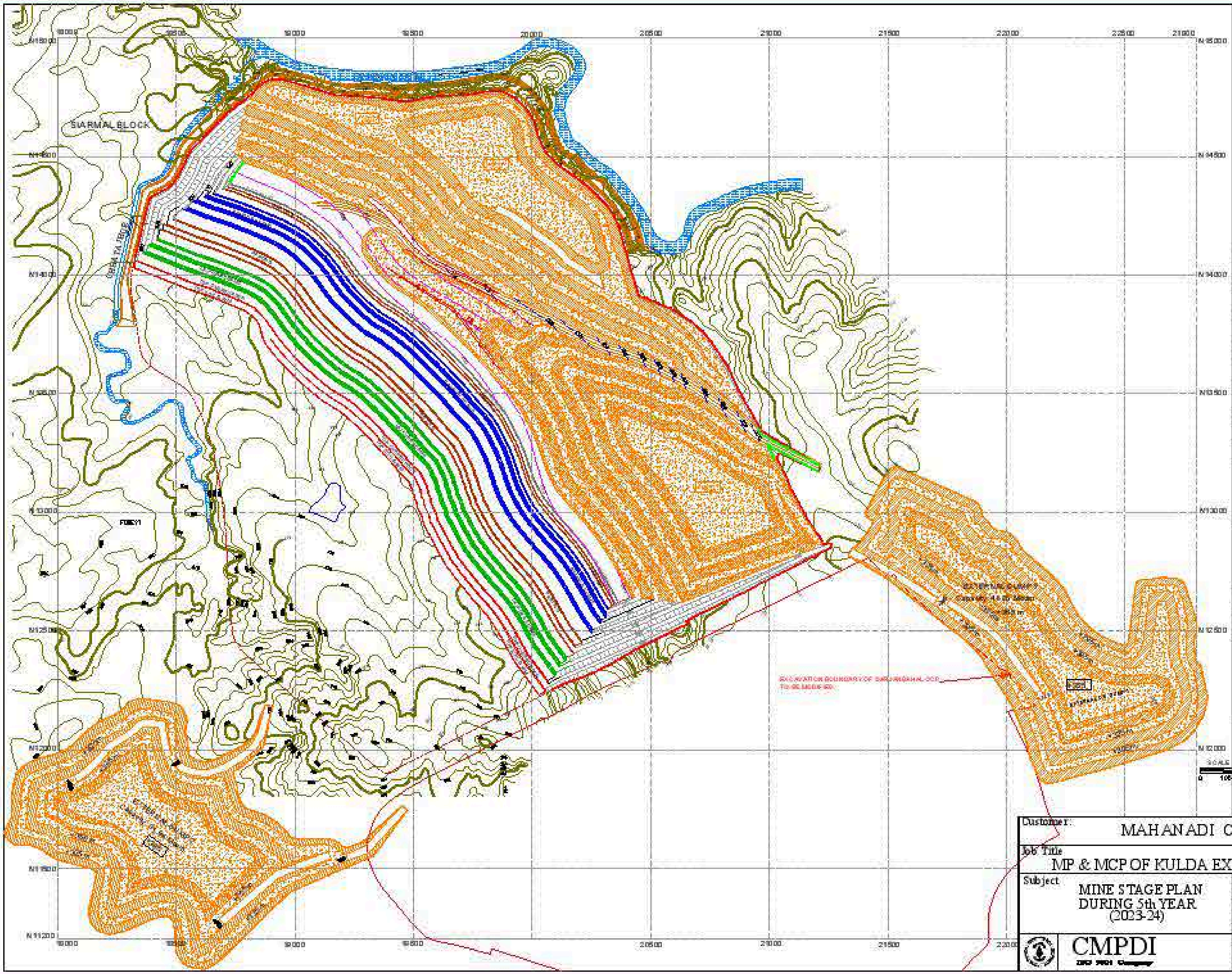
CMPDI
ISO 9001 Company

Scale: REDUCED COPY

Sheet

Drg.No: R7 P&D 002783

Rev.No.



