PARTIAL OUTSOURCING OPTION APPROVED ON 28.11.2018

PROJECT REPORT

FOR

JHIRIA WEST OC PROJECT (1.50 MTY)

OF

SOUTH EASTERN COALFIELDS LIMITED

(A MINI RATNA COMPANY)

(HASDEO AREA)

JUNE 2018

REGIONAL INSTITUTE - V
CENTRAL MINE PLANNING & DESIGN INSTITUTE LIMITED
(An ISO 9001 & A Mini Ratna Company)
(A Subsidiary of Coal India Limited)
SECL COMPLEX, SEEPAT ROAD
BILASPUR - (C.G.) 495006

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GENERAL MANAGER
SECL, Hasdeo Area

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FOR JHIRIA WEST OPENCAST PROJECT (1.50 Mty)
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PRE-PLANNING INTERACTIVE PROCESSING

Sl.No.	Particulars	Date of Record Notes
1.	Draft Project Report prepared and circulated on	15th February, 2016
2.	Record Note of discussions held on 27.02.2016 during the presentation of draft PR for Jhiria West Opencast Project(1.50 Mty) at CMPDI, HQ, Ranchi.	27th February, 2016
3.	Minutes of Planning Committee Meeting held on 10.03.2016 in the Board Room of DT(P&P), SECL to discuss the draft PR of Jhiria West Opencast Project(1.50 Mty)	10th March, 2016
4.	Final Project Report prepared and submitted.	30th March, 2016
5	PR discussed in 79th TSC Meeting of SECL for projects held on 27.04.2016 in the Conference Hall of DT(P&P), SECL Bilaspur.	27 April, 2016
6	Final Project Report updated and submitted	October, 2016.
7	PR discussed in 89th TSC Meeting of SECL for projects held on 15.02.2017 in the Conference Hall of DT(P&P), SECL Bilaspur.	15 February, 2017
6	Project Report submitted incorporating minutes of 89th TSC of SECL	March, 2017
7	PR presented before SECL Board held on 05.07.2017 at New Delhi and suggested to incorporate some modifications in the report.	July, 2017
8	Project Report submitted incorporating minutes of SECL board observation	June, 2018
9	Final Project Report submitted incorporating minutes of 95th TSC of SECL	September, 2018
10	Project Report with Partial Outsourcing Option Approved by SECL Board on 28.11.2018	28 November 2018

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कार्यालय, महाप्रबंधक (यो./परि.)
एस.ई.सी.एल., मुख्यालय, बिलासपुर
प्रमांक 2654
दिनांक.....10.12.18
11.12.18

SOUTH EASTERN COALFIELDS LIMITED

CIN: U10102CT1985GOI003161

SEEPAT ROAD, BILASPUR (CG)

MINUTES OF THE 279TH MEETING OF THE BOARD OF DIRECTORS OF SOUTH EASTERN COALFIELDS LIMITED HELD ON 28.11.2018 (WEDNESDAY) AT RAIPUR (CG).

Ref. No. SECL/BSP/CAD/279 BM EXT/18-19/ 1246 Date: 08.12.2018

ITEM NO:279:4:2

Sub: Project Report for Jhiria West Opencast Project (1.50 MTY)

The Board recalled that the subject Project Report for Jhiria West Opencast Project (1.50 MTY) was discussed at its 259th Meeting held on 05.07.2017 (Item No. 259:4:2) therein the Board deferred the PR with a direction *'to review and re-submit the same on empirical study basis for all the project parameters of the PR and firm up the Capital Cost Estimates with other critical details and therefore advised to submit the reviewed PR inter alia with the technical feasibility, financial and economical viability taking into consideration the organizational, managerial and environmental aspect along with sensitivity analysis.'*

The Board viewed the presentation on the subject PR and GM (P&P)-HOD apprised the Board in detail, the salient features of the subject Project Report for Jhiria West Opencast Project (1.50 MTY) as under:

- The subject Project Report for Jhiria West Opencast Project (1.50 MTY) has been reviewed and re-submitted by CMPDIL, as per the above directives of SECL Board with three options i.e. (I) Outsourcing Option, (II) Partial Outsourcing Option and (III) Departmental Option involving Capital outlay of ₹340.45 Crore, against the earlier proposed capital outlay of ₹409.86 Crore. The three options worked out are tabulated below:

Sl.	Particulars	Unit	Outsourcing Option-I	Partial Outsourcing Option-II	Departmental Option-III
1	Total Mineable Reserves	M Te.	14.35	14.35	14.35
2	Weighted Average Grade		G-6	G-6	G-6
3	Volume of OB	M.Cum	115.33	115.33	115.33
4	Stripping Ratio (Av.)	Cum/t	8.04	8.04	8.04
5	Target Output	Mt/Yr.	1.50	1.50	1.50
6	Peak OBR	Mcum/yr	11.50	11.50	11.50
7	Project life	Year	12	12	12
8	Total capital investment	₹ Crore	340.45	389.97	731.54
9	a) Capital requirement of P&M	₹ Crore	36.86	82.30	383.02
10	Selling price	₹/t	2395.15	2395.15	2395.15
11	Estimated cost of production				
	a) at 100% level	₹/t	1335.49	1499.74	2059.51
	b) at 85% level	₹/t	1449.16	1644.23	2340.55

8/12/18

GM(P&P)-II

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Sl.	Particulars	Unit	Outsourcing Option-I	Partial Outsourcing Option-II	Departmental Option-III
12	Profit per tonne a) at 100% level	₹/t	1059.66	895.41	335.64
	b) at 85% level	₹/t	945.99	750.92	54.60
13	Break-even-point	%	37.81	47.76	82.59
		MTY	0.57	0.72	1.24
14	No. of personnel		197	304	722
15	OMS	₹/t	27.00	17.46	7.41
16	EMS	₹	3307.75	3360.90	3223.60
17	IRR at 100% level of production	%	71.28%	55.57%	14.17%
18	IRR at 85% level of production	%	56.35%	41.87%	2.90%
19	Completion capital	₹ Crore	377.58	433.69	825.68

CMPDIL has recommended the Option-I (Total Outsourcing) having highest IRR of 56.35% at 85% level of production, for competent approval.

- Financial Appraisal Report submitted by M/s. CARE Advisory indicates that the Project IRR (Pre-tax) under 'Total Outsourcing Option' works out to 71.25% at 100% production capacity and 56.32% at 85% production capacity; and the Project IRR (Pre-tax) under 'Partial Outsourcing Option' works out to 55.53% at 100% production capacity and 41.77% at 85% production capacity; as such, recommended that the project is viable under both these options.
- The Technical Sub-Committee (TSC) of SECL Board at its 95th Meeting held on 12.09.2018 (Item No. 95.1) deliberated on the subject PR and recommended the same for approval of SECL Board, with the Total Outsourcing (Coal & OB) Option-I, involving capital outlay of ₹340.45 Crore."

The Board noted the above apprisal and after detailed discussions, observed and opined that although the main purpose of outsourcing remains to cut cost and to obtain the capabilities not available in-house, business transformation and concentrating on the core business and retaining core competency are equally important factors for consideration, as such, the Board after detailed deliberations approved the subject Project Report for Jhiria West Opencast Project (1.50 MTY) of Hasdeo Area, for Partial Outsourcing Option-II (Coal Departmental and OB Outsourcing), involving a capital investment of ₹389.97 Crore, as detailed and brought out in the agenda.

While deliberating on the Item Nos. 279:4:1 (i.e. Project Report for Rampur Batura Opencast Project (4.0 MTY), Sohagpur Area) and 279:4:2, (i.e. Project Report for Jhiria West Opencast Project (1.50 MTY)), the Board advised the P&P Department to make a presentation in consultation with CMPDIL on the IRR of the approved PRs of mega projects viz. Gevra, Dipka and Kusmunda OCPs vis-a-vis Current IRR of these mega projects, in the next Board meeting.

8/12/18

COMPANY SECRETARY

Distribution for action:

1. GM (P&P)-HOD, SECL 2.GM (Hasdeo), SECL 3. GM (F)-HOD, SECL

Copy to: All Functional Directors. Page 02 of 02

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SUMMARISED DATA

PROJECT REPORT FOR
JHIRIA WEST OPENCAST PROJECT (1.50 Mty)

SUMMARISED DATA

Sl. No.	Particulars	Unit	Value
A.	**GENERAL**		
1	Name of Project		JHIRIA WEST OC
2	Name of Area / Company / State		Hasdeo Area / SECL / MP
3	Nearest Railway Station from project	Name Km	Bijuri/Manendragarh 12 / 13 Km
4	Nearest National / State Highway / Approach Road	Name Km	Pendra - Manendragarh Road about 1.5km from block.
B.	**GEOLOGICAL**		
1	Name of geological blocks considered	Name	West Jhiria Block
2	Area of the geological blocks(part area)	sq. km.	4.17
3	Borehole Density within blocks	BHs / Sq.km.	6.0
C.	**TECHNICAL**		
1	Area of the proposed mine boundary	Ha	362.388
2	Borehole density within mine area	BHs /sq. km	6.10
3	Mine parameters (Quarry-wise) Extent along strike (min. – max.) Extent along dip	 m m	 1260-3164 1706
4	Description of coal seams proposed to be worked along with the parting details		

Coal Seam Name/Parting	Thickness range(m)		Av. gradient (in degrees)	Mineable Reserves (Mt)	Volume of OB (Mcum)
Top OB	6.22	42.87			51.16
Seam 3T	0.50	2.14	1 in 60	2.37	
Parting	1.56	8.35			6.75
Seam 3B	0.86	2.95	1 in 60	4.03	
Parting	13.78	21.72			55.36
Seam LKII	0.50	5.25	1 in 60	5.47	
Parting with3B					0.62
Seam LKIIT	0.50	3.25	1 in 60	0.53	
Parting	1.00	2.11			1.44

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Coal Seam Name/Parting	Thickness range(m)		Av. gradient (in degrees)	Mineable Reserves (Mt)	Volume of OB (Mcum)
Top OB	6.22	42.87			51.16
Seam LKIIB	0.50	5.25	1 in 60	1.95	
TOTAL				**14.35**	**115.33**

5	Av. Stripping Ratio	cum/t	8.04
6	Method of Mining		Coal with Surface Miner OB with Shovel – Dumper
7	Target Output Nominal production capacity (at 100%) Peak production capacity (at 125%) Production capacity (at 85%)	 Mt Mt Mt	 1.50 1.875 1.275
8	Year of achieving Target Production (from zero date)		4^{TH}
9	Year of start of Internal Dumping		4^{TH}
10	Production Phasing (from zero date upto target year)	Mt	

Year / Coal Seam	***Year 1***	***Year 2***	***Year 3***	***Year 4***	***Year 5***		
Coal	0.00	0.50	1.00	1.50	1.50		
OB	0.00	4.00	8.00	11.50	11.50		

Sl. No.	Particulars	Unit	OUTSOURCING OPTION	PARTIAL OUTSOURCING (Approved)	DEPARTMENTAL OPTION
11	Total Mine Life (at Nom. production capacity) Pre-construction period Construction period Production build-up period Production period Tapering / mine closure period	Years Years Years Years Years	12 - 1 3 7 1	12 - 1 3 7 1	12 - 1 3 7 1
12	Major HEMM Deployed for Coal Surface miner Dumper Pay loader	Nos. & Capacity	Hiring of HEMM	1 7 2	1 7 2

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Sl. No.	Particulars	Unit	OUTSOURCING OPTION	PARTIAL OUTSOURCING (Approved)	DEPARTMENTAL OPTION
13	Major HEMM Deployed for OB Shovel Dumper Drill Dozer	Nos. & Capacity	Hiring of HEMM	Hiring of HEMM	 4 26 4 4
14	Total Manpower Existing Additional	Nos Nos. Nos.	197 0 197	304 0 304	722 0 722
15	OMS	Tonnes	27.00	17.46	7.41
16	Seam-wise weighted average grade of coal		G-6 with GCV 5524 Kcal/Kg	G-6 with GCV 5524 Kcal/Kg	G-6 with GCV 5524 Kcal/Kg
17	Presence of Major Surface Constraints (Nallas, road, power line, etc.)	(type)	Diversion of HT Line & Road	Diversion of HT Line & Road	Diversion of HT Line & Road
18	Coal Transport within the mine (In-pit belt conveying system or by Truck)		By Dumper/Truck	By Dumper/Truck	By Dumper/Truck
19	Surface Coal Transport to Siding/Despatch Point and Mode of Despatch		By Tipper / Truck	By Tipper / Truck	By Tipper / Truck
20	Any Railway Siding and distance		Rajnagar RO siding (6.0Km)	Rajnagar RO siding (6.0Km)	Rajnagar RO siding (6.0Km)
21	Name of any Specific Customer/Industry		Miscellaneous	Miscellaneous	Miscellaneous
D.	**ENVIRONMENTAL & OTHERS**				
1	Civil Construction Residential houses Existing Additional	 Nos. Nos. Nos.	 116 116 0	 168 168 0	 401 401 0
2	Water Demand Colony Industrial	 MLD MLD	 0.098 0.223	 0.145 0.228	 0.362 0.248
3	Total Land to be acquired Government land Tenancy land Forest land (type of forest)	Ha Ha Ha Ha	482.694 54.817 104.140 323.737	482.694 54.817 104.140 323.737	482.694 54.817 104.140 323.737

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Sl. No.	Particulars	Unit	OUTSOURCING OPTION	PARTIAL OUTSOURCING (Approved)	DEPARTMENTAL OPTION
4	Land to be acquired within mine area (excavation area)	Ha	362.388	362.388	362.388
	Government land	Ha	45.493	45.493	45.493
	Tenancy land	Ha	48.400	48.400	48.400
	Forest land (type of forest)	Ha	268.495	268.495	268.495
5	Land to be acquired outside mine area (Beyond Excavation Area, such as,Safety zone, Approach Road, Infrastructure, Colony, etc.)	Ha	120.306	120.306	120.306
6	Land to be acquired for external dumping	Ha	0.0	0.0	0.0
7	Net Present Value of Forest Land	Lakhs/Ha	22.25	22.25	22.25
	Total Area	Ha	323.737	323.737	323.737
	Total Value	Rs.Lakhs	7203.15	7203.15	7203.15
8	Rehabilitation & Resettlement				
	No. of villages within mine boundary	Nos.	Two	Two	Two
	No. of homestead to be rehabilitated	Nos.	220	220	220
9	Cost of land & Rehabilitation				
	Total Cost R&R only	Rs. Lakhs	4732.77	4732.77	4732.77
10	Total EMP Capital	Rs. crores	7068.26	7076.44	7328.98
11	Average annual rainfall	mm	1200	1200	1200
12	Make of Water (Peak)	m 3/day	284300	284300	284300
13	Total installed pumping capacity	lps	869	869	869
14	Drainage of the Area		Through Kulharia nala	Through Kulharia nala	Through Kulharia nala
15	Any proposed diversion of road or power line		Road & HT Line	Road & HT Line	Road & HT Line

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SL	FINANCIAL	Unit	OUT-SOURCING	PARTIAL OUTSOURCING (Approved)	DEPARTMENTAL OPTION
1	Total Capital Investment	Rs. Crores	340.45	389.97	731.54
2	Total Capital Investment on P&M	Rs. Crores	36.86	82.30	383.02
3	Capital requirement upto target year	Rs. crores	338.12	389.33	730.90
4	Earnings per manshift (EMS)	Rs.	3307.75	3360.90	3223.60
5	Cost of Production				
a)	At 100% production level	Rs. / tonne	1335.49	1499.74	2059.51
b)	At 85% production level		1449.16	1644.23	2340.55
6	Weighted average selling price	Rs. / tonne	2395.15	2395.15	2395.15
7	Estimated Profit				
a)	At 100% production	Rs./Te	1059.66	895.41	335.64
b)	At 85% production	Rs./Te	945.99	750.92	54.60
8	Financial Internal rate of return (FIRR)				
a)	At 100% production	%	71.28%	55.57%	14.17%
b)	At 85% production	%	56.35%	41.87%	2.90%
9	Break-even point				
a)	Production	Mty	0.57	0.72	1.24
b)	Production level	%	37.81	47.76	82.59
10	Cost of Outsourcing				
a)	OB	Rs/cum	51.25	51.25	0.00
b)	Coal	Rs/tonne	67.29	0.00	0.00
c)	OB Rehandling	Rs/cum	41.00	41.00	41.00
11	Mine Closure Cost	Rs/tonne	37.44	37.44	37.44
12	Expected Completion Capital	Rs. crores	377.58	433.69	825.68

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

1.1 BACKGROUND OF THE PROJECT REPORT

The Jhiria West Opencast Project is situated in Sohagpur coalfields and is under administrative control of Hasdeo area of SECL. The area is included in the Survey of India Toposheet No. 64 I/4. The block is located in the close proximity of existing Rajnagar RO UG mine.

The existing Rajnagar RO UG mine which is adjacent to proposed Jhiria West OCP is likely to be exhausted within few years as communicated by Hasdeo Area. It was also noted that the infrastructure of Rajnagar RO may be utilized for mining in Jhiria West Opencast Project since it is adjacent to Rajnagar RO. Accordingly, Project Report for Jhiria West Opencast Project has been prepared to finalise the modalities to extract coal from West Jhiria geological block.

The PR for Jhiria West Opencast (1.50Mty) presented before SECL Board held on 05.07.2017 at New Delhi and SECL Board suggested to incorporate some modifications in the report. Accordingly Project Report modified incorporating SECL board observation and submitted in June 2018.

PR for Jhiria West Opencast (1.50Mty) with three options ie outsourcing Option, Partial Outsourcing Option and Departmental Option was placed before SECL Board on 28.11.2018 held at Raipur. **SECL Board after detailed deliberations approved the Project Report for Jhiria West Opencast (1.50Mty) for Partial Outsourcing Option (Coal Departmental and OB Outsourcing) involving a capital investment of Rs. 389.97 Crores vide 279th meeting of Board of Directors of SECL held on 28.11.2018 (Wednesday) at Raipur.**

1.1.1 SALIENT FEATURES OF LAST APPROVED REPORT

Within this block, previously no opencast project report formulated.

1.2 EXPLORATION STATUS

The area was first geologically mapped for the first time by T.W.Hughes (1881-83). Shri M. Venkatappay and K. Ramarao of GSI surveyed the Jhagrakhand area in 1960-61. During the period from 1973 to 1976, surrounding area of Jhagrakhand was surveyed by GSI and carried out regional exploration along with detailed mapping on

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scale of 1:8000 around the area located south of Jhagrakhand group of mines. Based on regional exploration, Directorate of Geology and Mining, M.P has taken up detailed exploration (1987 to 1999) at the instance of CMPDI, RI-V, Bilaspur in the area bounded by Kulharia nala in the east and Jhiria nala in the south and findings are incorporated in Geological report on exploration for coal in Jhiria block, Sohagpur Coalfield, District Anuppur, M.P. (F.S. 1987-99).

The northern part of the Jhiria block has not been explored completely, which need additional boreholes at closer interval for complete proving the area.

The detailed exploration in the West Jhiria block by drilling at an interval of 400m have been carried out by Directorate of Geology and Mining, M.P during the period from December 1997 to April 2000. Altogether 26 boreholes have been drilled in the area involving total of 1644.60m.

The detail of the drilling meterage shown in Table

Table: Financial year-wise drilling meterage

AGENCY	YEAR	NO.OF BOREHOLES DRILLED	METERAGE
DGM,M.P.	1997-98	6	412.57
	1999-00	18	1114.33
	2000-01	2	117.70
	Total	26	1644.60

Data of 09 Nos. of boreholes drilled by Directorate of Geology and Mining, M.P of MPJH series of Jhiria Block have also been utilized for interpretation and assessment purposes falling within the block.

At the time of the execution of the project, confirmatory drilling will have to be done for precise alignment of incrops of seams and also for pinpointing position of faults. The study/MINEX model has been done based on only 26 boreholes drilled by DGM, M.P. in 4.17sq.km. area. The density of the borehole in the area of West Jhiria block is only about 6 boreholes / sq. km. Hence, around 20 boreholes with an expected meterage of around 1500m is required to be drilled within and around the West Jhiria Block for further enhancing the degree of confidence.

1.4 JUSTIFICATION FOR PREPARATION OF PR

The existing Rajnagar RO UG mine which is adjacent to proposed Jhiria West OCP is likely to be exhausted within few years as communicated by Hasdeo Area. It was also noted that all the infrastructure of Rajnagar RO may be utilized for mining in Jhiria West Opencast Project since it is adjacent to Rajnagar RO.

As per Road Map for Enhancement Coal Production of Coal India, the production projection of SECL for the year 2018-19 is 193.10 Mt and production projection of SECL for the year 2019-20 is 239.60Mt.

Jhiria West OC is a virgin project & Average grade of coal is grade 'G-6' with GCV 5524 Kcal/Kg. From Table above, it can be seen that in the year 2018-19 and 2019-20, there is a need of SECL for opening of new Projects to bridge the production projection. Preparation of Project Report for Jhiria West Opencast is therefore proposed with a view to fulfill part of the above indicated growth in production projection.

1.5 SALIENT FEATURE OF THE PR

The PR has been formulated to win coal by Surface Miner & OB by Shovel Dumper combination. Coal from face will be transported to pit top by higher capacity truck/dumper. Coal from pit top will be transported to Rajnagar siding by higher capacity truck/tipper to dispatch coal by rail.

In this PR three options have been worked out namely Total Outsourcing Option, Partial Outsourcing Option and Total Departmental Option. The three options have been worked out in this PR are as given below.

Sl No	Options	Details
1	Total Outsourcing Option	Both Coal extraction and OB removal is by Outsourced HEMM
2	Partial Outsourcing Option	Coal extraction by Departmental HEMM and OB removal is by Outsourced HEMM
3	Total Departmental Option	Both Coal extraction and OB removal is by Departmental HEMM

The techno-economics have been worked out based on the prevalent norms of productivity, operating cost and spare consumption etc. The financial parameters of all three options are as given below.

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Salient features of present PR(June,2018) (Capacity, Capital, etc.)

Sl.	Particulars	Unit	Outsourcing Option	Partial Outsourcing	Departmental Option
1	Total Mineable Reserves	M Te.	14.35	14.35	14.35
2	GCV Band		G-6 (GCV 5524)	G-6 (GCV 5524)	G-6 (GCV 5524)
3	Volume of OB	M.Cum	115.33	115.33	115.33
4	Stripping Ratio (Av.)	Cum/t	8.04	8.04	8.04
5	Target Output	Mt/Yr.	1.50	1.50	1.50
6	Peak OBR	Mcum/yr.	11.50	11.50	11.50
7	Project life	Year	12	12	12
8	Total capital investment	Rs. crores	340.45	389.97	731.54
9	a) Capital requirement of P&M	Rs. crores	36.86	82.30	383.02
10	Selling price	Rs./ t	2395.15	2395.15	2395.15
11	Estimated cost of production				
	a) at 100% level	Rs./t	1335.49	1499.74	2059.51
	b) at 85% level	Rs./t	1449.16	1644.23	2340.55
12	Profit per tonne a) at 100% level	Rs./t	1059.66	895.41	335.64
	b) at 85% level	Rs./t	945.99	750.92	54.60
13	Break-even-point (%)		37.81	47.76	82.59
	(Mty)		0.57	0.72	1.24
14	No. of personnel		197	304	722
15	OMS	Rs./t	27.00	17.46	7.41
16	EMS	Rs.	3307.75	3360.90	3223.60
17	Anticipated year of achieving target	Year	4 th YEAR	4 th YEAR	4 th YEAR
18	IRR at 100% level of production	%	71.28%	55.57%	14.17%
19	IRR at 85% level of production	%	56.35%	41.87%	2.90%
20	Completion capital	Rs. crores	377.58	433.69	825.68
21	NPV @ 12% at 100% level of production	Rs crores	647.83	520.69	39.15
22	NPV @ 12% at 85% level of production	Rs crores	476.37	348.29	-154.05

Box cut & initial external OB (about 19.08 Mcum) are proposed to be dumped within quarry area and safety zone area to keep the land requirement bare minimum.

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The OB so dumped is proposed to be rehandled back to the internal dump. More land would be required if external dump kept outside quarry area and there will be additional impact on environmental point of view. So OB externally dumped within quarry area is proposed to be rehandled back to decoaled area as internal dump.

Sometimes with favorable geo-mining conditions and improved productivity of the HEMM, the project may produce coal upto 1.25 times of the planned capacity. So, EMP should be prepared for 1.875Mty, accordingly approval from the Competent Authority is to be sought.

In Total Outsourcing Option, the project is yielding a profit of Rs.1059.66 per tonne at 100% and Rs. 945.99 per tonne at 85% level of production. The financial IRR of the project in outsourcing option works out to 56.35% at 85% capacity. The outsourcing option of Jhiria West OC (1.50 Mty) is meeting the criteria of approval i.e. 12% IRR at 85% capacity level.

In Partial Outsourcing Option, the project is yielding a profit of Rs. 895.41 per tonne at 100% and Rs. 750.92 per tonne at 85% level of production. The financial IRR of the project in partial outsourcing option works out to 41.87% at 85% capacity. The Partial outsourcing option of Jhiria West OC (1.50 Mty) is meeting the criteria of approval i.e. 12% IRR at 85% capacity level.

In Total Departmental Option, the project is yielding a profit of Rs. 335.64 per tonne at 100% and Rs. 54.60 per tonne at 85% level of production. The financial IRR of the project in outsourcing option works out to 2.90% at 85% capacity. The Total departmental option of Jhiria West OC (1.50 Mty) is not meeting the criteria of approval i.e. 12% IRR at 85% capacity level.

1.6 FLEXIBILITY IN IMPLEMENTATION

The flexibility in the implementation stage may be exercised within the approved cost estimates to respond to improvements in technology and equipment which would result in improved profitability and productivity measures. Following points may be considered under the flexibility: -

a) Re-alignment of working layout for better working layout / dump etc.
b) Change in the specification of HEMM to higher capacity at the time of procurement of new equipment or replacement of the equipment.

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c) To procure state-of-the-art safety equipment, whenever they are introduced, even if the same is not provided in approved Project Report.

d) Relocation of site for infrastructure facilities depending upon techno-economic reasons and availability of land / forest area etc.

e) Hiring of equipment for loading, transportation etc., at a competitive price, so as to cater to the needs of increased demand of coal and subsequent removal of higher OB and for augmentation of coal production.

f) For upgradation of new technology in mining method for improving performance and reduction in manpower, at a subsequent date after project completion.

g) In this PR it is proposed that coal would be mined by surface miner. However, in circumstances where Operational/Geotechnical difficulties persist small quantity of coal may be mined out by alternative technology such as ripping/drilling etc. Prior approval may be obtained for use of alternative technology citing the circumstances/operational difficulties.

2.1 DEMAND AND SUPPLY SCENARIO

As per Road Map for Enhancement Coal Production of Coal India, the idea of ramping up the production to 1 Billion Tonne of Coal by 2019-20 was germinated. An exercise has been carried out to prepare a roadmap for achieving a production level of 1 Billion Tonne of Coal by the year 2019-20. All the subsidiary companies were requested to identify the potential projects to achieve the desired goal. As per Road Map for Enhancement Coal Production of Coal India, projects to produce about 908.10 Mt in 2019-20 has been identified and for balance to reach 1 Bt was underway. The subsidiary-wise yearwise breakup of the production projection is as given in the Table no 2.1.

***Table2.1 : subsidiary-wise yearwise breakup of the production projection**

(Figures in Mt)

Company	14-15	15-16	16-17	17-18	18-19	19-20
ECL	38	42.03	46.9	51.7	56.6	62
BCCL	34	35.51	37	41	46	53
CCL	55	60.5	67	80	102	133.5
NCL	77	80	82	90	99	110
WCL	44	45	48	50	55	60
SECL	131.2	135	149.7	161	193.1	239.6

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Company	14-15	15-16	16-17	17-18	18-19	19-20
MCL	127	150	167	187	222	250
CIL	**506.2**	**548.04**	**597.6**	**660.7**	**773.7**	**908.1**

NOTE: *-Production Projection is based on "Road Map for Enhancement Coal Production of CIL"

As per Road Map for Enhancement Coal Production of Coal India, the group-wise yearwise breakup of the production projection of SECL are as given in the Table no 2.2.

***Table 2.2 : Group-wise yearwise Production Projection for SECL**

(Figures in Mt)

SECL		14-15	15-16	16-17	17-18	18-19	19-20
Existing		1.85	1.66	1.66	1.64	1.57	1.11
Completed		20.46	19.80	18.67	16.80	15.59	14.43
Ongoing		108.90	112.57	128.34	136.57	157.38	180.26
Future		0.00	1.00	1.00	6.00	18.60	43.80
		131.2	**135.0**	**149.7**	**161.0**	**193.1**	**239.6**

From Table No-2.2, it can be seen that in the year 2018-19 and 2019-20, there is a need of SECL for opening of new Projects to bridge the production projection. Preparation of Project Report for Jhiria West Opencast is therefore proposed with a view to fulfill part of the above indicated growth in production projection.

3.1 LOCATION

The Jhiria West Opencast Project is about 12 km SW of Bijuri town, 13 km SW of Manendragrah town and 8 km SW of Rajnagar OC Colliery in Anuppur district of Madhya Pradesh. The area is included in the Survey of India Toposheet No. 64 I/4. The Manendragarh Pendra road is passes through the Western side of the block.

3.2. ACCESSIBILITY AND COMMUNICATION

The Jhiria West Opencast Project, lying immediate West of old Rajnagar incline of Rajnagar lease hold Area. The Jhiria West OC Project can be approached from Rajnagar RO Siding. The distance from Rajnagar RO siding to Jhiria West OC Project is about 6.0 Km. The area can be approached by Manendragarh – Pendra road near village Phulwari-tola, located about 13 km. and 12 km. from Manendragarh and Bijuri township respectively. The district Head Quarter Anuppur is connected by an all weather

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road. The Rajnagar RO siding is located in the north eastern side of the West Jhiria block. The Nearest rail head are Bijuri and Manendragarh.

4.1 DEFINING BLOCK BOUNDARY

The boundary of the West Jhiria Block has been considered as follows as per the Geological Report submitted by Directorate of Geology and Mining, M.P:

1. **In the North** : An arbitrary line 200m north and parallel to the line joining the borehole no. MPWJH-09 and MPWJH-07.
2. **In the South** : An arbitrary line running east-west approximately 200m south of MPWJH-04 and .200m in the east up to confluence of Jhiria and Sautanchuanala and extending along the nala up to confluence of Kulharianala in the east.
3. **In the East** : Kulharia Nala.
4. **In the West** : An arbitrary line 200m west of borehole no. MPWJH-09 and extended due south to join the southern boundary of the block.

The block boundary as defined above covers an area of 4.17 sq.km.

4.2 SEQUENCE OF THE COAL SEAMS

The sub-surface data from drilling in West Jhiria block reveals the presence of two prominent coal horizons i.e. seam-3 and seam-1 (LK-II). Both the seam split in top and bottom section viz. seam-3T, seam-3B and LK-IIT and LK-IIB. The topmost seam-3 (either 3T or 3B or both) has been intersected in 19 boreholesviz. MPWJH-01,02,03,04,06,10,12,13,16,18,23 & 26 and MPJH-72,73,78,81,82,84 &107 and it developed with workable thickness in patches in Jhiria and Amadand area located in south of present block. The seam thickness decreases towards eastern direction and developed in thin bands in Rajnagar Colliery.

The sequence of the coal seams with inter seam parting in West JhiriaBlock is shown in Table:

Table : Sequence of the Coal seam in West Jhiria

Coal Seam & Parting	Thickness (m)	No. of borehole intersected workable seam(>0.50m thickness)	Remarks
Weather	3.65-27.58		Soil, weathered mantle

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Coal Seam & Parting	**Thickness (m)**	**No. of borehole intersected workable seam(>0.50m thickness)**	**Remarks**
mantle			
Seam-3T	0.35-2.14	13no. of boreholes MPWJH-1,2,3,6,10,12,18,23,26 and MPJH-78,81,82,84	Thickness reduces eastward. GCV varies from G2-G16, but average grade is G7.
Parting	1.56-8.35		
Seam-3B	0.86-2.95	21 no. of boreholes MPWJH-1,2,3,4,5,6,10,11,12,13,16,18,23,26 and MPJH-72,73,78,81,82,84,107	Thickness reduces westward. GCV varies from G3-G11, but average grade isG6.
Parting	13.78-21.72		
LK-II	0.18-5.25	14 no. of boreholes MPWJH-2,3,6,9,10,11,15,18,20,22,25 and MPJH-70,81,107	GCV varies from G5-G10 but average grade is G7.
LK-IIT	0.55-1.54	14 no. of boreholes MPWJH-1,4,5,12,13,14,17,19,21,23,24 and MPJH-72,73,76	Developed as thin workable bands. GCV varies from G3-G9 but average grade is G6
Parting	1.00-2.11		
LK-IIB	0.40-3.25	14 no. of boreholes MPWJH-1,4,5,12,13,14,17,19,21,23,24 and MPJH-72,73,76	Consistent in development. GCV varies from G5-G8 but average grade is G7.

4.3 ADDITIONAL EXPLORATION

At the time of the execution of the project, confirmatory drilling will have to be done for precise alignment of incrops of seams and also for pinpointing position of faults. The study/MINEX model has been done based on only 26 boreholes drilled by DGM, M.P. in 4.17sq.km. area. The density of the borehole in the area of West Jhiria block is about 6 boreholes / sq. km. Hence, around 20 boreholes with an expected meterage of around 1500m is required to be drilled mainly in the North-East, North-West and South-West areas around the West Jhiria Block for further enhancing the degree of confidence.

5.1 MINE BOUNDARIES

The boundary of quarry are as given below: -

North : Incrop of LKII Seam

South : Fault F1F1 and 0.50m thickness line of seam LKII.

East : 60m barrier from Western bank of Kulharia Nalla.

West : Block boundary of West Jhiria Geological Block.

5.2 MINEABLE RESERVES

10% geological and 5% mining losses are considered for reserves estimation.

Sectorwise mineable reserves

The total mineable coal reserves have been estimated as 14.35 Mt with a corresponding OB volume of 115.33 Mcum. While, calculating mineable reserves, a geological loss of 10% and a mining loss of 5% have been considered. The estimation of mineable reserves is based on a minimum mineable thickness of 0.5 m. The mineable coal reserves and OB quantity have been estimated through MINEX model.

The sectorwise mineable reserves and volume of OBR are summarised in the following table: -

Sectorwise mineable reserves, volume of OBR and stripping ratio of quarry

COAL SEAMS	L3T	L3B	LKII	LKIIT	LKIIB	TOTAL
SEC-1	0.00	0.00	1.67	0.06	0.18	**1.91**
SEC-2	0.52	1.40	1.06	0.16	0.63	**3.77**
SEC-3	1.06	1.56	1.29	0.23	0.78	**4.92**
SEC-4	0.68	0.53	1.13	0.08	0.23	**2.65**
SEC-5	0.11	0.54	0.32	0.00	0.13	**1.10**
TOTAL	**2.37**	**4.03**	**5.47**	**0.53**	**1.95**	**14.35**

OVERBURDEN AND PARTING OB

PARTINGS	TOP OB	L3T-L3B	L3B-LKII	L3B-LKIT	LKIIT-LKIIB	TOTAL
SEC-1	0.11	0.00	11.41	0.02	0.18	**11.72**

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PARTINGS	TOP OB	L3T-L3B	L3B-LKII	L3B-LKIT	LKIIT-LKIIB	TOTAL
SEC-2	15.38	2.42	12.30	0.15	0.48	**30.73**
SEC-3	19.67	2.71	13.65	0.19	0.58	**36.80**
SEC-4	9.98	1.02	8.85	0.26	0.15	**20.26**
SEC-5	6.02	0.60	9.15	0.00	0.05	**15.82**
TOTAL	**51.16**	**6.75**	**55.36**	**0.62**	**1.44**	**115.33**

6.1 MINE PARAMETERS

The geological and mining characteristics of both the quarries have been summarised in the following table: -

Geological and Mining Characteristics

Sl. No.	Particulars	Unit	Thickness
1	**Dominant Thickness of Seams Excluding Band**		
	Seam 3T	Metre	0.50 – 2.14
	Seam 3B	Metre	0.86 – 2.95
	Seam LKIIT		0.55 – 1.54
	Seam LKIIB		0.50 – 3.25
	Seam LKII	Metre	0.55 – 5.25
2	**Dominant Thickness of OB & Parting**		
	Top OB	Metre	6.22 – 42.87
	Seam L3T & Seam L3B	Metre	1.56 – 8.35
	Seam L3B & Seam LKII & LKIIT		13.78 – 21.72
	Seam LKIIT & Seam LKIIB	Metre	1.00 – 2.11
3	Gradient		1 in 60
4	Average Grade of coal		G-6 with GCV 5524 Kcal/Kg
5	**Mineable Reserves**		
	Seam 3T	Mt	2.37
	Seam 3B	Mt	4.03
	Seam LKIIT	Mt	0.53
	Seam LKIIB		1.95
	Seam LKII		5.47
	TOTAL		**14.35**
6	**Volume of OB**		
	Top OB	Mcum	51.16
	Seam L3T & Seam L3B	Mcum	6.75
	Seam L3B & Seam LKII	Mcum	55.36
	Seam L3B & Seam LKIIT		0.62
	Seam LKIIT & Seam LKIIB		1.44

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Sl. No.	Particulars	Unit	Thickness
	TOTAL		**115.33**
7	Target output	Mty	1.50
8	Stripping Ratio (Av.)	Cum/t	8.04
9	Project life	Year	12
10	Main Customers		Miscellaneous
11	Anticipated year of achieving target	Year	4th
12	Total Land involved	Ha	482.694

III.	Quarry Parameters		
1	Maximum width along strike		
	- at surface	m	3164
	- at floor	m	3080
2	Minimum width along strike		
	- at surface	m	1260
	- at floor	m	1206
3	Maximum length along dip		
	- at surface	m	1706
	- at floor	m	1648
4	Maximum depth	m	60.12
5	Minimum depth	m	10.62
6	Maximum lift	m	61.00
7	Area of excavation		
	- at surface	Ha	344.70
	- at floor	Ha	318.70

6.2 CHOICE OF TECHNOLOGY

Due to flexibility of operation, Shovel-Dumper combination will be suitable for OB removal. The PR has been formulated to win coal by Surface Miner & OB by Shovel Dumper combination by Outsourcing of HEMM.

Coal from face will be transported to pit top and then it will be transported to Rajnagar siding to dispatch coal by rail.

The salient feature of the mining system is as follows: -

(i) Height & width of the benches in coal and OB will depend upon the size of the leased equipment. The provision of Coal Mine Regulation and related circulars shall be strictly followed for designing bench parameters in coal and OB.

(ii) Dump bench height - 30m (each bench)

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(iii) Bench Slope

Coal / OB - 70^0

Spoil - 37^0

(iv) Total Dump Height - Total dump height is 80 m from quarry floor & 50m from surface.

7.1 DUMPING STRATEGY

In the initial years i.e. upto 3rd year, OB quantities will be dumped to external dumping site within quarry area and safety zone area in dip side of quarry. Internal dumping will start from the 4th year onwards.

Initially, the top soil from top bench of OB will be stacked and stored separately. The spoil dump benches in the internally backfilled OB will be in the form of benches. With the sufficient advance of coal production bench, the backfilled OB will be leveled with dozer. After leveling of back filled OB dump, the top soil will be spreaded over the back filled OB dump to grow vegetation.

The slope stability study of OB dump bench should be conducted. Based on slope stability study report, the OB dump design like dump bench height, total dump height & slope etc. should be modified to avoid dump failure. In addition to that proper precautions should be taken to avoid sliding of internal OB bench.

Box cut & initial external OB (19.08 Mcum) are proposed to be dumped within quarry area and safety zone area to keep the land requirement bare minimum. The OB so dumped is proposed to be rehandled back to the internal dump. More land would be required if external dump kept outside quarry area and there will be additional impact on environmental point of view. So OB externally dumped within quarry area is proposed to be rehandled back to decoaled area as internal dump.

OB quantity of 19.08 Mcum will be externally dumped within quarry quarry area and safety zone area area from 2nd year to 3rd year for which 78 Ha land will be required within quarry area and safety zone area. External dump has been made near western boundary as shown in Plate No-8. This temporary external dump will be rehandled to internal dump subsequently. From 7th year to 10th year the external dump will be rehandled back to internal dump.

In case of external dump, spoil bench height will be kept 30 m. There will be one bench and total dump height above surface will be 30m. Plate No. 16 shows the proposed design and location of initial cut and proposed external dumps.

The break-up of OB quantity to be accommodated in various dumps is as follows:-

Dump	**OB accommodated in Mcum**
1. Internal dump	115.33
2. External dump outside Quarry area	0.00

Initially, top soil will be removed and stored separately. After leveling of back filled OB dump, the top soil will be spreaded over the back filled OB dump to grow vegetation. Later on top soil may be directly spread over the leveled graded backfilled OB dump for reclamation.

7.2 DETAILS OF DUMPING OPERATIONS

The details of quantity of OB dump considering internal and external quantity are given below.

Sl.No.	Particulars of working	Total
1.	Coal mined (Mt)	14.35
2.	OBR (Mcum)	115.33
3.	Stripping ratio (Mcum/t)	8.04
4.	Internal dump (Mcum)	115.33
5.	External dump outside quarry (Mcum)	0.00

8.1 DEPLOYMENT OF HEMM

The PR has been formulated to win coal by Surface Miner & OB by Shovel Dumper combination. For OB removal yearwise lead has been estimated and based on that average lead for OB removal is estimated to 1.60 Km. The average lead for Coal is estimated to 1.50 Km. Based on revised norms of CMPDI the average lead in coal transportation and OB removal the productivity of HEMM has been calculated and accordingly deployment of HEMM for coal and OB are as follows.

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Sl.	Particulars	Unit	OUTSOURCING OPTION	PARTIAL OUTSOURCING	DEPARTMENTAL OPTION
1.	**Major HEMM for Coal** Surface miner Dumper Pay loader	Nos. & Capacity	Hiring of HEMM	1 60T – 7Nos 6.4m3 – 2Nos	1 60T – 7Nos 6.4m3 – 2Nos
2.	**Major HEMM for OB** Shovel Dumper Drill Dozer	Nos. & Capacity	Hiring of HEMM	Hiring of HEMM	10m3 – 4Nos 100T – 26Nos 250mm – 4Nos 410Hp – 4Nos

8.2 CALENDAR PROGRAMME OF EXCAVATION

Considering the average width of quarry and annual advance of quarry floor, the calendar programme has been prepared and given in the following table: -

YEAR	TOTAL COAL	TOP OB PLANNED	TOTAL OB PLANNED	SR	OB REHANDLE
1					
2	0.50	0.95	4.00	8.00	
3	1.00	1.93	8.00	8.00	
4	1.50	4.56	11.50	7.67	
5	1.50	5.40	11.50	7.67	
6	1.50	5.58	11.50	7.67	
7	1.50	6.27	11.50	7.67	4.00
8	1.50	6.27	11.50	7.67	4.00
9	1.50	6.27	11.50	7.67	5.00
10	1.50	5.73	11.50	7.67	6.08
11	1.50	4.45	11.50	7.67	
12	0.85	3.75	11.33	13.33	
TOTAL	**14.35**	**51.16**	**115.33**	**8.04**	**19.08**

9.1 PROJECTED COAL QUALITY

The weighted average GCV of the seams considered for mining works out to be 5524Kcal/Kg(G-6 grade). The seam wise GCV and weighted average GCV of mine area of Jhiria West OC are as given below.

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SL NO	SEAM NAME	GCV (Kcal/kg)	Weighted Average Grade
1	Seam 3T	5464	G7
2	Seam 3B	5778	G6
3	Seam LKII	5313	G7
4	Seam LKIIT	5635	G6
5	Seam LKIIB	5583	G6
	Average	**5524**	**G6**

The Weighted average **GCV** of coal within quarry area of Jhiria West OC is **5524 Kcal/Kg** has been considered for project costing.

10.1 PUMPS

Three numbers of main pumps each of 225lps, 70m head have been provided to meet the requirements. Provisions have been made considering the peak demand which is occasional, so no standby pumps have been provided. Further the pumps may be repaired and kept ready for use in rainy season. Main pumps will be installed on pontoons. Provision of pontoons for each main pump has been given in the estimate.

One diesel engine operated pump of 80lps capacity, 60m head has been provided for operation in the initial period and then as standby for use in case of emergency. Similarly electrically operated pump of same capacity has also been provided.

All the main pumps will be provided with pressure gauges on delivery side and suction side for measuring the head developed so that corrective action will be taken for operating the pump at the duty point. The main pumps have been provided considering life of the mine. The requirement of pumps has been shown for entire life of the mine; however procurement shall be made as per requirement. During heavy rainfall, overburden may be washed away from edges of slopes and internal dumps, pumps capable of slurry handling will be required. Pumping of clear water and slurry will be from upper and lower part of sump respectively.

11.1 CHP & COAL TRANSPORTATION

- Coal will be mined by surface miner as such no crushing arrangement is required.
- Coal mined by surface miner will be transported by trucks/dumpers to pit top.

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- Coal from pit top will be transported to Rajnagar siding about 6.0 KM by road.
- A wharf wall or mechanical loading arrangement suitable for loading of one rack (59 box N) will be constructed at the siding.
- Coal from siding to various customer will be transported by rail through Rajnagar Railway siding.

12.1 WORKSHOP AND STORES

An E&M workshop, Excavation workshop and store have been proposed, in which repair and maintenance will be done for departmental & partial hiring option and An E&M workshop and store have been proposed, in which repair and maintenance will be done for outsourcing option.

13.1 POWER SUPPLY

13.1.1 Source of Power

West Jhiria Opencast Project is located in the close proximity of existing Rajnagar RO UG mine of SECL in Hasdeo Area. The source of power supply for this Project shall be from Rajnagar Substation of CSPDCL located at around 6.5 km from the Project site. This project shall receive power at 33kV by means of DCDS overhead line (AAAC, WOLF equivalent) on steel towers drawn from Rajnagar RO Substation .

The power demand for outsourcing option , the maximum power demand comes to around 866 kVA for which 2x1000 kVA, 33/3.4 kV substation shall be adequate . For partial outsourcing option shall be around 882 kVA for which 2x1000 kVA, 33/3.4 kV substation shall be adequate. For departmental option shall be around 3296 kVA for which 2x5000 kVA, 33/3.4 kV substation shall be adequate.

13.1.3 Energy Consumption

The energy consumption has been calculated considering active power, annual number of working hours of equipment/ installation wise.

For Outsourcing Option, the specific energy consumption will be approximately 5.02 kWh / tonne. For Partial Outsourcing Option, the specific energy consumption will be approximately 5.72 kWh / tonne . For Deptt. Option, the specific energy consumption will be approximately 13.23 kWh / tonne.

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14.1 COST INDEX & SPECIFICATION OF BUILDING:

The preparation of cost estimates for civil infrastructures is based on prevailing cost index of the area in June'2018. The cost index value has been calculated from market rate of the area. The same was provided by the staff officer (Civil) of the area. Standard guidelines provided by B.P.E have been adopted for arriving at cost index value. Considering the prevalent rates of materials and labour in Hasdeo Area, the cost index works out to 3581 in June 2018 with reference to 100 base in Delhi as on 1.10.76. The detailed calculation for Cost Index is shown in Appendix A.2.3. All civil construction has predominantly been envisaged to be of temporary specification.

Taking off from the nearby major road new approach of length 8.0 km has been assessed for the project. This road will also serve the purpose of initial coal transport and as such 15.0m or 7.50m wide (as per requirement at the time of implementation) bituminous road has been proposed.

15.1 SAFETY MEASURES AGAINST INUNDATION OF RAIN WATER

Adequate pumping capacity has been provided to deal with strata and surface water. At the same time, one diesel pump set has also been provided to pump out those waters logged which can not flow to the sump. The HFL of Kulharia Nala is not known, it is suggested to conduct hydro-geological survey to estimate the above HFL. Based on the HFL, to reduce the water inundation from Nala, embankment will be made at the required places for which capital provision has been given in the Appendix A.8.1. Intermittent capacity pump has also been provisioned to deal with average pumping load.

15.2 DUST SUPPRESSION

Major source of dust in opencast mine operation have been identified to be from haul roads, due to spillage from dumpers and abrasion by their wheels. Provision of adequate nos. of water sprinklers have been made for spraying of water on haul roads to prevent emission of dust. All along life, haul roads and other heavy duty roads likely to be negotiated by heavy vehicles and equipment have been proposed to be metalled and coated to facilitate control of emission of dust.

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The drills to be engaged is to be equipped with dust arrester so that dust emission is minimum. As the blasting is not continuous one and while blasting, persons will be removed to the safe zone, chances of exposure to dust due to blasting are less. At siding, sufficient arrangements have been provided to suppress coal dust at vulnerable points.

16.1 Existing Environment Quality

Jhiria West OC Project (1.50 Mty) is located in the Hasdeo Area of SECL. The project comprises mostly forest land (i.e. 323.737 Ha, 67.06 %) & tenancy land (i.e. 104.140 Ha, 21.57 %). The project area is not involved with any industrial and mining activities for which require regular environmental monitoring/audit. However in the study area, there are mining activities in Ramnagar Sub-Area in which CMPDI on behalf of SECL is carrying out environmental monitoring at different locations of the sub-area, which are utilized for preparation of this PR.

This data will enable to obtain a comprehensive idea of environmental quality in and around the proposed project area in respect of air quality, water quality, noise level, flora fauna, socio economic data etc. Detail existing environmental base line data will be generated before submission of final EIA/EMP to MoEF.

16.2 Environment Management System

16.2.1 Monitoring Schedule

Environmental monitoring will be carried out following the monitoring schedule for Air, Water, and Noise levels as per Standards of MOEF (Vide GSR 742 (E) dated 25.9.2000).

16.2.2 Plantation Monitoring

The project authority at field level will continuously monitor the growth and survival/mortality rates of the plantations till the end of 3 years. Once trees attain desired growth, no further monitoring will be required.

16.2.3 Action Plan for Land Reclamation and Plantation

The estimated life of the mine is 12 years. Maximum height of internal dump would be 50 m from the ground level. The dump surface would be maintained flat and top soil would be sprayed over it as a part of final reclamation. The maximum depth of quarry would be 60 m from the ground level. Approximate total no. of plants is estimated

as 1010010 Nos. An area of 67.93 Ha would be left as final void/water body after mine closure.

17.1 LAND

Jhiria West OC mine is being planned on a virgin block. The topography of the quarry area is almost flat with surface elevation varying from 515m to 555m above MSL. The details of land use and PAF are based on landuse plan supplied by area authority..

Total land involved for the project is 482.694 Ha including land for industrial development, colony, approach road, coal transport road & road diversion, magazine and quarry safety zone. Out of total 482.694 Ha land, forest land is 323.737 Ha, tenancy land is 104.140 Ha and Govt. land is 54.817 Ha. Two villages namely, Bhalmuri and Soutanchua village are located within the mine area.

Break-up of land use has been estimated on the basis of landuse plan supplied by area authority. The break-up of land for the purpose of this report are as follows: -

Sl. No.	Particulars	Forest Land	Tenancy Land	Govt Land	Grand Total
	Land requirement				
a	Quarry area	268.495	48.400	45.493	362.388
b	Safety zone	52.082	24.812	7.884	84.778
c	External dump				0.000
d	Land for infrastructures		3.338	1.440	4.778
e	Additional Land for Approach road etc.	3.160	4.580		7.740
	Sub-Total	**323.737**	**81.130**	**54.817**	**459.684**
f	Land for Belt, CHP & siding etc.		15.000		15.000
g	Land for R&R site		8.010		8.010
	Sub-Total	**0.000**	**23.010**	**0.000**	**23.010**
	TOTAL LAND TO BE ACQUIRED	**323.737**	**104.14**	**54.817**	**482.694**

The estimated capital requirement for land acquisition of the quarry as per RFCTLARR Act 2013 has been given in the Appendix A1.

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17.2 STATUS OF LAND ACQUISITION

Two villages namely, Bhalmuri and Soutanchua village are located within the mine area. As per the data provided by Hasdeo Area the Project Affected Family of these villages are about 220 Nos. The capital provision for R&R of these villages has been considered in the report.

The area is free from any industrial activity, and is also devoid of any monument of historical or archaeological importance. Jhiria West OC project is being planned on a virgin block. No land has been acquired so far. So, all the required land is to be acquired.

18.1 Mine Closure Cost

The mine closure cost will cover the following activities for which a corpus escrow account @ Rs. 6.0 lakhs per Ha. for OCP & @ Rs. 1.0 lakh per Ha for UG mine of the project area shall be opened with the coal controller organization. In case of mines having acid mine drainage, post closure acid mine drainage management cost shall also be included in the total closure cost.

18.2 Mine Closure Cost for OC mine

As per the guidelines of the MoC, the cost of the mine closure is to be computed based on the basis of involved project area. In Jhiria West OCP, the total project area is **474.684 Ha (excluding area for R&R site)**. So, the closure cost is to be computed considering a project area of 474.684 Ha. The latest WPI as on Apr 2018 is 116.8 based on the 2011-12 series.

The escalation factor for Apr 2018 (WPI 116.8) over Aug 2009 (WPI 129.6) comes to 0.901. This has to be updated with the linking factor of 2004-05 & 2011-12 series.
The linking factor for all commodities between these two series is 1.561.

The final escalation factor for Apr 2018 (series 2011-12) over Aug 2009 (series 2004-05) comes to 1.406 (0.901 * 1.561) .

The estimated updated cost of the mine closure as on Apr 2018 is Rs. 8.436 lakh per hectare (6.00 * 1.406 ,considering the admissible escalation over Rs. 6.00 lakh per Ha as on August 2009).

Total Final mine closure cost (@ Rs.8.436 lakhs/Ha.)**: Rs. 4004.434 Lakhs**

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The current value of corpus is **Rs. 4004.434 Lakhs** (as on Apr 2018). This corpus is to be divided by estimated life of mine. Since, the balance life of the mine is estimated as **12 years,** the annual corpus comes to **Rs**. **333.703 Lakhs** by dividing the total corpus by 12 years. This amount is to be deposited in escrow account every year.

Fund to be deposited in escrow account: Year wise amount to be deposited has been given below in table 18.11.

Table – 18.11

Year	Fund Deposited in Escrow Fund	Fund to be Reimbursed (Maximum)	
1	333.703	Nil	(+) accrued interest as applicable
2	350.388	Nil	
3	367.907	Nil	
4	386.302	Nil	
5	405.617	Nil	
1st Phase	**1843.917**	**1475.134**	
6	425.898	Nil	
7	447.193	Nil	
8	469.553	Nil	
9	493.031	Nil	
10	517.683	Nil	
2nd Phase	**2353.358**	**1882.686**	
11	543.567	Nil	
12	570.745	Nil	
13	599.282	Nil	
14	629.246	Nil	
15	660.708	Nil	
Final phase	**3003.548**	**3843.003**	
Total	**7200.823**	**7200.823**	

The total escalation from the base year Aug'2009 is given in the table 18.12 below:

Table – 18.12

Year	Amount (As of August'09)	Escalation	Total amount to be deposited in escrow account (As of Jun'18)
1	237.342	96.361	333.703
2	237.342	113.046	350.388
3	237.342	130.565	367.907
4	237.342	148.960	386.302
5	237.342	168.275	405.617
Phase 1	**1186.710**	**657.207**	**1843.917**

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Year	Amount (As of August'09)	Escalation	Total amount to be deposited in escrow account (As of Jun'18)
6	237.342	188.556	425.898
7	237.342	209.851	447.193
8	237.342	232.211	469.553
9	237.342	255.689	493.031
10	237.342	280.341	517.683
Phase 2	**1186.710**	**1166.648**	**2353.358**
11	237.342	306.225	543.567
12	237.342	333.403	570.745
13	237.342	361.940	599.282
14	237.342	391.904	629.246
15	237.342	423.366	660.708
Final phase	**1186.710**	**1816.838**	**3003.548**
Total	**3560.130**	**3640.693**	**7200.823**

19.1 MANPOWER ASSESSMENT

The requirement of departmental manpower at the rated capacity of 1.50Mt of coal per year has been estimated as 197 in Outsourcing Option, 304 in Partial Outsourcing Option and 722 in Departmental Option. The manpower requirement for proposed project has been calculated on the basis of 3 shift operation for 330 days in a year.The breakup of the manpower requirement of this project has been summarised as follows:

Manpower Requirement

Sl. No	Particular	**Outsourcing Option**.(Nos)	**Partial Outsourcing Option**.(Nos)	**Departmental Option**.(Nos)
1	Workers	96	170	532
2	Monthly paid staff	83	108	152
3	Officers	18	26	38
	Total	197	304	722

20.1 PROJECT SCHEDULE

It is well known fact that for timely implementation of a project, it is essential that all the activities related with project construction are properly planned, closely monitored and effectively supervised.

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All implementing departments should have their own implementation manuals which are followed for monitoring and construction of the project, so that, man, materials and money are made available to the project in time as spelt in the project report, with a view to prevent cost and time over-run. Responsibility, power for each executive has also been included in the implementation manual to prevent overlapping of operational areas. Sufficient administrative and financial power has been defined for key executive to take timely and effective decisions for the implementation of the project. Time estimates are broad and indicative only, necessary modifications to suit local site conditions are to be incorporated subsequently.

The life of the proposed mine will be 12 years including construction period. The maximum quarry depth will be around 60.12 m. The Production Program proposed is as given below:-

Year	Coal Production (Mt)	OB Removal (M.Cum)
1	0	0
2	0.50	4.00
3	1.00	8.00
4	1.50	11.50
5	1.50	11.50

20.2 Technically, zero date has been adopted as the date of approval and/or date of environmental clearance or the date of the land acquisition whichever is later.

21.1 PROJECT ECONOMICS

In this PR three options have been worked out namely Total Outsourcing Option, Partial Outsourcing Option and Total Departmental Option. The three options have been worked out in this PR are as given below.

Sl No	Options	Details
1	Total Outsourcing Option	Both Coal extraction and OB removal is by Outsourced HEMM
2	Partial Outsourcing Option	Coal extraction by Departmental HEMM and OB removal is by Outsourced HEMM
3	Total Departmental Option	Both Coal extraction and OB removal is by Departmental HEMM

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The financial evaluation have been worked out based on the prevalent norms of productivity, operating cost and spare consumption etc.

In this Para financial evaluation of Departmental option, Outsourcing and Partial Outsourcing has been detailed. The Capital required for the project in Outsourcing option, Partial Outsourcing option and Departmental option works out to be **Rs 340.45** crores, **Rs 389.97** crores and **Rs 731.54** crores respectively. The phasing of additional capital has been given in para 21.1. The summarised form of Appendix-A is given in Table below.

Summary of Capital Expenditure (Outsourcing, Partial Outsourcing and Departmental Option) (*updated June 2018)*

A/c Head	Particulars	Additional Capital Provisions (**Rs** Crs.)		
		Outsourcing	Partial Outsourcing	Departmental
01	Land	107.09	107.09	107.09
02	Service Building	7.70	11.42	45.53
03	Residential Building	0.07	0.11	0.23
04	Plant & Machinery	36.86	82.30	383.02
05	Furniture & Fittings	0.44	0.44	0.44
06	Railway Siding	16.76	16.76	16.76
07	Vehicles	1.50	1.50	1.50
08	Prospecting & Boring	1.23	1.23	1.23
09	Mine Development	76.37	76.37	76.37
10	Roads & Culverts	71.99	71.99	78.78
11	Water Supply	7.73	9.04	8.89
12	PR/EMP	3.60	3.60	3.60
13	Revenue Expn. Capital.	14.53	14.54	14.54
14	Less Depreciation	6.41	6.41	6.41
	Total	**340.45**	**389.97**	**731.54**

21.1 Capital investment and its phasing

OPTIONS	**PHASING OF CAPITAL (Rs. In lakhs)**					**TOTAL CAPITAL**
	1st	**2nd**	**3rd**	**4th**	**5th**	
Outsourcing Option	8498.94	10070.26	8891.36	6351.25	233.68	34045.48
Partial Outsourcing	8499.86	12127.67	10851.43	7454.21	64.00	38997.17
Departmental Option	8495.92	26575.90	19556.92	18461.36	64.00	73154.10

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21.2 METHOD OF ESTIMATION OF CAPITAL COST:

a) Land

Rate of revenue and forest land are provided by SECL Rate of tenancy land is provided by SECL as per RFCTLARR Act 2013.

	Rate/Ha(` lakhs)
Tenancy Land	**28.40**
Forest Land	**22.25**
Govt. Land	**10.00**

b) Civil Construction (alongwith Cost Index)

The preparation of cost estimates for civil infrastructure is based on prevailing cost index of the area in June 2018. Considering the prevalent rates of materials and labour in Hasdeo Area, the cost index works out to 3581 in June 2018 with reference to 100 base in Delhi as on 1.10.76.

c) P&M

Price of P&M has been taken from the standard price list published by CMPDI, HQ on May 2017. Prices have been updated upto June 2018 as per escalation rate given in the price list.

21.3 COST OF PRODUCTION

Cost of production of Total Outsourcing Option, Partial Outsourcing Option and Total Departmental Option are as given below.

Sl. No.	Particulars	Unit	Outsourcing Option	Partial Outsourcing	Departmental Option
1	Salaries,Wages & Benefits	Rs/t	122.50	192.54	434.83
2	Stores	Rs/t	118.87	226.44	567.36
3	Power	Rs/t	65.84	74.32	169.62
4	Misc. exp	Rs/t	115.34	123.20	191.31
5	Admn. Charges	Rs/t	88.00	88.00	88.00
6	Coal O/S Cost	Rs/t	67.29		
7	OB O/S Cost	Rs/t	411.89	411.89	
8	OB Rehandling cost	Rs/t	54.51	54.51	54.51
9	Int. on wkg. cap	Rs/t	52.28	58.40	74.58

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Sl. No.	Particulars	Unit	Outsourcing Option	Partial Outsourcing	Departmental Option
10	Int. on loan cap	Rs/t	0.00	0.00	0.00
11	Mine Closure Cost	Rs/t	37.44	37.44	37.44
12	Depreciation	Rs/t	201.53	232.98	441.86
	Total Cost	Rs/t	**1335.49**	**1499.74**	**2059.51**

21.4 SELLING PRICE

The weighted average selling price of coal for this coal project has been taken as Rs 2395.15 per tonne for ROM processed coal (-100 mm). The weighted average grade of coal is 'G-6' with GCV 5524 Kcal/Kg.

CALCULATION OF SELLING PRICE

Sl. No.	Particulars	Price (Rs./t)
a)	Base Price coal (Grade G6)*	2317.00
b)	Considering 5% grade slippage	2201.15
c)	Charges for Sizing (-100 mm)	87.00
d)	Transport reimbursement, if any	57.00
e)	Evacaution Facility Charges	50.00
f)	**Total sale price**	**2395.15**

*As per price notification No. CIL:S&M:GM(F):Pricing2018:07 dated 08.01.2018.

21.5 OUTSOURCING RATES

The rates have been considered based on the escalated rates received from SECL.

OB Outsourcing Rate

For OB removal yearwise lead has been estimated and based on that average lead for OB removal is estimated to 1.60 Km. The outsourcing rate of OB for average lead of 1.60 Km based on the escalated rates received from SECL is works out to Rs. 51.25 per cum with current diesel price @Rs 74.02 per litre (based on outsourcing rate of Rajnagar OC as base rate). The OB rehandle rate calculated by dividing the OB removal rate by 1.25 and it comes to Rs.41.00/cum.

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Coal Outsourcing Rate

The outsourcing cost of Coal for surface miner cutting, loading, transport from face to pit top and Transportation from Pit top to siding for different lead are follows:-

Particulars	Outsourcing Option	Partial Outsourcing	Departmental Option
Cutting (by Surface Miner) (Rs./t)	21.30	-	-
Loading (Rs./t)	15.36	-	-
Transportation from face to pit top(1.50Km) (Rs./t)	30.63	-	-
Total (Rs./t)	**67.29**	-	-

Loading & Transportation cost of Rs 66.22 per te to transport coal from pit top to siding (for 6.00Km) for all three options has been considered in project costing.

Service Tax component of HoE rate has not been considered in costing of the project as CENVAT credit is available against it. The above hiring rates have been considered only for economic evaluation of the project report for the planning purpose.

21.6 FINANCIAL EVALUATION RESULTS:-

The financial evaluation results for Total Outsourcing option, Partial Outsourcing option and Total Departmental Option are as shown in the table below:-

Sl.	Particulars	Unit	Outsourcing Option	Partial Outsourcing	Departmental Option
1	Total capital investment	Rs. crores	340.45	389.97	731.54
2	a) Capital requirement of P&M	Rs. crores	36.86	82.30	383.02
3	Selling price	Rs./ t	2395.15	2395.15	2395.15
4	Estimated cost of production				
5	a) at 100% level	Rs./t	1335.49	1499.74	2059.51
	b) at 85% level	Rs./t	1449.16	1644.23	2340.55
6	Profit per tonne a) at 100% level	Rs./t	1059.66	895.41	335.64
	b) at 85% level	Rs./t	945.99	750.92	54.60
7	Break-even-point (%)		37.81	47.76	82.59
	(Mty)		0.57	0.72	1.24
8	No. of personnel		197	304	722
9	OMS	Rs./t	27.00	17.46	7.41
	EMS	Rs.	3307.75	3360.90	3223.60

Sl.	Particulars	Unit	Outsourcing Option	Partial Outsourcing	Departmental Option
10	Anticipated year of achieving target	Year	4 th	4 th	4 th
11	IRR at 100% level of production	%	71.28%	55.57%	14.17%
12	IRR at 85% level of production	%	56.35%	41.87%	2.90%
13	Completion capital	Rs. crores	377.58	433.69	825.68
14	NPV @ 12% at 100% level of production	Rs crores	647.83	520.69	39.15
15	NPV @ 12% at 85% level of production	Rs crores	476.37	348.29	-154.05

21.7 Sensitivity Analysis - given in the Appendix-C.4.

21.8 CONCLUSION

The project has been planned in line with the present technology and forthcoming changes in neighbouring mines as well as in other parts of the country. The techno-economics have been worked out based on the prevalent norms of productivity, operating cost, spare consumption etc. Following three options have been worked out in this PR.

Sl No	Options	Details
1	Total Outsourcing Option	Coal extraction and OB removal is by Outsourced HEMM
2	Partial Outsourcing Option	Coal extraction by Departmental HEMM and OB removal is by Outsourced HEMM
3	Total Departmental Option	Both Coal extraction and OB removal is by Departmental HEMM

In Total Outsourcing Option, the project is yielding a profit of Rs.1059.66 per tonne at 100% and Rs. 945.99 per tonne at 85% level of production. The financial IRR of the project in outsourcing option works out to 56.35% at 85% capacity. The outsourcing option of Jhiria West OC (1.50 Mty) is meeting the criteria of approval i.e. 12% IRR at 85% capacity level.

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In Partial Outsourcing Option, the project is yielding a profit of Rs. 895.41 per tonne at 100% and Rs. 750.92 per tonne at 85% level of production. The financial IRR of the project in partial outsourcing option works out to 41.87% at 85% capacity. The Partial outsourcing option of Jhiria West OC (1.50 Mty) is meeting the criteria of approval i.e. 12% IRR at 85% capacity level.

In Total Departmental Option, the project is yielding a profit of Rs. 335.64 per tonne at 100% and Rs. 54.60 per tonne at 85% level of production. The financial IRR of the project in outsourcing option works out to 2.90% at 85% capacity. The Total departmental option of Jhiria West OC (1.50 Mty) is not meeting the criteria of approval i.e. 12% IRR at 85% capacity level.

PR for Jhiria West Opencast (1.50Mty) with three options ie outsourcing Option, Partial Outsourcing Option and Departmental Option was placed before SECL Board on 28.11.2018 held at Raipur. **SECL Board after detailed deliberations approved the Project Report for Jhiria West Opencast (1.50Mty) for Partial Outsourcing Option (Coal Departmental and OB Outsourcing) involving a capital investment of Rs. 389.97 Crores vide 279th meeting of Board of Directors of SECL held on 28.11.2018 (Wednesday) at Raipur.**

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TEXT

CHAPTER – I

INTRODUCTION

1.1 BACKGROUND OF THE PROJECT REPORT

The Jhiria West Opencast Project is situated in Sohagpur coalfields and is under administrative control of Hasdeo area of SECL. The area is included in the Survey of India Toposheet No. 64 I/4. The block is located in the close proximity of existing Rajnagar RO UG mine.

The existing Rajnagar RO UG mine which is adjacent to proposed Jhiria West OCP is likely to be exhausted within few years as communicated by Hasdeo Area. It was also noted that the infrastructure of Rajnagar RO may be utilized for mining in Jhiria West Opencast Project since it is adjacent to Rajnagar RO. Accordingly, Project Report for Jhiria West Opencast Project has been prepared to finalise the modalities to extract coal from West Jhiria geological block.

The PR for Jhiria West Opencast (1.50Mty) presented before SECL Board held on 05.07.2017 at New Delhi and SECL Board suggested to incorporate some modifications in the report. Accordingly Project Report modified incorporating SECL board observation and submitted in June 2018.

PR for Jhiria West Opencast (1.50Mty) with three options ie outsourcing Option, Partial Outsourcing Option and Departmental Option was placed before SECL Board on 28.11.2018 held at Raipur. **SECL Board after detailed deliberations approved the Project Report for Jhiria West Opencast (1.50Mty) for Partial Outsourcing Option (Coal Departmental and OB Outsourcing) involving a capital investment of Rs. 389.97 Crores vide 279th meeting of Board of Directors of SECL held on 28.11.2018 (Wednesday) at Raipur.**

1.1.1 SALIENT FEATURES OF LAST APPROVED REPORT

Within this block, previously no opencast project report formulated.

1.2 EXPLORATION STATUS

The area was first geologically mapped for the first time by T.W.Hughes (1881-83). Shri M. Venkatappay and K. Ramarao of GSI surveyed the Jhagrakhand area in 1960-61. During the period from 1973 to 1976, surrounding area of Jhagrakhand was surveyed by GSI and carried out regional exploration along with detailed mapping on scale of 1:8000 around the area located south of

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Jhagrakhand group of mines. Based on regional exploration, Directorate of Geology and Mining, M.P has taken up detailed exploration (1987 to 1999) at the instance of CMPDI, RI-V, Bilaspur in the area bounded by Kulharia nala in the east and Jhiria nala in the south and findings are incorporated in Geological report on exploration for coal in Jhiria block, Sohagpur Coalfield, District Anuppur, M.P. (F.S. 1987-99).

The northern part of the Jhiria block has not been explored completely, which need additional boreholes at closer interval for complete proving the area.

The detailed exploration in the West Jhiria block by drilling at an interval of 400m have been carried out by Directorate of Geology and Mining, M.P during the period from December 1997 to April 2000. Altogether 26 boreholes have been drilled in the area involving total of 1644.60m.

The detail of the drilling meterage shown in Table 4.1:

Table 4.1: Financial year-wise drilling meterage

AGENCY	YEAR	NO.OF BOREHOLES DRILLED	METERAGE
DGM,M.P.	1997-98	6	412.57
	1999-00	18	1114.33
	2000-01	2	117.70
	Total	26	1644.60

Data of 09 Nos. of boreholes drilled by Directorate of Geology and Mining, M.P of MPJH series of Jhiria Block have also been utilized for interpretation and assessment purposes falling within the block.

At the time of the execution of the project, confirmatory drilling will have to be done for precise alignment of incrops of seams and also for pinpointing position of faults. The study/MINEX model has been done based on only 26 boreholes drilled by DGM, M.P. in 4.17sq.km. area. The density of the borehole in the area of West Jhiria block is only about 6 boreholes / sq. km. Hence, around 20 boreholes with an expected meterage of around 1500m is required to be drilled within and around the West Jhiria Block for further enhancing the degree of confidence.

1.2.1 History of the Block

Within this block, previously no opencast project report has been formulated. Previously in small part in the eastern side of the block one UG mining in the name of Dumarkachhar UG was started. As per mine authority, this UG working has been closed after touching coal seams due to some difficulties.

1.3 MINING ACTIVITIES

1.3.1 PRESENT STATUS OF THE NEAREST MINE/PROJECT

The nearest working mine of Jhiria West Opencast Project is Rajnagar RO UG mine. Rajnagar OC mine is at a distance of about 6-7 Km from West Jhiria Block.

1.4 JUSTIFICATION FOR PREPARATION OF PR

The existing Rajnagar RO UG mine which is adjacent to proposed Jhiria West OCP is likely to be exhausted within few years as communicated by Hasdeo Area. It was also noted that all the infrastructure of Rajnagar RO may be utilized for mining in Jhiria West Opencast Project since it is adjacent to Rajnagar RO.

As per Road Map for Enhancement Coal Production of Coal India, the production projection of SECL for the year 2018-19 is 193.10 Mt and production projection of SECL for the year 2019-20 is 239.60Mt.

Jhiria West OC is a virgin project & Average grade of coal is grade 'G-6' with GCV 5524 Kcal/Kg. From Table above, it can be seen that in the year 2018-19 and 2019-20, there is a need of SECL for opening of new Projects to bridge the production projection. Preparation of Project Report for Jhiria West Opencast is therefore proposed with a view to fulfill part of the above indicated growth in production projection.

1.5 SALIENT FEATURE OF THE PR

The PR has been formulated to win coal by Surface Miner & OB by Shovel Dumper combination. Coal from face will be transported to pit top by higher capacity truck/dumper. Coal from pit top will be transported to Rajnagar siding by higher capacity truck/tipper to dispatch coal by rail.

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In this PR three options have been worked out namely Total Outsourcing Option, Partial Outsourcing Option and Total Departmental Option. Following three options have been worked out in this PR

Sl No	Options	Details
1	Total Outsourcing Option	Both Coal extraction and OB removal is by Outsourced HEMM
2	Partial Outsourcing Option	Coal extraction by Departmental HEMM and OB removal is by Outsourced HEMM
3	Total Departmental Option	Both Coal extraction and OB removal is by Departmental HEMM

The techno-economics have been worked out based on the prevalent norms of productivity, operating cost and spare consumption etc. The financial parameters of all three options are as given below.

Salient features of present PR(June,2018) (Capacity, Capital, etc.)

Sl.	**Particulars**	**Unit**	**Outsourcing Option**	**Partial Outsourcing**	**Departmental Option**
1	Total Mineable Reserves	M Te.	14.35	14.35	14.35
2	GCV Band		G-6 (GCV 5524)	G-6 (GCV 5524)	G-6 (GCV 5524)
3	Volume of OB	M.Cum	115.33	115.33	115.33
4	Stripping Ratio (Av.)	Cum/t	8.04	8.04	8.04
5	Target Output	Mt/Yr.	1.50	1.50	1.50
6	Peak OBR	Mcum/yr.	11.50	11.50	11.50
7	Project life	Year	12	12	12
8	Total capital investment	Rs. crores	340.45	389.97	731.54
9	a) Capital requirement of P&M	Rs. crores	36.86	82.30	383.02
10	Selling price	Rs./ t	2395.15	2395.15	2395.15
11	Estimated cost of production				
	a) at 100% level	Rs./t	1335.49	1499.74	2059.51
	b) at 85% level	Rs./t	1449.16	1644.23	2340.55
12	Profit per tonne a) at 100% level	Rs./t	1059.66	895.41	335.64
	b) at 85% level	Rs./t	945.99	750.92	54.60
13	Break-even-point (%)		37.81	47.76	82.59
	(Mty)		0.57	0.72	1.24

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Sl.	Particulars	Unit	Outsourcing Option	Partial Outsourcing	Departmental Option
14	No. of personnel		197	304	722
15	OMS	Rs./t	27.00	17.46	7.41
16	EMS	Rs.	3307.75	3360.90	3223.60
17	Anticipated year of achieving target	Year	4 th YEAR	4 th YEAR	4 th YEAR
18	IRR at 100% level of production	%	71.28%	55.57%	14.17%
19	IRR at 85% level of production	%	56.35%	41.87%	2.90%
20	Completion capital	Rs. crores	377.58	433.69	825.68
21	NPV @ 12% at 100% level of production	Rs crores	647.83	520.69	39.15
22	NPV @ 12% at 85% level of production	Rs crores	476.37	348.29	-154.05

Box cut & initial external OB (about 19.08 Mcum) are proposed to be dumped within quarry area and safety zone area to keep the land requirement bare minimum. The OB so dumped is proposed to be rehandled back to the internal dump. More land would be required if external dump kept outside quarry area and there will be additional impact on environmental point of view. So OB externally dumped within quarry area is proposed to be rehandled back to decoaled area as internal dump.

Sometimes with favorable geo-mining conditions and improved productivity of the HEMM, the project may produce coal upto 1.25 times of the planned capacity. So, EMP should be prepared for 1.875Mty, accordingly approval from the Competent Authority is to be sought.

In Total Outsourcing Option, the project is yielding a profit of Rs.1059.66 per tonne at 100% and Rs. 945.99 per tonne at 85% level of production. The financial IRR of the project in outsourcing option works out to 56.35% at 85% capacity, considering the notified price of coal (G-6 grade) for power sector consumer. The outsourcing option of Jhiria West OC (1.50 Mty) is meeting the criteria of approval i.e. 12% IRR at 85% capacity level.

In Partial Outsourcing Option, the project is yielding a profit of Rs. 895.41 per tonne at 100% and Rs. 750.92 per tonne at 85% level of production. The

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financial IRR of the project in partial outsourcing option works out to 41.87% at 85% capacity, considering the notified price of coal (G-6 grade) for power sector consumer. The Partial outsourcing option of Jhiria West OC (1.50 Mty) is meeting the criteria of approval i.e. 12% IRR at 85% capacity level.

In Total Departmental Option, the project is yielding a profit of Rs. 335.64 per tonne at 100% and Rs. 54.60 per tonne at 85% level of production. The financial IRR of the project in outsourcing option works out to 2.90% at 85% capacity, considering the notified price of coal (G-6 grade) for power sector consumer. The Total departmental option of Jhiria West OC (1.50 Mty) is not meeting the criteria of approval i.e. 12% IRR at 85% capacity level.

1.6 FLEXIBILITY IN IMPLEMENTATION

The flexibility in the implementation stage may be exercised within the approved cost estimates to respond to improvements in technology and equipment which would result in improved profitability and productivity measures. Following points may be considered under the flexibility: -

a) Re-alignment of working layout for better working layout / dump etc.
b) Change in the specification of HEMM to higher capacity at the time of procurement of new equipment or replacement of the equipment.
c) To procure state-of-the-art safety equipment, whenever they are introduced, even if the same is not provided in approved Project Report.
d) Relocation of site for infrastructure facilities depending upon techno-economic reasons and availability of land / forest area etc.
e) Hiring of equipment for loading, transportation etc., at a competitive price, so as to cater to the needs of increased demand of coal and subsequent removal of higher OB and for augmentation of coal production.
f) For upgradation of new technology in mining method for improving performance and reduction in manpower, at a subsequent date after project completion.

g) In this PR it is proposed that coal would be mined by surface miner. However, in circumstances where Operational/Geotechnical difficulties persist small quantity of coal may be mined out by alternative technology such as ripping/drilling etc. Prior approval may be obtained for use of alternative technology citing the circumstances/operational difficulties.

