REVISED COST ESTIMATE FOR

CHITRA EAST OCP (2.50 MTY)

(S.P. MINES AREA)

EASTERN COALFIELDS LIMITED

JULY, 2017

Regional Institute-1
Central Mine Planning & Design Institute Ltd.
(A Subsidiary of Coal India Ltd.)
G.T.Road (West End)
Asansol-713 304.

कोल इंडिया Coal India

cmpdi
A Mini Ratna Company

REVISED COST ESTIMATE FOR

CHITRA EAST OCP (2.50 MTY)

(S.P. MINES AREA)

EASTERN COALFIELDS LIMITED

JULY, 2017

Regional Institute-1
Central Mine Planning & Design Institute Ltd.
(A Subsidiary of Coal India Ltd.)
G.T.Road (West End)
Asansol-713 304.

CONTENTS

LIST OF APPENDICES

LIST OF APPENDICES

SUMMARISED DATA

Sl. No.	Particulars	Unit	Value
A.	**GENERAL**		
1	Name of Project		Chitra East OCP (2.50 Mty)
2	Name of Area / Company		Eastern Coalfields Ltd.
3	Nearest Railway Station from project	Name km	Jamtara 26 Km.
4	Nearest State Highway	Name km	Jamtara-Dumka-Pirpaiti Road 10 Km.
B.	**GEOLOGICAL**		
1	Name of geological blocks considered	Name	Chitra Block
2	Area of the geological blocks	sq. km	7.00
3	Borehole Density within the block	BHs/sq.km	26
4	Description of all coal seams within block		

Stratigraphic Sequence	***Thickness (m)***		***No. of borehole intersections***	***Geological Reserves (Mt)***	***Remarks***
	Min.	***Max.***			
Tulsdabar Top	1.00	7.00	33	12.624	
Parting	3.00	16.00			
Tulsidabar Bot	1.00	8.00	37	18.069	
Parting	5.00	38.00			
Bhabanipur Top	1.00	13.00	41	36.043	
Parting	1.00	17.00			
Bhabanipur Bot	1.00	13.00	33	9.481	
Parting	25.00	45.00			
Chitra Top	1.00	2.00	23	1.814	
Parting	0.00	9.00			
Chitra Middle	1.00	4.00	26	3.558	
Parting	0.00	19.00			
Chitra Bottom	4.00	10.00	50	51.240	
Chitra Comb.	19.00	24.00		20.80	
Parting	3.00	55.00			
Colony Top	1.00	11.00	65	24.673	
Col. (Top + Mid)	4.00	11.00		9.557	
Parting	0.00	35.00			
Colony Middle	1.00	11.00	55	20.999	
Parting	0.00	21.00			
Colony Bottom	1.00	11.00		16.014	
Col. (Mid + Bot)	2.00	13.00		3.080	
Parting	12.00	38.00			
Patrika Top	1.00	5.00	69	7.520	

Sl. No.	Particulars		Unit	Value	
Parting	0.00	36.00			
Patrika Bottom	0.00	36.00	-	3.521	
Patrika (T + B)	4.00	5.00	-	5.373	
Parting	3.00	20.00			
Saharjuri Top	1.00	23.00	108	69.406	
Parting	0.00	50.00			
Saharjuri Bot	1.00	9.00	82	8.173	
Saharjuri Comb.	-	-		4.801	
TOTAL				326.836	In march 1991

C.	TECHNICAL				
1	Area of the proposed mine block		sq. km	2.66	
2	Borehole density within mine area		BHs/sq. km	26.00	
3	Mine parameters			Quarry-1	Quarry-2 & 3
	Extent along strike (min. – max.)		km	0.45 – 1.60	0.80 – 2.60
	Extent along dip (min.-max.)		km	0.18 – 0.36	0.80 – 1.20
	Area of Excavation		Ha	44.00	222.00
4	Description of coal seams proposed to be worked along with the parting details				

Name of seam	***Thickness range considered(m)***	***Av. Parting / Top OB Thickness (m)***	***Av.Grade (UHV/ GCV)***	**Mineable Reserves (Mt)**	
				As Per Approved PR	***Balance Resvs. As Per RCE***
Top OB		10 - 34			
Tulsdabar Top	3 - 4		G8	1.42	0.83
Parting		7 - 10			
Tulsidabar Bot	4 - 6		G8	1.81	1.55
Parting		10 - 15			
Bhabanipur Top	3 - 9		G8	2.83	2.79
Parting		2 - 4			
Bhabanipur Bot	3 - 6		G8	1.38	1.07
Parting		12 - 32			
Chitra Top	1 - 2		G8		
Parting					
Chitra Middle	2 - 3		G8	1.21	0.65
Parting		0 - 19			
Chitra Bottom	9 - 10		G8	10.76	6.58
Parting		3 - 6			
Colony Top	4 - 6		G6	4.16	3.55
Col. (Top + Mid)			G6		
Parting		1 - 34			
Colony Middle	4 - 5		G6	4.79	3.97
Parting		1 - 10			

Sl. No.	Particulars		Unit	Value	
Colony (Bot, B&M)	3 - 13		G6	4.83	3.56
Parting		12 - 38			
Patrika Top	1 – 2.5		G6	1.61	0.83
Parting		1 - 6			
Patrika Bottom	1 - 2		G6	5.03	4.43
Parting		1 - 16			
Saharjuri Top	4.5 - 17		G6	19.97	17.15
Parting		3 - 5			
Saharjuri Bottom	1 - 3		G6	0.60	0.46
Saharjuri Comb.			G6		
Total			**G7**	**60.40**	**47.42**
	Total OB (in-Situ)		***(Mcum)***	168.95	141.66
Rehandling			***(Mcum)***	12.20	14.60
5	Av. Stripping Ratio		m^3/t	**3.00**	**3.30**
9	Method of Mining			Shovel And Dumper	
10	Target Output		Mty	2.50	
11	Year of achieving Target Production			3RD Year	

12	Approved Production Phasing										
Year	***1st Yr***	***2nd Yr***	***3rd Yr***	***4th Yr***	***5th Yr***	***6th Yr***	***7th Yr***	***8th Yr***	***9th Yr***	***10th***	***11th***
Coal (Mt)	1.20	1.20	1.60	2.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50
OB (Mm^3)	2.80	4.00	4.80	5.80	6.30	5.70	5.60	5.90	7.00	7.50	7.60
13	**Actual prodn.**										
Coal (Mt)	1.25	1.27	1.40	1.40	1.50	1.45	1.42	1.73	1.64	1.18	2017
OB (Mm^3)	1.86	1.95	2.02	2.29	2.26	2.14	2.84	4.18	2.02	3.03	-18
	Production Phasing of RCE										
Coal (Mt)	2.00	2.20	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
OB (Mm^3)	6.40	6.80	7.20	8.50	8.80	8.80	8.75	8.00	7.00	7.00	7.20

14	Total Mine Life (Approved PR)	Years	26
	Total Mine Life (RCE)	Years	20
	Balance Life of the mine	Years	20 (incl.2017-18)

15	Major HEMM for Partial Outsourcing Option		**Approved PR**	**As Per RCE**
			Nos.	Nos.
		3-4 cum Shovel	3	5
		35T Dumper	19	28
		160mm Drill	2	5
		Chain Dozer	2	7
		Ripper Dozer	1	-
16	Total Manpower	Nos.	**Approved PR**	**RCE**
			626	646
17	(OMS)	Tonnes	16.82	14.66
18	EMS	Rs./te	922.49	2621.22
19	Av. Grade of coal		UHV Grade D	GCV Grade G7

Sl. No.	Particulars	Unit	Value	
20	Presence of Major Surface Constraints (nallas, road, power line, etc.)		Rehabilitation of 6 no. villages	
21	Coal Transport within the mine		By Dumper	
22	Surface Coal Transport to Siding/Despatch Point and Mode of Despatch		By contractual truck Transport	
23	Any Railway Siding and distance		Jamtara Rly Siding, 26-27Km	
24	Name of any Specific Customer/Industry		Basket	
D.	**ENVIRONMENTAL & OTHERS**			
1	Civil Construction		**Approved PR**	**RCE Provision**
	Residential houses	Nos.	106	48
2	Total Land Required	Ha	780.80	784.04
	Non Forest land	Ha	625.20	553.59
	Forest land	Ha	155.60	230.45
	Land already Acquired	Ha	209.50	402.15
	Land to be acquired	Ha	571.30	381.89
3	Land to be required within minetake area (excavation area including safety zone)	Ha	376.00	
4	Land to be required outside minetake area (Beyond Excavation Area, such as Approach Road, Infrastructure, Colony, Rehabilitation colony etc.)	**Ha**	**159.80**	**163.04**
6	Land required for external dumping (including safety zone)	**Ha**	245.00	
8	Habitation & Rehabilitation		6	6
	No. of villages To Shift	Nos.		
	No. of PAFs to be rehabilitated		586	1596
9	Cost of land & Rehabilitation	Rs. crores		
	Total Cost		44.13	422.10
	R&R only		17.24	57.34
10	Total EMP Capital	Rs. crores	25.16	65.43
	Social cost		17.24	57.49
	Environment cost		7.92	7.94

Sl. No.	Particulars	Unit	Value	
E.	FINANCIAL		Approved PR Provision	Revised Cost Estimate
1	Total Capital Investment	Rs. Crores	169.85	784.70
1A	Total Additional Capital Investment	Rs. Crores	112.69	513.99
1B	Existing Capital	Rs. Crores	57.16	270.71
1C	Cost of Land	Rs. Crores	26.90	436.08
2	Specific Investment (Total)	Rs. / tonne	679.40	3138.80
3	Total Capital Investment on P&M	Rs. crores	61.37	185.77
4	Addl. Capital Investment on P&M	Rs. crores	43.75	63.75
5	Addl. Capital requirement upto target year	Rs. crores	81.99	357.31
6	Year of opening of Revenue account (from zero date)		1st Year	
7	Earnings per manshift (EMS)	Rs.	922.49	2621.22
8	Estimated Cost of Production At 100% production level At 85% production level	Rs. / tonne	 517.47 557.12	 1261.52 1385.06
9	Estimated average selling price (at 95% sales realization)	Rs. / tonne	1247.50	1770.78
10	Estimated Profit At 100% production level At 85% production level	Rs. / tonne	 730.03 690.83	 509.26 385.72
11	Financial Internal rate of return At 100% production level At 85% production level	 %	 118.05 63.29	 63.23 40.24
12	Break-even point Production Production level	 Mty %	 0.59 23.54	 1.45 57.89
13	Cost of Outsourcing (average)	Rs/tonne	196.89	394.26
14	Mine Closure Fund	Rs. crores	-	101.96
15	Expected Completion Capital	Rs. crores	-	588.74

RCE OF PR FOR CHITRA EAST OCP

1.0 INTRODUCTION

1.1 The Chitra East OCP is located in Saharjuri Coalfield (popularly known as Chitra Coalfield) and is within Deoghar district of Jharkhand. The proposed OCP is under the administrative control of S.P.Mines Area of ECL.

1.2 A number of coal seams starting from Saharjuri (Bot.) seam at the bottom and Tulsidabar (Top) at the top belonging to Karharbari and Barakar formations occur in the form of a basin in Saharjuri Coalfield. A large number of old & abandoned quarries and underground workings mined by erstwhile owners exist over the entire area.

1.3 At the time of preparation of the PR, two quarries, namely, Chitra-A and Chitra-B were working at Chitra mine. These two opencast mines together were producing a total of about 1.50 MTY of coal. The two mines were physically connected and they are basically two sectors of a single excavation. However, presently two quarry part has been amalgamated into a single unit.

1.4 Earlier two Project Reports namely, Revised FR of Girija Quarry (Capital-6.22 crore) and FR for Chitra OCP (Ph-I) (Capital-19.63 Crore) were approved by competent authority in Dec-1985 and in FY 1988-89 respectively.

1.5 Subsequently, the Project Report namely Chitra East OCP (2.50 Mty) had been prepared at eastern part of the geological block (including the zone of Girija quarry and Chitra OCP Phase-I) in February 2007. This PR was prepared by amalgamating the workings of the then existing Chitra-A and Chitra-B quarry considering Saharjuri seam as floor of the quarry. The PR was prepared envisaging three following options.

Option- I : In this option all the activities involved in the OCP proposed to be done departmentally.

Option-II : In this option production of coal was proposed to be done departmentally with the existing HEMM and the total OB removal was proposed

to be done by outsourcing of HEMM. Excess HEMM (beyond the requirement for coal production) was envisaged to be transferred to other mines.

Option-III : In this option entire mining operation was proposed to be outsourced with the proposal of transferring out all existing HEMM.

ECL as well as CIL Board approved the PR in **Option-II** i.e Partial Outsourcing mode in Aug'07 with additional capital investment of Rs. 112.69 crores. EMP of Chitra East OCP (2.50 Mty) has also been approved by MOEF in March 2010. Salient features of this approved PR (2.50 Mty) is given below:

Sl.No.	Particulars	Provision
1	Reference Date	December '06
2	Mineable Reserve (Mte)	60.40
3	Target output of coal (Mte/Yr.)	2.50
4	Peak Volume of OB (Mm^3/Yr.)	7.60
5	Average stripping ratio (Cum/te)	3.00
6	Life of Project (Years)	26
7	Quality of coal	Grade 'D'
8	Additional capital (Rs. Crores)	112.69
9	Total Capital Investment (Rs. Crores)	169.85

1.6 The project could not attain the Completion Criteria till date. The provisions contained in the above approved PR also has not been implemented. Some provisions of the approved PR like CHP is envisaged to be no longer required. However, capital expenditure under some heads specially, land has been far exceeded the provision of the approved PR.