LEGEND

SL	SYMBOL	PARTICULARS
1	CMRF-015	BOREHOLE DRILLED BY CMPDI
2	DBS-020	BOREHOLE DRILLED BY CMPDI
3	MSP-006/ MSE-001	BOREHOLE DRILLED BY GSI
4	290	SURFACE CONTOUR
5	300	FLOOR CONTOUR OF RAMPUR II SEAM
6	340	FLOOR CONTOUR OF IB BOTTOM SEAM
7		SURFACE BOUNDARY
8		FLOOR BOUNDARY
9		NALA / RIVER
10		HAUL ROAD
11		EMBANKMENT
12		EXTERNAL DUMP

NOTE

1. ALL DIMENSIONS ARE IN METRE.
2. ALL DATA ARE TAKEN FROM GR ON KULDA BLOCK, IB RIVER Coalfield PREPARED by CMPDI, RI-7 in Feb,94.

REFERENCES

Sl.	NAME OF DRAWING	DRAWING NO
1.	TOPOGRAPHICAL PLAN OF KULDA BLOCK	RI-7/GEO/IB/KL/164
2.	FLOOR CONTOUR PLAN OF IB BOTTOM SEAM	RI-7/GEO/IB/KL/164
3.	FLOOR CONTOUR PLAN OF RAMPUR-II SEAM	RI-7/GEO/IB/KL/167

SCALE

0 100 200 300 400 500 600 700 800 900 1000

PLATE NO - MIN IV

Customer: MAHANADI COALFIELDS LIMITED

Job Title: MP & MCP OF KULDA EXP. OCP (18.75 MTY)

Job No. 702231

Subject: MINE STAGE PLAN DURING 5th YEAR (2023-24)

Activity	Name	Designation	Signature	Date
Drawn	A.RAY	Chief D/Man		Dec/2018
Design	S. S. Basu	Sr.Manager		
Checked	G.K.Mishra	HOD(P&D)		
Approved	R.K.Mohapatra	R.D.		

CMPDI

ISO 9001 Company

Scale: REDUCED COPY

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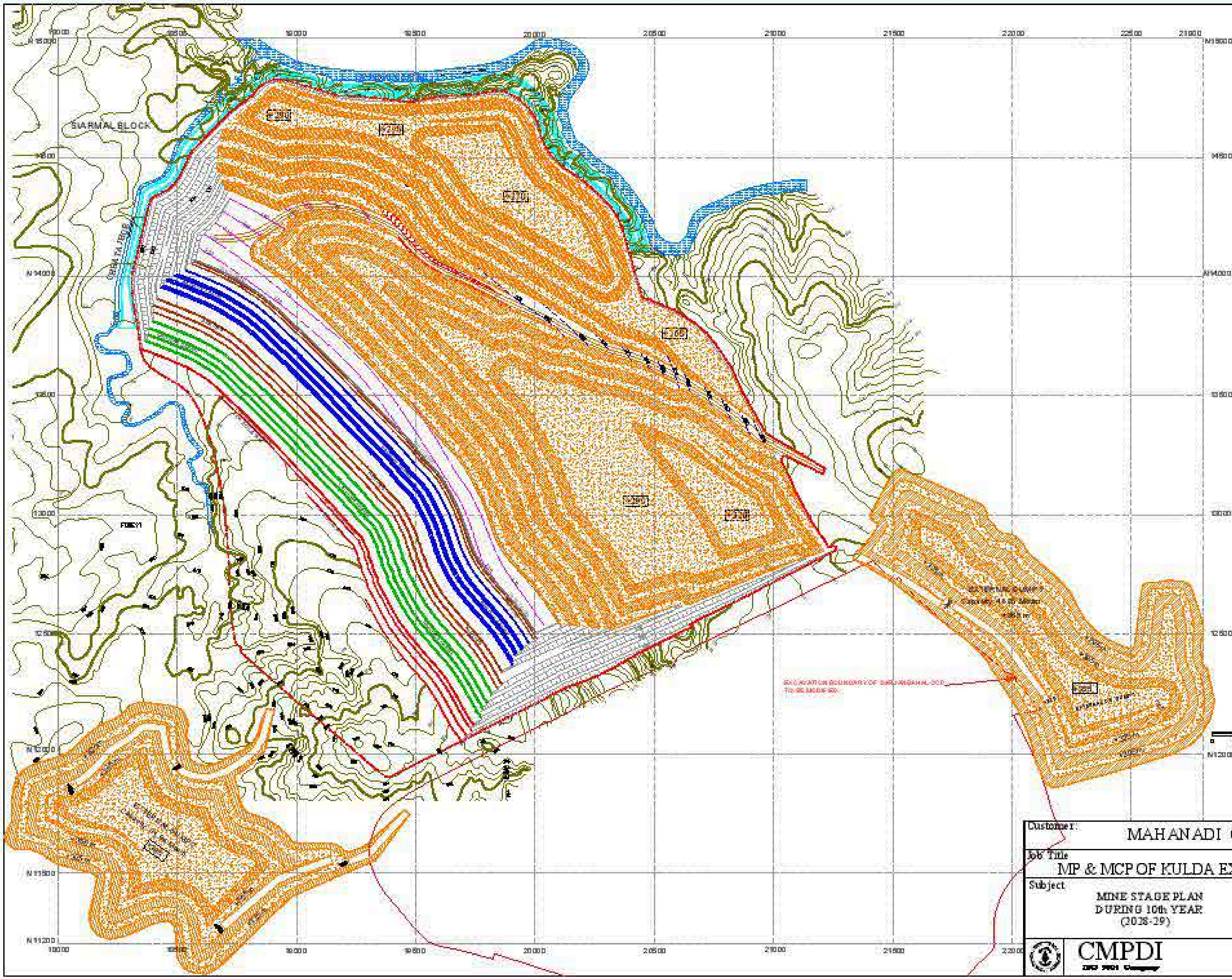
Drg.No R7 P&D 002784