1.7 DIFFICULTIES AND CONSTRAINTS IN MINING WITH ASSOCIATED RISK

(i) A nalla named as "Kulharia nalla" is flowing along the periphery of the eastern boundary of the Project. Sufficient care should be taken to avoid inrush of water from Kulharia Nalla into the mine.

(ii) Rehabilitation & resettlement of two villages namely, Bhalmuri and Soutanchua village is involved in the project. Acquisition of land alongwith R&R of PAP is a critical activity and should be done for opening of the project.

1.8 CRITICAL ACTIVITIES PRIOR TO ENVIRONMENT CLEARENCE

Critical activities, which could be taken up prior to environmental, forestry and other statutory clearances to expedite project implementation are as given below.

a) Rehabilitation & resettlement of two villages namely, Bhalmuri and Soutanchua village, is involved in the Project. The study for acquisition of R&R site should be processed to rehabilitate the project affected family at the earliest.

b) Preliminary study about alignment and construction of approach road/coal transportation road is to be made.

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CHAPTER - II

MARKETABILITY & JUSTIFICATION

2.1 DEMAND AND SUPPLY SCENARIO (COMPANY)

Liberalisation of power sector by Government of India has generated wide spread interests for private and public sector investments in power generation and other industrial development. As such, there is an appreciable increase in the number of upcoming new projects in both private and public sectors.

As per Road Map for Enhancement Coal Production of Coal India, the idea of ramping up the production to 1 Billion Tonne of Coal by 2019-20 was germinated. An exercise has been carried out to prepare a roadmap for achieving a production level of 1 Billion Tonne of Coal by the year 2019-20. All the subsidiary companies were requested to identify the potential projects to achieve the desired goal. As per Road Map for Enhancement Coal Production of Coal India, projects to produce about 908.10 Mt in 2019-20 has been identified and for balance to reach 1 Bt was underway. The subsidiary-wise yearwise breakup of the production projection is as given in the Table no 2.1.

***Table2.1 : subsidiary-wise yearwise breakup of the production projection**

(Figures in Mt)

Company	14-15	15-16	16-17	17-18	18-19	19-20
ECL	38	42.03	46.9	51.7	56.6	62
BCCL	34	35.51	37	41	46	53
CCL	55	60.5	67	80	102	133.5
NCL	77	80	82	90	99	110
WCL	44	45	48	50	55	60
SECL	131.2	135	149.7	161	193.1	239.6
MCL	127	150	167	187	222	250
CIL	**506.2**	**548.04**	**597.6**	**660.7**	**773.7**	**908.1**

NOTE: *-Production Projection is based on "Road Map for Enhancement Coal Production of CIL"

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As per Road Map for Enhancement Coal Production of Coal India, the group-wise yearwise breakup of the production projection of SECL are as given in the Table no 2.2.

***Table 2.2 : Group-wise yearwise Production Projection for SECL**

(Figures in Mt)

SECL		**14-15**	**15-16**	**16-17**	**17-18**	**18-19**	**19-20**
Existing		1.85	1.66	1.66	1.64	1.57	1.11
Completed		20.46	19.80	18.67	16.80	15.59	14.43
Ongoing		108.90	112.57	128.34	136.57	157.38	180.26
Future		0.00	1.00	1.00	6.00	18.60	43.80
		131.2	**135.0**	**149.7**	**161.0**	**193.1**	**239.6**

NOTE: *-Production Projection is based on "Road Map for Enhancement Coal Production of CIL"

2.2 UTILITY OF MARKET FOR THE COAL FROM MINE / PROJECT

The production projection of SECL for the year 2018-19 is 193.10 Mt and production projection of SECL for the year 2019-20 is 239.60Mt.

Jhiria West OC is a virgin project & Average grade of coal is grade 'G-6' with GCV 5524 Kcal/Kg. Preparation of PR for Jhiria West Opencast with enhance coal production is, therefore, proposed with a view to fulfill the above indicated growth in production projection.

2.3 AVAILABLE LINKAGE OR FIRM FUEL SUPPLY AGREEMENT (FSA)

Jhiria West OC is a virgin project & Average grade of coal is grade 'G-6' with GCV 5524 Kcal/Kg can be used for basket linkage to various industries.

From Table No-2.2, it can be seen that in the year 2018-19, there is a need of SECL for opening of new Projects to bridge the production projection. Preparation of Project Report for Jhiria West Opencast is therefore proposed with a view to fulfill part of the above indicated growth in production projection.

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CHAPTER-III

PROJECT SITE INFORMATION

3.1 LOCATION

The Jhiria West Opencast Project is about 12 km SW of Bijuri town, 13 km SW of Manendragrah town and 5 km SW of Rajnagar Colliery in Anuppur district of Madhya Pradesh. The area is included in the Survey of India Toposheet No. 64 I/4. The Manendragarh Pendra road passes through the Western side of the block.

3.2. ACCESSIBILITY AND COMMUNICATION

The Jhiria West Opencast Project, lying immediate West of old Rajnagar incline of Rajnagar lease hold Area. The Jhiria West OC Project can be approached from Rajnagar RO Siding. The distance from Rajnagar RO siding to Jhiria West OC Project is about 8.0 Km. The area can be approached by Manendragarh – Pendra road near village Phulwari-tola, located about 13 km. and 12 km. from Manendragarh and Bijuri township respectively. The district Head Quarter Anuppur is connected by an all weather road. The Rajnagar RO siding is located in the north eastern side of the West Jhiria block. The Nearest rail head are Bijuri and Manendragarh.

3.3 PHYSIOGRAPHY:

The area has an undulatory to moderately rugged topography with general slope toward south-east direction. The area is governed by Kulharia nala flowing to SE in which numbers of small seasonal nalas are joining at rectangular fashion and from trellis type of drainage pattern. Kulharia nala is perennial in nature and discharging into Southerly-flowing Hasdeo river (a tributary of Mahanadi). The elevation of area ranges from 515 to 555 m. above M.S.L. the highest elevation recorded in the western part of the block while lowest elevation located in extreme SE corner of the block.

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3.4 DEFINING BLOCK BOUNDARY

The boundary of the West Jhiria Block has been considered as follows as per the Geological Report submitted by Directorate of Geology and Mining, M.P:

1. In the **north** : An arbitrary line 200m north and parallel to the line joining the borehole no. MPWJH-09 and MPWJH-07.
2. In the **south** : An arbitrary line running east-west approximately 200m south of MPWJH-04 and .200m in the east up to confluence of Jhiria and Sautanchuanala and extending along the nala up to confluence of Kulharianala in the east.
3. In the **east** : KulhariaNala.
4. In the **west** : An arbitrary line 200m west of borehole no. MPWJH-09 and extended due south to join the southern boundary of the block.

The block boundary as defined above covers an area of 4.17 sq.km.

3.3 CLIMATE AND RAINFALL DATA

The area is characterised by tropical climate with well defined summer from April to June, monsoon from July to September and winter from November to February. May is the hottest month when the temperature rises to 46^{o}C and during winter temperature falls as low as 7^{o}C to 8^{o}C. The relative humidity during monsoon ranges from 76% to 90% and in summer 26% to 42%. The average annual rainfall recorded was 1894.10mm (1994). Out of which 1756.70mm was monsoonic rainfall (July to September). However, the average rainfall is about 1200.00 mm. The metereological data recorded at Pendra Observatory Dist. Manendragarh (CG) from 1991 to 1995 is given in the following table : -

Metereological Data, Pendra Observetory, Dist.Manendragarh (CG)

Month	Temperature (0.1^{O} C)		Range of Rainfall (0.1 mm)	No. of Rainy Days (Range)	Range of Relative Humidity		Range of Wind Speed (Kmph)		Direction	
	Min	Max			Morning	Evening	Morning	Evening	Morning	Evening
January	105	254	0-467	0-4	50-75	32-56	13-21	13-28	N	N
February	125	297	0-323	0-3	49-66	27-49	16-31	27-41	N	N
March	174	346	0-766	0-6	37-61	26-48	17-32	26-59	N	N
April	219	377	31-196	0-3	33-41	23-31	27-36	32-55	N	N

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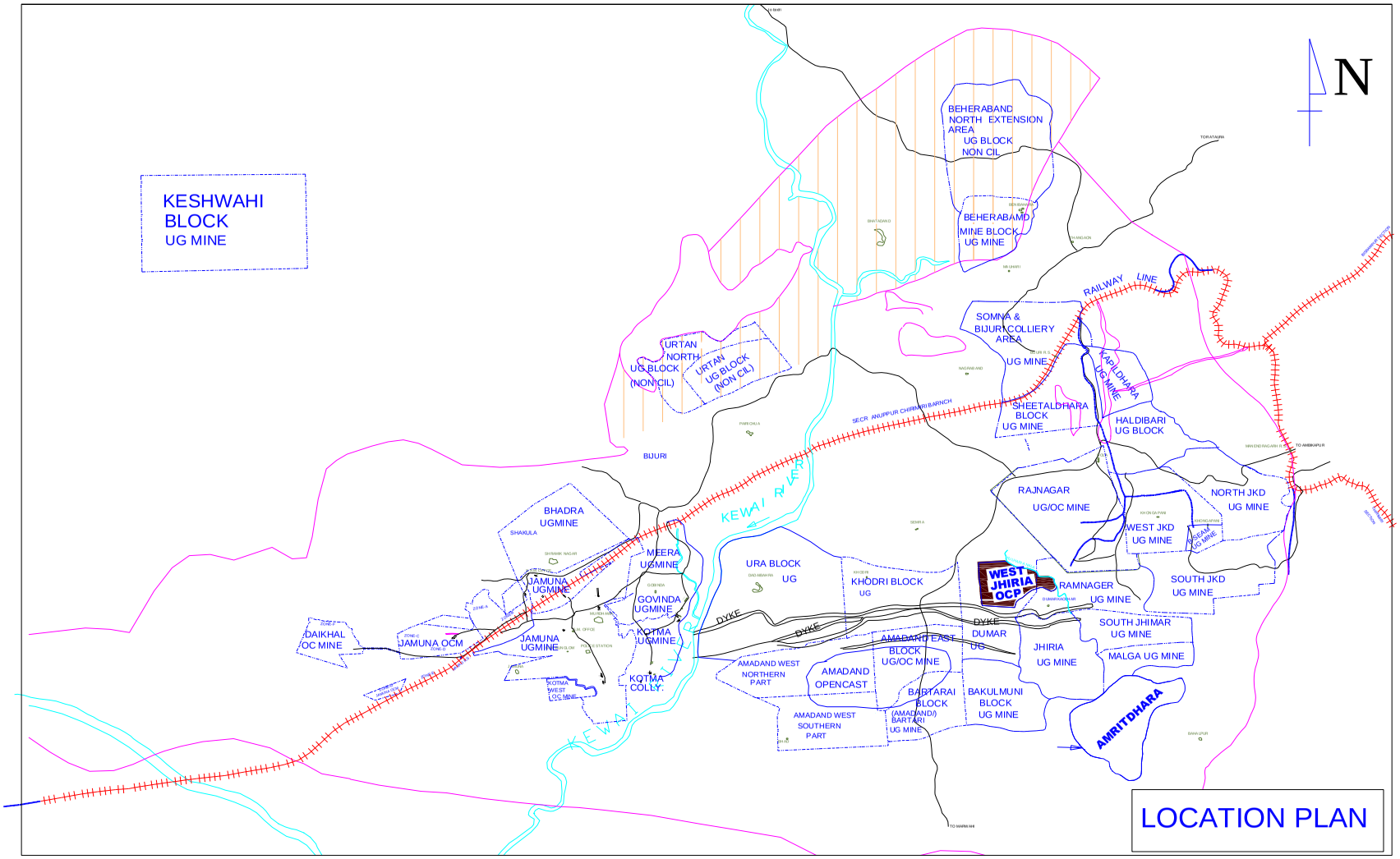
Month	Temperature (0.1^{O} C)		Range of Rainfall (0.1 mm)	No. of Rainy Days (Range)	Range of Relative Humidity		Range of Wind Speed (Kmph)		Direction	
	Min	Max			Morning	Evening	Morning	Evening	Morning	Evening
May	243	414	8-572	0-6	29-47	19-38	26-49	36-53	S	N
June	242	382	455-5381	4-16	51-73	42-71	32-45	33-49	SW	SW
July	233	314	3585-5105	15-22	80-90	76-85	25-32	23-33	SW	SW
August	230	295	2864-5184	14-21	84-90	79-85	11-36	18-35	N	NW
September	217	304	791-4940	7-16	78-87	67-84	21-38	11-39	N	N
October	182	306	141-2806	1-5	61-74	50-67	7-23	5-19	N	N
November	141	276	0-133	0-1	58-70	47-58	3-17	3-11	N	N
December	112	254	0-797	0-3	58-70	42-59	2-10	1-15	N	N
Annual	185	318	656-2223	3-9	56-70	44-61	17-31	19-36	N	N
No. of Years (1991-95)	5	5	5	5	5	5	5	5	5	5

Source : The meteorological data, Pendra Observatory.


KESHWAHI
BLOCK
UG MINE
N
BEHERABAND
NORTH EXTENSION
AREA
UG BLOCK
NON CIL
BEHERABAND
MINE BLOCK
UG MINE
RAILWAY LINE
SOMNA &
BIJURI COLLIERY
AREA
UG MINE
KAPILDHARA
UG MINE
SHEETALDHARA
BLOCK
UG MINE
HALDIBARI
UG BLOCK
URTAN
NORTH
UG BLOCK
(NON CIL)
URTAN
UG BLOCK
(NON CIL)
BIJURI
SECR ANUPPUR CHIRIMIRI BRANCH
KEWAI RIVER
BHADRA
UGMINE
MEERA
UGMINE
GOVINDA
UGMINE
JAMUNA
UGMINE
DAIKHAL
OC MINE
JAMUNA OCM
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WEST
OC MINE
URA BLOCK
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KHODRI BLOCK
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DYKE
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DUMAR
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AMADAND EAST
BLOCK
UG/OC MINE
AMADAND WEST
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OPENCAST
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OCP
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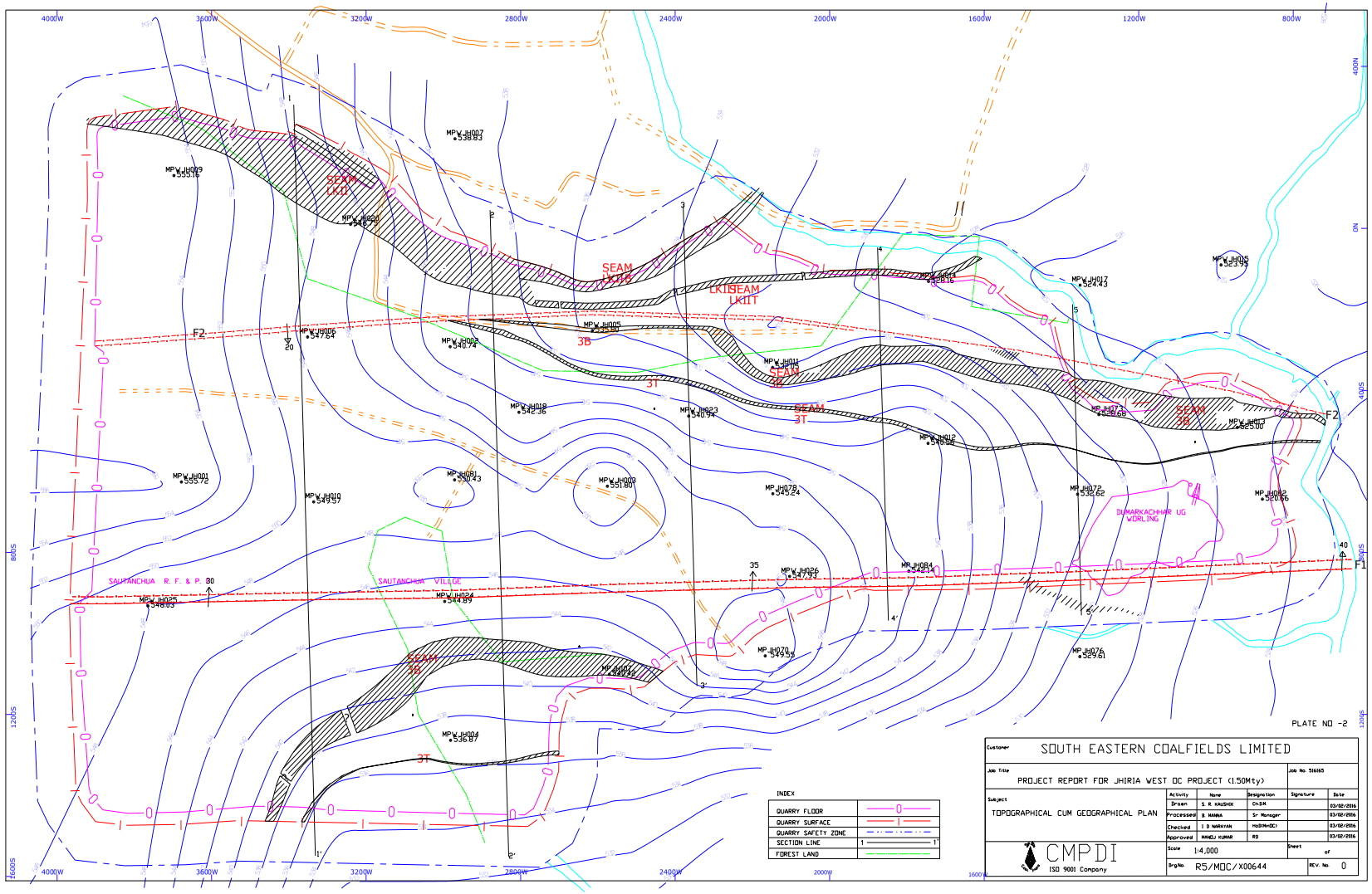
NORTH JKD
UG MINE
SOUTH JHIMAR
UG MINE
MALGA UG MINE
AMRITDHARA
LOCATION PLAN


SEAM LKII
SEAM LKIII
LKIISEAM LKIIT
SEAM 3B
SEAM 3T
F1
F2
SAUTANCHUA R. F. & P.
SAUTANCHUA VILLAGE
DUMARKACHHAR UG WORLING
INDEX
QUARRY FLOOR
QUARRY SURFACE
QUARRY SAFETY ZONE
SECTION LINE
FOREST LAND
PLATE NO -2
SOUTH EASTERN COALFIELDS LIMITED
PROJECT REPORT FOR JHIRIA WEST OC PROJECT (1.50Mty)
TOPOGRAPHICAL CUM GEOGRAPHICAL PLAN
CMPDI
ISO 9001 Company
Scale 1:4,000
Drg.No. R5/MOC/X00644
REV. No. 0

CHAPTER - IV

GEOLOGY AND DEPOSIT APPRAISAL

4.1 INTRODUCTION

4.1.1 BACKGROUND

The detailed exploration work to prove the existence of coal has been carried out by Directorate of Geology and Mining, M.P during the period from 1987 to 1999 in the area bounded by Kulharia Nala in the east and Jhiria nala in the south, based on the Regional Exploration carried out by GSI during the period of 1973-76. The Exploration in the northern part of Jhiria Block indicates the presence of two prominent coal horizons which have been correlated as seam-4 and seam-3 due to its adjoining location to old Rajnagar and abandoned Dumarkachar workings of Ramnagar lease hold area.

For proving the continuity and lay & disposition of the coal seams in western part of Ramanagar lease hold area, Directorate of Geology and Mining, M.P, carried out detailed exploration. Thus drilling was commenced in the West Jhiria Block in December 1997 to April 2000, completing 26 boreholes at 400m interval with total 1644.40m.

Earlier, the Chapter-4 for PR of this project had been submitted vide Noting Sheet No. RV/EXP/15/E-429, Dt. 16/03/2015 considering the Block boundary of reported in the Geological Report of West Jhiria Block, submitted by DGM, M.P. However, in reference to the Noting Sheet No. CMPDI/RI-5/2015/NIL, Dt.13/10/2015, as per discussion in the chamber of Director (T) (P&D), CMPDIL, Ranchi on 28/09/2015, the Block boundary of both western and south-western side has been straightened to get uniform strike length. The reserve estimation has been done accordingly in the annexed boundary (area 4.17 sq. km) of the block as advised vide above referred letter.

4.1.2 DEFINING BLOCK BOUNDARY

The boundary of the West Jhiria Block has been considered as follows as per the Geological Report submitted by Directorate of Geology and Mining, M.P:

1. In the north : An arbitrary line 200m north and parallel to the line joining the borehole no. MPWJH-09 and MPWJH-07.

2. In the south : An arbitrary line running east-west approximately 200m south of MPWJH-04 and .200m in the east up to confluence of Jhiria and Sautanchuanala and extending along the nala up to confluence of Kulharianala in the east.
3. In the east : Kulharia Nala.
4. In the west: An arbitrary line 200m west of borehole no. MPWJH-09 and extended due south to join the southern boundary of the block.

The block boundary as defined above covers an area of 4.17 sq.km.

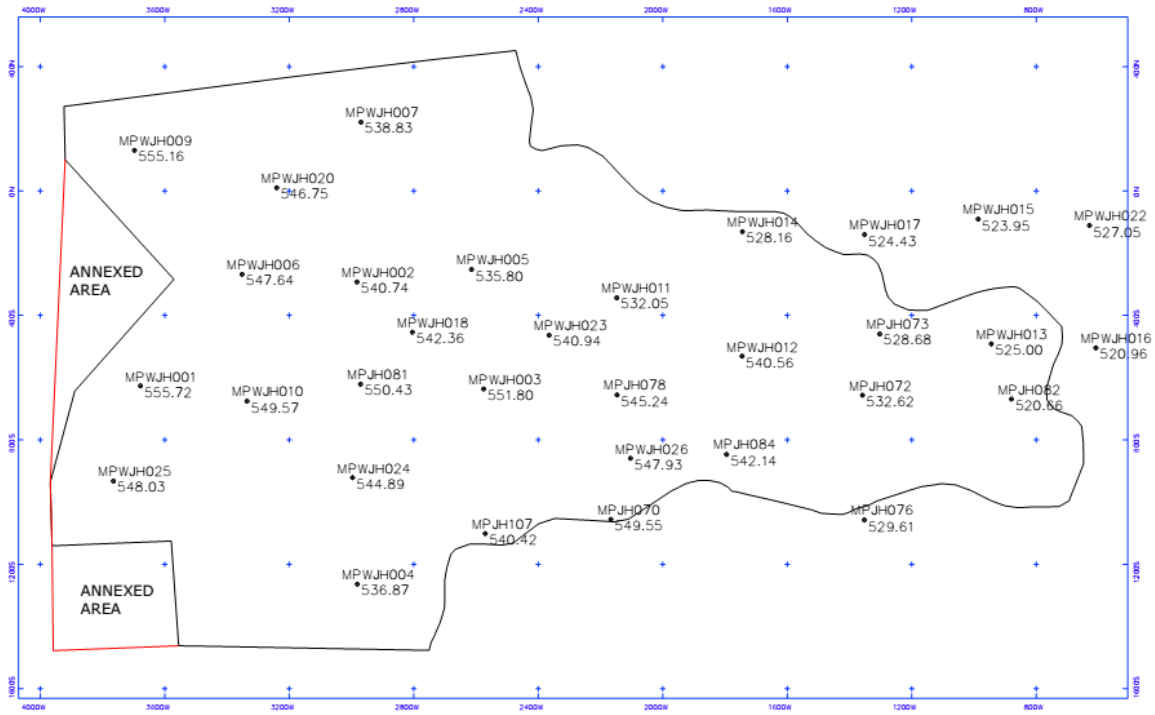


Fig 4.1 BLOCK BOUNDARY WITH ANNEXED AREA OF WEST JHIRIA BLOCK, SOHAGPUR COALFIELD

4.2 EXPLORATION STATUS

4.2.1 SCHEME

The area was first geologically mapped for the first time by T.W.Hughes (1881-83). Shri M. Venkatappay and K. Ramarao of GSI surveyed the Jhagrakhand area in 1960-61. During the period from 1973 to 1976, surrounding area of Jhagrakhand was surveyed by GSI and carried out regional exploration along with detailed mapping on scale of 1:8000 around the area located south of Jhagrakhand group of mines. Based on regional exploration, Directorate of Geology and Mining, M.P has taken up detailed exploration (1987 to 1999) at the instance of CMPDI, RI-V, Bilaspur in the area

bounded by Kulharianala in the east and Jhirianala in the south and findings are incorporated in Geological report on exploration for coal in Jhiria block, Sohagpur Coalfield, District Anuppur, M.P. (F.S. 1987-99).

The northern part of the Jhiria block has not been explored completely, which need additional boreholes at closer interval for complete proving the area.

The detailed exploration in the West Jhiria block by drilling at an interval of 400m have been carried out by Directorate of Geology and Mining, M.P during the period from December 1997 to April 2000. Altogether 26 boreholes have been drilled in the area involving total of 1644.60m. The detail of the drilling meterage shown in Table 4.1:

Table 4.1: Financial year-wise drilling meterage

AGENCY	FINANCIAL YEAR	NO.OF BOREHOLES DRILLED	METERAGE
DGM,M.P.	1997-98	6	412.57
	1999-00	18	1114.33
	2000-01	2	117.70
	Total	26	1644.60

Data of 09 Nos. of boreholes drilled by Directorate of Geology and Mining, M.P of MPJH series of Jhiria Block have also been utilized for interpretation and assessment purposes falling within the block.

4.2.2 BOREHOLE DENSITY

The density of the borehole in the revised area of West Jhiria block is about 6 boreholes / sq. km.

4.2.3 COAL ANALYSIS STATUS

Band by band analysis: On the basis of moisture & ash percentage different litho units are defined as under:

Coal	:	Ash% + Moisture% upto 40%.
Shaly Coal	:	Ash% + Moisture% > 40% upto 55%.
Carbonaceous shale/ Combustible dirt band	:	Ash% + Moisture% > 55% upto 75%.

Non-combustible band : Ash% + Moisture% exceeding 75%.

(obvious dirt bands are sandy shale ,sandstone etc.)

Overall Proximate Analysis and Gross Calorific Value (GCV): The overall proximate analyses and GCV were advised on 60% RH and 40^0C for high moisture coals for a maximum of 50% of boreholes of the block covering all seams.The analyses were advised for BCS, I_{30}/$I_{100}$and$I_p$samples, which are defined as under:

BCS Sample: Only coal and shaly coal.

I_{30} Sample: BCS sample + combustible upto 30cm included.

I_{100} Sample: BCS sample + combustible dirt bands up to 100cm included.

Ipsample: I_{30}/I_{100}sample + carbonaceous and grey shale bands irrespective of their thickness and excluding all other obvious bands.

Coal cores received from boreholes have been analyzed for their chemical properties at CFRI, Bilaspur unit for band-by-band and proximate analysis at 60% R.H. and 40°C as suggested by CMPDI, RI-V, Bilaspur time to time.Total 81.60m (extrapolated length 86.83m) samples including combustible and non-combustible bands have been sent for chemical analysis. The details of coal analysis given in the Table 4.2:

Table 4.2: Details of coal core analysis

Core sample prepared & sent for analysis		Recommended for Analysis and result recieved		Not recommended for analysis		Total sample and Analytical result recieved	
Recovered length in m.	Extrap. Length in m.	No. of sample	Length in m.	No. of samples	Length in m.	No. of samples	Length in m.
81.60	86.83	95.00	77.42	26.00	4.18	121.00	81.60

The details of overall proximate analysis executed on I_{30}/I_{100}samplesare given in table 4.3A. Special tests were advised for those boreholes for BCS samples whose Overall Proximate Analysis were available are given in table 4.3B.

Table 4.3A: Overall quality and thickness ranges of coal seams in West Jhiria Block, Sohagpur Coalfield

Coal Seam / Section	Thickness range		Nos. of intersection	At 60% RH & 40°C				UHV (K. cal./ kg.)		GCV (K. cal./ kg.)		GCV Grade	Average Grade
				M%		A%							
	Min.	Max.		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
3T	0.20 MPWJH02	2.14 MPWJH10	13	5.50	8.40	11.80	30.20	3973	6402	4780	6485	G16 –G2	G7
3B	0.40 MPWJH26	2.95 MPWJH12	20	2.60	7.80	10.50	38.30	3236	6540	4910	6648	G11-G3	G6
LKIIT	0.10 MPJH073	1.54 MPWJH19	14	5.90	7.20	11.40	31.10	3794	6471	4725	6540	G9-G3	G7
LKIIB	0.12 MPJH076	3.25 MPWJH01	17	4.40	8.10	16.00	30.20	3973	5781	4780	6100	G8– G5	G7

Table 4.3B: Details of Ultimate analysis and special tests of coal seams in West Jhiria Block, Sohagpur Coalfield

Seam	Number of intersections	Overall proximate analysis on 60% RH & 40°C (I_{30} sample)	Ultimate analysis	Ash analysis	AFT	HGI
3T	13	6	-	-	-	-
3B	20	12	-	1	-	-
LKIIT	14	4	-	1	-	-
LKIIB	17	17		1	-	-
Total		**39**	**-**	**3**	**-**	**-**

4.3GEOLOGICAL SET-UP

4.3.1 REGIONAL SETTING

The Gondwana lithic fill in India has been regarded to comprise a pile of predominantly continental clastics of Late Carboniferous/Early Permian to Early Cretaceous,with floral elements.

Gondwana sediments in Indian Sub-continent occur along several conspicuous rectilinear belts of Peninsular India, on the Pre-Cambrian platform, coinciding with the present day river valleys. The Gondwana basins of Peninsular India are considered to represent rift-related graben belts which generally coincide with the boundary zones of pre-cambrianprotoplate components of the Peninsular Shield mosaic (Mitra, 1991).

The subsidence along the graben zones was episodic and these basins evolved gradually with basin infilling by sediment influx. These episodic extension, subsidence and sedimentation were essentially controlled by boundary faults although syndepositional intrabasinal longitudinal faults also controlled the basin development. Continuity of sedimentation was often punctuated by erosion and non-deposition leading to development of unconformity.

In one of the narrow zones of Gondwana sediments deposition, lies the Son valley coalfields. The Western extension of it marks the Satpura area and further west coincides with Narmada rift. In conformity with the basin elongation, the rocks of Sohagpur Coalfield located within Son valley, exhibit a general E-W trend with a low northerly dip.

Large scale mapping in the Sohagpur/Johilla master basin by GSI has proved that the Lower Coal Measures (Barakar Formation) is succeeded by a sequence of rocks which is barren of workable coal seams. This barren horizon is overlain by a sequence of strata containing thin coal seams and grouped as Upper Coal Measures.

However, due to inadequate palaentological information, it is difficult to say whether these horizons are homotaxial with the Barakar, Barren Measures and Raniganj formations because significant variations in the lithofacies of these formations have been noticed even with those of the adjacent areas.

Within the Sohagpur basin, the most structural element is the intrabasinal almost E-W trending Bahmni-Chilpafault. This fault has downthrown the northern block by more than 400m at places and the 'Barakar Measure' occurs in this area at depth, under a thick cover of younger sediments. In the southern upthrown block, the Barakars are either exposed or occur under a thin cover of younger sediments. Mining activity, except "Beheraband Pilot Mine', located to the north of Bahmni-chilpa fault, is entirely confined to the shallower southern part of the coalfield.

The West Jhiria block lies immediate SW of old Rajnagar workings of Jhagrakhand group of mines located eastern part of Sohagpur Coalfield. The rock formation of Sohagpur basin are highly disturbed by number of E-W with two other sets of NE-SW and NW-SE trending normal faults and traversed by basic dykes and sills. The southern part of Bahmni-Chilpa fault i.e. lower Sohagpur Coalfield consists of Talchir and coal seams at shallower depth while north of Bahmni-Chilpa fault termed as

upper Soahgpur Coalfield where coal seams occur at greater depth and covered by Supra Barakar formation of Triassic sediments.

The Talchir rocks are exposed along the southern and eastern fringes of basin in lower Sohagpur coalfield and unconformably overlies the Pre-Cambrian granitic rock and overlain by Barakar Formation, exhibits in general WNW-ESE to E-W trend with gentle northernly dip. At places centripetal dip has been observed indicating the presence of sub-basinal structure within the basin. The development of such sub-basinal structure was probably due to greater amount of subsidence comparatively to the adjoining area.

The generalized stratigraphic succession for the entire Sohagpur Coalfield is given in Table 4.4:

Table 4.4: Generalized stratigraphic succession of Sohagpur Coalfield

Age	Formation	Lithology
Recent-Sub recent	Soil & Alluvium	
	^^^^^^^^Unconformity^^^^^^^^	
Eocene-Upper Cretaceous	Deccan Trap	Effusive and intrusive rocks, mostly basalt and dolerite.
	^^^^^^^^^Unconformity^^^^^^^^^	
Upper Cretaceous	Lameta Beds	Reddish & greyish sandstone & nodular limestone
	^^^^^^^^Unconformity^^^^^^^^	
Upper Triassic	Supra Barakars	Pink,buff& red sandstone, red shale
	^^^^^^ Unconformity^^^^^^^	
Lower Permian	Barakar	Coarse to fine grained sandstone sub-ordinate shales and coal seams
----------Transitional----------		
Basal Permian(?) to Upper Carboni-ferous	Talchir	Diamictite, sandstone,siltstone and needle shales
	^^^^^^^^^^Unconformity^^^^^^^^	
Pre-cambrian		Porphyritic granite-gneiss with Aplite and pegmatite veins.

4.3.2 COAL BEARING FORMATION

The Barakar Formation covers the major part of the Gondwana Basin. It comprises essentially medium to coarse grained sandstones, a few pebble beds, conglomerates, shales and coal seams. The sandstones are usually feldspathic and the feldspar is generally kaolinised to a high degree and does not form good binding matter for the quartz grains.

Total thickness of Barakar existed in this block, as revealed in borehole intersection of BH No. MPWJH-13 drilled by DGM, M.P. in the area is 138.80m. In the block top 60.00m Barakar are only productive while basal Barakar are devoid of productive coal horizons except the occurrence of few thin and impersistant coaly bands.

The Barakar Formation overlies the Talchir and dominantly consist of feldspathic sandstone of varying grain size from very coarse to fine grained sandstone, at places gritty with sub-ordinate shale and coal seams. The fine grained sandstone is generally interbanded with shaly strata. The grain size of basal Barakar sandstone is comparatively finer than top-Barakar and become fine towards Talchir. The contact between Talchir and Barakar is transitional.

The stratigraphic succession based on the sub-surface data of West Jhiria Block is given in Table 4.5:

Table 4.5: Stratigraphic Sequence of West Jhiria Block

Age	Formation	Lithology
Recent/	Soil & Alluvium (1 to 3 m thick)	sub recent
^^^^^^^^^^^^^	Unconformity ^^^^^^^^^^	
Lower Permian	Barakar (about 170.00m)	Coarse, medium and fine grained sandstone, sandy shale, grey shale, carbonaceous shale with coal seams
----------	Transitional contact ----------	----------
Upper Carboniferous		Fine grained sandstone with green shale and siltstone

The West Jhiria block is south-eastern continuation of Jhagrakhand-Jamuna-Kotma sub basin, lying immediate SW of old Rajnagar Colliery, NE of Amadand area

and west of Jhiria Block. The area is mostly covered by rocks of Barakar Formation under a thin cover of soil and alluvium at places. The exposures of Barakar are observed in low lying area nearer to nala and along the nala courses. Outcrops of coal seams are observed in nala cutting of Kulharianala and its tributary (seasonal).Basement Complex (Precambrian) has not been met in any of the borehole.

Talchir Formation:Due to gradational nature Talchir-Barakar contact is difficult to demarcate. The lithological assemblage of Talchir Formation is represented bysandstone and green shale and siltstone.

Thickness range of different geological formations intersected in West Jhiria Block is given in Table 4.6:

Table 4.6: Geological Formations intersected in West JhiriaBlock

FORMATION	THICKNESSRANGE (m)	
	MINIMUM	MAXIMUM
Weathered Mantle	3.65(MPJH-78)	27.58(MPWJH-02)
Barakars	18.30(MPWJH-09)	115.90(MPJH-84)
Talchirs	1.50(MPJH-107)	24.40(MPWJH-13)

4.3.3 SEQUENCE OF THE COAL SEAMS

The sub-surface data from drilling in West Jhiria block reveals the presence of two prominent coal horizons i.e. seam-3 and seam-1 (LK-II). Both the seam split in top and bottom section viz. seam-3T, seam-3B and LK-IIT and LK-IIB. The topmost seam-3 (either 3T or 3B or both) has been intersected in 19 boreholesviz. MPWJH-01,02,03,04,06,10,12,13,16,18,23 & 26 and MPJH-72,73,78,81,82,84 &107 and it developed with workable thickness in patches in Jhiria and Amadand area located in south of present block. The seam thickness decreases towards eastern direction and developed in thin bands in Rajnagar Colliery.

The sequence of the coal seams with inter seam parting in West Jhiria Block is shown in Table no.4.7:

Table 4.7 Sequence of the Coal seam in West Jhiria

Coal Seam & Parting	Thickness (m)	No. of borehole intersected workable seam(>0.50m thickness)	Remarks
Weather mantle	3.65-27.58		Soil, weathered mantle
Seam-3T	0.35-2.14	13 no. of boreholes MPWJH-1,2,3,6,10,12,18,23,26 and MPJH-78,81,82,84	Thickness reduces eastward. GCV varies from G2-G16, but average grade is G7.
Parting	1.56-8.35		
Seam-3B	0.86-2.95	21 no. of boreholes MPWJH-1,2,3,4,5,6,10,11,12,13,16,18,23,26 and MPJH-72,73,78,81,82,84,107	Thickness reduces westward. GCV varies from G3-G11, but average grade isG6.
Parting	13.78-21.72		
LK-II	0.18-5.25	14 no. of boreholes MPWJH-2,3,6,9,10,11,15,18,20,22,25 and MPJH-70,81,107	GCV varies from G5-G10 but average grade is G7.
LK-IIT	0.55-1.54	14 no. of boreholes MPWJH-1,4,5,12,13,14,17,19,21,23,24 and MPJH-72,73,76	Developed as thin workable bands. GCV varies from G3-G9 but average grade is G6
Parting	1.00-2.11		
LK-IIB	0.40-3.25	14 no. of boreholes MPWJH-1,4,5,12,13,14,17,19,21,23,24 and MPJH-72,73,76	Consistent in development. GCV varies from G5-G8 but average grade is G7.

4.3.4 STRUCTURE

Among the three well defined sub-basinal structures of Sohagpur basin, Jhagrakhand sub-basin occurs in the east. Basinal evolution in these three sectors was probably controlled by greater subsidence resulting in thick Barakar Formation in comparison to the adjoining areas with shallow Barakar cover. The entire coalfield represents very complex structural features which are resultant of the interplay of the forces causing deep faulting and igneous intrusives. The prominent structural feature of the Sohagpur basin is the system of ENE-WSW to E-W trending sub-parallel faults. The most important among the faults is the Bahmni-chilpa fault. This, in fact, appears to be set of faults having a variable net downthrow of 350m to 400m towards north.

The structural interpretation of the area has been made on the basis of available sub-surface data met in the borehole intersection, outcrop pattern observed in Kulharianala and tributaries and structural parameter available from the adjoining working of seam 4 in old Rajnagar colliery located in NE and Amadand area located in SW of the area under report.

4.3.5 DIP AND STRIKE

The coal beds of the block from the floor contour plan exhibits sub-basinal structure with a very gentle centripetal dip of 1° to 4°. The trend shows from WNW-ESE to E-W and NE-SW.

4.3.6 FAULTS

Two normal faults trending E-W have been interpreted in the area. The details of faults are given in the Table 4.8

Table 4.8: Faults in West Jhiria Block

FAULT	TREND	THROW		EXTENT	JUSTIFICATION
		DIRECTION	AMOUNT		
F1	E-W	North	20m near MPWJH-25 decrease to west and increases towards east and about 40m near south of MPJH-82	From the area south of MPJH-82 in the east and beyond it to North of MPWJH-25 and further west.	Difference in floor level of seam in borehole on either side of fault. Seam thickness reduces in MPWJH-26 and MPJH-84. Omission of Seam-3 in upthrown block. Conformity with the known dislocation met in adjoining Ramnagar working in the east of the block.
F2	E-W	South	15m near MPWJH-05,11 reduces eastward & about 5m near MPWJH-13 and ultimately die out in adjoining old Rajnagar working in the east and also reduces westward about 20m near MPWJH-06 and further west.	From the area to north of MPWJH-13 in the east of the block and beyond it to the area north of MPJH-11, 05, 06 and further west.	Difference in floor level of seams in B.H.on either side of fault. Omission of seam-3 in upthrown side of fault. Seam thickness reduces in B.H. No. MPWJH-05, 11 and MPJH-73. Conformity with the known alignment of dislocation met in adjoining old Rajnagar Colliery in the east of the block.

4.3.7 INTRUSIVES

No intrusive has been encountered in the Block.

4.4 DESCRIPTION OF COAL SEAMS

4.4.1 IMPORTANT COAL SEAMS OF THE BLOCK

The coal seams intersected in boreholes in the West Jhiria block have been correlated on the basis of their thickness, physical make up, quality, inter-seam parting and associated lithology.

Two prominent coal horizons have been demarcated in the area. Both the seam 3 and LK-II splits in top and bottom section i.e. seam-3T, seam-3B, LK-IIT and LK-IIB.

Seam-3T intersected in borehole with thickness 0.50m or above in 10 boreholes and it occurs down to maximum depth of 39.50m (MPWJH-26) from the ground surface.

Seam-3B intersected in borehole with thickness 0.50m or above in 18 boreholes and it occurs down to maximum depth of 41.05m (MPWJH-26) from the ground surface. The parting between seam-3T and seam-3B is around 1.56m to 8.35m.

Seam-LKIIT intersected in borehole with thickness 0.50m or above in 11 boreholesand it occurs down to maximum depth of 53.87m (MPWJH-01) from the ground surface. In 14 boreholes it occurs as combined seam-LKII with maximum thickness of 5.25m (MPWJH-20). The average parting from seam-3B ranges in between 13.78m to 21.72m.

Seam-LKIIB intersected in borehole with thickness 0.50m or above in 12 boreholesand it occurs down to maximum depth of 60.17m (MPWJH-01) from the ground surface. The parting from LK-IIT ranges in between 1.00m to 2.11m.

The thickness of the seam decreases in the eastern direction and developed as thin band in Rajnagar Colliery.

4.4.2 DESCRIPTION OF INDIVIDUAL COAL SEAMS

The details of individual coal seams falling within the West Jhiria are considered here for discussion.

4.4.2.1 Seam-3T

Seam 3T is the youngest coal horizon in the block.

Depth of intersection of Roof

i) Shallowest : 11.84 (MPJH82)

ii) Deepest : 42.32m (MPWJH26)

Minimum & Maximum FRLs

i) Minimum : 505.06m (MPWJH26)

ii) Maximum : 523.06m (MPWJH02)

PARTING

Particulars	Thickness(m)	Nature
With underlying seam-3B	1.56-8.35	Shale, Intercalations and sandstone coarse grained

THICKNESS

i)Range 0.20m –2.14m (MPWJH02)(MPWJH10)

ii) General thickness 0.50m-1.20m

INCROP

The seam incrops from the north of borehole no. MPWJH02 towards east, trending E-W.The strike length of incrop is about 2.4km along the south of fault F1-F1 and another incrop strike length is 732m on the south of F2-F2.

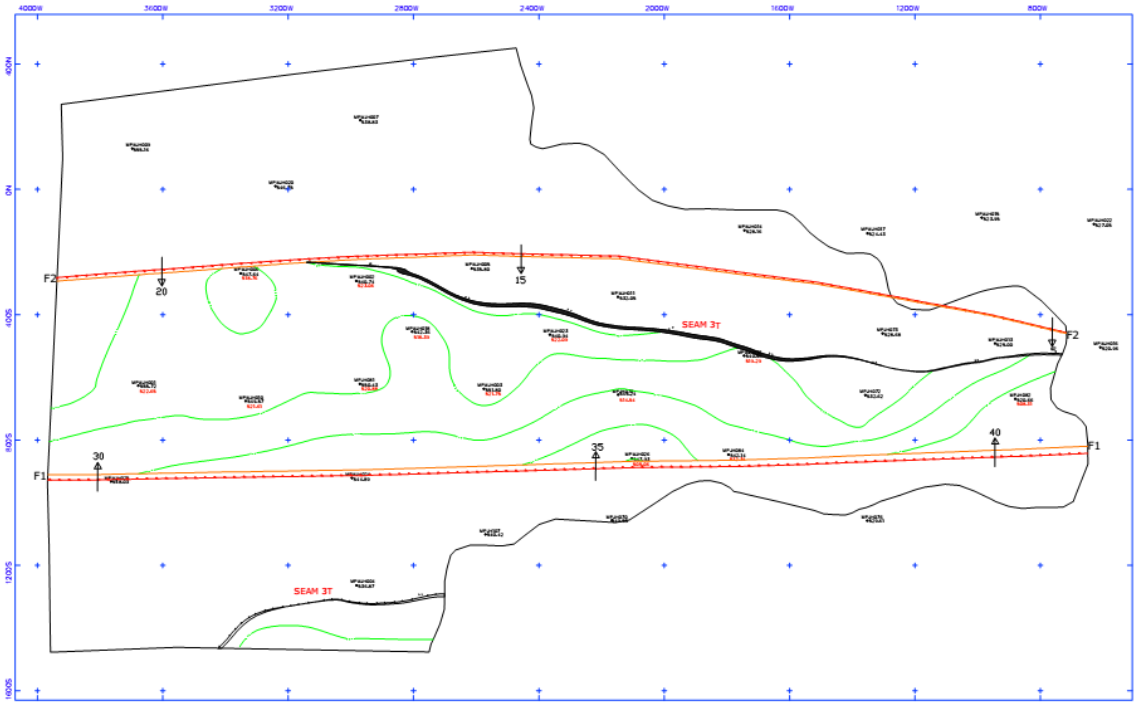


FIG.4.2Incrop and Floor Contour Plan of Seam 3T

ROOF & FLOOR

i) Immediate roof : Coarse grained sandstone.

iI) Immediate floor : sandy shale, alternative shale & sandstone.

DIRT BANDS

The dirt band present in the seam are inconsistent in nature. However, the cumulative thickness of dirt bands ranges from 0.05m to 0.16m.

PROXIMATE ANALYSIS

Sl No.	**Particular**		**Proximate analyisis at 60% RH and 40°C**			**GCV in K.Cal/ Kg**	**UHV in K.Cal/ Kg**	**Grade in UHV**	**Grade in GCV**
			Moisture	**Ash%**	**VM%**				
1	Range	Min	5.50	11.80	24.20	4780	3973	E	G16
		Max	8.40	30.20	29.00	6485	6402	A	G2
2	No. of Samples		6	6	6	6	6		
3	Mean		5.80	17.20	27.40	5823	5655	B	G5
4	Std.Deviation		0.98	3.70	1.60	513	826		

4.4.2.2 SEAM 3B

Seam 3B is occurring below seam 3T and above seam LK-II.

Depth of intersection of Roof

i) Shallowest : 6.30m (MPWJH11)

ii) Deepest : 43.87m (MPWJH26)

Minimum & Maximum FRLs

i) Minimum : 503.66m (MPWJH26)

ii) Maximum : 530.77m (MPJH107)

PARTING

Particulars	**Thickness(m)**	**Nature**
With underlying seam-LKIIT	13.78-21.72	Shale, Intercalations and sandstone coarse grained

THICKNESS

i)Range 0.40m-2.95m

(MPWJH26)(MPWJH12)

ii) General thickness 0.70m-1.50m

INCROP

The seam incrops from the north-east of borehole no. MPWJH02 and south of fault F2, towards east, trending E-W.The strike length of incrop is about 2.4km and another incrop is south of fault F1, trending SW-NE. The strike length of this incrop is about 1.3km.

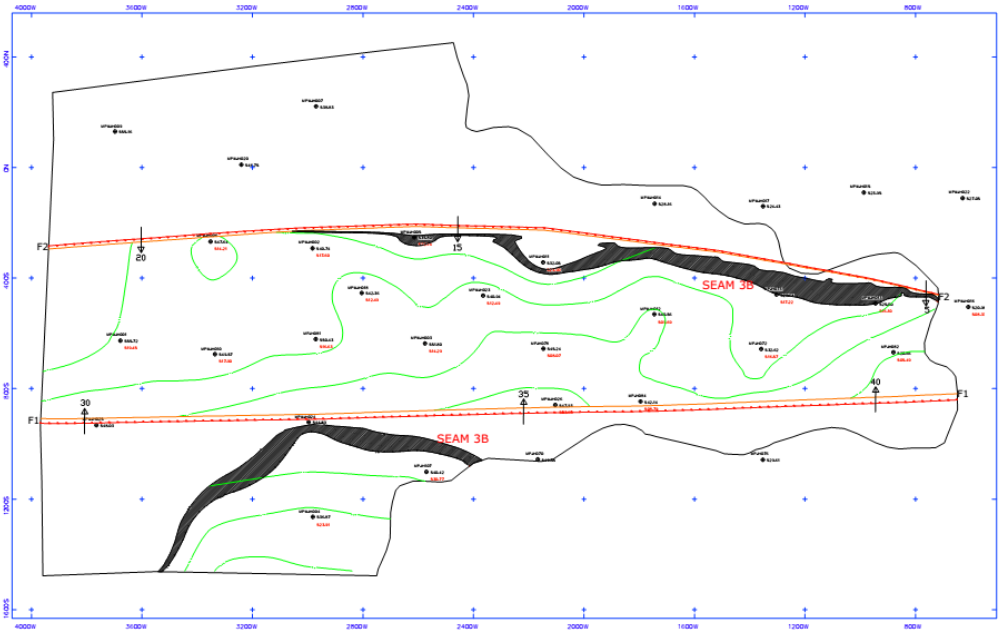


FIG 4.3Incrop and Floor Contour Plan of Seam 3B

ROOF & FLOOR

i) Immediate roof : Alternative shale & sandstone, coarse grained sandstone.

iI) Immediate floor : Sandy shale, alternative shale & sandstone.

DIRT BANDS

The dirt band present in the seam are inconsistant in nature. However, the cumulative thickness of dirt bands ranges from 0.07m to 0.15m.

PROXIMATE ANALYSIS

Sl No.	Particular		Proximate analysis at 60% RH and 40°C			GCV in K.Cal/ Kg	UHV in K.Cal/ Kg	Grade in UHV	Grade in GCV
			Moisture	Ash%	VM%				
1	Range	Min	2.60	10.50	24.10	4910	3256	F	G11
		Max	7.80	38.30	30.10	6525	6540	A	G3
2	No. of Samples		12	12	12	12	12		
3	Mean		6.00	18.10	27.30	5864	5560	C	G5
4	Std.Deviation		1.20	7.70	1.80	488	938		

Ash analysis and low temperature carbonization assay in respect of seam 3B of borehole no. MPWJH-12 is given in Table 4.8A and Table 4.8B:

Table 4.8A: ASH ANALYSIS

BH No.	Depth in M		Thickness in M.	Ash analysis seam-3B									Un.De. Alkalies (by.d.)
	From	To		SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	TiO_2	P_2O_5	Mn_3O_4	
MPWJH-12	27.92	30.87	2.95	63.56	22.78	4.71	1.56	1.20	0.75	2.40	0.01	0.04	2.99

TABLE 4.8B:LOW TEMPERATURE CARBONIZATION ASSAY

BH No.	Depth in M		Thickness in M.	Low temperature carbonization assay per tonne of dry coal							
	From	To		Coke (Kg)	Tar (Lit)	Liquar (Lit)	Gas (Cum)	Ammonia (Kg)	Coke Type	Gas Point	Oil Point
MPWJH-12	27.92	30.87	2.95	770.50	90.00	62.50	95.70	1.20	B	320	342

The presence of high silica and alumina indicates the refractory nature of coal ash and Tar yield is moderate.

4.4.2.3 SEAM LKIIT

Seam LKIIT is occurring below seam 3B and above seam LK-IIB.

Depth of intersection of Roof

i) Shallowest : 6.22 (MPWJH14)

ii) Deepest : 53.87m (MPWJH01)

Minimum & Maximum FRLs

i) Minimum : 490.36m (MPWJH12)

ii) Maximum : 522.84m (MPWJH24)

PARTING

Particulars	Thickness(m)	Nature
With underlying seam-LKIIB	1.00-2.11	Shale, Intercalations and sandstone coarse grained

THICKNESS

i)Range 0.10m-1.54m (MPJH73)(MPWJH19)

ii) General thickness 0.49m-1.00m

INCROP

The seam incrops from the north of fault F2, towards north-east, trending SW NE.The strike length of incrop is about 1.2 km and another incrop is south of fault F1, trending NW-SE. The strike length of this incrop is about 237m.

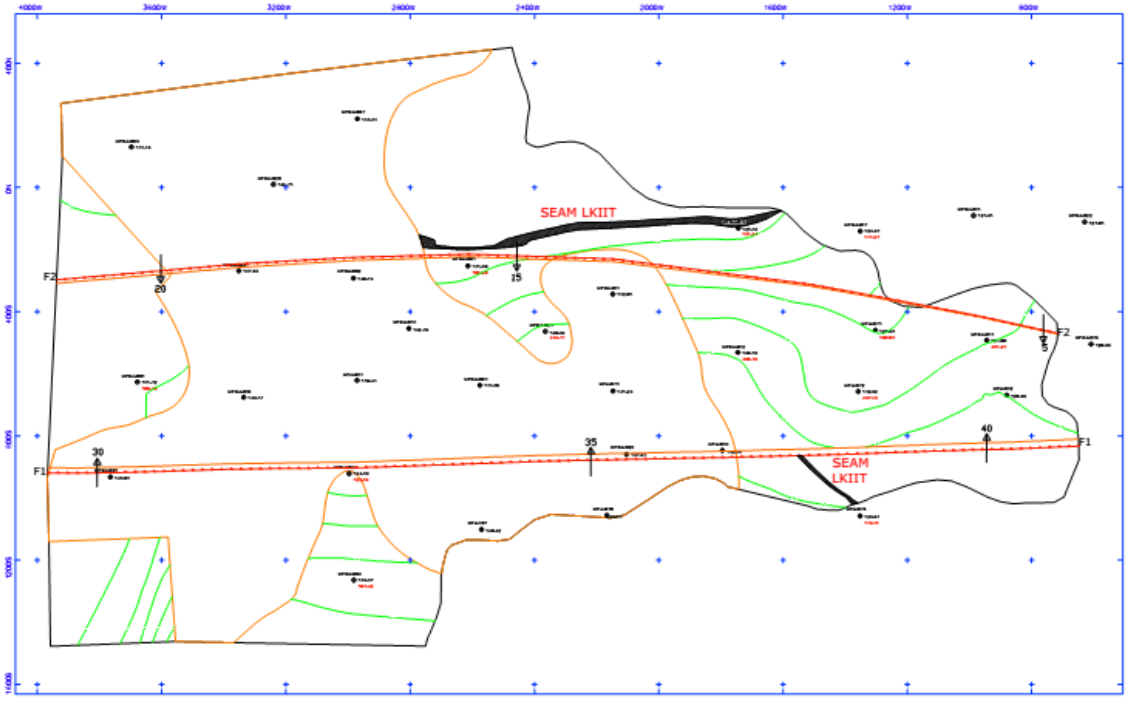


FIG4.4Incrop and Floor contour plan of seam LKIIT

ROOF & FLOOR

i) Immediate roof : Coarse grained sandstone.

iI) Immediate floor : Sandy shale, alternative shale & sandstone.

DIRT BANDS

The dirt band present in the seam are inconsistent in nature. However, the cumulative thickness of dirt bands ranges from 0.01m to 0.08m.

PROXIMATE ANALYSIS

Sl No.	**Particular**		**Proximate analysis at 60% RH and 40°C**			**GCV in K.Cal/ Kg**	**UHV in K.Cal/ Kg**	**Grade in UHV**	**Grade in GCV**
			Moisture	**Ash%**	**VM%**				
1	Range	Min	5.90	11.40	25.10	4725	3794	E	G9
		Max	7.20	31.10	30.00	6540	6471	A	G3
2	No. of Samples		4	4	4	4	4		
3	Mean		6.60	18.40	28.30	5813	5450	C	G5
4	Std.Deviation		0.60	9.60	2.0	720	1040		

Ash analysis and low temperature carbonization assay in respect of seam LKIIT of borehole no. MPWJH-24 is given in Table 4.9A and Table 4.9B:

Table 4.9A: ASH ANALYSIS

BH No.	**Depth in M**		**Thickness in M.**	**Ash analysis seam-3B**									**Un.De.Alkalies (by.d.)**
	From	To		SiO2	Al2O3	Fe2O3	CaO	MgO	SO3	TiO2	P2O5	Mn3O4	
MPWJH-24	21.13	22.05	0.92	65.32	21.82	2.57	2.01	0.56	0.38	3.60	0.06	0.04	3.64

TABLE 4.9B:LOW TEMPERATURE CARBONIZATION ASSAY

BH No.	Depth in M		Thickness in M.	Low temperature carbonization assay per tonne of dry coal							
	From	To		Coke (Kg)	Tar (Lit)	Liquar (Lit)	Gas (Cum)	Ammonia (Kg)	Coke Type	Gas Point	Oil Point
MPWJH-24	21.13	22.05	0.92	760.00	87.00	72.50	90.10	1.20	B	320	340

4.4.2.4 SEAM LKIIB

Seam LKIIB is occurring below seam LKIIT and bottom most correlated seam.

Depth of intersection of Roof

i) Shallowest : 9.52m (MPWJH14)

ii) Deepest : 60.17m (MPWJH01)

Minimum & Maximum FRLs

i) Minimum : 486.94m (MPWJH12)

ii) Maximum : 517.54m (MPWJH14)

THICKNESS

i)Range 0.12m-3.25m

(MPJH76)(MPWJH01)

ii) General thickness 0.30m-2.00m

INCROP

The seam incrops from the north of fault F2, towards north-east, trending E-W.The strike length of incrop is about 746m and another incrop is south of fault F1, trending NW-SE. The strike length of this incrop is about 241m.

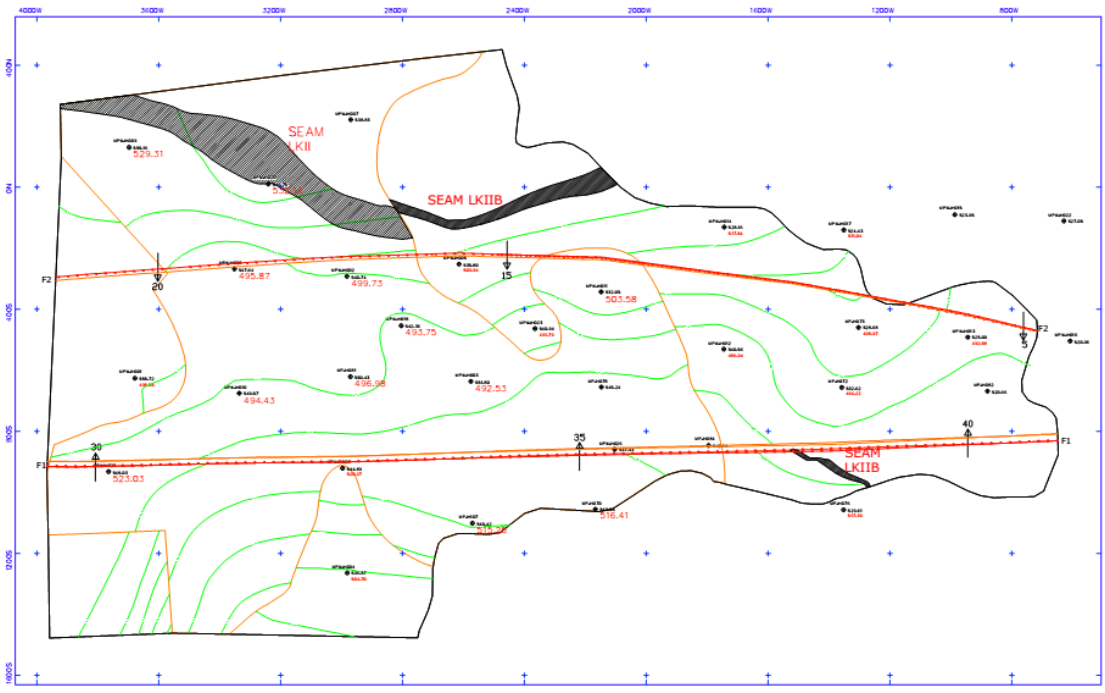


FIG 4.5Incrop and Floor contour plan of Seam LKII and LKIIB

ROOF & FLOOR

i) Immediate roof : Sandstone, Shale, alternative shale & sandstone

iI) Immediate floor : Sandy shale, alternative shale & sandstone.

DIRT BANDS

The seam contain 2 or 4 combustible band and non-combusatible dirt bands. Thickness of combustible band of carb shale ranges from 0.04 to 0.18 and non-combustible bands of shale and sandy shale have thickness ranges from 0.01 to 0.50m.

PROXIMATE ANALYSIS

Sl No.	**Particular**		**Proximate analyisis at 60% RH and 40°C**			**GCV in K.Cal/ Kg**	**UHV in K.Cal/ Kg**	**Grade in UHV**	**Grade in GCV**
			Moisture	**Ash%**	**VM%**				
1	Range	Min	4.40	16.00	20.50	4780	3973	E	G8
		Max	8.10	30.20	28.10	6100	5781	B	G5
2	No. of Samples		17	17	12	12	17		
3	Mean		6.10	22.20	24.70	5542	5000	C	G7
4	Std.Deviation		0.70	4.30	2.30	392	528		

Low temperature carbonization assay in respect of seam LKIIB of borehole no. MPWJH-24 is given in Table 4.10:

Table 4.10: LOW TEMPERATURE CARBONIZATION ASSAY

BH No.	Depth in M		Thickness in M.	Low temperature carbonization assay per tonne of dry coal							
	From	To		Coke (Kg)	Tar (Lit)	Liquar (Lit)	Gas (Cum)	Ammonia (Kg)	Coke Type	Gas Point	Oil Point
MPWJH-24	23.07	24.62	1.55	799.00	77.00	55.00	84.70	0.80	B	320	350

Low temperature carbonization assay coal indicate the Tar yield is poor.

4.5 GEOTECHNICAL AND HYDROGEOLOGICAL INFORMATION

4.5.1 GEOTECNICAL INFORMATION

No geotechnical information has been incorporated in the Geological Report of West Jhiria prepared by Directorate of Geology and Mining, M.P.

4.5.2 HYDROGEOLOGICAL INFORMATION

4.5.2.1 Surface Hydrology

The surface drainage of West Jhiria is characterized by the occurrences of Kulharia Nala which is flowingalong the north-east part of the block boundary towards south and a first order stream is flowing along the south-eastern boundary which finally meets the Kulharia Nala in the eastern part of the block.

4.5.2.2 HYDROGEOLOGY

4.5.2.2.1 Aquifer system:

The block area, is covered by Barakar formation, comprises of soil cover and sandstone of different grain sizes with shale beds and coal seams. The Barakars, comprising medium to very coarse grained sandstone are saturated and behave as aquifers. Whereas, the shale beds and coal seams behave as aquiclude. Due to stratification and with the presence of aquiclude (shale/coal), a multi-aquifer system developed. The various hydrogeological units developed in the Block area are furnished in Table 4.11.

TABLE 4.11:
VARIOUS HYDROGEOLOGICAL UNITS DEVELOPED IN THE WEST JHIRIA, SOHAGPUR COALFIELD

Hydrogeological Unit	*Formation*	**Thickness (m)**
Phreatic aquifer	***Coarse grained sandstone***	***11.84 – 42.32***
Aquiclude	Coal Seam – 3 TOP	0.30 – 2.40
Aquitard	***Sandy shale and alternating sandstone and shale***	***2.00 – 8.00***

Aquiclude	Coal Seam – 3 BOTTOM	0.80 – 2.95
Aquitard	***Sandy shale and alternating sandstone and shale***	***13.00 – 20.00***
Aquiclude	Coal seam – LK II TOP	0.50 – 1.54
Aquitard	***Sandy shale and alternating sandstone and shale***	***1.00 – 2.00***
Aquiclude	Coal seam – LK II BOTTOM	0.40 – 5

The thickness of unconfined aquifer zone present above Coal Seam 3 Top, varying from 11.84 m to 42.32 m, behaves as phreatic and most potential aquifer. The lower aquifers, due to compaction and presence of shale, are usually less potential and the ground water flow dominates through secondary porosity developed. The aquifer system exhibit a more or less uniform dip of 1° to 2° towards south.

4.5.2.2.2 General aquifer parameters:

Detailed Hydrogeological investigation was carried out in the adjacent Bartarai UG project. Wherein, the aquifer parameters for lower aquifers (compact sandstone) were evaluated and the permeability was reported as K=0.25 m/d.

Detailed Hydrogeological investigation has been carried out by CGWB & CMPDI in Jamuna coalfield under S&T project: "Studies on Groundwater Flow into Coal Mines". The aquifer parameters for the formation lying above the working seam (i.e. multi-aquifer) were reported as follows:

Transmissivity (T) : 175 m^2/d
Permeability(k) : 5 m/day
Storage coefficient : 5.0 x 10^{-4}
Specific Yield : 0.038

The above mentioned aquifer parameters have been considered by CGWB, Bhopal, representative for the Anuppur District (where West Jhiria Block is situated) in their "District Ground Water Information Booklet", dated November 2007, of Anuppur District, Madhya Pradesh.

4.5.2.3 Ground water levels:

4.5.2.3.1 Groundwater levels in villages:

The West Jhiria Block is devoid of any villages. The water levels in the Dumarkachar village and Sautanchua village which are situated close to West Jhiria block (within 500m from block boundary) are under continuous monitoring for assessing the impact of nearby coal mines on local ground water levels. The monitored water levels in the villages during pre-monsoon season (May 2010 and May 2012) are furnished below.

TABLE 4.12:
DETAIL OF WELL INVENTORY & GROUNDWATER LEVEL, WEST JHIRIA BLOCK, SOHAGPUR COALFIELD

Village	Well Owner	Well diameter (m)	Parapet Height (m)	Well Depth (m) (b.g.l.)	Water Level, may '10 bgl (m)	Water Level, may '12 bgl (m)	Remarks
Dumarkachar	Gendu	2.60	0.50	10.7	9.8	5.9	Village entry, RHS of road abt 100m, partially stone lined/naked
Sautanchua	Lallan s/o SamayLal	3.30	0.00	9.7	8.8	-	village entry, adj to bamboo grooves, hand pump, inside house

4.5.2.3.2 Historic Ground Water Levels

The District Groundwater Survey Unit**,** Shahdol District, Madhya Pradesh and Koriya District, Chhattisgarh,has been monitoring the groundwater levels in the region.The pre-monsoon and post-monsoon historical groundwater levels for the last 23 years (1990 to 2012) recorded at the nearest permanent hydrograph station; Khodri Village (situated 6.6 km north west from block boundary) and for the last 13 years (2000 to 2012) recorded at hydrograph station: Manedragarh (situated 9.5 km north east from block boundary) were collected and given in Table 4.13:

TABLE 4.13:
GROUNDWATER LEVEL RECORDS, WEST JHIRIA BLOCK, SOHAGPUR COALFIELD

(in meter, below ground level)

Hydrograph Station/Year	Khodri (POW -08)			Manendragarh (POW-11)		
	Pre - Monsoon	Post - Monsoon	Fluctuation	Pre-Monsoon	Post-Monsoon	Fluctuation
1990	6.13	2.98	3.15	-	-	-
1991	6.05	3.80	2.25	-	-	-
1992	7.05	3.08	3.97	-	-	-
1993	8.27	3.75	4.52	-	-	-
1994	8.10	2.05	6.05	-	-	-
1995	7.95	3.40	4.55	-	-	-
1996	8.55	3.73	4.82	-	-	-
1997	9.06	2.77	6.29	-	-	-
1998	8.27	3.88	4.82	-	-	-
1999	9.08	3.95	5.13	-	-	-
2000	9.20	4.45	4.75	7.00	2.60	4.40
2001	9.28	4.50	4.78	8.60	1.20	7.40
2002	9.80	5.10	4.70	3.05	1.15	1.90
2003	11.00	3.00	8.00	3.85	0.95	2.90
2004	7.25	4.00	3.25	1.90	0.70	1.20
2005	7.65	3.70	3.95	2.10	0.60	1.50
2006	7.55	3.98	3.57	3.70	1.25	2.45
2007	7.70	4.40	3.30	0.85	1.35	-0.50
2008	7.72	5.10	2.62	2.63	0.70	1.93
2009	7.92	6.35	1.57	2.60	2.10	0.50
2010	8.00	6.35	1.65	8.50	3.00	5.50
2011	8.11	4.85	3.26	6.90	1.10	5.80
2012	7.87	5.62	2.25	6.90	1.10	5.80
Average	***8.15***	***4.12***	***4.05***	***4.51***	***1.37***	***3.14***

The historical groundwater levels monitored, at Khodri and Manendragarh reveals that the pre-monsoon water levels vary from 0.85 m (Manendragarh, 2007) to 11.00 m (Khodri, 2003) with an average of 6.33 m. The post monsoon water levels in the area vary from 0.60 m (Manendragarh, 2005) to 6.35 m (Khodri, 2009 & 2010) with an average of 2.745 m. Thus, the average water level fluctuation in the area varies from is 0.50 m (Manendragarh, 2009) to 8.00 m (Khodri, 2003) with an average of 3.60 m.

4.5.2.3.3 Water level trends:

The Pre-monsoon and Post-monsoon water level trends of the above Hydrograph stations are given in Fig. 4.6& 4.7.

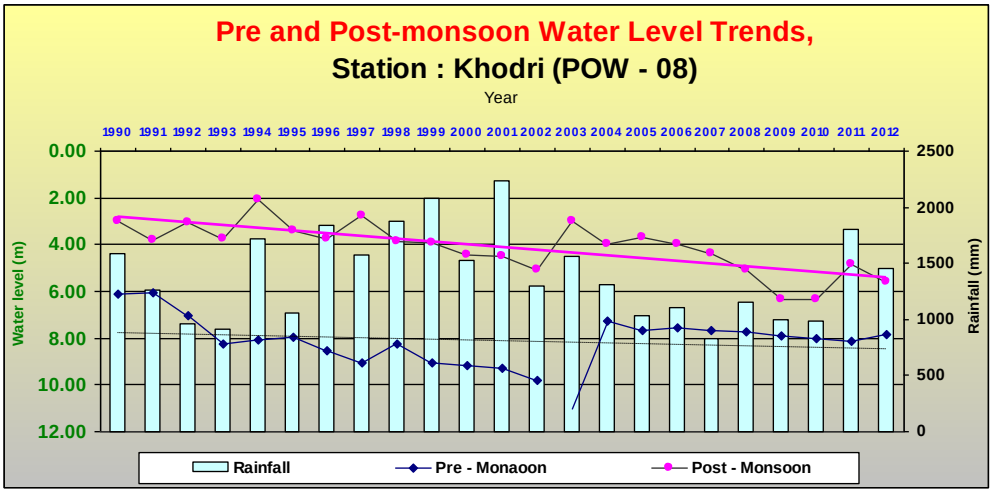


Fig. 4.6

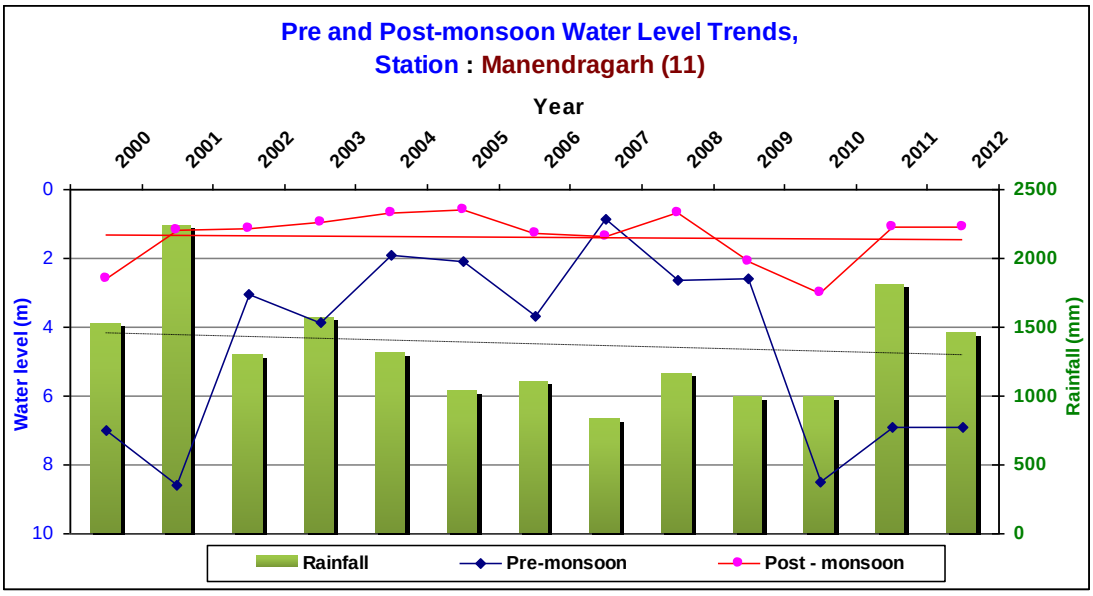


Fig. 4.7

Both the pre monsoon and post monsoon water levels of Khodri stations reveal a declining trend. This declining trend may be attributed to the increase in population and ground water use.

The pre-monsoon level trend at Manendragarh shows a decreasing trend. The declining trends of water level at Manedragarh may be due to the increase in population and ground water use. However, the post -monsoon groundwater level trend at Manedragarh reveals increasing trend. This may be attributed to the increase in rainfall and recharge from other sources.

4.5.2.4 Mine drainage:

In sedimentary rocks, due to stratification, the horizontal permeability (K_H) is many folds higher than the vertical permeability (K_V). The permeable beds act as individual hydrogeological units and develop a multi-aquifer system**.** Thereby, the groundwater velocity / flow along the bedding plane are higher than across the plane. A mine can be simulated as a large diameter well /sink and the mine inflow is contributed mainly from the saturated formation lying above the working seam. Thus, the mine inflow is directly proportional to the aquifer expose and progress of mine development.

If the block is selected for open cast method of mining, in the initial stage the mine inflow is in proportion to the rate of mine expansion. With the presence of low permeable formations, the inflow is significantly small. In due course, due to partial de-saturation of the aquifer, the inflow reduces and gets stabilized in time. With the development of secondary porosity due to blasting and continuity developed, the intermittent confined aquifer units get converted to unconfined near to the active mine face. With this, the unconfined aquifer close to the high wall face gets drained. So also, in the reclaimed area, with high porosity, about 40% of rainfall infiltrates and contributes to the groundwater system.

If the block is selected for underground method of mining, then the immediate aquifer present above the working coal seams will be affected by the mining. The inflow of the ground water within the mine takes places in two phases. During development phase continuous water inflow will take place from the active part of the mine and from some part of the older panels, whereas during depillaring stage immediate water inrush takes place from the depillared area and later the inflow reduces and gets stabilized in due course.

The mine discharges from the operating mines within and close to West Jhiria Block are as follows:

TABLE 4.14:
MINE DISCHARGE FROM THE OPERATING MINE CLOSE TO WEST JHIRIA BLOCK, SOHAGPUR COALFIELD

Sl. No.	Mine	Distance from the exploration block	Groundwater discharge from mine (Cum/day)	Groundwater discharge from mine (M. Cum/year)
1	Jhiria UG	Within Block	8,219	3.00
2	Malga UG	Adjacent to Block in East side	1,068	0.39

4.5.2.5 Water quality

Under routine environmental monitoring, the surface, groundwater and mine water quality, for all the operating mines in the area, have been monitored and found to be well within the permissible limits of stipulated standards. Mine water and other effluents have been treated before disposal and usage.

The District Groundwater Survey Unit, Bilaspur District, Chhattisgarh, has been monitoring the groundwater quality in the area. As a representative, the groundwater quality of 2013 of the water sample collected at Manedragarh, located in the Manendragarh Development Block, Korea District, is given below:

TABLE 4.15: GROUNDWATER QUALITY DATA OF MANENDRAGARH (POW 11), KOREA DIST., C.G.

pH	EC, Mho/cm	TDS, mg/l	DO, mg/l	BOD, mg/l	Total Alkalinity, mg/l	Total Hardness, mg/l	Ca, mg/l	Mg, mg/l	Na, mg/l	K, mg/l	Cl, mg/l	CO_3, mg/l	HCO_3, mg/l
7.9	303	193.92	4.2	2.2	90	95	34	2.43	55.5	12.4	35.45	0	109.8

In this context, the water quality data of the mine water effluent of August 2014 and the drinking water quality data of Pre-monsoon (May 2014) and Post-monsoon (October 2014) of Ramnagar RO Sub-area (which is adjacent to the West Jhiria Block) has been provided in Table 4.15, Table 4.16 and Table 4.17 respectively.