1.7 NEED FOR REVISED COST ESTIMATE (RCE)

1.7.1 Even after nine years of approval, envisaged land acquisition process could not be materialized due to delay in the process by State Govt. Already an amount of Rs.71.32 crores has been spent towards land acquisition till 2016-17 against the approved capital of 26.90 crores. Balance estimated capital for land acquisition is Rs.364.76 crores. Owing to escalation of land cost, total estimated cost for land works out to Rs.436.08 crores. Other major cost escalation has been happened towards Re-habilitation of villages. Though some of the approved expenditure is proposed to be dropped, total capital requirement will be much more than approved capital of Rs.112.69 crores.

1.7.2 Though the PR was approved in partial outsourcing mode (envisaging total OB removal to be outsourced and excess HEMM other than required for coal production transferred to other mines), mine has been continued to run departmentally with all HEMM being replaced in regular basis. Now ECL desires to continue with the existing strength of HEMM which is much more than what was envisaged in the approved PR. As a result, with existing departmental mine capacity, mine will also be able to remove some OB after producing the targeted quantity of coal.

1.7.3 Increased requirement of capital and change in scope of mine operation makes it necessary to prepare a Revised Cost Estimate for the approved PR of Chitra East OCP (2.50 Mty). As the OCP has already been run for more than ten years after approval of the 2.50 Mty PR, other provisions of the approved PR have also been reviewed during preparation of the RCE.

1.7.4 Salient features of the approved PR and the present RCE is given below.

SALIENT FEATURES				In Rs. crores
Sl. No.	**Particulars**	**Unit**	**Provision in Sanctioned PR**	**RCE**
1	Target Production	Mty	2.50	2.50
2	Stripping Ratio	cum/te	3.00	3.30
3	Life of the mine		26	20
4	Total Capital	Rs crore	169.85	784.70
5	Existing capital	Rs crore	57.16	270.71
6	Additional Capital	Rs crore	112.69	513.99
7	Capital For Land Acquisition	Rs crore	26.90	436.08
8	Capital For Rehabilitation	Rs crore	17.24	57.49
9	Specific Investment	Rs./te	679.40	3138.80
10	Cost of Production			
	100% Production Level	Rs./te	517.47	1261.52
	85% Production Level	Rs./te	557.12	1385.06
11	Weighted average Grade of Coal		Grade-D	G-7
12	Weighted average Selling Price	Rs./te	1247.50	1770.78
13	Profit at 100% Production Level	Rs./te	730.03	509.26
	Profit at 85% Production Level	Rs./te	690.83	385.72
14	Financial IRR			
	100% Production Level	%	118.05	63.23

	85% Production Level	%	63.29	40.24
15	Manpower	No.	626	646
16	OMS	te.	16.82	14.66

2.0 MARKETABILITY AND JUSTIFICATION

2.1 The scenario of Demand – supply of coal with respect to ECL in the next five years from 2015-16 to 2019-2020, as obtained from GM(P), ECL (Vide ECL:PM:CMPDIL:164 dated 24.04.2015) is given below.

PROJECTED DEMAND AND SUPPLY SCENARIO OF ECL					
Consumer Sector	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**
Projected Production (MT)	42.500	46.939	51.678	56.564	62.00
Demand Considering Trend (MT)	36.601	36.912	37.244	37.586	37.966
Addl. ACQ Required Considering Trend (MT)	8.804	13.369	19.245	25.304	32.045
Total Demand (MT)	45.405	50.281	56.489	62.890	70.011
Shortage/Surplus (MT)	(-)2.905	(-)3.342	(-)4.811	(-)6.326	(-)8.011

2.2 As can be seen from the aforesaid table, there is substantial gap between the demand and expected supply of Coal on part of ECL. Chitra OCP will help ECL in bridging this gap.

3.0 PROJECT SITE INFORMATION

3.1 The Saharjuri Coalfield is located in Deoghar district of Jharkhand state. The coalfield falls between latitudes 24° 05’ to 24° 10’ north and longitudes 86° 49’ 30” to 86° 57’ 30” east and covers an area of 7 sq.km. The coalfield is included in the survey of India Topo Sheet no. 72L /16.

3.2 The OCP is well connected to Asansol, Jamtara, Dumka, Bhagalpur, Godda and Pirpainthee by road. This road passes through a distance of 10 Kms from the project site and is connected to the project by a metalled road branching from Basti-palajori More. The nearest rail head connected to the project by all weather road is

Jamtara station on Eastern Railway Main line at a distance of 26 Kms from the project.

3.3 Provision of approved PR with respect to deployment of HEMM has not been implemented. The existing mine is being run departmentally as before the approval of the P.R for Chitra East OCP. Only recently outsourcing of some OB volume has been proposed. HEMM in excess of requirement for coal production (2.5 Mty) was supposed to be transferred to other mines. However, the Mine could not be developed properly due to non-availability of land for mining as well as for outside OB dumping. In absence of any siding at mine site, coal is being transported from mine to Jamtara Railway siding, 26 Km away.

3.4 Normal working of the mine has been restricted due to non-availability of land for the expansion of the mine. 277.87 Ha. of tenancy land has been acquired under L.A Act, though physical possession is yet to be obtained in some part of it. Stage-I clearance for 124.28 Ha. forest land has been obtained in 2010. But Stage-II clearance is yet to be obtained. Fresh acquisition of 381.89 Ha. of land including 106.17 Ha. of forest land is yet to be done.

3.5 The approved PR envisaging Partial Outsourcing mode kept provision of HEMM to be required for coal production only suggesting other HEMM to be either surveyed off (after life) without replacement or transferred to other mines. However, strength of HEMM almost remain the same with regular replacement of surveyed off HEMM and no transfer of equipment. The approved as well as existing population of HEMMs at Chitra OCP is as under:

Sl. No.	Major HEMM	Population in 2007	Approved Population	Present population
1	4-5 m^3 Rope Shovel	2	-	2
3	3.0-4.0 m^3Hyd. Shovel	3	2	4
4	2-3 m^3 Hyd. B/H	2	1	-
5	1-1.5 m^3Hyd. Shovel/Backhoe	-	1	1
6	35T Dumper	30	19*	28
7	160mm Drill	4	2	5
8	115mm Drill	1	1	-
9	320 HP Dozer	7	2	7
10	770 HP Dozer with Ripper	-	1	-
11	460 HP wheel Dozer	-	1	

12	145 HP Grader	1	-	-
13	3.5-4.0 cum F.E.Loader	3	1	-
14	Water sprinkler (10 Kl)	1	2	2

- * 4 no. proposed gradually after 10th year to cater increasing lead distance for coal.

In the Approved PR Excess HEMM other than required for coal production were proposed to be transferred to other mines.

3.6 Though the PR has been approved in Partial Outsourcing mode envisaging entire OB to be produced by outsourcing agency, the mine has been run fully departmentally till recently. In recent past due to shortage of departmental mine capacity some OB removal job has been outsourced. The approved PR has a targeted capacity of 2.50 Mty. Since its approval (2007-08) till 2016-17 the mine has produced 14.24 Mt of coal and removed 24.59 M.cum of OB, along with 2.36 m.cum of re-handling the detail of which is given below.

	Year	Schedule of approved PR			Actual Production		
		Coal(Mt)	OB (M.Cum)	Rehandling (M.Cum)	Coal(Mt)	OB (M.Cum)	Rehandling (M.Cum)
1	2007-08	1.20	2.80		1.25	1.86	
2	2008-09	1.20	4.00	1.00	1.27	1.95	
3	2009-10	1.60	4.80	2.00	1.40	2.02	
4	2010-11	2.00	5.80	1.70	1.40	2.29	
5	2011-12	2.50	6.30	1.30	1.50	2.26	
6	2012-13	2.50	5.70	1.90	1.45	2.14	
7	2013-14	2.50	5.60	2.00	1.415	2.84	0.62
8	2014-15	2.50	5.90	1.70	1.73	4.18	0.49
9	2015-16	2.50	7.00	0.60	1.64	2.02	
10	2016-17	2.50	7.50		1.18	3.03	1.25
11	2017-18	2.50	7.60				
12	2018-19	2.50	7.60				
13	2019-20	2.50	7.55				
14	2020-21	2.50	7.60				
15	2021-22	2.50	7.60				
16	2022-23	2.50	7.60				
17	2023-24	2.50	7.60				
18	2024-25	2.50	7.60				
19	2025-26	2.50	7.60				
20	2026-27	2.50	7.60				
21	2027-28	2.50	7.20				
22	2028-29	2.50	6.80				
23	2029-30	2.50	6.60				

24	2030-31	2.50	6.50				
25	2031-32	2.50	6.50				
26	2032-33	1.90	4.00				
	Total	**60.40**	**168.95**	**12.20**	**14.24**	**24.59**	**2.36**

3.7 Chitra mine does not have any CHP or siding facilities at the pit head. Though CHP was provided in approved PR, the same has not been implemented. Instead of departmental CHP, coal is being crushed at the pit head by Mobile crusher through outsourcing. The entire production is being transported through State Highway to the Jamtara Rly. siding located about 26 Km away for the final despatch.

3.8 Only a few of the jobs envisaged in the approved PR has been completed till date. Others are either in the process of being implementation or to be taken up for implementation shortly. Again some of the activities like construction of CHP, have been decided not to be implemented. Head wise execution status of the provisions (as conveyed by Area authority) of approved PR is given below.

SL No	PARTICULARS	Approved Addl. Capital (Rs. lakh)	Expenditure Against Approved Capital upto 31.03.17 (In Rs. lakh)	Status Of Execution
1	Land Acquisition:-	**2689.81#**	7132.14	Partly Acquired
2	Buildings :-			
	a) Residential	323.98	432.28	Partly completed
	b)Non- Residential	358.81	351.72	mostly completed
	Sub-Total - (2)	**682.79**	**784.00**	
3	Plants & machineries :-			
	a)HEMM	1725.36	133.86	Mostly Not Required
	b) Other than HEMM			
	Electrical P&M	707.80	44.75	Mostly to be done
	Workshop & Stores P&M	146.62	0.50	Mostly Not Required
	Pump pipes & fittings	265.78	117.75	Rest to procure
	Coal handling plant	1418.40	-	Not to implement
	Other P&M	110.99	48.08	Partly procured
	Sub-Total - (3)	**4374.95**	**344.94**	
4.	Furniture & Fittings	34.00	48.14	-
5.	Railway Siding	30.98	54.45	-
6.	Vehicles	32.50	-	Not Required
7.	Prospecting & Boring	45.00	2.40	Required Later
8.1	Mine Development			
a.	Mine Development Jobs	396.00	84.18	Mostly to be done

b.	Rehabilitation of village	1723.60	14.80	Under process
	Sub-Total - (8.1)	**2119.60***	**98.98**	
8.2	Roads & Culverts	890.35	188.63	Mostly to be done
8.3	Water Supply & sewerage	169.55	128.45	Partly Done
8.4	PR Preparation & Scientific Study	199.76	199.06	
	Total (8)	**3485.85**	**615.12**	
	TOTAL	**11269.28**	**8981.19**	

- ** Excluding cost of Forest Land, # including cost of forest land.*

4.0 GEOLOGY

4.1 The Deoghar group of Coalfields lying north of the Damodar valley coalfields comprises of three Gondowana outliers (Jainti, Saharjuri and Kundith-Kuraiah from west to east). These outliers, aligned roughly in a WNW-ESE direction, represent intracratonic asymmetrical basins with fault truncation on one side. They are also affected by a number of dolerite and mica peridotite intrusive. The Saharjuri Coalfield (Chitra Block) is located in Deoghar district of Jharkhand state. The Coalfield was initially explored by GSI during 1979 to 1984. The Saharjuri Coalfield is located in Deoghar district of Jharkhand state. The Coalfield was initially explored by GSI during 1979 to 1984. The Geological Report of Chitra Block was published by CMPDI in March, 1991.

4.2 Chitra Block has been explored by a total of 186 boreholes drilled by GSI, CMPDI, ECL & MECL. The total explored area of the block being 7 sq.km. The borehole density works out to 26 boreholes/sq.km. Thus, the area considered for opencast working is fully explored.

4.3 Saharjuri coalfield represents an asymmetrical synclinal basin with long axis of about 9 km length (NW-SE trending) and short axis of about 3.5 km width (NE-SW trending). The coal measures, which are present in the central part of the basin, are represented by Karharbari and Barakar formations of the Gondwanas. The coal measures are underlain by Talchirs, which rest on the metamorphic basement. The coal measures and associated coal seams dip at 10^{o} to 20^{o} towards the central part of the basin exhibiting a curvilinear pattern of deposition.