Rev.No.



LEGEND

SL.	SYMBOL	PARTICULARS
1	CMKL-315	BOREHOLE DRILLED BY CMPDI
2	CBS-098	BOREHOLE DRILLED BY CMPDI
3	NMP-009/ NMR-001	BOREHOLE DRILLED BY GSI
4	270	SURFACE CONTOUR
5	255	FLOOR CONTOUR OF RAMPUR II SEAM
6	140	FLOOR CONTOUR OF IB BOTTOM SEAM
7		SURFACE BOUNDARY
8		FLOOR BOUNDARY
9		NALA / RIVER
10		HAUL ROAD
11		EMBANKMENT
12		EXTERNAL DUMP

NOTE

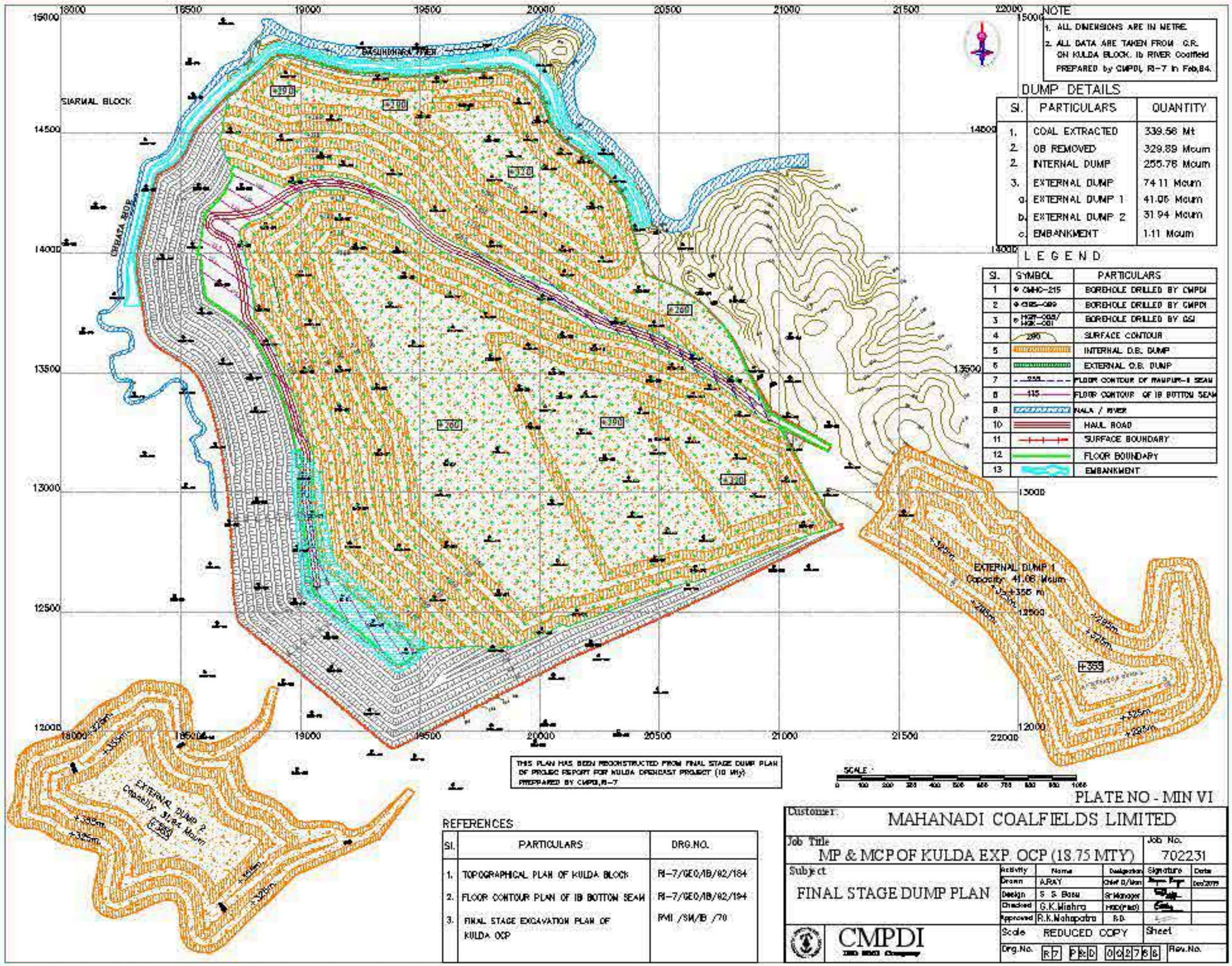
1. ALL DIMENSIONS ARE IN METRE.
2. ALL DATA ARE TAKEN FROM G.R. ON KULDA BLOCK, IB RIVER Coalfield PREPARED by CMPDI, RI-7 in Feb.94.

REFERENCES

SL.	NAME OF DRAWING	DRAWING NO
1.	TOPOGRAPHICAL PLAN OF KULDA BLOCK	RI-7/GEO/IB/92/104
2.	FLOOR CONTOUR PLAN OF IB BOTTOM SEAM	RI-7/GEO/IB/92/104
3.	FLOOR CONTOUR PLAN OF RAMPUR-II SEAM	RI-7/GEO/IB/93/107

PLATE NO - MIN V

Customer:	MAHANADI COALFIELDS LIMITED				
Job Title	MP & MCP OF KULDA EXP. OCP (18.75 MTY)			Job No.	702231
Subject	Activity	Name	Designation	Signature	Date
MINE STAGE PLAN DURING 10th YEAR (2028-29)	Drawn	A.RAY	Chief D/Man		
	Design	S. S. Basu	Sr.Manager		
	Checked	G.K.Mishra	HOD(P&D)		
	Approved	R.K.Mohapatra	R.D.		
CMPDI ISO 9001 Company	Scale	REDUCED COPY		Sheet	
	Drg.No	R7 P&D 002785		Rev.No.	



NOTE

1. ALL DIMENSIONS ARE IN METRE.
2. ALL DATA ARE TAKEN FROM G.P. ON KULDA BLOCK, Ib RIVER Coalfield PREPARED by CMPDI, R-7 in Feb,84.