4.5.2.6 Groundwater Stage Development:

Except for coal mining, no major industrial development activity is in the area. Due to dominant forest area and backwardness, the groundwater development in the area is very insignificant. CGWB, Bhopal, in "District Ground Water Information Booklet", dated November 2007, of Anuppur District, Madhya Pradesh has reported the stage of

Groundwater development in the Kotma Development Block, Anuppur District (Where West JhiriaBlock exists) as **25.74%** and identified the region within category "**Safe"**. The Groundwater development in Anuppur District was reported as 14.02% and falls under the category of **"Safe".**

TABLE 4.16:

MINE WATER EFFLUENT OF MALGA UG AND SOUTH JHIMAR UG QUALITY DATA

Company	**SECL**	Year	2014-15
Area	Hasdeo	Project	Ramnagar Sub Area
Name Of Station	12.Malga Mine Discharge	Date of Sampling	08.08.14
	13.South Jhimar Mine Discharge		08.08.14

All parameter are in mg/l unless Specified NA- Not Applicable

S.No	Parameter	Sampling Station			Below Detection Limit	MOEF-SCH-VI STANDARDS
		12	13			
1	Colour & Odour	Acceptable	Acceptable		-	Acceptable
2	Total suspended Solids, mg/l, max	29.1	45.7		5.0	100.0
3	pH value	6.79	6.99		0.01	5.5 to 9.0
4	Temperature(°C)				-	Shall not exceed 3°C above the receiving temp.
5	Oil & Grease, mg/l, max	2.28	1.57		1.00	10.0
6	Total Residual Chlorine, mg/l, max				0.04	1.0
7	Ammonical Nitrogen, mg/l, max	0.01	0.02		0.02	50.0
8	Total Kjeldahl Nitrogen, mg/l, max	14	35		0.02	100.0
9	Free Ammonia, mg/l, max	BDL	BDL		0.02	5.0
10	B.O.D.(3 days 27 °C) , mg/l, max	BDL	0.9		1.00	30.0
11	C.O.D , mg/l, max	BDL	160		5.00	250.0
12	Arsenic, mg/l, max				0.01	0.2
13	Lead, mg/l, max				0.05	0.1
14	Hexavalent Chromium, mg/l, max	0.022	0.023		0.01	0.1
15	Total Chromium, mg/l, max	0.02	0.01		0.10	2.0
16	Copper, mg/l, max	0.02	0.06		0.02	3.0
17	Zinc, mg/l, max	0.01	0.96		0.10	5.0
18	Selenium, mg/l, max				0.01	0.05
19	Nickel, mg/l, max	NIL	0.25		0.10	3.0
20	Fluoride, mg/l, max	0.78	0.53		0.05	2.0
21	Dissolved Phosphate, mg/l, max	0.399	NIL		0.01	5.0
22	Sulphide, mg/l, max	0.007	0.008		0.01	2.0
23	Phenolic Compound, mg/l, max	BDL	BDL		0.001	1.0
24	Manganese, mg/l, max	0.02	6.30		0.05	2.0
25	Iron, mg/l, max	0.06	0.27		0.05	3.0
26	Nitrate Nitrogen, mg/l, max	NIL	12.3		0.01	10.0

TABLE 4.17:
DRINKING WATER QUALITY DURING PRE-MONSOON, RAMNAGAR R.O. SUB AREA

Name of the Company	**SECL**	Year	**2014-15**
Name of the Project	Ramnagar R.O.Sub area	Month	May
Name of the Station	7. Input of Indranagar filter Plant	Date of Sampling	02.05.14
	8. Output of Indranagar filter Plant	Date of Sampling	02.05.14
		Date of Sampling	

Sl. No.	Parameter	Sampling Stations			IS:10500 Desirable Limit	Below Detection Limit	Remarks
		7	8				
1	Colour,Hazen	03	02		5	<1.0 Hazen	
2	Odour	Unobjectionable	Unobjectionable		Unobjectionable	---	
3	Taste	Agreeable	Agreeable		Agreeable	---	
4	Turbidity,NTU	01	03		5	<1.0 NTU	
5	pH	7.53	7.34		6.5-8.5	<0.01	
6	Alkalinity as CaCO3	23	54		200	<0.5	
7	Total Hardness as CaCO3	210	208		300	<0.5	
8	Iron	Nil	Nil		0.3	<0.05	
9	Chlorides	28	54		250	<0.25	
10	Residual Free Chlorine,min	Nil	0.08		0.2	<0.04	
11	Dissolved Solids	403	410		500	<5.0	
12	Calcium	29	24.8		75	<0.02	
13	Copper	Nil	Nil		0.05	<0.02	
14	Manganese	Nil	Nil		0.1	<0.05	
15	Sulphate	12.2	14.8		200	<1.0	
16	Nitrate	12	34		45	<0.01	
17	Fluoride	0.68	0.91		1.0	<0.01	
18	Selenium	Nil	Nil		0.01	<0.01	
19	Arsenic	Nil	Nil		0.05	<0.01	
20	Lead	Nil	Nil		0.05	<0.05	
21	Zinc	0.2	07		5	<0.005	
22	Hexavalent Chromium	Nil	Nil		0.05	<0.01	
23	Faecal Coliform, MPN/100ml	Nil	Nil		Nil	_	
24	Boron	Nil	Nil		1	<0.01	
25	Phenolics	Nil	Nil		0.001	<0.001	

TABLE 4.18:
DRINKING WATER QUALITY DURING POST-MONSOON, RAMNAGAR R.O. SUB AREA

Name of the Company	SECL	**Year**	2014-15
Name of the Project	Ramnagar R.O.Sub area	**Month**	October
Name of the Station	7. Input of Indranagar filter Plant	**Date of Sampling**	14.10.2014
	8. Output of Indranagar filter Plant	**Date of Sampling**	14.10.2014

Sl. No.	Parameter	Unit of Measurement	Observed Value			IS 10500:2012	
			7	8		Acceptable Limit	Permissible Limit in the Absence of Alternate Source
1	Colour	Hazen	01	02		5	15
2	Odour	Unitless	Agreeable	Agreeable		Agreeable	Agreeable
3	Taste	Unitless	Agreeable	Agreeable		Agreeable	Agreeable
4	Turbidity	NTU	0.60	0.32		1	5
5	pH	Unitless	7.56	7.49		6.5-8.5	No relaxation
6	Alkalinity as $CaCO_3$	mg/l	30	128		200	600
7	Total Hardness as $CaCO_3$	mg/l	332	348		200	600
8	Iron	mg/l	0.31	0.35		0.3	No relaxation
9	Chlorides	mg/l	16	16.5		250	1000
10	Residual Free Chlorine	mg/l	Nil	Nil		0.2	1
11	Total Dissolved Solids	mg/l	512	541		500	2000
12	Calcium	mg/l	46.4	46.4		75	200
13	Copper	mg/l	0.02	0.02		0.05	1.5
14	Manganese	mg/l	0.07	0.08		0.1	0.3
15	Sulphate	mg/l	p	15		200	400
16	Nitrate	mg/l	3.10	0.89		45	No relaxation
17	Fluoride	mg/l	0.54	0.64		1.0	1.5
18	Selenium	mg/l	Nil	Nil		0.01	No relaxation
19	Arsenic	mg/l	Nil	Nil		0.01	0.05
20	Lead	mg/l	Nil	Nil		0.01	No relaxation
21	Zinc	mg/l	0.72	0.74		5	15
22	Hexavalent Chromium	mg/l	0.004	0.011		0.05	No relaxation
23	Fecal Coliform	MPN/ 100 ml	11	NIL		Nil	No relaxation
24	Boron	mg/l	1.4	1.9		0.5	1.0
25	Phenolic compounds	mg/l	Nil	Nil		0.001	0.002

4.6 GEOLOGICAL RESERVES

Based on the data of 26 boreholes of MPWJH series and 9 boreholes of MPJH series falling in the West Jhiria block drilled by DGM, occurrence of 2 coal seams (each seam splitted into top & bottom, thus comes to 4 coal seams) has been established in the concerned block. All the seams (LKII comb. & bot, LKIIT, 3B& 3T) incrop inside the block. Potentiality of all coal seams have been assessed.

The emphasis of this report is primarily to assess and quantify overall assessment of the seams occurring in the block. A geological minex model has been prepared for the preparation of PR .Reserve estimation has been done in accordance with opencast mining norms as decided during the discussion with mine planners keeping in view of its depth of occurrence of coal seams.

4.6.1 BASIC ASSUMPTIONS AND NORMS FOLLOWED

For calculation of opencast reserves pertaining to all the seams, following assumptions and norms are followed:

i) For reserve estimation, seams having thicknesses more than 0.50m have been considered.

ii) Isochore & Iso-GCV lines have been drawn on I_{30}/I_{100} samples for effective workable thicknesses of coal seams excluding all non-combustible dirt bands (ash+moisture>75%) and carbonaceous shale bands having thicknesses more than 0.30m.

iii) Areas within the heave zone of faults, coal have been excluded from the estimation of reserves.

iv) Isochore and Iso-GCV lines have been drawn for workable thickness of seams (I_{30} basis) including combustible dirt bands up to 0.30m of their thickness and excluding all non-combustible &obvious dirt bands irrespective of their thickness for estimation of reserves and grade determination.

v) Reserves have been estimated seam-wise and grade-wise.

vi) As per the data generated through the boreholes, no igneous intrusive has been noticed in the boreholes and all the potential seams are unaffected by igneous activity.

vii) Density of boreholes in the combined block is 6 boreholes/ sq.km. and the reserves are grouped under "PROVED CATEGORY". To obtain net geological reserves, a total deduction of 10% has been made from the estimated gross reserves to compensate for loss on account of unforeseen geological conditions.

viii) Coal quality of the non-coking coal of all the seams has been categorized into various grades on the basis of its Gross Calorific Value (GCV), which has been determined in the boreholes.

The range of Gross Calorific Value for the different grades is as follows:

Sl. No.	Grade	GCV Kcal/kg	
		Lower	Higher
1	G1	>7000	
2	G2	6701	7000
3	G3	6401	6700
4	G4	6101	6400
5	G5	5801	6100
6	G6	5501	5800
7	G7	5201	5500
8	G8	4901	5200
9	G9	4601	4900
10	G10	4301	4600
11	G11	4001	4300
12	G12	3701	4000
13	G13	3401	3700
14	G14	3101	3400
15	G15	2801	3100
16	G16	2501	2800
17	G17	2201	2500

4.6.2 PROCEDURE

4.6.2.1 BARRIER

Statutory 60m barrier has been left from the nala bank of both the seasonal and perennial nalas.

4.6.2.2METHODOLOGY

Seam folio plans showing the block boundary, seam incrops, isochores and iso-GCV lineson I_{30}samples with data of effective thickness and GCV were generated and plotted through MINEX 6.3 software and have been used as the base for the estimation of coal reserves. The intersections of all the grids such as effective thickness grids, GCV grids and specific gravity grids within the limit of seam effective thickness of

0.50m and above, seam incrop, fault and block boundary were taken as input data and put in database of MINEX.

4.6.2.3SPECIFIC GRAVITY

Specific gravity of coal has been calculated from the following formula, considered for high moisture non-coking coal.

Sp. Gr. = 1.29 + (0.01 x Ash%)

The specific gravity of each coal seam generated through CEMPDOC softwareis considered for estimation of reserves by MINEX software.

4.6.2.4 COMPUTATION OF COAL RESERVES

The seam-wise and grade-wise reserves have been computed for all the 4 coal seams.

Effective thickness grids, specific gravity grids and GCV grids for 22 nos. of seams are prepared through SeamModel>Multi-seam Multi-variable Gridding menu of MINEX 6.3 software. Thickness limit of seam of 0.50m and limit of polygon of block boundary are fed into database of MINEX. Then by operating SeamModel>Detailed Resource Reporting menu of MINEX 6.3, seam-wise, grade-wise, coal area, coal volume, Gross Geological Reservesare determined. A deduction of 10% has been made to arrive at Net Geological Reserves from above mentioned Gross Geological Reserves towards unforeseen geological disturbance or localized deviation of the thickness, development of intra-seam dirtbands, quality etc.

Total Net Proved Reserves of **16.254 mt** have been estimated. The details of seam-wiseand grade-wise reserves from all the seams have been provided in Table 4.19.

Table 4.19: Seamwise & GCV Gradewise Net Proved Reserves in West Jhiria Block, Sohagpur Coalfield.

SEAM NAME	GRADEWISE RESERVE											TOTAL
	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	
3T	0.013	0.060	0.088	1.099	0.271	0.194	0.189	0.190	0.180	0.152	0.031	2.468
3B		0.475	0.699	1.047	0.850	0.749	0.310	0.103	0.056	0.028	0.004	4.321
LKII				0.079	1.954	2.275	0.624	0.466	0.377			5.774

SEAM NAME	GRADEWISE RESERVE											TOTAL
	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	
LKIIT			0.076	0.366	0.194	0.037	0.002	0.166				0.840
LKIIB		0.019	0.164	1.298	0.207	0.439	0.724					2.851
TOTAL	**0.013**	**0.554**	**1.027**	**3.888**	**3.476**	**3.693**	**1.850**	**0.925**	**0.613**	**0.181**	**0.035**	**16.254**

4.6.3 OVERBURDEN

4.6.3.1 NATURE

The overburden is composed of soil, weathered mantle and mainly sandstones and shaly sandstone of varying grain size.

4.6.3.2 INSEAM BURDEN

The inseam burden is composed mainly of shales, sandy shales, alternative shale and sandstone, carbonaceous shale and sandstones.

4.6.3.3 METHODOLOGY OF OVERBURDEN ESTIMATION

The following procedure has been adopted for the estimation of overburden in the combined block.

- The estimation of overburden has been done through MINEX software.
- From SeamModel>Detailed Resource Reporting menu of MINEX 6.3, seam-wise, grade-wise, coal area, coal volume, Gross Geological Reserves and OB volume are determined.
- This procedure is repeated for different depth interval in the SeamModel>Detailed Resource Reporting menu of MINEX 6.3

4.6.3.4 DEPTH OF EXCAVATION

The maximum depth of excavation would be about 60m up to the floor of bottom most seam LKIIB.

4.6.4 STRIPPING RATIO

The ratio between coal in million ton and volume of OB in mm^3 is called stripping ratio. The depth wise and stripping ratio wise reserves are given in the table 4.20.

Table 4.20: Depth-wise and Seam wise Net Proved Geological Reserves and OB volume with resultant Stripping ratio in West Jhiria Block, Sohagpur Coalfield

DEPTH RANGE	SEAM NAME	NET RESERVE (mt)	NET OVERBURDEN (mm3)	STRIPPING RATIO
0-50	3T	2.468	42.558	17.244
	3B	4.321	10.758	2.490
	LKII	3.744	53.473	14.282
	LKIIT	0.640	7.362	11.494
	LKIIB	2.188	7.254	3.316
TOTAL		**13.361**	**121.405**	**9.086**

DEPTH RANGE	SEAM NAME	NET RESERVE (mt)	NET OVERBURDEN (mm3)	STRIPPING RATIO
50-100	LKII	2.030	2.874	1.416
	LKIIT	0.200	1.828	9.162
	LKIIB	0.663	2.566	3.869
TOTAL		**2.892**	**7.268**	**2.513**

DEPTH RANGE	SEAM NAME	NET RESERVE (mt)	NET OVERBURDEN (mm3)	STRIPPING RATIO
0-100	3T	2.468	42.558	17.241
	3B	4.321	10.758	2.489
	LKII	5.774	56.346	9.759
	LKIIT	0.840	9.190	10.940
	LKIIB	2.851	9.820	3.445
TOTAL		**16.254**	**128.673**	**7.916**

4.7.1 CONCLUSION AND RECOMMENDATION

On the basis of Regional Exploration carried out by GSI during the period 1973-76, Jhiria Block was identified for detailed proving for seam 5 & 4. Northern part of Jhiria block has not been proved completely. Existence of two prominent coal horizons in the northern part of the Jhiria block was encouraging and hence drilling at 400m interval has taken up for proving the area by Directorate of Geology and Mining, M.P in 1997-2000 at instance of CMPDI, RI-V, Bilaspur. Now for preparation of Project Report of West Jhiria block for Rajnagar R.O. Sub Area, the reserve of the coal horizon has been reassessed through MINEX model based on the Geological Report of West Jhiria submitted by Directorate of Geology and Mining, M.P.

Earlier, the Chapter-4 for PR of this project had been submitted vide Noting Sheet No. RV/EXP/15/E-429, Dt. 16/03/2015 considering the Block boundary of reported in the Geological Report of West Jhiria Block, submitted by DGM, M.P. However, in reference to the Noting Sheet No. CMPDI/RI-5/2015/NIL, Dt.13/10/2015, as per discussion in the chamber of Director (T) (P&D), CMPDIL, Ranchi on 28/09/2015, the Block boundary of both western and south-western side has been straightened to get uniform strike length. The reserve estimation has been done accordingly in the annexed boundary (area 4.17 sq. km) of the block as advised vide above referred letter.

i) The West Jhiria block measures an area of 4.17 sq.km.

ii) The West Jhiria block is about 8km SW of Bijuri town, 13km. SW of Manendragarh town and 5km SW of RajnagarColliary and lies between 23°10'05"N-23°11'05"N and 82°05'00'E-82°07'05"E in Anuppur district of Madhya Pradesh. The area is included in the Survey of India Toposheet No. 64 I/4. The Manendragrah-Pendra asphalt road is passes through the block and marks its western boundary. The area can be approached by forest road covering a distance of 1.5km which connect Manendragarh-Pendra asphalt road near village Phulwaritola, located about 18km and 12km from Manendragarh and BijuriTownship respectively. The district headquarter Anuppur is connected by an all-weather asphalt road covering a distance of around 70km. Siding to existing 7-8 incline of Rajnagar lease hold, located in the north of the block and is extend from Bijuri railway Station on Anuppur-Chirimiri-Bisrampur line of S.E railway. Nearest rail heads are Bijuri and Manendragarh.

iii) The area has an undulatory to moderately rugged topography with general slope towards SE direction. The area is governed by Kulharianala flowing to SSE in which number of small seasonal nalas are joining at rectangular fashion and form trellis type of drainage pattern. Kulharianala is perennial in nature and discharge into southerly flowing Hasdeo river (a tributary of Mahanadi). The elevation of area ranges from 515.00 to 555.00m above MSL. The highest elevation recorded in the western part of the block while lowest elevation located in the extreme SE corner of the block.

iv) Detailed exploration has been carried by DGM, M.P in the block during 1997-2000.

v) This report is based on the 26 boreholes of MPWJH series and 8 boreholes of MPJH series, both are drilled by DGM,M.P.

vi) The sedimentary formations in the block are concealed under the cover of thick soil. The Barakar Formation is represented by sandstone, shale and carbonaceous shale along with coal seams occurring below soil/weathered mantle.

vii) In general coal beds exhibits gentle centripetal dip of 1° to 4° and formed sub-basinal structure. The coal shows frequent changing in their trend from WNW-ESE to E-W and NE-SW.

viii) The area is affected by two E-W trending opposite thrown normal faults. The fault F1-F1 is situated on southern portion of the block. The fault has down throw of about 20m to 40m towards north and the throw is increasing towards east. Another fault F2-F2 is located on the northern part of the block which has down throw of about 5m-20m towards south. The throw amount is increasing towards west. Both the faults are diminishing towards E-W direction. Due to these opposite thrown normal faults, seam 3 has been preserved in the graben.

ix) Occurrence of two prominent coal horizons have been revealed by drilling in the concerned area with its top and bottom splits viz. seam 3T and seam 3B and LKIIT and LKIIB. Among these seams LKIIB has been found most potential coal horizon and consistently developed over the sizable area.

x) The generalized overall quality, thickness and grade of the coal seams **within the PR boundary**are given below in table 4.21.

Table 4.21: Quality and thickness ranges of coal seams in West Jhiria Block, Sohagpur Coalfield.

Coal Seam/ Section	Thickness range		Nos. of intersection	At 60% RH & 40°C				UHV (K. cal./ kg.)		GCV (K. cal./ kg.)		GCV Grade	Average Grade
				M%		A%							
	Min.	Max.		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
3T	0.20 MPWJH 02	2.14 MPWJH 10	13	5.50	8.40	11.80	30.20	3973	6402	4780	6485	G2-G16	G7
3B	0.40 MPWJH2 6	2.95 MPWJH 12	21	2.60	7.80	10.50	38.30	3256	6540	4910	6525	G3-G11	G6
LKII T	0.10 MPJH73	1.54 MPWJH 19	14	5.90	7.20	11.40	31.10	3794	6471	4725	6540	G3-G9	G6
LKII B	0.12 MPJH76	3.25 MPWJH 01	14	4.40	8.10	16.00	30.20	3973	5781	4780	6100	G5-G8	G6

xi) Considering the seam thickness and depth of occurrence, the reserves established are for opencast proposition.

xii) The coal seams of the combined block are generally dull in appearance, high in moisture and low in rank i.e. non-coking type.

xiii) A total **16.254 mt** Net Proved Reserves have been established for the 4 seams.

xiv) The seam-wise and grade-wise net proved reserves are given in the table 4.22.

Table 4.22: Seam-wise, Grade-wise Net Proved Geological Reserves in West Jhiria Block, Sohagpur Coalfield

SEAM NAME	GRADEWISE RESERVE											TOTAL
	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	
3T	0.013	0.060	0.088	1.099	0.271	0.194	0.189	0.190	0.180	0.152	0.031	2.468
3B		0.475	0.699	1.047	0.850	0.749	0.310	0.103	0.056	0.028	0.004	4.321
LKII				0.079	1.954	2.275	0.624	0.466	0.377			5.774

SEAM NAME	GRADEWISE RESERVE											TOTAL
	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	
LKIIT			0.076	0.366	0.194	0.037	0.002	0.166				0.840
LKIIB		0.019	0.164	1.298	0.207	0.439	0.724					2.851
TOTAL	**0.013**	**0.554**	**1.027**	**3.888**	**3.476**	**3.693**	**1.850**	**0.925**	**0.613**	**0.181**	**0.035**	**16.254**

xv) On perusal of the table 4.22, it can be observed that a bulk of 0.035mt (0.215%) of reserves belong to G12 grade, followed by 0.181mt (1.114%) of G11 grade, 0.613mt (3.771%) belong to G10 grade, 0.925 mt (5.691%) belong to G9, 1.850 mt (11.382%) belongs to G8 grade,3.693mt (22.721%) belong to G7, 3.476mt (21.386%) belongs to G6 grade, 3.888mt (23.92%) belongs to G5 grade, 1.027mt (6.318%) belongs to G4 grade, 0.554mt (3.408%) belongs to G3 grades, 0.013mt (0.079%) belongs to G2 grade.

xvi) The depth wise net proved reserve with stripping ratio is given in table no. 4.23.

Table 4.23: Depth-wise and Seam wise Net Proved Geological Reserves and OB volume with resultant Stripping ratio in West Jhiria Block, Sohagpur Coalfield

DEPTH RANGE	SEAM NAME	NET RESERVE (mt)	NET OVERBURDEN (mm3)	STRIPPING RATIO
0-50	3T	2.468	42.558	17.244
	3B	4.321	10.758	2.490
	LKII	3.744	53.473	14.282
	LKIIT	0.640	7.362	11.494
	LKIIB	2.188	7.254	3.316
TOTAL		**13.361**	**121.405**	**9.086**

DEPTH RANGE	SEAM NAME	NET RESERVE (mt)	NET OVERBURDEN (mm3)	STRIPPING RATIO
50-100	LKII	2.030	2.874	1.416
	LKIIT	0.200	1.828	9.162
	LKIIB	0.663	2.566	3.869
TOTAL		**2.892**	**7.268**	**2.513**

DEPTH RANGE	SEAM NAME	NET RESERVE (mt)	NET OVERBURDEN (mm3)	STRIPPING RATIO
0-100	3T	2.468	42.558	17.241
	3B	4.321	10.758	2.489
	LKII	5.774	56.346	9.759
	LKIIT	0.840	9.190	10.940
	LKIIB	2.851	9.820	3.445
TOTAL		**16.254**	**128.673**	**7.916**

xvii) The average GCV of the block (weighted with tonnes) are computed as 5527 Kcal/Kg.

xviii) The seam-wise average GCV and grade within the PR boundary (weighted with tonnes) are given in table 4.24.

Table 4.24: Seam-wise average GCV and average grade of West Jhiria Block, Sohagpur Coalfield

SEAM NAME	AVERAGE GCV	AVERAGE GRADE
3T	5464	G7
3B	5778	G6
LKII	5313	G7
LKIIT	5635	G6
LKIIB	5583	G6
	5524	**G6**

4.7.2 RECOMMENDATION

At the time of the execution of the project, confirmatory drilling will have to be done for precise alignment of incrops of seams and also for pinpointing position of faults. The study/MINEX model has been done based on only 26 boreholes drilled by DGM, M.P. in 4.17sq.km. area. Hence, around 20 boreholes with an expected meterage of around 1500m is required to be drilled mainly in the north-east, north-west and south-west areas around the West Jhiria Block for further enhancing the degree of confidence.

CHAPTER - V

MINE BOUNDARY, RESERVES AND MINE LIFE

5.1 INTRODUCTION

The Jhiria West Opencast Project is situated in Sohagpur coalfiels and is under administrative control of Hasdeo area of SECL. The area is included in the Survey of India Toposheet No. 64 I/4. The block is located in the close proximity of existing Rajnagar RO UG mine.

The existing Rajnagar RO is likely to be exhausted within few years as communicated by notesheet no- SAM/RAJ RO/2014/1614 dated 11.03.2014. It was also noted that all the infrastructures of Rajnagar RO mine may be utilized for mining in Jhiria West Opencast Project since it is adjacent to Rajnagar RO mine.

Accordingly, Project Report for Jhiria West Opencast Project has been prepared to finalise the modalities to extract coal from Jhiria West Opencast Project.

The Jhiria West Opencast Project, lying immediate West of old Rajnagar incline of Rajnagar RO lease hold Area. The Jhiria West Opencast Project can be approached from Rajnagar RO Siding. The distance from Rajnagar RO siding to Jhiria West OC Project is about 6.0 Km. The area can be approached by Manendragarh – Pendra road near village Phulwari-tola, and Jhiria West Opencast Project is about 13 km. and 12 km. from Manendragarh and Bijuri township respectively. The district Head Quarter Shahdol is connected by an all-weather asphalted road covering a distance of 115km. The Nearest rail head are Bijuri and Manendragarh.

5.2 PIT FORMULATION STRATEGY

It is proposed to work all the seams LKII, 3T & 3B as they can be mined techno-economically by opencast method. Quarry floor has been proposed on the floor of Seam-LKII. Access trench & Haul Road is proposed to touch seam LKII at floor RL of 532m.

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SECL Hasdeo Area

Haul roads have been planned at a maximum gradient of 1 in 16, the width of the haul road has been kept as 30 m. Except F1F1 and F2F2 fault, the property is free from any major geological disturbances. The fault F2F2 is down throw fault and the fault F1F1 is up throw fault. While haul road is crossing the fault F2F2 digging of floor may be done by maintaining gradient of haul road 1 in 16 to touch quarry floor on other side of fault F2F2. While haul road is crossing the fault F1F1 filling of floor may be done by maintaining gradient of haul road 1 in 16 to touch quarry floor on other side of fault F1F1.

This PR has been formulated mainly considering the following details:-

1. Increased demand of superior grade coal from CIC Coalfields.
2. Sufficient mineable reserves
3. Workable strike length

5.3 MINE BOUNDARIES

The quarriable area for the opencast mining is shown on Plate No.9. One quarry on floor of Seam II has been planned. The boundary of quarry has been fixed as follows: -

Quarry Boundary

North : Incrop of LKII Seam
South : Fault F1F1 and 0.50m thickness line of seam LKII.
East : 60m barrier from Western bank of Kulharia Nalla.
West : Block boundary of West Jhiria Geological Block.

5.4 MINEABLE RESERVES

10% geological and 5% mining losses are considered for reserves estimation.

Sector & mineable reserves

The total mineable reserves within the quarry have been estimated as 14.35 Mt with a corresponding OB volume of 115.33 Mcum. While, calculating mineable reserves, a geological loss of 10% and a mining loss of 5% have been considered. The estimation of mineable reserves is based on a minimum mineable thickness of 0.5 m. The mineable reserves have been estimated by iso-chore method from the seam extent plan of individual seams. Similarly, OB

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has been estimated based on iso-parting and Top OB plan. The plan showing seam extent of individual seams under consideration is given at Plate No. 5 to 9. The Top OB and the iso-parting plan between seams under consideration are given at Plate No. 10 to 14.

The sectorwise quarry wise mineable reserves, volume of OBR and stripping ratio are summarised in the following table: -

Sectorwise mineable reserves, volume of OBR and stripping ratio of quarry

COAL SEAMS	L3T	L3B	LKII	LKIIT	LKIIB	TOTAL
SEC-1	0.00	0.00	1.67	0.06	0.18	**1.91**
SEC-2	0.52	1.40	1.06	0.16	0.63	**3.77**
SEC-3	1.06	1.56	1.29	0.23	0.78	**4.92**
SEC-4	0.68	0.53	1.13	0.08	0.23	**2.65**
SEC-5	0.11	0.54	0.32	0.00	0.13	**1.10**
TOTAL	**2.37**	**4.03**	**5.47**	**0.53**	**1.95**	**14.35**

OVERBURDEN AND PARTING OB

PARTINGS	TOP OB	L3T-L3B	L3B-LKII	L3B-LKIT	LKIIT-LKIIB	TOTAL
SEC-1	0.11	0.00	11.41	0.02	0.18	**11.72**
SEC-2	15.38	2.42	12.30	0.15	0.48	**30.73**
SEC-3	19.67	2.71	13.65	0.19	0.58	**36.80**
SEC-4	9.98	1.02	8.85	0.26	0.15	**20.26**
SEC-5	6.02	0.60	9.15	0.00	0.05	**15.82**
TOTAL	**51.16**	**6.75**	**55.36**	**0.62**	**1.44**	**115.33**

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SECL Hasdeo Area

5.5 TARGET OUTPUT & MINE LIFE

The total mineable reserves within the quarry have been estimated as 14.35 Mt with a corresponding OB volume of 115.33 Mcum. The mine is proposed for peak coal production of 1.50 Mty and peak OB removal is of 11.50 Mty.

Mine Life

The mine life for nominal production is 12 years. The break-up is as under:

- Construction period - 1 year
- Production build-up period - 3 years
- Production period - 7 years
- Tapering period - 1 year
- Total period - 12 years

5.6 FUTURE EXPANSION POTENTIAL

The mine boundary is proposed to be extracted upto the incrop of seam LKII which is the bottom most seam of the area in the northern side. In the south mine boundary kept along 0.50m thickness line of seam LKII. In the Eastern side mine boundary fixed keeping 60m barrier from Western bank of Kulharia Nalla. In the Western side coal seam has workable thickness but it is yet to be explored. After getting sufficient exploration data the mine may be extended in the western side.

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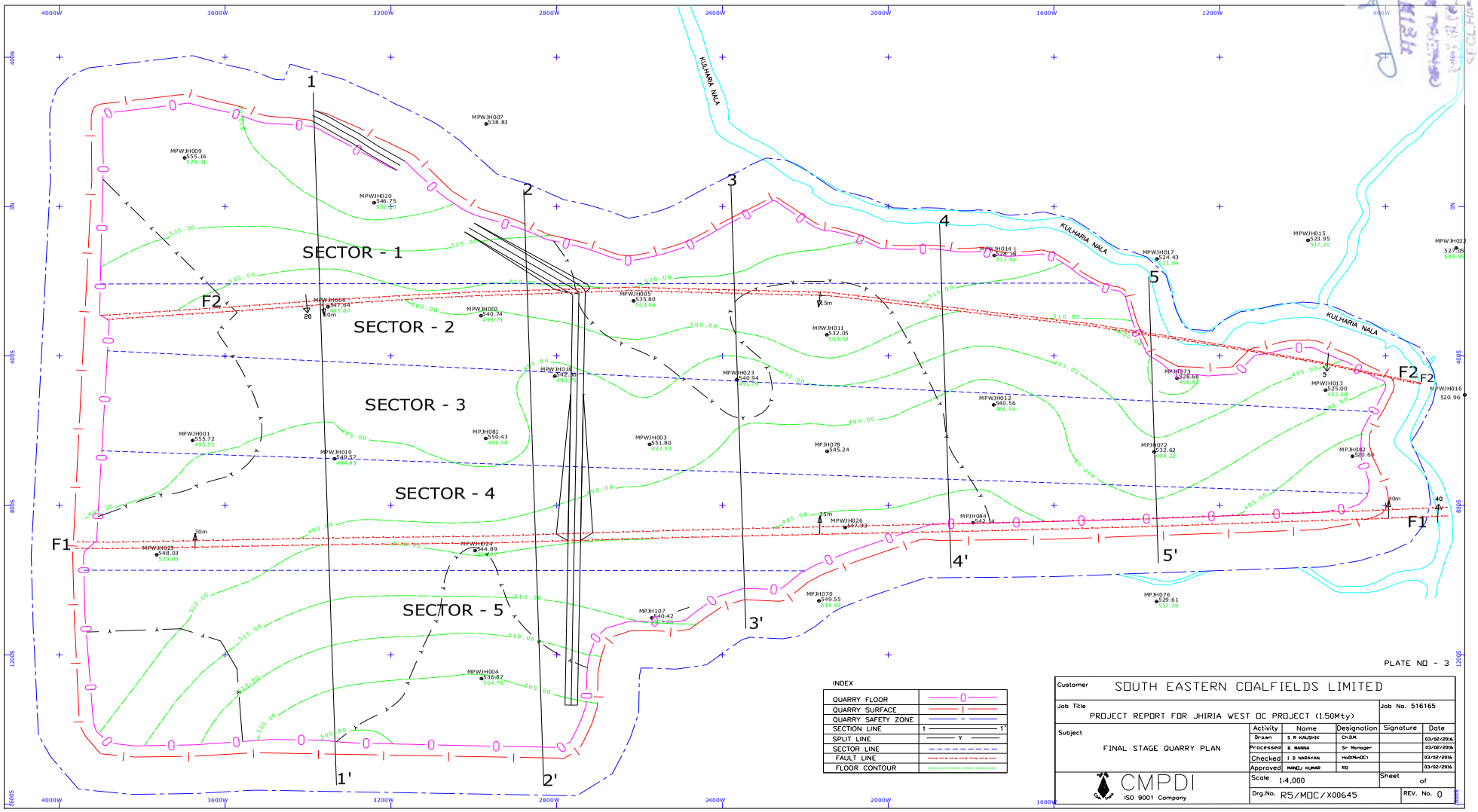
SECTOR - 1
SECTOR - 2
SECTOR - 3
SECTOR - 4
SECTOR - 5
KULHARIA NALA
1
1'
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5'
F1
F2
INDEX
QUARRY FLOOR
QUARRY SURFACE
QUARRY SAFETY ZONE
SECTION LINE
SPLIT LINE
SECTOR LINE
FAULT LINE
FLOOR CONTOUR
PLATE NO - 3
Customer
SOUTH EASTERN COALFIELDS LIMITED
Job Title
PROJECT REPORT FOR JHIRIA WEST OC PROJECT (1.50Mty)
Job No. 516165
Subject
FINAL STAGE QUARRY PLAN
Activity
Name
Designation
Signature
Date
Drawn
S R KAUSHIK
Ch.Dn
Processed
B. MANNA
Sr Manager
Checked
I D NARAYAN
HoDM+OC)
Approved
MANOJ KUMAR
RD
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1:4,000
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of
Drg.No.
R5/MOC/X00645
REV. No. 0
CMPDI
ISO 9001 Company

CHAPTER-VI

METHOD OF MINING

6.1 GENERAL

The PR has been formulated to win coal by Surface Miner & OB by Shovel Dumper combination. Coal from face will be transported to pit top by higher capacity truck/dumper. Coal from pit top will be transported to Rajnagar siding by higher capacity truck/tipper to dispatch coal by rail.

In this PR three options have been worked out namely Total Outsourcing Option, Partial Outsourcing Option and Total Departmental Option. The three options have been worked out in this PR are as given below.

Sl No	Options	Details
1	Total Outsourcing Option	Both Coal extraction and OB removal is by Outsourced HEMM
2	Partial Outsourcing Option	Coal extraction by Departmental HEMM and OB removal is by Outsourced HEMM
3	Total Departmental Option	Both Coal extraction and OB removal is by Departmental HEMM

It is proposed that mine will be operated for 330 days in a year. In a day, there will be 3 shifts and each shift is of 8 hours.

6.2 GEO-MINING CHARACTERISTICS

At the time of the execution of the project, confirmatory drilling will have to be done for precise alignment of incrops of seams and also for pinpointing position of faults. The study/MINEX model has been done based on only 26 boreholes drilled by DGM, M.P. in 4.17sq.km. area. The density of the borehole in the area of West Jhiria block is only about 6 boreholes / sq. km. Hence, around 20 boreholes with an expected meterage of around 1500m is required to be drilled within and around the West Jhiria Block for further enhancing the degree of confidence.

6.2.1 Seam Gradient - Variation, average gradient of quarry floor 1 in 60.

The strata including coal seams strike almost NW-SE.

6.2.2 Geological Disturbances -

Two normal faults trending E-W have been interpreted within the proposed quarry boundary. Fault F1F1 is trending E-W and having throw of 20 to 40m. Fault

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F2F2 is trending E-W and having throw of 5 to 20m. However, the occurrence of faults of small lesser magnitude cannot be entirely ruled out in the area.

6.2.3 Presence of In-seam band seam-wise

The quality parameters of Seam LKII, LKIIT, LKIIB, 3B and 3T, which are amenable for opencast mining, have been considered for workable thickness of seams (I_{30} basis) including combustible dirt bands up to 0.30m of their thickness and excluding all non-combustible &obvious dirt bands irrespective of their thickness for estimation of reserves and grade determination.

6.2.4 Details of sequence of coal seam and parting

The sequence of coal seams with their thickness and parting range, mineable coal and volume of OB within the proposed mine area are as shown in table below:-

Coal Seam Name/Parting	Thickness range(m)		Av. gradient (in degrees)	Mineable Reserves (Mt)	Volume of OB (Mcum)
Top OB	6.22	42.87			51.16
Seam 3T	0.50	2.14	1 in 60	2.37	
Parting	1.56	8.35			6.75
Seam 3B	0.86	2.95	1 in 60	4.03	
Parting	13.78	21.72			55.36
Seam LKII	0.50	5.25	1 in 60	5.47	
Parting with3B					0.62
Seam LKIIT	0.50	3.25	1 in 60	0.53	
Parting	1.00	2.11			1.44
Seam LKIIB	0.50	5.25	1 in 60	1.95	

6.3 MINE PARAMETERS

The geological and mining characteristics of both the quarries have been summarised in the following table: -

Geological and Mining Characteristics

Sl. No.	Particulars	Unit	Thickness
1	**Dominant Thickness of Seams Excluding Band**		
	Seam 3T	Metre	0.50 – 2.14
	Seam 3B	Metre	0.86 – 2.95
	Seam LKIIT		0.55 – 1.54
	Seam LKIIB		0.50 – 3.25
	Seam LKII	Metre	0.55 – 5.25

Sl. No.	Particulars	Unit	Thickness
2	**Dominant Thickness of OB & Parting**		
	Top OB	Metre	6.22 – 42.87
	Seam L3T & Seam L3B	Metre	1.56 – 8.35
	Seam L3B & Seam LKII & LKIIT		13.78 – 21.72
	Seam LKIIT & Seam LKIIB	Metre	1.00 – 2.11
3	Gradient		1 in 60
4	Average Grade of coal		G-6 with GCV 5524 Kcal/Kg
5	**Mineable Reserves**		
	Seam 3T	Mt	2.37
	Seam 3B	Mt	4.03
	Seam LKIIT	Mt	0.53
	Seam LKIIB		1.95
	Seam LKII		5.47
	TOTAL		**14.35**
6	**Volume of OB**		
	Top OB	Mcum	51.16
	Seam L3T & Seam L3B	Mcum	6.75
	Seam L3B & Seam LKII	Mcum	55.36
	Seam L3B & Seam LKIIT		0.62
	Seam LKIIT & Seam LKIIB		1.44
	TOTAL		**115.33**
7	Target output	Mty	1.50
8	Stripping Ratio (Av.)	Cum/t	8.04
9	Project life	Year	12
10	Main Customers		Miscellaneous
11	Anticipated year of achieving target	Year	4th
12	Total Land involved	Ha	482.694
III.	**Quarry Parameters**		
1	Maximum width along strike		
	- at surface	m	3164
	- at floor	m	3080
2	Minimum width along strike		
	- at surface	m	1260
	- at floor	m	1206
3	Maximum length along dip		
	- at surface	m	1706
	- at floor	m	1648
4	Maximum depth	m	60.12
5	Minimum depth	m	10.62
6	Maximum lift	m	61.00
7	Area of excavation		
	- at surface	Ha	344.70
	- at floor	Ha	318.70

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6.4 CHOICE OF TECHNOLOGY

Due to flexibility of operation, Shovel-Dumper combination will be suitable for OB removal and coal will be extracted by surface miner. In Partial Outsourcing Option, the PR has been formulated to win coal by departmental HEMM & OB by Shovel Dumper combination by Outsourcing of HEMM.

Coal from face will be transported to pit top and then it will be transported to Rajnagar siding to dispatch coal by rail.

The salient feature of the mining system is as follows: -

(i) Height & width of the benches in coal and OB will depend upon the size of the leased equipment. The provision of Coal Mine Regulation and related circulars shall be strictly followed for designing bench parameters in coal and OB.

(ii) Dump bench height - 30m (each bench)

(iii) Bench Slope

Coal / OB - 70^0

Spoil - 37^0

(iv) Total Dump Height - total dump height is 80 m from quarry floor & 50m from surface.

Considering the average mine floor gradient of about 1 in 60, the coal benches are proposed parallel to seam floor and self-draining. The mining system is shown at Plate No. 18.

DRILLING & BLASTING

Pattern for drilling of blast holes will depend upon the height of the bench and may design as follows: -

Height of Bench = H

Burden (B) ~ H/2

Spacing (S) ~ B*1.25

The suggested drilling pattern is for average mining conditions. These may be suitably modified during actual mining operations as per the site conditions preferably based on blasting studies.

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HAUL ROAD

Haul roads have been planned at a maximum gradient of 1 in 16, the width of the haul road has been kept as 30 m. The haul road may be maintained by outsourcing agencies.

6.5 EQUIPMENT SELECTION

The PR has been formulated to win coal by Surface Miner & OB by Shovel Dumper combination. Due to flexibility of operation, Shovel-Dumper combination will be suitable for OB removal for working multiple seams and partings.

In Partial Outsourcing Option, the PR has been formulated to win coal by departmental HEMM & OB by Shovel Dumper combination by Outsourcing of HEMM. To handle the larger OB quantity optimum no. of equipment with required capacity is proposed be used. Minimum 5 cum Shovels with 60T rear dumpers preferably will be used for OBR by outsourcing agency. For thin partings, smaller backhoe may be used. Coal from face will be transported to pit top and then it will be transported to Rajnagar RO siding to dispatch coal by rail.

Except F1F1 and F2F2 fault, the property is free from any major geological disturbances. Average gradient of quarry floor is 1 in 60. Sufficient care is proposed to be taken for optimum efficiency of surface miner. The average strike length of the quarry is 2.4 km. Thus, sufficient face length will be available for optimum efficiency of surface miner.

6.6 MINING SYSTEM & SYSTEM PARAMETERS

Surface miner has been proposed for extraction of coal.

The salient features of mining system are as follows:-

i) Height of bench in OB will depend on the size of equipment.
Coal bench height will depend on the thickness of the coal seams.
The provision of coal mine regulations and related circulars shall be strictly followed for designing bench parameters in coal and OB.

ii) Average Seam gradient – 1 in 60.

iii) Total dump height –50m from surface. (80 m from quarry floor)

iv) Bench slope –

Coal/OB - 70 degree

Spoil - 37 degree

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Keeping the geo-mining characteristics of the deposit, in view, optimum no. of equipment with optimum capacity is proposed be used.

6.7 SCOPE OF WORK PROPOSED TO BE OUTSOURCED (IN OB OUTSOURCING)

i) Drilling

The external agency will prepare the site and carry out blast hole drilling in OB as per the pattern decided by the project authorities according to strata conditions and stipulations of DGMS.

ii) OB Removal

The work involves excavation of OB and dumping of the same to different dump locations. This includes construction and maintenance of haul roads for plying of dumpers/tippers with suitable number of graders and dozers. The leveling of the dumps is to be carried out by the agency to whom the work has been awarded for OB removal.

The outsourcing of HEMM would also include water sprinkling. The site of excavation and dumping is to be decided by the project authorities in accordance with the requirement of the project. All statutory rules, regulation and applicable laws are to be followed including those related to Govt. licenses, workmen compensation, insurance etc. by the agency to whom the job has been awarded.

iii) Accommodation, Site Office, Electricity etc.

Site office may be provided by the company on availability basis, which will be chargeable. Electricity to the site office may be provided on chargeable basis.

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CHAPTER-VII

MINING & DUMPING STRATEGY

7.1 CONSTRAINTS ON MINE DEVELOPMENT

(i) The nalla named as "Kulharia nalla" is flowing along the periphery of the eastern boundary of the Project. Sufficient care should be taken to avoid inrush of water from Kulharia Nalla into the mine.

(ii) Rehabilitation & resettlement of two villages namely, Bhalmuri and Soutanchua village is involved in the project. Acquisition of land alongwith R&R of PAP is a critical activity and should be done for opening of the project.

7.2 MINING STRATEGY / MINING SEQUENCE

In the 1st year the acquisition of land and other development activities will be done. Initial box cut of quarry is proposed to be developed in the 2nd year of mine operation by grading properly the access trench and making its width 30 m wide. The access trench is to be graded at less than 6% to the mine floor of about 532 m R.L. The box cut is developed in such a manner so as to facilitate the proper drainage of water towards the sump. This would also facilitate extension of coal and OB bench for full development of mine. After creation of sufficient decoaled area, internal backfilling of OB will be started in the 4th year. The coal production will continue from the 2nd year of mine life and the target coal production of 1.50 Mty will be achieved in the 4th year. The target OB removal will be achieved in the 4th year of mine operation.

For reducing the external dump area and healthy operation of mine, 2 plans i.e. final stage of mine excavation and final dump plan showing backfilling, Plate No. 3 & 4 are enclosed. The life of mine will be 12 years including construction period.

7.3 DUMPING STRATEGY

In the initial years i.e. upto 3rd year, OB quantities will go to the external dumps. Internal dumping will start from the 4th year onwards. The parting OB in case of older seam may be transported through central haul road, while mining in the multi seam zone.

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Initially, the soil/alluvium from top bench of OB will be stacked and stored separately. The spoil dump benches in the internally backfilled OB will be in the form of benches. With the sufficient advance of coal production bench, the backfilled OB will be leveled with dozer. Dumper/Tipper will transport soil/alluvium OB from the top OB bench and will dump the soil directly on the leveled backfilled OB.

The OB dump will be terraced at the height of 30m. The barrier distance between internal dump and coal production bench will be 100 m to have smooth functioning of machineries. While crossing the Fault F1F1 and F2F2 the fault surface should be benched to avoid any sliding of strata to working face. The surface of OB dump will be leveled and graded. Plantation will be made on the slope of OB heap to avoid the sliding of spoil.

The slope stability study should be done. According to study report the dump design like dump bench height, berm width, total dump height & slope etc. should be modified to avoid internal dump failure. In addition to that proper precautions / observations should be taken to avoid sliding of internal OB bench. Sufficient distance should be maintained from the toe of internal OB dump to fault on quarry floor to avoid sliding of strata to working face.

Box cut & initial external OB (19.08 Mcum) are proposed to be dumped within quarry area and safety zone area to keep the land requirement bare minimum. The OB so dumped is proposed to be rehandled back to the internal dump. More land would be required if external dump kept outside quarry area and there will be additional impact on environmental point of view. So OB externally dumped within quarry area is proposed to be rehandled back to decoaled area as internal dump.

OB quantity of 19.08 Mcum will be externally dumped within quarry quarry area and safety zone area area from 2nd year to 3rd year for which 78 Ha land will be required within quarry area and safety zone area. External dump has been made near western boundary as shown in Plate No-8. This temporary external dump will be rehandled to internal dump subsequently. From 7th year to 10th year the external dump will be rehandled back to internal dump.

In case of external dump, spoil bench height will be kept 30 m. There will be one bench and total dump height above surface will be 30m. Plate No. 16 shows the proposed design and location of initial cut and proposed external dumps.

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The break-up of OB quantity to be accommodated in various dumps is as follows:-

Dump	**OB accommodated in Mcum**
1. Internal dump	115.33
2. External dump outside Quarry area	0.00

Top soil will be removed and stored separately. This soil will be directly spread over the leveled graded backfilled spoil for reclamation of the quarried out land.

7.4 DETAILS OF DUMPING OPERATIONS

The details of quantity of OB dump considering internal and external quantity are given below.

Sl.No.	Particulars of working	Total
1.	Coal mined (Mt)	14.35
2.	OBR (Mcum)	115.33
3.	Stripping ratio (Mcum/t)	8.04
4.	Internal dump (Mcum)	115.33
5.	External dump outside quarry (Mcum)	0.00

7.5 DUMPING ARRANGEMENTS & PRECAUTIONS

Maximum height of internal dump will be upto 80m from quarry floor (50 m above surface level) (refer Plate-4).

Maximum height of temporary external dump will be 30 m above surface level (refer Plate-16).

External dump - 37 degrees
Internal dump - 37 degrees

30 m will be the height of individual bench.

30 m will be width of berm.

The slope stability study should be done. According to study report the dump design like dump bench height, total dump height & slope etc. should be

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modified to avoid internal dump failure. In addition to that proper precautions / observations should be taken to avoid sliding of internal dump.

7.6 RECLAMATION AFTER MINE CLOSURE

After exhaustion of the mine, as a mine closure activity, all the OB dumps internal or external will be re-organised for minimum possible height above ground level and levelled top surface. After the final grading the topsoil would be redistributed in a manner that achieves an approximate uniform stable thickness consistent with the post mining land uses, and surface water drainage system.

7.7 TOP SOIL MANAGEMENT

1.0 INTRODUCTION

The topsoil at proposed Jhiria West OC comprises of rich humus with minerals and nutrients. Proper handling and management is necessary for future vegetation growth in the mine reclaimed area. The thickness of the top soil varies between 25 cm to 35 cm.

1.1 Objectives of the Soil Stripping management plan

The objectives of Top Soil Management are to:

- Maintain a topsoil balance that achieves rehabilitation objectives during the life of Mine.
- Ensure effective topsoil removal techniques are employed to maximise volumes of suitable topsoil removed and minimise wastage.
- Maintain topsoil viability during stripping, spreading, and stockpiling, through best practice technique and effective stockpile design and treatment .

  In accordance with the objective of providing sufficient stable soil material for rehabilitation and to optimise soil recovery, the following strategies will be adopted during the mining operation at Mahan opencast mines.

1.2 Stripping

Prior to the commencement of stripping, areas will be cleared of vegetation. Soil stripping will be undertaken by dozers and hydraulic backhoe excavators to maximise the preservation of the quality of the soil.

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The HEMM operators and supervisors should be trained and made aware for the same. This will ensure that all suitable topdressing material resources are salvaged and that the quality of the stripped top dressing material is not reduced through contamination with unsuitable soils. Care will be taken during stripping, stockpiling, and re-spreading to ensure that structural degradation of the soil is avoided and that excessive compaction does not occur during stockpiling.

1.3 Stock piling

- Where possible, topdressing material will be re-spread directly from stripped areas onto areas being rehabilitated. Where this is not possible, topdressing material will be stored in stockpiles.
- Stock piles will be dumped at places where they would not be disturbed by future mining. Sediment fences or other barriers can be used where necessary to retain sediment.
- The overall topography for the graded surface should be designed to minimize the uncontrolled flow of runoff.
- Dispersed sheet flow should be broken up by terraces or benches along the slope that also follow topographic contours.
- On a fine scale the ground surface can be roughened by the tracks of a bulldozer perpendicular to the slope. Construction of stockpiles with a "rough" surface condition will reduce erosion hazard, improve drainage and promote revegetation.

1.4 Stockpile preservation

Stockpiling topsoil may result in disruption & loss of beneficial soil microorganisms and nutritional values, hence needs the following amendments during preservation:-

1) Re-vegetation of the stockpile will be done as scheduled below to protect the soil from erosion, discourage weeds and maintain active populations of beneficial soil microbes.

- Temporary Seeding- To protect topsoil stockpiles by temporarily seeding as soon as possible, within 30 days after the formation of the stockpile.

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- Permanent Vegetation- If stockpiles will not be used within 12 months they will be stabilized with permanent vegetation to control erosion and weeds. Likely grass species for revegetating top soil stock piles are green panic, Japanese millet (spring sowing), Oats (winter sowing), Dryland Lucerne, Seaton park sub-clover.

  Topsoil can be mixed with organic material or manufactured soil amendments to improve the growing capability.

2) To the extent practicable, above ground vegetation, including tree litter should be mixed or otherwise incorporated into the topsoil.
3) Soil amendments: Soil amendments should be applied before seeding or planting. Common soil amendments used are biosolids, compost, manure, lime and coal combustion byproducts.

Prior to the placement, the top 0.30 cm of stockpile material should be mixed with the remainder of stockpile to ensure that living organisms are distributed throughout the topsoil material at the time of final placement. In case, the material has been stockpiled for over nine month period, use of microorganisms inoculates may be necessary to re-establish microorganisms in the topsoil material. The quantity should be 200 ml for one Heactare area in case of Azatobactor and Rhizobium.

1.5 Site Preparation

- Before spreading topsoil, establish erosion and sedimentation control structures such as diversions, berms, dikes, waterways and sediment basins.
- Adjust grades and elevations for receipt of topsoil.
- Roughening - Immediately prior to spreading the topsoil, loosen the subgrade to ensure bonding of the topsoil and subsoil.
- Soil horizons will be replaced in the same order that they were removed.
- Top soil will be uniformly distributed to pre-mining thickness. Topsoil will not be spread while it is frozen or muddy.
- The topsoil will be compacted to ensure good contact with the underlying soil, but excessive compaction will be avoided, as it increases runoff and inhibits seed germination. Light compaction with roller will be done where turf is to be established.

On slopes and areas that will not be mowed, the surface will be left rough after spreading topsoil.

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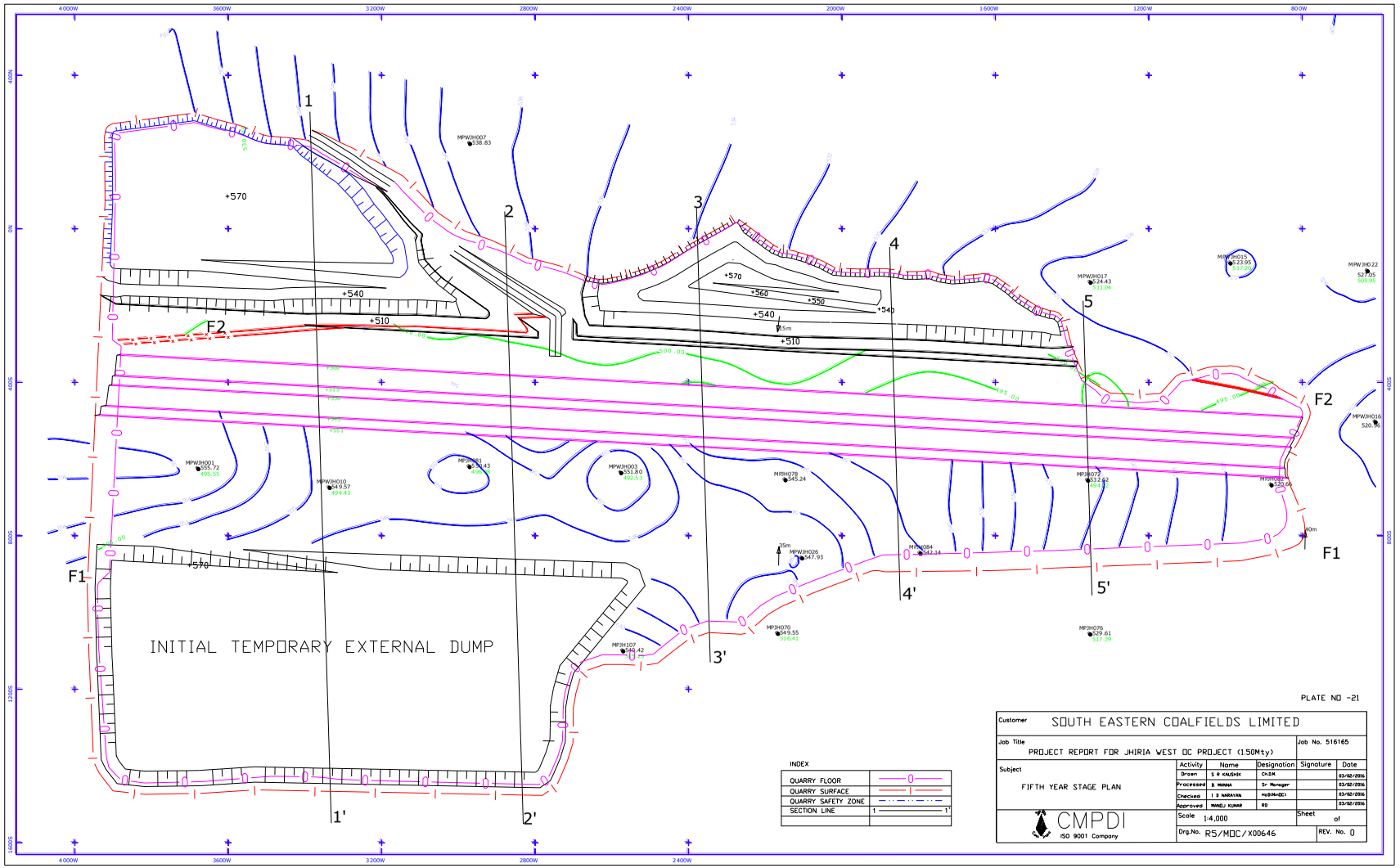
1.6 Monitoring

Specific team / manpower is to be deployed for this most important step of topsoil management. The team will monitor the area and quantum of top soil management with the authorities of mine on quarterly basis and regularly monitor the given points of significant importance:

- Monitoring Erosion Control: This step is necessary during stock piling as well as reclamation stage of topsoil management. Take corrective measure in areas showing evidence of erosion, sedimentation or slope failure. This is a serious problem, because erosion causes fertile farmland to lose nutrients and water retention ability.
- Regular monitoring of top soil management should be done until vegetation is demonstrated to be successfully established.
- Reseeding: Take appropriate measures to address evidence of invasive species or poorly established vegetation. Reseeding should be done, if germination is not uniform or poor.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QUARRY SURFACE
QUARRY SAFETY ZONE
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Job No. 516165
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Processed B MANNA Sr Manager 03/02/2016
Checked I D NARAYAN Mgr(Min&DC) 03/02/2016
Approved MANOJ KUMAR RD 03/02/2016
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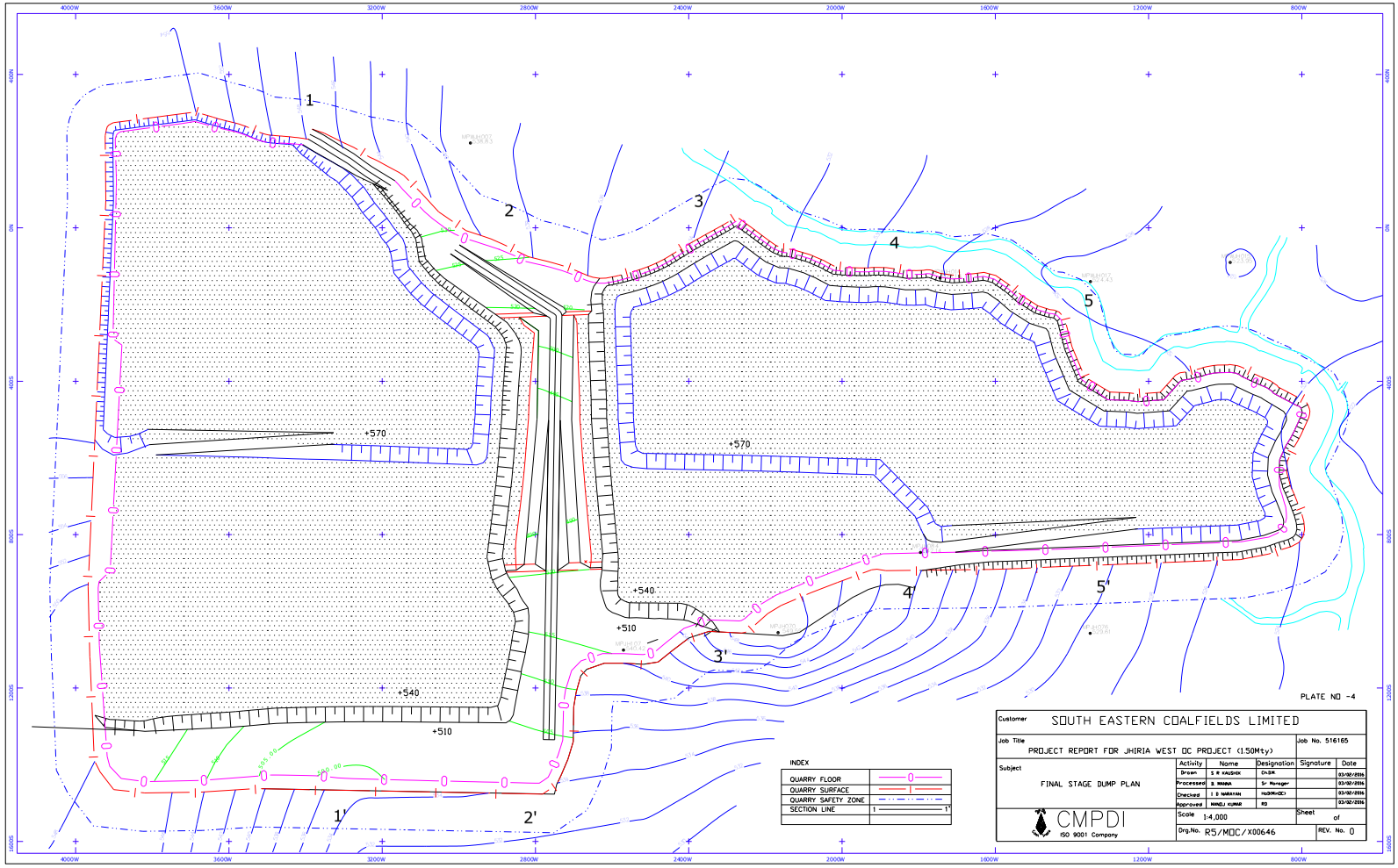
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QUARRY SAFETY ZONE
SECTION LINE
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CHAPTER - VIII

MINING SCHEDULE & EQUIPMENT PHASING

8.1 DESIGN CRITERIA

The mine has been planned for 330 days with 3 shifts working per day.

Duration of shift hours will be eight.

Excavation category assumed

i) Coal - - III

ii) Alluvial OB - Cat.I/II : Assumed

iii) Hard OB - 50% cat.III + 50% cat.IV

Insitu volume weight t/cum

i) Coal - 1.51 t/cum

ii) Overburden - 2.20 t / cum

8.2 ANNUAL PRODUCTIVITY OF HEMM

The PR has been formulated to win coal by Surface Miner & OB by Shovel Dumper combination. For OB removal yearwise lead has been estimated and based on that average lead for OB removal is estimated to 1.60 Km. The average lead for Coal is estimated to 1.50 Km.

In Partial Outsourcing Optionm, winning of coal will be by departmental HEMM and removal of OB will be done through outsourcing HEMM.

Annual Productivity of HEMM considering 330 working days

S.N.	Particulars of HEMM	Unit	Annual Productivity
	For Coal		
1	Surface Miner	MT	1.5 – 2.5
2	6.4 cum FEL	Mcum	0.825
3	60 T Rear Dumper	Mcum	0.189

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8.3 DRILLING & BLASTING

OB will be loosened by drilling and blasting to facilitate their excavation. The actual pattern for drilling and blasting will be decided after field trials. For secondary blasting 10% of additional explosives will be required for OB. SMS explosives should be used wherever possible. The pattern for drilling of blast holes will depend upon the height of the bench and may be designed as follows: -

Height of bench	=	H
Burden (B)	-	H/2
Spacing (S)	-	B*1.25

The suggested drilling pattern is for average mining conditions. These may suitably be modified during actual mining operations as per the site conditions. The explosives consumption has been assumed as 0.30 - 0.35 kg/cum of excavation for planning purpose only. Actual consumptions may be decided based on the field trails during blasting studies.

The ground vibration due to blasting can be controlled by:-

i) reducing the amount of explosives charged per delay,

ii) reducing spacing and burden of blast holes,

iii) reducing the amount of explosives charged per blast,

iv) proper strata movement during blast by using suitable initiating sequence.

Since above parameters are site specific, the exact blasting pattern will be designed by conducting field trials.

8.4 CALENDAR PROGRAMME OF EXCAVATION

Considering the average width of quarry and annual advance of quarry floor, the calendar programme has been prepared and given in the following table: -

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Table : Calendar programme of Excavation

	COAL(Mt)						OVERBURDEN (Mcum)							OB REHANDLE
YEAR	TOTAL COAL	L3T	L3B	LKII	LKIIT	LKIIB	TOP OB PLANNED	L3T-L3B	L3B-LKII	L3B-LKIT	LKIIT-LKIIB	TOTAL OB PLANNED	SR	
1														
2	0.50	0.00	0.00	0.43	0.02	0.05	0.95	0.00	2.99	0.01	0.05	4.00	8.00	
3	1.00	0.00	0.00	0.88	0.03	0.09	1.93	0.00	5.97	0.01	0.09	8.00	8.00	
4	1.50	0.15	0.40	0.67	0.06	0.22	4.56	0.70	6.01	0.05	0.18	11.50	7.67	
5	1.50	0.21	0.56	0.42	0.06	0.25	5.40	0.96	4.89	0.06	0.19	11.50	7.67	
6	1.50	0.23	0.53	0.42	0.07	0.25	5.58	0.93	4.74	0.06	0.19	11.50	7.67	
7	1.50	0.32	0.48	0.39	0.07	0.24	6.27	0.83	4.16	0.06	0.18	11.50	7.67	4.00
8	1.50	0.32	0.48	0.39	0.07	0.24	6.27	0.83	4.16	0.06	0.18	11.50	7.67	4.00
9	1.50	0.32	0.48	0.39	0.07	0.24	6.27	0.83	4.16	0.06	0.18	11.50	7.67	5.00
10	1.50	0.38	0.31	0.62	0.05	0.14	5.73	0.59	4.95	0.14	0.09	11.50	7.67	6.08
11	1.50	0.35	0.37	0.61	0.03	0.14	4.45	0.62	6.25	0.11	0.07	11.50	7.67	
12	0.85	0.09	0.42	0.25	0.00	0.09	3.75	0.46	7.08	0	0.04	11.33	13.33	
TOTAL	**14.35**	**2.37**	**4.03**	**5.47**	**0.53**	**1.95**	**51.16**	**6.75**	**55.36**	**0.62**	**1.44**	**115.33**	**8.04**	**19.08**

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CHAPTER - IX

COAL QUALITY

9.1 INTRODUCTION

COAL ANALYSIS

The analyses were obtained for Bcs, I_{10} & I_{100} basis which are defined as under :

Bcs Sample : Coal and shaly coal.

I_{10} Sample : Bcs sample + Carb.shale band and non-combustible dirt bands upto 10cm thickness.

I_{100} Sample : Bcs sample + combustible and non-combustible dirt bands upto 1m thickness.

On the basis of moisture and ash percentage, different litho units are defined as under:

Coal : Ash+Moisture upto 40%.

Shaly Coal : Ash+Moisture >40 upto 55%.

Carbonaceous Shale : Ash+Moisture >55 upto 75%.
(Combustible dirt bands)

Obvious dirt band : Ash + Moisture > 75%.

For assessment of grade of the seam, proximate analysis for I_{10} seam samples on equilibrated basis have been considered in the report and are produced in Annexure-VI. The M100 value considered for equilibration is 6.216 for Seam II and 6.438 for Seam L1 and it may be further noted that all the boreholes considered for Seam III are of determined quality.

9.2 QUALITY ANALYSIS

Seamwise Quality analysis are as given below.

9.2.1 Seam-3T

Seam 3T is the youngest coal horizon in the block.

DIRT BANDS

The dirt band present in the seam are inconsistent in nature. However, the cumulative thickness of dirt bands ranges from 0.05m to 0.16m.

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PROXIMATE ANALYSIS

Sl No.	Particular		Proximate analyisis at 60% RH and 40°C			GCV in K.Cal/ Kg	UHV in K.Cal/ Kg	Grade in UHV	Grade in GCV
			Moisture	Ash%	VM%				
1	Range	Min	5.50	11.80	24.20	4780	3973	E	G16
		Max	8.40	30.20	29.00	6485	6402	A	G2
2	No. of Samples		6	6	6	6	6		
3	Mean		5.80	17.20	27.40	5823	5655	B	G5
4	Std.Deviation		0.98	3.70	1.60	513	826		

9.2.2 SEAM 3B

Seam 3B is occurring below seam 3T and above seam LK-II.

DIRT BANDS

The dirt band present in the seam are inconsistant in nature. However, the cumulative thickness of dirt bands ranges from 0.07m to 0.15m.

PROXIMATE ANALYSIS

Sl No.	Particular		Proximate analyisis at 60% RH and 40°C			GCV in K.Cal/Kg	UHV in K.Cal/ Kg	Grade in UHV	Grade in GCV
			Moisture	Ash%	VM%				
1	Range	Min	2.60	10.50	24.10	4910	3256	F	G11
		Max	7.80	38.30	30.10	6525	6540	A	G3
2	No. of Samples		12	12	12	12	12		
3	Mean		6.00	18.10	27.30	5864	5560	C	G5
4	Std.Deviation		1.20	7.70	1.80	488	938		

Ash analysis and low temperature carbonization assay in respect of seam 3B of borehole no. MPWJH-12 is given in Table 4.8A and Table 4.8B:

Table 4.8A: ASH ANALYSIS

BH No.	Depth in M		Thickness in M.	Ash analysis seam-3B									Un.De.Alkalies (by.d.)
	From	To		SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	TiO_2	P_2O_5	Mn_3O_4	
MPWJH-12	27.92	30.87	2.95	63.56	22.78	4.71	1.56	1.20	0.75	2.40	0.01	0.04	2.99

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TABLE 4.8B:LOW TEMPERATURE CARBONIZATION ASSAY

BH No.	Depth in M		Thickness in M.	Low temperature carbonization assay per tonne of dry coal							
	From	To		Coke (Kg)	Tar (Lit)	Liquar (Lit)	Gas (Cum)	Ammonia (Kg)	Coke Type	Gas Point	Oil Point
MPWJH-12	27.92	30.87	2.95	770.50	90.00	62.50	95.70	1.20	B	320	342

The presence of high silica and alumina indicates the refractory nature of coal ash and Tar yield is moderate.

9.2.3 SEAM LKIIT

Seam LKIIT is occurring below seam 3B and above seam LK-IIB.

DIRT BANDS

The dirt band present in the seam are inconsistent in nature. However, the cumulative thickness of dirt bands ranges from 0.01m to 0.08m.

PROXIMATE ANALYSIS

Sl No.	**Particular**		**Proximate analysis at 60% RH and 40°C**			**GCV in K.Cal/Kg**	**UHV in K.Cal/Kg**	**Grade in UHV**	**Grade in GCV**
			Moisture	**Ash%**	**VM%**				
1	Range	Min	5.90	11.40	25.10	4725	3794	E	G9
		Max	7.20	31.10	30.00	6540	6471	A	G3
2	No. of Samples		4	4	4	4	4		
3	Mean		6.60	18.40	28.30	5813	5450	C	G5
4	Std.Deviation		0.60	9.60	2.0	720	1040		

Ash analysis and low temperature carbonization assay in respect of seam LKIIT of borehole no. MPWJH-24 is given in Table 4.9A and Table 4.9B:

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Table 4.9A: ASH ANALYSIS

BH No.	Depth in M		Thickness in M.	Ash analysis seam-3B									Un.De.Alkalies (by.d.)
	From	To		SiO2	Al2O3	Fe2O3	CaO	MgO	SO3	TiO2	P2O5	Mn3O4	
MPWJH-24	21.13	22.05	0.92	65.32	21.82	2.57	2.01	0.56	0.38	3.60	0.06	0.04	3.64

TABLE 4.9B:LOW TEMPERATURE CARBONIZATION ASSAY

BH No.	Depth in M		Thickness in M.	Low temperature carbonization assay per tonne of dry coal							
	From	To		Coke (Kg)	Tar (Lit)	Liquar (Lit)	Gas (Cum)	Ammonia (Kg)	Coke Type	Gas Point	Oil Point
MPWJH-24	21.13	22.05	0.92	760.00	87.00	72.50	90.10	1.20	B	320	340

9.2.4 SEAM LKIIB

Seam LKIIB is occurring below seam LKIIT and bottom most correlated seam.

DIRT BANDS

The seam contain 2 or 4 combustible band and non-combusatible dirt bands. Thickness of combustible band of carb shale ranges from 0.04 to 0.18 and non-combustible bands of shale and sandy shale have thickness ranges from 0.01 to 0.50m.

PROXIMATE ANALYSIS

Sl No.	Particular		Proximate analyisis at 60% RH and 40°C			GCV in K.Cal/ Kg	UHV in K.Cal/ Kg	Grade in UHV	Grade in GCV
			Moisture	Ash%	VM%				
1	Range	Min	4.40	16.00	20.50	4780	3973	E	G8
		Max	8.10	30.20	28.10	6100	5781	B	G5

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2	No. of Samples	17	17	12	12	17		
3	Mean	6.10	22.20	24.70	5542	5000	C	G7
4	Std.Deviation	0.70	4.30	2.30	392	528		

Low temperature carbonization assay in respect of seam LKIIB of borehole no. MPWJH-24 is given in Table 4.10:

Table 4.10: LOW TEMPERATURE CARBONIZATION ASSAY

BH No.	Depth in M		Thickness in M.	Low temperature carbonization assay per tonne of dry coal							
	From	To		Coke (Kg)	Tar (Lit)	Liquar (Lit)	Gas (Cum)	Ammonia (Kg)	Coke Type	Gas Point	Oil Point
MPWJH-24	23.07	24.62	1.55	799.00	77.00	55.00	84.70	0.80	B	320	350

Low temperature carbonization assay coal indicate the Tar yield is poor.

9.3 PROJECTED COAL QUALITY

The average GCV of the seams considered for mining together comes to 5524Kcal/Kg. So, the average grade of coal 'G-6'.

The seamwise GCV and average GCV of mine area of Jhiria West OC are as given below.

SL NO	SEAM NAME	GCV (Kcal/kg)	AVERAGE GRADE
1	Seam 3T	5464	G7
2	Seam 3B	5778	G6
3	Seam LKII	5313	G7
4	Seam LKIIT	5635	G6
5	Seam LKIIB	5583	G6
	Average	**5524**	**G6**

The aveWeighted average **GCV** of coal within quarry area of Jhiria West OC is **5524 Kcal/Kg** has been considered for project costing.

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CHAPTER- X

WATER MANAGEMENT (PUMPING AND DRAINAGE)

10.1.0 INTRODUCTION

10.1.1 Location:-

The West Jhiria geological block is situated in Sohagpur Coalfields and its under administrative control of Hasdeo Area of SECL. The West Jhiria block can be approached by forest road covering distance of 1.5 KM. which connect Manendragarh – Pendra asphalted road near village Phulwari-tola, located about 18 KM. and 12 KM. from Manendragarh and bijuri township respectively.

10.1.2 Surface Topography and drainage:-

The area has an undulatory to moderately rugged topography with general slope towards South-East.the drainage of area is govern by Kulharia nala. Kulharia nala is perennial in nature and discharging into southerly –flowing Hasdeo river. The elevation of area ranges from 520 to 555 m above M.S.L.

10.2.0 SOURCE OF WATER

In general the sources of water inside the quarry are as given below:

- Direct rainfall in the excavated area.
- Inflow of water from back filled area due to rain fall on it.
- Inflow of water from area beyond excavation due to rainfall on it.
- Seepage of water from strata water/Ground Water.

10.2.1 Direct rainfall in excavated area:

The rain water falling directly in the excavated area will flow down and collected in the sump. It is assumed that 60% of water falling in this area will be collected in the sump

10.2.2 Inflow from back filled area:

A part of rainwater falling on the Internal dumping area will flow down into the mine. As the internal dump will be relatively loose so run off coefficient into the mine has been considered as 0.1

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10.2.3 Inflow from area beyond excavation:

A part of the rain water falling in the area beyond excavation will find its way into the mine. Garland drains will be provided around the mine to arrest the outside water so it is assumed that 10% of rain falling in this area will flow down into the mine and collected in the sump.

10.2.4 Seepage from strata:/Ground water

There will be some seepage from Strata/Ground water. This seepage during dry season say November-June is expected to be low. During monsoon and post monsoon period i.e. July-October the seepage will be more. This is assumed as 10% of make of water in the mine.

10.3.0 MAKE OF WATER

10.3.1 General considerations:

The general parameters considered for calculating the pumping requirements and make of water are as given below:

(i) Geographical location of the opencast workings.
(ii) Life of the mine.
(iii) Surface features of the area surrounding the opencast workings.
(iv) Total annual rainfall, maximum rainfall in a day (assumed).
(v) Catchments area - Exposed area, area beyond excavation, internal dump area etc.
(vi) Depth of quarry - Initial, final etc.
(vii) Run-off characteristics of the area.
(viii) Inflow/Seepage from underground water into the mine.
(ix) Sump location and capacity.
(x) Desired location on surface where the mine water can be discharged, surface drainage system.
(xi) Dewatering time for the water collected due to maximum rainfall in a day.
(xii) Standby capacity required.
(xiii) Hydraulic gradient of strata water
(xiv) Size of pipe, piping layout etc.
(xv) PH value of water...