4.4 A total of 16 coal seams have been identified within the block out of which 14 seams are persistent enough to be considered as mineable. These 14 coal seams,

based on their relative occurrence in vertical column and the pattern of splitting / merger, have been classified into 6 groups of coal seams namely, Saharjuri group Patrika group, Colony group, Chitra group, Bhawanipur group and Tulsidabour group from bottom upwards respectively. Sequence of coal seam as established in the block is given below:

4.5 The floor of Sahajuri seam forms the floor of Chitra opencast project. The floor generally consists of sandstone (occasionally shale/sandy shale. The quarry floor, on an average, dips at 10^0- 15^0. Twelve faults (excluding two boundary faults) occur within the block with throw up to 80m.

SEQUENCE OF COAL SEAMS, SAHARJURI BLOCK
Coal seams / partings in Chitra Block with their thickness

Seam	Thickness (m)
Tulsidabor Top	1.0-7.0 (3.0-4.0)
Parting	3.0-16.0
Tulsidabor Bottom	1.0-8.0 (5.0-6.0)
Parting	5.0-38.0
Bhabanipur Top	U/W-13.0 (7.0-8.0)
Parting	1.0-17.0
Bhabanipur Bottom	U/W-13.0 (2.0-3.0)
Parting	25.0-45.0
Chitra Top	U/W-2.0 (1.0-2.0)
Parting	Nil – 9.0
Chitra Middle	U/W-4.0 (2.0-3.0)
Parting	Nil-19.0
Chitra Bottom	4.0-24.0 (9.0-10.0)
Parting	3.0-55.0
Colony Top	U/W-11.0 (4.0-5.0)
Parting	Nil-35.0
Colony Middle	U/W-11.0 (4.0-5.0)
Parting	Nil-21.0
Colony Bottom	U/W-13.0 (2.0-3.0)
Parting	12.0-38.0
Patrika Top	U/W-5.0 (2.0-3.0)
Parting	Nil-36.0
Patrika Bottom	U/W-4.0 (1.0-2.0)
Parting	3.0-20.0
Saharjuri Top	1.0-23.0 (11.0-12.0)
Parting	Nil-50.0
Saharjuri Bottom	U/W-9.87

Note :
i. Figures in paranthesis are usual thickness.
ii. Above seams merge with each other forming different combinations

5.0 MINE BOUNDARY, RESERVES AND MINE LIFE

5.1 The mine boundaries of the approved Chitra East OCP (2.50 Mty) was fixed considering the various surface constraints and geological information given in the G.R. In the approved PR the proposed mining zone had been divided into three parts viz, Quarry-1, Quarry-2 and Quarry-3.

Quarry-1 is isolated elongated narrow patch at eastern part of the property.

Quarry- 2 is fixed by in-crop of bottom most seam i.e Saharjuri in the east, fault F3 at the west and Chitra market in the north.

Quarry-3 is fixed by Fault F3 in the east, Boundary fault F10 at the west and Damagoria village at the north.

5.2 In the approved PR Quarry-2 was envisaged to be worked from 1st. to 8th year of quarry operation. Quarry-1 was proposed to be started after completion of Quarry-2 and to be worked from 9th to 13th year of quarry operation. Quarry-3 was envisaged to be worked from the very 1st year and continued till the end of the project. Thus initially quarry-2 & Quarry-3 was envisaged to be worked simultaneously followed by quarry-1 & quarry-3. The combined production of two quarries have been planned to achieve the rated capacity of 2.5 MTY. However, though Quarry-2 has been mostly mined out, Quarry-1 is yet to be started. At present only Quarry-3 is being run.

5.3 Floor of Saharjuri (Bot) seam has been considered as the quarry floor. But where Saharjuri (Bot) is unworkable, Saharjuri(Top) seam has been considered as mine floor.

5.4 The quarry parameters, mineable reserves, volume of waste materials and re-handling as estimated in the approved PR is given below:

Quarry Parameters						
S.N.	**Particulars**	**Unit**	**Quarry 1**	**Quarry 2**	**Quarry 3**	**Total**
1	Mining area	Ha	44.00	34.00	188.00	266.00
2	Max. strike length along surface	Km.	1.60	0.80	2.60	
3	Max. Dip-rise extent	km.	0.36/0.18	0.44	0.85	
4	Max. Depth	m.	60	130	250	
5	Mineable Reserves**	Mte.	2.10	6.60	51.70	60.40
6	Overburden	Mm^3	8.45	12.90	147.60	168.95
7	Av. Stripping Ratio	m^3/te	4.02	1.95	2.90	2.80
8	Re-handling of OB	Mm^3	3.00	0.20	9.00	12.20
8	Av. Stripping Ratio (including Re-handling)	m^3/te	5.45	1.98	3.03	3.00

****Mineable reserves have been estimated taking into account 10% deduction on account of mining losses.**

5.5 Owing to non-availability of land for external OB dump some overburden has been dumped on coal bearing zone of both quarry-1 and Quarry-3. In the approved PR about 12.20 M.cum of OB was needed to be re-handled for exposing the coal bearing zone. In the approved PR with 12.20 M.cum of re-handling, total volume of OBR was worked out to be 181.20 M.cum making the overall stripping ratio as 3.00 cum/te.

5.6 Since its approval in 2007 (considering 2007-08 as the 1st year) the OCP has produced 14.24 Mte. of coal and 24.59 M.cum of OB till 2016-17. Estimated reserves in the balance zone of the mine as on 1.04.2017 is 47.42 Mt. of coal and 141.66 M.cum of OB. In addition 14.60 M.cum OB is also to be re-handled for releasing some coal bearing area under Quarry-1 and Quarry-3.

5.7 As envisaged in the approved PR, Quarry-2 and Quarry-3 has been operating simultaneously, since beginning and Quarry-2 has been mostly mined out. But Quarry-1 is yet to be started due non-availability of forest land and rehabilitation of village.

5.8 Considering targeted production of 2.50 Mty, life of the mine in the approved PR was envisaged to be 26 years. Balance reserves of coal in the mine is 47.42 Mte as

on 1.04.2017. Till date the mine has achieved maximum production of 1.73 Mty in 2014-15. **Considering a target of 2.50 Mty balance life of the mine is 20 years including 2017-18.**

6.0 METHOD OF MINING

6.1 It was proposed to extend the excavation along the floor of Saharjuri seam thereby amalgamating the working of Chitra-A and Chitra-B OCP. In the process of amalgamation Quarry-2 has been almost exhausted except in the northern most part where the quarry could not be extended upto the projected limit due to non-rehabilitation of Bhawanipur village. However, Quarry-1(envisaged to be started after exhaustion of Quarry-2) has not been started. Presently entire production is coming from the zone of Quarry-3 only.

6.2 Shovel and dumper combination is considered to be the most suitable technology under prevailing geo-mining conditions where gradient of seams are 10° to 20°. It is proposed to work the mine by horizontal slicing method with sump at floor of the quarry.

6.3 In approved PR the mining zone was divided into 3 quarries of which Quarry-1 is an isolated patch and other two are adjacent. The Quarry-1 and Quarry-2 have seam of lower horizon whereas Quarry-3 has all seams of geological block. The geo-mining features of the quarries are given below:

Major Mining & Geological Characteristics					
Sl.no.	**Particulars**	**Unit**	**Quarry-I**	**Quarry-II**	**Quarry-III**
1	Usual seam thickness	m	**Value**	**Value**	**Value**
	Tulsidabar (T)				3.0-4.0
	Tulsidabar (B)				4.0-6.0
	Bhabanipur (T)				3.0-9.0
	Bhabanipur (B)				3.0-6.0
	Chitra Seam (Comb)			17-19	17.0-19.0
	Colony top				4.0-6.0
	Colony middle & bottom comb.			6-10	13.0
	Colony bottom		4-6	4-6	3.0-5.0
	Patrika top		1-2	1.5-2.5	2.0
	Patrika bottom & top comb.				5.0-6.0
	Patrika bottom		1-2	1-2	2.0
	Saharjuri top		4.5-12	8-12	13.0-17.0
	Saharjuri Bottom				1.02-3.2

2	Usual parting thickness	m			
	Top cover				10.0-34.0
	Bet. Tulsidabar (T) & Tulsidabar (B)				7.0-10.0
	Bet. Tulsidabar (B) & Bhabanipur (T)				10.0-15.0
	Bet. Bhabanipur (T) & Bhabanipur (B)				2.0-4.0
	Bet. Bhabanipur (B) & Chitra				12.0-32.0
	Bet. Chitra & Colony top			4-6	3.0-6.0
	Bet. Colony top & Colony middle				1.0-34.0
	Bet. Colony middle & Colony bot			4-10	1.0-6.0
	Bet. Colony bot. & Patrika top		18-19	18-26	12.0-38.0
	Bet. Patrika top & Patrika bot.		1-4	1-3	1.0-6.0
	Bet. Patrika bot. & Saharjuri top		3-8	8-16	1.0-13.0
	Bet. Saharjuri bot. & Saharjuri top				3.0-5.0
3	Usual gradient of the strata	Deg			15-20
4	Category of excavation - OB -Coal				50% III + 50% IV III
5	Minimum Depth of OCP	m	16	20	18
6	Maximum Depth of OCP	m	70	130	250
7	Quarry width on surface along dip-rise	m	 360/180	440	850
8	Strike Length of quarry on surface	M	1600	800	2600
9	Quarry Area	Ha	44	34	188

6.4 Quarry-2 has been mostly worked out except in the north western part and in-pit dumping has been done in the de-coaled zone. The north western part of Quarry-2 can be mined only after rehabilitation of Bhawanipur village. Hence, in this RCE balance reserves of Quarry-2 & 3 have been considered together. Quarry-1, the isolated zone is envisaged to start mining since 4th year of REC after stage-II clearance of forest land and rehabilitation of villages (Tarabad & Jamua). Seam wise balance coal reserves and intervening OB/parting volume is given below.

Balance Coal And Overburden In The Mine			
Coal (Mt)	Quarry-1	Quarry-2 & 3	**Total**
Tulsidabar (T)		0.83	0.83
Tulsidabar (B)		1.55	1.55
Bhabanipur (T)		2.79	2.79
Bhabanipur (B)		1.07	1.07
Chitra (M)		0.65	0.65
Chitra (B)/(B+M))		6.58	6.58
Colony (T)		3.55	3.55
Colony (M)		3.97	3.97
Colony(B)/(B+M)	0.13	3.43	3.56
Patrika (T)	0.13	0.70	0.83
Patrika (B)/(B+M)	0.16	4.27	4.43
Saharjuri (T)	1.68	15.47	17.15

Saharjuri (B)		0.46	0.46
Total	**2.10**	**45.32**	**47.42**
OB (M.Cu.m)			
Top OB	6.37	36.89	43.26
Parting Bet. Tulsidabar(T) & (B)		1.84	1.84
Parting Bet. Tulsidabar(B) & Bhabanipur(T)		3.62	3.62
Part. Bet. Bhabani(T) & Bhabani (B)		0.60	0.60
Part. Bet. Bhabani(B) & Chitra		19.59	19.59
Part. Bet. Chitra(M) & Chitra (B)		1.53	1.53
Part. Bet. Chitra & Colony (T)		5.20	5.20
Part. Bet. Colony(T) & Colony (M)		15.61	15.61
Part. Bet. Colony(M) & Colony (B)		7.19	7.19
Part. Bet. Colony(B) & patrika(T)	0.60	32.50	33.10
Part.Bet.Patrika (T) & Patrika(B)	0.34	1.42	1.76
Part.Bet. Patrika(B) & Saharjuri(T)	1.13	6.23	7.36
Part.Bet.Saharjuri(T) & Saharjuri(B)		1.00	1.00
Total	**8.45**	**133.21**	**141.66**

6.5 The PR has been approved in Partial Outsourcing Option where coal production was envisaged to be done departmentally and entire OB production was to be done by outsourcing means. However, the mine has continued to run departmentally with some outsourcing of OB removal only in recent past.

6.6 At present the Top OB is being removed by 5.0 cum rope shovel and 35 T dumpers. The Coal from all the seams and intervening parting are being extracted by 3-4 cum diesel hydraulic shovel loading into 35 T dumpers for transportation to the crushing point on surface.

7.0 MINING AND DUMPING STRATEGY

7.1 As envisaged in the approved PR, Quarry-2 and Quarry-3 has run simultaneously since beginning. Quarry-2 has been almost mined out except in the zone at the north where Bhawanipur village is yet to be rehabilitated. However, Quarry-1 envisaged in the approved PR to be mined simultaneously with Quarry-3 since 9th year of PR is yet to be started. Moreover, Quarry-3 could not be expand along its strike as envisaged in the approved PR due to non-availability of land.

7.2 Before Quarry-1 is started diversion of forest land for mining is to be completed. Two villages namely, Jamua and Taraband falling within the zone of Quarry-1 also needs to re-habilitated. About 3.60 M.cum of existing OB dump is to be re-handled

for working the Quarry-1. Considering all these constrains, it is envisaged in the RCE that Quarry-1 will be started in the 4th year of RCE i.e (2020-21). Till its exhaustion in 8th year (as per the RCE) it will run simultaneously with Quarry-3. Completion of Quarry-1 is necessary to facilitate external dumping zone for Quarry-3.