DUMP DETAILS

Sl.	PARTICULARS	QUANTITY
1.	COAL EXTRACTED	339.56 Mt
2.	OB REMOVED	329.89 Mcum
2.	INTERNAL DUMP	255.78 Mcum
3.	EXTERNAL DUMP	74.11 Mcum
a.	EXTERNAL DUMP 1	41.06 Mcum
b.	EXTERNAL DUMP 2	31.94 Mcum
c.	EMBANKMENT	1.11 Mcum

LEGEND

Sl.	SYMBOL	PARTICULARS
1	⊕ CMHC-215	BOREHOLE DRILLED BY CMPDI
2	⊕ CMR-089	BOREHOLE DRILLED BY CMPDI
3	⊕ HGR-003/ HGR-001	BOREHOLE DRILLED BY GSI
4	290	SURFACE CONTOUR
5		INTERNAL O.B. DUMP
6		EXTERNAL O.B. DUMP
7	255	FLOOR CONTOUR OF RAMPUR-II SEAM
8	415	FLOOR CONTOUR OF IB BOTTOM SEAM
9		NALA / RIVER
10		HAUL ROAD
11		SURFACE BOUNDARY
12		FLOOR BOUNDARY
13		EMBANKMENT

REFERENCES

Sl.	PARTICULARS	DRG.NO.
1.	TOPOGRAPHICAL PLAN OF KULDA BLOCK	R-7/GEO/IB/82/184
2.	FLOOR CONTOUR PLAN OF IB BOTTOM SEAM	R-7/GEO/IB/82/194
3.	FINAL STAGE EXCAVATION PLAN OF KULDA OCP	RMI /SM/IB /70

PLATE NO - MIN VI

Customer: MAHANADI COALFIELDS LIMITED

Job Title: MP & MCP OF KULDA EXP. OCP (18.75 MTY) — Job No. 702231

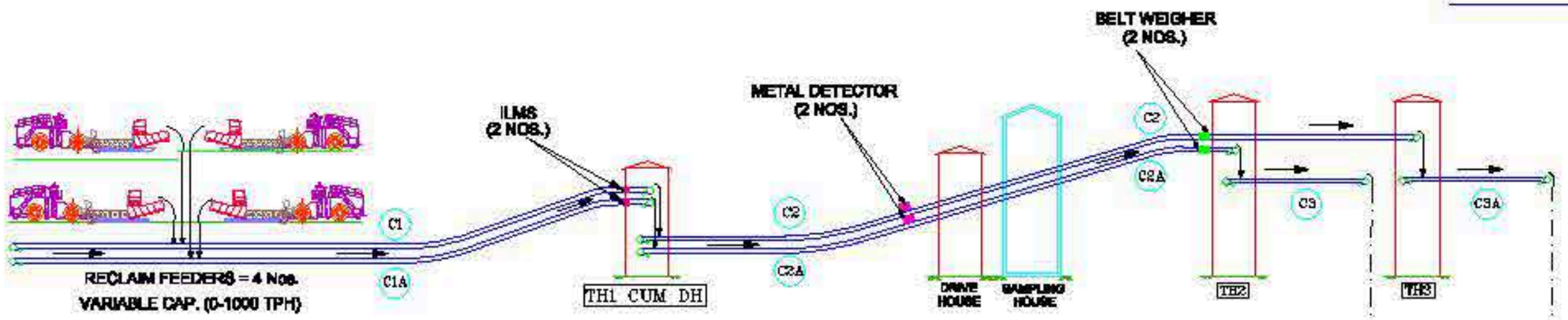
Subject: FINAL STAGE DUMP PLAN

Activity	Name	Designation	Signature	Date
Drawn	A.RAY	Chief D/Man		Dec/2019
Design	S. S. Basu	Sr.Manager		
Checked	G.K.Mishra	HOD(Plan)		
Approved	R.K.Mahapatra	G.M.		