10.3.2 Basic data

The basic data considered for calculating make of water and pumping capacity is as given below:

(i)	Yearly rainfall (average)	mm	1200
(ii)	Maximum rainfall in a day (From probability curve)	mm	190
(iii)	Monsoon season (July to Oct)	days	120
(iv)	Life of the quarry	years	13
(v)	Depth of operation		
	Minimum	m	10
	Maximum	m	57
(vi)	Quarry open excavation area		
	5th year	HA	133.62
	10th year	HA	130.73
	Final stage	HA	199.67
(vii)	Quarry back filled area		
	5th year	HA	25.90
	10th year	HA	145.03
	Final stage	HA	145.03
(viii)	Area beyond excavation (5% of excavated area)		
	5th year	HA	7.96
	10th year	HA	13.78
	Final stage	HA	17.23
(ix)	Run-off co-efficient for inflow of water into the mine		
	Open excavation		0.60

	Area beyond excavation	0.10
	Internal dump area	0.10

(x)	Seepage/Inflow of water into the Mine due to strata water	10% of water accumulated in the mine due to rainfall	
(xi)	Time required de-watering the water Collected outside the sump in the Mine due to maximum rainfall in a day	hours	18
(xii)	Time required de-watering the water Collected in the mine due to Maximum rainfall in a day	hours	100
(xiii)	Standby capacity		As required
(xiv)	Pumping losses		10 %

10.3.3 Assessment of maximum rainfall in a day

The assessment of maximum rainfall in a day during the life of the project has been made by drawing a probability curve (fig. 10.1) based on calculated/ theoretical values and observed values of the maximum rainfall in a day, life of the project etc.

i) Probability based on observed values:

The maximum rainfall in a day at Hasdeo area for the period 2000-2014 has been arranged in the descending order and the probability of the same has been calculated and tabulated below:

Observation No.(N)	Year	Highest Rainfall in one day(mm)	%P=(N-0.3)* 100/(M+0.4)
1	2012	215.00	4.55
2	2010	170.00	11.04
3	2003	165.00	17.53
4	2014	157.38	24.03

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5	2011	156.00	30.52
6	2006	150.00	37.01
7	2009	144.00	43.51
8	2004	130.00	50
9	2001	97.80	56.49
10	2013	96.00	62.99
11	2008	91.00	69.48
12	2002	84.00	75.97
13	2005	80.00	82.47
14	2007	67.00	88.96
15	2000	62.48	95.45

Where N = Observation Number

M = Total number of observations i.e 15

ii) Probability based on calculated / theoretical values:

The probability of calculated /theoretical rain fall based on the observed data is shown below:

Observation No.(N)	Highest Rainfall in one day (mm)hn	K=hn/ham	K-1	(K-1)^2
1	215.00	1.73	0.73	0.53
2	170.00	1.37	0.37	0.14
3	165.00	1.33	0.33	0.11
4	157.38	1.27	0.27	0.07
5	156.00	1.25	0.25	0.06
6	150.00	1.21	0.21	0.04
7	144.00	1.16	0.16	0.03
8	130.00	1.05	0.05	0.00
9	97.80	0.79	-0.21	0.04
10	96.00	0.77	-0.23	0.05
11	91.00	0.73	-0.27	0.07

12	84.00	0.68	-0.32	0.1
13	80.00	0.64	-0.36	0.13
14	67.00	0.54	-0.46	0.21
15	62.48	0.5	-0.5	0.25
Sigma hn=	1865.66		Sigma(K-1)^2=	1.83

Where as

N= Observation Number

M= Total number of observations i.e.15

ham= Mean value of recorded maximum rain fall

= Sigma hn/m = 1865.66/15= **124.38**

Cv = Co-efficient of variation =((Sigma(k-1)^2/(m-1))^0.5

= **0.3615**

Cs = Asymmetrical ratio = 3 Cv **1.0846**

h = Calculated rainfall

The values of f(Cs) the" Deviation of ordinates of Binomial curve of probability from "Rib kin chart" at the Cs value as calculated above have been selected for different probabilities. By using f(Cs) value the maximum rainfall and its probability has been calculated as given in the table below:-

Probability Percentage)	f(Cs)=Phai (from R.C).	Ms=Phai*Cv	Ks=Ms+1	h=Ks*ham
0.1	4.67	1.69	2.69	334.58
1	3.09	1.12	2.12	263.68
5	1.89	0.68	1.68	208.95
10	1.34	0.48	1.48	184.08
20	0.74	0.27	1.27	157.96
25	0.54	0.20	1.20	149.25
30	0.36	0.13	1.13	140.55
40	0.07	0.03	1.03	128.11

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50	-0.18	-0.07	0.93	115.67
60	-0.41	-0.15	0.85	105.72
70	-0.62	-0.22	0.78	97.01
80	-0.85	-0.31	0.69	85.82
90	-1.10	-0.40	0.60	74.63
95	-1.28	-0.46	0.54	67.16
99	-1.52	-0.55	0.45	55.97

A rainfall probability curve (Fig.10.1) has been drawn taking into consideration the calculated values and observed values. The maximum daily rainfall at probabilities of 10% and 7.6923 % which corresponds to 10 and 13 years (life of the project) has been found out from the above curve and are approximately 172mm and 190mm respectively.

10.3.4 Calculations:

S.no	Description	5thyear	10th year	Final stage
1	Inflow due to direct rainfall in exposed area (cum)	152327	149032	227624
2	Inflow due to direct rainfall on internal dump area (cum)	4921	27556	27556
3	Inflow due to direct rainfall on area beyond excavation (cum.)	1515	2620	3275
4	Seepage from ground water (cum.)	15876	17921	25845
5	Total water collected in a day (cum.)	174640	197128	284300
6	Sump capacity provided	158095	178453	257366
7	Water lying outside the sump(cum)	16545	18675	26934
8	Pumping cap (lps) to dewater the water lying outside sump in 18hrs. including 10 % pump	281	317	457

	losses			
9	Pumping cap (lps) to dewater entire water including 10 % pump losses in 100 hrs.	534	602	869
10	No of 225 lps cap. pumps required to dewater lying outside the sump in 18 hrs	1	1	2
11	No of 225 lps cap. pumps required to dewater entire water in 100 hrs	2	3	4

10.4.0 **SUMP**

In the quarry, sump will be provided at the deep most point of the mine. The sumps will be shifted as the mine advances. The layout of quarry provides suitable gradient along the floor of the benches to facilitate self-drainage of water into the sump.

During heavy monsoon period, the work in the lower most benches may be drowned as it will not be possible to pump out the entire make of water in the wettest day. Therefore, it is proposed to drown a part of the lower most bench which will work as a sump to accommodate the required quantity of water which will be equivalent to the water accumulated due to a rainfall of 172 mm in a day (at 10 % probability).

Water from the main sump/ intermediate sump as per requirement will be pumped to surface which will pass through sedimentation ponds before finally discharged into natural drainage system. Sumps will be cleaned periodically to avoid silting and muck accumulation.

10.5.0 **PUMPS**

Three numbers of main pumps each of 225lps, 70m head have been provided to meet the requirements. Some of the stages of the main pumps may be blanked when they have to operate at shallow depths. This has been provided to reduce the capital investment and utilize the pumps till the end of life. Provisions have

been made considering the peak demand which is occasional, so no standby pumps have been provided. Further the pumps may be repaired and kept ready for use in rainy season. Main pumps will be installed on pontoons. Provision of pontoons for each main pump has been given in the estimate.

One diesel engine operated pump of 80lps capacity, 60m head has been provided for operation in the initial period and then as standby for use in case of emergency. Similarly electrically operated pump of same capacity has also been provided.

All the main pumps will be provided with pressure gauges on delivery side and suction side for measuring the head developed so that corrective action will be taken for operating the pump at the duty point.
The main pumps have been provided considering life of the mine. The requirement of pumps has been shown for entire life of the mine; however procurement shall be made as per requirement.

During heavy rainfall, overburden may be washed away from edges of slopes and internal dumps, pumps capable of slurry handling will be required. Pumping of clear water and slurry will be from upper and lower part of sump respectively.

10.6 PIPING

ERW pipes of 355.6mm outer diameter will be used for carrying the discharge from 225lps capacity pumps. Similarly, ERW pipes of 219mm outside diameter will be provided for carrying the discharge from 80lps capacity main pump / diesel engine operated pumps. Initially the delivery pipes from each pumping stations are proposed to be taken out through haul road and then through access trench and through side batters of quarry at a later date. Provision for crossways are made on the floor of the side batters for crossing the haul road so that dumper transportation is not affected. These pipes are evenly brought to the surface from where water will be discharged to the sedimentation ponds and then water will be discharged to natural drainage system. Provision will be provided at pump house for connecting the delivery of the pumps to at least two numbers of delivery

ranges. Flow meters will be provided in each 355.6mm diameter pipe for measuring the discharges.

10.7 CAPITAL INVESTMENT

The details of the proposed pumps, pipes and pipe fittings along with estimated cost and brief specifications are shown in Appendix A.3.4.

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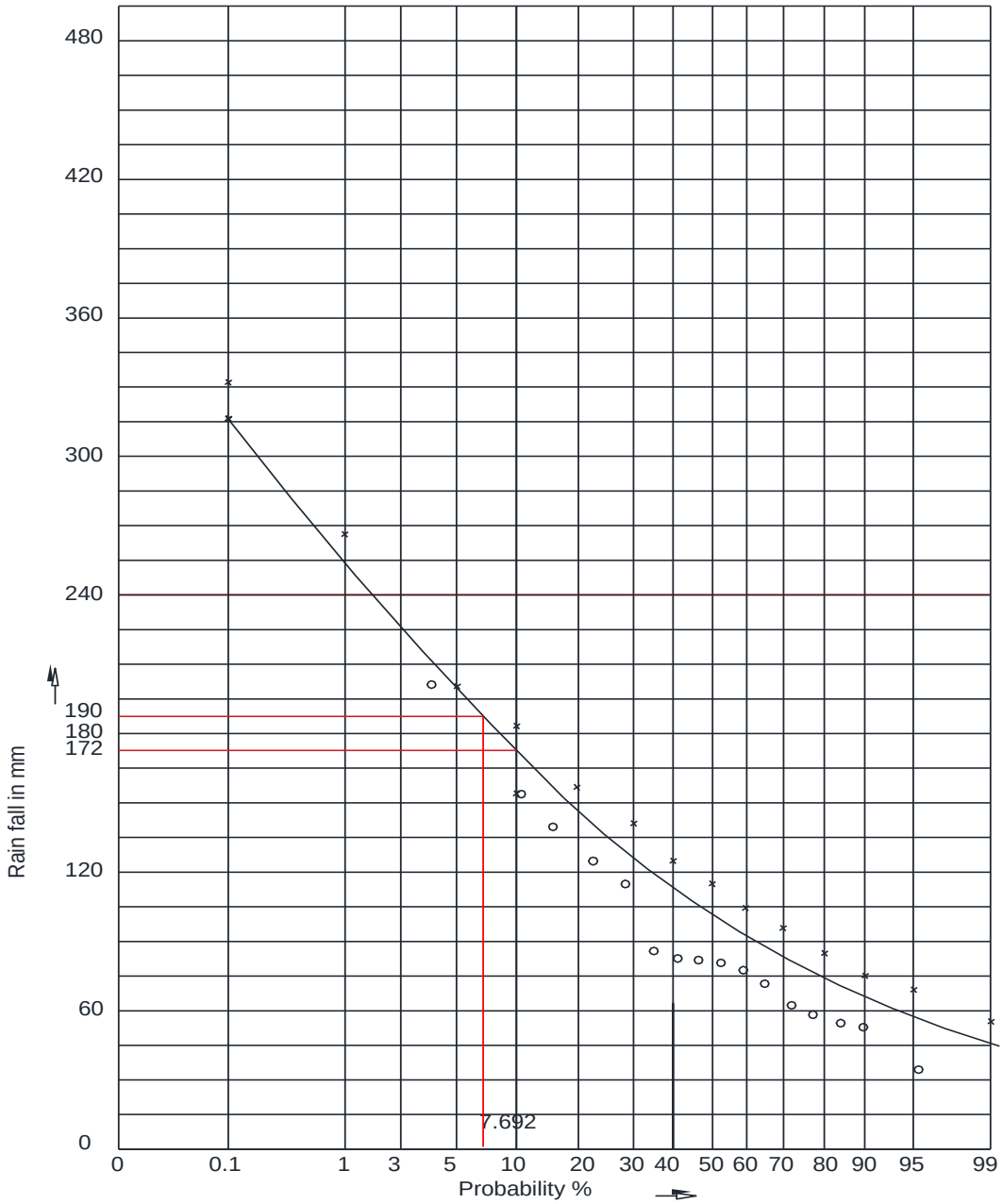
RAINFALL - PROBABILITY GRAPH

(Fig. 10.1)



Theoretical values of probability and rainfall shown as:- ×

Observed values of probability and rainfall shown as :- ○

Rain fall data taken from SECL office

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CHAPTER – XI

COAL HANDLING PLANT AND DESPATCH ARRANGEMENT

11.1 INTRODUCTION:

The West Jhiria is situated in Sohagpur Coalfields and its under administrative control of Hasdeo Area of SECL. In this mine it is proposed to deploy Surface Miner to produce coal. Due to this, it is expected that the size of coal lumps to be produced will of the order of (-) 100mm and so no crushing arrangement is required.

11.2 SCOPE

The scope of coal handling plant is as given below:

(i) Receipt of ROM coal from opencast mine by tipping trucks at the coal stock.

(ii) Weighment of trucks on weigh bridges.

(iii) Hard stand for coal stock.

11.3 SYSTEM DESCRIPTION

The cutting drum of Surface Miner will cut the coal and leave on surface itself or load in the trucks / dumpers in case the coal is left on the ground Pay Loaders will load ROM coal in the trucks / Dumpers. These trucks will carry coal to surface pit top. Coal from pit top will be transported to Rajnagar siding about 6.0 KM by road and then by rail through existing Rajnagar Railway siding.

One number of pit less electronic, 100 t capacity weigh bridge suitable to weigh tipping trucks will be installed at a suitable location near the mine for weighment of coal loaded trucks. The Weigh Bridge will have printout facility which facilitates for keeping the records of dispatch.

11.4 MANPOWER REQUIREMENT

The details manpower required for operation and maintenance of weigh bridges are shown in Appendix B.

11.5 CAPITAL INVESTMENT

Total estimated capital expenditure for the CHP has been given in Appendix A.3.5.

11.6 DESPATCH ARRANGEMENT / RAILWAY SIDING

11.6.1 INTRODUCTION

The coal from the mine will be extracted by surface miner. The coal from pit top will be sent to railway siding with the help of trucks by contractual means.

11.6.2 RAILWAY SIDING AND DESPATCH

The cutting drum of Surface Miner will cut the coal and leave on surface itself or load in the hired trucks / contractors trucks in case the coal is left on the ground Pay Loaders will load ROM coal in the trucks / dumpers. These trucks/dumpers will carry coal to surface pit top. Coal from pit top will be transported to Rajnagar siding about 6.0 KM by road and then by rail through existing Rajnagar Railway siding.

A railway siding consisting of one load standage line (suitable for 59 box N wagons), one empty standage line (suitable for 59 box N wagons), engine escape line, one loading station crossovers, turnouts, electrification, signaling etc. Will be constructed at a suitable location near the proposed siding.

A wharf wall suitable for loading of one rack (59 box N) will be constructed at the siding. The coal received from the mine will be spread along the railway siding which will be subsequently loaded into rail wagons with the help of pay loaders.

One number of road weigh bridge, 100te, electronic type, will be provided for weighment of coal at the near siding for proper record and avoiding pilferage etc.

An electronic, in motion weigh-bridge of 100t capacity will be provided at wharf wall railway siding for weighing the wagons while they are being drawn out

after loading. The print out facility will also be available which will help in keeping the records.

Proper illumination arrangement will be provided near the siding for easy operation at site.

11.7 MANPOWER REQUIREMENT

The details manpower required for operation and maintenance of weigh bridges are shown in Appendix B.

11.8 CAPITAL REQUIREMENT

The capital requirement with phasing for weigh bridges etc, are shown in Appendix – A.5.

CHAPTER-XII

UNIT WORKSHOP AND STORES

12.0 INTRODUCTION

In this project report it is envisaged to will be extracted by surface miner and OB by shovel dumper combination. Two option are being worked out .the two option are as follows.

(i) Option-I Both winning of coal and extraction of OBR will be done through outsourcing.

(ii) Option-II winning of coal loading and removal of OB will be carried out by departmentally

(iii) Option-III winning of coal departmental and removal of OB will be carried out by outsourcing.

Accordingly three options have been proposed for unit workshop .One for outsourcing and for departmental and another partially departmental.

12.1 WORKSHOP FOR OUTSOURCING (Fig. 12.1)

12.1.1 FACILITIES:

The unit workshop will consist of the following shops for undertaking the jobs as envisaged above.

i) Machine shop

ii) Electrical repair shop

iii) Equipment repair/structural repair shop

12.1.2 FUNCTIONS:

The shop wise functions are as follows:-

i) Machine shop:-The shop will have necessary machine tools for repair/restoration of parts, manufacture of spares to a limited extent which are in short supply.

ii) Electrical repair shop:- The repair facilities are limited to the replacement of parts, facilities have also been provided to undertake winding of motors to a limited extent.

iii) Equipment repair/structural repair shop:- This shop will undertake minor repairs and maintenance of the equipment's like pumps, couplings etc. The equipment/components will be dismantled into individual sub-assemblies for through checking. The parts/ sub-assemblies which are completely worn-out or damaged beyond repair will be replaced by new parts/sub-assemblies. The worn-out /damaged parts which are repairable will be re-conditioned for further use.

iv) Power supply: A switching station will be established for installing 415 V switch board to receive power from the projects main substation. Sub distribution boards will be provided in the respective shops for feeding power to different equipment. The shops will be properly illuminated.

12.1.3 STORES:

A small unit stores will be provided in the work shop premises or at adjacent area for storage of equipment, consumables, spares etc. In this stores required racks, bins, steel cabinets, pallet trucks, wheel barrows, hangers etc will be provided. Electric hoist block and chain pulley blocks will be provided for lifting of heavy masses.

12.1.4 MANPOWER:

Details of manpower required for manning work shop and stores are given Appendix-B.

12.1.5 CAPITAL REQUIREMENT:

The details of Plant and machinery provided, estimated cost along with pashing are given in Appendix-A.3.3 (Outsourcing).

12.2 WORKSHOP FOR DEPARTMENTAL

12.2.1 WORKSHOP FOR DEPARTMENTAL (Fig.12.2)

12.2.2 INTRODUCTION

In Option-II both winning of Coal and OBR will be carried out by departmentally .Mine dewatering & power supply will be by departmental. Due to this reason a workshop has been provided to cater the needs of daily maintenance, schedule maintenance, lubrication, routine inspection, minor repair and replacement of parts/ sub-assemblies of equipment such as pumps, electrical equipment, Dumpers, Dozer, Pay Loader and Surface miner etc. deployed in the project.

Any major repair/ overhaul of equipment and manufacturing of spares on large scale are beyond the scope of this workshop. These works will be carried out at Regional workshop of the Hasdev area.

The workshop in general works in two shifts however a section of the workshop will work round the clock. In addition a unit store for storage of spare parts, consumables, POL, scrap etc. has also been provided.

12.2.3 SCOPE OF WORKSHOP

This workshop will undertake the following jobs

i) Repair/restoration of parts, manufacture of spares to a limited extent which are in short supply.

ii) Minor and medium repair of switch gears, motors, self-starters and other electrical equipment, motor rewinding, battery charging facilities etc.

iii) Minor repairs and maintenance of the equipment like pumps, couplings, pulleys etc.

iv) Washing of assemblies and sub-assemblies of equipment.

v) Structural fabrication to a limited extend

vi) Power supply, illumination

12.2.4 FACILITIES

The workshop will consist of the following shops for undertaking the jobs as envisaged above.

i) Machine shop

ii) Electrical repair shop

iii) Engine repair shop

iv) Radiator repair shop

v) Dumper /Heavy repair and maintenance shop

vi) Hydraulic repair shop

vii) Washing platform, water reservoir etc.

12.2.5 Shop functions:

The various shops will be fully equipped to undertake the jobs as mentioned below

i) Machine shop: In this shop manufacturing of spares which are in short supply will be undertaken in a limited way. In this shop, machining and reconditioning of spares will also be undertaken; lathes, drilling m/c, grinder, hacksaw, tools & tackles etc. have been provided.

ii) Electrical Repair shop: In this shop winding of the burnt out motors will be undertaken to a limited extent. Minor repairing of all the electrical equipment such as motors, circuit breakers, transformers, starters, dynamos etc. will also be undertaken. Testing of relays etc. will also be done here. Transformer oil filtration machine has been proposed for filtration of the transformer oil as and when necessary.

iii) Equipment Repair shops: The equipment (excluding electrical items) received in these shops will be dismantled, washed and then thoroughly checked. The worn-out spares, defective sub-assemblies/assemblies will be replaced by new ones. Further minor repairs of the equipment will also be undertaken in this shop. In this shop the fabrication work of new structures, repair of old structures, building up of materials on worn out parts will be undertaken.

iv) Dumper/Heavy Repair shop- All HEMM like Dumper, Dozer, Pay loader, Surface miner etc. are repaired in this shop.

v) A ground water reservoir along with a pump house will be provided near washing platform to supply water at high pressure.

vi) Lifting tackles:- Electrical hoist block (5 t cap.) chain pulley blocks (3 t cap.) will be provided in the workshop shed for lifting and movement of the equipment etc. during repair in the work shed.

vii) Miscellaneous:- Required provisions have been made for fire fighting and ventilation of the sheds.

12.2.6 STORES:

A small unit stores will be provided in the work shop premises or adjacent to work shop for storage of assemblies, tyres, cables, pipes, other equipment, consumables, spares, POL etc. In this store, required stands, racks, bins, cabinets, almirahs, tables, trolleys, pallet trucks etc. will be provided. Hoists and material handling equipment will be provided for lifting of heavy masses.

12.2.7 MANPOWER

Details of manpower required for manning workshop and stores are given Appendix-B.

CAPITAL REQUIREMENT:

The details of Plant and machinery provided, estimated cost along with phasing are given in Appendix A.3.3 (Departmental).

12.3 WORKSHOP FOR PARTIAL OUTSOURCING

12.2.1 WORKSHOP FOR PARTIAL OUTSOURCING (Fig.12.3)

12.2.2 INTRODUCTION

Mine dewatering & power supply will be by departmental. Due to this reason a workshop has been provided to cater the needs of daily maintenance, schedule maintenance, lubrication, routine inspection, minor repair and replacement of parts/ sub-assemblies of equipment such as pumps, electrical equipment, Dumpers, Dozer, Pay Loader and Surface miner etc. deployed in the project.

Any major repair/ overhaul of equipment and manufacturing of spares on large scale are beyond the scope of this workshop. These works will be carried out at Regional workshop of the Hasdev area.

The workshop in general works in two shifts however a section of the workshop will work round the clock. In addition a unit store for storage of spare parts, consumables, POL, scrap etc. has also been provided.

12.2.3 SCOPE OF WORKSHOP

This workshop will undertake the following jobs

i) Minor and medium repair of switch gears, motors, self-starters and other electrical equipment, motor rewinding, battery charging facilities etc.

ii) Minor repairs and maintenance of the equipment like pumps, couplings, pulleys etc.

iii) Washing of assemblies and sub-assemblies of equipment.

iv) Structural fabrication to a limited extend

v) Power supply, illumination

12.2.4 FACILITIES

The workshop will consist of the following shops for undertaking the jobs as envisaged above.

i) Machine shop

ii) Electrical repair shop

iii) Dumper /Heavy repair and maintenance shop

iv) Dozer repair shop

12.2.5 Shop functions:

The various shops will be fully equipped to undertake the jobs as mentioned below

i) Machine shop: In this shop manufacturing of spares which are in short supply will be undertaken in a limited way. In this shop, machining and reconditioning of spares will also be undertaken; lathes, drilling m/c, grinder, hacksaw, tools & tackles etc. have been provided.

ii) Electrical Repair shop: In this shop winding of the burnt out motors will be undertaken to a limited extent. Minor repairing of all the electrical equipment such as motors, circuit breakers, transformers, starters, dynamos etc. will also be undertaken. Testing of relays etc. will also be done here. Transformer oil filtration machine has been proposed for filtration of the transformer oil as and when necessary.

iii) Equipment Repair shops: The equipment (excluding electrical items) received in these shops will be dismantled, washed and then thoroughly checked. The worn-out spares, defective sub-assemblies/assemblies will be replaced by new ones. Further minor repairs of the equipment will also be undertaken in this shop.

iv) Dumper/Heavy Repair shop- All HEMM like Dumper, Dozer, Pay loader, Surface miner etc. are repaired in this shop.

v) Lifting tackles:- Electrical hoist block (5 t cap.) chain pulley blocks (3 t cap.) will be provided in the workshop shed for lifting and movement of the equipment etc. during repair in the work shed.

v) Miscellaneous:- Required provisions have been made for fire fighting and ventilation of the sheds.

12.2.6 STORES:

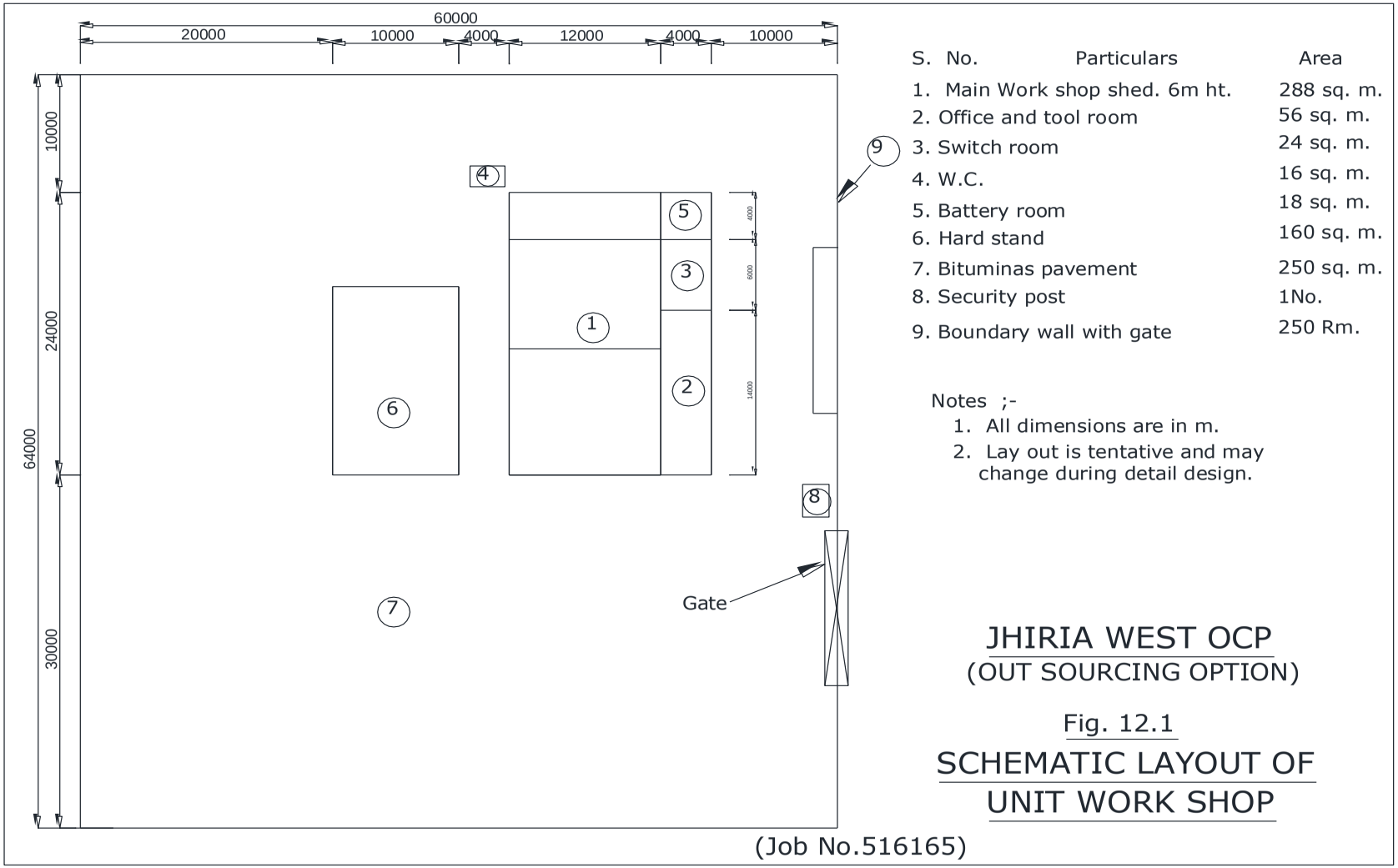
A small unit stores will be provided in the work shop premises or adjacent to work shop for storage of assemblies, tyres, cables, pipes, other equipment, consumables, spares, POL etc. In this store, required stands, racks, bins, cabinets, almirahs, tables, trolleys, pallet trucks etc. will be provided. Hoists and material handling equipment will be provided for lifting of heavy masses.

12.2.7 MANPOWER

Details of manpower required for manning workshop and stores are given Appendix-B.

CAPITAL REQUIREMENT:

The details of Plant and machinery provided, estimated cost along with phasing are given in Appendix A.3.3 (Partial Outsourcing).



S. No.	Particulars	Area
1.	Main Work shop shed. 6m ht.	288 sq. m.
2.	Office and tool room	56 sq. m.
3.	Switch room	24 sq. m.
4.	W.C.	16 sq. m.
5.	Battery room	18 sq. m.
6.	Hard stand	160 sq. m.
7.	Bituminas pavement	250 sq. m.
8.	Security post	1No.
9.	Boundary wall with gate	250 Rm.

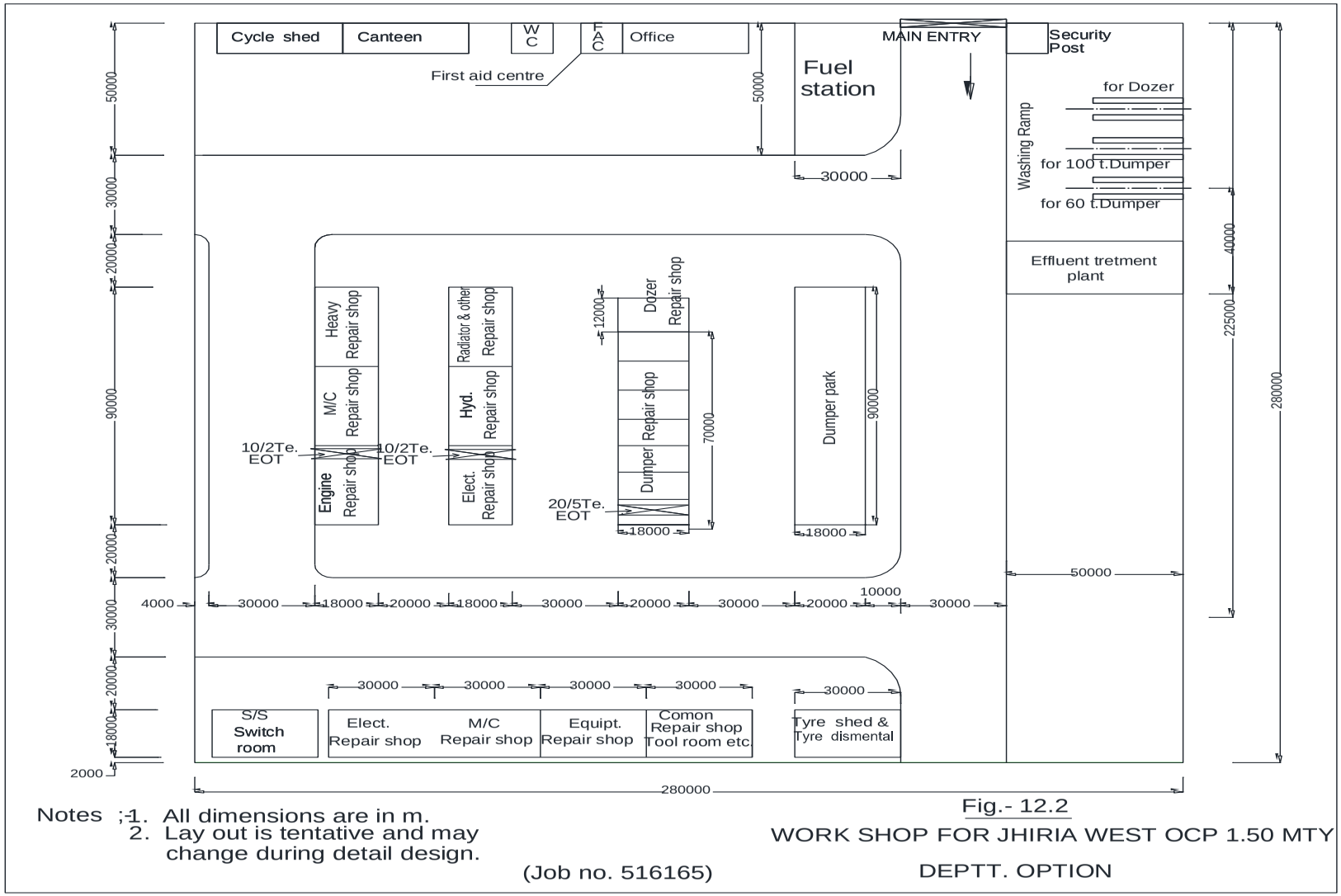
Notes ;-

1. All dimensions are in m.
2. Lay out is tentative and may change during detail design.

JHIRIA WEST OCP
(OUT SOURCING OPTION)

Fig. 12.1
SCHEMATIC LAYOUT OF
UNIT WORK SHOP

(Job No.516165)



Notes ;-1. All dimensions are in m.
2. Lay out is tentative and may change during detail design.

(Job no. 516165)

Fig.- 12.2

WORK SHOP FOR JHIRIA WEST OCP 1.50 MTY

DEPTT. OPTION

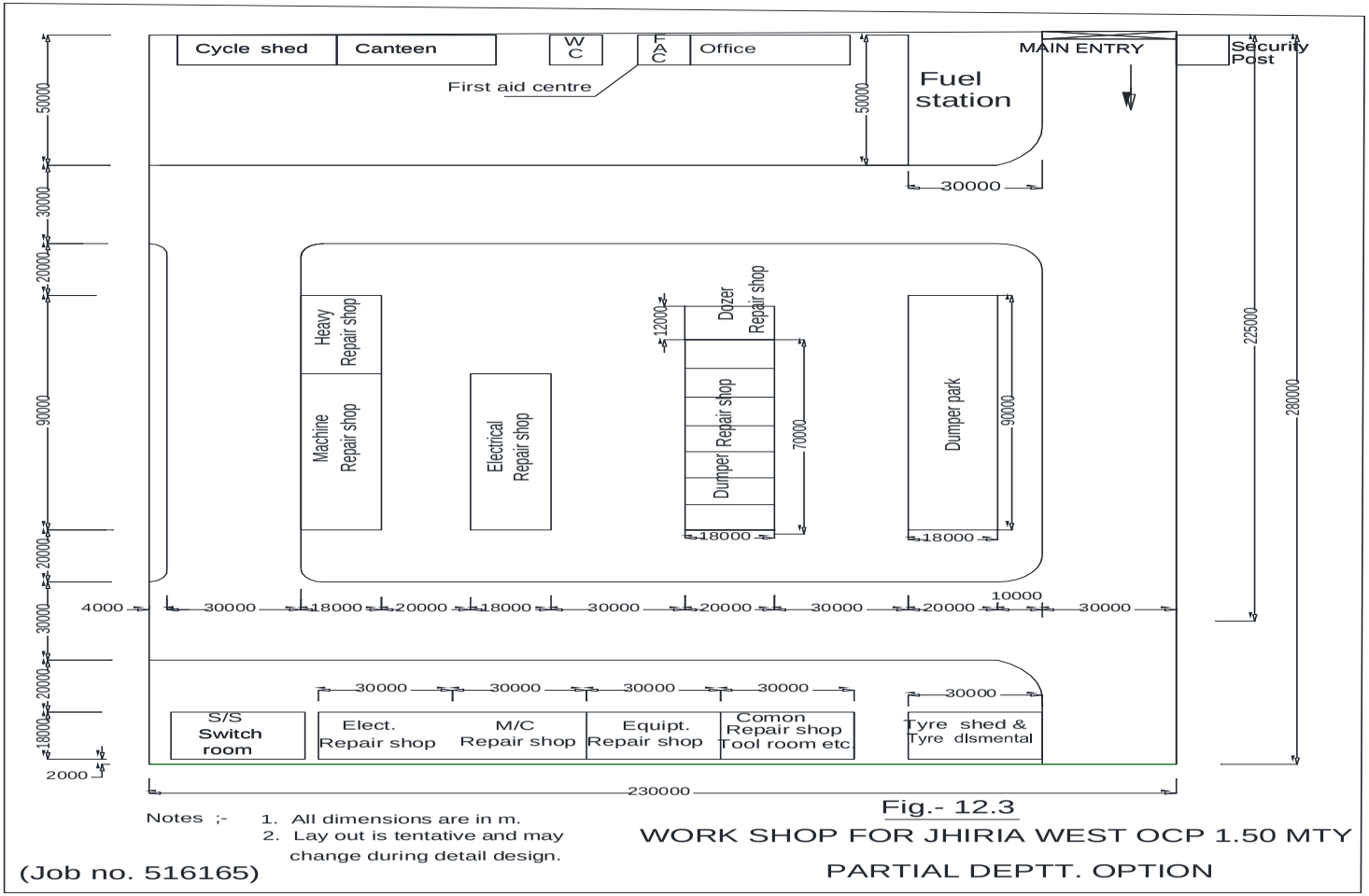


Fig.- 12.3

WORK SHOP FOR JHIRIA WEST OCP 1.50 MTY

PARTIAL DEPTT. OPTION

CHAPTER - XIII
POWER SUPPLY, ILLUMINATION AND COMMUNICATION

13.1 POWER SUPPLY

13.1.1 Source of Power

West Jhiriya Opencast Project is located in the close proximity of existing Rajnagar RO UG mine of SECL in Hasdeo Area. The source of power supply for this Project shall be from Rajnagar Substation of CSPDCL located at around 6.5 km from the Project site. This project shall receive power at 33kV by means of DCDS overhead line (AAAC, WOLF equivalent) on steel towers drawn from Rajnagar RO Substation .

Three options- Departmental, Outsourcing & Partial Hiring have been worked out.The power demand for Departmental option (quarry, CHP and Common loads) shall be around 3296 kVA for which 2x5000 kVA, 33/3.4 kV substation shall be adequate.

For outsourcing option , the maximum power demand comes to around 866 kVA (Common loads & CHP) for which 2x1000 kVA, 33/3.4 kV substation shall be adequate .

For Partial outsourcing option , the maximum power demand comes to around 882 kVA (Common loads & CHP) for which 2x1000 kVA, 33/3.4 kV substation shall be adequate

13.1.2 Proposed Stage

13.1.2.1 Other 33 kV Substations

In the Departmental Option, it is proposed to install one nos. 33kV substations – 2x5000 kVA, 33/3.4 kV) . The quarry substation shall feed power at 3.4 kV to 10

cu.m. Electrical Rope shovel , 250 mm RBH drills, 3.3 kV pumps, CHP , workshop and lighting loads. The details of loads are given in the power balance.

In case of Outsourcing option, as mentioned above, 2x1000 kVA,33/3.4 kV substation shall be sufficient to feed power to common loads , CHP , pumping loads of the Project . The power balance of the above electrical loads are given in Table-13.1 (for Deptt. Option) .For outsourcing option, the power balance is given at Table 13.2. The schematic single line diagram of substations are shown in Fig 13.1.

The major functional components for 33 kV sub-stations are as follows.

(i) Outdoor Installations for 33 kV Substations

a) 33 kV Isolators

b) 33 kV Bus Section

c) 33 kV Vacuum Circuit Breakers

d) (I) 5000 kVA ,33 kV/3.4 kV transformers -2 nos. For quarry loads (for Deptt. Option)

(ii) 1000 kVA, 33/3.4 kV transformer- 2 nos.(for outsourcing and partial outsourcing option)

e) 33 kV Current transformer and potential transformer

f) 33 kV Lightning arrestors

g) 160 kVA , 3.3 /0.433 kV station transformer

h) 63 kVA ,33/0.230 kV (L-L) lighting transformer

(ii) Indoor Installations for all 33/3.3 kV substations

a) 33 kV Remote Control Panel for 33 kV circuit breakers.

b) 3.3 kV Switch Board

c) 415 V Switch board

d) 230 V (L-L) lighting Switch Board

e) 3.3 kV Capacitor Banks

3.3 kV Indoor Type Switch Board

For Deptt. Option

In the substation , one number 18 panel 3.3 kV indoor type switch board will be installed for secondary control of the main transformers (5000 kVA, 33/3.3 kV), control of power supply to the quarry, workshop, CHP and pumping load centres of the project. The capacitor bank controlling panel will incorporate automatic power factor controlling equipment.

The 3.3 kV indoor type switch board will comprise 18 numbers of vacuum circuit breakers for following functions:

Incoming feeder control	2 nos.
Sectionaliser	1 no.
Capacitor Bank control	2 nos.
Quarry Lighting feeder control	1 nos.
CHP Feeder	2 nos.
Quarry Loads	2 no.
Workshop feeder control	1 no.
Pump feeder control for pumps	2 Nos.
Surface Ltg.feeder	1 nos.
Reserve	4 nos.
Total	**18 nos.**

For Outsourcing and Partial Outsourcing Option

In the Substation, one number 14 panel 3.3 kV indoor type switch board will be installed for secondary control of the main transformers (1000 kVA, 33/3.3 kV), control of power supply to the workshop , CHP and pumping load centers of the project. The capacitor bank controlling panel will incorporate automatic power factor controlling equipment.
The 3.3 kV indoor type switch board will comprise 14 numbers of vacuum circuit breakers for following functions:

Incoming feeder control	2 nos.
Sectionaliser	1 no.
Capacitor Bank control	2 nos.
CHP Feeder	2 nos.

Quarry Lighting feeder control	1 nos.
Workshop feeder control	1 no.
Surface Lighting feeder control	1 nos
Pump feeder control	2 nos.
Reserve	2 nos.
Total	**14 nos.**

(iv) 160 kVA, 33/0.440 kV Transformer and 415V Switch Board(Both Options)

It is proposed to install one number 160 kVA, 33/0.440 kV station transformer for 33 kV substations at the outdoor yard. A four panel 415 V indoor type switch board will be installed in the substation buildings which will receive power from the secondary side of the transformer and required nos. of MCB's/MCCB's.

(v) 63 kVA, 33 kV/ 0.240 kV (L-L) lighting transformer and Lighting Main Distribution Board (Both Options)

It is proposed to install one no. 63 kVA, 33 kV/ 0.240 kV (L-L) lighting transformer for substations for meeting the lighting loads on the surface. It will feed power to the distribution boards consisting of required nos. of 2 pole MCB's.

(vi) Connected Load and Maximum Demand

Electrically operated equipments like HEMM, pumps,CHP , workshop, surface and quarry lighting have been proposed in the project for which power will be required. Considering the mine area , one no. substation has been proposed to be located at strategic location to uniformly cater to the loads to minimize the voltage drop & line loss of the feeders for Deptt. option.

In case of Deptt. Option , the maximum demand of the quarry substation has been assessed as 3296 kVA (at 3.3 kV) with a corrected power factor of 0.98

(lagging) for quarry, workshop, CHP , quarry and surface lighting, and pumping loads.

In case of outsourcing option, the maximum demand for overall loads (workshop, CHP , surface lighting, and pumping loads) of the Project is estimated at around 866 kVA at 0.98 power factor (lagging).

For Partial outsourcing option , the maximum power demand comes to around 882 kVA (Common loads & CHP) for which 2x1000 kVA, 33/3.4 kV substation shall be adequate

(vii) Protection of Substation, Control and Signaling, Interlocking and earthing

Vacuum Circuit Breakers conforming to IS: 2516 (current) will be used for incoming feeder control and primary control of the 5000 kVA and 1000 kVA transformers. The secondary of 5000 kVA/ 1000 kVA transformers will be grounded through 76 ohm rated resistor for restricted earth neutral system and will be provided with relays for protection from earth fault.

The Circuit Breakers in conjunction with current transformer offer protection of the transformers against over current, short circuit and earth fault.

The live parts of the circuit breakers will be properly shrouded as per relevant safety rules. Remote control of 33 kV circuit breakers will be performed by the control panel located in the control room of the substation.

The following system of signaling will be used in the substation:-

- Signaling to inform personnel about automatic tripping of circuit breaker due to fault.
- Warning signal about occurrence of abnormality in any particular device.

- Signal to show actuation of automatic and protective relays.(flags and pointer on relays)

  Similar control, protection and signaling devices will be incorporated in the 3.3 kV indoor panels also. Additionally insulation monitoring device will be provided in the 3.3 kV bus.

(viii) Protection against Lightning

Station class Lightning arrestors conforming to IS: 3070 and IS: 4004 will be provided on 33 kV side in the substation yard for protection against lightning and will be connected to separate earth pits.

For the protection of the substation building from lightning, spikes will be provided on the roof of the building and will be connected by means of G.I. flats.

(ix) Interlocking System

The air break isolators associated with 33kV circuit breaker will be interlocked with the circuit breakers to avoid mal-operation.

The 3.3 kV sectionaliser circuit breakers in the 3.3 kV switchboard panel will have electrical inter-lock with the incoming 3.3kV circuit breakers to avoid parallel operation of transformers. Primary and Secondary control circuit breakers will be connected for inter - tripping, i.e the secondary control circuit breaker will trip automatically when the primary circuit breaker trips.

(x) Earthing

In order to maintain the earth resistance of the substation below 1 ohm, sufficient number of earth pits will be provided in the substation premises. All these earth pits will be interconnected. Substation earthing will conform

to IS: 3043 (current). The neutral of the 5000 kVA (1000 kVA) transformers will be earthed through resistance (76 ohm for 3.3 kV side). Separate earth pits shall be provided for lightning arresters (33 kV) and lightning protection system in the substation. The earthing electrodes will be preferably of safe electrodes.

(xi) Safety and Fire Fighting

For safety of the electrical system "The Central Electricity Authority Regulation-2010" and other Safety regulations/IS will be complied with. The boundary of the substation outdoor yards will be suitably fenced by wire-net fencing which will be suitably earthed by independent earth pit. Soak pits will be provided for collection of the oil leaked from the transformer to avoid any damage due to fire. Rubbles will be spread in the yard and the ground in the out door yard will be treated for anti grass. Baffle wall shall be provided in between power transformers. High Velocity Water Spray System shall be provided for 5000 kVA , 33/3.4 kV Transformer in Departmental Option.

Fire hydrant system shall be provided in the outdoor yard for fire fighting. In the control room heat and smoke sensers along with audio-visual fire alarm system shall be provided. A separate disel pump of suitable rating shall be deployed exclusively for fire fighting system. Additionally following fire fighting facilities will be provided -

- sand buckets
- Dry Powder type and Portable foam type chemical fire extinguishers
- CO_2 fire extinguishers

The following items will also be provided:-

- Electrician rubber gloves for HT working
- Standard discharging rod
- Danger Notice plate

- First - Aid box complete with necessary contents
- Electric shock treatment chart
- Trolley mounted ladder (FRLS type)
- Safety belt etc.
- Anti climbing device on the termination poles of 33 kV incoming line.

(xii) Maintenance and Testing Tools and Tackles

The following tools and tackles will be used:

- Insulation tester (500 V, 5 kV) and intrinsically safe megger.
- Earth resistance tester
- Clip Volt Ampere meter (Tong Tester)
- AVO meter
- Transformer oil tester
- Cable jointer kit
- Portable Ammeter, voltmeter, etc
- High voltage cable testing apparatus
- Hand operated crimping tool

13.1.2.2 Energy Consumption

The energy consumption has been calculated considering active power, annual number of working hours of equipment/ installation wise. For Deptt. Option, the details of the year wise energy consumption including colony loads are given in Table 13.3.The specific energy consumption will be approximately 13.23 kWh / tonne (at the targeted production of 1.5 Mt/yr) .

For Outsourcing Option, the details of the year wise energy consumption including colony loads are given in Table 13.4.The specific energy

consumption will be approximately 5.02 kWh / tonne (at the targeted production of 1.5 Mt/yr) .

For Partial Outsourcing Option, the details of the year wise energy consumption including colony loads are given in Table 13.6.The specific energy consumption will be approximately 5.72 kWh / tonne (at the targeted production of 1.5 Mt/yr)

13.1.2.3 System Voltage

The supply voltage and operating voltage used in the project are as follows:

Sl. No.	Equipment	Voltage
1	Incoming supply voltage	33 kV
3	Supply voltage to HEMM	3.3 kV
4	Supply voltage to Pumps	3.3 kV
6	Supply voltage to workshop	3.3 V
7	Supply voltage to intermediate Pumps	433V
8	Quarry lighting	230 V (L-L)

Restricted Earthed Neutral System has been envisaged for 3.3 kV side and quarry distribution.

13.1.2.4 Power Factor Improvement

In order to maintain a high system power factor of around 0.98 even during maximum demand hours, two sets of 3.3 kV capacitor banks (APFC) each of 950 kVAr capacity (in the secondary side of 5000 kVA , 33/3.3 kV transformers) have been provided in the 3.3 kV switch board of Substation . In case of outsourcing option , two sets of 3.3 kV capacitor banks each of 200 kVAr capacity (in the secondary side of 1000 kVA , 33/3.3 kV transformers) have been provided in the 3.3 kV switch board of Main Substation.

The capacitor banks will have the facility to connect and disconnect required number of units depending upon the loading pattern of sub-station. The capacitor bank will be provided with automatic control facility to be incorporated in the respective control panel.

13.1.2.5 Quarry Power Supply Distribution

For Deptt. option,7 nos. 3.3 kV overhead feeders (1 nos. for 10 cu m shovel, 1 nos. for 250 mm RBH Drills, 2 nos for pumps , 2 nos. for CHP and 1 for quarry lighting) with ACSR 'WOLF' conductors will be drawn to quarry from substation (i.e. 2x5000 MVA, 33/3.3 kV) . For out sourcing option, 6 nos. of quarry feeders (3 no. for pumps , 1 nos. for Workshop and 1 no. for quarry lighting AND 1 NO FOR SURFACE LIGHTING) are to be drawn from 2x1000 kVA, 33/3.3 kV substation. At required locations, power will be tapped by providing pole mounted air break switches to feed power to corresponding equipment.

For supplying power to main pumps operating at 3.3 kV , 3.3 kV switch boards have been provided to be installed at required pumping stations in the quarry. For power supply to intermediate pumps, 2 nos. of unitised substations of 3.3kV/433V, 400 kVA each have been provided.

13.2 QUARRY ILLUMINATION

General illumination will be done by 85W/100W CFL lamps/suitable ratings LED mounted on suitable supports fixed along quarry periphery. The permanent type of illumination in haul road, and inside the quarry will also be done by 250 W HPSV lamps for proper illumination & visibility. These lights are to be supplied from 240 V (L-L) systems. Haul roads will also be illuminated by required no. of 250 W HPSV light fittings. Other surface lighting

& quarry periphery lighting will be done by CFL lamps/suitable ratings LED of suitable capacity.

Provision of mobile lighting masts/towers has also been made in this report for illumination in the working zones of quarry and dump area.

Required number of 3.3 kV/ 240 V (L-L), 25 kVA transformers will be provided for supplying power to luminaires used for quarry lighting and over burden dumps.

13.3 POWER BALANCE AND ANNUAL ENERGY CONSUMPTION, YEAR-WISE ENERGY CONSUMPTION

The details of power balance of substation is given at Table-13.1(for Deptt. Option) and Table-13.2 (outsourcing option)) and Table-13.5 (Partial outsourcing option). The annual energy consumption and year wise energy consumption are shown in Table 13.3 (for Deptt. Option) and in Table 13.4 (for outsourcing option) and in Table 13.6 (for outsourcing option).

13.4 SALIENT ELECTRICAL FEATURES AND COST ESTIMATE

The total capital investment of Electrical P&M including incoming overhead line to be drawn on steel towers with insulators and communication equipment have been estimated. The quarry supply shall be fed on 3.3 kV insulators with ACSR WOLF conductors. Details along with phased capital and brief specifications are shown at Appendix A.3.2.1. The summarized head wise capital requirement for electrical P&M and communication system are shown in Appendix A.3.2 for all options.

TABLE - 13.1

Power Balance of Electrical Load West Jhiria (Excluding Colony load) Deptt Option

Sl,no.	Equipment Details	Voltage V	Qty.	Unit Load (kW)	Total Load (kW)	Demand Factor	Power Factor Cos(Phi)	TAN (PHI)	Active Power (kW)	Reactive Power (kVAR)	Apparaent Power (kVA)
A	**Overburden**										
1	Elect. Hydraulic Shovel 10 Cu M	3300	4	900	3600	0.50	0.80	0.75	1800	1350	2250
2	RBH Drill 250 mm	3300	4	372	1488	0.50	0.70	1.02	744	759	1063
B	**Common**										
1	Workshop	3300	-	-	300	0.50	0.70	1.02	150	153	214
2	Main Pumps,225lps,70 m Head	3300	3	200	600	0.60	0.80	0.75	360	270	450
3	Main Pumps,80lps,60 m Head	415	2	125	250	0.60	0.80	0.75	150	113	188
4	Slurry Pumps	415	2	55	110	0.60	0.80	0.75	66	50	83
5	Priming Pumps	415	2	7.5	15	0.60	0.80	0.75	9	7	11
6	Illumination (Surface)	230 (L-L)	-	-	150	0.90	0.90	0.48	135	65	150
7	Illumination (Quarry)	230 (L-L)	-	-	150	0.90	0.90	0.48	135	65	150
	TOTAL				**6663**		0.78	0.80	3549	2832	4540
	Considering Diversity factor of 1.1						0.78	0.80	3226	2574	4127
	Total after improvement of p.f. to 0.98						0.98	0.20	3226	655	3292
	kVAR capacity of capacitor bank to improve p.f. upto 0.98									**1919**	
	Rating of selected capacitor bank		2 X950 kVAR							1900	
	Projected Total						0.98		3226	674	**3296**
	Transformer selected	**2 X 5000 kVA, 33 kV/3.4 kV (proposed)**									

TABLE - 13.2

Power Balance of Electrical Load West Jhiria (Excluding Colony load) Outsourcing Option

Sl,no.	Equipment Details	Voltage V	Qty.	Unit Load (kW)	Total Load (kW)	Demand Factor	Power Factor Cos(Phi)	TAN (PHI)	Active Power (kW)	Reactive Power (kVAR)	Apparaent Power (kVA)
A	**Common**										
1	Workshop	3300	-	-	150	0.50	0.70	1.02	75	77	107
2	Main Pumps,225lps,70 m Head	3300	3	200	600	0.60	0.80	0.75	360	270	450
4	Main Pumps,80lps,60 m Head	415	2	125	250	0.60	0.80	0.75	150	113	188
6	Slurry Pumps	415	2	55	110	0.60	0.80	0.75	66	50	83
7	Priming Pumps	415	2	7.5	15	0.60	0.80	0.75	9	7	11
8	Illumination (Surface)	230 (L-L)	-	-	150	0.90	0.90	0.48	135	65	150
9	Illumination (Quarry)	230 (L-L)	-	-	150	0.90	0.90	0.48	135	65	150
	TOTAL				**1425**		0.82	0.69	**930**	**646**	1132
	Considering Diversity factor of 1.1						0.82	0.69	845	587	1029
	Total after improvement of p.f. to 0.98						0.98	0.20	845	172	863
	kVAR capacity of capacitor bank to improve p.f. upto 0.98									**416**	
	Rating of selected capacitor bank		2 X 200 kVAR							400	
	Projected Total						0.98		845	187	**866**
	Transformer selected	**2 X 1000 kVA, 33 kV/3.4 kV (proposed)**									

TABLE - 13.5

Power Balance of Electrical Load West Jhiria (Excluding Colony load) Partial Hiring Option

Sl,no.	Equipment Details	Voltage V	Qty.	Unit Load (kW)	Total Load (kW)	Demand Factor	Power Factor Cos(Phi)	TAN (PHI)	Active Power (kW)	Reactive Power (kVAR)	Apparaent Power (kVA)
A	**Common**										
1	Workshop	3300	-	-	180	0.50	0.70	1.02	90	92	129
2	Main Pumps,225lps,70 m Head	3300	3	200	600	0.60	0.80	0.75	360	270	450
4	Main Pumps,80lps,60 m Head	415	2	125	250	0.60	0.80	0.75	150	113	188
6	Slurry Pumps	415	2	55	110	0.60	0.80	0.75	66	50	83
7	Priming Pumps	415	2	7.5	15	0.60	0.80	0.75	9	7	11
8	Illumination (Surface)	230 (L-L)	-	-	150	0.90	0.90	0.48	135	65	150
9	Illumination (Quarry)	230 (L-L)	-	-	150	0.90	0.90	0.48	135	65	150
	TOTAL				**1455**		0.82	0.70	**945**	**661**	1153
	Considering Diversity factor of 1.1						0.82	0.70	859	601	1049
	Total after improvement of p.f. to 0.98						0.98	0.20	859	174	877
	kVAR capacity of capacitor bank to improve p.f. upto 0.98									**427**	
	Rating of selected capacitor bank		2 X 200 kVAR							400	
	Projected Total						0.97		859	201	**882**
	Transformer selected	**2 X 1000 kVA, 33 kV/3.4 kV (proposed)**									

Table 13.3

Estimated year wise energy consumption of West Jhiria OCP (Departmental option)

Sl,no.	Equipment Details	TOTAL CONNECTED LOAD (kW)	DEMAND FACTOR	TOTAL WORKING HRS./ YEAR	I st YEAR TOTAL LOAD (kW)	I st YEAR POWER CONSN. (kWh)	II nd YEAR TOTAL LOAD (kW)	II nd YEAR POWER CONSN. (kWh)	III rd YEAR TOTAL LOAD (kW)	III rd YEAR POWER CONSN. (kWh)	IV th Year TOTAL LOAD (kW)	IV th Year POWER CONSN. (kWh)	V th & VI th YEAR TOTAL LOAD (kW)	V th & VI th YEAR POWER CONSN. (kWh)	VII th year onwards TOTAL LOAD (kW)	VII th year onwards POWER CONSN. (kWh)
A	**Over Burden**															
1	Elect. Hydraulic Shovel 10 Cu M	3600	0.5	4410		0	1800	3969000	2700	5953500	3600	7938000	3600	7938000	3600	7938000
2	RBH Drill 250 mm	1488	0.5	2880		0	744	1071360	1116	1607040	1488	2142720	1488	2142720	1488	2142720
	Sub Total					**0**		**5040360**		**7560540**		**10080720**		**10080720**		**10080720**
B	**Common**															
1	Workshop	300	0.50	1650	100	82500	150	123750	200	165000	300	247500	300	247500	300	247500
2	Main Pumps,225lps,70 m Head	600	0.60	2100		0	200	252000	400	504000	600	756000	600	756000	600	756000
3	Main Pumps,80lps,60 m Head	250	0.60	2100	0	0	125	157500	250	315000	250	315000	250	315000	250	315000
4	Slurry Pumps	110	0.60	1800	0	0	55	59400	110	118800	110	118800	110	118800	110	118800
5	Priming Pumps	15	0.60	1500	0	0	8	6750	15	13500	15	13500	15	13500	15	13500
6	Illumination (Surface)	150	0.90	3650	40	131400	60	197100	100	328500	150	492750	150	492750	150	492750
7	Illumination (Quarry)	150	0.90	3650	40.0	131400	60.0	197100	100.0	328500	150	492750	150	492750	150	492750
8	Colony & Water Treatment Plant	2000	0.90	3650	500.0	1642500	800.0	2628000	1000.0	3285000	2000	6570000	2000	6570000	2000	6570000
	Sub Total					**1987800**		**3621600**		**5058300**		**9006300**		**9006300**		**9006300**
C	Line losses 4% of above all					79512		346478		504754		763481		763481		763481
D	Total of items A to D					2067312		9008438		13123594		19850501		19850501		19850501
	Specific Energy Consumption (kWh/T) for targetted production of 1.50 Mty											**13.23**				
	Energy Cost Rs.12/- per kWh	**(in lakhs)**				**248.07744**		**1081.012608**		**1574.831232**		**2382.060096**		**2382.060096**		**2382.060096**
	Energy Cost per Tonne										**Rupees**	**158.80**				

Table 13.4

Estimated year wise energy consumption of West Jhiria OCP (Outsourcing option)

Sl.no.	Equipment Details	TOTAL CONNECTED LOAD (kW)	DEMAND FACTOR	TOTAL WORKING HRS./ YEAR	Ist YEAR		IInd YEAR		IIIrd YEAR		IV th Year		V th & VI th YEAR		VII th year onwards	
					TOTAL LOAD (kW)	POWER CONSN. (kWh)	TOTAL LOAD (kW)	POWER CONSN. (kWh)	TOTAL LOAD (kW)	POWER CONSN. (kWh)	TOTAL LOAD (kW)	POWER CONSN. (kWh)	TOTAL LOAD (kW)	POWER CONSN. (kWh)	TOTAL LOAD (kW)	POWER CONSN. (kWh)
A	**Common**															
1	Workshop	150	0.50	1650	75	61875	110	90750	125	103125	150	123750	150	123750	150	123750
2	Main Pumps,225lps,70 m Head	600	0.60	2100		0	200	252000	400	504000	600	756000	600	756000	600	756000
3	Main Pumps,80lps,60 m Head	250	0.60	2100	0	0	125	157500	250	315000	250	315000	250	315000	250	315000
4	Slurry Pumps	110	0.60	1800	0	0	55	59400	110	118800	110	118800	110	118800	110	118800
5	Priming Pumps	15	0.60	1500	0	0	8	6750	15	13500	15	13500	15	13500	15	13500
6	Illumination (Surface)	150	0.90	3650	40	131400	60	197100	100	328500	150	492750	150	492750	150	492750
7	Illumination (Quarry)	150	0.90	3650	40.0	131400	60.0	197100	100.0	328500	150	492750	150	492750	150	492750
8	Colony & Water Treatment Plant	1500	0.90	3650	500.0	1642500	800.0	2628000	1000.0	3285000	1500	4927500	1500	4927500	1500	4927500
	Sub Total					**1967175**		**3588600**		**4996425**		**7240050**		**7240050**		**7240050**
B	Line losses 4% of above all					78687		143544		199857		289602		289602		289602
C	Total of items A to C					2045862		3732144		5196282		7529652		7529652		7529652
	Specific Energy Consumption (kWh/T) for targetted production of 1.50 Mty											**5.02**				
	Energy Cost Rs.12/- per kWh	**(in lakhs)**				**245.50344**		**447.85728**		**623.55384**		**903.55824**		**903.55824**		**903.55824**
	Energy Cost per Tonne										**Rupees**	**60.24**				

Table 13.6

Estimated year wise energy consumption of West Jhiria OCP (Partial Hiring Option)

Sl,no.	Equipment Details	TOTAL CONNECTED LOAD (kW)	DEMAND FACTOR	TOTAL WORKING HRS./ YEAR	I st YEAR		II nd YEAR		III rd YEAR		IV th Year		V th & VI th YEAR		VII th year onwards	
					TOTAL LOAD (kW)	POWER CONSN. (kWh)	TOTAL LOAD (kW)	POWER CONSN. (kWh)	TOTAL LOAD (kW)	POWER CONSN. (kWh)	TOTAL LOAD (kW)	POWER CONSN. (kWh)	TOTAL LOAD (kW)	POWER CONSN. (kWh)	TOTAL LOAD (kW)	POWER CONSN. (kWh)
A	**Common**															
1	Workshop	180	0.50	1650	75	61875	110	90750	125	103125	180	148500	180	148500	180	148500
2	Main Pumps,225lps,70 m Head	600	0.60	2100		0	200	252000	400	504000	600	756000	600	756000	600	756000
3	Main Pumps,80lps,60 m Head	250	0.60	2100	0	0	125	157500	250	315000	250	315000	250	315000	250	315000
4	Slurry Pumps	110	0.60	1800	0	0	55	59400	110	118800	110	118800	110	118800	110	118800
5	Priming Pumps	15	0.60	1500	0	0	8	6750	15	13500	15	13500	15	13500	15	13500
6	Illumination (Surface)	150	0.90	3650	40	131400	60	197100	100	328500	150	492750	150	492750	150	492750
7	Illumination (Quarry)	150	0.90	3650	40.0	131400	60.0	197100	100.0	328500	150	492750	150	492750	150	492750
8	Colony & Water Treatment Plant	1800	0.90	3650	500.0	1642500	800.0	2628000	1200.0	3942000	1800	5913000	1800	5913000	1800	5913000
	Sub Total					**1967175**		**3588600**		**5653425**		**8250300**		**8250300**		**8250300**
B	Line losses 4% of above all					78687		143544		226137		330012		330012		330012
C	Total of items A to C					2045862		3732144		5879562		8580312		8580312		8580312
	Specific Energy Consumption (kWh/T) for targetted production of 1.50 Mty											**5.72**				
	Energy Cost Rs.12/- per kWh	**(in lakhs)**				**245.50344**		**447.85728**		**705.54744**		**1029.63744**		**1029.63744**		**1029.63744**
	Energy Cost per Tonne										**Rupees**	**68.64**				

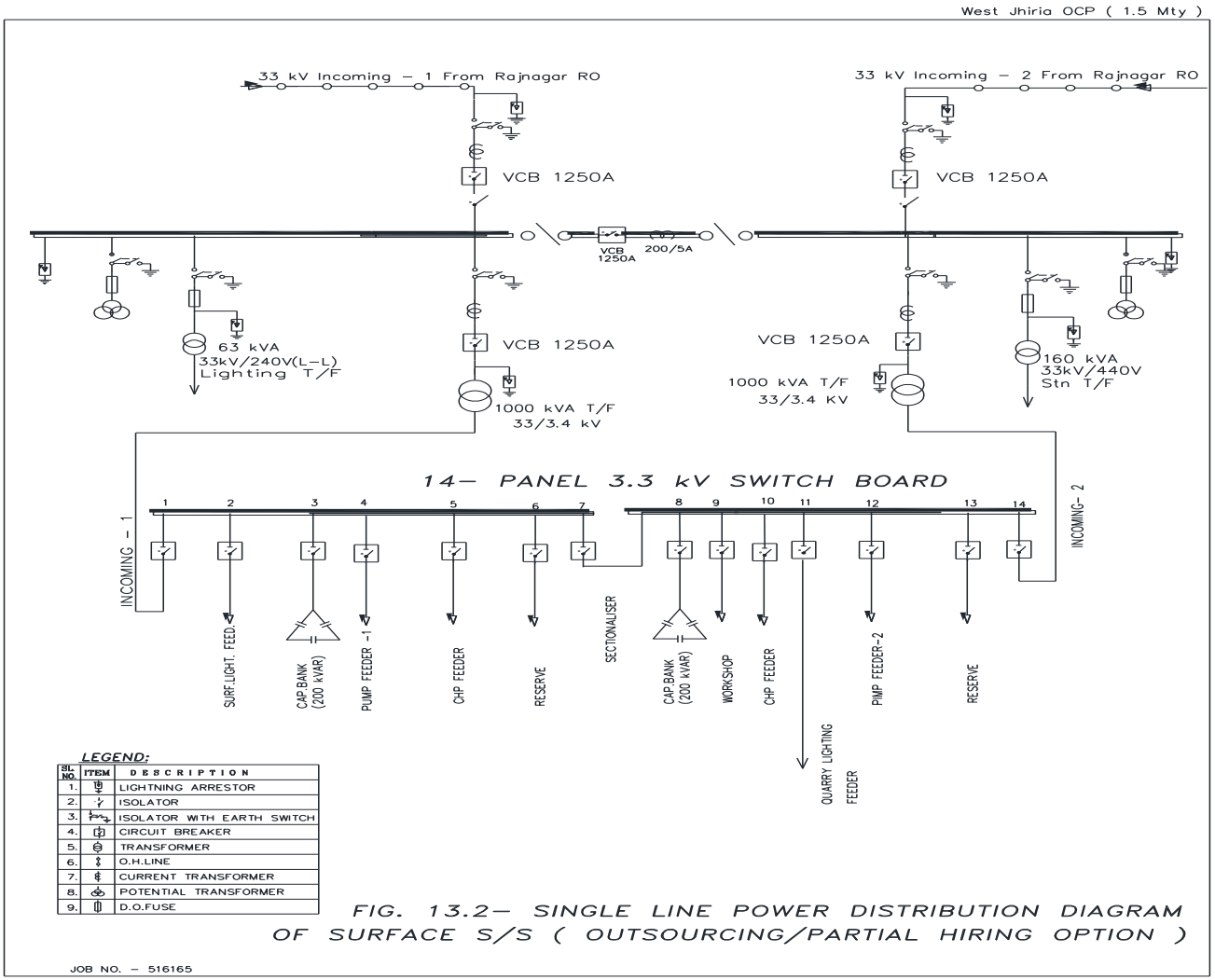


FIG. 13.2– SINGLE LINE POWER DISTRIBUTION DIAGRAM OF SURFACE S/S (OUTSOURCING/PARTIAL HIRING OPTION)

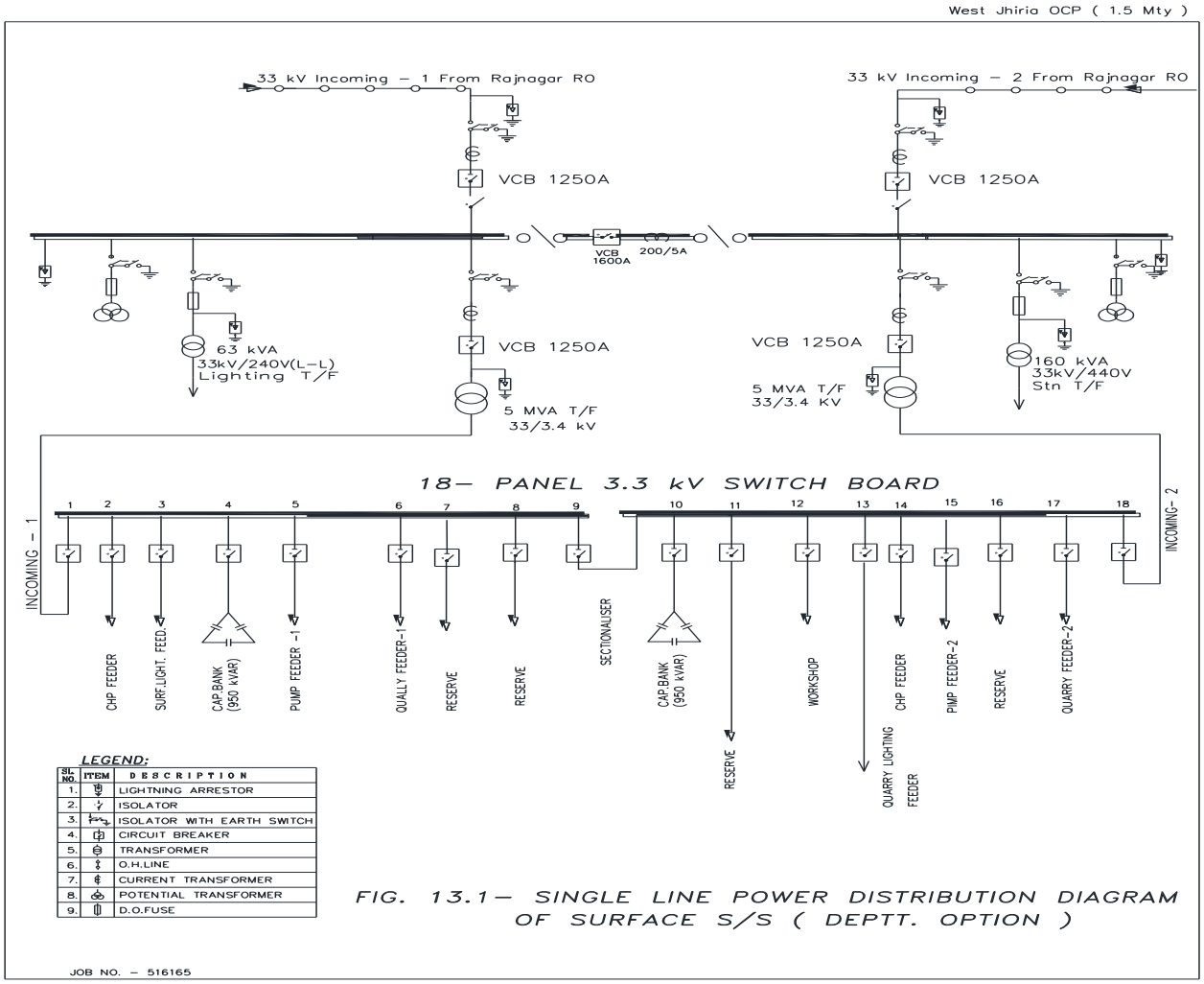


FIG. 13.1– SINGLE LINE POWER DISTRIBUTION DIAGRAM OF SURFACE S/S (DEPTT. OPTION)

Chapter – 14

CIVIL CONSTRUCTION

14.1 GENERAL:

Jhiria West open cast project is situated in Hasdeo area of SECL. The location and general topography of the proposed block has been elaborated elsewhere in this report.

14.1.1 Life & Type of Specification:

The planned life of the proposed block is 12 years and as per B.P.E guidelines temporary specifications have been envisaged for all civil structures. All civil structures should preferably be constructed over non-coal bearing area. Service infrastructures should preferably be located at distant locations preferably on non coal-bearing area.

14.1.2 Nature of soil:

In general poor soil is available in this area. As such necessary provision wherever required has been made.

14.1.3 External Services:

Coal will be transported by road from the mine. For truck loading CHP with silo has been considered which has been dealt separately by E&M department.

14.2 COST INDEX & SPECIFICATION OF BUILDING:

The preparation of cost estimates for civil infrastructures is based on prevailing cost index of the area in June'2018. The cost index value has been calculated from market rate of the area. The same was provided by the staff officer (Civil) of the area. Standard guidelines provided by B.P.E have been adopted for arriving at cost index value. Considering the prevalent rates of materials and labour in Hasdeo Area, the cost index works out to 3581 in June 2018 with reference to 100 base in Delhi as on 1.10.76. The detailed calculation for Cost Index is shown in Appendix A.2.3. All civil construction has predominantly been envisaged to be of temporary specification.

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14.3 SERVICE BUILDINGS:

14.3.1 Provision of Service/Welfare Building:

Considering the requirement of the project and its operational criteria, assessment of service and welfare buildings have been finalised with the planners with due consideration of total outsourcing option and departmental option. The same has been provided in this report. Since in mine is located in isolated area which has still not developed provisions has been made considering all the essential requirement and covers broadly service buildings like Project office, Store shed, Workshop, Substation, welfare buildings like canteen, officers' rest house, garage, scooter & cycle shed etc. and Statutory buildings like magazine, lavatories , C.D.S control room etc.

14.3.2 Site of Service Building:

All the proposed service buildings will be located near/ surrounding mine activity area on the basis of operational requirement and preferably on stable ground with due consideration of land availability and minimum blockage of coal.

14.3.3 Salient features of important service buildings:

To meet the daily requirement workshop complex area has been assessed by E&M department with required facilities which have been elaborated elsewhere. The detail provision along with their cost estimates have been indicated in Appendix-A.2.1.

The salient features of some of the important service buildings are as follows:-

14.3.3.1 Workshop:

This workshop will provide support services for regular activity of the mine. Workshop layout has been provided by E&M department considering requirements as per deployment of departmental machineries. The proposed workshop should be located at a suitable place near the operation activities and with due consideration of non coal bearing area / minimum coal blockage.

Workshop structure has been envisaged predominantly with structural steel construction i.e. structural frame with columns, bracing, trusses, purlins, louvers etc.

Roofing is suggested with 0.8mm CGI sheeting and side covering with 0.63mm CGI sheeting.

For natural lighting within the sheds thick translucent sheets of area up to 10% of covered area is to be provided in a staggered fashion. Other detailing within the sheds will have to be finalised during detailed design with due considerations of equipments and supporting services.

14.3.3.2 Store:

For the storage of essential materials required for the operational requirement a store has been provided. The store structure has been envisaged predominantly to be structural steel construction i.e. structural frame with columns, bracing, trusses, purlins, louvers etc. For natural lighting translucent sheets of area up to 10% of covered area is to be provided in a staggered fashion. Detailing within the store has to be finalised during detailed design considering the utilities.

14.3.3.3 Sub Station:

As per requirement of power supply, 33/3.3 KV Substation with outdoor structures have been provided which includes substation building to accommodate various electrical equipments. The Substation buildings will be R.C.C framed structure with well ventilation. Cable ducts are to be covered with steel chequered plates. Foundation for heavy equipment is part of substation flooring and the same are to be finalised with equipment load during detailed design.

For other structures following type of construction have been envisaged.

1.Project office: -	RCC framed structure
2.Magazine: -	- do -
3.Canteen:-	- do -
4.Garage, Scooter & Cycle shed: -	Steel structure with CGI roofing
5.Under ground reservoir: -	RCC structure
6. Security post: -	Brick masonry structure
7.Overhead tank: -	RCC structure

14.3.4 Cost Estimate:

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The details of cost estimate, as per prevalent cost index, against service buildings have been elaborated in appendix A.2.1.

14.4 RESIDENTIAL BUILDINGS:

14.4.1 Provision of Houses:

Since there are surplus houses in the area and the life of the project is very short, no new houses has been proposed in this report. However, provision has been made for rain water harvesting of the existing quarters.

14.4.2 Type of Construction:

Not required.

14.4.3 Site of Township:

Not required.

14.4.4 Rain Water Harvesting

The concept of rain water harvesting involves 'tapping the rain water where it falls'. A major portion of rain water that falls on the earth's surface runs off into streams and rivers and finally into the sea.

The technique of rain water harvesting involves collecting the rain from localized catchments surfaces such as roofs, plain/sloping surfaces etc., either for direct use or to augment the ground water resources depending on conditions.

Among various techniques of water harvesting, roof rain water harvesting is one of the appropriate options for augmenting ground water recharge/ storage.

In a typical domestic roof top rain water harvesting system, rain water from the roof is collected in storage vessel or tank for use during periods of scarcity. Such systems are usually designed to support the drinking water and cooking needs during the scarcity time and comprise a roof, a storage tank and guttering to transport water from the roof to the storage tank. In addition, a flush system to divert the dirty water, which contains debris, collected on the roof during non-rainy period and a filter unit to remove debris and contaminants before water enters the storage tank are also provided. The roof top rain water can also be used for recharging of

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the ground water through recharge pits or putting into the dried bore wells/ open dug wells.

14.4.5 Unit cost and Cost Estimate:

The details of cost estimate, as per unit cost with prevalent cost index, against residential buildings have been elaborated in appendix A.2.2.

14.5 ROAD AND CULVERTS:

14.5.1 Colony Roads & Culverts:

As no colony has been proposed, there is no requirement of colony roads and hence no provision has been made in this report.

14.5.2 Service Roads & Culverts:

This has been dealt along with approach road.

14.5.3 Approach Roads & Culverts:

Taking off from the nearby major road new approach of length 8.0 km has been assessed for the project. This road will also serve the purpose of coal transport and as such 15.0m wide bituminous road has been proposed. As per prevalent norms culverts have also been provided. The detail cost estimates have been elaborated in the Appendix-A.8.2.2.

14.5.4 Diversion of Non CIL Roads:

Provision has been made for diversion of 2.0km long road which falls within the quarry. For this purpose, 7.5m wide bituminous road has been proposed. As per prevalent norms culverts have also been provided. The detail cost estimates have been elaborated in the Appendix-A.8.2.4.

14.5.5 Haul road & Culverts :

The mine has been planned for both departmental and outsourcing option. So for movement of trucks/ dumpers suitable haul roads has been planned. Specification along with capital requirement has been indicated in appendix – A.8.2.3.

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14.5.6 Service Road and Culverts:

Provision has been made 1.0km long service road for interconnectivity of various service buildings. For this purpose, 7.5m wide bituminous road has been proposed. As per prevalent norms culverts have also been provided. The detail cost estimates have been elaborated in the Appendix-A.8.2.5.

14.5.7 Coal Transport Roads & Culverts:

This has been dealt along with approach road.

Summary of capital requirement against different types of roads are given in appendix A.8.2.

14.6 WATER SUPPLY AND SEWERAGE DISPOSAL ARRANGEMENT:

14.6.1 Colony water supply and sewage:

Based on conventional norm for water supply, the total water demand for this Project has been worked out. As no residential quarter has been proposed, there is no requirement of water residential quarters. For non-resident persons 45 litres per head has been adopted. Detailed calculation of water demand has also been provided.

The water demand has been envisaged to be met from 1 no. Bore well. Water from deep bore well will be collected to ground reservoir at different suitable locations near colony site. From ground reservoir water will be pumped to overhead reservoirs and the same will be distributed to the desired locations through gravity.

To augment the water supply system to the existing quarters, provision has been made for water treatment plant.