7.3 In the approved PR it was envisaged that after the completion of Quarry-1 and Quarry-2, the Quarry-3 would run alone since 14th year onwards producing targeted 2.50 Mty. However, even after 10 years due to non-rehabilitation of Bhawanipur village part of Quarry-2 is yet to be fully mined out and no preparatory job has done for starting of Quarry-1. It is being envisaged in the RCE that Quarry-1 will be started in the 4th year and run simultaneously with Quarry-3. Remaining part of Quarry-2 is being proposed to be worked after rehabilitation of Bhawanipur village.

7.4 Total volume of OB estimated in the approved PR was 181.20 m.cum including 12.20 M.cum of re-handling. The revised estimated balance volume for re-handling is 14.60 M.cum. Estimated balance in-situ OB in the mine as on 1.04.2017 is 141.66 Mcum. Including 14.60 M.cum of rehandling, total volume of OBR during balance life of the mine is 156.26 Mcum. Out of the total OB, 23.16 Mcum will be dumped internally and rest in the two external dumps located in the final stage quarry plan. Owing to steep gradient of base seam there is limited scope of internal dumping during the course of mining. Hence, about 84% OB of needs to be put in external dump.

7.5 External Dump no.-1 is proposed to be used for the OB from Quarry-1 and initial years from Quarry-3. External Dump no.-1 along with the void of Quarry-I shall contain about 88.20 MCum (in-situ) of OB upto 90m height in three lift of 30m each. The external Dump no.-2 is proposed to be used during later half for OB from Quarry-3. External dump no.2 will have a capacity of 53.10 M.cum. External Dumps will have three lifts each of 30m height. Slope of the individual lift will be at natural angle of repose. However, overall slope of dump will be maintained at 28^0 or less.

7.6 Scope of internal dumping during the course of mining is limited due to steep gradient of seam. There is no scope of internal dumping in Quarry-1 during the mining operation. OB from Quarry-3 will fill the void of Quarry-1.Internal dumping in

Quarry-2 has already been started and will gradually progress towards Quarry-3 as void is created in it. A distance of minimum 100 m has to be left open between toe of the internal dump and final edge of the quarry floor in order to avoid rolling of boulders as well as collapsing of dump towards working face. Due to high slope there will always be a chance of rolling of boulders from immediate dump near bottom most coal face.

7.7 Location and quantity wise OB to be dumped in both external and internal dump is given below.

Area & Capacity of OB Dumps			
Sl No	**Particulars of Dumps**	**Area (Ha)**	**Capacity (Mm3)**
External Dumps			
1	External Dump-1	138.00	80.00
2	External Dump-2	98.00	53.10
Total External Dump		**236.00**	**133.10**
Internal Dumps			
3	Internal Dump in Quarry -I	45.00*	8.20
4	Internal Dump in Quarry -2&3	140	14.96
Total Internal Dump			**23.16**
Total Dump (Ext+Int)			**156.26**

- * included in the area of external dump-1.

In the existing external dump Balance OB after re-handling will be 6.00 M.cum

8.0 MINING SCHEDULE AND EQUIPMENT PHASING

8.1 The calendar plan of excavation has been formulated based upon the adopted sequence of mine development and optimum condition of mining operation for the entire life of the opencast mine.

8.2 Owing to the problem of land acquisition, the mine could not be run as envisaged in the approved PR. The OCP is yet to achieve its target production. The summarised calendar programme of excavation of the approved PR is given below :

Production Schedule of Approved PR					
Year	Coal(Mt)	OB (M.Cum)	Rehandling (M.Cum)	Total OB (M.Cum)	Stripping Ratio(Cum/te)
1	1.20	2.80		2.80	2.33
2	1.20	4.00	1.00	5.00	4.17
3	1.60	4.80	2.00	6.80	4.25
4	2.00	5.80	1.70	7.50	3.75
5	2.50	6.30	1.30	7.60	3.04
6	2.50	5.70	1.90	7.60	3.04
7	2.50	5.60	2.00	7.60	3.04
8	2.50	5.90	1.70	7.60	3.04
9	2.50	7.00	0.60	7.60	3.04
10	2.50	7.50		7.50	3.00
11	2.50	7.60		7.60	3.04
12	2.50	7.60		7.60	3.04
13	2.50	7.55		7.55	3.02
14	2.50	7.60		7.60	3.04
15	2.50	7.60		7.60	3.04
16	2.50	7.60		7.60	3.04
17	2.50	7.60		7.60	3.04
18	2.50	7.60		7.60	3.04
19	2.50	7.60		7.60	3.04
20	2.50	7.60		7.60	3.04
21	2.50	7.20		7.20	2.88
22	2.50	6.80		6.80	2.72
23	2.50	6.60		6.65	2.66
24	2.50	6.50		6.50	2.60
25	2.50	6.50		6.50	2.60
26	1.90	4.00		4.00	2.11
Total	**60.40**	**168.95**	**12.20**	**181.15**	3.00

- * Year 2007-08 is considered as 1st year

8.3 As per the RCE for first three years production will come from Quarry-3 only i.e existing zone of working. By this time it is envisaged that various constraints over Quarry-1 like diversion of forest land and rehabilitation of villages will be overcome. Since 4th year (2020-21) Quarry-1 and Quarry-3 is envisaged to run simultaneously producing 2.50 Mty. After the rehabilitation of Bhawanipur village the balance part of Quarry-2 is proposed to be worked along with Quarry-3.

8.4 Estimated balance coal and OB in the mine as on 1.04.2017 is 47.42 Mte and 141.66 M.cum respectively. Highest production achieved by the mine till date is 1.73 Mte in the year 2014-15. Considering all aspects of the mine, revised production schedule for the OCP for rest of the mine life is given below:

	Revised Production Schedule					
	Year	Coal(Mt)	OB (M.Cum)	Rehandling (M.Cum)	Total OB (M.Cum)	Stripping Ratio(Cum/te)
1	2017-18	2.00	6.40	1.20	7.60	3.80
2	2018-19	2.20	6.80	1.80	8.60	3.91
3	2019-20	2.50	7.20	2.00	10.70	4.28
4	2020-21	2.50	8.50	2.00	12.00	4.80
5	2021-22	2.50	8.80	2.00	11.40	4.56
6	2022-23	2.50	8.80	2.00	10.80	4.32
7	2023-24	2.50	8.75		8.75	3.50
8	2024-25	2.50	8.00		8.00	3.20
9	2025-26	2.50	7.00		7.00	2.80
10	2026-27	2.50	7.00		7.00	2.80
11	2027-28	2.50	7.20		7.20	2.88
12	2028-29	2.50	7.20		7.20	2.88
13	2029-30	2.50	7.20		7.20	2.88
14	2030-31	2.50	7.40		7.40	2.96
15	2031-32	2.50	7.40		7.40	2.96
16	2032-33	2.50	7.40		7.40	2.96
17	2033-34	2.50	7.40		7.40	2.96
18	2034-35	2.50	6.80		6.80	2.72
19	2035-36	2.00	4.00		4.00	2.00
20	2036-37	1.22	2.41		2.41	1.98
	Total	**47.42**	**141.66**	**14.60**	**156.26**	**3.30**

Quarry wise coal production, OB removal and re-handling for the RCE is given in Table no. 8.1.

8.5 The PR was approved in Partial outsourcing option with coal to be produced departmentally and OB to be removed by Outsourcing agency. However, provision of the PR has not been implemented and presently the mine has more HEMM than envisaged in the approved PR (required for coal production only). List of HEMM

envisaged in the approved PR as well as the present strength of HEMM is given below:

Sl. No.	Major HEMM	Approved Population	Present population	RCE population
1	5 m^3 Rope Shovel	-	2	-
2	4-5 m^3 Hyd. Shovel	-		
3	3.0-4.0 m^3Hyd. Shovel	2	4	5
4	2-3 m^3 Hyd. B/H	1		
5	1m^3Hyd. Backhoe (Auxilliliary)	1	1	1
6	35T Dumper	15+4*	28	28
7	160mm Drill	2	5	5
8	115mm Drill	1	-	-
9	320 HP Dozer	2	7	7
10	770 HP Dozer with Ripper	1	-	-
11	460 HP wheel Dozer	1	-	1
12	280 HP Grader	-	1	1
13	3.5-4.0 cum F.E.Loader	1	1	1
14	Water sprinkler (16 Kl)	2	-	-
15	Water sprinkler (10 Kl)		2	2
16	Water sprinkler (28 Kl)		-	2

- ** 4 no. were proposed to procure beyond 10th year onwards due to increasing lead.*

8.6 Considering the lead of 2.0-4.5 Km for coal and average 2.5 Km for OB with the existing strength of HEMM, the departmental mine capacity for the balance life of the mine will vary from 2.94 Mcum to 2.37 M.cum. Existing HEMMs will be replaced as per schedule except the Rope shovel. Out of the two existing rope shovels, one is not proposed to be replaced after survey off and the other one is proposed to be replaced by Hyd. Shovel. Replacement schedule for the existing and additional HEMM is given in Table no.8.2.

8.7 As the existing digging capacity of the mine is much higher than its transportation capacity, 1 no. of Rope shovel is proposed not to be replaced after survey off. The other Rope shovel is proposed to be replaced by 3-4 cum hyd. shovel after its life. Spare capacity beyond the requirement for target coal production will be used for OB removal as is seen in the table no. 8.3 (given below).

8.8 For calculating the departmental mine capacity, the Coal transportation leads vary from 2-4.5 Km. Average lead for OB removal is 2.5 Km. With the existing strength

of HEMM, only a small volume of OB can be removed departmentally after producing the targeted quantity of coal.

8.9 For the last 4-5 years powder factor at Chitra OCP varies from 7.40-7.90 te/kg for coal and 2.22-2.50 cum/kg for OB. Considering the powder factor of 2.4 m^3/ Kg and 7.5 te/Kg. for OB and coal respectively, the total annual explosive requirement for the OCP with peak OB removal will be about 3080 te or about 9.3 tpd. It is envisaged that SMS will be used for blasting as per the present practice.

8.10 With the existing strength of HEMM, it is envisaged in the RCE that the mine will produce entire coal and partly OB as per the departmental mine capacity. Balance capacity required for OB removal will be met by outsourcing means. Outsourcing load has been determined considering the year wise departmental mine capacity. Entire re-handling of OB is proposed to be done by outsourcing agency. The following table (Table no. 8.3) shows the year wise load of OB and coal for departmental as well as outsourcing agency.

Year Wise Quarry Wise Calendar Plan Table no. 8.1

Year		Quarry -1			Quarry 2 & 3			Total					
		Rehandling Of	Coal	OB	Rehandling Of	Coal	OB	Total coal	Total In-Situ OB	In-Situ Stripping Ratio	Rehandling	Total Waste	Overall S.R
		Dump (Mcum)	In Mte.	(Mcum)	Dump (Mcum)	In Mte.	(Mcum)	In MTe.	(Mcum)	(cum/Te.)	(Mcum)	(Mcum)	(cum/Te.)
1	2017-18				1.20	2.00	6.40	2.00	6.40	3.20	1.20	7.60	3.80
2	2018-19				1.80	2.20	6.80	2.20	6.80	3.09	1.80	8.60	3.91
3	2019-20	1.50			2.00	2.50	7.20	2.50	7.20	2.88	3.50	10.70	4.28
4	2020-21	1.50	0.30	1.50	2.00	2.20	7.00	2.50	8.50	3.40	3.50	12.00	4.80
5	2021-22	0.60	0.50	2.00	2.00	2.00	6.80	2.50	8.80	3.52	2.60	11.40	4.56
6	2022-23		0.50	2.00	2.00	2.00	6.80	2.50	8.80	3.52	2.00	10.80	4.32
7	2023-24		0.50	1.95		2.00	6.80	2.50	8.75	3.50		8.75	3.50
8	2024-25		0.30	1.00		2.20	7.00	2.50	8.00	3.20		8.00	3.20
9	2025-26					2.50	7.00	2.50	7.00	2.80		7.00	2.80
10	2026-27					2.50	7.00	2.50	7.00	2.80		7.00	2.80
11	2027-28					2.50	7.20	2.50	7.20	2.88		7.20	2.88
12	2028-29					2.50	7.20	2.50	7.20	2.88		7.20	2.88
13	2029-30					2.50	7.20	2.50	7.20	2.88		7.20	2.88
14	2030-31					2.50	7.40	2.50	7.40	2.96		7.40	2.96
15	2031-32					2.50	7.40	2.50	7.40	2.96		7.40	2.96
16	2032-33					2.50	7.40	2.50	7.40	2.96		7.40	2.96
17	2033-34					2.50	7.40	2.50	7.40	2.96		7.40	2.96
18	2034-35					2.50	6.80	2.50	6.80	2.72		6.80	2.72
19	2035-36					2.00	4.00	2.00	4.00	2.00		4.00	2.00
20	2036-37					1.22	2.41	1.22	2.41	1.98		2.41	1.98
Total		**3.60**	**2.10**	**8.45**	**11.00**	**45.32**	**133.21**	47.42	**141.66**	**2.99**	**14.60**	**156.26**	3.30
		In-situ Stripping Ratio 4.02			In-situ Stripping Ratio 2.94			In-situ Stripping Ratio		**2.99**			
		S.R. incl. rehandling 5.74			S.R. incl. rehandling 3.18			S.R. incl. rehandling					**3.30**