CMPDI — Scale: REDUCED COPY — Sheet

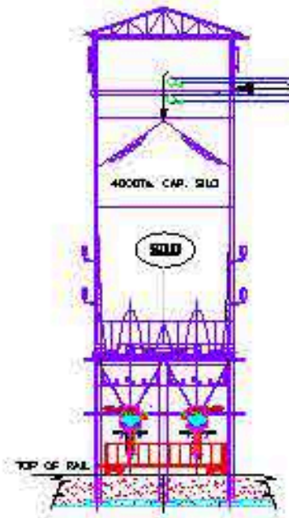
Drg.No. R7 P&D 002786 — Rev.No.

PLATE NO.-Engg-I

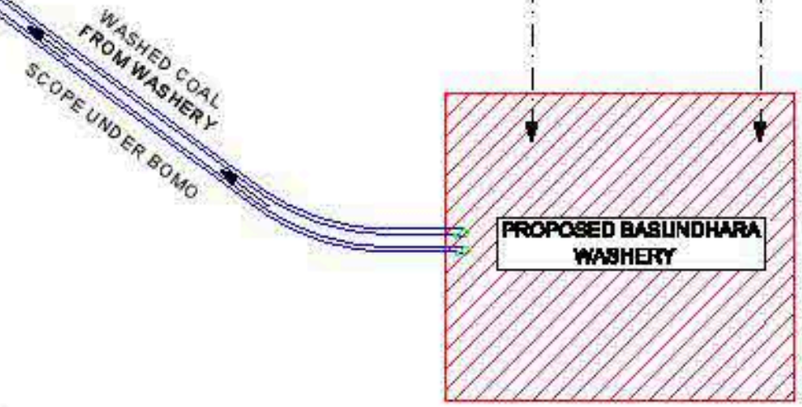


CONVEYOR DATA SHEET

BELT NAME	C1	C1A	C2	C2A	C3	C3A
WIDTH (mm)	1400.00	1400.00	1400.00	1400.00	1400.00	1400.00
PEAK CAPACITY(TPH)	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00
LENGTH (m)	282.50	285.00	192.00	172.00	56.00	50.00
BELT SPEED(m/sec)	2.4	2.4	2.4	2.4	2.4	2.4
LIFT (m)	13.75	13.75	13.00	13.00	0	0
MOTOR POWER (kW)	2 x 110	2 x 110	2 x 90	2 x 90	1 x 55	1 x 55



RAPID LOADING SYSTEM TO DESPATCH WASHED COAL FROM WASHERY



LIST OF MAJOR EQUIPMENT

SL.NO.	PARTICULARS	UNIT	QTY
1	RAPID LOADING SYSTEM-4000 te CAPACITY SILO INCLUDING 2 Nos. PRE-WEIGH HOPPERS, 1 No. LIFT, TELESCOPIC CHUTES, AIR CANON, AIR COMPRESSOR, HYDRAULIC SYSTEM, TEST WEIGHTS PIPES & FITTINGS WITH ELECTRICALS, PRINTER, DISPLAY FACILITY ETC.	NO	1
2	AUTOMATIC COAL SAMPLING SYSTEM	NO	1
3	RECLAIM FEEDER,CAPACITY 0-1000 TPH (VARIABLE CAPACITY)	NO	4
4	IN MOTION RAIL WEIGHBRIDGE 120t CAP WITH PRINTER,DIGITAL DISPLAY ETC.	NO	2

Customer: MAHANADI COALFIELDS LIMITED

Job Title: MINING PLAN & MINE CLOSURE PLAN OF KULDA OCP (16.75 Mty)

Job No. 702231

Subject: COAL FLOW DIAGRAM (for 10 Mty Washery)

Activity	Name	Designation	Signature	Date
Drawn	S. RAJKUMAR	A.M.(E&M)		
Designed	S.RAJKUMAR	A.M.(E&M)		
Checked	S.K.MAITY	H.O.D (E&M)		
Approved	S.K.MAITY	H.O.D (E&M)		

CMPDI
ISO 9001 Company

Scale: NTS

Sheet

Drg. No. R/7 E&M 301

REV. No. 0