In this report, provision has been made for Sewerage treatment plant. The sewerage from individual houses collected through conventional sewerage disposal system, will ultimately be connected to sewerage treatment plant.

14.6.2 Industrial water supply & sewage:

Total industrial water requirement for the mine has been calculated for both the options.

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This water demand has been envisaged to be met from quarry water. Quarry water will be pumped and delivered to ground reservoir at different suitable locations near industrial site. From ground reservoir water will be distributed to the desired locations through pumping.

Industrial sewerage will be collected at a centrally located settling tank and after settlement of industrial waste the supernatant liquid is to be disposed of in nearest natural water course.

14.6.3 Capital Requirement:

Capital requirement against colony water supply and industrial water supply has been elaborated in appendix A.8.3.

Capital requirement against colony sewerage and industrial sewerage has been elaborated in appendix A.8.3a.

14.7 SURFACE REORGANISATION AND REHABILITATION, IF ANY:

This aspect has been dealt separately in the Mining write-up portion.

14.8 CONSTRUCTION MANPOWER:

For both departmental and outsourcing option manpower required to run regular mining activity has been considered by the planner.

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CHAPTER-XV

SAFETY AND CONSERVATION

15.1 DEGREE OF GASSINESS

Since it is an opencast mine, degree of gassiness is of no relevance at present.

15.2 SAFETY MEASURES AGAINST INUNDATION OF RAIN WATER

Adequate pumping capacity has been provided to deal with strata and surface water. At the same time, one diesel pump set has also been provided to pump out those waters logged which can not flow to the sump. The HFL of Kulharia Nala is not known, it is suggested to conduct hydro-geological survey to estimate the above HFL. Based on the HFL, to reduce the water inundation from Nala, embankment will be made at the required places for which capital provision has been given in the Appendix A.8.1. Intermittent capacity pump has also been provisioned to deal with average pumping load.

15.3 DUST SUPPRESSION

Major source of dust in opencast mine operation have been identified to be from haul roads, due to spillage from dumpers and abrasion by their wheels. Provision of adequate nos. of water sprinklers have been made for spraying of water on haul roads to prevent emission of dust. All along life, haul roads and other heavy duty roads likely to be negotiated by heavy vehicles and equipment have been proposed to be metalled and coated to facilitate control of emission of dust.

The drills to be engaged is to be equipped with dust arrester so that dust emission is minimum. As the blasting is not continuous one and while blasting, persons will be removed to the safe zone, chances of exposure to dust due to blasting are less. At siding, sufficient arrangements have been provided to suppress coal dust at vulnerable points.

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15.4 SLOPE STABILITY

SPOIL DUMP

The spoil will be stacked in the temporary external and internal dump space at the natural angle of repose to avoid the sliding of OB bench. The OB dump will be terraced at the height of 30m. The barrier distance between internal dump and coal production bench will be 100 m to have smooth functioning of machineries. While crossing the Fault F1F1 and F2F2 the fault surface should be benched to avoid any sliding of strata to working face. The surface of OB dump will be leveled and graded. Plantation will be made on the slope of OB heap to avoid the sliding of spoil.

The slope stability study should be done. According to study report the dump design like dump bench height, berm width, total dump height & slope etc. should be modified to avoid internal dump failure. In addition to that proper precautions / observations should be taken to avoid sliding of internal OB bench. Sufficient distance should be maintained from the toe of internal OB dump to fault on quarry floor to avoid sliding of strata to working face.

Dumping of top soil will be avoided at the bottom of the cut as it leads to instability. Dumping of soil and clayey material should be on the top of finally reclaimed internal dump.

Final regrading of internal dumps is done in such a way that rain water is drained outside the mine through drains and culverts. Proper monitoring system shall be used for internal dump stabilization to avoid sliding of OB dump.

15.5 HAUL ROAD MAINTENANCE

Haul road for dumper / tipper has been designed double lane with shoulders on both side for movement of dumper and ancillary equipment. Sharp turnings have been avoided to reduce the chance of any unhappenings. The access trench is graded to 6% slope. The ramp from one bench to another bench is graded at 1 in 10 slopes.

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15.6 BLASTING

For blasting crews, the blasting shelter has been provided. To reduce the chance of fly rock and misfire, the perfect blasting pattern is to be developed by trial. In view of the safety of the villages / public / mine infrastructure against blasting hazards like fly rocks, ground vibrations etc. proper safe distance has been kept from the mine working. However, when the mine working reaches near to the village boundaries/mine infrastructure, controlled blasting will be adopted alongwith other necessary precautions laid down by the DGMS. Misfire if any, should be handled cautiously

15.7 CONSERVATION OF COAL

The coal recovery is 50% and 80 to 85% of extractable coal by Bord & Pillar Method and Longwall Method of underground mining respectively. On the other hand, coal recovery is almost 100% by opencast mining method. And so wastage of natural resource is almost nil in opencast mining method.

The OB bench cut working will be kept sufficiently advanced in respect to the coal bench working to avoid mixing of OB into the coal during blasting. At the same time, the coal bench surface will be cleaned with scoops to avoid dilution and contamination of coal.

Best efforts will be made to restore pre-mining aesthetic view of the area or better.

15.8 ADDITIONAL PERMISSION / RELAXATIONS REQUIRED FROM DGMS SAFETY ASPECTS FOR OUTSOURCING / HIRING OF HEMM / EQUIPMENT

Outside agency deploying HEMM or any equipment in the mine for excavation of coal shall plan their activities in confirmation with the prevailing statutory provisions as per Mines Act 1952 and CMR 1957 applicable for safety in opencast mines.

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However, all statutory rules, regulations, applicable laws etc. and statutory requirement related to Govt. licenses, workers compensation, insurance, etc., including minimum wage act for workers employed by the outside agency shall have to be adhered to. Rules if any imposed by local / state / central authorities should also be complied by leaser of HEMM / equipment and then shall have to supply various protective equipment viz., helmet, shoes etc. to the workmen at their cost.

All the regulations and schedules of Coal Mines Regulations 1957 relating to opencast mining have to be adhered to and implemented in order to maintain day to day safety precautions as per stature.

Special precaution should be taken while deploying workers in the mine. Before employing any worker to the mine proper vocational training should be imparted and recommendations of VIII Safety Conference should be strictly followed. Terms and conditions shall be fixed by management for deployment of workers by outside agency. Some of the major aspects are as follows: -

A) For Persons :

i) No persons shall be deployed unless he is trained at VTC.

ii) Records in Form-B, Form-D shall be maintained.

iii) Records of Vocational Training Certificate and driving license of operators shall be kept by HEMM outsourcing agency and shall be made readily available for inspection by management.

iv) Salaries shall be distributed in front of management representative.

v) No person shall be employed unless person holds VTC certificate and management is informed. A record of it shall be maintained.

vi) Adequate supervision shall be maintained by qualified competent persons.

vii) Outside agency shall follow safety guidelines and safety instructions from project authorities.

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B) For Machineries as recommended by DGMS Cir. (Tech.) 1 of 1999 :

i) All the machineries to be deployed in mines should be checked before deployment by competent authority.

ii) Regular checking of m/c deployed by outside agency shall be done. No unfit machine shall be deployed before the defect is rectified.

iii) A proper record of repair and maintenance along with inspection done by management and defect pointed out shall be maintained and signed by authorized person.

iv) The trucks deployed outside agency shall be provided with audio visual alarms, proper light for use at night and period when natural light is not sufficient. Also audiovisual alarms for reversing on trucks shall be provided.

Other precautions for machines

i) RTO certificate photocopies of all vehicles shall be submitted to management.

ii) Daily welding, monitoring, inspection shall be done by the agency's mechanic as directed by management.

iii) Machine manufacturers should be asked to give risk analysis details in respect of machines deployed by outside agencies.

iv) Suitable type of the fire extinguishers shall be provided in every machine.

C) General :

i) No person / vehicle shall be deployed at any place other than authorized place.

ii) All workers should obey lawful instruction of mine management.

iii) Risk Management Plan of tipper / pay loader shall be made and implemented.

iv) All drivers shall obey systematic traffics rules prepared by management.

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v) Before deploying workers, they must be trained and briefed about safety aspects in opencast mine. However, during course of execution of the work, if any accident occurs whether major or minor, the matter shall have to be immediately informed to mine management i.e. Colliery Manager / Agent / GM of Area, so that, notices of accidents in accordance of (Reg.9 of CMR 1957) and Section 23 of Mines Act 1952 may be given and other necessary steps may be taken in accordance with the Mines Act 1952.

vi) Outside Agency shall operate transport system in such a way so as to minimize pollution in the mine.

Recommendations of 11th conference on Safety in Mines held on 4th & 5th July, 2013 at New Delhi.

The related recommendation of XIt Conference on safety in mines is to be followed while implementation of project report.

1. **Review of status of implementation of recommendations of 10th Conference on Safety in Mines.**

The committee unanimously decided to carry forward the following Para of the recommendations of the 10th Conference on Safety in Mines, namely:-

1.1(a)	Necessary facilities for monitoring the environmental parameters in respect of Methane and Carbon Monoxide should be provided at mines. Facilities of continuous type monitoring should be installed within two years in all degree III gassy COAL and in such other mines having active underground fire.
1.1(b)	Indigenous manufacturers should be encouraged to manufacture necessary equipments.
1.1(c)	Time bound programme is to be made, which should be decided in a tripartite committee at company level.
1.2	In underground specified mines where long or arduous travel is involved, arrangement for transport of men should be made with a target of 20 % every year.

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1.3(a)	In respect of small-mechanised mines, which are operating in NON-COAL sector, it may not be feasible for a small organization to create a special department on Occupational Health Services. For such small mines, it is suggested that an Association of small mines operators creates common facilities and infrastructure for occupational health services. Creation of such facilities are specially needed for asbestos, manganese and mica mines.
1.4	Development of a portable instrument for detecting hidden slips in roof of COAL mines should be taken up on priority by R&D organizations. The instrument should be developed by S&T project which should be guided by a committee consisting of an officer from DGMS and others from COAL Industry and Research Organisations.
1.8(a)	Before the valid gate pass is issued for entry of trucks and other vehicles not belonging to management into the mine, the mine engineer should check the road-worthiness of such vehicles.
1.8(b)	In order to check entry of un-authorized vehicles in mine premises, each mine should establish property manned check gate(s) at the entrance(s) where record of entry and exist of each such vehicle should be maintained.
1.9(a)	All persons engaged at any work within the mine premises through the contractors have received relevant training and other job-related briefings and that the drivers of vehicles belonging to contractors entering the mine premises have additionally been explained the salient provisions of "traffic rules".
1.9(b)	Each mining company should draw up appropriate training schedules and modalities in this regard and implement the same.
1.9(c)	In case of smaller mines, such arrangement may be made by association of mine operators.
1.11.1	Considering the risk of fire, all COAL mine companies shall rank its COAL mines on a uniform scale according to its risk from fire on scientific basis. Guidelines may be framed by DGMS and circulated to all mining companies.

2.0 Contractor work vis-à-vis safety

2.0	Contractor work vis.-a-vis. safety
2.1	Employer's responsibilities
2.1(a)	Suitable clauses (in consistence with risk of the work allotted) shall be included in tender document (including NITs) stating how the risk arising to men and material from the mining operation/operations to be done by the contractors shall be managed.
2.1(b)	Ensure that contractors are familiar with the relevant parts of the statutes,

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	health and safety management system and are provided with copies of such documents prior to commencing work.
2.1(c)	Ensure that contractor's arrangements for health and safety management are consistent with those for the mine owner. All the rules, regulations and bye-laws as applicable to the mine owner are also applicable to the contractor. Details of the contractor's workmen should be maintained in the owners Form-B register. Whereas as C, D & E registers for contractor men may be maintained independently by the owner and shall be kept in the mine office of the manager.
2.1(d)	Ensure that contracts should preferably of longer period (3 years), so that there is adequate scope of management of safety by the contractor.
2.1(e)	Ensure that contractors provide the machinery, operator and other staff with written safe work procedures for the work to be carried out, stating clearly the risk involved and how it is to be managed.
2.1(f)	Monitor all activities of the contractors to ensure that contractors are complying with all the requirements of statute and the system related to safety. If found non-compliance of safety laws directing the contractors to take action to comply with the requirements and for non-compliance, the contractor may be suitably penalized. Clause to this affect may be a part of the agreement between the employer and the contractor.
2.1(g)	Where a risk to health or safety of a person arises because of a non-compliance directing the contractor to cease work until the non- compliance is corrected.
2.2	**Contractor's responsibilities:**
2.2(a)	Prepare written Safe Operating Procedure (SOP) for the work to be carried out, including an assessment of risk, wherever possible and safe methods to deal with it/them.
2.2(b)	Provide copy of the SOP to the person designated by the mine owner who shall be supervising the contractor's work.
2.2(c)	Keep an up to date SOP and provide a copy of changes to a person designated by the mine owner
2.2(d)	Ensure that all work is carried out in accordance with the Statue and SOP and for the purpose he may deploy adequate qualified and competent personnel for the purpose of carrying out the job in a safe manner.
2.2(e)	For work of a specify scope/nature, develop and provide to the mine owner a site specific Code of Practice (COP).
2.2(f)	Ensure that all sub-contractors hired by him comply with the same requirement as the contractor himself and shall be liable for ensuring the compliance all safety laws by the sub or sub-sub contractors.
2.2(g)	All persons deployed by the contractor for working in mine must undergo vocational training, initial medical examination, PME. They should be issued cards stating the name of the contractor and the work and its validity period, indicating status of VT & IME.
2.2(h)	Every person deployed by the contractor in a mine must wear safety gadgets to be provided by the contractor. If contractor is unable to provide, owner, agent and manager of the mine shall provide the same.

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2.2(i)	The contractor shall submit to DGMS returns indicating -Name of his firm, Registration number, Name and address of person heading the firm, Nature of work, type of deployment of work persons, Number of work persons deployed, how many work persons hold VT Certificate, how many work persons undergone IME and type of medical coverage given to the work persons. The return shall be submitted quarterly (by 10th of April, July, October and January) for contracts of more than one year. However, for contracts of less than one year, returns shall be submitted monthly.
2.3	**Employees Responsibilities**
2.3(a)	An employee must, while at work, take reasonable care for the health and safety of people who are at the employee's place of work and who may be affected by the employee's act or omissions at work.
2.3 (b)	An employee must, while at work, co-operate with his or her employer or other persons so far as is necessary to enable compliance with any requirement under the act or the regulations that is imposed in the interest of health, safety and welfare of the employee or any other person.

3.0 Safety issues in mines in un-organised sector

3.2	In case of stone quarried on hillocks, whole of the hillock should be given out as a single lease so that necessary development could be done from top-downwards after making approach road to reach to top of the hillock before starting extraction of stone. A condition to this effect may be incorporated before granting such leases.
3.3	In the lease document, reference should be made to the Mines Act and the Rules and Regulations made there under for compliance. The DGMS may prepare, in consultation with Ministry of Mines a model document for grant of leases by the state governments so that the conditions of leases are such that there is a uniformity and compliance with central laws.
3.4	A copy of the lease document should be sent to the DGMS and lessees explicitly asked to send notice of opening of mine to DGMS in accordance to the Provisions of the Mines Act.
3.5	The Conference has noted that there have been instances in some States where leases have been granted in close proximity of inhabited area and within 45 m. of Railway acquired land and land acquired for National and State highways, public works without consulting the appropriate statutory authority. The conference recommends that the States may grant mining leases in conformity of Central Laws.
3.6	DGMS should organize Orientation Programmes for officers of State Mines and Geology Departments to inform them about safety laws.

4.0 Occupational Health surveillance and Notified Diseases

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4.1	Noise mapping should be made mandatory of various workplaces in the mine premises based on the various machines being used in concerned mines along with personal noise dosimetry of individual workmen exposed to noise level above 85 dB(A).
4.2	Vibration studies of various mining machineries before their introduction in mining operation should be done as per ISO Standards.
4.3	Ergonomical assessment of all latest machines, before their introduction into mining operation as per ISO standards. Ergonomical assessment should include: * Assessment of work process. * Assessment of working Aids/tools * Assessment of working posture.
4.5	Portability tests of drinking water supplied to the mine employees, to be made mandatory once in a year irrespective of its source, preferably after Rainy seasons, the sample of water should be collected from the points of consumption.
4.7(a)	In addition to measurement of blood pressure, detailed cardiovascular assessment of employees should be done. This should be include 12 leads electrocardiogram and complete lipid profile.
4.7(b)	Detailed neurological examinations including testing of all major superficial and deep reflexes and assessment of peripheral circulation to diagnose vibrational syndromes.
4.7(c)	In addition to routine urine, fasting and post-prandial blood sugar should be included for early diagnosis of diabetes mellitus.
4.7(d)	Serum Urea Creatinine should be included for assessment of Renal function.
4.8	Special tests should be included in the PME for employees exposed to specific health hazard:
4.8(a)	For employees exposed to manganese, special emphasis should be given to behavioural and neurological disturbances such as speech defect, tremor, impairment of equilibrium, adiadochokinesia H2S and emotional changes.
4.8(b)	For persons exposed to lead, PME should include blood lead analysis and delta aminolevulinic acid in urine, at least once in a year.
4.8(c)	Employees engaged in food handling and preparation and handling of stemming material activities should undergo routine stool examination once in

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	a every six months and sputum for AFB and chest radiograph once in a year.
4.8(d)	Employees engaged in driving/HEMM operation jobs should undergo eye refraction test at least once in a year.
4.8(e)	Employees exposed to ionizing radiation should undergo blood count at least once in a year.
4.9(a)	All other types of Pneumoconiosis excluding Coal workers pneumoconiosis, silicosis and asbestosis. This include Siderosis & Berilllyosis
4.10	For smaller mines where PME facilities are not existing, medical examinations can be done through other competent agencies.

5.0 Mechanisation with view to phase out manual loading etc.

5.1	Keeping in view the objective of phasing out manual loading, all COAL companies shall identify appropriate technology suitable for the prevailing geo-mining conditions and introduce the same in such a manner so as to phase out manual loading operation completely within a period of five years in COAL seams with gradient of 1 in 5 or less, within a period of seven years where gradient steeper than 1 in 5.
5.2	While formulating the strategies for face mechanization in underground workings, it shall be ensured that back facilities like COAL evacuation, support system, ventilation arrangements etc. are compatible with face mechanization.
5.3	The scheme of face mechanization shall be based on proper scientific investigation. The scheme shall also include arrangements for monitoring strata behaviour and environmental conditions.
5.4	Possibility of deployment of multi-skilled miners in the face shall be explored to reduce the exposure at hazardous areas without affecting employment.
5.5	Suitable training for efficient and safe operation of machinery shall be imparted to all concerned.
5.6	While planning for face mechanization, due considerations shall be given for long term sustainability of the technology.

6.0 Reduction from risk from roof and sides falls in coal mines

6.1	In every Coal mining company, STRATA CONTROL CELL shall be established at corporate and area levels within a period of one year, to assist mine managers, for formulation of Systematic Support Rules, monitoring strata control measure in a scientific way to ensure efficacy of support system and for procurement/supply of quality supporting materials. Such cell shall be

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	manned by adequate number of technical personnel headed by a senior official not below the rank of General Manager at Corporate level and Dy. General Manager at Area level.
6.2	Roof bolting shall be used as a primary means of support for freshly exposed roof in development as well as depillaring districts. For the roof category Poor, having value of RMR of 40 or less, or where there is excessive seepage of water from the roof strata, roof bolts exclusively with resin capsules shall be used to ensure adequate & immediate reinforcement of the strata.
6.5	To ensure proper drilling for roof bolting in all types of roof strata, suitable fit-for-use roof bolting machines shall be introduced in all mines within a period of one year. Such machines shall be capable of being operated from a distance or be provided with suitable canopy to protect the supporting personnel during drilling or bolting operations.
6.6	Risk assessment exercise shall be carried out in the mines for assessing for risk from the hazards of roof and sides falls and identifying the control mechanism with specific responsibility for implementation. This exercise shall be reviewed at regular intervals not exceeding a year.
6.7	Each company shall take steps to impart structured training to officers, supervisors and support personnel on roof bolting.

8.0 Below ground communication and tracking system

8.2	Mining companies in collaboration with research institutions/equipment manufacturers shall initiate and fund for, suitable research initiatives for establishment of appropriate communication system for below ground mines including to locate the trapped miners.
8.3	Mine management in collaboration with equipment manufacturers shall evolve a system of proximity warning device in HEMM and initiate measures for its implementation.

9.0 Safety Management system" Strategies for implementation and path forward.

9.1	Every mine should employ a sound risk analysis process, should conduct a risk assessment, and should develop a safety management plan to address the significant hazards identified by the analysis / assessment.
9.2	The managements of every mining company should adopt the process of safety management system and commit itself for proper formulation and implementation of the same in totality. Necessary resources should be

	allocated for implementation of the control measures identified by the risk assessment process.
9.3	Necessary training of all employees of Mining Companies should be organized with the help of experts, both national and international, for optimal adoption of safety management system.

10.0 Implementation of ILO convention No. 176 in Mines

10.0	The committee decided that a separate discussion be held by the Govt. of India in a tripartite forum to deliberate on the implications arising out of ILO Convention No. 176.

Small Scale Mining

(1) The concerned authority in State Government may grant prospecting lease/mining lease/ mining right after ascertaining technical feasibility of mineral extraction in pursuance with provisions of the mining law, so that the lessee can make medium to long-term plan for investment in infrastructure and work the mines in a safe and scientific manner. While conduct of mining operations, it should be ensured that the Central Laws, including the Mines Act are complied with.

(2) The State Governments may explore the feasibility of demarcation of mining zones to avoid problems of growing habitation encroaching into the mining area, thereby creating unsafe and unhealthy conditions. However, the State Government may take efforts to relocate the habitation already existing near mining zones.

(3) The lease granting authority of State Government may assign a unique identification number, which will serve as a common reference for all central and state authorities responsible for administration of central and state laws.

The details of lease may be displayed in a board of permanent nature in a prominent place in the lease hold are showing following:

a. Name of lessee:
b. Lease number:
c. Period of lease:

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d. Unique identification number:

(4) The lease granting authority of State Government may insert a clause in the lease document requiring the lessee to submit a notice of (i) commencement of any mining operation, and (ii) appointment of a manager, prescribed under the Mines Act, 1952 and Rules and Regulations framed there under.

(5) The concerned authorities of State Government may be requested to explore the possibility of introducing a course in Mining at Industrial Training Institutes in consultation with DGMS to augment the requirement of Mining Mates.

(6) Orientation Programmes may be organized for officers of State Mine and Geology Departments on OSH Laws.

(7) Organized mines of public and private sector may consider extending their facilities in Vocational Training, Occupational Health Surveillance and other Safety Awareness Programmes for workers engaged in small scale mining sector.

(8) As a promotional initiative, social dialogue and deliberations at appropriate level may be initiated to facilitate formation of Cooperative Society/Mine Owners Association to tackle issues of resource and logistics management essential for safe and healthy mining.

(9) The Conference appreciates the efforts made by Ministry of Labour & Employment and Directorate General of Mines Safety for encouraging and adopting innovative means to create awareness about OSH issues and improving compliance in small scale mining sector with public private interventions. It is recommended to continue with such initiatives vigorously and in enhanced manner.

(10) The concerned authorities may explore possibilities of setting up of Mine Workers Welfare Boards for minerals like sandstone, marble and granite.

Safety, Health and Welfare of Contractual Workers.

(1) The recommendations made in the 10th conference on Safety in Mines regarding safety, health and welfare of contractor's workers shall be complied within two years. Owner, Agent and Manager shall be responsible for ensuring compliance at the their respective mines.

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(2) There shall be provisions for modifications in Notice Inviting Tenders (NITs) to fulfill the requirement of statute/circulars issued by DGMS from time to time subsequent to the finalization of NITs also.

(3) The contractor shall not employ or terminate his worker without the knowledge of the mine management.

(4) Payment to contractor's workers including leave with wages shall be made through bank only.

(5) In case of non-routine type of work in the mine a Work-Permit system, outlining the precautions to be adopted, SOPs, supervision, persons responsible for the job etc., shall be adopted.

(6) Each company shall frame a safety, health and welfare policy for their contractor's workers keeping in view the requirement of Mines Act and Rules & Regulations made there-under. The details of the policy shall be included in the tender document which will be a binding clause for the contractor.

(7) Each mining company shall extend all benefits including medical facilities and payment of wages, to contractor's workers receiving injury whilst on duty. Owner, Agent and Manager shall be responsible for ensuring compliance at their respective mines.

(8) Medical facilities shall be extended to contractor workers.

(9) Central Government should take steps against non-compliance of the recommendations of the National Safety Conferences.

Surface Transportation Machinery:

MACHINERY FOR SURFACE OR OPENCAST OPERATIONS

(a) Mine Planning & Design

The provisions of requirements of HEMMs and their installations, operations, maintenance and training shall be included in the project at planning stage.

(b) Safety Features in HEMMs

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(i) Audio-Visual Alarm

- ✓ The sound level of AVA should be at least 5 to 20% higher than the ambient noise level; and
- ✓ The audio frequency and its amplitude band should be increasing and uniquely heard to keep persons alert in the blind zone during reversal.
- ✓ AVA should be of IP 67 compliance.

(ii) Anti-Skid and Tail-End Protection System

The provision of tail end protection, bumper extension or any other device shall be provided in dumpers/tippers to prevent collision both head on and head to tail conditions.

(iii) GPS-GSM Based Navigation System

The GPM-GSM based vehicle navigation system shall be used in large mines in a phased manner.

(c) Risk Control and Management

Risk Assessment and Control of Risks should be conducted by the mine management quarterly and annually.

(d) Skill Development and Training

General Skill Development programme should be undertaken for training of operators and all other associated staffs using state of the art technique including simulation and 3D Virtual Reality system.

(e) Protection against Fatigue

(i) Long or Extended Hours of driving beyond 8 continuous hours with a rest interval of half an hour after four hours of continuous operation, shall not be permitted, for which biometric system of check-in & check-out system of attendance associated with suitable software shall be introduced in the mine.

(ii) Additional warning system for operator's fatigue should be provided in the machine.

(iii) Operator's Seat in the Vehicle/HEMMs should be ergonomically designed to have adequate comforts while driving continuously.

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CHAPTER-XVI

ENVIRONMENT MANAGEMENT

16.1 Existing Environment Quality

Jhiria West OC Project (1.50 Mty) is located in the Hasdeo Area of SECL. The project comprises mostly forest land (i.e. 323.737 Ha, 67.06 %) & tenancy land (i.e. 104.140 Ha, 21.57 %). The project area is not involved with any industrial and mining activities for which require regular environmental monitoring/audit. However in the study area, there are mining activities in Ramnagar Sub-Area in which CMPDI on behalf of SECL is carrying out environmental monitoring at different locations of the sub-area, which are utilized for preparation of this Chapter.

This data will enable to obtain a comprehensive idea of environmental quality in and around the proposed project area in respect of air quality, water quality, noise level, flora fauna, socio economic data etc. Detail existing environmental base line data will be generated before submission of final EIA/EMP to MoEF.

16.1.1 Ambient Air quality in core and buffer zone

Environmental Monitoring data of Ramnagar Sub-Area carried out in the year 2015 for air and noise and drinking and effluent quality data, at different stations in core & buffer zone, are utilized for preparation of this Chapter. To assess the ambient air quality, five monitoring stations were fixed on the basis of physiography of the area, meteorological parameters like predominant wind direction, wind speed etc.

Air quality status: The summarized air quality monitoring data for SPM, RPM, SO_2, & NO_X shown below in Table -16.1. The air quality data of different locations are found to be within the permissible limit of CPCB.

Table – 16.1 Summarised Air Quality Data

Season: Oct-Dec 2015 (Values are in µgm/m^3)

Monitoring Location	SPM		RPM		SO_2		NO_X	
	Min	Max	Min	Max	Min	Max	Min	Max
Malga Incline/ Mine	*259*	*392*	*106*	*157*	*13*	*23*	*23*	*35*
Ravinagar Sub Station	*142*	*186*	*40*	*69*	*11*	*21*	*15*	*28*
Block " 1 " Sam Qtr.	*127*	*197*	*34*	*91*	*13*	*18*	*17*	*27*

South Jhimar Colliery	*346*	*420*	*130*	*241*	*12*	*21*	*23*	*34*
Indira Nagar Colony	*118*	*189*	*32*	*134*	*12*	*15*	*16*	*24*

The National Ambient Air Quality Standards (NAAQS) as per CPCB norms is given in table 16.2 below

Table – 16.2

Standards	Category	SPM	RPM	SO_2	NO_X
NAAQS	Industrial (A)	500	150	120	120
	Residential (B)	200	100	80	80
	Sensitive (C)	100	75	30	30
As per MOEF notification GSR 742(E), dated 25th Sep'2000	Old mines (A-O)	600	300	120	120
	New mines (A-N)	500	250	120	120

16.1.2 Drinking water quality:

The following are the drinking water quality data of Ramnagar Sub-Area.

Table - 16.3

Period: One season data (Oct-Dec 2015)

Sl. No.	Parameter	Unit of Measurement	Observed Value			IS 10500:2012	
			Input of Indranagar filter Plant	Output of Indranagar filter Plant	Below Detection Limit	Acceptable Limit	Permissible Limit in the Absence of Alternate Source
1	Colour	Hazen	8	10	5	5	15
2	Odour	Unitless	Agreeable	Agreeable	---	Agreeable	Agreeable
3	Taste	Unitless	Agreeable	Agreeable	---	Agreeable	Agreeable
4	Turbidity	NTU	BDL	BDL	1	1	5
5	pH	Unitless	7.16	7.26	0.01	6.5-8.5	No relaxation
6	Alkalinity as $CaCO_3$	mg/l	100.00	56.67	10	200	600
7	Total Hardness as $CaCO_3$	mg/l	403.33	258.67	4	200	600
8	Iron	mg/l	0.08	0.07	0.06	0.3	No relaxation
9	Chlorides	mg/l	15.17	17.50	1	250	1000
10	Residual Free Chlorine	mg/l	NIL	0.04	0.02	0.2	1
11	Total Dissolved Solids	mg/l	667.00	480.33	35	500	2000
12	Calcium	mg/l	65.07	58.40	2	75	200
13	Copper	mg/l	0.04	0.05	0.03	0.05	1.5
14	Manganese	mg/l	0.02	0.03	0.02	0.1	0.3

15	**Sulphate**	**mg/l**	106.00	106.67	**2**	**200**	**400**
16	**Nitrate**	**mg/l**	BDL	BDL	**0.5**	**45**	**No relaxation**
17	**Fluoride**	**mg/l**	0.41	0.39	**0.02**	**1**	**1.5**
18	**Selenium**	**mg/l**	BDL	BDL	**0.002**	**0.01**	**No relaxation**
19	**Arsenic**	**mg/l**	BDL	BDL	**0.002**	**0.01**	**0.05**
20	**Lead**	**mg/l**	BDL	BDL	**0.005**	**0.01**	**No relaxation**
21	**Zinc**	**mg/l**	0.03	0.02	**0.01**	**5**	**15**
22	**Hexavalent Chromium**	**mg/l**	0.01	0.02	**0.01**	**0.05**	**No relaxation**
23	**Fecal Coliform**	**MPN/ 100 ml**	NIL	NIL	**---**	**Nil**	**No relaxation**
24	**Boron**	**mg/l**	1.40	0.60	**0.2**	**0.5**	**1**
25	**Phenolic compounds**	**mg/l**	BDL	BDL	**0.001**	**0.001**	**0.002**

Effluent water quality: Table -16.4 **Period:** Oct-Dec 2015

S/L No.	SAMPLING STATIONS	PARAMETERS			
		pH	TSS	COD	O&G
1	MALGA MINE DISCHARGE	7.35	19.50	20.67	<1.0
2	SOUTH JHIMAR MINE DISCHARGE	7.30	22.50	23.33	<1.0

16.1.3 Noise level

Noise levels vary depending on the various activities in mining areas such as blasting, extraction of coal, movements of machinery, equipment and vehicles, as well as due to activities in the workshop, CHP etc. Noise levels have been recorded in the adjoining areas of the proposed project to assess the sound levels. The details of Noise levels are given in Table- 16.5 and the Noise Levels Standard are given in table – 16.6.

Table – 16.5 Summarized Noise Quality Data

Season: Oct-Dec 2015 (Values are in dB (A)

Sl. No.	Location	Minimum dB(A)		Maximum dB(A)		Average dB(A)	
		Day	Night	Day	Night	Day	Night
1	MALGA INCLINE/ MINE	55.40	49.80	62.10	53.90	59.95	52.10
2	RAVINAGAR SUB STATION	46.80	43.00	60.10	53.20	51.30	46.35
3	BLOCK " 1 " SAM QTR.	49.80	43.50	54.70	44.80	52.32	44.03
4	SOUTH JHIMAR COLLIERY	60.40	41.90	65.20	62.30	63.60	53.18
5	INDIRA NAGAR COLONY	49.20	42.90	64.10	49.00	55.38	45.30

All the noise level values are found to be less than 90 dB (A) for 8 hours exposure as per Occupational Safety and Health Administration (OSHA) standard. While comparing with IS: 4954 -1968 norms for acceptable outdoor noise levels in residential area, these values are found to be within the limits.

Table- 16.6 Noise Levels Standard

Maximum permissible limits in dB(A) of Ambient noise level as per MOEF notification S>O123(E) dated 14th Feb 2000 and GSR 742(E),dated 25th Sep 2000	**Category of Area**	**Limits in dB(A)**	
		Day time (6.00 am to 10.00 pm)	**Night time (10.00 pm to 6.00 am)**
	Industrial Area	75	70
	Commercial Area	65	55
	Residential Area	55	45
	Silence zone	50	40

16.1.4 Flora and Fauna

For the detail data of flora and fauna present in the core and buffer zone of the proposed project a flora and fauna study of core and buffer zone would be made prior to preparation of EIA/EMP. The flora and fauna report of the nearest Rajnagar OC Project generated earlier reveals the following summarized list of flora and fauna normally found in that forest.

The study area for the Flora & Fauna covers 10 KM radius from periphery of the Core Zone of the Rajnagar OCM in the Hasdeo area of South Eastern Coalfield Limited (SECL).

The baseline status of Flora & Fauna was evaluated through field sampling, reconnaissance surveys and from secondary sources. Important Flora & Fauna species of the eco systems of the study area have been enumerated. The impact in the context of Flora & Fauna in the study area is not considered to be significant as the proposed project area does not contain any endangered and endemic Flora & Fauna. Stage-wise implementation of preservation and upgradation of ecological environment shall be carried out if it requires on regular monitoring during operation of the proposed project members.

Flora assessment

The forests in the study area fall under sal and mixed forests type. The sal forests of the area are further classified as high level and low level moist deciduous forest and southern dry mixed deciduous forest. The top canopy comprised of sal *(Shorea Robusta),* Bahara *(Terminalies balerica)*, Bijasal *(Petrocarpus marsupium),* Harra *(Terminalies Chebula),* Seja *(Lagerstoemis parviflora)*, Mahua *(Madhuca indica)*, Haldu *(Adina cardofloia)*, Tendu *(Diospyrs malanoxylon)*. The wild species Amaltas *(Cassia fistula)* and sagon *(Tectona garndis)* on the hillocks is true representative of the tropical dry deciduous forests. In the forest useful shrubs like fodder for animals, herbs of medicinal value, grass species for grazing are also found.

Fauna assessment

Wild life found in the buffer zone generally includes Hyaena *(Hyaena hyaena)* and Jackal *(Canis aureus)* among the Carnivora and Nilgai *(Boselaphus tragocamelus)* and hare *(Lepus nigricollis)* among the herbivora. Other animals found are Langus *(Presbytis entellus)* and Fox *(Vulpes nengalensis).*

Common varities of **birds** of importance found in the area are Lowwa *(Perdicula asiatica),* Teetar *(Francolinus Pondicerianus)*, Harial/common Green Pegion *(Treron phoenicoptera)* and Fakhta/Spotted Dove *(Streptopelia Chinensis)*. Other birds commonly found are Tota *(Psittacula supatria)*, Bulbul *(Pycnonotus cafer)*, Cattle erget *(Bubulcus ibis)*, Brahminy myna *(Sturnus pagodarum)*, Common king fisher *(Alcedo athis)*, Red wattled lapwing *(Venellus indicus)*, White backed vultures *(Gyps bengalensis)* and blue jay *(Coracias bengalensis)*.

Reptiles generally noticed are snakes, i.e. Cobra *(Naja naja),* Python *(Python molurus)*, Rat Snake *(Ptyas mucosus)* etc. and monitor Lizard *(Varanus sps.)*

In the tanks and rivers, variety of **fish** is found. Commonly found species are Rohu *(Labeo rohita)*, Vam *(Mastocembelus armatus)*. Chital *(Notopterus Chitala)*, Padhin *(Waltage Atta)*, Catla *(Catla Catla)*, Shanwar *(Channa Marulies)*, Manguri *(Clarias Batrachus)*, Singham *(Heberos neuster fossilis)*, Keu *(Anabas tertudineus)* etc.

Among **reptiles**, Krait and Rat snakes are the commonest

Conservation Plan

Compensatory afforestation and Strengthening of safety zone will be done. The reclaimed and afforested internal dump will form one integral unit at the cessation of the mining activity. SECL will develop this integrated area, as habitat for the fauna.

16.1.5 Socio-economic Status

In the core zone there are two villages viz. Bhalmuri and Soutanchua located. The population predominantly comprises of agriculture labourers and non-workers.

16.2 Environment Impact

16.2.1 Air Quality:

Impact assessment on air quality has been shown in table 16.7.

Table 16.7

Sl.No	Parameters	Impact Assessment	
1.00	Meteorological Condition	Coal dumps are susceptible to fire, and Spontaneous combustion may occur therein; hence, there may be a likely change in ambient temperature, wind speed and direction to somewhat extent.	
2.00	Ambient air quality	**Type**	**Impact**
2.01		Direct	Minimal increase in dust & noxious emission to the air owing to transport vehicles, Blasting, coal & dump handling causing to slight increase in the ambient SPM levels.
2.02		Indirect	Surface coal transport & dump handling & Workshop will generate indirect impact in the long run
2.03		Short term	Drilling and Blasting may be attributed to slight increase in the ambient SPM levels
2.04		Long term	Surface coal transport, dump handling & Workshop will produce long term impact upon the air quality

16.2.2 Water Quality

Impact assessment on water is shown in table 16.8 below.

Table 16.8

Sl.No	Parameters	Impacts Assessment
1.00	**Hydro-geological-Ground water**	
1.01	Topography	Topography and drainage by developing micro basins

	& drainage	
1.02	Aquifer geometry	Changes in aquifer geometry, water level in the vicinity of the mine and disturb ground water flow direction. This can also create secondary fractures and higher permeability zones within the aquifer. After the mining activity, the aquifer restores its original water level and mined out area acts as a good reservoir.
1.03	Water levels	The project is an opencast mine, the impact of mining on local water levels will be limited to few hundred meters.
2.00	**Water Quality- Physico-Chemical and Bacteriological ones**	
2.01	Ground Water Quality	Acceptable; No abnormality.
2.02	Surface Water Quality	-Do-

16.2.3 Ground Water Resource

A detailed hydrogeological study will be carried out, to predict the probable impact of mining on local water regime, during preparation of EIA/EMP report of the project. Water Balance for Rajnagar OC is given below:

Rajnagar OC: The net annual ground water recharge and net draft in the buffer zone were estimated at **52.16 M.Cum and 25.01 M.Cum** respectively. Thus, the balance available annual ground water recharge in the area would be **27.15 M.Cum**. The details of recharge estimates and balance are shown in the following pie diagram.

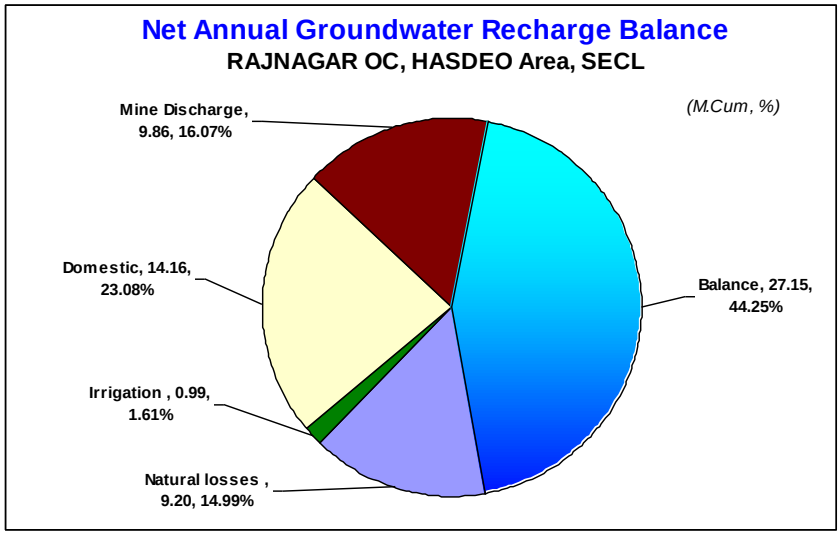

Figure – 16.1

16.2.4 Noise Impact

Noise impact assessment has been shown in the following table 16.9.

Table -16.9

Sl.No	Parameters	Impacts Assessment
1.00	Increase in Noise Levels at drilling and blasting	May have impact upon the workers and the nearby habitants. The impact of noise more than permissible dosage may cause Annoyance and irritation, Mental and Physical fatigue, Interference in normal activities, Health hazards resulting from impaired hearing. In extreme cases, cardio-vascular diseases etc., Task interference, Interference with communication i.e., masking.
2.00	Increase in Noise Levels at Operation of HEMMs like shovel, dumper, dozer, excavator etc.	Same as above
3.00	Increase in Noise Levels at Operation of equipment in CHP, workshop etc	Same as above
4.00	Increase in Noise Levels due to transport system	Same as above

16.2.5 Flora and Fauna

Impact assessment on flora & fauna has been shown below in Table 16.10.

Table 16.10

Sl.No	Parameters	Impact Assessment
1.00	**Negative**	
1.01	Vegetation Cover	Except the area such as used for quarry excavation, erection & development of plants, service & allied structures, colony, roads, diversions, culverts, etc, no other area is going to affected directly or indirectly by mining activities . Hence, impact on flora and fauna will not be of appreciable level.

Sl.No	Parameters	Impact Assessment
1.02	Forests degradation	323.737 Ha (67.06%, of total project area of 482.694 Ha.) of forests land is going to be affected by mining activity. Against this, 404.004 Ha of area will be generated by way of reclamation of dump areas, plantation in other available areas etc. By coal & OB transportation air pollution may affect photosynthesis and transpiration in plants by plugging their leaves pores. SO_2 causes Necrosis disease in plants. Hence, major impact on flora and fauna.
1.03	Ecological change	Being an opencast project, there is minor change expected in ecological parameters on which survival of flora and fauna depends directly or indirectly, and hence, expected impact on flora and fauna are not going to an appreciable level.
1.04	Hydro-geological aspects	Owing to opencast project, water level and draw down are likely to be affected to a nominal value; ground water and surface water on which the flora and fauna of the area directly or indirectly depend upon are not going to be affected to an appreciable level. After mine closure, the Mine void will act a stable water source for the flora & fauna.
2.00	**Positive**	
2.01	Plantation work and forest & wild life conservation	Plantation work and forest & wild life conservation in a scientific way by project authorities in mine area will increase aestheticism of the area.

16.2.6 Land Use

Impact assessment on land use has been shown below in Table 16.11.

Table 16.11

Sl. No.	Parameters	Impact Assessment	
		Within mining area	**Outside mining area**
1.0	Topography	In the quarry area, the dump area and the mining equipment area, there will be a marked change in topography.	No appreciable damage is envisaged.
2.0	Change in Landscape and Land use pattern than pre-	Total scenario of landscape land use pattern will undergo a stark change.	Landscape and land use pattern will change where erection and development of

Sl. No.	Parameters	Impact Assessment	
		Within mining area	**Outside mining area**
	mining scenario such as visual impact-loss of aesthetic beauty, ugly scar on land; deforestation-loss of surface soil and vegetation cover		plants, service /allied services buildings are established.
3.0	Change in Surface Drainage.	There will be a stark change in surface drainage; rather new pattern of drainage will be developed.	Surface drainage is likely to change where construction of colony, roads and drainage are to be executed.

16.2.7 Impact on Socio-Economic Status

In the core zone there are are two villages viz. Bhalmuri and Soutanchua located. The population predominantly comprises agriculture labour and non-workers. The no. of PAFs is 160. Rehabilitation & Resettlement of the PAFs will be done following the State R & R Provisions & CIL R&R policies. The involved homesteads will be suitably shifted in rehabilitation site of 8.01 Ha land. The population of the study area are predominantly comprises with agriculture labor and marginal workers. The probable impact on Socio-Economic Status of the study area is assessed below in table – 16.12.

Table-16.12

Sl.No	Impact on Socio- Economic Status
1	Population Growth & In-migration
2	Human Settlement & Resettlement / Rehabilitation
3	Transport & Communication
4	Income & Employment
5	Civic Amenities& Community Development
6	Educational facilities & Literacy Drive
7	Economic growth
8	Growth of Financial Revenues (State & Central)
9	Social status growth

16.3 Environment Management

16.3.1 Air Quality Management

Following air pollution control measures are will be practiced within the mining area and at coal handling plants and railway siding.

1. Water spraying will be done regularly on approach roads within the mining area to minimise the dust generation.

2. Fixed sprinklers will be provided at the coal loading points/ discharging points.

3. Adequate plantation will be done along the width of the haul road and other road to minimize transport generated pollutants. The distance of haul road provided is 1.8 Km.

4. Coal transportation to railway siding will be done in covered trucks. The distance of railway siding from the quarry area is 7 Km.

5. Exposed overburden dumps will be covered through an appropriate plantation.

6. The drills will be equipped with dust arresting devices or wet drilling arrangement.

7. Optimum blast-hole geometry will be followed to reduce the dust during blasting.

8. Regular monitoring of ambient air quality of project area.

16.3.2 Water Quality Management

Management of surface water drainage: -

Garland drains will be made around the periphery of the quarry to drain out the water of catchment area into the reservoir. In the workings, heavy duty pumps will be deployed in rainy season which after passing through settling ponds will throw the accumulated water from the working face into these garland drains, which in turn will be delivered into the reservoir.

Mine Water Discharge

The water quantity at the floor of mine sump to be collected in different stages has been assessed at 10% probability. The sump capacity is 257366 Cum. in the final stage of mine operation. The sump water will be pumped out and discharged to the settling tank where suspended solids will get settled.

The clear water after sedimentation & treatment will be recycled for water sprinkling, plantation & agriculture purpose, ground water recharge & for use by the local villagers etc. Collected water, after settling tank will also be discharged into the surface drain which in turn will deliver into the reservoir. Workshop effluents will be recycled through Oil and Grease trap and sedimentation tank.

Domestic Effluent Treatment: -

No separate colony is required for the workers of this project.

Water Conservation: -

The waste water recycling after due treatment will enable conservation of water. The clear water after sedimentation & treatment will be reused for water sprinkling, plantation & agriculture purpose, ground water recharge & for use by the local villagers etc. Workshop effluents will be discharged and treated through Oil and Grease trap and sedimentation tank.

Storage of conserved water in mine pits would be given due emphasis to provide water round the year and the quality of water would be maintained. The balance left mined out area of 67.93 Ha would be treated as water body after mine closure. The depth of the void is 60 m from ground level. The water body would serve as a considerable source of water for the use of local population after final closure.

Control measures adopted against impact on ground water regime:-

i) The impact will be limited to a smaller distance and for a temporary period. The effected habitation will be provided with suitable drinking water supply by sinking hand pumps in the habitat.

ii) The entire mine industrial water demand, would be met from the treated mine discharge. The wastage of water will be minimized.

iii) The surplus treated mine water will be discharge into the agricultural fields. Thereby, the mine water will behave as constant source of recharge and improves the water levels in the mine area. This will also become a resource for the local public and increase agriculture output.

iv) So also, after cessation of mining, part of the quarry area will be reclaimed with highly permeable OB material. The final void would be converted into a water reservoir. Thus, in post-mining, the recharge and source potential in core zone will be much higher than the existing.

v) With the increase in secondary porosity, a significant improvement in the rainfall infiltration rate, close to the mine area can be anticipated.

16.3.3 Noise Management

The present noise levels are below the prescribed limits. If the impulsive noise levels increase due to mining operation, suitable measures will be adopted to maintain the noise level within permissible limits at working zone. The following measures are adopted and will be continued:

1. Planting of rows of trees with thick foliage along roads and other noise generating centers to act as acoustic barriers.

2. Isolating/enclosing the noisy machines/sources by using resilient mounting/altering structures.

3. Routine maintenance schedules for HEMM and other machineries to eliminate noise as far as possible.

4. Balanced and properly aligned conditioning of machines to reduce vibration.

5. Provision of ear muffs/ear plugs to workers subjected to noise level above recommended limits.

6. Controlled blasting.

7. Regular monitoring of noise level of project area.

16.3.4 Flora and Fauna Management

The location of Jhiria West OC project does not have any importance as a holiday resort. The surface to be disturbed by open cast mining operation does contain any rare variety of flora or fauna. The area is also thinly populated. As such, consequent to the opencast mining operation, deterioration in quality of life or loss of amenity is not envisaged. Conservation plans of schedule I & II animals, if any, will be prepared and implemented.

Compensatory afforestation and Strengthening of safety zone will be done.

The reclaimed and afforested internal dump of 294.458 Ha will form one integral unit at the cessation of the mining activity. SECL will develop this integrated area, as habitat for the fauna. The following steps will be taken for development of habitat.

Reclamation of mine void:

In the core zone, after the cessation of mining activity a void will be created. This void will be used as a water body. This will be graded to a gentle slope so that it acts as a safe approach / access to the water body for the faunal species.

Through CSR activities in villages existing in the buffer zone, existing water sources particularly the village tanks will be improved to provide drinking water to the local community so that biotic pressure on water resources present in the forest areas and used by fauna is gradually reduced.

Control of forest fire, fire in coal seam and coal stock:

Fire can destroy the entire habitats (micro and macro) and its life supporting potential in a forest area. Fire does not spare fauna also. SECL will implement the existing DGMS stipulated fire protection norms on coal seams and coal stock. This will ensure that a congenial atmosphere is created and fire does not affect the fauna and flora as well.

16.3.5 Land Resource Management

Present land use would be converted into internal dump, green belt, built up area, surface infrastructure, final void/water body & other surface water body etc. after the cessation of mining operation. In the initial years i.e. upto 3rd year, OB quantities will go to the external dumps. Internal dumping will start from the 4th year onwards.

The parting OB in case of older seam may be transported through central haul road, while mining in the multi seam zone. 19.08 Mcum OB will be externally dumped within quarry area from 2nd year to 3rd year for which 78 Ha land will be required within the quarry boundary area. External dump has been made near western boundary. This temporary external dump will be rehandled to internal dump subsequently. From 7th year to 10th year the external dump will be rehandled back to internal dump. Site of external dump has been proposed within the quarry boundary area to save forest land beyond quarry excavation area. In case of external dump, spoil bench height will be kept 30 m. There will be one bench and total dump height above surface will be 30m.

Dump	**OB accommodated in Mcum**
1. Internal dump	115.33
2. External dump outside Quarry area	0.00

Top soil will be removed and stored separately. This soil will be directly spread over the leveled graded backfilled spoil for reclamation of the quarried out land.

Out of 362.388 Ha of quarry area, plantation would be done in 294.458 Ha. There would be a final void/water body of 67.93 Ha left in the project after mine closure. The dump surface would be maintained flat and top soil would be sprayed over it as a part of final reclamation.

Plantation of 736145 No in 294.458 Ha of internal dump, 211945 No in 84.778 Ha of safety zone and 61920 Nos. in 24.768 Ha around the mine infrastructure, colony etc. @ 2500 Nos./Ha. The no. of plantation is given as under.

Table -16.13

No.	Locations	No. of trees
1.	Mine infrastructure, colony etc.	61920
2.	Internal Dump after backfilling	736145
3.	External dump	0.00
4.	Safety zone	211945
	Total Plantation	**1010010**

Pre-mining Land Use: The pre-mining land requirement is given below.

Table 16.14 (Area in Ha.)

Sl. No	Requirement of Land	Forest Land	Tenancy Land	Govt. Land	Total
1	Quarry Area	268.495	48.400	45.493	362.388
2	Safety Zone	52.082	24.812	7.884	84.778
3	External dump	0.000	0.000	0.000	0.000
4	Land for Infrastructure	0.000	3.338	1.440	4.778
5	Additional Land for approach road etc.	3.160	4.580	0.000	7.740
	Sub-Total	**323.737**	**81.130**	**54.817**	**459.684**
5	Land for Belt, CHP & Siding	0.000	15.000	0.000	15.000
6	Land for R&R site	0.000	8.01	0.000	8.010
	Sub-Total	**0.000**	**23.010**	**0.000**	**23.010**
	Total Land TO BE ACQUIRED	**323.737**	**104.140**	**54.817**	**482.694**

Post-Mining Land Use: The conceptual post–mining land use is given below. This will be updated further after obtaining the present land-use.

Table-16.15 Post- Mining Land Use (Figures in Ha.)

Sl.No	Particulars	Quarry Area	External Dump	Safety zone as green belt	Land of Infrastructure, colony and others	R&R site	Grand Total
1.	Afforested area	294.458	0.000	84.778	24.768	0.000	**404.004**
2.	Grassland	0.000	0.000	0.000	0.000	0.000	**0.000**
3.	Final Void / Water Body	67.930	0.000	0.000	0.000	0.000	**67.930**
4.	Other Water Bodies	0.000	0.000	0.000	0.000	0.000	**0.000**
5.	Built-Up Area.	0.000	0.000	0.000	2.750	8.010	**10.76**
Total Land		**362.388**	**0.000**	**84.778**	**27.518**	**8.010**	**482.694**

16.4 Environment Management System

16.4.1 Monitoring Schedule

Environmental monitoring will be carried out following the monitoring schedule for Air, Water, and Noise levels as per Standards of MOEF (Vide GSR 742 (E) dated 25.9.2000).

16.4.2 Plantation Monitoring

The project authority at field level will continuously monitor the growth and survival/mortality rates of the plantations till the end of 3 years. Once trees attain desired growth, no further monitoring will be required.

16.4.3 Action Plan for Land Reclamation and Plantation

The estimated life of the mine is 12 years. Maximum height of internal dump would be 50 m from the ground level. The dump surface would be maintained flat and top soil would be sprayed over it as a part of final reclamation. The maximum depth of quarry would be 60 m from the ground level. Approximate total no. of plants is estimated as 1010010 Nos. An area of 67.93 Ha would be left as final void/water body after mine closure.

Year wise programme of OB removal, dumping, & plantation has been given in table 16.16 and stage plans (5 year) as well as final stage reclamation plan & cross-section thereof are shown in Figures -18.2, 18.3, 18.4 & 18.5 respectively

The action programme for EMP implementation is given below in figure-16.2.

16.4.4 Organizational Structure

For implementing the environment management plan (EMP) of the project, the organizational structure has been shown in figure-16.3.

Table16.16 Programme of O.B. Removal, Dumping & Plantation

Year	Coal production (MTes)	OB removal (Mcum)	Dump plan (Mcum)		Dump area (Ha.)		Dump area available for reclamation (Ha.)		No of plantation /2500 Nos / Ha.
			External	Internal	External	Internal	External	Internal	
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
2	0.50	4.00	4.00	0.00	16.35	0.00	0.00	0.00	0
3	1.00	8.00	8.00	0.00	32.71	0.00	0.00	0.00	0
4	1.50	11.50	7.08	4.42	28.94	12.572	0.000	0.000	0
5	1.50	11.50	0.00	11.50	0.00	29.563	0.000	0.000	0
6	1.50	11.50	0.00	11.50	0.00	29.563	0.000	18.380	45950
7	1.50	11.50	-4.77	16.27	0.00	41.011	0.000	18.380	45950
8	1.50	11.50	-4.77	16.27	0.00	41.011	0.000	18.380	45950
9	1.50	11.50	-4.77	16.27	-19.50	41.011	0.000	18.380	45950
10	1.50	11.50	-4.77	16.27	-19.50	41.011	0.000	18.380	45950
11	1.50	11.50	0.00	11.50	-19.50	29.563	0.000	29.444	73610
12	1.50	11.33	0.00	11.33	-19.50	29.155	0.000	29.444	73610
MC	0.00	0.00	0.00	0.00	0.00	0.000	0.000	47.890	119725
MC	0.00	0.00	0.00	0.00	0.00	0.000	0.000	47.890	119725
MC	0.00	0.00	0.00	0.00	0.00	0.000	0.000	47.890	119725
Total	**33.31**	**249.79**	**0.00**	**115.33**	**0.00**	**294.458**	**0.000**	**294.458**	**736145**

Note 1: The number of plantation 736145 mentioned above is calculated for internal dump area alone. Since external dump will be rehandled grassland is proposed for 78. Ha area.

ACTION PROGRAMME FOR EMP IMPLEMENTATION

Jhiria West OC Project (1.50 Mty), Hasdeo Area.

Sl.NO	Duration/ Activities	1	2	3	4	5	6	7	8	9	10	11	12	M1	M2	M3
1	Rehabilitation & Resettlement of project Affected Families/ Persons															
2	Afforestation/ Plantation															
3	Compensatory Afforestation															
A	External Dump															
	a. Filling(Dumping)															
	b. Grass plantation															
	c. Rehandling															
B	Internal Dump															
	a. Filling															
	b. Reclamation (Technical)															
	c. Plantation															
4	Env. monitoring / health monitoring															
5	Operation/ maintenance of oil, grease trap, DETP															
6	Water sprinkling on haul roads, chp															
7	CSR Activities in villages															
8	Final Mine closure activity															

M - MINE CLOSING STAGE

Figure-16.2

ORGANISATION CHART FOR ENVIRONMENT MANAGEMENT SYSTEM (JHIRIA WEST OCP, 1.50 Mty)

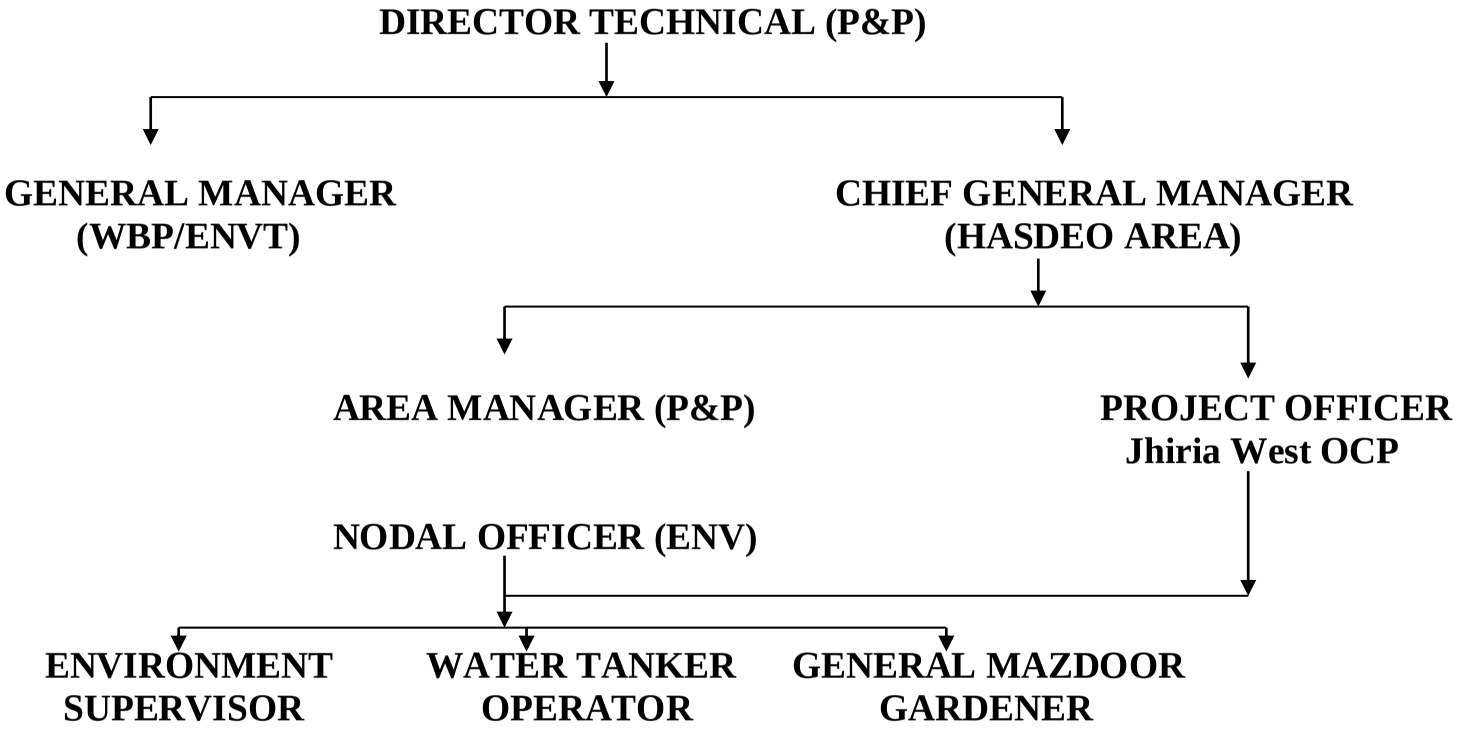

Figure-16.3

16.4 Capital Provision

Statement showing the estimated capital requirement for Environmental and Social Measures is shown in following tables 16.17, 16.18 and 16.19.

Table -16.17

APPENDIX-F

PROJECT REPORT FOR JHIRIA WEST OPENCAST PROJECT (1.50 Mty)

Statement showing the estimated capital requirement for Environmental Protection Measures.

Outsourcing Option

S.N.	PARTICULARS	AMOUNT
1.	**COST OF REHABILITATION**	
i)	Total No. of Displaced Family likely to be rehabilitated	220
	CAPITAL ESTIMATE	
		Amt. Rs.in Lakhs
A.	Total Cost of R&R	
a)	Total cost of R&R as per second schedule of RFCTLARR Act 2013	3616.81
b)	Total cost for provision of infrastructure as per third schedule of RFCTLARR Act 2013	888.48
c)	Land for R&R site etc (5.825 Ha).	227.48
	Sub-total of (1)	**4732.77**

Note : 1. Total number of displaced family is as supplied by area authority.

2. Total cost of R&R as per RFCTLARR Act 2013 as supplied by SECL

Amt.Rs.in Lakhs

S.N.	PARTICULARS	AMOUNT
2.	**CAPITAL FOR RESTORATION**	
a	Piezometers for measuring water level (6 Nos)	40.00
b	Green belt fencing 15m width along safety zone of the Project (approx.11.0 km)	22.00
	Sub-Total (2)	**62.00**
3.	**CAPITAL FOR ANTI-POLLUTION MEASURE IN MINE & INDUSTRIAL AREA**	
a	Settling tank for mine water disposal (Appendix-A.8.3.(A)	47.20
b	Chain Link Fencing double row around the Project (approx.2x11.0 km) (Appendix-A.8.1)	220.00
c	Other development measures in industrial site viz. drains,tree guards etc. (Appendix-A.8.2.1)	87.89
d	Garland drains (Appendix-A.8.1)	110.00
e	Arboriculture/plantation in industrial area (Appendix-A.8.1.)	2.50
f	Misc. and Contingency	200.00

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Amt.Rs.in Lakhs

S.N.	PARTICULARS	AMOUNT
g	Dust suppression at Haul Road & CHP (Appendix-A.3.5, A.3.6)	60.00
h	Dust suppression at Railway siding (Appendix-A.5)	20.00
i	Water Treatment Plant for mines(LS) (Appendix-A.8.1)	200.00
j	Oil and grease trap (Appendix A21)	5.90
k	Real time slope monitoring system (Appendix A.8.1)	700.00
	Sub-Total(3)	**1653.49**
4.	**ENVIRONMENTAL CONTROL MEASURES IN TOWNSHIP**	
a	Aboriculture/plantation (Appendix-A.8.1)	2.50
b	Rain Water Harvesting (Appendix-A.2.2)	7.08
c	Water Treatment Plant (Appendix-A.8.3)	12.31
d	Sewerage Treatment Plant(Appendix-A.8.3(A)	472.00
e	Other development measures in township to improve cleanliness & aesthetics parks-play-grounds & tree guards (App-A.8.2)	5.90
	Sub Total (4)	**499.79**
5.	Stone pitching of Embankment on nallah side (App.-A.8.1)	50.00
6.	Cost of EMP preparation(Appendix-A.8.4)	50.00
7.	Community development in surrounding villages (Appendix-A.8.1)	20.00
	Total capital from 1 to 7	**7068.05**
B.	**Different type of Revenue nature cost to be considered in cost of production per tonne of Coal:-**	
1.	Land reclamation/restoration @1.25 lakhs/Ha for technical and biological reclamation (lakhs/annum)	50.28
2	Environment Audit Rs @ 0.60 lakhs/annum	0.60
3	Environment monitoring Rs @156.0 lakhs/annum	156.00
4	Monitoring of landuse through satellite surveillance lakhs/annum	8.00
5	Mine Closure cost lakhs/annum	333.703
6	Monitoring of CSR and RR plan lakhs/annum	2.00
	Total Revenue nature cost per annum	**550.583**

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SECL Hqrs

Table 16.18

Departmental option

Amount in Rs Lakhs

S.N.	PARTICULARS	AMOUNT
1.	**COST OF REHABILITATION**	
i)	Total No. of Displaced Family likely to be rehabilitated	220
	CAPITAL ESTIMATE	
		Amt. Rs.in Lakhs
A.	Total Cost of R&R	
a)	Total cost of R&R as per second schedule of RFCTLARR Act 2013	3616.81
b)	Total cost for provision of infrastructure as per third schedule of RFCTLARR Act 2013	888.48
c)	Land for R&R site etc (5.825 Ha).	227.48
	Sub-total of (1)	**4732.77**
2.	**CAPITAL FOR RESTORATION**	
a	Piezometers for measuring water level (6 Nos)	40.00
b	Green belt fencing 15m width along safety zone of the Project (approx.11.0 km)	22.00
	Sub-Total (2)	**62.00**
3.	**CAPITAL FOR ANTI-POLLUTION MEASURE IN MINE & INDUSTRIAL AREA**	
a	Settling tank for mine water disposal (Appendix-A.8.3.(A)	47.20
b	Other development measures in industrial site viz. drains,tree guards etc. (Appendix-A.8.2.1)	87.89
c	Garland drains (Appendix-A.8.1)	110.00
d	Arboriculture/plantation in industrial area (Appendix-A.8.1.)	2.50
e	Misc. and Contingency	200.00
g	Dust suppression at Haul Road & CHP (Appendix-A.3.5, A.3.6)	60.00
h	Dust suppression at Railway siding (Appendix-A.5)	20.00
i	Water Treatment Plant for mines(LS) (Appendix-A.8.1)	200.00
j	Real time slope monitoring system (Appendix A.8.1)	700.00
k	Effluent Treatment Plant (Appendix-A.8.3(A)	472.00
	Sub-Total(3)	**1899.59**
4.	**ENVIRONMENTAL CONTROL MEASURES IN TOWNSHIP**	
a	Aboriculture/plantation (Appendix-A.8.1)	2.50
b	Rain Water Harvesting (Appendix-A.2.2)	22.42
c	Sewerage Treatment Plant(Appendix-A.8.3(A)	472.00
d	Other development measures in township to improve cleanliness & aesthetics parks-play-grounds & tree guards (App-A.8.2)	17.70

Departmental option
Amount in Rs Lakhs

S.N.	PARTICULARS	AMOUNT
	Sub Total (4)	**514.62**
5.	Stone pitching of Embankment on nallah side (App.-A.8.1)	50.00
6.	Cost of EMP preparation(Appendix-A.8.4)	50.00
7.	Community development in surrounding villages (Appendix-A.8.1)	20.00
	Total capital from 1 to 7	**7328.98**
B.	**Different type of Revenue nature cost to be considered in cost of production per tonne of Coal:-**	
1.	Land reclamation/restoration @1.25 lakhs/Ha for technical and biological reclamation (lakhs/annum)	50.28
2	Environment Audit Rs @ 0.60 lakhs/annum	0.60
3	Environment monitoring Rs @156.0 lakhs/annum	156.00
4	Monitoring of landuse through satellite surveillance lakhs/annum	8.00
5	Mine Closure cost lakhs/annum	333.703
6	Monitoring of CSR and RR plan lakhs/annum	2.00
	Total Revenue nature cost per annum	**550.583**

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Table 16.19

Partial Outsourcing Option

S.N.	PARTICULARS	AMOUNT
1.	**COST OF REHABILITATION**	
i)	Total No. of Displaced Family likely to be rehabilitated	220
	CAPITAL ESTIMATE	
		Amt. Rs.in Lakhs
A.	Total Cost of R&R	
a)	Total cost of R&R as per second schedule of RFCTLARR Act 2013	3616.81
b)	Total cost for provision of infrastructure as per third schedule of RFCTLARR Act 2013	888.48
c)	Land for R&R site etc (5.825 Ha).	227.48
	Sub-total of (1)	**4732.77**

Note : 1. Total number of displaced family is as supplied by area authority.

2. Total cost of R&R as per RFCTLARR Act 2013 as supplied by SECL

APPENDIX-F (CONTD.)

Amt.Rs.in Lakhs

S.N.	PARTICULARS	AMOUNT
	CAPITAL FOR RESTORATION	
a	Piezometers for measuring water level (6 Nos)	40.00
b	Green belt fencing 15m width along safety zone of the Project (approx.11.0 km)	22.00
	Sub-Total (2)	**62.00**
3.	**CAPITAL FOR ANTI-POLLUTION MEASURE IN MINE & INDUSTRIAL AREA**	
a	Settling tank for mine water disposal (Appendix-A.8.3.(A)	47.20
b	Chain Link Fencing double row around the Project (approx.2x11.0 km) (Appendix-A.8.1)	220.00
c	Oil and grease trap (Appendix-A.2.1	5.90
d	Other development measures in industrial site viz. drains,tree guards etc. (Appendix-A.8.2.1)	87.89
e	Garland drains (Appendix-A.8.1)	110.00
f	Arboriculture/plantation in industrial area (Appendix-A.8.1.)	2.50

g	Misc. and Contingency	200.00
h	Dust suppression arrangement at CHP (Appendix-A.3.5, A.3.6)	60.00
i	Dust suppression at Railway siding (Appendix-A.5)	20.00
j	Water Treatment Plant for mines(LS) (Appendix-A.8.1)	200.00
k	Real Time Slope Monitoring System (AppA81)	700.00
	Sub-Total(3)	**1653.49**

S.N.	PARTICULARS	AMOUNT
4.	**ENVIRONMENTAL CONTROL MEASURES IN TOWNSHIP**	
a	Aboriculture/plantation (Appendix-A.8.1)	2.50
b	Rain Water Harvesting (Appendix-A.2.2)	10.62
c	Water Treatment Plant for colony (Appendix-A.8.3)	17.16
d	Sewerage Treatment Plant (Appendix-A.8.3(A)	472.00
e	Other development measures in township to improve cleanliness & aesthetics parks-play-grounds & tree guards (App-A.8.2)	5.90
	Sub Total (4)	**508.18**
5.	Stone pitching of Embankment on nallah side (App.-A.8.1)	50.00
6.	Cost of EMP preparation(Appendix-A.8.4)	50.00
7.	Community development in surrounding villages (Appendix-A.8.1)	20.00
	Total capital from 1 to 7	**7076.44**
B.	**Different type of Revenue nature cost to be considered in cost of production per tonne of Coal:-**	7296.44
1.	Land reclamation/restoration @1.25 lakhs/Ha for technical and biological reclamation (lakhs/annum)	50.28
2	Environment Audit Rs @ 0.60 lakhs/annum	0.60
3	Environment monitoring Rs @156.0 lakhs/annum	156.00
4	Monitoring of landuse through satellite surveillance lakhs/annum	8.00
5	Mine Closure cost lakhs/annum	333.70
6	Monitoring of CSR and RR plan lakhs/annum	2.00
	Total Revenue nature cost per annum	**550.58**

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CHAPTER - XVII

LAND REQUIREMENT

17.1 GENERAL

Jhiria West OC mine is being planned on a virgin block. The topography of the quarry area is almost flat with surface elevation varying from 515m to 555m above MSL. The details of land use and PAF are based on land use plan supplied by area authority.

Total land involved for the project is 482.694 Ha including land for industrial development, colony, approach road, coal transport road & road diversion, magazine and quarry safety zone. Out of total 482.694 Ha land, forest land is 323.737 Ha, tenancy land is 104.140 Ha and Govt. land is 54.817 Ha. Two villages namely, Bhalmuri and Soutanchua village are located within the mine area.

. Break-up of land use has been estimated on the basis of landuse plan supplied by area authority. The break-up of land for the purpose of this report are as follows: -

Sl. No.	Particulars	Forest Land	Tenancy Land	Govt Land	Grand Total
	Land requirement				
a	Quarry area	268.495	48.400	45.493	362.388
b	Safety zone	52.082	24.812	7.884	84.778
c	External dump				0.000
d	Land for infrastructures		3.338	1.440	4.778
e	Additional Land for Approach road etc.	3.160	4.580		7.740
	Sub-Total	**323.737**	**81.130**	**54.817**	**459.684**
f	Land for Belt, CHP & siding etc.		15.000		15.000
g	Land for R&R site		8.010		8.010
	Sub-Total	**0.000**	**23.010**	**0.000**	**23.010**
	TOTAL LAND TO BE ACQUIRED	**323.737**	**104.140**	**54.817**	**482.694**

The estimated capital requirement for land acquisition of the quarry as per RFCTLARR Act 2013 has been given in the Appendix A1.

17.3 STATUS OF LAND ACQUISITION

Two villages namely, Bhalmuri and Soutanchua village are located within the mine area. As per the data provided by SECL the Project Affected Family of these villages are about 220 Nos. The capital provision for R&R of these villages has been considered in the report.

The area is free from any industrial activity, and is also devoid of any monument of historical or archaeological importance. Jhiria West OC project is being planned on a virgin block. No land has been acquired so far. So, all the required land is to be acquired.

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CHAPTER-XVIII

MINE CLOSURE PLAN

18.1 Closure Planning details of mine

Jhiria West OC Project (1.50 Mty) is located in the Hasdeo Area of SECL. The project comprises mostly forest land (i.e. 323.737 Ha, 67.06 %) & tenancy land (i.e. 104.14 Ha, 21.57 %). The project area is not involved with any industrial and mining activities for which require regular environmental monitoring/audit. However in the study area, there are mining activities in Ramnagar Sub-Area in which CMPDI on behalf of SECL is carrying out environmental monitoring at different locations of the sub-area, which are utilized for preparation of this Chapter.

The project has been planned for a target capacity of 1.50 Mty for 12 years life to meet power grade coal. Beyond this life, the mine will be closed, if no further expansion towards the adjoining blocks/deeper seams, if any, is considered. The closure details are described below.

18.1.1 Mined out Land & proposed final land use

Pre-mining Land Use:

Table 18.1 Pre-mining land use (Area in Ha.)

Sl. No	Requirement of Land	Forest Land	Tenancy Land	Govt. Land	Total
1	Quarry Area	268.495	48.400	45.493	362.388
2	Safety Zone	52.082	24.812	7.884	84.778
3	External dump	0.000	0.000	0.000	0.000
4	Land for Infrastructure	0.000	3.338	1.440	4.778
5	Additional Land for approach road etc.	3.160	4.580	0.000	7.740
	Sub-Total	**323.737**	**81.130**	**54.817**	**459.684**
5	Land for Belt, CHP & Siding	0.000	15.000	0.000	15.000
6	Land for R&R site	0.000	8.010	0.000	8.010
	Sub-Total	**0.000**	**23.010**	**0.000**	**23.010**
	Total Land TO BE ACQUIRED	**323.737**	**104.140**	**54.817**	**482.694**

Table 18.2 Post-mining landuse (Area in Ha.)

Sl.No	Particulars	Quarry Area	External Dump	Safety zone as green belt	Land of Infrastructure, colony and others	R&R site	Grand Total
1.	Afforested area	294.458	0.000	84.778	24.768	0.000	**404.004**
2.	Grassland	0.000	0.000	0.000	0.000	0.000	**0.000**
3.	Final Void / Water Body	67.930	0.000	0.000	0.000	0.000	**67.930**
4.	Other Water Bodies	0.000	0.000	0.000	0.000	0.000	**0.000**
5.	Built-Up Area.	0.000	0.000	0.000	2.750	8.010	**10.76**
Total Land		**362.388**	**0.000**	**84.778**	**27.518**	**8.010**	**482.694**

18.2 Water quality management:

a) Physiography and drainage

The area has an undulatory to moderately rugged topography with general slope toward south-east direction. The area is governed by Kulharia nala flowing to SE in which numbers of small seasonal nalas are joining at rectangular fashion and from trellis type of drainage pattern. Kulharia nala is perennial in nature and discharging into Southerly-flowing Hasdeo river (a tributary of Mahanadi). The elevation of area ranges from 515 to 555 m. above M.S.L. the highest elevation recorded in the western part of the block while lowest elevation located in extreme SE corner of the block.

b) Details of Environmental Stations:

The project area is not involved with any industrial and mining activities for which require regular environmental monitoring/audit. However in the study area, there are mining activities in Ramnagar Sub-Area in which CMPDI on behalf of SECL is carrying out environmental monitoring at different locations of the sub-area, which are utilized for preparation of this Chapter. This will enable to obtain a comprehensive idea of water quality in and around the mining area. These stations were selected in the core and buffer zone of the project covering mine effluent, surface water, and ground water of the area.

c) Water quality status: The summarized water quality data are given below.

Drinking water quality:

The following are the drinking water quality data of Ramnagar Sub-Area.