Table-8.2

Proposed Excavation Load **Table no. 8.3**

	Year	Departmental		Outsourcing		Total OB (Mcum)
		Coal (Mt)	OB(M.cum)	OB(M.cum)	Rehandling(M.cum)	
1	2017-18	2.00	1.58	4.82	1.20	7.60
2	2018-19	2.20	1.49	5.31	1.80	8.60
3	2019-20	2.50	1.30	5.90	3.50	10.70
4	2020-21	2.50	1.27	7.23	3.50	12.00
5	2021-22	2.50	1.24	7.56	2.60	11.40
6	2022-23	2.50	1.14	7.66	2.00	10.80
7	2023-24	2.50	1.14	7.61		8.75
8	2024-25	2.50	1.14	6.86		8.00
9	2025-26	2.50	1.04	5.96		7.00
10	2026-27	2.50	1.04	5.96		7.00
11	2027-28	2.50	1.04	6.16		7.20
12	2028-29	2.50	0.95	6.25		7.20
13	2029-30	2.50	0.95	6.25		7.20
14	2030-31	2.50	0.95	6.45		7.40
15	2031-32	2.50	0.86	6.54		7.40
16	2032-33	2.50	0.76	6.64		7.40
17	2033-34	2.50	0.76	6.64		7.40
18	2034-35	2.50	0.76	6.04		6.80
19	2035-36	2.00	1.05	2.95		4.00
20	2036-37	1.22	1.62	0.79		2.41
Total		**47.42**	22.08	**119.58**	14.60	**156.26**

8.11 In the approved PR excess dumper and shovel other than required for producing targeted quantity of coal were proposed to be transferred to other mines of ECL. Existing strength of dumper in 2007 was 30 of which 15 were proposed to transferred and 9th year onward 4 no. dumpers were proposed to procure in phases to meet increasing lead distance of coal. A provision of Rs.17.25 crores was in approved PR for procurement of some auxiliary HEMM (including a 770 HP ripper dozer) along with above 4 no. of dumpers. An amount of Rs.1.34 crores has been spent for procuring some auxiliary equipment. In the RCE a provision of Rs. 8.99 crores has been kept for procuring balance auxiliary equipment (excluding the ripper dozer).

9.0 COAL QUALITY

9.1 The coal seams in Chitra OCP are long-flame non-coking. The grading of the coal is based on their useful heat value. Average UHV grade of coal in the approved PR

was grade “D”. Economic analysis of the approved PR was done on basis of selling price of grade ‘D’ coal.

Subsequently, basis for pricing system of coal has been changed to GCV grade instead of UHV grade. After adaptation of GCV base pricing system, coal from existing Chitra OCP is being sold at declared GCV grade for individual seam.

9.2 Seam-wise Declared/analysed GCV grade of coal (by ECL) within Chitra OCP is given in the following table. Weighted average Declared GCV grade of coal for the balance mineable reserves works out to G7 (5480 Kcal/Kg).

Seam-wise ECL Declared GCV Grade of Coal		
Name Of Seams	**Balance Mineable Reserves In (Mt.)**	**Av. Grade**
Tulsidabar (T)	0.83	G8
Tulsidabar (B)	1.55	G8
Bhabanipur (T)	2.79	G8
Bhabanipur (B)	1.07	G8
Chitra (M)	0.65	G8
Chitra (B)/(B+M))	6.58	G8
Colony (T)	3.55	G6
Colony (M)	3.97	G6
Colony(B)/(B+M)	3.56	G6
Patrika (T)	0.83	G6
Patrika (B)/(B+T)	4.43	G6
Saharjuri (T)	17.15	G6
Saharjuri (B)	0.46	G6
Total	**47.42**	**G7**

9.3 Chitra OCP is a running mine. Hence, Economic analysis of Revised Cost Estimate for Chitra East OCP has been done (as desires by ECL) on the basis of existing Declared grade of coal i.e **G7.** Average specific gravity of coal has been considered as 1.52.

10.0 PUMPING AND DRAINAGE

10.1 The pumping system of proposed OCP has been designed to manage not only the inflow of water due to precipitation falling within the active pit limit during the monsoon but also the seepage water, which is to be worked in course of mining.

The primary aim of the proposed pumping system is to enable the mining activity to continue round the year.

10.2 Pumping system has been designed for the volume of water that will get accumulated in the mine at the final stage of production considering maximum daily rainfall as 300 mm. Peak required pumping capacity per day worked out as 25938 cum/day for Quarry-1, 15972 Cu.m/day for Quarry-2 and 51744 cum/day for Quarry-3. However, Quarry-2 and Quarry-3 have already been merged.

10.3 Considering the above derived peak pumping requirements, pumps selected for the proposed OCP are given below:

1	150m3/hr x 90m head x 55KW, 550V	3 nos. already exist in the mine. These pumps will be in use in Quarry-I and Quarry-III during different stages of mining activities
2	300m3/hr x 120m head x 150KW, 6.6KV	Out of approved 4 nos, 4 no. has been procured. 3 nos. shall be used in Quarry-I sump. After exhaustion of Quarry-I these 3 nos. pumps shall be shifted in Quarry-III sump
3	300m3/hr x 250m head x 300KW, 6.6KV	4 nos. to be procured. To be deployed in the dip side of Quarry-III for direct discharge of water to the surface
4	Slurry pumps, 70m3/hr x 35m head x 30KW	All the approved 3nos. have been procured. To be deployed at faces

10.4 In the approved PR a provision of Rs.2.66 crores was kept for pumps and pipelines. Against that provision a capital of Rs.1.18 has been spent including additional procurement of Rs.0.16 crores. In the RCE additional provision of Rs.2.19 crores has been made for the balance life of the mine.

11.0 COAL HANDLING AND DESPATCH

11.1 A coal handling plant of 2.50 Mty capacity was provided in the approved in the PR. In the approved report it had been envisaged to dispatch coal at (-) 100 mm size. However, in-spite of repeated tender, the job of building a CHP has not been materialised. As a result, the job of crushing coal has been given to outsourcing agency.

11.2 As per suggestion of ECL management the proposal of CHP is dropped in the RCE. As per existing prevalent system ROM coal will be hauled to surface from the

mine by departmental dumpers. In the surface, ROM coal is proposed to be crushed to (-)100mm size by outsourcing means before being transported to Jamtara Rly. siding 26 Km away by contractual trucks.

11.3 The entire capital of Rs.14.18 crores in the approved PR for CHP has been dropped in the RCE.

12.0 WORKSHOP AND STORE

12.1 In the approved PR the existing facilities was proposed to be either replaced or renovated along with proposal of additional construction like, new pump house and underground reservoir.

12.2 No major overhaul job has been done. However, some renovation and extension job have been completed and some proposed to be done for the existing facilities. Existing facilities in the mine is enlisted below

a) Engine & Machine repair shop
b) Dozer, shovel and drill repair/maintenance shed
c) Dumper/ Dozer washing bay
d) Fuelling station
e) E&M repair shop
f) Store shed
g) Pump house and water reservoir

In RCE capital has been provided for proposed balance job for the above facilities.

12.3 A capital of Rs. 1.47 crores was provided in the approved PR for work-shop P&M. No capital has been spent on these head till date. However, a provision of Rs.0.23 crores has been kept in the RCE towards some equipment of machine shop and E&M shop as per the advice of ECL.

13.0 POWER SUPPLY ILLUMINATION & COMMUNICATION

13.1 At present the project is receiving power at 33kV by one no single ckt. 33 kV O/H transmission line from the 132/33 kV substation at Jamtara of M/s. Jharkhand State Electricity Board at a distance of about 20 Km. The present installed transformer

capacity of the substation is 2X2.0 MVA, 33/11 kV. However, drawing power supply from Jamtara causes lots of problem in the OCP like voltage fluctuation and repeated break down.

Existing Supply System :

The main 33KV substation of the project is located at the south-east of the main quarry and near the Area Office and existing workshop. In this substation, 33KV has been stepped down to 11KV by two nos. of 2MVA, 33/11KV transformers. 11KV has been further stepped down to 3.3KV by two nos. of 2MVA, 11/3.3KV Transformers. Out of above, one no. 2 MVA 33/11KV and one no. 2MVA 11/3.3KV transformers are kept as standby. The existing load of quarry bed power consumers, colony lighting, workshop etc. are being catered from the other 2 MVA 11/3.3KV transformer.

13.2 A 132 KV H.T line of Jharkhand State Electricity Board passes within a distance of 1 Km. of Chitra OCP sub-station. Now, ECL wants power supply arrangement from this nearby 132 KV power line to avoid the problem it is facing presently. In this regard Functional directors of ECL has accorded the proposal for a 132/33 KV sub-station for drawing power from the nearby 132 KV line in its meeting held on 26.09.2014. All the provisions for the substation including civil, electrical and land requirement has been provided in the PR. Already some advance payment has been made to the JSEB for the purpose.

13.3 In the proposed system the project will receive power at 33 kV from a proposed 132/33 kV Substation through one no 33 kv double circuit over head line. In the proposed system.

a) Two nos. of 3.15 MVA, 33/3.3 kV Transformer will feed power to the mobile crushers, workshop, Quarry bed electrical equipment, pumps etc.

13.4 Capital provision made for the electrical equipment in the approved PR has not been spent till date as the mine is yet to get the envisaged expansion and major infrastructure has not been commissioned. However, capital required towards electrical P&M for the balance life of the mine has been provided in the RCE.

13.5 The Connected load and maximum demand in the RCE have been estimated as:

The connected load	Maximum demand
4580 KW	2761.1 KVA

Energy Consumption (Target year)

SL.NO.	Description	Annual Energy Consumption(kWHX10^6)	Energy Consumption/Te of Prod(KWH/Te)	Cost/te(Rs.)
1	COAL	2.33	0.93	6.19
2	OB			
3	COMMON	11.58	4.63	30.80
4	TOTAL	13.91	5.56	36.99

Salient Electrical Features:-

Maximum Demand	:	2761.1 KVA
Annual Energy Consumption (Target)	:	13.91 MKWH
Annual Energy Consumption (MAX)	:	13.91 MKWH
Power Factor	:	0.98
kWh/Te (Target)	:	5.56
Rs./Te (Target)	:	36.99
Rs./kWh	:	6.65

Year Wise Energy Cost

Sl. No	Year	Production(MTY)	Annual Energy Cost (Rs Lakh)
1	2017-18	2.00	974.38
2	2018-19	2.20	983.62
3	2019-20	2.50	997.48
4	2020-21	2.50	946.55
5	2021-22	2.50	895.61
6	2022-23	2.50	895.61
7	2023-24	2.50	895.61
8	2024-25	2.50	895.61
9	2025-26	2.50	895.61
10	2026-27	2.50	895.61
11	2027-28	2.50	895.61
12	2028-29	2.50	895.61

13	2029-30	2.50	895.61
14	2030-31	2.50	895.61
15	2031-32	2.50	895.61
16	2032-33	2.50	895.61
17	2033-34	2.50	895.61
18	2034-35	2.50	895.61
19	2035-36	2.00	872.51
20	2036-37	1.22	836.48
	Total	**47.42**	18149.62

13.6 A capital of Rs. 7.08 crores was provided in the approved PR for elecrtical P&M. Not much capital has been spent on these head till date as mine did no expand much since its approval. However, a new grid sub-station has been proposed by ECL for a capital of Rs.16.65 crores. Thus the additional capital for electrical P&M in RCE has been estimated to Rs. 23.50 crores.

14.0 CIVIL CONSTRUCTION

14.1 Based on prevalent rate of different building materials in the project area, the Building Cost Index for this RCE has been worked out as 5060 with respect to 100 base at Delhi as on 1.10.76. Civil cost index for the approved PR was 1519.

14.2 In the approved PR 106 no. of different categories of quarter were proposed. Out of these 24 no. have already been constructed and another 48 no. are to be constructed. Balance 34 no. quarter are proposed to be dropped.

14.3 Provisions have been made for various service buildings, which include community buildings, offices, workshop & stores, sub-station, & other statutory buildings. Some construction has been done and some will be done during next few year. Some proposal of approved PR however, will be dropped.

14.4 Provisions have also been made for colony roads, haul road and diversion of public Road.

14.5 Mine water and the underground water are the source of water required for the Project and residential colony. The requirement has been estimated as 0.636 MLD of potable water and 0.454 MLD of industrial water.

14.6 In the approved PR there was provision of Rs.3.24 crores and Rs.3.59 crores for residential and non-residential buildings. For residential building Rs. 4.32 crores has been spent to build 24 no. quarters of different type. However, as per ECL required no of quarter has been reduced from 106 to 72. For the balance 48 no. of quarter Rs. 5.21 crores has been provided in the RCE.

Non-residential construction have been mostly completed or under construction and a capital of Rs.3.52 crores has already been spent. For the balance job Rs.1.06 crores has been provided in the RCE.

15.0 SAFETY AND CONSERVATION

15.1 SAFETY

Safety has been given importance while making provisions for men, materials, machinery and equipment. The following paragraphs will broadly indicate the proposed safety measures. However, it is suggested that bye laws should be formulated and approved by DGMS for safe operation of the project wherever necessary.

15.2 STABILITY OF BENCHES & DUMP

The individual bench slope for high wall benches should be kept 70^{o} to the horizontal and that for spoil benches should be kept at 37^{o} to the horizontal. It is suggested that stability studies be conducted for arriving at safe overall slope angle for high wall and also for dumps. This is particularly important in view of high dump heights proposed in the project and abundance of soil type materials in over burden. The spoil will be stacked in the external and internal dump space at the natural angle of repose to avoid the sliding of OB bench. OB dump will be terraced at intervals of 30m height. The barrier distance between internal dump and coal production bench will be maintained at a minimum of 100m to have smooth functioning of the machineries. The surface of OB dump will be levelled and the slope will be graded to 37^{o} to the horizontal. Plantation will be made on the slope of finished OB dumps to avoid the sliding of spoil.

15.3 PROTECTION AGAINST FIRE

Adequate precautions have been suggested against the risk of fire in coal faces, coal stocks and other places liable to such occurrences. Exposed coal faces are proposed to be mined out as early as possible to avoid bench fire. Water spraying has been envisaged on the haul roads starting from the quarry bench to external dump yard and around CHP to prevent rising of dust in the air.

15.4 DANGER DUE TO WATER

There is no river/nallah near the project from where the danger of mine inundation may be expected. Hence, there is no apparent danger of inundation from surface sources at Chitra OCP. Garland drains around the proposed quarry boundaries will be provided and periodically maintained as far as possible for adequate safety measure. Proper drainage system will be provided in haul roads and other roads to guard against damage of pavement and slippery condition during heavy shower.

15.5 HAUL ROAD DESIGN AND MAINTENANCE

Haul road shall be designed and maintained with considerations to the following aspects:

i. Gradient of roads shall not be steeper than 1 in 16 at any place and at ramps over small stretches shall not be more than 1 in 10.

ii. One way traffic, otherwise width should be more than 3 times the width of the largest vehicle.

iii Clear visibility of at least 30m at corners and bends of roads.

iv Parapet wall (berm) of minimum of 1m high on road sides when roads are at elevated level.

v Formulation, approval and enforcement of traffic rules.

15.6 BLASTING

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

Controlled blasting techniques including muffled blasting will be adopted during blasting within 300 m of any village, dwellings, surface structure, road etc. Total quantity of explosive to be detonated at a time will be so regulated that ground vibration which may affect the nearby surface structures, are kept within the stipulated value.

15.7 ROLE OF OUTSOURCING AGENCY FOR SAFETY

15.7.1 Slope Stability

The Outsourcing agency must ensure that the overall pit slope and dump slope at any time does not exceed safe limits.

15.7.2 General Safety

Observance of safety aspects by outsourcing agency will be subject to regular monitoring by ECL authority. Non-compliance to these by outsourcing agency will entail ECL authority to take appropriate measures.

15.8 HEMM OPERATION AND HIRING OF HEMM

Special precaution should be taken before deploying HEMM and workers in the mine. Some of the major aspects are as follows:-

A For Persons

i) No persons shall be deployed unless he is trained at VTC. A record of it shall be maintained.

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) Qualified competent persons shall maintain adequate supervision.

B For Machineries

i) As recommended by DGMS Cir. (tech.) 1 of 1999.

a. All the machineries to be deployed in mines should be checked before deployment by competent authority.

b. No unfit machine shall be deployed before the defect is rectified.

c. 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.

16.0 ENVIRONMENT MANAGEMENT

16.1 Chitra OCP is an existing mine with an approved PR of 2.50 Mty. As per the directive of MoEF, Environment monitoring survey is being done in Chitra OCP quarterly and Environment statements are submitted to MOEF and JSPCB annually. EMP for Chitra East OCP (2.50 Mty) has been approved vide.J-11015/652/2007-1A.II(M) dated, 4.03.2010.

16.2 Opencast mining creates various types of environment pollution generating dust, oil effluents, noise and land degradation etc. The PR envisages well planned control measures to keep the pollution parameters under permissible limit. The different control measures are given below.

- Comprehensive water spraying arrangement.
- Construction of Oil catcher and settling pond.
- Periodic maintenance of HEMM and controlled blasting technique.
- Large scale plantation on OB dumps and in & around the project area.
- Water quality monitoring and remedial measures as and when required
- Flora and Fauna management
- Minimizing land degradation
- Physical and biological reclamation of affected land
- Noise control measures

16.3 Capital provision for pollution control arrangements, technical & biological reclamation and rehabilitation / resettlement have been made in the project report. The details of capital provision are given below.

Capital Investment on Environment Control

S.N.	Particulars		Additional	Total
		Capital Spent	RCE Capital	RCE Capital
I	**Rehabilitation of villages**			
a.	Compensation for Home assets	2.56	2300.00	2302.56
b.	Shifting Allowance @Rs.50000 To 1596 PAF		798.00	798.00
c.	One time Assistance@Rs.90000 To 1596 PAF		1436.40	1436.40
d.	Site Development in rehabilitation colony.	12.24	1200.00	1212.24
	Sub-total (I)	**14.80**	5734.40	5749.20
II	**Capital for Restoration**			
a.	HEMM for reclamation	51.68	369.27	420.95
b.	Biological Reclamation of Dump	-	100.00	100.00
c.	.Afforestation in and around the Project		10.00	10.00
	Sub-total (II)	**51.68**	410.13	530.95
III	**Capital for anti-pollution measures in mine & industrial area.**			
a.	Sewerage disposal system	-	60.00	60.00
b.	Garland drains	16.92	30.00	46.92
c.	Settling Pond	-	36.00	36.00
	Sub-total (III)	**16.92**	**126.00**	**142.92**
IV	**Environmental control measures in township**			
a.	Sewerage disposal in colony	-	120.00	120.00
	Sub-total (IV)	**-**	120.00	120.00
Grand Total (I to IV)		**83.40**	**6459.67**	**6543.07**

16.4 Besides above, adequate provisions have been made in the PR for covering the operating cost to be incurred on environmental control measures.

17.0 LAND AND REHABILITATION

17.1 The total land requirement for the Chitra East Open Cast Project is 780.80 Ha. The land area involves different types of land viz, forest land, tenancy land, Govt. land and Gochar land. After verification with the land records of State Govt. amount of different categories of land has been found to be different from that of the approved PR though the total quantity of land remain the same.

17.2 Status of different categories of land as given in the approved PR is found to have been changed after verification with the land records of the State Govt. Verified quantity of different types of land vis-à-vis quantity given in the approved PR is given below.

Sl. No.	Particulars	Land Requirement(Ha)			
		Given In Approved PR	After Verification (RCE)	Addl. Land Requirement For Grid Sub.Stn.	Total Requirement In RCE
1	Forest Land	155.60	230.45		230.45
2	Tenancy Land	503.40	464.76	3.24	468.00
3	Govt. Land	81.80	61.79		61.79
4	Gochar Land	40.00	23.80		23.80
Total Land		**780.80**	**780.80**	**3.24**	**784.04**
Acquired		**402.15***			
To be Acquired		**381.89**			

* considering 124.28 Ha. of forest land for which Stage-I clearance has been obtained.

17.3 Out of 402.15 Ha. of acquired land 277.87 Ha. is tenancy land and 124.28 Ha. is Forest land. Stage-I clearance of 124.28 Ha. of forest has already been obtained and 2nd Stage clearance is awaited. Out of 277.87 Ha. of acquired tenancy (under LA) land, physical possession has been done for 212.00 Ha. of land and 263 no. employment has already been provided. Against 468.00 Ha of required tenancy land, balance land to be brought under physical possession is 256 Ha.(632.58 acre). Number of employment to be provided against this balance tenancy land is 316.

17.4 A total of six villages have been proposed to be rehabilitated in the PR. Out of these 6 villages, 2 village namely Tulsidabar and Bhawanipur have been partly rehabilitated. Negotiation for shifting another two villages namely, Khun and Chitra have been going on. The rest two villages namely, Jamua and Tarabad have to be shifted before start of quarry-1.

17.5 Total no. of PAF to be rehabilitated was 586 in the approved PR. Out of which 61 PAF have been rehabilitated. But as per recent survey by project authority balance no. of PAF to be rehabilitated in 6 no. of villages is 1596 (considering adult male as

PAF) The details of the villages proposed to be rehabilitated with revised number of PAF as supplied by the Project authority are given below.

Sl. No.	Name of the Villages	No. of PAF As Per Approved PR	No. Of PAF Already Shifted	No. Of PAF To Be Shifted in The RCE
1	Tulsidabar	94	51	186
2	Khun	90	-	286
3	Chitra(Part)	105	-	320
4	Bhawanipur	92	10	192
5	Tarabad	95	-	246
6	Jamua (part)	110	-	366
	Total	**586**	**61**	**1596**

17.6 A comprehensive resettlement and rehabilitation package (social, cultural and economic) will be offered to the project affected families as per the latest Norms of CIL for formulating R&R package. The details of R& R package are as under:

Details of Resettlement & Rehabilitation Package		
Sl. No.	**Particulars**	**Amount Rs Lakh**
1	Compensation for home assets	2300.00
2	Shifting charges @Rs 50000/family for 1596 PAF	798.00
3	One time Assistance@Rs.90000 To 1596 PAF	1436.40
4	Infrastructure development for rehabilitated colony	1200.00
Total		**5734.40**

18.0 MINE CLOSURE PLANNING

18.1.1 Mine closure plan for Chitra OCP has been approved by ECL Board in 2013 with a capital of Rs.101.96 crores. Deposit to Escrow a/c is being made since 2013-14. The features of the approved MCP is described below.

18.1.2 **Final mine closure planning strategy**

The final Mine Closure Plan would cover the various mine closure activities which would start towards the end of mine life and may continue even after the reserves

are exhausted and/or mining is discontinued till the mining area is restored to an acceptable level to create a self-sustained ecosystem.

Present OCP is estimated to continue for a period of 20 years from now. At this point of time, it is practically very difficult to comprehend the exact conditions that would prevail at the time of final closure of mining activities in the Colliery. That is why, the final mine closure plan has been prepared on the basis of presently available inputs and the anticipated broader conditions, which are likely to develop in course of mining till the end of mine life.

Thus, the final Mine Closure planning would initially be a conceptual exercise, which would subsequently undergo regular revisions as more and more authentic information are gathered in course of mining. In conceptual stage, the plan would communicate on a broader basis, the outcomes of mining, goals of Mine Closure plan and various mine closure activities to be carried out for attaining the identified goals. It will also tentatively estimate the cost involved in successful completion of mine closure activities on the basis of MOC guidelines.

As stipulated in the MOC guidelines, the detailed Mine Closure Plan would be prepared at least 5 years before the intended final closure of the mine. This detailed Mine Closure Plan would reflect item-wise activities, milestones, schedule and also an accurate estimate of the cost involved.

18.2 Final mine closure

In view of the above, the final mine closure plan cannot be rigidly prepared at this point of time. However, the broad mine closure activities towards the end of mine closure can be grouped under the following heads:

18.2.1 Management of mined out area

18.2.1.1 By the end of quarry operation, most of the quarried out area will get completely backfilled and an area of about 183 Ha shall remain partially filled/ un-filled, which shall be used for further extension of OC to be back-filled subsequently by the OB obtained from the Expansion Project.

The exposed coal surfaces and benches shall be gently sloped, stabilized and reclaimed with plantation. Any exposed coal will be covered with waste material to

prevent spontaneous heating. The high-walls shall be properly sloped up to permanent water level with an aim to ensure stability of surrounding area. If needed, slope study shall be carried out to find out the right angle at which the high wall shall be sloped. The entire void shall be kept securely fenced to avoid inadvertent entry of human and stray animals into it.

If the expansion project did not fructify due to some unforeseen reasons, the void area shall be developed into a water lagoon. If this lagoon is to be used by local people, a proper, suitable and safe access to it shall be made. To prevent inadvertent walk off, the shore line, which shall be available for access, shall be graded to a gentle slope which shall extend up to at least 2 meters below the low water mark of the water logged void. Danger signs shall also be posted to warn the local users to stay away from the deep zone.

The water lagoon may serve following purposes:

- Source of supply of water for industrial and fire fighting purposes.
- Source of supply of potable water after necessary treatment.
- A place of bathing and washing for the local population.
- Pisciculture.
- For recharging the aquifer in the area.

18.2.1.2 The back-filled area shall cover an area of approximately 112.17 Ha. Major portion of the back-filled area shall be reclaimed in course of progressive mine closure itself. The balance back-filled area shall be reclaimed during post closure period. The back-filled area shall be dozed and levelled to a slope of 28^0 to safe guard against any future instability. The back-filled area shall be stabilized and biologically reclaimed too. Sufficient protection against erosion by running water and wind shall be provided on back-filled dump. The area in and around the back-filled dump shall be kept in such a shape as to ensure smooth drainage. Regular inspection of the dump shall be carried out in post closure period till it gets reclaimed to an acceptable level. If required, appropriate remedial actions shall be taken for ensuring long term stability of these dumps.