Table 18.3 Period: Oct-Dec 2015

Sl. No.	Parameter	Unit of Measurement	Observed Value			IS 10500:2012	
			Input of Indranagar filter Plant	Output of Indranagar filter Plant	Below Detection Limit	Acceptable Limit	Permissible Limit in the Absence of Alternate Source
1	Colour	Hazen	8	10	5	5	15
2	Odour	Unitless	Agreeable	Agreeable	---	Agreeable	Agreeable
3	Taste	Unitless	Agreeable	Agreeable	---	Agreeable	Agreeable
4	Turbidity	NTU	BDL	BDL	1	1	5
5	pH	Unitless	7.16	7.26	0.01	6.5-8.5	No relaxation
6	Alkalinity as $CaCO_3$	mg/l	100.00	56.67	10	200	600

7	**Total Hardness as $CaCO_3$**	**mg/l**	403.33	258.67	**4**	**200**	**600**
8	**Iron**	**mg/l**	0.08	0.07	**0.06**	**0.3**	**No relaxation**
9	**Chlorides**	**mg/l**	15.17	17.50	**1**	**250**	**1000**
10	**Residual Free Chlorine**	**mg/l**	NIL	0.04	**0.02**	**0.2**	**1**
11	**Total Dissolved Solids**	**mg/l**	667.00	480.33	**35**	**500**	**2000**
12	**Calcium**	**mg/l**	65.07	58.40	**2**	**75**	**200**
13	**Copper**	**mg/l**	0.04	0.05	**0.03**	**0.05**	**1.5**
14	**Manganese**	**mg/l**	0.02	0.03	**0.02**	**0.1**	**0.3**
15	**Sulphate**	**mg/l**	106.00	106.67	**2**	**200**	**400**
16	**Nitrate**	**mg/l**	BDL	BDL	**0.5**	**45**	**No relaxation**
17	**Fluoride**	**mg/l**	0.41	0.39	**0.02**	**1**	**1.5**
18	**Selenium**	**mg/l**	BDL	BDL	**0.002**	**0.01**	**No relaxation**
19	**Arsenic**	**mg/l**	BDL	BDL	**0.002**	**0.01**	**0.05**
20	**Lead**	**mg/l**	BDL	BDL	**0.005**	**0.01**	**No relaxation**
21	**Zinc**	**mg/l**	0.03	0.02	**0.01**	**5**	**15**
22	**Hexavalent Chromium**	**mg/l**	0.01	0.02	**0.01**	**0.05**	**No relaxation**
23	**Fecal Coliform**	**MPN/ 100 ml**	NIL	NIL	**---**	**Nil**	**No relaxation**
24	**Boron**	**mg/l**	1.40	0.60	**0.2**	**0.5**	**1**
25	**Phenolic compounds**	**mg/l**	BDL	BDL	**0.001**	**0.001**	**0.002**

Table 18.4 Effluent water quality

S/L No.	SAMPLING STATIONS	PARAMETERS			
		pH	TSS	COD	O&G
1	MALGA MINE DISCHARGE	7.35	19.50	20.67	<1.0
2	SOUTH JHIMAR MINE DISCHARGE	7.30	22.50	23.33	<1.0

e) Measures for control of pollution

Management of surface water drainage: -

Garland drains will be made around the periphery of the quarry to drain out the water of catchment area into the reservoir. In the workings, heavy duty pumps will be deployed in rainy season which after passing through settling ponds will throw the accumulated water from the working face into these garland drains, which in turn will be delivered into the reservoir.

Mine Water Discharge

The water quantity at the floor of mine sump to be collected in different stages has been assessed at 10% probability. The sump capacity in final stage of mine operation is 257366 Cum. The sump water will be pumped out and discharged to the settling tank where suspended solids will get settled.

The clear water after sedimentation & treatment will be recycled for water sprinkling, plantation & agriculture purpose, ground water recharge & for use by the local villagers etc. Collected water, after settling tank will also be discharged into the surface drain which in turn will deliver into the reservoir. Workshop effluents will be recycled through Oil and Grease trap and sedimentation tank.

Domestic Effluent Treatment: -

E.T.P will be provided for industrial effluent treatment. A capital of Rs.400 lakhs has been allotted under the head of E.T.P. for Departmental Option. No separate colony is required for the workers of this project.

Water Conservation: -

The waste water recycling after due treatment will enable conservation of water. Storage of conserved water in mine pits would be given due emphasis to provide water round the year and the quality of water would be maintained. The balance left mined out area of 67.93 Ha. would be treated as water body after mine closure. This would serve as a considerable source of water for the use of local population.

e) Water balance of the area

A detailed hydrogeological study will be carried out, to predict the probable impact of mining on local water regime, during preparation of EIA/EMP report of the project. Water Balance for Rajnagar OC is given below:

Rajnagar OC: The net annual ground water recharge and net draft in the buffer zone were estimated at **52.16 M.Cum and 25.01 M.Cum** respectively. Thus, the balance available annual ground water recharge in the area would be **27.15 M.Cum**. The details of recharge estimates and balance are shown in the following pie diagram.

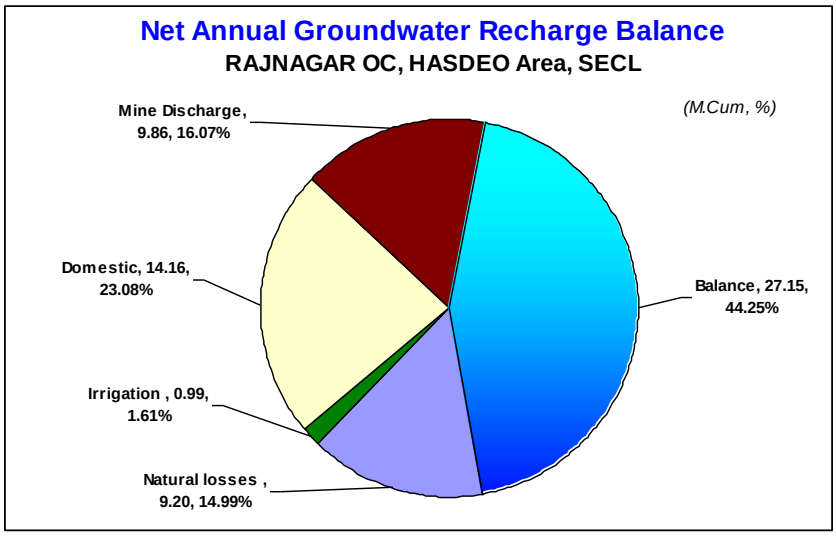


Figure – 18.1

c) Acid mine drainage source (if any), the existing practice of control and future plan.

The existing mine water quality of the nearby mines are not acidic and it is expected the acid mine drainage problem will not arise in this project also. If however acid mine drainage problem arises suitable measures will be taken as per standard prevailing practice.

d) Underground water/ quarry water management after closure (specify its usage like domestic water supply, irrigation, pisciculture or stabilizing the ground water regime).

67.93 Ha of mine void will act as a major water body in area after mine closure, which may be utilized by local population for domestic water supply (after treatment), irrigation, pisciculture and it will stabilize the ground water regime after mine closure. This may also act as water source for survival of fauna.

e) Water quality monitoring for three years after closure (specify the monitoring sampling station and frequency). The sampling stations shall be one no. mine water with quarterly frequency and two numbers ground water samples in core and buffer zone with quarterly frequency.

In the study area, there are mining activities in Ramnagar Sub-Area in which CMPDI on behalf of SECL is carrying out environmental monitoring at different locations of the sub-area, which are utilized for preparation of this Chapter. After

opening of the mine, environmental monitoring locations will be fixed, considering topography, population etc. of the core and buffer zone.

Thereafter, regular environmental monitoring will be carried out on the scheduled locations, and will continue up to 3 years after closure of the mine. Frequency of monitoring will be as per statute.

18.3 Air quality management:-

a) Air quality (Monitored data) Monitoring for next three years will be done. 3 samples at quarterly frequency for 3 years. One sample will be at core zone and one sample each in upwind and downwind directions of the project.

After opening of the mine, environmental monitoring locations will be fixed, considering topography, population etc. of the core and buffer zone. Thereafter, regular environmental monitoring will be carried out on the scheduled locations, and will continue up to 3 years after closure of the mine. Frequency of monitoring will be as per statute.

b) Ambient Air quality in core and buffer zone

Since, environmental monitoring data is available for Ramnagar Sub-Area, the same is utilised for this project. The locations for air sampling of Ramnagar Sub-Area, were decided considering the topography of the area, prevailing wind directions and approachability to the sampling site, regional background, population density and industrial activities in the area and their proximity to downwind direction.

c) Air quality status:

The summarised air quality monitoring data for SPM, RPM, SO2, & NO2 shown below in table -18.5. The air quality data of different locations are found to be within the permissible limit of CPCB.

Table – 18.5 Summarized Air Quality Data

Season: Oct-Dec 2015 (Values are in μgm/m^3)

Monitoring Location	SPM		RPM		SO_2		NO_X	
	Min	Max	Min	Max	Min	Max	Min	Max
Malga Incline/ Mine	*259*	*392*	*106*	*157*	*13*	*23*	*23*	*35*
Ravinagar Sub Station	*142*	*186*	*40*	*69*	*11*	*21*	*15*	*28*
Block " 1 " Sam Qtr.	*127*	*197*	*34*	*91*	*13*	*18*	*17*	*27*
South Jhimar Colliery	*346*	*420*	*130*	*241*	*12*	*21*	*23*	*34*
Indira Nagar Colony	*118*	*189*	*32*	*134*	*12*	*15*	*16*	*24*

The National Ambient Air Quality Standards (NAAQS) as per CPCB norms is given in table 18.6 below

Table 18.6

Standards	Category	SPM	RPM	SO_2	NO_X
NAAQS	Industrial (A)	500	150	120	120
	Residential (B)	200	100	80	80
	Sensitive (C)	100	75	30	30
As per MOEF notification GSR 742(E), dated 25th Sep'2000	Old mines (A-O)	600	300	120	120
	New mines (A-N)	500	250	120	120

d) Proposed Air Quality Management (if needed)

Following air pollution control measures will be practiced within the mining area and at coal handling plants and railway siding site.

1. Water spraying will be done regularly on approach roads within the mining area to minimise the dust generation.

2. Water sprinkling arrangement will be provided at the CHP and transfer point of coal.

3. Intensive plantation of adequate width all along the transportation road will be raised to minimise transport generated pollutants. The distance of haul road provided is 1.8 Km.

4. Coal transportation to railway siding will be done in covered trucks. The distance of railway siding from the quarry area is 7 Km.

5. Exposed overburden dumps will be covered through an appropriate plantation

6. Optimum blast-hole geometry will be followed to reduce the dust during blasting.

7. Regular monitoring of ambient air quality of project area.

18.4 Waste disposal :-

a) External OB dump & internal backfilling details (specify the reclaimed backfilled area, area of voids for water reservoir and also the OB dump area height and volume) prior to closure of mine or during progressive mine closure (as the case be).

19.08 Mcum OB will be externally dumped within quarry area from 2nd year to 3rd year for which 78 Ha land will be required within the quarry boundary area. External dump has been made near western boundary. This temporary external dump will be rehandled to internal dump subsequently. From 7th year to 10th year the external dump will be rehandled back to internal dump. Site of external dump has been proposed within the quarry boundary area to save forest land beyond quarry excavation area. In case of external dump, spoil bench height will be kept 30 m. There will be one bench and total dump height above surface will be 30m.

Dump	**OB accommodated in Mcum**
1. Internal dump	115.33
2. External dump outside Quarry area	0.00

Maximum height of internal dump will be	-	50 m (above ground level)
Slope of waste bench of internal dump	-	37 degrees
Height of individual bench	-	30 m
Width of berm	-	30 m

Top soil will be removed and stored separately. This soil will be directly spread over the leveled graded backfilled spoil for reclamation of the quarried out land.

b) Stabilization of external O.B. dumps and backfilled area (Technical Reclamation)

Initially, to the extent possible, top soil will be removed and stored separately. Subsequently, this soil will be directly spread over the leveled graded backfilled spoil for reclamation of the quarried out land. Biological reclamation work will follow in next progressive year.

Technical reclamation involves breaking and levelling the top of OB dumps, filling of gulleys and terracing etc. with the help of dozers keeping a mild slope of about 1 in 200 for surface water drainage. After technical reclamation, biological reclamation will start by plantation from 6th year onwards on internal dump.

The estimated life of the mine is 12 years. Maximum height of internal dump would be 50m from the ground level. Final depth of the quarry is 60 m. Estimate of

Plantation @ 2500 Nos./Ha throughout the life and closure phase of mine is given below.

Plantation of 736145 No in 294.458 Ha of internal dump, 211945 No in 84.778 Ha of safety zone and 61920 Nos. in 24.768 Ha around the mine infrastructure, colony etc. @ 2500 Nos./Ha. The no. of plantation is given as under.

Table -16.13

No.	Locations	No. of trees
1.	Mine infrastructure, colony etc.	61920
2.	Internal Dump after backfilling	736145
3.	External dump	0.00
4.	Safety zone	211945
	Total Plantation	**1010010**

Year wise programme of OB removal, dumping, & plantation has been given in table 16.16 and stage plans (5 year) as well as final stage reclamation plan & cross-section thereof are shown in Figures -18.2, 18.3, 18.4 & 18.5 respectively.

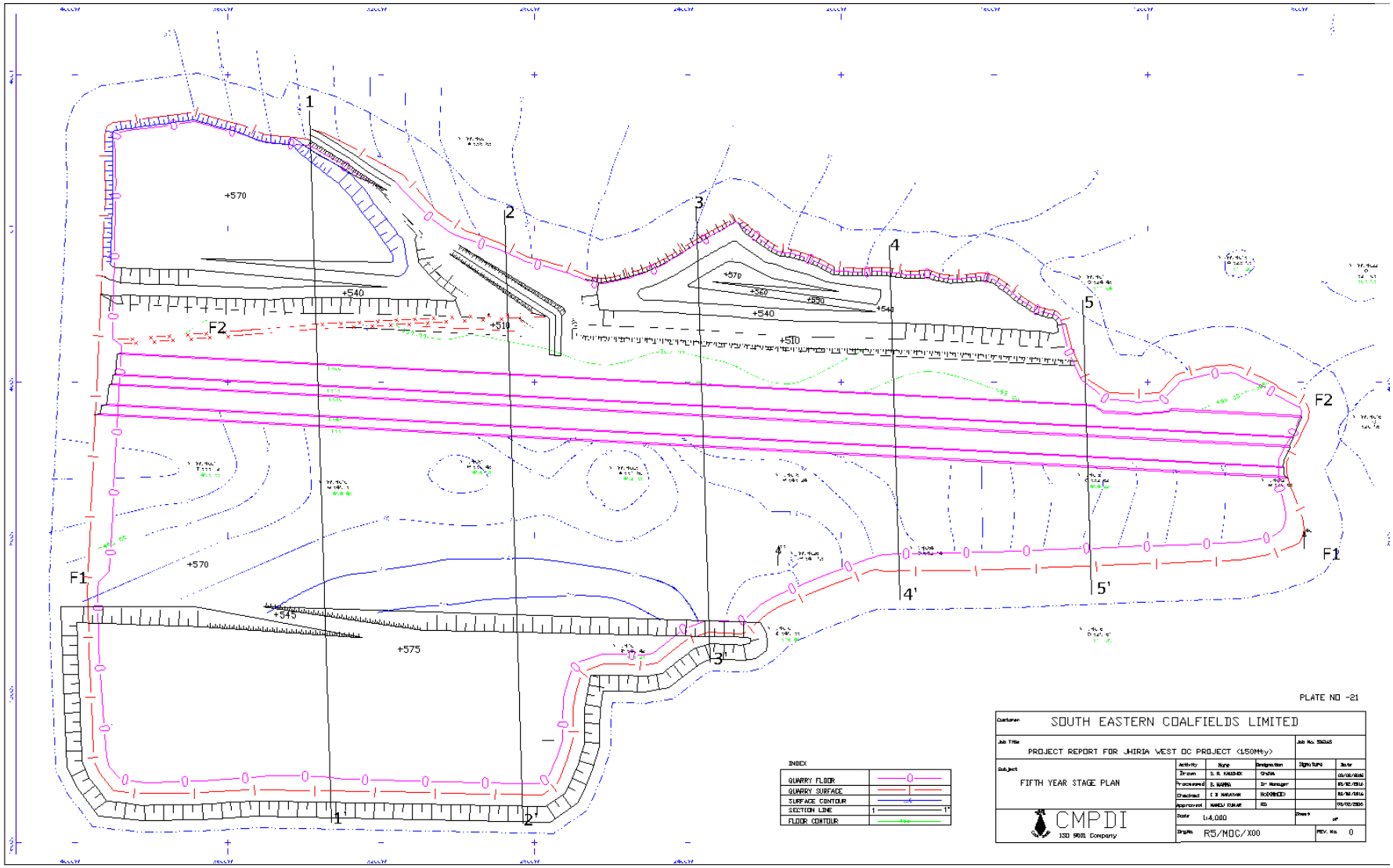


Figure-18.2 Fifth year Dump Plan

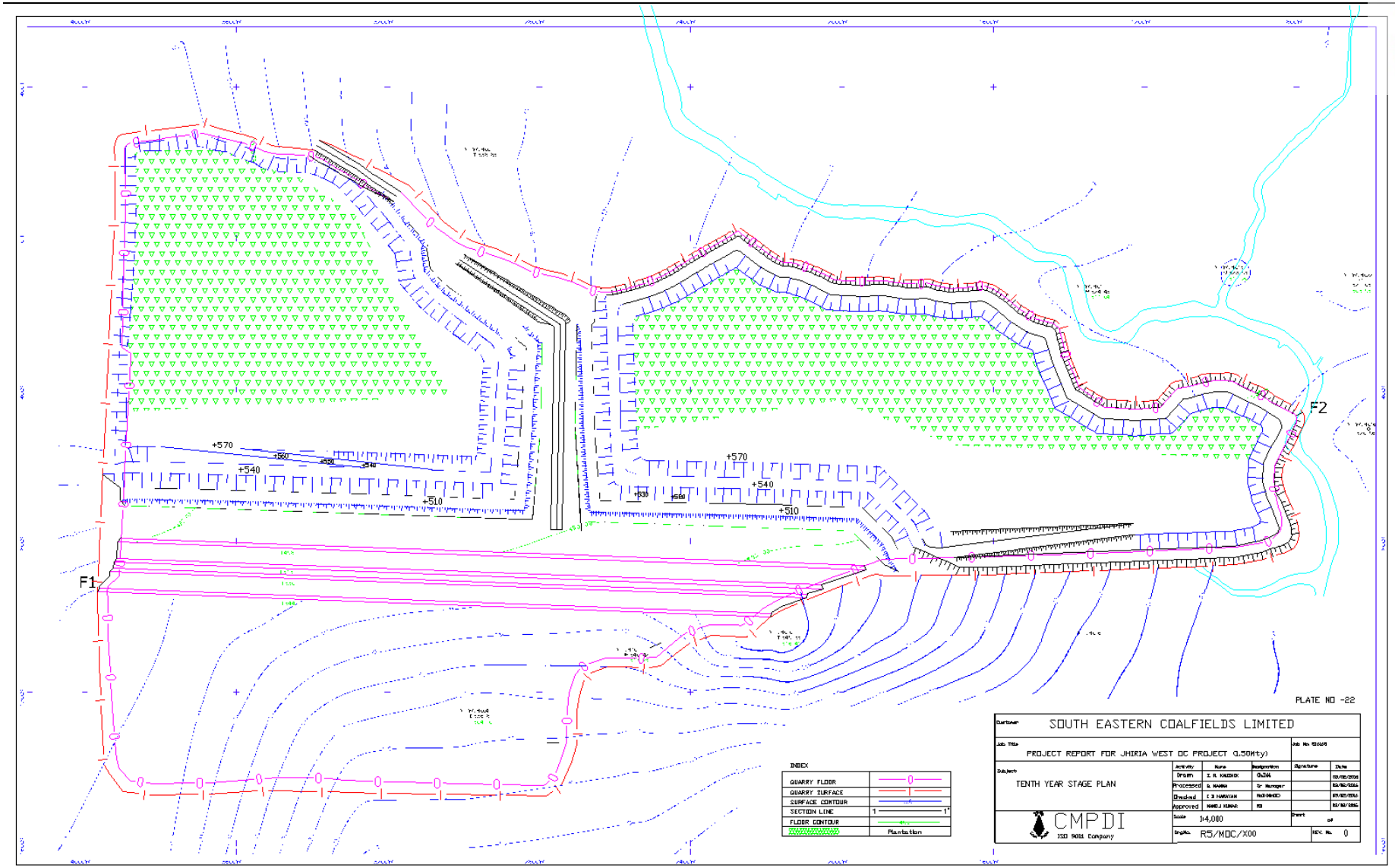


Figure-18.3 10th year Dump Reclamation Plan

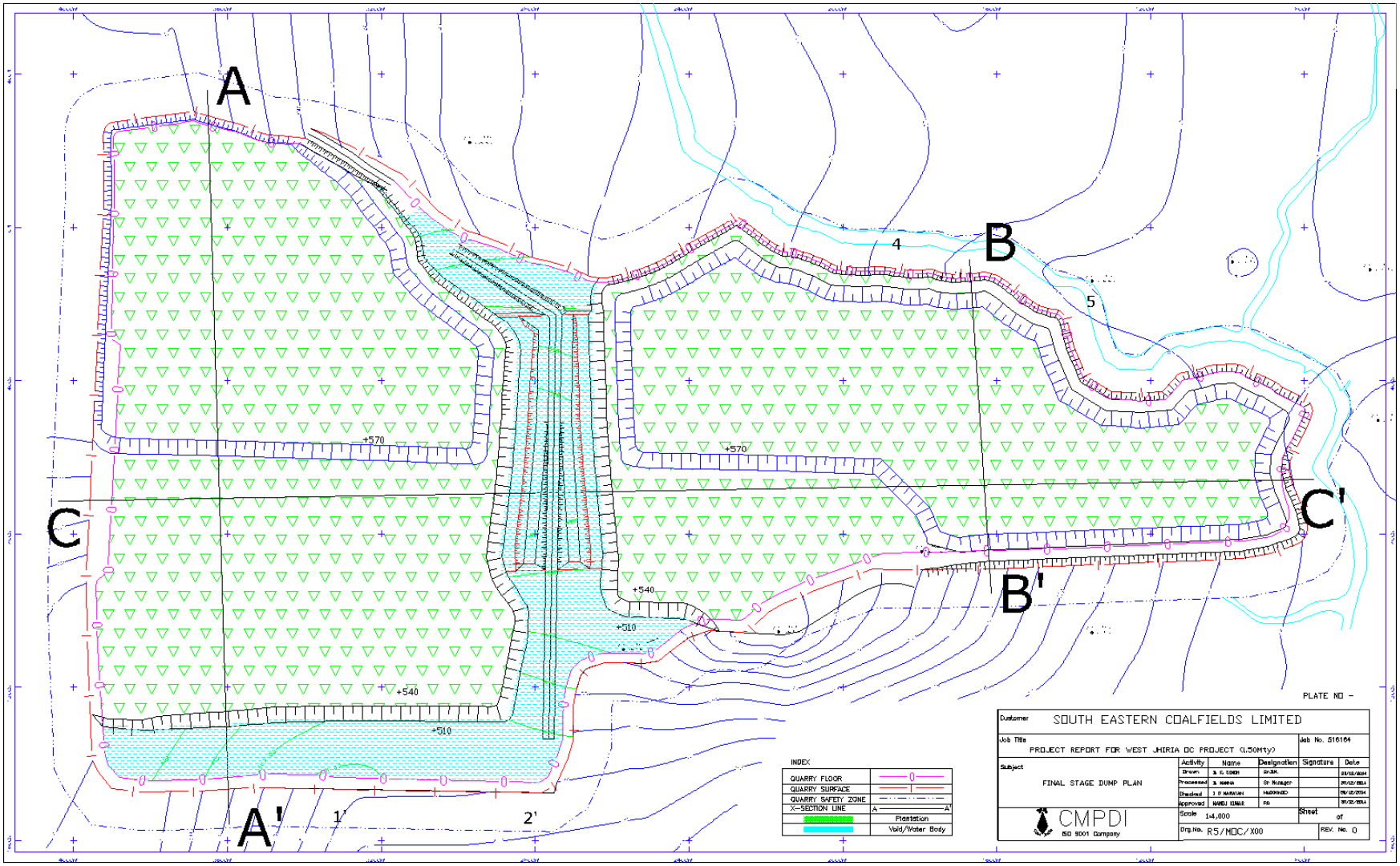
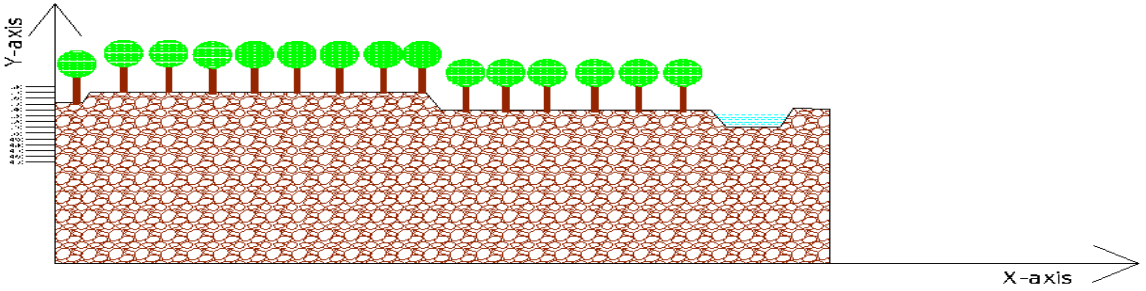
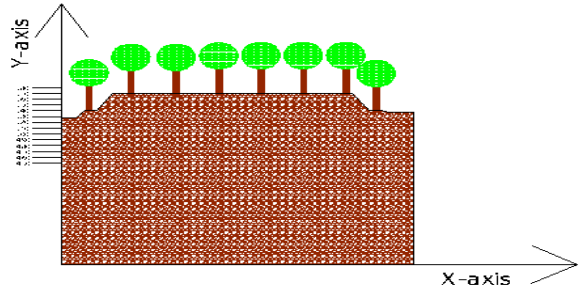


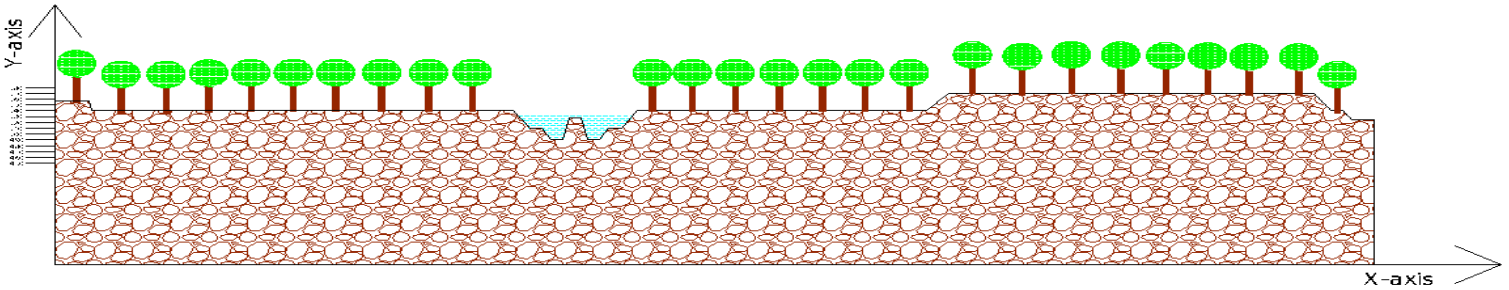
Figure-18.4 Final Stage Dump Reclamation Plan



Cross-Sectional View along AA'



Cross-Sectional View along BB'



Cross-Sectional View along CC'

Figure-18.5 X-section of Final Stage Dump Reclamation Plan

c) Top soil / soil amendment application

The stock piling of top soil will be as follows:

i) Top soil and other materials removed shall be stock-piled only when it is impractical to promptly redistribute such materials on re-graded areas.

ii) Stock-piled materials shall be selectively placed on a stable area, not disturbed, and protected from wind and water erosion, unnecessary compaction, and contaminants which lessen the capability of the materials to support vegetation when redistributed.

iii) After the final grading the topsoil would be redistributed in a manner that achieves an approximate uniform stable thickness consistent with the post mining land uses, contours, and surface water drainage system.

d) Plantation on external & backfilled area, avenue and block plantation with type of plantation i.e. local/native species. Name the local species for plantation.

Green belt on dumps:-

After technical reclamation of OB dumps and redistribution of top soil over it, the dumps will be biologically reclaimed followed by plantation as details shown in tables 16.16. About 736145 nos. of plants will be planted over internal dump and will continue after mine closure for 3 years.

Green Belt around Mine: -

In the directions where natural forest does not exist, there is need for creating green belt of adequate width as an effective dust and sight curtain in the periphery of mining area. The trees planted in the green belt area shall act as buffers and shock absorber against dusts, noise and stone flying. The trees in the green belt will be tall, wind firm, broad leaved and evergreen.

Haul Roads: -

A green belt of adequate width on either side of the haul road will be raised and the existing vegetation will be protected. The plants will be raised at spacing of 2.0x2.0 m.

All other roads: -

Along the roads other than the haul roads also, dust resistant plants will be planted.

Infrastructural Facilities (Nursery):-

A nursery is a prerequisite for supply of seedlings of suitable species of right size to the extent required. Rajya Van Vikas Nigam may be contracted the above supply.

Species for plantation.-

- **Fruit bearing trees**
  - Mango, Imli, Jamun, Sitaphal, Bel etc.
- **Medicinal trees**
  - Neem, Karanj, Harra, Behara, Aonla, Arjun, Shikakai, Mahua, Kusum.
- **Timber value trees**
  - Teak, Shivan / Ghamar, Sissoo, Sisham, Bamboo, Peltaforum, Babool.
- **Ornamental trees**
  - Gulmohur, Kachnar, Amaltas, Saptaparni, Grevelia, Peepal.

e) Disposal of Coal beneficiation process reject.

Not applicable in Jhiria West OC Project.

18.5 Details of surface structures proposed for dismantling (brief description) (Unless used in a gainful way)

a) Industrial / mine structures

The CHP, Managers & Pit Offices will be dismantled unless otherwise gainfully utilized by company, State Govt. /Local Body.

b) Residential Buildings will be handed over to closest project.

c) Service buildings

Dispensary, telephone exchange, sub area Managers Office, Store will be handed over to closest project.

d) Telephone Cables will be removed for re-use in other projects of the area, as far as practicable.

e) Sub-stations will be dismantled and equipment will be gainfully utilized in other projects.

f) Transformer will be dismantled and equipment will be gainfully utilized in other projects.

g) Community Services: Will be handed over to the local authorities.

h) Water line: Will be handed over to the local authorities.

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i) **Water Treatment Plants:** Will be handed over to the local authorities.

j) **Power line:** Will be dismantled.

18.6 Disposal of Plants & Machineries.

Table-18.8

Sl. No.	Particulars	Proposed Disposal Practice
A	Disposal or reuse of existing HEMM, workshop and railway siding for OC.	HEMM and other equipments will be transferred to other project as per requirement.
B	Disposal or reuse of haulage system, ventilation, CHP, workshop, and railway siding for UG.	Not applicable.
C	Disposal or reuse of transmission and sub-station.	Structure Will be dismantled & its equipment will be gainfully reused in other project.

18.7 Safety and security arrangement

Table- 18.9

Sl. No.	Particulars	Proposed Disposal Practice
A	Details of fencing around abandoned quarry indicating the length of the fencing.	In the last there will be a void/water body of 67.93 Ha. and length of fencing will be 11 Km. around the mine including void/water body to guard against falling of faunal species after mine final mine closure.
B	Mine entry sealing arrangements and subsidence management for UG mines. Sealing details and dimensions shall also be	- Not applicable.

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	provided.	
C	Providing one time lighting arrangement.	Will be provided.
D	Slope stability arrangement for high wall and back filled dumps.	Slope stability study will be done, if necessary.

NOTE: However, possibility shall be explored for handing over the residential & non-residential buildings and other infrastructures including the reclaimed land to state govt. 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.

18.8 Economic Repercussions of closure of mine

18.8.1 Manpower of the Project-

Proposed manpower requirement of the project for different options is as under,

- Departmental option – 722 Nos.
- Outsourcing option – 197 Nos.

18.8.2 Assessment of Income Scenario of Local People

Table – 18.10

Sl. No	Particulars	Proposed Disposal Practice
A	Number of local employees redeployed in other projects of the company till their superannuation	All manpower including local employees in the role of SECL will be engaged in other projects of SECL till their superannuation.
B	Approximate no. of people engaged in indirect employment / ancillary activities.	This number would vary. It would be about 3 to 4 times of departmental employees. They would find no financial loss due to the mine closure as their activities will be shifted in the new or expansion mines located in the same or other coalfield

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		area.
C	Resettlement/ Redeployment of a & b.	(i) Decided by the company. (ii) Will be decided in consultation with local authority if required.
D	If no redeployment is possible then sustenance plan. i) Compensation for losing employment or income. ii) Vocational training for continuance / sustenance of income level	Affected persons would be given vocational and skill development training for continuance / sustenance of income level.
E	Views of society and expectation on closure of mine.	Society's anxiety is limited to assurance about continuation of employment opportunities and availability of civic amenities presently provided by mine management. The employment opportunities will remain available, albeit in other nearby projects. Civic amenities will also be available as the infrastructure for same will be handed over to State Government for future use of society.

NOTE: It is proposed that reclaimed and afforested land will be handed over to State Forest Dept for the benefit of local ecosystem. The forest wealth can also be utilized by local people or tribal in the form of fruits and fodders. The water reservoir in the mine voids will be utilized for pisciculture, irrigation, domestic drinking water or stabilizing the ground water regime. Landscaping during closure of mine will make the spot for tourist attraction.

18.9 Time Schedule

The closure of mines involves environmental, technical, social aspect and financial assurance for implementing the post closure activities as per guidelines of Ministry of Coal. The post closure implementing activities will run for three years. The following activities will be implemented as per bar chart. The manpower for implementing the above activities with time bound manner will be provided.

Figure- 18.4 (Final Closure Activities)

Sl.No	Activities	Time Frame	Half Yearly					
			1	2	3	4	5	6
1.	Preparation of Survey & Disposal Report	6 months						
2.	Slope Stability study for high walls and internal backfilled dumps	3 months						
3.	Rehabilitation of P&M including HEMM, CHP, W/S, Siding etc.	2 and half years						
4.	Backfilling of mined out Area (OC)	2 years						
5.	Dismantling of Industrial structure	2 years						
6.	Grading & dozing of high walls for OC	2 years						
7.	Fencing of quarry	2 years						
8.	Clearing of Coal Stock and Infrastructural Area.	2 years						
9.	Disposal / Dismantling of Residential colony	2 &1/2 years						
10.	Plantation & landscaping on backfilled area.	3 years						
11.	Plantation over cleaned land of Infrastructure.	from 2nd year						
12.	Post Environmental Monitoring	3 years						
13.	Any project specific activities	Nil						

NOTE: The progressive mine closure will be done as per the calendar plan of the project for technical and biological reclamation of dumps and internal voids.

Progressive closure activities

The time scheduling is being provided on the basis of time interval of five year as required in the MoC guidelines. This period of 5 years is considered as one phase of five years and reclamation of one phase must be taken-up before commencement of mining activity in the subsequent phase. The action plan for progressive closure activities has been provided in Figure 18.5

Sl.No.	Activities in Reclamation Phase	1st					2nd					3rd	
	For Jhiria West OCP												
1	Backfilling & Grading of dump												
2	Leveling of Dump												
3	Toe Walling												
4	Provision of Water Coursing Channels												
5	Provision of Sedimentation Pond												
6	Provision of Garland Drains												
7	Provision of Check dams at high velocity points												
8	Top soil Preservation & Application												
9	Site preparation for plantation												
10	Plantation												
11	Environmental Monitoring												

Figure 18.5

NOTE: The above table indicates the tentative progressive closure activities for a Jhiria West Opencast mine having 12 years of life. The reclamation activities for the mine concerned will be followed as per the given schedule for the balance life of the mine. However, changes may occur due to prevalent geo-mining conditions.

18.10 Mine Closure Cost

The mine closure cost will cover the following activities for which a corpus escrow account @ Rs. 6.0 lakhs per Ha. for OCP & @ Rs. 1.0 lakh per Ha for UG mine of the project area shall be opened with the coal controller organization. In case

of mines having acid mine drainage, post closure acid mine drainage management cost shall also be included in the total closure cost.

18.10.1 Mine Closure Cost for OC mine

As per the guidelines of the MoC, the cost of the mine closure is to be computed based on the basis of involved project area. In Jhiria West OCP, the total project area is **474.684 Ha (excluding area for R&R site)**. So, the closure cost is to be computed considering a project area of 474.684 Ha. The latest WPI as on Apr 2018 is 116.8 based on the 2011-12 series.

The escalation factor for Apr 2018 (WPI 116.8) over Aug 2009 (WPI 129.6) comes to 0.901. This has to be updated with the linking factor of 2004-05 & 2011-12 series.

The linking factor for all commodities between these two series is 1.561.

The final escalation factor for Apr 2018 (series 2011-12) over Aug 2009 (series 2004-05) comes to 1.406 (0.901 * 1.561) .

The estimated updated cost of the mine closure as on Apr 2018 is Rs. 8.436 lakh per hectare (6.00 * 1.406 ,considering the admissible escalation over Rs. 6.00 lakh per Ha as on August 2009).

Total Final mine closure cost (@ Rs.8.436 lakhs/Ha.)**: Rs. 4004.434 Lakhs**

The current value of corpus is **Rs. 4004.434 Lakhs** (as on Apr 2018). This corpus is to be divided by estimated life of mine. Since, the balance life of the mine is estimated as **12 years,** the annual corpus comes to **Rs**. **333.703 Lakhs** by dividing the total corpus by 12 years. This amount is to be deposited in escrow account every year.

Fund to be deposited in escrow account: Year wise amount to be deposited has been given below in table 18.11.

Table – 18.11

Year	Fund Deposited in Escrow Fund	Fund to be Reimbursed (Maximum)	
1	333.703	Nil	(+) accrued interest as applicable
2	350.388	Nil	
3	367.907	Nil	
4	386.302	Nil	
5	405.617	Nil	
1st Phase	**1843.917**	**1475.134**	
6	425.898	Nil	
7	447.193	Nil	
8	469.553	Nil	
9	493.031	Nil	
10	517.683	Nil	
2nd Phase	**2353.358**	**1882.686**	
11	543.567	Nil	
12	570.745	Nil	
13	599.282	Nil	
14	629.246	Nil	
15	660.708	Nil	
Final phase	**3003.548**	**3843.003**	
Total	**7200.823**	**7200.823**	

The total escalation from the base year Aug'2009 is given in the table 18.12 below:

Table – 18.12

Year	Amount (As of August'09)	Escalation	Total amount to be deposited in escrow account (As of Jun'18)
1	237.342	96.361	333.703
2	237.342	113.046	350.388
3	237.342	130.565	367.907
4	237.342	148.960	386.302
5	237.342	168.275	405.617
Phase 1	**1186.710**	**657.207**	**1843.917**
6	237.342	188.556	425.898
7	237.342	209.851	447.193
8	237.342	232.211	469.553
9	237.342	255.689	493.031
10	237.342	280.341	517.683
Phase 2	**1186.710**	**1166.648**	**2353.358**
11	237.342	306.225	543.567
12	237.342	333.403	570.745
13	237.342	361.940	599.282
14	237.342	391.904	629.246
15	237.342	423.366	660.708
Final phase	**1186.710**	**1816.838**	**3003.548**
Total	**3560.130**	**3640.693**	**7200.823**

Note: 1.An agreement, outlining detailed terms and conditions of operating the Escrow Account, shall be executed amongst the mining company, the coal controller, and the concerned bank in order to give effect to this. The agreement shall be executed before the grant of permission by the coal controller to open the mine.

2. Up to 80% of the total deposited amount including interest accrued (as applicable), in the Escrow account may be recovered after every five years in line with the periodic examination of closure plan. The recoverable amount should be equal to expenditure incurred on the progressive mine closure plan in the past five years or 80% whichever is less. The balance amount at the end of final mine closure shall be recovered by the mine owner on compliance of all provisions of closure plan

duly signed by lessee to the effect that said closure of mine complied all statutory rules, regulations, orders made by the Central or State Government, statutory organisations court etc. and duly certified by the coal controller.

18.10.3 Mine Closure Activities & Tentative Cost Break-up:

The break-up of some major mine closure activities along with their tentative estimation of cost in terms of percentages of mine closure cost (stage wise) has been indicated in Table-18.13 below. The detailed activity schedule for the 'Final Mine Closure Plan' would be prepared five years before the intended final closure of the mine along with the detailed mine closure cost break-up.

Table 18.13 TENTATIVE MINE CLOSURE ACTIVITIES & COST BREAK-UP

Type of mine: Open cast **Production Capacity:** 1.50 MTY

Mining Project Area: 474.684 Ha **Depth of the mine:** 60.12

Sl. No.	Activity	Mine Closure Cost (Percentage Weightage)	Remarks
A	**Dismantling of Structures**		To be included in final mine closure plan
	- Service Buildings	0.20	
	- Residential Buildings,	2.67	
	- Industrial Structures like CHP, workshop, Field Sub -Station etc.	0.30	
B	**Permanent Fencing of mine void and other dangerous area**		To be included in final mine closure plan
	- Random rubble masonry of height 1.2 metre including levelling up in cement concrete 1:6:12 in mud mortar.	1.50	
C	**Grading of highwall Slopes**		To be included in final mine closure plan.
	- Levelling & Grading of highwall slopes.	1.77	
D	**OB Dump Reclamation**		
	- Handling/Dozing of external OB dump into mine void.	88.66	71% for progressive & 17.66% for Final mine closure.
	- Bio-reclamation including soil spreading, plantation & maintenance.	0.40	Equal Weightage throughout the life of the mine
E	**Landscaping**		
	- Landscaping of the cleared land for improving its esthetic.	0.30	To be included in final mine closure plan.

F	**Plantation**		
	- Plantation over area obtained after dismantling.	0.50	To be included in final mine closure plan.
	- Plantation around fencing.	0.20	To be included in progressive mine closure plan.
	- Plantation over the cleared off external OB dump	0.00	To be included in progressive mine closure plan.
G	**Monitoring / testing of environmental parameters for three years.**		For three years after mine closure.
	- Air quality	0.22	
	- Water quality.	0.20	
H	**Entrepreneurship development (vocational and skill development training for sustainable income of affected people).**	0.26	Equal Weightage throughout the life of the mine
I	**Miscellaneous & other mitigative measures.**	2.02	Equal Weightage throughout the life of the mine
J	**Manpower cost for Supervision**	0.80	To be included in final mine closure plan.
	Total	**100**	

NOTE: (i) In case of mines having acid mine drainage, post closure acid mine drainage management cost shall also be included in the total closure cost.

(ii) Additional amount beyond the escrow account will be provided by the mine operator after estimating the final mine closure cost five years prior to mine closure (as per the mine closure guideline)**.**

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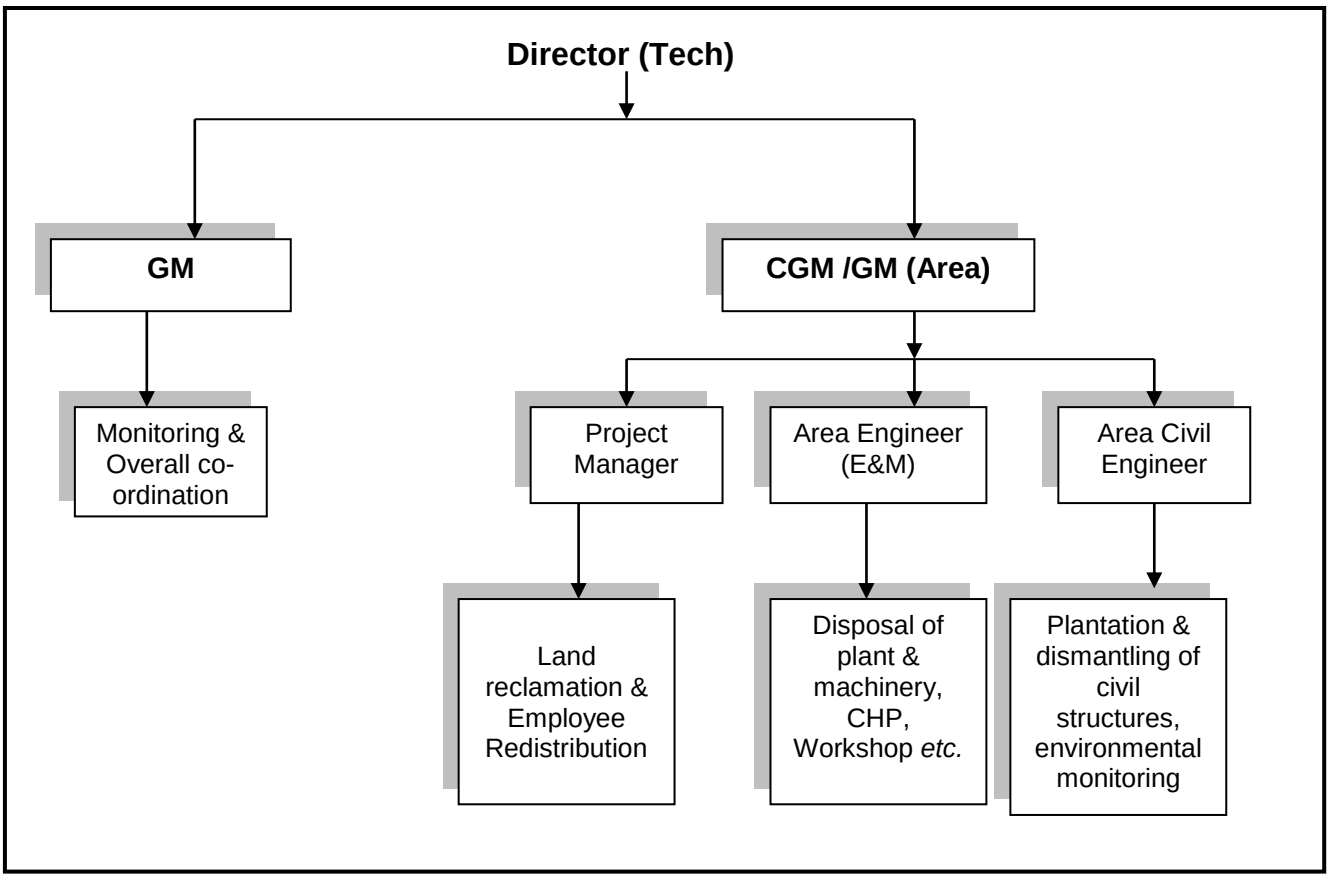
18.11 Implementation Protocol

For implementing the mine closure activities, the following organisational structure has been proposed:

Figure 18.6



Environmental monitoring for three years after closure of mine will be carried out to evaluate the environmental quality of the area. If needed, proper mitigation measures will be taken up after evaluating the environmental quality. The funds for this have been provided in the cost estimate.

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CHAPTER - XIX

MANPOWER, PRODUCTIVITY AND TRAINING

19.1 MANPOWER ASSESSMENT

In Outsourcing Option, the requirement of departmental manpower at the rated capacity of 1.50Mt of coal per year has been estimated as 197 numbers resulting in an overall OMS of 27.00 t. While estimating the total manpower an additional provision of 25% has been made for leave and sick considering 330days working.

In Partial Outsourcing Option, the requirement of departmental manpower at the rated capacity of 1.50Mt of coal per year has been estimated as 304 numbers resulting in an overall OMS of 17.46 t. While estimating the total manpower an additional provision of 25% has been made for leave and sick considering 330days working.

In Departmental Option, the requirement of departmental manpower at the rated capacity of 1.50Mt of coal per year has been estimated as 722 numbers resulting in an overall OMS of 7.41 t. While estimating the total manpower an additional provision of 25% has been made for leave and sick considering 330days working.

19.2 In outsourcing option, the details of estimated departmental manpower with scale/category wise are given in Appendix-B. The break-up of total manpower in groups' viz., workers, monthly paid staff and officers are given below:-

Sl. No	Particular	No.	Percentage of total Manpower
1	Workers	96	48.73%
2	Monthly paid staff	83	42.13%
3	Officers	18	9.14%
	Total	197	100%

In Partial Outsourcing option, the details of estimated departmental manpower with scale/category wise are given in Appendix-B. The break-up of total

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manpower in groups' viz., workers, monthly paid staff and officers are given below:-

Sl. No	Particular	No.	Percentage of total Manpower
1	Workers	170	55.92%
2	Monthly paid staff	108	35.53%
3	Officers	26	8.55%
	Total	304	100.00%

In Departmental option, the details of estimated departmental manpower with scale/category wise are given in Appendix-B. The break-up of total manpower in groups' viz., workers, monthly paid staff and officers are given below:-

Sl. No	Particular	No.	Percentage of total Manpower
1	Workers	532	73.68%
2	Monthly paid staff	152	21.06%
3	Officers	38	5.26%
	Total	722	100.00%

In outsourcing option, on the basis of production and equipment deployment, the phased requirement of manpower is broadly worked out and is given below:-

Year	Coal Production (Mt)	OB Removal (M.Cum)	Manpower Requirement	Total manpower (cumulative)
1	0	0	10	10
2	1.00	4.00	71	81
3	1.50	8.00	68	149
4	1.50	11.50	48	197

In Partial Outsourcing option, on the basis of production and equipment deployment, the phased requirement of manpower is broadly worked out and is given below:-

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Year	Coal Production (Mt)	OB Removal (M.Cum)	Manpower Requirement	Total manpower (cumulative)
1	0	0	10	10
2	1.00	4.00	122	132
3	1.50	8.00	105	237
4	1.50	11.50	67	304

In Departmental option, on the basis of production and equipment deployment, the phased requirement of manpower is broadly worked out and is given below:-

Year	Coal Production (Mt)	OB Removal (M.Cum)	Manpower Requirement	Total manpower (cumulative)
1	0	0	10	10
2	1.00	4.00	277	287
3	1.50	8.00	250	536
4	1.50	11.50	186	722

19.3 In Outsourcing Option, some manpower (35 including 25 nos. in security) related to security, dispatch, welfare etc is proposed to be outsourced. The impact of outsourced manpower with salary & wages of category I has been envisaged in the IRR calculations.

In Partial Outsourcing Option, some manpower (44 including 25 nos. in security) related to security, dispatch, welfare etc is proposed to be outsourced. The impact of outsourced manpower with salary & wages of category I has been envisaged in the IRR calculations.

In Departmental Option, some manpower (43 including 25 nos. in security) related to security, dispatch, welfare etc is proposed to be outsourced. The impact of outsourced manpower with salary & wages of category I has been envisaged in the IRR calculations.

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19.4 PRODUCTIVITY

The overall OMS of outsourcing option will be 27.00 te/manshift.

The overall OMS of partial outsourcing option will be 17.46 te/manshift.

The overall OMS of departmental option will be 7.41 te/manshift.

19.6 TRAINING

It is proposed that all the workers who will operate the HEMM etc. will be given proper training, so that, they are able to operate these equipment efficiently and safely. Refresher training will also be given to these workers at regular interval. For safe and proper operation of the project, an executive of higher rank has been proposed to be the chief of the project. Adequate no. of executives has been provided in the report to look after different activities. These executives have also been proposed to be given training in their fields at regular intervals, so that; they will be updated with the advancement in their respective field of operation.

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CHAPTER - XX

PROJECT IMPLEMENTATION SCHEDULE

20.1 INTRODUCTION

It is well known fact that for timely implementation of a project, it is essential that all the activities related with project construction are properly planned, closely monitored and effectively supervised. All implementing departments have their own implementation manuals which are followed for monitoring and construction of the project, so that, man, materials and money are made available to the project in time as spelt in the project report, with a view to prevent cost and time over-run. Responsibility, power for each executive has also been included in the implementation manual to prevent overlapping of operational areas. Sufficient administrative and financial power has been defined for key executive to take timely and effective decisions for the implementation of the project.

Time estimates are broad and indicative only, necessary modifications to suit local site conditions are to be incorporated subsequently.

20.2 PROJECT SCHEDULE

The life of the proposed mine will be 12 years including construction period. The maximum quarry depth will be around 60.12 m. The Production Program proposed is as given below:-

Year	Coal Production (Mt)	OB Removal (M.Cum)
1	0	0
2	0.50	4.00
3	1.00	8.00
4	1.50	11.50
5	1.50	11.50

20.3 Technically, zero date has been adopted as the date of approval and/or date of environmental clearance or the date of the land acquisition whichever is later.

Some of the preliminary activities as enumerated below may be initiated as advance action.

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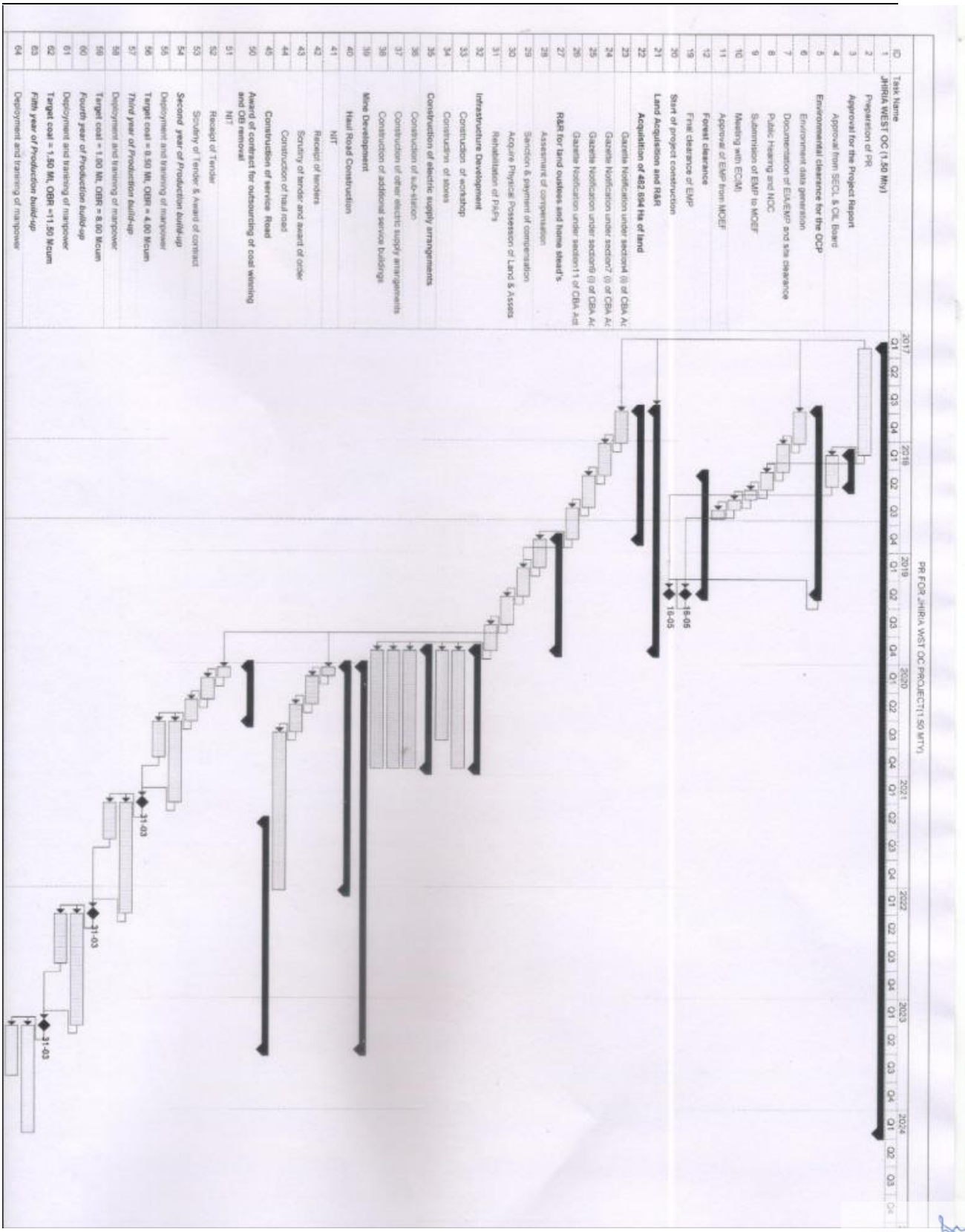
1. Posting of key personnel.
2. Proceedings of land acquisition for the proposed quarry complex.
3. Survey and marking of the road alignment, dumping area, site for service building etc.
4. Alignment of power line and sub-station.
5. Arrangement of water supply and sub-station
6. Construction of approach roads and culverts.
7. Processing indent for principal HEMMs to be used during development period.



ID	Task Name
1	**JHIRIA WEST OC (1.50 Mty)**
2	Preparation of PR
3	**Approval for the Project Report**
4	Approval from SECL & OIL Board
5	**Environmental clearance for the OCP**
6	Environment data generation
7	Documentation of EIA/EMP and site clearance
8	Public Hearing and NOC
9	Submission of EMP to MOEF
10	Meeting with EC(M)
11	Approval of EMP from MOEF
12	**Forest clearance**
19	Final clearance of EMP
20	**Start of project construction**
21	**Land Acquisition and R&R**
22	**Acquisition of 492.694 Ha of land**
23	Gazette Notification under section4 (i) of CBA Ac
24	Gazette Notification under section7 (i) of CBA Ac
25	Gazette Notification under section6 (i) of CBA Ac
26	Gazette Notification under section11 of CBA Act
27	**R&R for land oustees and home stead's.**
28	Assessment of compensation
29	Sanction & payment of compensation
30	Acquire Physical Possession of Land & Assets
31	Rehabilitation of PAFs
32	**Infrastructure Development**
33	Construction of workshop
34	Construction of stores
35	**Construction of electric supply arrangements**
36	Construction of sub-station
37	Construction of other electric supply arrangements
38	Construction of additional service buildings
39	**Mine Development**
40	**Haul Road Construction**
41	NIT
42	Receipt of tenders
43	Scrutiny of tender and award of order
44	Construction of haul road
45	**Construction of service Road**
50	**Award of contract for outsourcing of coal winning and OB removal**
51	NIT
52	Receipt of Tender
53	Scrutiny of Tender & Award of contract
54	***Second year of Production build-up***
55	Deployment and training of manpower
56	**Target coal = 0.50 Mt, OBR = 4.00 Mcum**
57	***Third year of Production build-up***
58	Deployment and training of manpower
59	**Target coal = 1.00 Mt, OBR = 8.00 Mcum**
60	***Fourth year of Production build-up***
61	Deployment and training of manpower
62	**Target coal = 1.50 Mt, OBR =11.50 Mcum**
63	***Fifth year of Production build-up***
64	Deployment and training of manpower

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CHAPTER - XXI

FINANCIAL EVALUATION

In this PR three options have been worked out namely Total Outsourcing Option, Partial Outsourcing Option and Total Departmental Option. The three options have been worked out in this PR are as given below.

Sl No	Options	Details
1	Total Outsourcing Option	Both Coal extraction and OB removal is by Outsourced HEMM
2	Partial Outsourcing Option	Coal extraction by Departmental HEMM and OB removal is by Outsourced HEMM
3	Total Departmental Option	Both Coal extraction and OB removal is by Departmental HEMM

The financial evaluation have been worked out based on the prevalent norms of productivity, operating cost and spare consumption etc. The financial parameters of all three options are as given below.

21.1 Capital investment and its phasing

OPTIONS	PHASING OF CAPITAL (Rs. In lakhs)					TOTAL CAPITAL
	1st	2nd	3rd	4th	5th	
Outsourcing Option	8498.94	10070.26	8891.36	6351.25	233.68	34045.48
Partial Outsourcing	8499.86	12127.67	10851.43	7454.21	64.00	38997.17
Departmental Option	8495.92	26575.90	19556.92	18461.36	64.00	73154.10

21.2 Basis of price of P&M, Civil works & hiring rate

Price of P&M has been taken from the standard price list published by CMPDI, HQ on May 2017. Prices have been updated upto June 2018 as per escalation rate given in the price list.

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The preparation of cost estimates for civil infrastructure is based on prevailing cost index of the area in June 2018. Considering the prevalent rates of materials and labour in Hasdeo Area, the cost index works out to 3581 in June 2018 with reference to 100 base in Delhi as on 1.10.76.

21.3 Foreign Capital

No foreign capital investment has been envisaged.

21.4 Capital upto target year

The capital upto target year are as given below.

OPTIONS	Outsourcing Option	Partial Outsourcing	Departmental Option
Capital upto target year(Crs.)	33811.81	38933.17	73090.10

21.5 OPENING OF REVENUE ACCOUNT

The norms for bringing coal projects into revenue account as decided in the me eting held under the chairmanship of JS&FA on 9.6.04 are as follows:-

1) Revenue expenditure to be capitalized should be net of sales receipts of coal produced during the construction period.

2) The period of construction has to be defined to determine the commercial readiness of the project to yield on a sustainable basis.

3) In case of opencast projects, the volume of stripping of OB and in case of UG projects, the completion of required development activities during the above period of construction have to be clearly defined.

4) Based on the above, the capitalization of revenue expenses / opening of revenue account will be decided.

Accordingly, a definition of the term 'commercial readiness of a project has been drafted and based on this a norm for capitalization of revenue expense / opening of revenue expenditure of a project has been suggested as under:-

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A. Commercial Readiness:

A project will be treated to have reached the stage of commercial readiness to yield production on sustainable basis from the year when all the following criteria have been achieved –

(i) 30% of the total volume of excavation (Coal and OB) envisaged in the target year.

(ii) The land required for the project upto target year has been acquired.

(iii) Construction of CHP and railway siding have been completed or adequate alternative arrangement for sizing and dispatch of coal have been commissioned for the Project.

B. Capitalisation of Revenue Expenses based on commercial readiness:

For the preparation of Feasibility Reports, the revenue expenditure of a project can be capitalized till the year the project achieves commercial readiness as per the plan envisaged. The capitalization of revenue expenditure, in no case, shall extend beyond the year the Project achieves the status of commercial readiness. This project will be commercially ready by the end of 4th year from zero date. However, in this project, the sales receipts are more than the aggregate revenue expenditures on a sustained basis from 2nd year itself and hence, capitalization of upto 1st year has been done.

Considering the above two i.e. A & B, the Project would be brought under revenue account w.e.f. the beginning of 2nd year of operation. Adequate alternative arrangements for dispatch of coal have been envisaged from the 2nd year.

The period of construction of this Project is 4 years and the capacity build-up for the Project would be as follows:-

Year	1st	2nd	3rd	4th
Production (Mt)	0.00	0.50	1.00	1.50
OB (Mcum)	0.00	4.00	8.00	11.50

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Within the above mentioned construction period, the project is in commercial readiness as it would be able to yield production on sustainable basis and most of the infrastructure facilities like Road, CHP, Workshop, Service Building, Power Supply, Water Supply and Development activities for mine operation would be completed and accordingly capital provision has been made.

21.6 REPLACEMENT CAPITAL

Year-wise phasing of replacement capital is given in Appendix-D.1 column No.3.

21.7 SOURCES OF FINANCE

The project will be financed completely by internal resources.

21.8 COMPLETION COST

As per the latest guidelines, the completion cost of a project will qualify all the following conditions:

- Achievement of coal production capacity of 80% of the rated output.
- Completion of all major facilities and initial mine development work.
- Procurement of major and essential plant & machinery.

Completion cost of the project is estimated are as given below

OPTIONS	Outsourcing Option	Partial Outsourcing	Departmental Option
Completion Capital (Crs.)	377.58	433.69	825.68

21.9 METHOD OF ESTIMATION OF CAPITAL COST:

a) Land

Rate of revenue and forest land are provided by SECL Rate of tenancy land is provided by SECL as per RFCTLARR Act 2013.

b) Civil Construction (alongwith Cost Index)

The preparation of cost estimates for civil infrastructure is based on prevailing cost index of the area in June 2018. Considering the prevalent rates of materials and labour in Hasdeo Area, the cost index works out to 3581 in June 2018 with reference to 100 base in Delhi as on 1.10.76.

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c) P&M

Price of P&M has been taken from the standard price list published by CMPDI, HQ on May 2017. Prices have been updated upto June 2018 as per escalation rate given in the price list.

21.10 COST OF PRODUCTION HEADWISE

a) Salaries & Wages Cos

The detail of category-wise / scale-wise manpower requirement and year-wise estimated wages cost is given in Appendix-B.1. The impact of provision of NCWA X has also been considered.

Estimated salaries & wages cost is worked out are as given below

OPTIONS	Outsourcing Option	Partial Outsourcing	Departmental Option
Estimated salaries & wages (Rs/Te)	122.50	192.54	434.83

b) Stores Cost

Stores Cost has been estimated taking into account provision for Repair & Maintenance, POL, Explosive and miscellaneous stores cost. The estimated Stores Cost has been worked out are as given below

OPTIONS	Outsourcing Option	Partial Outsourcing	Departmental Option
Estimated Stores Cost (Rs/Te)	118.87	226.44	567.36

c) Power Cost

Estimated Energy Consumption is given in the relevant chapter for Power Supply. The power cost has been taken as Rs.6.0/unit. The average power cost per tonne of coal production works are as given below

OPTIONS	Outsourcing Option	Partial Outsourcing	Departmental Option
Power Cost (Rs/Te)	65.84	74.32	169.62

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d) Misc. Expenditure

This cost has been estimated to cover expenditure on Printing & Stationary, Postage, Telephone, repair & Maintenance of assets other than P&M, Workshop Workshop Debit, and Insurance & Taxes for vehicles and other repairs and a further provision has been made for deterioration of coal stock. Miscellaneous expenditure per tonne works out are as given below

OPTIONS	Outsourcing Option	Partial Outsourcing	Departmental Option
Estimated Misc Expenditure (Rs/Te)	115.34	123.20	191.31

e) Administrative Charges

A provision has been made in total revenue cost estimate for Administrative charges based on the Admn. Cost per tonne of coal production as was appearing in the last Annual Report of SECL. Total Admn. Cost has been calculated at 100% level and treated as fixed cost. As such for all other estimated level of operation the absolute Admn. Cost has been taken as it worked out for 100% level of operation. The Admn. Cost comes are as given below

OPTIONS	Outsourcing Option	Partial Outsourcing	Departmental Option
Admn. Cost (Rs/Te)	88.00	88.00	88.00

For calculating IRR only 10% of its been considered as cash outflow as per revised norms approved by coal india board.

f) Interest on Working Capital

Interest on Working Capital has been calculated on the basis of 4 months operating expenditure. Rate of interest is taken as 14.50%. The Interest on Working Capital comes are as given below

OPTIONS	Outsourcing Option	Partial Outsourcing	Departmental Option
Interest on working capital (Rs/Te)	52.28	58.40	74.58

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g) Depreciation

Straight line method of depreciation has been provided to arrive at depreciation cost per tonne of coal production. The depreciation Cost comes are as given below

OPTIONS	Outsourcing Option	Partial Outsourcing	Departmental Option
Depreciation Cost (Rs/Te)	201.53	232.98	441.86

h) Interest on Loan Capital

Interest @ 11.5% on loan capital is to be considered for computation based on given Debt Equity Mix. However, loan capital in this project is NIL.

i) Environment related Cost

The environmental related cost in the project are as given below

OPTIONS	Outsourcing Option	Partial Outsourcing	Departmental Option
Environmental Cost (Rs/Te)	158.67	158.80	161.53

j) Mine Closure Cost

The Mine Closure Cost considerd in the project are as given below

OPTIONS	Outsourcing Option	Partial Outsourcing	Departmental Option
Mine Closure Cost (Rs/Te)	37.44	37.44	37.44

k) Cost of production per tonne at 100%, 85% and 80% level of production works out are as given below

Cost of production(Rs/Te)	Outsourcing Option	Partial Outsourcing	Departmental Option
At 100%	1335.49	1499.74	2059.51
At 85%	1449.16	1644.23	2340.55
At 80%	1496.53	1704.43	2457.65

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I) CSR cost as per latest CIL's CSR Policy communicated vide CGM (Welfare), CIL, letter No.CIL/C-5C/231(CSR)/269 dated 3.12.2009, source of fund under this head will be 5% of the retained earning of the previous year subject to minimum Rs.5/- per tonne of coal production of previous year. However, this fund is not a part of project costing and the same will be spent by company as per CSR activities.

21.11 COST OF PRODUCTION

Cost of production of Total Outsourcing Option, Partial Outsourcing Option and Total Departmental Option are as given below.

Sl. No.	Particulars	Outsourcing Option	Partial Outsourcing	Departmental Option
a)	Salaries,Wages & Benefits	122.50	192.54	434.83
b)	Stores	118.87	226.44	567.36
c)	Power	65.84	74.32	169.62
d)	Misc. exp. incl.w/s debits	115.34	123.20	191.31
e)	Admn. Charges	88.00	88.00	88.00
f)	Coal O/S Cost	67.29		
g)	OB O/S Cost	411.89	411.89	
h)	OB Rehandling cost	54.51	54.51	54.51
i)	Int. on wkg. cap @ 14.5%	52.28	58.40	74.58
j)	Int. on loan cap @ 11.50%	0.00	0.00	0.00
k)	Mine Closure Cost	37.44	37.44	37.44
l)	Depreciation	201.53	232.98	441.86
m)	Total Cost	1335.49	1499.74	2059.51
n)	Environment related Cost	158.67	158.80	161.53

21.11 SELLING PRICE

The weighted average selling price of coal for this coal project has been taken as Rs 2395.15 per tonne for ROM processed coal (-100 mm). The weighted average grade of coal is 'G-6' with GCV 5524 Kcal/Kg.

CALCULATION OF SELLING PRICE

Sl. No.	Particulars	Price (Rs./t)
a)	Price as per GCV coal (Grade G6)*	2317.00
b)	Price taken in PR, coal **	2201.15
c)	Sizing (-100 mm)	87.00

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Sl. No.	Particulars	Price (Rs./t)
d)	Transport reimbursemet, if any	57.00
e)	Evacaution Facility Charges	50.00
f)	Total sale price	2395.15

*As per price notification No. CIL:S&M:GM(F):Pricing2018:07 dated 08.01.2018.
**95% of the grade based on borehole data as per norms.

21.12 OUTSOURCING RATES

Coal extraction and OB removal is proposed to be done by outsourcing. The rates have been considered based on the escalated rates table received from SECL.

OB Outsourcing Rate

For OB removal yearwise lead has been estimated and based on that average lead for OB removal is estimated to 1.60 Km. The outsourcing rate of OB for average lead of 1.60 Km based on the escalated rates received from SECL is works out to Rs. 51.25 per cum with current diesel price @Rs 74.02 per litre (based on outsourcing rate of Rajnagar OC as base rate). The OB rehandle rate calculated by dividing the OB removal rate by 1.25 and it comes to Rs.41.00/cum.

Coal Outsourcing Rate

The outsourcing cost of Coal for surface miner cutting, loading, transport from face to pit top and Transportation from Pit top to siding for different lead are follows:-

Particulars	Outsourcing Option	Partial Outsourcing	Departmental Option
Cutting (by Surface Miner) (Rs./t)	21.30	-	-
Loading (Rs./t)	15.36	-	-
Transportation from face to pit top(1.50Km) (Rs./t)	30.63	-	-
Total (Rs./t)	**67.29**	-	-

Loading & Transportation cost of Rs 66.22 per te to transport coal from pit top to siding (for 6.00Km) for all three options has been considered in project costing.

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Service Tax component of HoE rate has not been considered in costing of the project as CENVAT credit is available against it. The above hiring rates have been considered only for economic evaluation of the project report for the planning purpose.

21.13 Profitability (Profit/Loss) : The Profit/loss estimated are as given below

Profit/Loss (Rs/Te)	Outsourcing Option	Partial Outsourcing	Departmental Option
At 100%	1059.66	895.41	335.64
At 85%	945.99	750.92	54.60
At 80%	898.62	690.72	(-)62.50

21.14 OMS/EMS : The OMS and EMS calculated are as given below

OPTIONS	Outsourcing Option	Partial Outsourcing	Departmental Option
OMS(Te)	27.00	17.46	7.41
EMS(Rs)	3307.75	3360.90	3223.60

21.16 Financial IRR

The Financial IRR of the project are as given below

Financial IRR	Outsourcing Option	Partial Outsourcing	Departmental Option
At 100%	71.28%	55.57%	14.17%
At 85%	56.35%	41.87%	2.90%

21.17 BREAK-EVEN PRODUCTION

It is estimated that the project will achieve Break-even and Break-even point are as given below

Break-even point	Outsourcing Option	Partial Outsourcing	Departmental Option
In Percent	37.81	47.76	82.59
In Mty	0.57	0.72	1.24

21.18 Completion IRR: Capital Expenditure has been estimated/increased for forward escalation on the Phasing of Initial Estimated Capital. The escalation rate is based on W.P.I. of preceding 12 months.

21.19 Sensitivity Analysis - given in the Appendix-C.4.

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21.20 CONCLUSION

In Total Outsourcing Option, the project is yielding a profit of Rs.1059.66 per tonne at 100% and Rs. 945.99 per tonne at 85% level of production. The financial IRR of the project in outsourcing option works out to 56.35% at 85% capacity, considering the notified price of coal (G-6 grade) for power sector consumer. The outsourcing option of Jhiria West OC (1.50 Mty) is meeting the criteria of approval i.e. 12% IRR at 85% capacity level.

In Partial Outsourcing Option, the project is yielding a profit of Rs. 895.41 per tonne at 100% and Rs. 750.92 per tonne at 85% level of production. The financial IRR of the project in partial outsourcing option works out to 41.87% at 85% capacity, considering the notified price of coal (G-6 grade) for power sector consumer. The Partial outsourcing option of Jhiria West OC (1.50 Mty) is meeting the criteria of approval i.e. 12% IRR at 85% capacity level.

In Total Departmental Option, the project is yielding a profit of Rs. 335.64 per tonne at 100% and Rs. 54.60 per tonne at 85% level of production. The financial IRR of the project in outsourcing option works out to 2.90% at 85% capacity, considering the notified price of coal (G-6 grade) for power sector consumer. The Total departmental option of Jhiria West OC (1.50 Mty) is not meeting the criteria of approval i.e. 12% IRR at 85% capacity level.

PR for Jhiria West Opencast (1.50Mty) with three options ie outsourcing Option, Partial Outsourcing Option and Departmental Option was placed before SECL Board on 28.11.2018 held at Raipur. **SECL Board after detailed deliberations approved the Project Report for Jhiria West Opencast (1.50Mty) for Partial Outsourcing Option (Coal Departmental and OB Outsourcing) involving a capital investment of Rs. 389.97 Crores vide 279th meeting of Board of Directors of SECL held on 28.11.2018 (Wednesday) at Raipur.**

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CHAPTER - XXII

A CHAPTER ON OUTSOURCING

22.1 INTRODUCTION

Outsourcing has become increasingly attractive for many organizations in recent past. Businesses irrespective of its size, skill, knowledge and technology are finding outsourcing mechanism most befitting in terms of cost reduction as well as quality improvement .With globalization and removal of barriers, outsourcing has created new opportunities for generation of employment. Today whether it is a canteen services or security services or courier services or gardening, is no longer one man providing service to one organization. These are just examples and we can go on listing them but essentially they are contractor or organizations which provide a specialized service at a competitive price. The service itself is much better than what an entrepreneur if he engages workmen on his roll would be able to provide. Further, the quality of the service is much better and it leaves the entrepreneur to concentrate on its core activity.

Outsourcing will remain in the four front of every business executive mind as a business strategy that will let their organization to create and sustain business value in the competitive global market for reduced cost, focus on core business processes, improve services, enhance skills, and increase competitive advantages.

Growth in outsourcing is expanding to include not only IT functions, but critical business processes, as well as evolving application areas like enterprise resource planning and re-business initiatives. Successful companies are incorporating outsourcing as a key strategy for growth and differentiation. No longer considered merely a tactic for cutting costs and adding temporary staff, outsourcing is being accepted in board rooms around the world as a critical success factor for business survival. We need to give as much attention to managing processes as we have in the past to managing products.

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For years, outsourcing was more a matter of "out asking" – hiring outside vendors to perform specific jobs or manage specific projects within a department of a large organization. Many things that are done inside the companies are labour intensive. Those are the kind of work where human being have to intervene in a process and use decision – making skills – such as interpretation, validation, translation, transliteration or transformation.

22.2 SCOPE OF WORK PROPOSED TO BE OUTSOURCED (IN OB OUTSOURCING)

i) Drilling

The external agency will prepare the site and carry out blast hole drilling in OB as per the pattern decided by the project authorities according to strata conditions and stipulations of DGMS.

ii) OB Removal

The work involves excavation of OB and dumping of the same to different dump locations. This includes construction and maintenance of haul roads for plying of dumpers/tippers with suitable number of graders and dozers. The leveling of the dumps is to be carried out by the agency to whom the work has been awarded for OB removal.

The outsourcing of HEMM would also include water sprinkling. The site of excavation and dumping is to be decided by the project authorities in accordance with the requirement of the project. All statutory rules, regulation and applicable laws are to be followed including those related to Govt. licenses, workmen compensation, insurance etc. by the agency to whom the job has been awarded.

iii) Accommodation, Site Office, Electricity etc.

Site office may be provided by the company on availability basis, which will be chargeable. Electricity to the site office may be provided on chargeable basis.

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22.4 ANNUAL WORK LOAD FOR EXTERNAL AGENCY

The total Coal and OB will be outsourced. Peak coal and OB production will be 1.50 Mty and 11.50 Mcum. The peak OB rehandle is 6.08Mcum. The maximum annual work load for the external agency will be 18.57 Mcum (approx.).

22.5 OUTSOURCING RATES FOR OUTSOURCING OPTION

Coal extraction and OB removal is proposed to be done by outsourcing. The rates have been considered based on the escalated rates table received from SECL.

OB Outsourcing Rate

For OB removal yearwise lead has been estimated and based on that average lead for OB removal is estimated to 1.60 Km. The outsourcing rate of OB for average lead of 1.60 Km based on the escalated rates received from SECL is works out to Rs. 51.25 per cum with current diesel price @Rs 74.02 per litre (based on outsourcing rate of Rajnagar OC as base rate). The OB rehandle rate calculated by dividing the OB removal rate by 1.25 and it comes to Rs.41.00/cum.

Coal Outsourcing Rate

The outsourcing cost of Coal for surface miner cutting, loading, transport from face to pit top and Transportation from Pit top to siding for different lead are follows:-

Particulars	Outsourcing Option	Partial Outsourcing	Departmental Option
Cutting (by Surface Miner) (Rs./t)	21.30	-	-
Loading (Rs./t)	15.36	-	-
Transportation from face to pit top(1.50Km) (Rs./t)	30.63	-	-
Total (Rs./t)	**67.29**	-	-

Loading & Transportation cost of Rs 66.22 per te to transport coal from pit top to siding (for 6.00Km) for all three options has been considered in project costing.

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Service Tax component of HoE rate has not been considered in costing of the project as CENVAT credit is available against it. The above hiring rates have been considered only for economic evaluation of the project report for the planning purpose.

22.6 SAFETY ASPECTS FOR OUTSOURCING OF HEMM

Outside agency deploying HEMM or any equipment in the mine for excavation of coal shall plan their activities in confirmation with the prevailing statutory provisions as per Mines Act 1952 and CMR 1957 applicable for safety in opencast mines.

However, all statutory rules, regulations, applicable laws etc. and statutory requirement related to Govt. licenses, workers compensation, insurance, etc., including minimum wage act for workers employed by the outside agency shall have to be adhered to.

Rules if any imposed by local / state / central authorities should also be complied by leaser of HEMM / equipment and then shall have to supply various protective equipment viz., helmet, shoes etc. to the workmen at their cost.

All the regulations and schedules of Coal Mines Regulations 1957 relating to opencast mining have to be adhered to and implemented in order to maintain day to day safety precautions as per stature.