18.2.1.3 It is estimated that around 201.63 Ha of land shall be occupied by the external dumps. The entire external dump area shall be reclaimed in course of progressive mine closure itself. The dumps shall be afforested by selecting proper plant species

in consultation with state Forest Department. Sufficient protection against erosion by running water and wind shall be provided on back-filled dump. The area in and around the back-filled dump shall be kept in such a shape as to ensure smooth drainage. Regular inspection of the dump shall be carried out in post closure period till it gets reclaimed to an acceptable level. If required, appropriate remedial actions shall be taken for ensuring long term stability of these dumps.

18.2.1.4 Barring roads left for use of local people, all other temporary/permanent roads and any other disturbed areas shall be loosened and topped with at least 100 mm top soil, where needed, followed by plantation of suitable species of plants.

18.2.1.5 All the coal dump sites shall be cleared of carbonaceous debris. The areas freed from coal stocks shall be loosened and topped with at least 100 mm top soil, where needed. Finally the entire freed area including the surrounding area shall be planted with suitable species of plants in consultation with State Government agency suitable for the purpose.

18.2.1.6 The usable infrastructures would be left for local/State agencies for use. Balance freed area after de-commissioning of redundant infrastructures shall be reclaimed and brought under green cover. Hence, the proposed post-mining land use plan will take a tentative shape, as depicted below:

<table>
<tr><th>Sl No</th><th>Land use Type (proposed)</th><th>Area (Ha)</th><th>Final Land use Type</th><th>Area (Ha)</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Excavated area including haul-road</td><td rowspan="2">295.57</td><td>Plantation on backfilled area</td><td>112.17</td></tr>
<tr><td>** this de-coaled zone shall be used for further expansion of OC to be subsequently back-filled by the OB from the expansion Project and reclaimed.</td><td>183.40</td></tr>
<tr><td>2</td><td>External OB Dump</td><td>201.63</td><td>Plantation on External OB Dumps</td><td>201.63</td></tr>
<tr><td>3</td><td>Colliery Infrastructure</td><td>39.79</td><td rowspan="5">Mostly undisturbed. Some areas freed from infrastructure along with other suitable areas shall be brought under green cover.</td><td rowspan="5">283.60</td></tr>
<tr><td>4</td><td>Road & Drain</td><td>13.40</td></tr>
<tr><td>5</td><td>Rehab Colony</td><td>66.80</td></tr>
<tr><td>6</td><td>Undisturbed Area</td><td>148.11</td></tr>
<tr><td>7</td><td>Afforestation</td><td>15.50</td></tr>
<tr><td colspan="2">Total</td><td>780.80</td><td></td><td>780.80</td></tr>
</table>

**** If the further expansion did not fructify due to any reason, the void shall be converted into water lagoon.**

18.2.1.7 Possibilities would also be assessed to see whether the reclaimed land or part of it could be made fit for agriculture. If studies revealed such possibilities, efforts would be made in that direction. Further, it would also be ensured that in the final land use plan, not only all the acquired forest land but also the other available free land is suitably afforested.

18.2.2 **Drainage pattern of the area**

In course of mining, it is anticipated that there would noticeable impact on the general drainage pattern. Rectification of any disturbance in the drainage profile would be carried out simultaneously under progressive mine closure plan activities so as to ensure smooth drainage of the project area.

Subsequent to closure of mining activities, the entire area shall once again be surveyed the drainage profile of the entire leasehold area would be modified and left in such a shape as to facilitate the smooth and normal run-off.

18.2.3 **Restoration of Ground water level**

18.2.3.1 After the cessation of mining, with copious rainfall and abundant groundwater recharge, the water levels will recoup and attain normalcy. Thus, the impact of mining on groundwater system may be considered as a temporary phenomenon.

18.2.3.2 A substantial portion of de-coaled area will be backfilled. The back-filled area would gradually restore the continuity of aquifers. Thus, in post-mining condition, the recharge and source potential in core zone will be much higher than the existing.

18.2.4 **Post closure Mine water discharge**

Although there would not be any discharge from the mine into the settling tank, but it is likely that the surface run-off may carry high proportion of suspended solids during first 2-3 years after mine closure. Hence, the surface-run-off shall be routed through the existing settling tanks, which shall be appropriately maintained till the entire area attains a state similar to its neighborhood.

Finally, the drains/settling tanks and other such areas shall be filled with inert material, appropriately graded and topped by at 1 m of sub soil overlain by at least 100 mm of top soil. Thereafter, the freed area including the surrounding area shall

be planted with suitable species of plants in consultation with State Government agency suitable for the purpose.

18.2.5 Water Quality Monitoring

The present practice of monitoring of quality of water would be continued for a period of 3 years after the final mine closure. If any deviation from the prescribed water quality standard is detected, the appropriate remedial actions shall immediately be enforced and frequency of sampling shall be increased till the water quality becomes normal.

The Colliery area has many surface water bodies such as water tanks, old waterlogged quarry and seasonal Jores. The quality of water contained in these water bodies shall be checked at regular intervals. If the test results show any deterioration in the quality beyond the prescribed limits, appropriate remedial action shall immediately be taken. The source of contamination shall be identified and removed. The contaminated water bodies shall be suitably treated.

18.2.6 Air quality management

As the sources of dust and fume generation would no longer be present, the present practice of arresting the air pollution, would no longer be required after the closure of the mine. However, water sprinkling would be done on the roads, which remain in use after the mine closure.

Quality of air would be monitored for a period of 3 years after cessation of mining activity. The test results would be compared with the standards prescribed by the MOEF and if any deviation is detected, remedial actions would be immediately taken to bring the AAQ standard within the prescribed limits.

18.2.7 Disposal of Buildings, Plants & Machineries

At the time of closure of the mine, the surveyed off equipments would be auctioned. However, the equipments, which would not have covered their rated life, would be diverted to the neighboring projects for gainful utilization.

As regards Railway Siding, it would be linked to some other collieries, if found economical after conducting transportation route analysis in respect of various available sources. If the said Siding is not found economical to be used, it will be

dismantled and the usable items/spares would be dispatched to needy Areas/Projects. The freed area shall be cleared of debris/carbonaceous material/contaminants, appropriately loosened and topped with 100 mm of top soil, where needed. Finally the entire freed area including the surrounding area shall be planted with suitable species of plants in consultation with State Government agency suitable for the purpose. Any other industrial structure, which becomes redundant for current or future use of the Company/local body, shall be demolished. Finally, the freed and clear area shall be taken up for biological reclamation.

Disposal or reuse of residential and non-residential buildings

At the time of final closure, a list of surface buildings would be prepared in detail. Thereafter following steps would be taken in chorological order in respect of the available buildings:

- An assessment would be made to find that whether the available buildings can be used by the existing neighboring projects or any new project that might have come up in the vicinity.

- In case the listed assets cannot be utilized by the nearby project, efforts would be made to sale these assets after making the list available to potential purchasers and asking the interested purchasers to submit sealed bids.

- Thereafter the state agencies/local agencies may be asked to take possession of the buildings, if they required few of them.

- When there would be no takers, the buildings would be demolished and usable items would be recovered for future use. The debris shall be suitably disposed off. The freed area shall be cleared of debris/contaminants, appropriately loosened and topped with at least 100 mm of top soil, where needed. Finally the entire freed area including the surrounding area shall be planted with suitable species of plants in consultation with State Government agency suitable for the purpose.

18.2.8 **Safety and security arrangement**

Fencing around abandoned quarry

A good portion of the quarry will be backfilled. The balance void would be properly fenced to avoid any inadvertent entry of animals or human beings. Sufficient Boards and danger signs shall be placed all around. Later on, the responsibility of keeping the fencing secured would be entrusted on the State Authorities.

Slope stability arrangement for high wall and back filled dumps

The exposed coal surfaces and benches of de-coaled void shall be gently sloped, stabilized. Any exposed coal will be covered with waste material to prevent spontaneous heating. Vegetation cover will also be provided along the slopes to arrest any failure.

Prior to handing over the project area to the State/Local authorities, it shall also be ensured that unstable areas, if any, are appropriately dealt with to render it safe and stable.

18.2.9 **Re-deployment of work force**

Workforce would be transferred to the similar projects. If vacancy in similar nature projects gets exhausted, the relatively young workforce would be re-trained and re-deployed in other projects.

After the completion of all post closure activities, the engaged manpower on these activities would be re-deployed in some other mines of the Company.

18.2.10 **Emancipation from the community facilities**

The local communities are being provided many civic facilities, such as educational facilities, health facilities, and drinking water by the mine management. One of the objectives of the present closure plan is to ensure that such facilities do not get discontinued after the mine closure.

18.3 **The Mine Closure Activities to be executed towards the end of mine life and in the post closure period**

At present, it is bit difficult to conclusively predict the likely mine closure activities that would be taken up towards the end of mine life and during the post closure period. However, a tentative schedule covering the anticipated final mine closure

activities to be carried out in the last phase of mine life and during the post-closure period have been prepared.

This tentative schedule shall be firmed up at the time of preparing detailed final mine closure, which shall be prepared at least 5 years before the intended final closure of the mine and be approved by the MOC. This detailed Mine Closure Plan would reflect item-wise activities to be executed towards the last phase of mine life and in the post closure period, various milestones and the schedule of execution of the identified closure activities.

18.4 The tentative schedule

In view of the above deliberation in the preceding paragraphs, a schedule of progressive and final mine closure activities has been given below.

18.5 Abandonment cost

At this juncture, it is difficult to reliably estimate the costs involved in execution of various mine closure activities in various phases of mine life. As required by the MOC guidelines, the details of the updated cost estimates for various mine closure activities shall be incorporated in the detailed final mine closure plan that shall be submitted to the MOC for approval at least 5 years prior to the intended final closure of the mine.

18.6 Estimation of Mine Closure Cost

18.6.1 Total estimated mine closure cost as on Base Year

Particulars	Relevant Data
WPI Month	Mar-13
Total Project area (Ha)	780.80
Rate of mine closure cost (Rs./Ha)	789815
Total estimated mine closure cost (In Lakh Rupees)	6166.88

18.6.2 Annual Mine closure cost (AMCC)

Particulars	Relevant Data
Life of Mine (Years)	20
Considered life (Years)	20
AMCC for 2013-14 (Lakh Rupees)	308.34
Nth year AMCC (Lakh Rupees)	308.34[1+0.05]^(N-1)
Total MC Cost (In Crore rupees)	101.96

18.6.3 Tentative allocation of mine closure on various mine closure activities

The above estimated total mine closure costs in respect of **Chitra East OCP** may be tentatively allocated on following MC activities (CMPDI norms):

Sl. No.	Item	Cost involved (Lakh rupees)
1.	Dismantling of industrial and residential structures	323.00
2.	Fencing of mine void and other dangerous area	153.00
3.	Handling/Dozing of external OB dump into mine void and bio-reclamation (including soil spreading, plantation and maintenance)	9080.00
4.	Grading of highwall slopes	180.00
5.	Landscaping	31.00
6.	Plantation	73.00
7.	Monitoring of environmental parameters	43.00
8.	Cost on supervision and execution of mine closure activities	82.00
9.	Miscellaneous and other mitigative measures	204.00
10.	Entrepreneurship development (vocational/skill development training for sustainable income of affected people	27.00
	Total Cost	10196.00

It may be noted that the above division of total cost has been made on the basis of a generalized norms for a typical OC mine and several projections made in respect of Chitra East OC Project. Hence, these costs may vary at the time of execution of various mine closure activities and even some new activities may also be included.

- **IMPLEMENTATION SCHEDULE FOR MINE CLOSURE (LIFE- 20 Years)**

S.N	Activity	Year				
		Progressive Mine Closure Phase	Final Phase	Post Closure Phase		
		3 Nos. of 5 year periods covering 15 years of life	Last 2 years	PC1	PC2	PC3
A	**Dismantling of Structures**					
	Service Buildings	*****	*****			
	Residential Buildings	*****	*****			
	Industrial structures like CHP, Workshop, field sub-station etc.	*****	*****			
B	**Permanent Fencing of mine void and other dangerous area**					
	Random rubble masonry of height 1.2 metre including levelling up in cement concrete 1:6:12 in mud mortar	#####	#####			
C	**Levelling & Grading of high wall slopes**					
D	**OB Dump Reclamation**					
	Handling/Dozing of OB Dump and backfilling					
	Technical and Bio-reclamation including plantation and post care					
E	**Landscaping**					
	Landscaping of open/cleared land for improving its esthetic					
F	**Plantation**					
	Plantation over cleared area obtained after dismantling					
	Plantation around the quarry area and in safety zone					
	Plantation over the external OB Dump					
G	**Environmental Monitoring / testing of parameters for 3 Yrs**					
	Air Quality	+++++	+++++			
	Water Quality	+++++	+++++			
H	**Entrepreneurship Development (Vocational/skill development training for sustainable income of affected people**					
I	**Miscellaneous and other mitigative measures**					
J	**Supervision of mine closure activities**					

***** - **Whenever any structure gets redundant, it shall be demolished and freed area shall be reclaimed**

- **Whenever any void gets unused or any area becomes unsafe/dangerous, it shall appropriately fenced**

+++++ - **The environmental monitoring is obligatory as per the terms and conditions laid out in EC**

18.7 The Mine Closure Plan of Chitra East OCP has been approved by ECL Board. As per approved MCP, the following instalments have been deposited in the Escrow a/c under coal controller.