Special precaution should be taken while deploying workers in the mine. Before employing any worker to the mine proper vocation training should be imparted and recommendations of VIII Safety Conference should be strictly followed. Terms and conditions shall be fixed by management for deployment of workers by outside agency. Some of the major aspects are as follows: -

A) For Persons:

i) No persons shall be deployed unless he is trained at VTC.

ii) Records in Form-B, Form-D shall be maintained.

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iii) Records of Vocational Training Certificate and driving license of operators shall be kept by HEMM outsourcing agency and shall be made readily available for inspection by management.

iv) Salaries shall be distributed in front of management representative.

v) No person shall be employed unless person holds VTC certificate and management is informed. A record of it shall be maintained.

vi) Adequate supervision shall be maintained by qualified competent persons.

vii) Outside agency shall follow safety guidelines and safety instructions from project authorities.

B) For Machineries as recommended by DGMS Cir. (Tech.) 1 of 1999 :

i) All the machineries to be deployed in mines should be checked before deployment by competent authority.

ii) Regular checking of m/c deployed by outside agency shall be done. No unfit machine shall be deployed before the defect is rectified.

iii) A proper record of repair and maintenance along with inspection done by management and defect pointed out shall be maintained and signed by authorized person.

iv) The trucks deployed outside agency shall be provided with audio visual alarms, proper light for use at night and period when natural light is not sufficient. Also audiovisual alarms for reversing on trucks shall be provided.

Other precautions for machines

i) RTO certificate photocopies of all vehicles shall be submitted to management.

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ii) Daily welding, monitoring, inspection shall be done by the agency's mechanic as directed by management.

iii) Machine manufacturers should be asked to give risk analysis details in respect of machines deployed by outside agencies.

iv) Suitable type of the fire extinguishers shall be provided in every machine.

C) General :

i) No person / vehicle shall be deployed at any place other than authorized place.

ii) All workers should obey lawful instruction of mine management.

iii) Risk Management Plan of tipper / pay loader shall be made and implemented.

iv) All drivers shall obey systematic traffic rules prepared by management.

v) Before deploying workers, they must be trained and briefed about safety aspects in opencast mine. However, during course of execution of the work, if any accident occurs whether major or minor, the matter shall have to be immediately informed to mine management i.e. Colliery Manager / Agent / GM of Area, so that, notices of accidents in accordance of (Reg.9 of CMR 1957) and Section 23 of Mines Act 1952 may be given and other necessary steps may be taken in accordance with the Mines Act 1952.

vi) Outside Agency shall operate transport system in such a way so as to minimize pollution in the mine.

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महाप्रबंधक
GENERAL MANAGER
SECL Hasdeo Area

APPENDICES
PARTIAL OUTSOURCING OPTION

महाप्रबंधक
GENERAL MANAGER
SECL Hasdeo Area

महाप्रबंधक
GENERAL MANAGER
SECL Hasdeo Area

APPENDIX-A

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

Life (yrs) : 12
Capacity (Mty) : 1.5

STATEMENT SHOWING THE ESTIMATED TOTAL CAPITAL INVESTMENT AND ITS PHASING

(Partial Outsourcing Option)

(Amount in Rs Lakhs)

SL.NO	PARTICULARS	Total Capital	EMP Capital Investment	PHASING OF CAPITAL				
				1	2	3	4	5
1.	LAND	10708.90	227.48	3500.00	2500.00	2500.00	2208.90	
2.	BUILDING :-							
	a) SERVICE	1141.58	5.90		400.00	400.00	341.58	
	b) RESIDENTIAL	10.94	10.62		10.94	0.00	0.00	
3.	PLANT & MACHINERY	8229.88	60.00		3577.06	2854.22	1734.60	64.00
4.	FURNITURE & FITTINGS	44.00			5.00	20.00	19.00	
5.	RAILWAY SIDING	1675.79	20.00	0.00	1042.09	633.71		
6.	VEHICLES	150.04		0.00	54.49	85.38	10.17	0.00
7.	PROSPECTING & BORING	122.71		6.45	58.13	58.14		
8.	DEVELOPMENT							
8.1	CAP. OUTLAY IN MINES	7637.29	6072.29	2000.00	2000.00	2000.00	1637.29	
8.2	ROADS & CULVERTS	7198.63	93.79	2000.00	2000.00	2000.00	1198.63	
8.3	WATER SUPPLY & SEWERAGE	904.04	536.36		300.00	300.00	304.04	
	DISPOSAL							
8.4	PR/EMP PREPARATION & OTHER	359.92	50.00	179.96	179.96			
	SCIENTIFIC/TECHNICAL STUDIES.							
	TOTAL OF 8	**16099.88**	**6752.44**	**4179.96**	**4479.96**	**4300.00**	**3139.96**	**0.00**
	TOTAL CAPITAL INVESTMENT	**38183.72**	**7076.44**	**7686.41**	**12127.67**	**10851.43**	**7454.21**	**64.00**
9(A)	OTHER EXPENSES OF REVENUE NATURE CAPITALISED DURING DEVELOPMENT PERIOD	1454.12		1454.12				
9(B)	OBRE-DRE							
	TOTAL OF 1 TO 9	**39637.84**	**7076.44**	**9140.53**	**12127.67**	**10851.43**	**7454.21**	**64.00**
10.	LESS-DEPRECIATION CAPITALISED DURING DEVELOPMENT PERIOD	640.67		640.67				
	TOTAL CAPITAL INVESTMENT	**38997.17**	**7076.44**	**8499.86**	**12127.67**	**10851.43**	**7454.21**	**64.00**

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

APPENDIX-A1

ESTIMATED CAPITAL INVESTMENT FOR LAND

(Land in Ha)

(Partial Outsourcing Option)

I. LAND REQUIREMENT

(Figures in Ha)

Sl. No.	Particulars	Forest Land	Tenancy Land	Govt Land	Grand Total
	Land requirement				
a	Quarry area	268.495	48.400	45.493	362.388
b	Safety zone	52.082	24.812	7.884	84.778
c	External dump				
d	Land for infrastructures		3.338	1.440	4.778
e	Additional Land for Approach road etc.	3.160	4.580		7.740
	Sub-Total	**323.737**	**81.130**	**54.817**	**459.684**
f	Land for Belt, CHP & siding etc.		15.000		15.000
g	Land for R&R site		8.010		8.010
	Sub-Total		**23.010**		**23.010**
	TOTAL LAND TO BE ACQUIRED	**323.737**	**104.140**	**54.817**	**482.694**

II. COST OF LAND

Amount in Rs Lakhs

Sl. No.	Particulars	Total Capital Provision		
		Area (Ha)	Rate per Ha	Amount
1.	Tenancy Land	104.140	As per LARR	2957.58
2	Forest Land	323.737	22.25	7203.15
3	Government Land	54.817	10.00	548.17
	TOTAL LAND TO BE ACQUIRED	**482.694**		**10708.90**

Note : 1. Tenancy land - @ Rs 28.40 Lakhs per Ha As per LARR(1st Schedule), Forest land- @22.25 lakhs per Ha, Govt. land @10.0 lakhs per Ha.

2. Land details given are as per land use plan supllied by area authorities.

3. Minor changes in figures of proposed land to be acquired may take place at the time of actual acquisition due to unforeseen discripencies/anomalies in different records with different departments of State Government.

APPENDIX-A.2

UCE of Project Report for Jhiria West Opencast Project (1.5 mty)

Statement showing the Capital Investment on Civil Works

(Amount in Rs. Lakhs)

Sl.No.	Particulars	PR Provision without GST	PR Provision with GST	References
1.	Service Buildings	967.44	1141.58	Appendix-A.2.1
2.	Residential Buildings	9.27	10.94	Appendix-A.2.2
3.	Roads and Culverts	6100.53	7198.63	Appendix-A.8.2
4.	Water Supply arrangement	194.23	229.19	Appendix-A.8.3
5.	Sewerage System	571.91	674.85	Appendix-A.8.3a
Total		**7843.37**	**9255.19**	

Appendix- A.2.1.

UCE of Project Report for Jhiria West Opencast Project (1.5 mty)

Statement Showing the Estimated Capital Requirement on Service Buildings

(Amount in Rs.Lakhs)

Sl. No.	Particulars	Unit	Quantity	Rate at 100CI (Rs.)	Rate at 3581 CI (Rs.)	Total Amount (lakhs)
1	i) Office of the General Manager and Project Officer	Sq.m.	700	375.00	13428.75	94.00
	ii) Boundary wall for office	RM	300	112.00	4010.72	12.03
2	First aid centre - 1no.	Sq.m.	17	392.00	14037.52	2.39
3	Magazine - 50 Te capacity	Sq.m.	152	550.00	19695.50	29.94
4	Lavatories & Urinals - 2nos.	Sq.m.	60	575.00	20590.75	12.35
5	Canteen (50 seater)	Sq.m.	162	319.00	11423.39	18.51
6	i) Officers' Rest House - 4 roomed	Sq.m.	276	380.00	13607.80	37.56
	ii) Boundary wall	RM	150	112.00	4010.72	6.02
7	Rest Shelter	Sq.m.	39	319.00	11423.39	4.46
8	Security Room - 4 nos.	Sq.m.	42	319.00	11423.39	4.80
9	CDS control room	Sq.m.	133.5	375.00	13428.75	17.93
10	Garage	Sq.m.	100	235.00	8415.35	8.42
11	Scooter and Cycle Shed - 2 nos.	Sq.m.	200	200.00	7162.00	14.32
12	Soil Investigation			LS		5.00
13	33 kV / 3.3kV Sub- Station	LS				240.24
14	**Workshop Complex**					
i)	Workshop Shed (6 m height)	Sq.m.	288	550.00	19695.50	56.72
ii)	Workshop Office, Tool room	Sq.m.	56	550.00	19695.50	11.03
ii)	Switch room	Sq.m.	24	550.00	19695.50	4.73
iv)	W.C.	Sq.m.	16	685.00	24529.85	3.92
v)	Battery room	Sq.m.	18	550.00	19695.50	3.55
vi)	Hard Stand	Sq.m.	160	45.00	1611.45	2.58
vii)	Bituminous pavement	Sq.m.	250	33.00	1181.73	2.95
viii)	Security post	Sq.m.	10.5	380.00	13607.80	1.43

Appendix- A.2.1.

UCE of Project Report for Jhiria West Opencast Project (1.5 mty)

Statement Showing the Estimated Capital Requirement on Service Buildings

(Amount in Rs.Lakhs)

Sl. No.	Particulars	Unit	Quantity	Rate at 100CI (Rs.)	Rate at 3581 CI (Rs.)	Total Amount (lakhs)
ix)	Boundary wall with gate	RM	250	112.00	4010.72	10.03
x)	Oil and grease trap		LS			5.00
xi)	Dumper Repair shop	Sq.m.	432	740.00	26499.40	114.48
xii)	Dozer Repair shop	Sq.m.	216	740.00	26499.40	57.24
xiii)	Electrical Repair shop	Sq.m.	540	550.00	19695.50	106.36
15	Parks & Play ground	LS				5.00
16	Security Barrack (twin sharing)	No.	13	9938.50	355897.69	46.27
	Sub-Total					**939.26**
	Add for contingencies @ 3%					28.18
	Total without GST					**967.44**
	GST @ 18%					**174.14**
	Total With GST					**1141.58**

Appendix - A.2.2

UCE of Project Report for Jhiria West Opencast Project (1.5 mty)

Statement showing Capital Investment on Residential Building

(Amount in Rs. Lakhs)

Sl. No	Category/Scale	Type of Qtrs.	Manpower	% satis-faction	No. of Quarters Reqd.	Net Quarters Reqd.	No. of existing Qtrs.	Balance Qtrs. Reqd.	Unit Cost at 100CI	Unit Cost at 3581 CI	Total Amount
1	Cat-I to VI and Grades B,C,D & E	MQ	134	45	60	60 (5 - 1)	60	0	0.150	5.372	0.00
2	16110.68 to 16691.02	A	9	58	5	4	4	0	0.157	5.622	0.00
3	16877.86 to 28566.68 Grade A and Spl. Grade E1 & E2	B	138	58	80	59 (80 - 21)	59	0	0.224	8.021	0.00
4	E3 to E5	C	19	100	19	19	19	0	0.359	12.856	0.00
5	E6 and above	D	4	100	4	4	4	0	0.772	27.645	0.00
6	Hostel type Accommodation					22	22	0	0.099	3.545	0.00
7	Provision for land development and Horticulture								LS		0.00
8	Provision for rain water harvesting								LS		9.00
	Sub - Total		**304**	**55.26**	**168**	**168**	**168**	**0**			**9.00**
	Add 3% contingencies										0.27
	Total without GST										**9.27**
	GST @ 18%										**1.67**
	Total with GST										**10.94**

Note: 1. 29 nos. of type quarters has been considered as hostel type accommodation.

Appendix-A.2.3

UCE of Project Report for Jhiria West Opencast Project (1.5 mty)

Statement showing the Building Cost Index with reference to 100 Base in Delhi as on 1.10.76 in May 2018

SL. NO.	DESCRIPTION	UNITS	RATES AS ON 1.10.76 AT DELHI	RATES AT AREA	PERCENTAGE INCREASE (RATIO BETWEEN COL.5&4)	WEIGH-TAGE	COST INDEX
1.	2.	3.	4.	5.	6.	7.	8.
1.	BRICKS	1000	106.15	2700.00	25.44	16.0	407.04
2.	SAND 67% COARSE, 33 % FINE	Cu.M	21.92	450.00	20.53	5.0	102.65
3.	CEMENT	QUINTAL	35.28	520.00	14.74	21.0	309.54
4.	STONES |50% - 40mm AGGREGATE |50% - 20mm	Cu.M	27.10	1220.00	45.02	6.5	292.63
5.	TIMBER (SAL/BIJA SAL)	Cu.M	2021.00	50000.00	24.74	18.0	445.32
6.	MILD/TOR STRUCTURAL STEEL	QUINTAL	183.20	4400.00	24.02	10.0	240.20
7.	LABOUR :						
	a) MASON	EACH	9.89	588.40	59.49	8.5	505.67
	b) CARPENTER	EACH	9.89	588.40	59.49	4.0	237.96
	c) UNSKILLED	EACH	4.41	417.06	94.57	11.0	1040.27
					TOTAL		3581.28
					SAY		**3581**

APPENDIX- A.3

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

Statement showing the estimated capital investment for Plant and Machinery

(Partial Outsourcing Option)

Amount in Rs. Lakhs

Sl.No.	Particulars	Total Provision	Phasing Of Additional Capital					Rate Of Deprn.(%)	Annual Depreciation
			1st Year	2nd Year	3rd Year	4th Year	5th Year		
	HEMM								
A.	**OVERBURDEN (App-A.3.1)**	0.00		0.00	0.00	0.00	0.00		0.00
B.	**COAL (App-A.3.1)**	3185.07		1913.54	443.61	827.92	0.00		353.86
C.	**RECLAMATION (App-A.3.1)**	448.89		149.63	149.63	149.63	0.00		49.87
D.	**COMMON (App-A.3.1)**	1297.88		40.09	1010.93	246.85	0.00		144.19
E.	**SPARES & CONTINGENCY**	564.58		240.94	188.26	135.38	0.00		62.72
	Sub-Total HEMM (A+B+C+D+E)	**5496.42**		**2344.20**	**1792.44**	**1359.78**	**0.00**		**610.65**
F.	**Other than HEMM**								
1	Electrical P&M (App-A.3.2)	935.83		554.32	330.94	50.57		5.56	52.03
2	Workshop P&M (App-A.3.3)	580.62		315.82	231.91	32.89		5.56	32.28
3	Pumps Pipes & Fittings (App-A.3.4)	363.47	0.00	34.95	153.16	111.36	64	5.56	20.21
4	Coal Handling Plant (App-A.3.5)	71.54	0.00	36.77	34.77	0.00	0.00	5.56	3.98
5	Other P&M (App-A.3.6)	782.00		291.00	311.00	180.00	0.00	11.11	86.88
	Sub-Total(F)	**2733.46**		**1232.86**	**1061.78**	**374.82**	**64.00**		195.38
	GRAND TOTAL (A+B+C+D+E+F)	**8229.88**		**3577.06**	**2854.22**	**1734.60**	**64.00**		**806.04**

Appendix- A 3.1

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

Statement showing the estimated capital requirement for HEMM(Partial Outsourcing Option)

Amount in Rs. Lakhs

Sl. No.	Particulars	Unit	Size/ Capacity	Capital Provision			Phasing of equipments								Rate of depreciation (%)	Annual Depreciation Amount
				No.	Unit Price	Amount	1st year		2nd year		3rd year		4th year			
							No.	Amount	No.	Amount	No.	Amount	No.	Amount		
A.	**OVERBURDEN**															
B.	**COAL**															
6	Surface Miner	Mty	1.50 - 2.50	1	419.20	419.20			1	419.20					11.11	46.57
7	Water Sprinkler	KL	28	1	173.44	173.44			1	173.44					11.11	19.27
9	Pay Loader	Cum	6.40	2	384.31	768.62			1	384.31			1	384.31	11.11	85.39
10	Rear Dumpers	T	60	7	221.81	1552.65			3	665.42	2	443.61	2	443.61	11.11	172.50
11	Dozers/Wheel Dozer	HP	400-410	1	271.17	271.17			1	271.17					11.11	30.13
	Sub-Total (B)					**3185.07**				**1913.54**		**443.61**		**827.92**		**353.86**
C.	**RECLAMATION**															
12	Misting Spray Sprinkler	KL	28	3	149.63	448.89			1	149.63	1	149.63	1	149.63	11.11	49.87
	Sub-Total (C)					**448.89**				**149.63**		**149.63**		**149.63**		**49.87**
D.	**COMMON**															
15	Dozers	HP	400-410	1	271.17	271.17					1	271.17			11.11	30.13
16	Motor Grader	HP	280	1	262.55	262.55					1	262.55			11.11	29.17
17	Front End Loader	Cum	2.0 - 3.0	1	40.09	40.09			1	40.09					11.11	4.45
18	Diesel Hydraulic Backhoe	Cum	2.5-3.0	1	205.96	205.96							1	205.96	11.11	22.88
20	Crane('C')	T	40/30	1	11.41	11.41					1	11.41			11.11	1.27
24	Tyre Handler	T	6 - 8	1	424.92	424.92					1	424.92			11.11	47.21
25	Diesel Bouser	KL	20	2	40.88	81.77					1	40.88	1	40.88	11.11	9.08
	Sub-Total (D)					**1297.88**				**40.09**		**1010.93**		**246.85**		**144.19**
	Total (A+B+C+D)					**4931.84**				**2103.26**		**1604.18**		**1224.40**		**547.93**
E	**SPARES & CONTINGENCY**															
26	Float assemblies for Dumpers & Dozers @ 12.5%					317.98				135.78		108.05		74.16	11.11	35.33
27	Contingencies @ 5%					246.59				105.16		80.21		61.22	11.11	27.40
	Sub-Total (E)					**564.58**				**240.94**		**188.26**		**135.38**		**62.72**
	Total (A+B+C+D+E)					**5496.42**				**2344.20**		**1792.44**		**1359.78**		**610.65**

Note : All HEMM should be Air Condition fitted.

Project Report for Jhiria West Open Cast Project - Partial Hiring Option

Estimated Summarised Capital Requirement for Electrical and Communication Plant and Machinery

APPENDIX-A.3.2

(Amount in Rs' lakhs)

Sl.No.	Particulars	Capital Requirement	Yearwise phasing of capital requirement		
			2nd	3rd	4th
1	**Surface Substation**	377.79	184.97	192.81	0.00
2	**Quarry Power Supply**	46.54	35.49	3.52	7.53
3	**O/H Line and Cables**	336.91	243.94	84.64	8.33
4	**Lighting Arrangement (in the Quarry)**	70.00	23.33	23.33	23.33
5	**Safety,Testing and maint.including telscopic ladder**	15.00	5.00	5.00	5.00
6	**Colony Electricals for Modifications**	20.00	10.00	5.00	5.00
	Total of Appendix A.3.2	**866.23**	**502.73**	**314.30**	**49.20**
	Total of Appendix A.3.2.2 (Communication System)	**69.60**	**51.59**	**16.64**	**1.37**
	Grand Total	**935.83**	**554.32**	**330.94**	**50.57**

APPENDIX-A.3.2.1

Project Report for Jhiria West Opencast Project(1.50 Mty) -Partial Hiring Option

Estimated capital investment on P&M-electrical

(Amount in Rs lakhs)

Sl.No.	Particulars	Capital Requirement			Yearwise phasing of capital requirement		
		Qty	Unit Price	Amount	2nd Yr	3rd Yr	4th Yr
1.0	**33/3.4 kV SUBSTATION**						
1.1	Isolator with earth switch, 33 kV, 3pole, outdoor type, gang operated, 1250 amps conforming to IS:1818 (Current)	4	2.02	8.08	4.04	4.04	
1.2	Isolator, 33 kV, 3pole, outdoor type, gang operated, 1250 amps conforming to IS:1818 (Current)	4	2.10	8.42	4.21	4.21	
1.3	Isolator, 33 kV, 3pole, outdoor type, gang operated, 1250 amps with earth switch and D.O. Fuses.	4	2.14	8.56	4.28	4.28	
1.4	Lightning arrestor,station class, 30 kV ,10 kA for 33 kV system	8	0.40	3.22	1.61	1.61	
1.5	Single phase current transformer ,outdoor type with CT ratio of 150/5 A for 33 kV system for metering and protection (1 set consists of 3 nos for 3 phase supply)	5	1.20	5.99	3.59	2.40	
1.6	Potential transformer ,outdoor type 33kV, 100 VA each 33 kV/ 110V with two cores for metering and protection	2	0.94	1.88	0.94	0.94	
1.7	Vaccum Circuit Breaker, 33kV,1250 A, outdoor type, 750 MVA symmetrical breaking capacity with remote control panel having IDMTL relay for O/L and E/F protection, Digital type microprocer based power meter, battery charging system etc.	4	5.54	22.18	11.09	11.09	
1.8	Vaccum Circuit Breaker, 33kV,1600 A, outdoor type, 750 MVA symmetrical breaking capacity with remote control panel having IDMTL relay for O/L and E/F protection, Digital type microprocer based power meter, battery charging system etc.	1	6.84	6.84	6.84		
1.9	Transformer outdoor type conforming to IS:2026 (current) having	2	7.55	15.11	7.55	7.55	
	OFF-LOAD tap changer on HV side with remote control panel						

APPENDIX-A.3.2.1

Project Report for Jhiria West Opencast Project(1.50 Mty) -Partial Hiring Option

Estimated capital investment on P&M-electrical

(Amount in Rs lakhs)

Sl.No.	Particulars	Capital Requirement			Yearwise phasing of capital requirement		
		Qty	Unit Price	Amount	2nd Yr	3rd Yr	4th Yr
	and all accessories as per IS:3639 (Current) with the ratinga as follows: Rated kVA: 1000 Rated Voltage(primary):33000V Rated Voltage(secondary):3400V Connection and vector group:Dy11						
1.10	Neutral Grounding Ressitance System with Instantaneous Earth Fault relay and CT	2	2.57	5.13	2.57	2.57	
1.11	14- panel ,3.4 kV switch-board, indoor type, with 16 vacuum circuit breakers, 1600 amps for incomer and sectionaliser, 630 amps for cap. bank panel and 630 amps for outgoing, 75 MVA symmetrical breaking capacity. The function of each panel is as follows:	1	26.11	26.11		26.11	
	-2nos incoming feeder control circuit breaker panel having CT ratio of 250/5 amps -1no sectionliser control circuit breaker panel having CT ratio of 250/5 amps -2nos capacitor bank control circuit breaker panel with automatic power factor control facility. having CT ratio of 75/5 amps -2 no outgoing feeder control circuit breaker panel for CHP Feeder having CT ratio of 175/5 amps -2 no outgoing feeder control circuit breaker panel for Pumps having CT ratio of 100/5 amps 1 no outgoing feeder control circuit breaker panel for Workshop having CT ratio of 75/5 amps						

APPENDIX-A.3.2.1

Project Report for Jhiria West Opencast Project(1.50 Mty) -Partial Hiring Option

Estimated capital investment on P&M-electrical

(Amount in Rs lakhs)

Sl.No.	Particulars	Capital Requirement			Yearwise phasing of capital requirement		
		Qty	Unit Price	Amount	2nd Yr	3rd Yr	4th Yr
	1 no outgoing feeder control circuit breaker panel for Surface Ltg. Feeder having CT ratio of 75/5 amps 1 no outgoing feeder control circuit breaker panel for Quarry Lighting Feeder having CT ratio of 75/5 amps -2 no outgoing feeder control circuit breaker panel for Reserve having CT ratio of 250/5 and 75/5 amps All panels will conform to IS:3427 (current) and relevent parts to IS:2516. These will be provided with cable end boxes. The incoming panels will be provided with earth fault Protection. All panels will be provided with IDMTL relays for over current and earth fault protection. All incoming control circuit breaker shall be provided with Digital type microprocer based Power meter and outgoing control circuit breaker shall be provided with Digital type ammeter & energy meter.						
1.12	Lighting Transformer,outdoor type rated as follows: Rated kVA: 63 Rated Voltage(primary):33000 V Rated Voltage(secondary):240 V (L-L)	1	1.50	1.50		1.50	
1.13	Station Transformer,outdoor type rated as follows: Rated kVA: 160	1	2.81	2.81		2.81	

APPENDIX-A.3.2.1

Project Report for Jhiria West Opencast Project(1.50 Mty) -Partial Hiring Option

Estimated capital investment on P&M-electrical

(Amount in Rs lakhs)

Sl.No.	Particulars	Capital Requirement			Yearwise phasing of capital requirement		
		Qty	Unit Price	Amount	2nd Yr	3rd Yr	4th Yr
1.14	Rated Voltage(primary):33000 V Rated Voltage(secondary):440 V 415V switch board, indoor type with 5nos Moulded Case circuit breakers having O/L ,S/C and E/L protection ,25MVA symmetrical breaking capacity. (All out going panels will be provided with Energy meter & ammeter. The incomming panel with be provided Energy merer, ammeter and voltmeter) The function of each panel will be as follows: --600 amps MCCB, CTR 300/5 (1no.)- Incomer -200 amps MCCB, CTR 75/5 (2 nos.)-outgoing -200 amps MCCB, CTR 60/5 (2 no.)-outgoing	1	3.42	3.42	3.42		
1.15	230 V (L-L) Lighting switch boardwith the following : --1no. MCCB, 3 pole,400 amps for control of incoming feeder. --2 nos. MCCB, 3 pole,100 amps for control of outgoinging feeders. -2 nos.,MCBs, 3 pole,63 amps for control of out going feeders. -3 nos.,MCBs, 2 pole,63 amps for control of out going feeders. -3 nos.,MCBs, 2 pole, 40 amps for control of out going feeders.	1	1.35	1.35	1.35		
1.16	Capacitor bank ,3.4 kV indoor type 200 kVAR including APFC and Control Panel.	2	8.62	17.25	8.62	8.62	
1.17	110 V Battery and battery charging set for emergency lighting inside Substation building & DC distribution board.	LS		7.00	7.00		
1.18	Substation earthing and Lightning protection arrangement.	LS		8.00	4.00	4.00	
1.19	Cables(Power,Lighting and Control)	LS		28.00	14.00	14.00	

APPENDIX-A.3.2.1

Project Report for Jhiria West Opencast Project(1.50 Mty) -Partial Hiring Option

Estimated capital investment on P&M-electrical

(Amount in Rs lakhs)

Sl.No.	Particulars	Capital Requirement			Yearwise phasing of capital requirement		
		Qty	Unit Price	Amount	2nd Yr	3rd Yr	4th Yr
1.20	33 kV String bus bar,Insulators , nut ,bolts etc	LS		4.00	2.00	2.00	
1.21	Illumination of substation	LS		25.00	15.00	10.00	
1.22	(i) Fire fighting System - Supply of Diesel Pump , Jockey Pump and Electric Pump for Hydrant type fire fighting, associated change over switch, 415 V Panel with protection and cables and Electricals , hoses , hydrant valves , high Velocity Water Spray system for Power transformers , electricals for submersible pump etc as per design . (ii) Fire Detection , Alarm and protection system in the substation building and pump house etc	LS		40.00	20.00	20.00	
1.23	Misc.items like safty items, tools, testing equpt, DG set ,Fans,coolers,cable tray etc.	LS		20.00	10.00	10.00	
1.24	Turnkey Execution charges.(40% of item1.1 to 1.23)	LS		107.94	52.85	55.09	
1.25	**Sub Total (1.1 to 1.24)**			**377.79**	**184.97**	**192.81**	
1.25	**GST ON TURNKEY**			**68.00**	**33.29**	**34.71**	
1.26	**TOTAL**			**445.79**	**218.26**	**227.52**	
2.0	**QUARRY POWER SUPPLY:**						
2.1	4- panel ,3.3 kV switch-board, outdoor type, with 4 vacuum circuit breakers, 630 amps, 75 MVA symmetrical breaking capacity. The function of each panel is as follows: -1 no. Circuit breaker panel having CT ratio of 350/5 A as controller for incoming feeder -3nos. Circuit breaker panels having CT ratio of 75/5 A as controller for pump feeders.	2 Sets	7.53	15.06	7.53		7.53

APPENDIX-A.3.2.1

Project Report for Jhiria West Opencast Project(1.50 Mty) -Partial Hiring Option

Estimated capital investment on P&M-electrical

(Amount in Rs lakhs)

Sl.No.	Particulars	Capital Requirement			Yearwise phasing of capital requirement		
		Qty	Unit Price	Amount	2nd Yr	3rd Yr	4th Yr
	All panels will conform to IS:3427 (Current) and relevent parts to IS:2516 (current). These will be provided with cable entry boxes. The incoming panels will be provided with restricted earth fault protection. All panels will be provided with IDMTL rrelayes for over current and earth fault protction. The incoming and outgoing panels shall be provided with Trivector meters.						
2.2	Unitised Substation, 400 kVA, 3.3 kV/415 V with3.3 kV, 630 amps, 75 MVA, VCB (1 no) and 433V, 800 amps, 50 MVA, ACB (2nos)	2	10.36	20.72	20.72		
2.3	Lighting transformer, single phase, pole mounted	8	0.63	5.07	2.53	2.53	
	25 kVA,3.3 kV/230 V (L-L)						
2.4	Isolator, 3.3 kV, 3pole, outdoor type, gang operated, 630/1250 amps conforming to IS:1818 (Current)	10	0.27	2.74	2.74		
2.5	Lightning arrestor 3.3 kV ,5 kA, distribution class for 3.3kV system	15	0.20	2.95	1.97	0.98	
	Sub Total (2.1 to 2.5)			**46.54**	**35.49**	**3.52**	**7.53**
3.0	**O/H LINE AND CABLES**						
3.1	33 kV O/H line Double Circuit with all accessories in km	6.0	25.00	150.00	150.00		
3.2	3.3 kV O/H line with all accessories in km	12	9.50	114.00	57.00	57.00	
3.3	Cables PVC DWA mining type, 3 core, copper conductors 3.3 kV grade of sizes 70 sq.mm in km.	1.5	18.61	27.91	18.61	9.30	
3.4	Cables PVC DWA mining type, 3 core, copper conductors 3.3 kV grade of size 35/25 sq.mm	LS		20.00	10.00	10.00	
3.5	Cables,PVCDWA, mining type, 3 core, copper conductors, 1100V grade of sizes 95 sq.mm, 70 sq.	LS		15.00	5.00	5.00	5.00

APPENDIX-A.3.2.1

Project Report for Jhiria West Opencast Project(1.50 Mty) -Partial Hiring Option

Estimated capital investment on P&M-electrical

(Amount in Rs lakhs)

Sl.No.	Particulars	Capital Requirement			Yearwise phasing of capital requirement		
		Qty	Unit Price	Amount	2nd Yr	3rd Yr	4th Yr
3.6	mm,35 sq.mm, 25 sq.mm.,16 sq.mm.& 10 sq. mm. 3.3 & 1.1 kV flexiable cable of different size.	LS		10.00	3.33	3.33	3.33
	Sub Total (3.1 to 3.6)			**336.91**	**243.94**	**84.64**	**8.33**
4.0	Lighting Arrangement (in the Quarry,roads etc.) includes towers/ masts, poles, cables, luminaries(LED/HPSV), conductors etc.			**70.00**	**23.33**	**23.33**	**23.33**
5.0	Misc. Items including mini truck mounted telescopic ladder etc.			**15.00**	**5.00**	**5.00**	**5.00**
6.0	Colony Electricals for Modifications	LS		20.00	10.00	5.00	5.00
7.0	**Grand Total (items 1 to 6)**			**866.23**	**502.73**	**314.30**	**49.20**

* Cable lengths are indicative and may vary as per site conditions.

Project Report for Jhiria West Open Cast project (Partial Hiring Option)

Estimated Capital investmenton P&M-Communication system

Appendix A.3.2.2

Amount in Rs000

Sl. No.	Particulars	Qty.	Unit Cost	Total Cost	Year Wise Phasing					
					2nd Year		3rd Year		4th Year	
					Qty.	Cost	Qty.	Cost	Qty	Cost
1.00	**2.00**	**3.00**	**4.00**	**5.00**	**6.00**	**7.00**	**8.00**	**9.00**	**10.00**	**11.00**
COMMUNICATION										
1.00	Surface Mine Communication									
	a. IP Exchange 150 lines with accessories	1.00		1200.00	LS	1000.00	LS	200.00		
	b. BSNL fixed lines	10.00	3.00	30.00	4.00	12.00	4.00	12.00	2.00	6.00
	c. Mobile Connection with sets	10.00	5.00	50.00	4.00	20.00	3.00	15.00	3.00	15.00
2.00	VHF System with accessories	LS		1500.00	LS	1000.00	LS	500.00		
3.00	10 PCs with LAN, Hardware and Software	LS		500.00	LS	300.00	LS	100.00	LS	100.00
4.00	L3 Switch	1.00	300.00	300.00	1.00	300.00				
5.00	L2 Switch	2.00	100.00	200.00	1.00	100.00	1.00	100.00		
6.00	Point to Multi Point Radio (1 Base,3Remote)	LS	150.00	300.00	LS	300.00				
7.00	Internet connectivity leased line 2/4 Mbps	LS	250.00	250.00	LS	250.00				
8.00	UPS 6 KVA	1.00	250.00	250.00	1.00	250.00				
9.00	Cables & Accessories along with laying	LS		1500.00	LS	1000.00	LS	500.00		
10.00	Furniture fitting with Air Conditioning etc.	LS		100.00	LS	100.00				
11.00	Testing & Measuring Equipment	LS		100.00			LS	100.00		
12.00	Installation and commissioning	LS		453.00		351.00		91.00		11.00
13.00	Spares	LS		227.00		176.00		46.00		5.00
Sub Total				**6960.00**		**5159.00**		**1664.00**		**137.00**

PROJCT REPORT FOR JHIRIA WEST OCP (1.50 Mty)

Statement showing summary of the estimated capital requirement for unit workshops and store P & M
(Considering 330 days working per year)
(Option - Partial Departmental)

Appendix-A.3.3
(Amount in Rs Lakhs)

Sl.no	Description		Year wise Phasing of additional capital			
		Amount	1st	2nd	3rd	4th
1	Unit Excavation workshop (Appendix A.3.3.1)	514.25	0.00	274.06	208.87	31.30
2	Unit E& M work shop (Appendix A.3.3.2)	41.06	0.00	26.66	12.8	1.59
3	Unit store (Appendix A.3.3.3)	25.33		15.10	10.24	0.00
4	**Total**	**580.64**	**0.00**	**315.82**	**231.91**	**32.89**

PR FOR JHIRIA WEST OPEN CAST PROJECT (1.50 MTY)
Statement Showing the Estimated Capital Investment on unit excavation Workshop Plant and Machinery
(Option - Partial Departmental)

Appendix A.3.3.1
(Amount in Rs.-lakhs)

Sl. no.	Description	Total Requirement			Year wise Phasing of capital requd.				GST%
		Qty	U Price	Amt	Ist	2nd	3rd	4th	
A	**MACHINE SHOP**								
1	Light duty Centre Lathe,CH-475-525 mm,DBC-1000mm alongwith accessories.	1	3.17	3.17			3.17		18.00
2	Medium duty Centre Lathe,CH-260 mm,DBC-1500mm alongwith accessories.	1	3.93	3.93		3.93			18.00
3	Radial drilling machine, drilling capacity in steel 50mm maximum drilling radius 1500 mm	1	13.58	13.58		13.58			18.00
4	Milling machine,1350x310mm,Longitudinal:800mm,cross:265mm, vertical:400mm,motor ;5.5kw	1	17.51	17.51			17.51		18.00
5	Shaping machine, stroke 630 mm	1	2.54	2.54		2.54			18.00
6	Pedestal grinder, whel dia-300 mm.	1	1.10	1.10			1.10		18.00
7	Power hack saw suitable for 125-150 mm rounds	1	1.59	1.59				1.59	18.00
8	Measuring gauges,tools,workman tables,tackles etc.	LS		5.00		2.00	2.00	1.00	18.00
9	**Sub total of items 1 to 8**			**48.42**	**0.00**	**22.05**	**23.78**	**2.59**	
B	**ELECTRICAL REPAIR SHOP**								
1	Cable vulcaniser	1	1.04	1.04		1.04			18.00
2	Cable crimping m/c, hydraulic operated	1	0.66	0.66		0.66			18.00
3	Motor cheker	2	0.24	0.48		0.24	0.24		18.00
4	Earth tester	2	0.11	0.22		0.11	0.11		18.00
5	Bearing puller, 50t cap.	2	14.31	28.62		14.31	14.31		18.00
6	Bearing heater , induction type	1	6.90	6.90		6.90			18.00
7	Battery charging units ,72 V	1	0.81	0.81			0.81		18.00
8	Distilled water plant , 15 lit /hr capacity	1	0.58	0.58		0.58			18.00

PR FOR JHIRIA WEST OPEN CAST PROJECT (1.50 MTY)
Statement Showing the Estimated Capital Investment on unit excavation Workshop Plant and Machinery
(Option - Partial Departmental)

Appendix A.3.3.1
(Amount in Rs.-lakhs)

Sl. no.	Description	Total Requirement			Year wise Phasing of capital requd.				GST%
		Qty	U Price	Amt	Ist	2nd	3rd	4th	
9	Test bench for testing of starters, dynamos, cut outs harns etc	1	2.64	2.64			2.64		18.00
10	Misc. items including tools,testing instruments,soldering rod, tackles, workman tables etc.	LS	-	5.00		2.00	2.00	1.00	18.00
11	Emergency inflatable portable lighting system	1	3.83	3.83			3.83		18.00
12	**Sub total of items 1 to 11**			**50.78**	**0.00**	**25.84**	**23.94**	**1.00**	
C	**DUMPER REPAIR AND MAINTENANCE SHOP**								
1	Pressuried automatic lubricating system with suitable air compressor	1	7.78	7.78		7.78			18.00
2	Air compressors, 8cum/min. capacity, 10 Kg/sq.cm along with accessories	1	9.31	9.31		9.31			18.00
3	Tyre inflator , electronic	2	3.60	7.20		3.60	3.60		18.00
4	Articulated mobile tank with funnel to collect waste oil	1	0.52	0.52			0.52		18.00
5	Nitrogen charging kit	1	0.27	0.27			0.27		18.00
6	Hydraulic jack								18.00
	200 t capacity	1	3.86	3.86			3.86		18.00
	100 t capacity	1	3.19	3.19			3.19		18.00
7	Hydraulic press, 200 t capacity along with accessories	1	9.88	9.88		9.88			18.00
8	Hydraulic puller, 200 t capacity, wheel mounted	1	18.48	18.48			18.48		18.00
9	Bearing heater, induction type	1	6.79	6.79			6.79		18.00
10	Portable boring with welding resurface machine	1	4.76	4.76			4.76		18.00
11	SPM vibration analiser	1	3.81	3.81				3.81	18.00
12	Portable oil filtration machine for solid particles	1	6.49	6.49		6.49			18.00
13	Transformer welding sets								18.00
	400 amps capacity	1	0.71	0.71		0.71			18.00

PR FOR JHIRIA WEST OPEN CAST PROJECT (1.50 MTY)
Statement Showing the Estimated Capital Investment on unit excavation Workshop Plant and Machinery
(Option - Partial Departmental)

Appendix A.3.3.1
(Amount in Rs.-lakhs)

Sl. no.	Description	Total Requirement			Year wise Phasing of capital requd.				GST%
		Qty	U Price	Amt	Ist	2nd	3rd	4th	
	600 amps capacity	1	0.95	0.95		0.95			18.00
14	Thyrister controlled welding set, 600 amps	1	4.37	4.37		4.37			18.00
15	Portable type welding set, invertor based, 100 amps	1	2.12	2.12			2.12		18.00
16	Oxy acetylene gas cutting brazing set	2	0.42	0.84			0.42	0.42	18.00
17	Torque wrench along with accessories	1	14.14	14.14		14.14			18.00
18	Master tool kits	4	3.93	15.72		7.86	7.86		18.00
19	Electric hand tools								18.00
	Hand drill 25 mm dia.	1	0.48	0.48				0.48	18.00
	Hand grinder, 100mm wheel dia.	1	0.14	0.14				0.14	18.00
	Flexible shaft grinder	1	0.50	0.50			0.50		18.00
	Portable Blower	1	0.10	0.10		0.10			18.00
20	Diagnostic tools, instruments, tools, instruments etc.	LS		6.00		2.00	2.00	2.00	18.00
21	**Sub total of items 1 to 20**			**128.41**	**0.00**	**67.19**	**54.37**	**6.85**	
D	**DOZER REPAIR SHOP**								
1	Pressurised automatic lubricating system with suitable air compressor	1	7.78	7.78		7.78			18.00
2	Master tool kit	2	3.93	7.86		3.93	3.93		18.00
3	Heavy duty impact sockets	2	16.91	33.82		16.91	16.91		18.00
4	Electric hand tools								18.00
	a) Hand Drill 25 mm	2	0.48	0.96		0.48	0.48		18.00
	b) Hand grinder100mm	2	0.14	0.28		0.14	0.14		18.00
	c) Angle grinder	2	0.50	1.00		0.50	0.50		18.00
5	Welding transformer, 600 A	1	0.95	0.95		0.95			18.00
6	Oxy- acetylene gas cutting and welding set	1	0.42	0.42		0.42			18.00

PR FOR JHIRIA WEST OPEN CAST PROJECT (1.50 MTY)
Statement Showing the Estimated Capital Investment on unit excavation Workshop Plant and Machinery
(Option - Partial Departmental)

Appendix A.3.3.1
(Amount in Rs.-lakhs)

Sl. no.	Description	Total Requirement			Year wise Phasing of capital requd.				GST%
		Qty	U Price	Amt	Ist	2nd	3rd	4th	
7	Oil filtration machine	1	6.49	6.49		6.49			18.00
8	Misc.like benches, racks for parts, cabinets, tools etc.	LS		2.00		1.00	0.70	0.30	18.00
9	**Sub total of items 1 to 8**			**61.56**	**0.00**	**38.60**	**22.66**	**0.30**	
E	**Common equipment**								
1	Fire fighting equipment(Sand buckets, Fire hydrants, Fire extinguishers, Fire pumps etc.)	LS		30.00		15.00	10.00	5.00	18.00
2	Furniture and fittings	LS		4.00		2.00	2.00		18.00
3	Diesel generator welding set 600 amps, tyre mounted	1	6.55	6.55		6.55			18.00
4	Ventilation and pressurisation system	LS		25.00		15.00	10.00	0.00	18.00
5	Air- conditioner	2	0.39	0.78				0.78	18.00
6	Portable incinerator for burning of combustible trash like oil soaked cotton etc.	1	7.15	7.15				7.15	18.00
7	Industrial vacuum cleaner	1	1.19	1.19			1.19		18.00
8	Oil testing instruments such as viscometer, particle counter, TAN/TBN	LS		25.00		15.00	10.00		18.00
9	Remote controlled tyre mounted hydraulic jack with pump for tyre mounting work cap.100te	1	15.43	15.43			15.43		18.00
10	**Sub total of items 1 to 10**			**99.67**	**0.00**	**53.55**	**33.19**	**12.93**	
F	**TOTAL (A TO E)**			**388.84**	**0.00**	**207.23**	**157.94**	**23.67**	
G	Electrical plant and machinery including substation power supply etc. @ 15% of item K.			58.33	0.00	31.08	23.69	3.55	18.00
H	Installation charges @ 10% of items (K+L)			44.72	0.00	23.83	18.16	2.72	18.00
I	Contingencies @ 5% of items (K+L)			22.36	0.00	11.92	9.08	1.36	18.00
K	**GRAND TOTAL OF ITEMS F TO I**			**514.25**	**0.00**	**274.06**	**208.87**	**31.30**	

PROJCT REPORT FOR JHIRIA WEST OC PROJECT (1.50 Mty)

Statement showing estimated capital requirement for E& M workshop plant and machinery
(Considering 330 days working per year)
(Option - Partial Departmental)

Appendix-A.3.3.2
(Amount in Rs Laks)

Sl. no	Description	Total requirement			Year wise Phasing of additional capital				GST%
		Qty	U Rate	Amt	1st	2nd	3rd	4th	
A.	**MACHINE SHOP**								
1	Centre lathe,swing over bed 400mm,centre distance 1000 mm alogwith accessories	1	3.17	3.17		3.17			18.00
3	Pedestal grinder, wheel dia. 300mm	1	1.10	1.10		1.10			18.00
4	Power hack saw suitable for 300mm rounds	1	1.59	1.59			1.59		18.00
5	Measuring gauges, tools, workman tables,tackles etc.	LS		0.70		0.30	0.20	0.20	18.00
6	**Sub Total of items 1 o 5**			**6.56**	**0**	**4.57**	**1.79**	**0.20**	
B.	**EQUIPMENT REPAIR SHOP**								
1	Transformer welding set,400A	1	0.71	0.71		0.71			18.00
2	Oxyacetylene gas welding set and brazing set	1	0.42	0.42			0.42		18.00
3	Electric hand tools								18.00
	I)Hand drill,drilling cap. 25mm	1	0.48	0.48		0.48			18.00
	ii)Hand grinder,100mm wheel dia.	1	0.14	0.14		0.14			18.00
	iii)Electric blower	1	0.10	0.1		0.1			18.00
4	Hydraulic press 50 t capacity	1	2.86	2.86			2.86		18.00
5	Induction type bearing heater	1	6.79	6.79		6.79			18.00
6	Steam jenny for washing of the equipment,2.7kW	1	2.62	2.62			2.62		18.00
7	Misc items including tools & tackles,workman table etc.	LS		2.50		1.00	1.00	0.50	18.00
9	**Sub total of items 1 to 8**			**16.62**	**0**	**9.22**	**6.9**	**0.5**	
C.	**ELECTRICAL REPAIR SHOP**								
1	Cable vulcaniser	1	1.04	1.04		1.04			18.00

PROJCT REPORT FOR JHIRIA WEST OC PROJECT (1.50 Mty)

Statement showing estimated capital requirement for E& M workshop plant and machinery
(Considering 330 days working per year)
(Option - Partial Departmental)

Appendix-A.3.3.2
(Amount in Rs Laks)

Sl. no	Description	Total requirement			Year wise Phasing of additional capital				GST%
		Qty	U Rate	Amt	1st	2nd	3rd	4th	
2	Motor drying heating chamber	1	1.44	1.44		1.44			18.00
3	Cable fault detector	1	0.98	0.98		0.98			18.00
4	Cable crimping machine,hydarulic operated	1	0.66	0.66		0.66			18.00
5	H V testing kit	1	0.71	0.71		0.71			18.00
6	Portable relay testing equipment	1	1.04	1.04		1.04			18.00
7	Transformer oil die electric strength kit with glass test cell	1	0.38	0.38			0.38		18.00
8	Earth tester	1	0.11	0.11			0.11		18.00
9	Misc. items including tools,testing instruments, soldering rod, tackles, workman table etc.	LS		1.50		0.50	0.50	0.50	18.00
14	**Sub total of items 1 to 13**			**7.86**	**0**	**6.37**	**0.99**	**0.5**	
E	**Total A to D**			**31.04**	**0.00**	**20.16**	**9.68**	**1.20**	
F	Electrical plant and machinery including sub station,power supply etc. @ 15 % of E			4.66	0	3.02	1.45	0.18	18.00
G	Installation charges @ 10% of (E+F)			3.57	0	2.32	1.11	0.14	18.00
H	Contengencies @ 5% OF (E+F)			1.79	0	1.16	0.56	0.07	18.00
J	**Grand Total of E to I**			**41.06**	**0.00**	**26.66**	**12.8**	**1.59**	

PR FOR JHIRIA WEST OPEN CAST PROJECT (1.50 MTY)
Statement showing the estimated capital requirement for unit Store P&M
(Considering 330 days working per year)
(Option - Partial Departmental)

Appendix-A.3.3.3
Amount in Rs lakhs

Sl. No.	Description	Total Requirement			Year wise Phasing of Capital Reqd.			
		Qty	U Price	Amt	Ist	2nd	3rd	4th
1	**Material Handling Equipment**							
1.1	Electric hoist block, mono rail mounted,. 3/5 t cap.	1	3.68	3.68		3.68		
1.2	Chain pulley block, 5t	2	0.24	0.48		0.24	0.24	
	Sub total of 1			**4.16**		**3.92**	**0.24**	**0.00**
2	**Storage Racks**							
2.1	Racks, bins, cabinets, almirahs, tables,trolleys, pallet trucks, cardex, ventillation equipment, weighing machine etc.	LS		15.00		7.50	7.50	
	Sub total of 2			**15.00**		**7.50**	**7.50**	**0.00**
3	**Total of item 1 to 2**			**19.16**		**11.42**	**7.74**	**0.00**
4	Electricals(15% of item3)			2.87		1.71	1.16	0.00
5	Installation(10% of item 3+4)			2.20		1.31	0.89	0.00
6	Contingencies(5% of item 3+4)			1.10		0.66	0.45	0.00
7	**Grand Total(item 3 to 6)**			**25.33**		**15.10**	**10.24**	**0.00**

PROJCT REPORT FOR JHIRIA WEST OCP 1.5 MTY

Statement showing estimated capital requirement for pumps, pipes and pipe fittings (Option - Outsourcing/Departmental)

Appendix - A.3.4
(Amount in Rs. Lakhs)

Sl No.	Particulars	Qty	Unit Rate	Amount	1st	2nd	3rd	4th	5th	Life in %	Annual Dep.	GST%
A	**Pumps**											
1	Centrifugal pump-motor set, multi stage, 225 lps,70m head, 200 kW, 3.3 kV, NFLP electricals alongwith non-return valve, foot valve ,sluice valve and accessories (such as base plate, coupling, coupling guard, foundation bolts) etc.	3	17.83	53.49			17.83	17.83	17.83	5.56	2.97	12.00
2	Centrifugal pump-motor set, multi stage, 80lps, 60m head, 125 kW, 415kV, NFLP electricals.	2	8.74	17.48			8.74	8.74		5.56	0.97	12.00
3	Diesel engine operated Pump of 80lps, 60m & 110hp head with all accessories.	1	5.74	5.74		5.74				5.56	0.32	12.00
4	singal stage submsible pump for handling slurry, capacity:450-500m^3/hr, 40-50m.	2	7.33	14.66			7.33	7.33		5.56	0.82	12.00
5	Priming pump of 50 cum/hr, 16m head, with all accessories.	2	1.26	2.52			1.26	1.26		5.56	0.14	12.00
6	Face pumps,diesel engine operated, 11lps, 30m head along with required valves, suitable for battery start	2	1.35	2.70			2.70			5.56	0.15	12.00

PROJCT REPORT FOR JHIRIA WEST OCP 1.5 MTY

Statement showing estimated capital requirement for pumps, pipes and pipe fittings (Option - Outsourcing/Departmental)

Appendix - A.3.4
(Amount in Rs. Lakhs)

Sl No.	Particulars	Qty	Unit Rate	Amount	1st	2nd	3rd	4th	5th	Life in %	Annual Dep.	GST%
	sub total of items 1 to 6			**96.59**		**5.74**	**37.86**	**35.16**	**17.83**			12.00
B	**Pipes and pipe fittings**											
1	ERW pipe, 355.6 mm out side dia., 8 mm wall thickness, in km	3	26.02	78.06			26.02	26.02	26.02	5.56	4.34	18.00
2	ERW pipe, 219 mm out side dia., 6.30 mm wall thickness, in km	4	15.40	61.60		15.40	30.80	15.40		5.56	3.42	18.00
3	GI pipes medium duty, 100 mm dia, in km	1.0	7.10	7.10			3.55	3.55		5.56	0.39	18.00
4	GI pipes medium duty, 50 mm dia., in km	0.2	2.93	0.59			0.29	0.30		5.56	0.03	18.00
5	Pipe fittings such as bends,t joints,elbows, flanges, valves etc.	LS		14.74		1.54	6.07	4.53	2.60	5.56	0.82	18.00
	Sub total of items 1 to5			**162.09**		**16.94**	**66.73**	**49.80**	**28.62**		0.00	18.00
C	Civil cost for providing cross ways	LS		40.00			15.00	15.00	10.00	5.56	2.22	18.00
D	Pontoons for mounting pumps	3	2.90	8.70			2.90	2.90	2.90	5.56	0.48	18.00
E	Installation charges	LS		25.87		2.27	10.46	8.50	4.65	5.56	1.44	
F	Truck mounted crane	1	15.21	15.21			15.21			5.56	0.85	18.00
G	Hydrogeology study	LS	15.00	15.00		10.00	5.00			5.56	0.83	
H	**GRAND TOTAL OF ITEMS A TO G**			**363.46**	**0.00**	**34.95**	**153.16**	**111.36**	**64.00**		**20.19**	

Appendix-A.3.5

PR for Jhiria West OCP (1.50 Mty)
Statement showing estimated capital requirement for CHP

Amount in Rs Lakhs

Sl .No	Description	Qty.	Unit rate	Amount	Yearwise Phasing				% Life	Annual Dep.
					1st	2nd	3rd	4th		
1	Digital Weighing make static electronic road weigh bridge, 100 t,complete with following:Weigh platform size 16 x 3 m,Load Cell of 100t capacity - 8 nos,Intellegent Weigh Indicators - 1 no,Jumbo Display Panel - 1 no,Junction Boxes & Cabin,PC, Monitor & key board - 1 set, Printer - 2 nos., System Software, Structural Work, UPS with battery, Inbuilt Lightening Protection, Weigh Cabin with Air Conditioner & Water tank, Cable with conduit GI pipe etc,	2.00	15.38	30.76		15.38	15.38		5.56	1.71
2	Power supply and illumination	ls		10.00		5.00	5.00		5.56	0.56
3	Dust suppresion	ls		10.00		5.00	5.00		5.56	0.56
4	Miscellaneous	ls		10.00		6.00	4.00		5.56	0.56
5	Civil and Structural works Including weighbridge foundation & Room etc.	ls		10.77		5.39	5.39		5.56	0.60
	Grand Total			**71.53**	**0.00**	**36.77**	**34.77**			**3.98**

APPENDIX-A.3.6

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

STATEMENT SHOWING THE ESTIMATED CAPITAL REQUIREMENT ON OTHER PLANT AND MACHINERY

(Partial Outsourcing Option)

(RS. IN LAKHS)

Sl. No.	Description	Size/ capacity	Unit Cost	Total Provision	Phasing of Capital Provision										Depreciation	
					1st year		2nd year		3rd year		4th year		5th year		%	Amt
					No.	Amt	No.	Amt	No.	Amt	No.	Amt	No.	Amt		
1	Exploder with Continuity Tester	25 Shots		2.00				1.00		1.00					11.11	0.22
2	Survey Instrument	LS		50.00				20.00		20.00		10.00			11.11	5.56
3	Safety Eqipments	LS		50.00				20.00		20.00		10.00			11.11	5.56
4	Vibration Monitoring Equipment, Near fields blast design assessment & geometry package	LS		50.00						20.00		30.00			11.11	5.56
5	Thin Seam Blasting Technology & Study	LS		50				20.00		30.00					11.11	5.56
6	Permanent water sprinkling arrangement on haul road & loading site(2.5Km)			50.00				20.00		10.00		20.00			11.11	5.56
7	Fire Fighting Equipments	LS		30.00				10.00		10.00		10.00			11.11	3.33
8	Miscellaneous(For incorporation of latest technology in mine Safety, Surveillance & controll system for colony, office, despatch network, magazine and attendance capturing etc.)	LS		500.00				200.00		200.00		100.00			11.11	55.55
8	Others															
	Total			**782.00**		**0.00**		**291.00**		**311.00**		**180.00**		**0.00**		**86.88**

APPENDIX-A.4

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

Statement showing estimated capital requirement for Furniture & Fittings

(Partial Outsourcing Option)

(Amount Rs.in lakhs)

Sl. No.	Particulars	Total Provision
1	General Furniture & Fittings	**7.00**
2	Air conditioners and Air coolers	**3.00**
3	Referigerators and Water coolers	**2.00**
4	Office equipment	**5.00**
5	Canteen Equipment	**2.00**
6	Computers(Mine Planning Software, E-Conferencing System,etc)	**15.00**
7	Miscellaneous	**10.00**
	Total	**44.00**

APP. A5

PR for Jhiria West OCP (1.5 Mty)
Statement showing estimated capital requirement for Railway siding

(Partial Outsourcing Option)

Sl .No	Description	Qty.	Unit rate	Amount	Yearwise Phasing			% Life	Annual Dep.
					1st	2nd	3rd		
1	Railway siding consisting of one load standage line(suitable for 58 box-N-wagons), one empty standagelines(suitable for 58 box-N-wagons),Engine escape line, loading stations, cross overs, turnouts, electrification signalling etc.at the project (Km)	1.50	800.00	1200.00		800.00	400.00	5.15	61.80
2	In-motion rail weigh bridge with electronic system, 120 t complete with all accessories, 1 kVA On line UPS with two hours battery backup ,2 kVA CVT, Construction of suitable weigh house, concrete slab and others1.5 T Split type Air Conditioner with 5 kVA voltage stablizer ,Construction of suitable weigh house, concrete slab and others Supply of furniture-one office table (Steel) (5.5'x3'), Two steel chairs, one fitting cabinet (steel) of standard make including Installation & Commissioning (not including civil construction)	1	16.62	16.62			16.62	5.15	0.86
3	Power supply and illumination	ls		20.00		10.00	10.00	5.15	1.03
4	Dust suppresion	ls		20.00		20.00		5.15	1.03
5	Miscellaneous	ls		15.00		10.00	5.00	5.15	0.77
6	Civil and Structural works Including Wharf wall, weighbridge foundation & Room etc.	ls		404.17		202.09	202.09	5.15	20.81
7	**Grand Total**			**1675.79**	**0.00**	**1042.09**	**633.71**		**86.30**

APPENDIX-A.6

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

Statement showing the estimated capital requirement on vehicles

(Partial Outsourcing Option)

(Amount Rs. in lakhs)

Sl. No.	Description	Totall provision			Phasing of Equipments									
					1st year		2nd year		3rd year		4th year		5th year	
		Nos.	Unit Cost	Additional Cost	No	Amount	No	Amount	No	Amount	No	Amount	No	Amount
A. OUTSOURCED VEHICLE														
1	Diesel Jeep/Light Vehicle	4			2		2							
2	School Bus	2					1		1					
3	Pick-up Bus	2					1		1					
4	Truck	3			1		1		1					
5	Canteen van	1							1					
6	Water Tanker (10 KL)	2					1				1			
	TOTAL(Outsourcing)	**14**												
B. DEPARTMENTAL VEHICLE														
1	Diesel Jeep/Light Vehicle	2	9.36	**18.71**			1	9.36			1	9.36		
2	Explosive Van(10Te)	1	22.88	**22.88**			1	22.88						
3	Ambulance	1	7.47	**7.47**					1	7.47				
4	Motor cycle	1	0.81	**0.81**							1	0.81		
5	Truck	1	22.26	**22.26**			1	22.26						
7	Fire Fighting Truck(8KL)	1	77.90	**77.90**					1	77.90				
	GRAND TOTAL	**7**		**150.04**		**0.00**		**54.49**		**85.38**		**10.17**		**0.00**

Note:-Capital for outsourced vehicle are not provided. The same may be arranged on leased.

APPENDIX-A.7

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

Statement showing the capital expenditure on prospecting and boring

(Partial Outsourcing Option)

(Amount in Rs. lakhs)

Sl. No.	Section/ Area	Total Meterage of Block (Mts.)	Exploration	Additional Expenditure		Total Provision
			Capital of block	Additional meterage	Additional Capital	
1.	EXPLORATION IN THE WEST JHIRIA BLOCK	1644.6	6.45	1500.00	116.25	122.70

Note : Provision for additional 1500m drilling kept to drill near Access Trench and other places

APPENDIX-A.8.1

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)
ESTIMATED CAPITAL OUTLAY IN MINES

(Amount in Rs Lakhs.)

Sl.No.	P A R T I C U L A R S	Total Capital
1.	Community Development in the surrounding villages	20.00
2	Levelling, Development of industrial site & colony site	10.00
3	Garland drains	110.00
4	Chain Link Fencing double row around the Project (approx.2x11.0 km)	220.00
5	Stone pitching of Embankment on nallah side	50.00
7.	Hydrogeological study including drilling, study etc.	50.00
8	Scientific study like slope stability study for internal & external OB dump, monitoring and other study etc.	50.00
9	Measures for Wild Life Conservation Plan	500.00
10	Green belt fencing 15m width along safety zone of the Project (approx.11.0 km)	22.00
11	Shifting of HT line(5.0Km)	250
12	Aboriculture/plantation in Colony & in Industrial Site	5.00
13	Flora & Fauna Study	5.00
14	Misc for Modernisation of Mine	500.00
15	Real Time Slope Monitoring System	700.00
16	Piezometers for measuring water level (6Nos)	40.00
17	Renovation of old Residential Quarters (LS)	200.00
18	Water Treatment Plant (LS)	200.00
	R & R PACKAGE IN QUARRY	
	Number of Displaced Family - 220	
a)	Total cost of R&R as per second schedule of RFCTLARR Act 2013	3616.81
b)	Total cost for provision of infrastructure as per third schedule of RFCTLARR Act 2013	888.48
c)	Misc. and Contingency	200.00
	TOTAL	**7637.29**

Note : 1. Total number of displaced family is as supplied by SECL.
2. Total cost of R&R as per RFCTLARR Act 2013 as supplied by SECL

Appendix.A.8.2.

UCE of Project Report for Jhiria West Opencast Project (1.5 mty)

Statement showing The Capital Investment on Roads and Culverts

(Amount in Rs. Lakhs.)

Sl.No.	Particulars	Length(km)	Amount without GST	Amount with GST	Remarks
1	Approach Road and Culverts	8.00	4321.52	5099.39	App - A.8.2.2
2	Haul Road and Culverts	1.80	987.38	1165.11	App - A.8.2.3
3	Diversion of Road and Culverts	2.00	529.99	625.39	App - A.8.2.4
4	Service Road	1.00	261.64	308.74	App - A.8.2.5
Total			**6100.53**	**7198.63**	

Appendix-A.8.2.1.

UCE of Project Report for Jhiria West Opencast Project (1.5 mty)

Statement showing the Estimated Capital Investment on Colony Roads

(Amount in Rs. Lakhs)

Sl.No.	Particulars	Unit	Quantity	Cost at 100CI (RS.)	Cost at 3581 CI (RS.)	Total Cost (Lakhs)
1	**Colony Roads**					
	3.75 M Wide Road (intermediate width road)	M.	0.00	-	8325.00	0.00
	Specifications					
	i) 20cm th.Grade-I over 40cm th.moorum filling as sub-base.					
	ii)15cm th.Grade - II & 7.5 cm th Grade-III WBM as . base					
	iii) 5.0cm th.bituminous macadam with 2.0 cm thick seal coat.					
	Rate estimated on the basis of CPWD DSOR'07 (equivalent Cost Index 1727) = Rs.4015/RM					
2	**Culverts:(7.5m wide)**					
	i)3.05m span RCC slab culvert	No.	0.00	25000.00	895250.00	0.00
	ii)0.61m diameter hume pipe culvert	No.	0.00	3100.00	111011.00	0.00
3	**Pucca Drains:**					
	i)22.5cm X 30cm	RM.	0.00	28.00	1003.00	0.00
	ii)30cm X 45cm	RM.	0.00	57.00	2041.00	0.00
	iii)60cm X 90cm	RM.	0.00	104.00	3724.00	0.00
4	**Tree Guards:**	No.	0.00	31.00	1110.00	0.00
5	**RCC slab for drain crossing:** (1.53m X 0.61m X 7.5cm)	No.	0.00	26.00	931.00	0.00
6	Add for poor soil @ 10% of 2 to 5					0.00
	Total					**0.00**
	Contingencies @ 3%					0.00
	Grand Total without GST					**0.00**
	GST @ 18%					**0.00**
	Grand Total with GST					**0.00**

Appendix-A.8.2.2

UCE of Project Report for Jhiria West Opencast Project (1.5 mty)

Statement showing the Estimated Capital Investment on Approach Road

(Amount in Rs. Lakhs)

Sl.No.	Particulars	Unit	Quantity	Rate at 100 CI (Rs.)	Rate at 3581 CI (Rs.)	Total Amount (Lakhs)
1	**Approach Road** **15.0M Wide Road (intermediate width road)** **Specifications :** i) 30cm th.Grade- I over 40cm th.moorum filling as sub-base. ii)15.0cm th.Grade - II over Grade-I WBM as base. ii)15cm th.Grade - III along with 5.0cm th.bituminous macadam with 2.0cm thick seal coat. Rate estimated on the basis of CPWD DSOR'2007 (equivalent Cost Index 1727) = Rs.19140/RM	RM	8000.000	-	39687.52	3175.00
2	**Culverts:**					
	i)4.57m span RCC slab culvert	Each	4.000	49500.000	1772595.00	70.90
	ii)3.05m span RCC slab culvert	Each	4.000	33000.000	1181730.00	47.27
	iii)0.61m diameter hume pipe culvert	Each	8.000	4100.000	146821.00	11.75
3	Bridge : (13.0m wide)	M.	100.000	LS		500.00
4	Pucca Drains : 60 x 90 cm	RM	8000.000	104.000	3724.24	297.94
5	Extra for poor/ B.C. soil on item no.2 to 4					92.79
	Sub Total					**4195.65**
	Contingencies(3%)					125.87
	Total without GST					**4321.52**
	GST @18 %					**777.87**
	Total with GST					**5099.39**

Appendix-A.8.2.3

UCE of Project Report for Jhiria West Opencast Project (1.5 mty)

Statement showing the Estimated Capital Investment on Haul Road

(Amount in Rs. Lakhs)

Sl.No.	Particulars	Unit	Quantity	Rate at 100CI	Rate at 3581 CI	Total Cost
1	**Service Road/ Haul road**					
	Total width of Road -23m(Double Lane)	M.	1800.00	-	49431.07	889.76
	Width of carriage way-14m					
	Width of Dozer track- 5m					
	Width of shoulder on each side-2m					
	Specifications:(For CBR value 4)					
	i)23m wide 900mm th. Moorum					
	ii)23m wide 300mm th. WBM Grade I					
	iii)23m wide 300mm th.WBM Grade II					
	Rate estimated on the basis of CPWD DSOR'07					
	(equivalent Cost Index 1727) = Rs.23839/RM					
2	**Culverts:**					
	i)4.57m span RCC slab culvert	No.	2.00	80700.00	2889867.00	57.80
	ii)0.61m diameter hume pipe culvert	No.	2.00	6700.00	239927.00	4.80
3	Add for poor soil @ 10% on item no. 2					6.26
	Total					**958.62**
	Contingencies(3%)					28.76
	Grand Total without GST					**987.38**
	GST @ 18%					**177.73**
	Grand Total without GST					**1165.11**

Appendix-A.8.2.4

UCE of Project Report for Jhiria West Opencast Project (1.5 mty)

Statement showing the Estimated Capital Investment on Diversion of Road

(Amount in Rs. Lakhs)

Sl.No.	Particulars	Unit	Quantity	Rate at 100 CI (Rs.)	Rate at 3581 CI (Rs.)	Total Amount (Lakhs)
1	**Diversion of Road** **7.5M Wide Road (intermediate width road)** **Specifications :** i) 30cm th.Grade- I over 40cm th.moorum filling as sub-base. ii)15.0cm th.Grade - II over Grade-I WBM as base. ii)15cm th.Grade - III along with 5.0cm th.bituminous macadam with 2.0cm thick seal coat. Rate estimated on the basis of CPWD DSOR'2007 (equivalent Cost Index 1727) = Rs.9570/RM	RM	2000.000	-	19843.76	396.88
2	**Culverts:**					
	i)4.57m span RCC slab culvert	Each	1.000	49500.000	1772595.00	17.73
	ii)3.05m span RCC slab culvert	Each	1.000	33000.000	1181730.00	11.82
	iii)0.61m diameter hume pipe culvert	Each	2.000	4100.000	146821.00	2.94
3	Pucca Drains : 60 x 90 cm	RM	2000.000	104.000	3724.24	74.48
4	Extra for poor/ B.C. soil on item no.2 to 4					10.70
	Sub Total					**514.55**
	Contingencies(3%)					15.44
	Total without GST					**529.99**
	GST @ 18%					**95.40**
	Total without GST					**625.39**

Appendix-A.8.2.5

UCE of Project Report for Jhiria West Opencast Project (1.5 mty)

Statement showing the Estimated Capital Investment on Service Road

(Amount in Rs. Lakhs)

Sl.No.	Particulars	Unit	Quantity	Rate at 100 CI (Rs.)	Rate at 3581 CI (Rs.)	Total Amount (Lakhs)
1	**Service Road** **7.5M Wide Road (intermediate width road)** **Specifications :** i) 30cm th.Grade- I over 40cm th.moorum filling as sub-base. ii)15.0cm th.Grade - II over Grade-I WBM as base. ii)15cm th.Grade - III along with 5.0cm th.bituminous macadam with 2.0cm thick seal coat. Rate estimated on the basis of CPWD DSOR'2007 (equivalent Cost Index 1727) = Rs.9570/RM	RM	1000.000	-	19843.76	198.44
2	**Culverts:**					
	i)3.05m span RCC slab culvert	Each	1.000	33000.000	1181730.00	11.82
	ii)0.61m diameter hume pipe culvert	Each	1.000	4100.000	146821.00	1.47
3	Pucca Drains : 60 x 90 cm	RM	1000.000	104.000	3724.24	37.24
4	Extra for poor/ B.C. soil on item no.2 to 3					5.05
	Sub Total					**254.02**
	Contingencies(3%)					7.62
	Total without GST					**261.64**
	GST @ 18%					**47.10**
	Total with GST					**308.74**

Appendix - A.8.3

UCE of Project Report for Jhiria West Opencast Project (1.5 mty)

Statement Showing the Capital Investment in Water Supply Arrangement

(Amount in Rs.Lakhs)

Sl.No.	Particulars	Unit	Qty	Rate at 100 CI (Rs.)	Rate at 3581 CI (Rs.)	Total Cost (Lakhs)
	For Domestic water requirement					
1	Bore well including submerssible pump ,GI connections upto RCC over head tank including electricals.	Nos	1	LS		10.00
2	**Clear water rising main :**					
	i) 150 mm.dia.	RM	150	143.45	5136.94	7.71
	ii) Add 7.5% for saddle supports valves,bends,etc.					0.58
3	**Zonal storage :**					
	RCC Overhead tank:					
	i) For clear water in service bldg.	Litres	15000	1.10	39.39	5.91
4	**Distribution system :**					
	A.For Colony :					
	i) 100 mm dia main.	RM	100	88.80	3179.93	3.18
	ii) 80 mm dia.	RM	100	68.25	2444.03	2.44
	iii) Add 7.5% for saddle supports,valves,bends etc.					0.42
5	Water treatment plant with aerator,, chemical house, clarifloculator, rapid gravity filter, chlorinator etc.	Litres	145000	0.28	10.03	14.54
	For Industrial water requirement					
6	Ground water reservoir - 2nos.	Litres	228000	0.65	23.28	53.08
7	Water pumps	Nos	4	LS		6.00
8	**Distribution system :**					
	B)For Industry:					
	i) 150 mm dia main.	RM	500	143.45	5136.94	25.68
	ii) 100 mm dia main.	RM	500	88.80	3179.93	15.90

Appendix - A.8.3

UCE of Project Report for Jhiria West Opencast Project (1.5 mty)

Statement Showing the Capital Investment in Water Supply Arrangement

(Amount in Rs.Lakhs)

Sl.No.	Particulars	Unit	Qty	Rate at 100 Cl (Rs.)	Rate at 3581 Cl (Rs.)	Total Cost (Lakhs)
	iii) 80 mm dia.main. iv) Add 7.5% for saddle supports, valves, bends etc.	RM	1000	68.25	2444.03	24.44 4.95
9	**Investigations for :** Hydro-geological & Geo - Technical data	LS				5.00
10	**Electrical installations :** A) Transformer and switchgear | B) Overhead line. | C) Instruments, tools etc. | D) Switch room. |	5%of sl. no.1 to 8 above				8.74
	Sub-Total					**188.57**
	Add contingencies @ 3%					5.66
	Grand Total without GST					**194.23**
	GST @ 18 %					**34.96**
	Grand Total with GST					**229.19**

Appendix - A.8.3(a)

UCE of Project Report for Jhiria West Opencast Project (1.5 mty)

Statement Showing the Capital Investment in Sewerage Disposal Scheme.

(Amount in Rs.Lakhs)

Sl.No.	Particulars	Unit	Qty	Rate (RS.) at 100CI	Cost at 3581 CI
1.	**Colony**				
	Total No. of houses in the colony	Nos.	0		
	Cost of sewage disposal scheme per house	Rs.		750	
	(For conventional sewerage disposal arrangement)				
	Therefore, total cost of sewage disposal scheme of colony	Rs.			0.00
2.	**Service buildings**				
	i) Total cost of service buildings	Rs.lakh	815.31		
	ii) Cost of sewage disposal scheme 5% of above				40.77
3.	Disposal of mine water settling tank (2 nos.)	LS			40.00
4	**Pucca Drains for industrial sewerage**				
	i)60cm X 90cm	RM.	2000.00	104.00	74.48
5	Sewage Treatment Plant	LS			400.00
	Sub-Total				**555.25**
	Contingencies @ 3%				16.66
	Grand Total without GST				**571.91**
	GST @ 18%				**102.94**
	Grand Total with GST				**674.85**

As per direction, the water demand for contractual option is to be kept considering outsourced manpower.

UCE of Project Report for Jhiria West Opencast Project (1.5 mty)

Water Demand Calculations

DATA AVAILABLE		
i)Manpower=	304	
ii)Total No.of houses required=	168	
iii)Total No.of existing houses=	0	
iv)Total No.of houses to be constructed=	168	
Population:		
1.Residential population @ 5 persons per house=	840	
2.Non - Residential workers=	136	
Water Demand:		
A.Potable Water Demand:		
i)Water requirement for residential populalion @135 litres per capita per day=	113400	
ii)Water requirement for non - residential population @45 litres per capita per day=	6120	
iii)Water requrement for service buildings 10%of item A(i)& (ii)	11952	
iv)Sub - total of above (i),(ii) & (iii)	131472	
v)Process and other losses 10% of (iv)	13147	
Total	144619	Litres per day
Say	**0.145**	**MLD**
B.Industrial Water Demand in Opencast Projects:		
i)Total No of Serviceable Dumpers and Dozers	2	
ii)Water required for washing of Dumpers and Dozers @2250 litres per dumper	4500	
iii)Water required for dust suppression in CHP & other industrial premises 22500 litres per day for million tonne of coal production per annum	33750	
iv)Water required for fire fighting in coal 45000 LPD for every million tonne of coal production per annum	67500	
v)Water required for road watering including watering of haul roads 67500 LPD for every million tonne coal production per annum	101250	
vi)Add for losses 10%of (ii) to (v)	20700	
	227700	Litres per day
Say,	**0.228**	**MLD**
Total Water Demand (Potable Water Demand & Industrial Water Demand)	**0.373**	**MLD**

WEST JHIRIA OCP [1.50 Mty]

Statement showing the revenue expenditure capitalised during development period

Option-II,PARTIAL OUTSOURCING App - A.9.1 & 2

RS. IN LAKHS.

Sl.No.	P a r t i c u l a r s	Yr.1	Yr.2	Total
A	Production (in mt)	0.00	0.50	0.50
B	Sales Value @ Rs.2395.15	0	11976	11976
C	**Revenue Expenses**			
1	Wages & benefits	88	1165	1253
2	Stores	0	1476	1476
3	Power	245	448	693
4	Misc.Exps.incl.w/s debits	480	1407	1886
5	Total (1 to 5)	813	4495	5309
6	Interest on loan capital	0	0	0
7	Depreciation	641	1622	2263
8	Total (6 to 8)	1454	6118	7572
9	Less sales realisation	0	11976	11976
10	Net Total	1454	-5858	-4404
11	Less depreciation	641	1622	2263
12	Net Development capital	813	-7480	-6667

APPENDIX-B

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

STATEMENT SHOWING JOB/CATEGORYWISE REQUIREMENT OF MANPOWER

(Partial Outsourcing Option)

SL. NO.	PARTICULARS	CATEGORY/ SCALE	DEPART MENTAL	OUT SOURCED	TOTAL
A.	**OB MANPOWER**	CAT	DEP	OUTSOURCED	TOT
1	Shovel Operator	EXCV-SPL.			0
2	Dumper Operator	EXCV-A			0
3	Dozer Operator	EXCV-A			0
4	Drill Operator	EXCV-B			0
5	Drill Helper	EXCV-D			0
6	PITMAN/DUMPMAN/TRIPMAN	GRADE-E	7		7
7	MINING SIRDAR/SHORTFIRER/OVERMAN	GRADE-C	10		10
8	MAZDOOR INCLUDING BLASTING	I/II	10		10
SUB-TOTAL			**27**	**0**	**27**
B.	**COAL MANPOWER**				
A.	**COAL DIRECT MANPOWER**				
1	SURFACE MINER OPERATOR	EXCV-SPL	4		4
2	SURFACE MINER HELPER	EXCV-B	4		4
3	WATER TANKER OPERATOR	EXCV-B	3		3
4	WATER TANKER HELPER	EXCV-C	2	1	3
7	PAY LOADER OPERATOR	EXCV-A	7		7
8	DUMPER OPERATOR	EXCV-A	23		23
9	DOZER OPERATOR	EXCV-A	2		2
10	PITMAN/TRIPMAN	GRADE-E	3		3
11	MINING SIRDAR	GRADE-C	4		4
12	MAZDOOR	I/II	1	4	5
SUB-TOTAL			**53**	**5**	**58**
B.	**COAL DESPATCH & TRANSPORT**				

APPENDIX-B

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

STATEMENT SHOWING JOB/CATEGORYWISE REQUIREMENT OF MANPOWER

(Partial Outsourcing Option)

SL. NO.	PARTICULARS	CATEGORY/ SCALE	DEPART MENTAL	OUT SOURCED	TOTAL
					0
b.	**CHP FOR COAL TRANSPORT**				
1	ASST MANAGER (E& M)	E3			0
2	FORMAN INCHARGE(MECH)	A1			0
3	FORMAN INCHARGE(ELECT)	A1			0
4	WEIGH BRIDGE CLERK	GRADE C			0
5	FOREMAN (MECH)				0
6	FOREMAN (ELECT)				0
7	MECHANICAL FITTER				0
8	ELECTRICAL FITTER				0
9	HELPERS FOR FITTERS				0
10	WELDER				0
11	CONVEYOR / FEEDER OPERATOR				0
12	MAZDOORS / BELT CLEANERS				0
13	CONTROL ROOM ATTENDANT				0
14	CRANE OPERATOR	IV/V			0
15	TYNDAL	IV/V			0
					0
SUB-TOTAL			**0**	**0**	**0**
B1	**Maintenance-Surface Miner**				
1	Asstt. Manager (Mech.)	E3			0

APPENDIX-B

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

STATEMENT SHOWING JOB/CATEGORYWISE REQUIREMENT OF MANPOWER

(Partial Outsourcing Option)

SL. NO.	PARTICULARS	CATEGORY/ SCALE	DEPART MENTAL	OUT SOURCED	TOTAL
2	Foreman (M)	GRADE-B			0
3	Fitter (Elect)	V/VI		**1**	1
4	WEIGH BRIDGE CLERK	GRADE C			0
5	Elect Fitter Helpers	II			0
6	Mechanic	V/VI		**1**	1
7	Helpers	II		**1**	1
		TOTAL	**0**	**3**	**3**
SUB-TOTAL (COAL)			**53**	**8**	**61**
C.	**COMMON MANPOWER**				
A.	**Supervision Excavation**				
3	Sr Manager (Excv)	E5	1		1
4	Asstt. Manager (Excv)	E3	1		1
5	Sr. Officer (Excv)	E2			0
6	Foreman (M)	GRADE-B	1		1
7	Foreman Incharge (M)	GRADE-A			0
8	Foreman (Elect.)	GRADE-B	1		1
9	Foreman Incharge (Elect.)	GRADE-A			0
10	Upper Division Clerk (Sp. Grade)	GRADE-C	1		1
11	LDC/Typist	GRADE-D	1		1
12	Miners Time Keeper/Record Keeper	GRADE-D	4		4
13	Peon	GRADE-H			0
14	Store Keeper	GRADE-C	1		1
15	Asstt. Store Keeper	GRADE-D	1		1

APPENDIX-B

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

STATEMENT SHOWING JOB/CATEGORYWISE REQUIREMENT OF MANPOWER

(Partial Outsourcing Option)

SL. NO.	PARTICULARS	CATEGORY/ SCALE	DEPART MENTAL	OUT SOURCED	TOTAL
		TOTAL	**12**	**0**	**12**
B1	**Maintenance-Excavation Plant and Equipment**				
1	Mechanic	I	4		4
2	Fitter Gr.I	I	4		4
3	Fitter Gr.II	II	4		4
4	Fitter Gr.III	III	8		8
5	Electrician Gr.I	I	2		2
6	Electrician Gr.II	II	2		2
7	Electrician Gr.III	III	2		2
8	Welder Gr.I	I	1		1
9	Welder Gr.II	II	1		1
10	Welder Gr.III	III	1		1
11	Machinist/Turner Gr.I	I	1		1
12	Machinist/Turner Gr.II	II	2		2
13	Machinist/Turner Gr.III	III	2		2
14	Blacksmith	V	1		1
15	Hammerman	II	1		1
16	Carpenter	IV	1		1
17	EOT Crane Operator	VI	2		2
18	Fork Lift Operator	VI	2		2
19	Washing M/C Operator	VI	1		1
20	Helper/Greaser	I	2		2

APPENDIX-B

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

STATEMENT SHOWING JOB/CATEGORYWISE REQUIREMENT OF MANPOWER

(Partial Outsourcing Option)

SL. NO.	PARTICULARS	CATEGORY/ SCALE	DEPART MENTAL	OUT SOURCED	TOTAL
21	Mazdoors	I	2		2
		TOTAL	**46**	**0**	**46**
B2	**DESPATCH AND QUALITY CONTROL**				
	QUALITY CONTROL & DESPATCH				0
11	LOADING SUPERVISOR	GRADE-B	3		3
12	SAMPLING ASST.	GRADE-D	1		1
13	SAMPLING MAZDOOR	II	1		1
15	LABORATORY ASST.	GRADE-D	1		1
4	WEIGH BRIDGE CLERK	GRADE C	7		7
16	TECH.INSPECTOR	GRADE-D	1		1
SUB-TOTAL			**14**	**0**	**14**
C.	**WORKSHOP & PUMPING**				
					0
1	ASST. MANAGER (E& M)	E4			0
2	FOREMAN INCHARGE(E&M)	A1	1		1
3	ELECTRICAL SUPERVISOR	A1	1		1
4	FOREMAN (E&M)	GRADE B	1		1
5	FITTER MECH/TURNER/MACHINIST	IV/V	1		1
6	ELECTRICAL FITTER	IV/V	1		1
7	PUMP KHALASI FOR WORKSHOP	IV/V	1		1
8	WELDER	IV/V	1		1
9	HELPER FOR FITTER/WELDER	II	2		2
10	GENERAL MAZDOORS, GREASING ETC.	I		6	6

APPENDIX-B

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

STATEMENT SHOWING JOB/CATEGORYWISE REQUIREMENT OF MANPOWER

(Partial Outsourcing Option)

SL. NO.	PARTICULARS	CATEGORY/ SCALE	DEPART MENTAL	OUT SOURCED	TOTAL
11	STORE KEEPER	IV/V	1		1
12	MINE PUMP KHALASI	IV/V	7		7
8	PEON	I/II	1		1
13	TYNDALS	IV/V	2		2
SUB-TOTAL			**20**	**6**	**26**
D.	**E&M SUPERVISION**				
1	SENIOR MANAGER (E&M)	E6	1		1
2	MANAGER (E&M)	E5	1		1
3	ASST. MANAGER (E&M)	E3/E4	1		1
5	SR. OFFICERS(E&M)	E2	1		1
6	SR.PA	GRADE-E			0
7	LDC/TYPIST	GRADE-D			0
8	PEON	GRADE-H			0
SUB-TOTAL			**4**	**0**	**4**
E.	**MINING SUPERVISION**				
1	Sr. MANAGER (MINING) /MANAGER	E6	1		1
2	Sr. MANAGER (MINING)/SAFETY OFFICER	E5	1		1
3	MANAGER (MINING)	E4	1		1
4	ASSTT. MANAGER (MINING)	E3	3		3
5	SR. OFFICER (MINING)	E2	1		1
6	OVERMAN	A1	4		4

APPENDIX-B

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

STATEMENT SHOWING JOB/CATEGORYWISE REQUIREMENT OF MANPOWER

(Partial Outsourcing Option)

SL. NO.	PARTICULARS	CATEGORY/ SCALE	DEPART MENTAL	OUT SOURCED	TOTAL
7	MINING SIRDARS	GRADE-C	4		4
8	PA./JR.STENOGRAPHER	GRADE-B	1		1
9	LDC/TYPIST	GRADE-D	1		1
10	MTK/REGISTER KEEPER	GRADE-D	4		4
11	PEON	GRADE-H	1		1
12	DY. MANAGER (MINING) / (BLASTING)	E3/E4	1		1
13	BLASTING FOREMAN	GRADE-B	1		1
	SUB TOTAL		***24***	***0***	***24***
F.	**POWER SUPPLY, LIGHTING ETC.**				
3	Asstt. Manager (E&M)	E3	1		1
4	Electrical Supervisor	A1	1		1
5	Foreman incharge (E&M)	A1			0
6	Foreman (E&M)	GRADE-B	1		1
7	Substation attendent	III	4		4
8	Electrician	IV/V	1		1
9	Mechanical fitter	IV/V			0
11	Electrical fitter/armature winder	IV/V	1		1
12	Welder	IV/V			0
13	Cable Jointer	IV/V	1		1
14	Helper	III	1		1
15	General Mazdoor, Greasing etc.	I			0
SUB-TOTAL			**11**	**0**	**11**
G.	**Communication & Electronics**				

APPENDIX-B

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

STATEMENT SHOWING JOB/CATEGORYWISE REQUIREMENT OF MANPOWER

(Partial Outsourcing Option)

SL. NO.	PARTICULARS	CATEGORY/ SCALE	DEPART MENTAL	OUT SOURCED	TOTAL
1	Dy. Manager ((E&M)	E4			0
2	Foreman (Incharge)	GRADE-A			0
3	Foreman	GRADE-B			0
4	Line Man	II			0
5	Telephone Mechanic	V/VI			0
6	Electronic Mechanic	V/VI			0
7	Helper/Mazdoors	I/II			0
		TOTAL	**0**	**0**	**0**
H.	**IMMS Section**				
1	Asstt. Manager (System)	E3			0
2	Foreman (Elect.)	GRADE-B			0
3	Asstt. Foreman (Elect.)	GRADE-C			0
4	Data Entry Operator	GRADE-C			0
5	General Mazdoors	I/II			0
I.	**Other Operations**				
1	Crane Operator	EXCV-D	3		3
2	FE Loader Operator	EXCV-C	3		3
3	Backhoe Operator	EXCV-C	3		3
4	Motor Grader Operator	EXCV-B	2		2
5	Heavy Vehicle driver	V/VI	8		8
6	Light Vehicle driver	IV	8		8
7	Mobile Service Van Operator	EXCV-C	2		2
8	Dozer Operator	EXCV-A	2		2

APPENDIX-B

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

STATEMENT SHOWING JOB/CATEGORYWISE REQUIREMENT OF MANPOWER

(Partial Outsourcing Option)

SL. NO.	PARTICULARS	CATEGORY/ SCALE	DEPART MENTAL	OUT SOURCED	TOTAL
9	Diesel Browser Operator	EXCV-C	2		2
		TOTAL	**33**	**0**	**33**
K.	**Project Office**				
1	Chief Manager (Project)	E7	1		1
2	Sr. Manager (Project)	E6	1		1
3	Asst. Manager (Sales)	E3	1		1
4	Personal Assistant	GRADE-B	1		1
5	Office Supdt.	GRADE-A	1		1
6	Sr. Clerk	GRADE-B	1		1
7	Upper Division Clerk	GRADE-C	1		1
8	LDC/Typist	GRADE-D	1		1
9	Stenographer	GRADE-C	1		1
10	Peon	GRADE-H	1		1
		TOTAL	**10**	**0**	**10**
L.	**Survey, Drilling, Planning, Development**				
	and Industrial Engineering				
5	Asst. Manager (Survey)	E3	1		1
6	Surveyor	A1	1		1
7	Chainman	GRADE-G	1		1
8	Survey Mazdoors	I	1		1
9	D'man/Tracer	GRADE-B	1		1
		TOTAL	**5**	**0**	**5**
M.	**Accounts & Finance**				

APPENDIX-B

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

STATEMENT SHOWING JOB/CATEGORYWISE REQUIREMENT OF MANPOWER

(Partial Outsourcing Option)

SL. NO.	PARTICULARS	CATEGORY/ SCALE	DEPART MENTAL	OUT SOURCED	TOTAL
2.	Manager (Finance)	E5	1		1
4.	Asstt. Manager (Finance)	E3	1		1
5.	Accountant	A1	1		1
6.	Sr. Clerk/Jr. Accountant	GRADE-C			0
7	Sr. Cashier	GRADE-B	1		1
8	LDC/Typist	GRADE-D	1		1
9	Personal Assistant	GRADE-B			0
10	Peon	GRADE-H	1		1
		TOTAL	**6**	**0**	**6**
N.	**Building, Water Supply, Roads and Civil Constn.**				
2	Asst. Manager (Civil)	E3	1		1
3	Overseersr/Eng. Asst.	GRADE-C	1		1
4	Accountant	GRADE-A			0
5	Sr. Works Supervisors	GRADE-D	1		1
6	LDC/Typist	GRADE-D	1		1
7	Fitter	V	1		1
8	Pump Khalasi	III	2		2
9	Helpers/ Mazdoors	II			0
		TOTAL	**7**	**0**	**7**
O.	**Medical and Sanitation**				
1	Medical Officer	E3	1		1
2	Compounders	GRADE-D	1		1
3	Dressers/Ward boys	GRADE-E	1		1
4	Nurse/Midwife	GRADE-D	2		2

APPENDIX-B

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

STATEMENT SHOWING JOB/CATEGORYWISE REQUIREMENT OF MANPOWER

(Partial Outsourcing Option)

SL. NO.	PARTICULARS	CATEGORY/ SCALE	DEPART MENTAL	OUT SOURCED	TOTAL
5	LDC/Typist	GRADE-D	1		1
6	Lab. Technicians	GRADE-D	1		1
7	Ayah	II	2		2
8	Peon	GRADE-H	1		1
9	Sanitary Inspector	GRADE-D	1		1
10	Sweepers	I	2		2
		TOTAL	**13**	**0**	**13**
P.	**Stores & Purchase**				
1	STORE OFFICER	E2	1		1
1	Store Keeper/Sr. Store Keeper	GRADE-C	1		1
5	Accountant	A1	1		1
6	UDC	GRADE-C	1		1
7	LDC/Typist	GRADE-D			0
8	Peon	GRADE-H			0
9	Tyndals	IV			0
10	Store Mazdoors/Cleaners	I	1		1
11	Carpenter	V			0
		TOTAL	**5**	**0**	**5**
Q.	**Security**				
1.	SECIRITY SUPERVISOR	GRADE-A	1		1
2.	Watch and Ward Inspector	GRADE-C	1		1
3.	Armed Guard	GRADE-G	4		4
4.	Security Guard	I		25	25
		TOTAL	**6**	**25**	**31**

APPENDIX-B

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

STATEMENT SHOWING JOB/CATEGORYWISE REQUIREMENT OF MANPOWER

(Partial Outsourcing Option)

SL. NO.	PARTICULARS	CATEGORY/ SCALE	DEPART MENTAL	OUT SOURCED	TOTAL
R.	**Welfare & Canteen**				
1	Manager (Personnel)	E5	1		1
2	Asstt. Manager (Personnel)	E3	1		1
3	Stenographer	GRADE-C	1		1
4	UDC	GRADE-C			0
5	LDC/Typist	GRADE-D	1		1
6	Pit Head Bath Attendant	GRADE-E			0
7	Canteen/Guest House Incharge	GRADE-D	1		1
8	Canteen Cook	I		2	2
9	Canteen Boys	I		2	2
10	Peon	GRADE-H		1	1
		TOTAL	**5**	**5**	**10**
	TOTAL(COMMON)		**221**	**36**	**257**
S.	**EMP**				
2	RECLAMATION SUPERVISOR	GRADE-B	1		1
3	MINING SIRDARS	GRADE-C	1		1
7	Helpers/ Mazdoors	II	1		1
		TOTAL(EMP)	**3**	**0**	**3**
		GRAND TOTAL	**304**	**44**	**348**

WEST JHIRIA OCP [1.50 Mty] **Appendix B-1**

Option-II,PARTIAL OUTSOURCING Statement Showing Wages & Benefits Cost RS. IN LAKHS.

Sl. No.	PARTICULARS	Annual Earning	O.B.		COAL		COMMON		SUB-TOTAL		L.R & EMP		GRAND TOTAL	
			NO.	AMT.	NO.	AMT.	NO.	AMT.	NO.	AMT.	NO.	AMT.	NO.	AMT.
	DAILY RATED EMPLOYEES													
	Excavation													
1	SPL.GRADE	9.33799		0.00	4	37.35		0.00	4	37.35		0.00	4	37.35
2	GRADE-A	8.93119		0.00	30	267.94	2	17.86	32	285.80		0.00	32	285.80
3	GRADE-B	8.46802		0.00	7	59.28	2	16.94	9	76.21		0.00	9	76.21
4	GRADE-C	8.14866		0.00	3	24.45	10	81.49	13	105.93		0.00	13	105.93
5	GRADE-D	7.89747		0.00		0.00	3	23.69	3	23.69		0.00	3	23.69
6	GRADE-E	7.44381		0.00		0.00		0.00	0	0.00		0.00	0	0.00
	Category													
7	CAT-I	7.03767	5	35.19	1	7.04	20	140.75	26	182.98		0.00	26	182.98
8	CAT-II	7.17480	5	35.87	1	7.17	15	107.62	21	150.67	1	7.17	22	157.85
9	CAT-III	7.36456		0.00		0.00	20	147.29	20	147.29		0.00	20	147.29
10	CAT-IV	7.49476		0.00		0.00	17	127.41	17	127.41		0.00	17	127.41
11	CAT-V	7.76673		0.00		0.00	15	116.50	15	116.50		0.00	15	116.50
12	CAT-VI	8.06483		0.00		0.00	9	72.58	9	72.58		0.00	9	72.58
	MONTHLY PAID EMPLOYEES													
13	A1	11.98444		0.00		0.00	10	119.84	10	119.84		0.00	10	119.84
14	A	9.50494		0.00		0.00	2	19.01	2	19.01		0.00	2	19.01
15	B	8.88807		0.00	3	26.66	10	88.88	13	115.54	1	8.89	14	124.43
16	C	8.30183	10	83.02	11	91.32	13	107.92	34	282.26	1	8.30	35	290.56
17	D	7.74949		0.00	3	23.25	23	178.24	26	201.49		0.00	26	201.49
18	E	7.46827	7	52.28	4	29.87	1	7.47	12	89.62		0.00	12	89.62
19	F	7.39621		0.00		0.00		0.00	0	0.00		0.00	0	0.00
20	G	7.30653		0.00		0.00	5	36.53	5	36.53		0.00	5	36.53
21	H	7.17199		0.00		0.00	4	28.69	4	28.69		0.00	4	28.69
	EXECUTIVES:													
22	E-1	11.31341		0.00		0.00		0.00	0	0.00		0.00	0	0.00
23	E-2	13.46281		0.00		0.00	3	40.39	3	40.39		0.00	3	40.39
24	E-3	15.66339		0.00		0.00	12	187.96	12	187.96		0.00	12	187.96
25	E-4	17.92138		0.00		0.00	2	35.84	2	35.84		0.00	2	35.84
26	E-5	19.88026		0.00		0.00	5	99.40	5	99.40		0.00	5	99.40
27	E-6	21.92416		0.00		0.00	3	65.77	3	65.77		0.00	3	65.77
28	E-7	25.35104		0.00		0.00	1	25.35	1	25.35		0.00	1	25.35
29	E-8	29.74819		0.00		0.00		0.00	0	0.00		0.00	0	0.00
			27	206.36	67	574.33	207	1893.44	301	2674.13	3	24.36	304	2698.49
E . M . S. (Rs.)														3360.90
Prod (Peak) In Lakh tonne.														15.00
O . M . S. (t)														17.46
COST/T (Rs.)														192.54

WEST JHIRIA OCP [1.50 Mty]

Statement Showing Unit Cost Estimate.

Option-II,PARTIAL OUTSOURCING **APP-C**

Sl.No	Particulars	Total Cost	Fixed Cost	Variable Cost	OB Cost	OB Cost	COAL Cost	COMN. Cost
		(Rs./t)	(Rs./t)	(Rs./t)	(Rs./cum)	(Rs./t)	(Rs./t)	(Rs./t)
1	Salaries,Wages & Benefits	192.54	192.54		1.79	14.38	42.71	135.45
2	Stores	226.44	69.08	157.37	10.70	85.96	111.25	29.24
3	Power	74.32	55.74	18.58	0.00	0.00	0.00	74.32
4	Misc. exp. incl.w/s debits	123.20	115.98	7.22	0.04	0.36	8.58	114.26
5	Mine Closure Cost	37.44	37.44					37.44
6	Admn. Expenses	88.00	88.00					88.00
7	Int. on wkg. cap @ 14.50%	35.86	27.01	8.85	0.61	4.87	7.86	23.14
8	Int. on loan cap @ *11.50%	0.00	0.00		0.00	0.00	0.00	0.00
9	Depreciation	232.98	232.98		0.00	0.00	38.82	194.16
	Sub-Total	1010.79	818.77	192.02	13.13	105.56	209.22	696.01
10	Comn cost apportioned to OB & Coal				80.01	643.02	52.99	696.01
11	OB O/S Cost	411.89		411.89	51.25	411.89		
12	OB Rehandling Cost/Ton	54.51		54.51	6.78	54.51		
13	Int. on wkg. cap @ 14.50%	22.54		22.54	2.80	22.54	0.00	0.00
	All Inclusive Cost	**1499.74**	**818.77**	**680.97**	**153.98**	**1237.54**	**262.20**	**0.00**

WEST JHIRIA OCP [1.50 Mty]
Statement Of Cost and Profitability At Various Levels

Option-II,PARTIAL OUTSOURCING **APP-C.1**

Sl.No	LEVEL OF PRODUCTION (%)	75	80	85	90	100
1	Production(mt)	1.13	1.20	1.28	1.35	1.50
2	Variable cost/t(Rs.)	680.97	680.97	680.97	680.97	680.97
3	Fixed cost/t(Rs.)	1091.69	1023.46	963.26	909.74	818.77
4	Total cost/t(Rs.)	1772.67	1704.43	1644.23	1590.72	1499.74
5	Cap.investment/annual	3466.42	3249.77	3058.60	2888.68	2599.81
	output(Rs.)					
6	Present s.p/t (Rs.)	2395.15	2395.15	2395.15	2395.15	2395.15
7	Profit/t (Rs.)	622.48	690.72	750.92	804.43	895.41
8	R.O.I.(gross before charging					
	int.on loan capital)(%)	17.96	21.25	24.55	27.85	34.44
9	B.E.P. (%)					47.76
	(Mt.)					0.72

WEST JHIRIA OCP [1.50 Mty]

Statement showing EMP Cost per/t **App-C.2**

Option-II,PARTIAL OUTSOURCING

SL.No	Particulars	Rs./t
1	Salaries,Wages & Benefits	2.04
2	Stores	28.73
3	Power	4.18
4	Misc. exp. incl.w/s debits	20.18
5	EMP Monitoring cost	3.00
6	Mine Closure Cost	37.44
7	Admn. Expenses	8.88
8	Int. on wkg. cap @ 14.50 %	5.05
9	Depreciation	49.31
	Total	**158.80**

WEST JHIRIA OCP [1.50 Mty]

Statement Showing Economics at different Capacity Utilisation

Appendix-C.3

Option-II,PARTIAL OUTSOURCING

		Capacity Utilisation Level				
		100%	**90%**	**85%**	**80%**	**75%**
1	Output(Mty)	1.50	1.35	1.28	1.20	1.13
2	Cost/te(Rs)	1499.74	1590.72	1644.23	1704.43	1772.67
3	Selling Price(Rs/te)	2395.15	2395.15	2395.15	2395.15	2395.15
4	Profit(Rs/te)	895.41	804.43	750.92	690.72	622.48
5	IRR (%)	55.57%	46.46%	41.87%	37.23%	32.54%

WEST JHIRIA OCP [1.50 Mty]

Statement showing sensitivity of IRR

Appendix-C.4

Option-II,PARTIAL OUTSOURCING

		Capacity utilisation level				
		100%	**90%**	**85%**	**80%**	**75%**
A	Base case	55.57%	46.46%	41.87%	37.23%	32.54%
B	Increase in Capital					
	i) 5%	52.49%	43.78%	39.39%	34.94%	30.44%
	ii) 10%	49.68%	41.33%	37.11%	32.84%	28.50%
	iii) 15 %	47.11%	39.09%	35.03%	30.91%	26.72%
C	Increase in op. cost					
	i) 5%	52.61%	43.64%	39.11%	34.53%	29.87%
	ii) 10%	49.65%	40.81%	36.33%	31.79%	27.15%
	iii) 15 %	46.68%	37.96%	33.53%	29.01%	24.38%
D	Decrease in Sales					
	i) 5%	49.37%	40.82%	36.48%	32.10%	27.63%
	ii) 10%	43.12%	35.09%	31.00%	26.82%	22.55%
	iii) 15 %	36.78%	29.22%	25.34%	21.35%	17.22%
E	Increase in both Capital & op. cost					
	i) 5%	49.67%	41.09%	36.74%	32.34%	27.86%
	ii) 10%	44.26%	36.14%	32.00%	27.80%	23.49%
	iii) 15 %	39.28%	31.54%	27.58%	23.52%	19.34%

WEST JHIRIA OCP [1.50 Mty] **APP-D.1**

Cashflow statement at 100 % capacity

& DCF Cost / tn. @ different rates

Option-II,PARTIAL OUTSOURCING Rs. in Lakhs.

YEAR (1)	Capital Exp. (2)	Repl. Cap. (3)	REV. Exp. (4)	Total Outflow (5)	Sales Receipt (6)	Prod. lakh te. (7)	Net Flow (8)
Yr 1	8500	0	0	8500	0	0.00	-8500
Yr 2	12128	0	6545	18673	11976	5.00	-6697
Yr 3	10851	0	11645	22496	23952	10.00	1455
Yr 4	7454	0	15791	23245	35927	15.00	12682
Yr 5	64	0	15854	15918	35927	15.00	20010
Yr 6	0	0	15885	15885	35927	15.00	20043
Yr 7	0	0	17627	17627	35927	15.00	18300
Yr 8	0	0	17651	17651	35927	15.00	18276
Yr 9	0	0	18106	18106	35927	15.00	17821
Yr 10	0	0	18597	18597	35927	15.00	17331
Yr 11	0	1954	16011	17964	35927	15.00	17963
Yr 12	0	1755	15340	17096	20359	8.50	3263
RES.VALUE		-3171		-3171	0	0	3171
	38997	538	169052	208587	343704	144	135117

IRR at 12% 55.57%

NPV at 12% (Rs. Crore) 520.69

APP-D.2

WEST JHIRIA OCP [1.50 Mty]

Cashflow statement at 85 % capacity

& DCF Cost / tn. @ different rates

Option-II,PARTIAL OUTSOURCING Rs. in Lakhs.

YEAR	Incremental Capital Exp.	Repl. Cap.	REV. Exp.	Total Outflow	Sales Receipt	Prod. lakh te.	Net Flow
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Yr 1	8500	0	0	8500	0	0.00	-8500
Yr 2	12128	0	6032	18159	10179	4.25	-7980
Yr 3	10851	0	10699	21551	20359	8.50	-1192
Yr 4	7454	0	14461	21915	30538	12.75	8623
Yr 5	64	0	14523	14587	30538	12.75	15951
Yr 6	0	0	14554	14554	30538	12.75	15984
Yr 7	0	0	16039	16039	30538	12.75	14500
Yr 8	0	0	16063	16063	30538	12.75	14476
Yr 9	0	0	16453	16453	30538	12.75	14085
Yr 10	0	0	16874	16874	30538	12.75	13665
Yr 11	0	1954	14680	16633	30538	12.75	13905
Yr 12	0	1755	14027	15783	17305	7.23	1522
RES.VALUE		-3171		-3171	0		3171
	38997	538	154403	193939	292148	121.98	98209

IRR at **41.87%**

NPV at 12% (Rs. Crore) **348.29**

Capacity 100% **WEST JHIRIA OCP [1.50 Mty]** APP-E.1

Revenue expenditure statement at 100 % capacity

Option-II,PARTIAL OUTSOURCING Rs.lakhs

Year	Wages				STORES						POWER			Misc. Expences			M.Closure	OB Reh Cost	OB O/S Cost	Admn. Expences		Int on w/c @	Total
	OB	COAL	COMN	var.	OB	COAL	COMN	TOTAL	Fixed	var.	TOTAL	Fixed	var.	TOTAL	Fixed	var.	37.44	41.00	51.25	TOTAL	Fixed	14.50%	Rev.Exp.
1	0	0	88		0	0	0	0	0	0	245	184	61	105	105	0	337	0	0	0	0	38	813
2	69	386	710		428	886	163	1476	414	1062	448	336	112	707	663	44	354	0	2050	44	44	302	6545
3	138	574	1378		856	1337	288	2481	817	1663	705	529	176	1272	1197	75	372	0	4100	88	88	537	11645
4	206	574	1918		1230	1527	418	3175	967	2208	1030	772	257	1744	1645	99	391	0	5894	132	132	728	15791
5	206	574	1918		1230	1527	419	3176	968	2208	1030	772	257	1783	1683	99	410	0	5894	132	132	731	15854
6	206	574	1918		1230	1527	419	3176	968	2208	1030	772	257	1792	1688	104	431	0	5894	132	132	732	15885
7	206	574	1918		1230	1527	419	3176	968	2208	1030	772	257	1793	1688	104	452	1640	5894	132	132	813	17627
8	206	574	1918		1230	1527	419	3176	968	2208	1030	772	257	1793	1689	104	475	1640	5894	132	132	814	17651
9	206	574	1918		1230	1527	419	3176	968	2208	1030	772	257	1793	1689	104	499	2050	5894	132	132	835	18106
10	206	574	1918		1230	1527	419	3176	968	2208	1030	772	257	1793	1689	104	524	2493	5894	132	132	857	18597
11	206	574	1918		1230	1527	419	3176	968	2208	1030	772	257	1793	1689	104	550	0	5894	132	132	738	16011
12	206	574	1918		1212	1527	393	3132	942	2190	1030	772	257	1314	1219	95	577	0	5807	75	75	707	15340

Capacity 85% **WEST JHIRIA OCP [1.50 Mty]**

Revenue expenditure statement at 85 % capacity APP-E.2

Option-II,PARTIAL OUTSOURCING

	Wages				**STORES**						**POWER**			**Misc. Expences**			**M.Closure**	**OB Reh Cost**	**OB O/S Cost**	**Admn. Expences**		**Int on w/c @**	**Total**
Year	OB	COAL	COMN	var.	OB	COAL	COMN	TOTAL	Fixed	var.	TOTAL	Fixed	var.	TOTAL	Fixed	var.		41		TOTAL	Fixed	14.50%	Rev.Exp.
1	0	0	88	0				0	0	0	236	184	52	105	105	0	337	0	0	0	0	37	804
2	69	386	710	0				1317	414	902.31	431	336	95	700	663	37	354	0	1743	44	44	278	6032
3	138	574	1378	0				2231	817	1413.8	679	529	150	1261	1197	64	372	0	3485	88	88	493	10699
4	206	574	1918	0				2844	967	1876.7	991	772	219	1729	1645	84	391	0	5010	132	132	667	14461
5	206	574	1918	0				2845	968	1877.2	991	772	219	1768	1683	84	410	0	5010	132	132	670	14523
6	206	574	1918	0				2845	968	1877.2	991	772	219	1776	1688	88	431	0	5010	132	132	671	14554
7	206	574	1918	0				2845	968	1877.2	991	772	219	1777	1688	88	452	1394	5010	132	132	739	16039
8	206	574	1918	0				2845	968	1877.2	991	772	219	1777	1689	88	475	1394	5010	132	132	741	16063
9	206	574	1918	0				2845	968	1877.2	991	772	219	1777	1689	88	499	1743	5010	132	132	759	16453
10	206	574	1918	0				2845	968	1877.2	991	772	219	1777	1689	88	524	2119	5010	132	132	778	16874
11	206	574	1918	0				2845	968	1877.2	991	772	219	1777	1689	88	550	0	5010	132	132	677	14680
12	206	574	1918	0				2803	942	1861.7	991	772	219	1300	1219	81	577	0	4936	75	75	647	14027

APPENDIX-F

PROJECT REPORT FOR WEST JHIRIA OPENCAST PROJECT (1.50 Mty)

Statement showing the estimated capital requirement for Environmental Protection Measures.

(Partial Outsourcing Option)

S.N.	PARTICULARS	AMOUNT
1.	**COST OF REHABILITATION**	
i)	Total No. of Displaced Family likely to be rehabilitated	220
	CAPITAL ESTIMATE	**Amt. Rs.in Lakhs**
A.	For quarry as recommended in PR	
a)	Total cost of R&R as per second schedule of RFCTLARR Act 2013	3616.81
b)	Total cost for provision of infrastructure as per third schedule of RFCTLARR Act 2013	888.48
b)	Land for R&R site etc (8.01 Ha).	227.48
	Sub-total of (1)	**4732.77**

Note : 1. Total number of displaced family is as supplied by SECL.
2. Total cost of R&R as per RFCTLARR Act 2013 as supplied by SECL

APPENDIX-F (CONTD.)

Amt.Rs.in Lakhs

S.N.	PARTICULARS	AMOUNT
	CAPITAL FOR RESTORATION	
a	Piezometers for measuring water level (6 Nos)	40.00
b	Green belt fencing 15m width along safety zone of the Project (approx.11.0 km)	22.00
	Sub-Total (2)	**62.00**
3.	**CAPITAL FOR ANTI-POLLUTION MEASURE IN MINE & INDUSTRIAL AREA**	
a	Settling tank for mine water disposal (Appendix-A.8.3.(A)	47.20
b	Chain Link Fencing double row around the Project (approx.2x11.0 km) (Appendix-A.8.1)	220.00
c	Oil and grease trap (Appendix-A.2.1	5.90
d	Other development measures in industrial site viz. drains,tree guards etc. (Appendix-A.8.2.1)	87.89
e	Garland drains (Appendix-A.8.1)	110.00
f	Arboriculture/plantation in industrial area (Appendix-A.8.1.)	2.50
g	Misc. and Contingency	200.00
h	Dust suppression arrangement at CHP (Appendix-A.3.5, A.3.6)	60.00
i	Dust suppression at Railway siding (Appendix-A.5)	20.00
j	Water Treatment Plant for mines(LS) (Appendix-A.8.1)	200.00
k	Real Time Slope Monitoring System (AppA81)	700.00
	Sub-Total(3)	**1653.49**

APPENDIX-F (CONTD.)

Amt.Rs.in Lakhs

S.N.	PARTICULARS	AMOUNT
4.	**ENVIRONMENTAL CONTROL MEASURES IN TOWNSHIP**	
a	Aboriculture/plantation (Appendix-A.8.1)	2.50
b	Rain Water Harvesting (Appendix-A.2.2)	10.62
c	Water Treatment Plant for colony (Appendix-A.8.3)	17.16
d	Sewerage Treatment Plant (Appendix-A.8.3(A)	472.00
e	Other development measures in township to improve cleanliness & aesthetics parks-play-grounds & tree guards (App-A.8.2)	5.90
	Sub Total (4)	**508.18**
5.	Stone pitching of Embankment on nallah side (App.-A.8.1)	50.00
6.	Cost of EMP preparation(Appendix-A.8.4)	50.00
7.	Community development in surrounding villages (Appendix-A.8.1)	20.00
	Total capital from 1 to 7	**7076.44**
B.	**Different type of Revenue nature cost to be considered in cost of production per tonne of Coal:-**	7296.44
1.	Land reclamation/restoration @1.25 lakhs/Ha for technical and biological reclamation (lakhs/annum)	50.28
2	Environment Audit Rs @ 0.60 lakhs/annum	0.60
3	Environment monitoring Rs @156.0 lakhs/annum	156.00
4	Monitoring of landuse through satellite surveillance lakhs/annum	8.00
5	Mine Closure cost lakhs/annum	333.703
6	Monitoring of CSR and RR plan lakhs/annum	2.00
	Total Revenue nature cost per annum	**550.58**

WEST JHIRIA OCP [1.50 Mty]

Option-II,PARTIAL OUTSOURCING **Replacement Schedule**

	Year			1	2	3	4	5	6	7	8	9	10	11	**12**
	Total													**1954**	**1755**
YEAR	DZ 410 T OB	Unit price	**271**	1	2	3	4	5	6	7	8	9	10	11	**12**
INVST.	Target+Addl.	**no**	2		**1**	**1**									
		Life	**9**		271	271									
REPLACEMENT		**no**												**1**	**1**
		Amt.												271	**271**
DEPR.														60	30
YEAR	SURFACE MINER	Unit price	**419**	1	2	3	4	5	6	7	8	9	10	11	**12**
INVST.	Target+Addl.	**no**	1		**1**										
		Life	**9**		419										
REPLACEMENT		**no**												**1**	
		Amt.												**419**	
DEPR.														93	
YEAR	WATER SPRINKLER 10 KL	Unit price	**173.00**	1	2	3	4	5	6	7	8	9	10	11	**12**
INVST.	Target+Addl.	**no**	1		**1**										
		Life	**9**		173										
REPLACEMENT		**no**												**1**	
		Amt.												**173**	
DEPR.														38	
YEAR	**PAY LOADER**	Unit price	**384**	1	2	3	4	5	6	7	8	9	10	11	**12**
INVST.	Target+Addl.	**no**	2		**1**	**1**									
		Life	**9**		384	384									
REPLACEMENT		**no**												**1**	**1**

WEST JHIRIA OCP [1.50 Mty]

Option-II,PARTIAL OUTSOURCING **Replacement Schedule**

		Amt.												**384**	**384**
DEPR.														85	43
YEAR	**REAR DUMPER**	Unit price	**222**	1	2	3	4	5	6	7	8	9	10	11	**12**
INVST.	Target+Addl.	**no**	5		**3**	**1**	**1**								
		Life	**9**		666	222	222								
REPLACEMENT		**no**												**3**	**1**
		Amt.												**666**	**222**
DEPR.							222							148	25
YEAR	**MISTING SPRAY SPRINKLER**	Unit price	**149.63**	1	2	3	4	5	6	7	8	9	10	11	**12**
INVST.	Target+Addl.	**no**	3		**1**	**1**	**1**								
		Life	**9**		150	150	150								
REPLACEMENT		**no**													**1**
		Amt.													**150**
DEPR.						166	150								17
YEAR	**FE LOADER**	Unit price	**40.09**	1	2	3	4	5	6	7	8	9	10	11	**12**
INVST.	Target+Addl.	**no**	1		**1**										
		Life	**9**		40										
REPLACEMENT		**no**												**1**	
		Amt.												40	
DEPR.														9	
YEAR	**DIESEL HYD BACKHOE**	Unit price	**205.96**	1	2	3	4	5	6	7	8	9	10	11	**12**
INVST.	Target+Addl.	**no**	1				**1**								
		Life	**9**				206								

WEST JHIRIA OCP [1.50 Mty]

Option-II,PARTIAL OUTSOURCING **Replacement Schedule**

REPLACEMENT		**no**													
		Amt.													
DEPR.							206								
YEAR	**CRANE 40 T**	Unit price	**11.41**	1	2	3	4	5	6	7	8	9	10	11	**12**
INVST.	Target+Addl.	**no**	1				**1**								
		Life	**9**				11								
REPLACEMENT		**no**													
		Amt.													
DEPR.							11								
YEAR	TYRE HANDLER	Unit price	**424.92**	1	2	3	4	5	6	7	8	9	10	11	**12**
INVST.	Target+Addl.	**no**	1			**1**									
		Life	**9**			425									
REPLACEMENT		**no**													**1**
		Amt.													**425**
DEPR.															47
YEAR	DIESEL BROWSER	Unit price	**40.88**	1	2	3	4	5	6	7	8	9	10	11	**12**
INVST.	Target+Addl.	**no**	2			**1**	**1**								
		Life	**9**			41	41								
REPLACEMENT		**no**													**1**
		Amt.													**41**
DEPR.							41								5
YEAR	MOTOR GRADER	Unit price	**262.55**	1	2	3	4	5	6	7	8	9	10	11	**12**
INVST.	Target+Addl.	**no**	1			**1**									
		Life	**9**			263									
REPLACEMENT		**no**													**1**

WEST JHIRIA OCP [1.50 Mty]

Option-II,PARTIAL OUTSOURCING **Replacement Schedule**

		Amt.													**263**
DEPR.															29
YEAR	**chp 18 yrs life**		1	1	2	3	4	5	6	7	8	9	10	11	**12**
INVST.					37	35									
		Life	**18**		37	35									
REPL.		**Amt.**													
DEPR.					22	19									
YEAR	**Other P&M,Misc**		1	1	2	3	4	5	6	7	8	9	10	11	**12**
INVST.					291	311	180								
		Life	**11**		291	311	180								
REPL.		**Amt.**													
DEPR.					291	283	147								

ANNEXURES

ANNEXURE – I

CENTRAL MINE PLANNING & DESIGN INSTITUTE LIMITED
REGIONAL INSTITUTE-V, SECL COMPLEX, BILASPUR- C.G. 495 006

MINUTES OF PLANNING COMMITTEE MEETING HELD ON 10TH MARCH 2016 IN THE CONFERENCE ROOM OF DT (P&P) SECL TO DISCUSS THE PROJECT REPORT OF WEST JHIRIA OPENCAST PROJECT(1.50 Mty), HASDEO AREA, SECL

No. CMPDI/RV/OC/2016/5215 Dated 14th March 2016
15

List of participants are as Annexure-I

The draft Project Report of West Jhiria OC Project (1.50 Mty) was presented and deliberated in details. During discussion following decisions were taken :

1. The Project Report of West Jhiria OC Project (1.50 Mty) may be renamed as Project Report of Jhiria West Opencast Project (1.50 Mty).
2. Both for winning of coal and removal of Overburden may be proposed through outsourcing in the final report as the Financial IRR of departmental option is negative.
3. The Capital provision for five departmental auxiliary HEMM has been incorporated in the report for smooth running of the mine. One Misting Spray truck to be given in the report in place of water sprinkler. In addition to that two additional Misting Spray Truck having unit cost of Rs 50 Lakhs may be given for water sprinkling in siding and pit top. One Backhoe and one FEL is also to be given in the report.
4. The Capital provision of Belt Conveyor for transportation of coal from Pit Top to siding for a length of 6.0 Km is to be considered and incorporated in the report. Capital provision for augmentation of Railway Siding to dispatch coal by rail may be incorporated in the report.
5. The Capital provision for approach road from Rajnagar OC Railway siding to Pit Top is to be proposed for a length of 8.0 Km. The width of approach road may be considered as 15m in place of 7.50m. This road will be used for coal transportation till commissioning of belt conveyor.
6. Capital provision for diversion of road for a length of 2.0 KM may be given in the report.
7. Capital provision for double row chain link fencing around the safety zone area may be provided as requirement of forest land diversion. Also provision of Rs 5.0 Crore may be incorporated towards preparation of Wild Life Conservation Plan.

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GENERAL MANAGER
SECL, Hasdeo Area

8. The Capital provision of 6.0 Km power line for extension of power line from Rajnagar Substation is to be made instead of 4.5 Km power line.
9. Old residential quarters should be proposed to be used for West Jhiria OC Project as life of project is only 12 years. Lumsum capital provision of Rs 2.0 Crore for renovation of old quarters and capital for construction of domestic effluent treatment plant may be given in the report. Also Capital provision may be provided for Water Filter Plant and settling tank of mine water.
10. The landuse plan, break-up of land details, number of affected villages and number of Project Affected Households will be provided by area authority to incorporate in the in the report.

Distribution to:-
All participants
Encl: List of participants as Annexure-I

Regional Director

महाप्रबंधक
GENERAL MANAGER
SECL Hasdeo Area

ANNEXURE-I

LIST OF PARTICIPANTS

LIST OF PARTICIPANTS OF PLANNING COMMITTEE MEETING HELD ON 10th MARCH 2016 IN THE CONFERENCE ROOM OF DT (P&P) SECL TO DISCUSS THE PROJECT REPORT OF WEST JHIRIA OPENCAST PROJECT(1.50 Mty), HASDEO AREA, SECL.

Sl.No	Name	Designation
A. SECL HQ AND AREA PARTICIPANTS		
01.	Shri Kuldeep Prasad	DT (P&P)
02	" R.K. Nigam	GM (P&P)
03	" M.S. Ahaluwalia	GM (CIVIL)
04	" A.K. Sinha	GM (E&M) POWER
05	" ERR Patro.	GM (F)
06	" U.T. Kanzarkar	GM (Envt)
07	" O.P.Katare	GM (O) Hasdeo Area
08	" S.K. Rai	GM (EXCV), Hasdeo Area
09	" A.S. Bapat	CM (Mining) P&P/Forest
10	" S.S.Jha	HOD (C/W)
11	" A.K. Sharma	C.M.(CIVIL) P&P
12	" S.K.Rai	GM(E&M) / S&R
13	" Sudhir Kumar	Dy GM/SAM, Rajnagar RO UG
14	" S.C. Dubey	CM (Civil)
15	" S.K. Sinha	Sr. Mgr(M), NO(Forest) Hasdeo
16	" Praveen Kumar	Sr. Mgr (Mining) (P&P)
17	" A K Dwivedi	Sr. Mgr (Ex) P&P
18	" S.R. Tripathi	Sr. Manager (Mining/Envt)
19	" K.K. Sharma	Sr. Mgr (M) / S&R
20	" Sanjay Kumar	Sr. Mgr (M) / Production Dept
21	" J. Choudhary	Sr. Mgr (S) L&R Deptt.
22	" J. Baksh	Sr. Officer(Survey)(L&R) Hasdeo
23	" H.P. Prajapati	Officer (Survey), Hasdeo Area
24	" Charu Sharma	Asst. Manager (Envt)
25	" Rajesh Kumar Meena	MT (Envt) Hasdeo Area
B. CMPDI, RI-V PARTICIPANTS		
26	Shri I.D. Narayan	HOD(OC) CMPDI
27	" B. Manna.	Sr. Mgr (Mining) CMPDI
28	" Tarun Bhatia	Dy. Mgr.(Min) CMPDI
29	" Amritanshu	Asst. Mgr (E&M) CMPDI
30	" D. Panth	Dy Mgr (E&M) CMPDI.

महाप्रबंधक
GENERAL MANAGER
SECL,Hasdeo Area

ANNEXURE - II

दिनांक 27.02.16 को एस.ई.सी.एल. की वेस्ट झिरिया खुली खदान परियोजना के प्रारूप परियोजना प्रतिवेदन पर हुई चर्चा का कार्यवृत्त

The Draft PR for West Jhiria OC of SECL was presented by RD, RI-5 and his team on 27.02.2016 in the Conference Room of CMPDI (HQ) for obtaining guidance of CMPDI (HQ) before finalization of the report.
During the discussions, the following suggestions were made:-

1. Exploration in the area between the proposed quarry and the Khodri Block may be expedited. Further expansion of this project towards west up to Khodri Block may be considered if found feasible on the basis of geological information of the aforesaid exploration.
2. Possibility of providing an option with coal transport from pit top to the railway siding by belt conveyor instead of road may be examined.
3. The outsourcing rate for transport from pit top to siding may include the rate for loading of trucks at pit top. Possibility of providing one rate of transport from face to siding may be examined in consultation with SECL.
4. The need for providing 11 km of stone-wall all around the project areas may be examined with a view to reduce capital expenditure.
5. Observations and Comments of other departments of CMPDI (HQ) should also be taken into consideration before finalizing this report.

== X ==

LIST OF PARTICIPANTS

CMPDI (HQ)

1. Shri S. Saran, CMD
2. Shri V.K. Sinha, Director (T) (RD&T)
3. Shri B.N. Shukla, Director (T) (CRD)
4. Shri B. Dayal, Director (T) (P&D)
5. Shri D. Bhattacharjee, GM (PAD/OC)
6. Shri Achint Kumar, CM (Civ)
7. Shri K.K. Singh, CM (E&T)
8. Shri P.K. Soren, Sr Mngr (Geol)
9. Shri Pankaj Pandey, Sr Mngr (Min)
10. Shri S.K. Sinha, Sr Mngr (E&M)
11. Shri Nimesh, Sr Mngr (E&M)
12. Shri R. Dutta, Sr Mngr (E&M)
13. Shri R.C. Dutta, Sr Mngr (Excvn)
14. Shri T. Verma, Sr Mngr (Min), PAD
15. Shri J. Dahanga, Dy Mngr (Geol)
16. Shri S. Ganguly, Dy Mngr (Fin)

RI-V

1. Shri Manoj Kumar, RD
2. Shri B. Manna, Sr Mngr (Min)
3. Shri P. Banerjee, Dy Mngr (Exp)
4. Shri Amritanshu, Asst Mngr (E&M)
5. Shri P.K. Somani, Asst Mngr (Fin)

महाप्रबंधक
GENERAL MANAGER
SECL, Hqrtrs, Amlai

ANNEXURE – III

Minutes of the 79th meeting of the Technical Sub Committee for the Projects of SECL held on 27th April 2016 at DT (P&P) conference room, SECL Bilaspur

Members participated:

1. Shri Kuldip Prasad, Director (T) (P&P) ,SECL : Chairman
2. Shri A.P. Panda, Director (F) ,SECL : Member
3. Shri R.P. Thakur, Director(T)(O) ,SECL : Member

In attendance:

1. Shri R. K. Nigam, GM(P&P)/HOD, SECL
2. Shri Manoj Kumar, RD, CMPDI,RI-V
3. Shri I. D. Narayan, HOD(OC), CMPDI, RI-V
4. Shri N. Rajshekhar, GM(Fin.), SECL
5. Shri D.K. Sharma, GM (Washery) , SECL
6. Shri Sanjeev Singh, Sr. Manager (M), CMPDI, RI-V
7. Shri Abhijit Bhattacharya, Sr. Manager (M), SECL
8. Shri Praveen Kumar, Sr. Manager (M) (P&P), SECL
9. Shri Anil Kumar Jain, Sr. Manager (M) (P&P), SECL
10. Shri Pabitra kumar Bag, Sr. Manager (CP) (P&P), SECL
11. Shri Badal Manna , Sr. Manager (M), CMPDI, RI-V
12. Shri B. Ravi, Manager (M) (P&P), SECL
13. Shri Tarun Bhatie, Dy Manager (M), CMPDI, RI-V

The chairman welcomed the members of the 79th Meeting of Technical Sub Committee (TSC) and called the meeting in order.

Item No. 79.3: Project Report for Jhiria West OC Project (1.5MTY)

Project Report for Jhiria West OCP (1.5MTY) prepared by CMPDI, RI-V was placed before TSC and discussed in detail. TSC directed to review the economics of the PR considering the provisions as per RFCTLARR Act 2013 and rules made thereunder & also directed to submit the PR with both departmental & outsourcing options. TSC opined that PR may be revised by CMPDI, RI-V as above and placed before TSC.

Item No. 79.4: Project Report Batura West OCP (1.5MTY)

Project Report for Batura West OCP (1.5MTY) prepared by CMPDI, RI-V was placed before TSC and discussed in detail. TSC directed to review the economics of the PR considering the provisions as per RFCTLARR Act 2013 and rules made thereunder & also directed to submit the PR with both departmental & outsourcing options. Only executive summary of PR was submitted. PR with all chapters in detail may be submitted. TSC opined that PR may be revised by CMPDI, RI-V as above and placed before TSC.

27/4/16
Director (T) (P&P)

27/4/16
General Manager (P&P)/HOD

No. SECL/BSP/P&P/16/ 307 dt 03.5.16

Copy to:
D (F) /DT (O), SECL
GM (CS/TS),SECL
Company Secretary, SECL
Members participated

महाप्रबंधक
GENERAL MANAGER
SECL, Head Office

ANNEXURE – IV

Minutes of the 89th meeting of the Technical Sub Committee(TSC) of SECL for Projects held on 15th February'17 at DT(P&P) Conference hall, SECL, Bilaspur

Members participated:

1. Shri P.K. Sinha, DT(P&P),SECL - Chairman
2. Shri A. P. Panda, D (F), SECL - Member
3. Shri Kuldip Prasad, DT(O), SECL - Member

In attendance:

1. Shri S.S.Sinha, GM(P&P)/HOD, SECL
2. Shri E.R.R. Patro,GM(Finance), SECL
3. Shri D.K.Chandrakar,GM(L&R),SECL
4. Shri I.D.Narayan, CM(Mining)/HOD (OC), CMPDI, RI-V
5. Shri K.Rajasekhar, CM (M)/(PMS) (P&P)
6. Shri Sanjay Shristav,Sr.Mgr(Finance),SECL
7. Shri B.Manna, Sr. Manager (Mining), CMPDI, RI-V
8. Shri P.K.Somani, Dy. Mgr.(Finance),CMPDI,RI-V
9. Shri Praveen Kumar,Sr. Mgr.(Mining)(P&P),SECL
10. Shri B. Ravi, Mgr(Mining)(P&P),SECL

The Chairman welcomed the members of the 89th Meeting of Technical Sub Committee (TSC) and called the meeting in order.

Item No. 89.1: Project Report for Jhiria West OC Project (1.50 MTY) of Hasdeo Area

Project Report for Jhiria West OC Project (1.50MTY) with both departmental & outsourcing option was prepared by CMPDI, RI-V and put up before the TSC. The report was discussed by TSC in detail. The salient features of the PR presented by CMPDI, RI-V is as below:

Parameters	Departmental option	**Outsourcing Option**
Financial Internal Rate of Return (FIRR)		
I) At 100% level of production	- 4.34%	**37.14%**
II) At 85% level of production	- 13.26%	**27.96%**
Total Capital(In Crores)	Rs 841.87	**Rs 409.86**

After detailed deliberation, TSC recommended that Project Report for Jhiria West OCP (1.50MTY) with outsourcing option should be considered with the impact of new wage structures of employee and may be put up to SECL Board along with its Financial Appraisal Report for kind perusal and its approval.

Item No. 89.2: Project Report for Batura West OC Project (1.50 MTY) of Sohagpur Area

Project Report for Batura West OC Project (1.50 MTY) with both departmental and outsourcing options was prepared and submitted by CMPDI, RI-V and put up before the TSC. The report was discussed by TSC in detail. The salient features of the PR presented by CMPDI, RI-V is as below:

Parameters	Departmental option	**Outsourcing Option**
Financial Internal Rate of Return (FIRR)		
I) At 100% level of production	- 13.99%	**20.92%**
II) At 85% level of production	- 18.78%	**15.60%**
Total Capital(In Crores)	Rs. 2318.39	**Rs. 781.14**

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GENERAL MANAGER
SECL,Hasdeo Area

After detailed deliberation, TSC recommended that Project Report for Batura West OCP (1.50 MTY) with outsourcing option should be considered with the impact of new wage structures of employee and may be put up to SECL Board along with its Financial Appraisal Report for kind perusal and its approval.

Meeting ended with vote of thanks to the chair.

23/2/17

General Manager (P&P) / HOD

23/2/17.

Director Technical (P&P)

Ref No. SECL/BSP/P&P/17/116 Dated: 23.02.2017

Copy to:

- D(F)/DT(O)/DT(P&P), SECL
- GM(CS/TS) - for kind information to CMD
- RD, RI-V, CMPDI, Bilaspur
- Company Secretary, SECL
- Members participated

महाप्रबंधक
GENERAL MANAGER
SECL, Hqrs.

ANNEXURE – V

South Eastern Coalfields Limited

(A MINIRATNA PSU)
CIN: U10102CT1985GOI003161
Regd. Office: SEEPAT ROAD, BILASPUR (CG) 495 006

CORPORATE AFFAIRS DEPARTMENT

Phone : 07752-246340, 417666 Fax : 07752-246412, 417666 Cell : 09425531303
Website :www.secl-cil.in E mail : compsecy@secl.gov.in

Ref. No. SECL/BSP/CAD/259 BM/17-18/ 190 Date:25.07.2017

EXTRACT OF THE 259TH MEETING OF THE BOARD OF DIRECTORS OF SOUTH EASTERN COALFIELDS LIMITED HELD ON 05.07.2017 (WEDNESDAY) AT NEW DELHI.

ITEM NO.259:4:2

Sub: Project Report for Jhiria West Opencast Project (1.50 MTY)

The item was ***deferred*** with a direction to review and re-submit the same on empirical study basis for all the project parameters of the PR including assumptions considered and its basis and the constraints identified which affect the project, rather than the theoretical formulation.

The Board further directed to firm up the Capital Cost Estimates with other critical details such as scope of supplies from the indigenous and imported sources and the cost estimate should correspond a fairly recent base date not more than six months old and the operating costs are to be estimated for 100% & 85% level of production in terms fixed and variable costs separately over the entire project life. The operating cost should also correspond to the same reference base to which the Capital Costs are related.

The Board advised to submit the reviewed PR along with the technical feasibility, financial and economical viability taking into consideration the organizational, managerial and environmental aspect along with sensitivity analysis.

25/7/17

COMPANY SECRETARY

Distribution for action:
1. GM(P&P)-HOD, SECL
2. GM(F)-HOD, SECL

NO (P&P) 26/7/17

Copy to:
All Functional Directors.

महाप्रबंधक
GENERAL MANAGER
SECL, Head Qrs.

ANNEXURE – VI

Observation of project review meeting held on 25.04.2018

in the conference room of CMD, SECL

"Under the Jurisdiction of Bilaspur Court only"
साऊथ ईस्टर्न कोलफील्ड्स लिमिटेड
SOUTH EASTERN COALFIELDS LIMITED
A MINIRATNA PSU
CIN No.U10102CT1985GOI003161
OFFICE OF THE GENERAL MANAGER (P&P)
महाप्रबंधक कार्यालय (योजना एवं परियोजना)
रजि.कार्यालय् : सीपत रोड, बिलासपुर – 495006 (छ.ग.)
Phone & Fax No. 07752-246319
Website : www.secl.gov.in E.mail : gmpp.secl@coalindia.in

सं.क्र.:एसईसील/बी.एस.पी/यो.एवंपरि./2018/ H - 678 दिनांक: 30.04.2018

प्रति,
RD,RI-V
CMPDI

विषय : UCE/Recasting of Jhiria West OC (1.50MTY) PR of Hasdeo Area

महोदय,

This has reference to your letter No. 150 dated 21.04.2018 regarding keeping provision for 6.0KM belt conveyor to transport coal from pit top to Rajnagar Siding in the Project Report for Jhiria West OCP (1.50MTY). The subject matter was discussed in the Project Review meeting held on 25.04.2018 in the conference room of CMD. It was decided to remove the provision of this belt conveyor.

You are requested to submit the PR at the earliest for placing this in the ensuing SECL Board for its approval.

भवदीय,

27/4/18
महाप्रबंधक (यो/परि)/विभागाध्यक्ष
एस.ई.सी.एल., बिलासपुर

प्रतिलिपि- आवश्यक कार्यवाही हेतु
महाप्रबंधक, Hasdeo क्षेत्र
महाप्रबंधक (खनन)/पीएमएस- योजना /परियोजना, SECL
स्टॉफ ऑफिसर(यो./परि.), Hasdeo क्षेत्र

महाप्रबंधक
GENERAL MANAGER
SECL,Hasdeo Area

ANNEXURE – VII

PROJECT REPORT FOR JHIRIA WEST OCP (1.50 MTY)

TECHNO-ECONOMIC COMPARISON OF OUTSOURCING OPTION,

PARTIAL OUTSOURCING OPTION & DEPARTMENTAL OPTION WITH POWER SECTOR PRICE

SL	FINANCIAL	Unit	OUT-SOURCING	PARTIAL OUTSOURCING	DEPARTMENTAL OPTION
1	Total Capital Investment	Rs. Crores	340.45	389.97	731.54
2	Total Capital Investment on P&M	Rs. Crores	36.86	82.30	383.02
3	Capital requirement upto target year	Rs. crores	338.12	389.33	730.90
4	Earnings per manshift (EMS)	Rs.	3307.75	3360.90	3223.60
5.a)	Cost of Production At 100% production level	Rs. / tonne	1335.49	1499.74	2059.51
5.b)	Cost of Production at 85%		1449.16	1644.23	2340.55
6	Average selling price	Rs. / tonne	2395.15	2395.15	2395.15
7. a)	Profit At 100% production	Rs./Te	1059.66	895.41	335.64
7.b)	Profit At 85% production	Rs./Te	945.99	750.92	54.60
8. a)	IRR at 100% production	%	71.28%	55.57%	14.17%
8.b)	IRR at 85% production	%	56.35%	41.87%	2.90%
9	Break-even point				
a)	Production	Mty	0.57	0.72	1.24
b)	Production level	%	37.81	47.76	82.59
10	Mine Closure Cost	Rs/tonne	37.44	37.44	37.44
11	Expected Completion Capital	Rs. crores	377.58	433.69	825.68

महाप्रबंधक
GENERAL MANAGER
SECL Hasdeo Area

ANNEXURE – VIII

Minutes of the 95th meeting of the Technical Sub Committee(TSC) of SECL for Projects held on 12th September'18 at CMD Board Room, SECL, Bilaspur

Members participated:

1. Shri Kuldip Prasad, DT (P&P)/DT(O), SECL - Chairman
2. Shri A. P. Panda, D (F), SECL - Member

In attendance:

1. Shri Umesh Choudhary, GM(P&P)/HOD, SECL
2. Shri E.R.K. Patro, GM(Finance), SECL
3. Shri I.D. Narayan, GM(Mining), RD, RI-V, CMPDI
4. Shri K.Rajasekhar, GM (Mining)(P&P),SECL
5. Shri G.S.Topagi, GM(Environment),SECL
6. Shri A. Bhattacharya, Sr. Mgr (Mining), SECL
7. Shri Sanjeev Singh, Sr.Mgr (Mining),CMPDI
8. Shri B. Manna, Sr. Manager (Mining), CMPDI, RI-V
9. Shri Praveen Kumar, Sr. Mgr.(Mining)(P&P),SECL
10. Shri P.K.Somani, Dy. Mgr.(Finance),CMPDI,RI-V
11. Shri Dexit Bhatt, Asst. Mgr (Finance),SECL

The Chairman welcomed the members of the 95th Meeting of Technical Sub Committee (TSC) and called the meeting in order.

Item No. 95.1: Project Report for Jhiria West OC Project (1.50 MTY) of Hasdeo Area

Project Report for Jhiria West OC Project (1.50MTY) with departmental, partial hiring (Coal departmental & OB outsourcing) and outsourcing option was prepared by CMPDI, RI-V as per the directives of SECL Board and put up before the TSC. The report was discussed by TSC in detail. The salient features of the PR presented by CMPDI, RI-V is as below:

Parameters	Departmental option	Partial Outsourcing (Coal departmental & OB Outsourcing)	Outsourcing Option
Financial Internal Rate of Return (FIRR)			
I) At 100% level of production	14.17%	55.57%	71.28%
II) At 85% level of production	2.90%	41.87%	56.35%
Total Capital(In Crores)	731.54	389.97	340.45

After detailed deliberation, TSC recommended that Project Report for Jhiria West OCP (1.50MTY) with outsourcing option and may be put up to SECL Board along with its Financial Appraisal Report for kind perusal and its approval.

Meeting ended with vote of thanks to the chair.

14/9/18

Director Technical (P&P)

14.9.18

General Manager (P&P) / HOD

Ref No. SECL/BSP/P&P/18/ 1316

Dated: 14.09.2018

Copy to:

- D(F)/DT(O)/DT(P&P), SECL
- RD, RI-V, CMPDI, Bilaspur
- Company Secretary, SECL
- Members participated

महाप्रबंधक
GENERAL MANAGER
SECL, Hasdeo Area

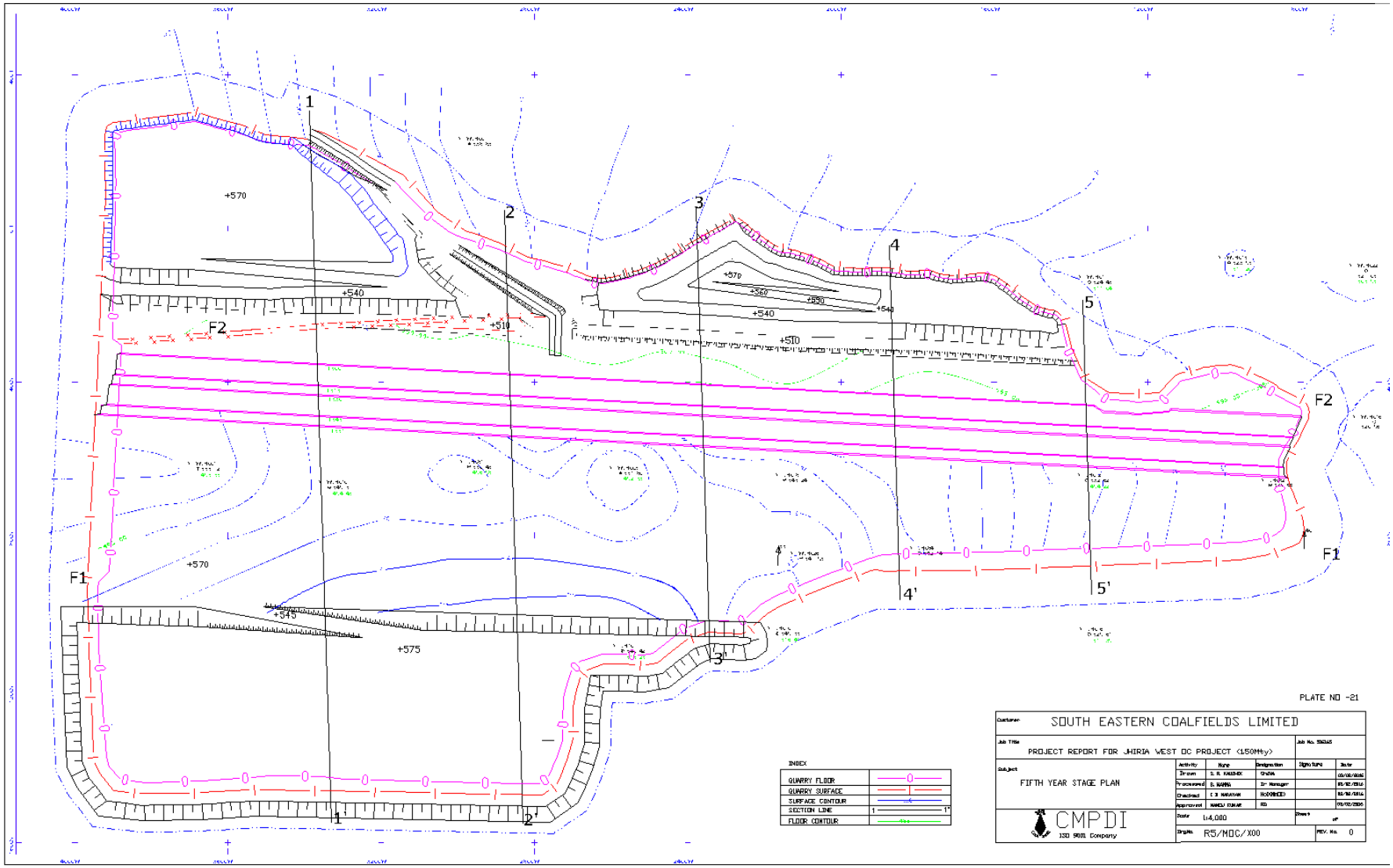


Figure-18.2 Fifth year Dump Plan

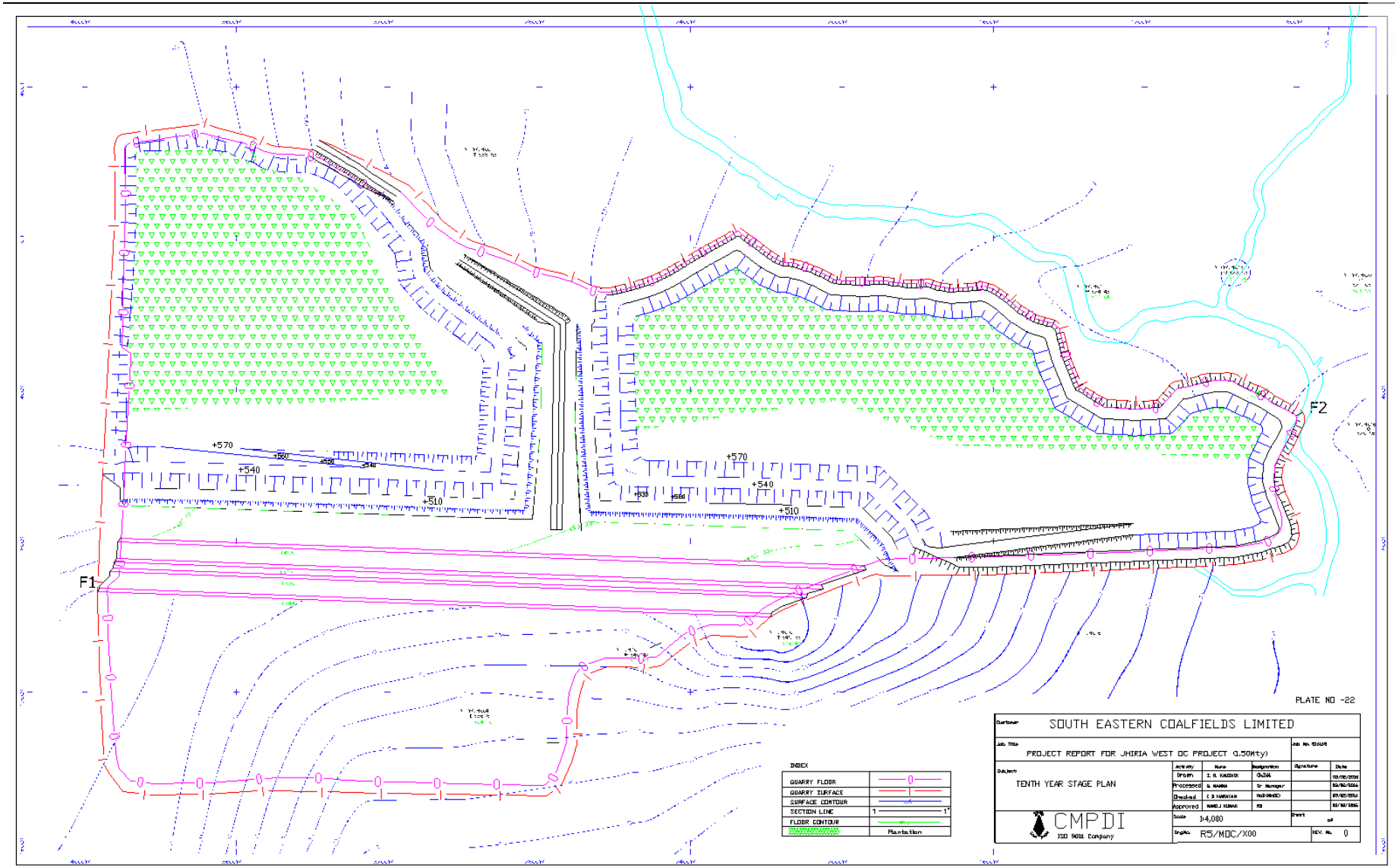


Figure-18.3 10th year Dump Reclamation Plan

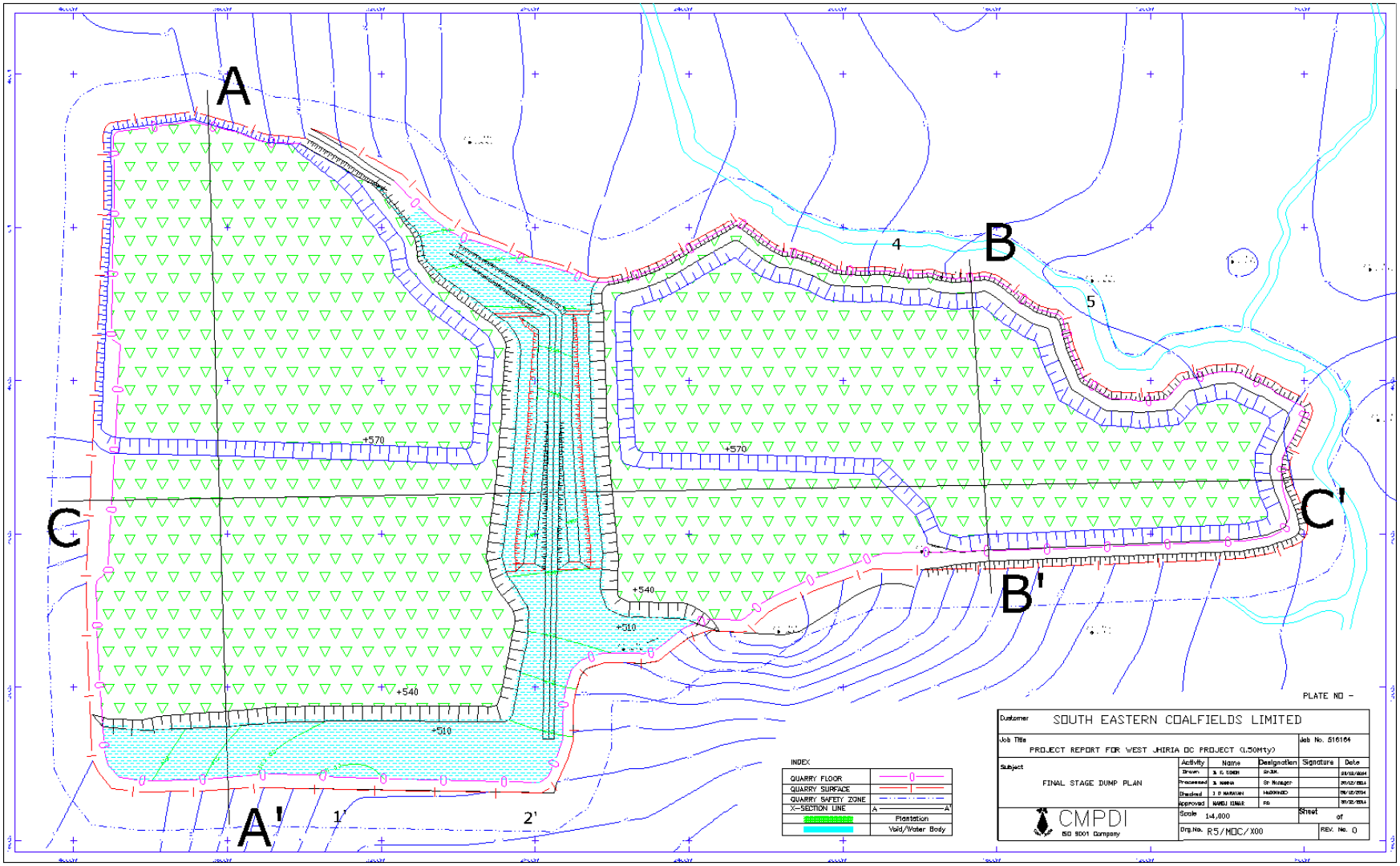
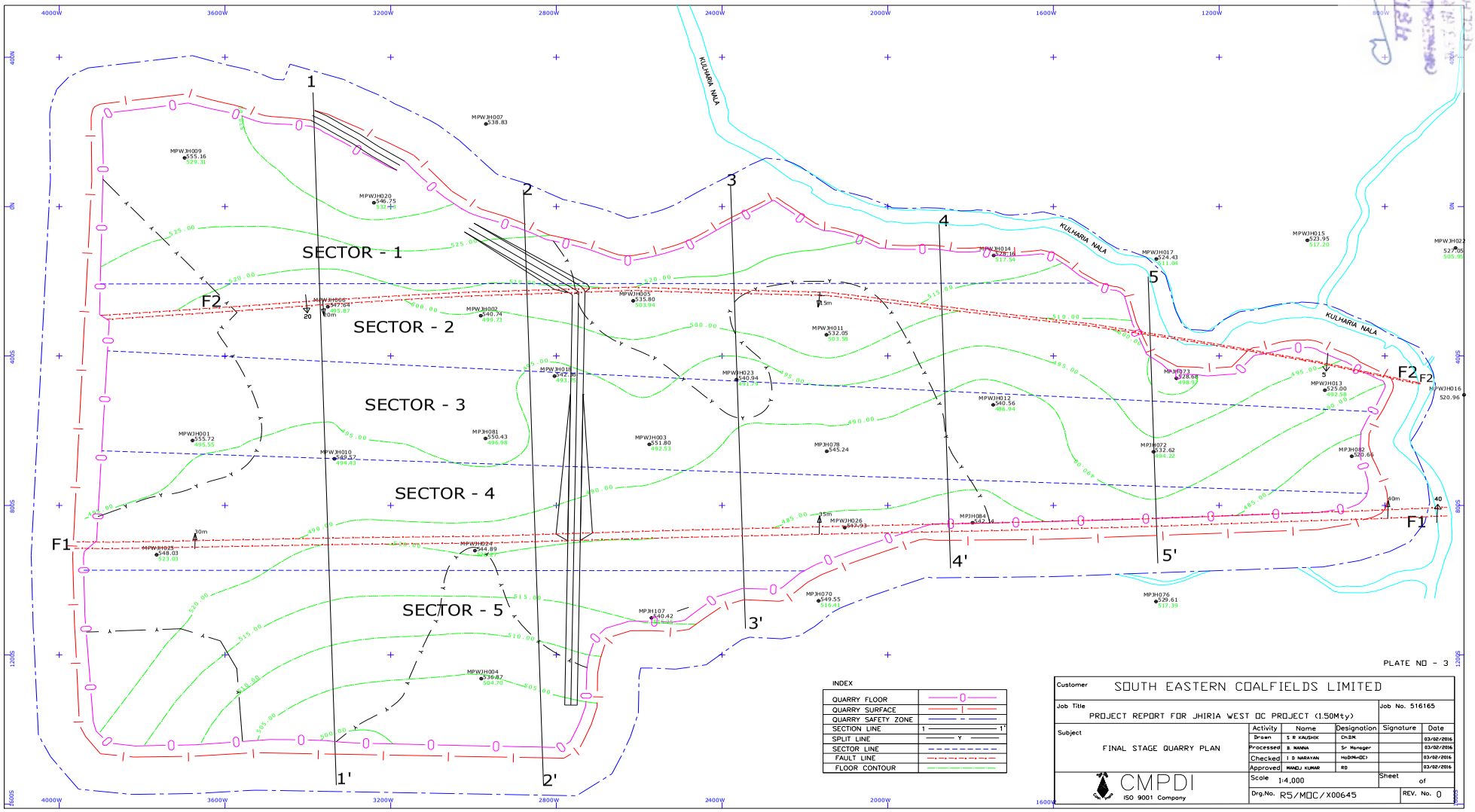


Figure-18.4 Final Stage Dump Reclamation Plan


SECTOR - 1
SECTOR - 2
SECTOR - 3
SECTOR - 4
SECTOR - 5
KULHARIA NALA
F1
F2
1
1'
2
2'
3
3'
4
4'
5
5'
INDEX
QUARRY FLOOR
QUARRY SURFACE
QUARRY SAFETY ZONE
SECTION LINE
SPLIT LINE
SECTOR LINE
FAULT LINE
FLOOR CONTOUR
PLATE NO - 3
Customer
SOUTH EASTERN COALFIELDS LIMITED
Job Title
PROJECT REPORT FOR JHIRIA WEST OC PROJECT (1.50Mty)
Job No. 516165
Subject
FINAL STAGE QUARRY PLAN
Activity
Name
Designation
Signature
Date
Drawn
S R KAUSHIK
Ch.Dr.
Processed
B. MANNA
Sr Manager
Checked
I D NARAYAN
HoD(M=OC)
Approved
MANOJ KUMAR
RD
Scale
1:4,000
Sheet
of
Drg.No.
R5/MOC/X00645
REV. No. 0
CMPDI
ISO 9001 Company