Year		Deposit in Escrow a/c (in Rs. Lakh)
1st	2013-14	308.34
2nd	2014-15	323.76
3rd	2015-16	339.95
4th	2016-17	356.95
	Total	1329.00

19.0 MANPOWER, PRODUCTIVITY AND TRAINING

19.1 In the approved PR for the rated capacity of 2.50 MTY of coal, the total manpower requirement was estimated as 626 (for Partial outsourcing option). But after the decision of ECL not to built up the CHP, manpower earmarked for the CHP has been excluded. However, additional manpower has been provided as more no. of HEMM have been envisaged in the RCE. Thereby requirement of revised manpower works out to 646. The break-up of manpower for the approved PR and RCE is given below:

	Particulars	Manpower	
Sl No		Approved PR	RCE
A. Mine Operation			
	Coal	102	102
	OBR	16	92
	Common / Auxiliary	41	35
B	CHP Operation & Maintenance	77	-
C	HEMM Maintenance	73	106
D	E&M Maintenance	46	44
E	Mining & Safety	43	43
F	Store	26	20
G	Survey	9	9
H	Office Staff	60	60
I	Medical & Sanitation	14	14
J	Communication	10	10
K	Colony & Water Supply	21	21
L	Miscellaneous	30	39
M	Environment	8	6
N	Executives	50	45
Total Strength		**626**	**646**

19.2 Existing strength of manpower in the OCP is 1136, which includes 855 Daily rated employees, 223 monthly rated employees and 58 executives. Existing manpower at Chitra OCP includes 191 no. of fitter, 193 fitter helper, 28 explosive carrier, 181 no. of Gen. mazdoor, 52 clerks and some u/g manpower. The excess manpower in the OCP can be productively deployed in other mines of ECL. Further, 316 additional employments are envisaged to be given against tenancy land required to be acquired for the OCP. Gradual retirement of existing manpower will be supplemented by fresh employment of phased land acquisition. Moreover, land looser after giving proper training will be gainfully deployed in other mines of ECL.

19.3 At the targeted production capacity of 2.50 MTY of coal with total manpower of 646, the OMS of Chitra East Opencast project works out to 14.66 te.

19.4 For efficient, effective and safe operation of the mine, a comprehensive and meticulous training programme for all levels of employees is imperative. The training would be:

i) On the job
ii) In the training centres of nearby opencast mines
iii) Conducted by the external agencies, including the equipment manufacturers.

20.0 PROJECT IMPLEMENTATION SCHEDULE

20.1 Balance life of Chitra East OCP do not involve any major construction job. CHP envisaged in the approved PR has been dropped in the RCE. The two crucial and major activities in the RCE is land acquisition and village rehabilitation.

20.2 Chitra OCP is a running mine. In the RCE 2017-18 has been considered as the 1st year. RCE is envisaged to obtain final approval in 2017-18. Land acquisition process involves application for diversion of 106.17 ha of forest land. Stage-I clearance for it is envisaged to be obtained in 3rd year (2019-20). The process of rehabilitation involves six no. of villages namely, Khoon, Tulsidabar, Bhawanipur, Chitra, Jamua and Taraband. Two villages namely, Khoon and Tulsidabar lying in the south side is proposed to be shifted by 3rd year of RCE followed by Chitra and

Bhawanipur in the north side by 4th year. Rehabilitation of Jamua and Tarabad villages is envisaged to be completed by 5th year.

20.3 The mine is expected to reach its targeted production of 2.50 Mty in 3rd year (2019-20). But major activities is envisaged to be completed by 5th year along with the spending of 90% of additional RCE capital. Hence, 31.03.2022 is considered as the date of completion of the project.

20.4 The proposed implementation schedule of different activities has been shown in the figure no. 20.1 considering 2017-18 as the 1st year of the RCE.

Fig-20.1

21.0 FINANCIAL EVALUATION

21.1 GENERAL

Approved PR of Chitra East OCP has a target capacity of 2.50 Mty. The balance mineable reserves in the mine is 47.42 Mte at an average stripping ratio of 3.30 cum/te. The mine is proposed to be run in partial outsourcing mode. Entire 47.42 Mte coal and some 22.08 M.cum OB (utilising full departmental capacity) will be excavated departmentally. Balance 134.18 Mcum OB removal including 14.60 Mcum of re-handling will be done by outsourcing means.

21.2 Capital Investment

21.2.1 Balance RCE capital has been estimated on basis of the requirement for balance life of the mine**.** Some of the approved provision no longer required (like CHP) has been excluded from the RCE capital**.** In order to estimate the balance RCE capital investment involved, the CMPDI price list published in May-2016 (with escalation up to June-2017) was taken as basis for P&M items. Capital estimation for Civil works are based at an index of 5060. No foreign capital is involved within the present PR.

21.2.2 Existing Capital, Additional Capital and Total capital for the approved PR as well as the RCE are presented below:

Particulars	Unit	Approved PR	RCE
Existing Capital	Rs in Crore	57.16	270.71
Additional Capital	Rs in Crore	112.69	513.99
Total Capital	Rs in Crore	169.85	784.70
Specific investment	Rs/te	679.40	3138.80
Specific investment (P&M)	Rs/te	245.50	743.07

The detailed head-wise capital investment with phasing is presented in Appendix-A. Head wise RCE capital is given below

Rs. In crores

Sl. No	Particulars	Expenditure Done Against Approved PR	Additional Provisioning	REC Capital
1	**Land**	**71.32**	**364.76**	**436.08**
2	**Buildings :**			
	Residential	4.32	5.21	9.53
	Non-Residential	3.52	1.06	4.58

	Sub-total (Building)	**7.84**	**6.27**	**14.11**
3	**Plant & Machinery :**			
	HEMM	1.34	8.99	10.33
	Other than HEMM	2.11	54.76	56.87
	Sub-total (P & M)	**3.45**	**63.75**	**67.20**
4	**Furniture & Fittings**	0.48	0.18	0.66
5	**Railway Siding**	0.54	5.56	6.10
6	**Vehicles**	-	-	-
7	**Prospecting & Boring**	.02	0.30	0.32
8	**Development :**			
	Capital Outlay	0.99	60.44	61.43
	Roads & Culverts	1.89	7.47	9.36
	Water Supply	1.28	2.98	4.26
	PR Preparation & Scientific Study	1.99	2.28	4.27
	Sub-Total(8)	**6.15**	**73.17**	**79.32**
Sub-total (1 to 8)		**89.81**	**513.99**	**603.80**

21.3 Opening of Revenue account

As the mine is a running project, the revenue account was already opened.

21.4 Replacement Capital

The Yearwise replacement capital requirement for the RCE is shown below:

Years	Amount in Rs Cr
1	11.84
2	6.75
3	11.12
4	10.64
5	6.64
6	4.58
7	16.92
8	10.01
9	11.12
10	8.58
11	19.75
12	2.83
13	18.36
14	1.34
15	17.12
16	5.80
17	11.07
18	2.83
Total Replacement Capital	**177.32**

21.5 Sources of Finance

Funding requirements of the Project will be met from internal resources, hence, Cost of Funding has not been considered while calculating the financial indices.

21.6 Cost of Production

21.6.1 Production of coal from the proposed OCP would entail expenditures on several heads/items/activities. The estimated head-wise costs have been furnished in the following paragraphs:

a. **Salaries and wages cost**

Manpower requirement for the proposed OCP under Partial Outsourcing option has been estimated as 646. The estimated wages cost has also been given in the following table:

Particulars	Salaries and wages cost	
	at 100% Capacity	at 85% Capacity
Wages (Rs/ Te)	188.29	221.52
% of wages to total cost	14.93%	15.99%

Statement showing annual wages cost is given in Appendix B.1.

b. **Stores Cost**

Stores cost has been calculated taking into account provision for repair & maintenance, POL, Explosive, etc. The estimated stores cost are as under:

Rs/Te

Stores Cost	
at 100% Capacity	at 85% Capacity
218.41	236.25

c. **Power Cost**

The estimated Power cost at 100% and 85% capacity are Rs.38.27 per te. and Rs. 43.34 per te. respectively.

d. **Misc. Expenditure**

Misc. expenditure includes TA/DA printing & Stationery, Workshop debit, Civil repairs, contingency etc. The estimated Misc. expenditure cost are as under:

Rs/Te

Misc. Cost	
at 100% Capacity	at 85% Capacity
27.36	29.64

e. **Administrative expenditure**

The administrative expenditure has been considered as Rs.163.97/Te. However for calculating IRR 10% of Administrative overhead has been considered.

f. **Interest on working capital**

Interest on working capital has been considered @ 14.5% on four months cash revenue expenditure. The calculated interest on working capital are as under:

Interest on working capital	
at 100% Capacity	at 85% Capacity
50.71	55.10

g. **Depreciation**

Depreciation on assets is computed on the estimated life of the respective investments after retaining 5% as residual value. Straight line method of depreciation has been adopted. Depreciation for Partial Outsourcing option are as under:

Rs/Te

at 100% Capacity	at 85% Capacity
72.96	85.84

h. **Mine Closure Cost**

Mine Closure Cost is presented below:

Rs/Te

at 100% Capacity	at 85% Capacity
18.70	22.00

i. **Amortization of Project Land**

Project land has been amortized during the project life. Amortization of Land cost shown in Appendix – C.

j. **Cost of outsourcing**

- Lead distances and corresponding volume of OB removal and re-handling for RCE is given below:

WASTE		
Year of Prdn.	**Lead (Km)**	**Quantity (M.cum)**
OB Removal	2-3	119.58
Re-handling of OB	2-3	14.60

- Based on the awarded rate, adjusted (effecting escalation) outsourcing rate for OB removal, re-handling at specified lead distances as given by CMC deptt. of ECL have been considered for economic evaluation. Considered outsourcing rates which excludes explosive cost and service tax are given below.

Particulars	Lead (Km)	Rate
Removal of OB (Rs./ m3)	2 - 3	74.45
Re-handling of OB(Rs./ m3)	2 - 3	50.00
Crushing of coal (Rs./ te)		19.34
Coal Transportation To Rly. Siding (Rs./ te)	26 - 27	171.78

Year wise OB removal and Re-handling load is given in table no.8.3.

21.6.2 In view of the above, total outsourcing cost becomes Rs. 394.26 per te. The total cost of production works out to Rs. 1261.52 per te. and Rs.1385.06 per te. at 100% and 85% respectively.

21.7 **Selling price**

21.7.1 Considering Declared GCV grade for working seams the weighted average GCV grade of coal at the Chitra OCP is G7.

As per the resolution of 270th meeting of ECL Board and subsequent communication by G.M, (P&P), ECL vide letter no. ECL/PLG/2212 dated 28.07.2014 economic analysis of this RCE has been done considering declared GCV grade of coal i.e G7 for worked out seams.

Considering Declared GCV grade (i.e G7) for power utility, selling price of crushed coal (-) 100mm works out to Rs.1770.78 as explained below.

Sl.no	Particulars	Base price
1	Notified Price of Grade"G7"	1600.00
2	Less-5% of Notified Price	80.00
3	Add-Transportation Charge (actual for >20 Km)	171.78
4	Add- Crushing charge to (-) 100 mm size	79.00
5	Net sale price	**1770.78**

21.7.2 Dispatch of coal has been envisaged to be at (-)100 mm size. Cost of crushing (to be done by outsourcing agency by deploying Mobile crusher) to (-) 100 mm size @ Rs.19.34 per te., (as per the existing contract) has been incorporated to the cost of production. And a corresponding benefit of Rs.79.00 per te. has been added to the selling price of coal.

21.7.3 Based on the above premises, the average Outsourcing cost works out to Rs. 394.26/te. Break-up of outsourcing cost under different heads are given below:

Particulars	**Rs. Per te.**
OB Removal	187.74
Rehandling Of OB	15.40
Crushing of Coal	19.34
Transp. Cost of Crushed Coal	171.78
Total O/S Cost	**394.26**

21.8 Profitability (Profit/Loss) & Financial IRR

In light of the preceding deliberations with regard to cost of production and average selling price, the expected profits and IRR at 100% capacity utilization and 85 % capacity utilization have been computed and presented below.

Particulars	**Unit**		
		at 100% Capacity	**at 85% Capacity**
Cost of Production	Rs / Te	1261.52	1385.06
Selling Price	Rs / Te	1770.78	
Profit/Loss	Rs / Te	509.26	385.72
IRR	%	63.23%	40.24%

As outsourcing job is involved, total cost of production includes two components, one departmental and other outsourcing. Different components of total cost under different option is given below.

Particulars	Cost Components	
	at 100% Capacity	at 85% Capacity
Departmental Component (Rs/Te)	867.26	990.80
Outsourcing Component (Rs/Te)	394.26	394.26
Total Cost of production (Rs/Te)	**1261.52**	**1385.06**

21.9 Conclusion

With GCV grade G7 the project is viable under Partial Outsourcing option.

21.10 Sensitivity Analysis

Sensitivity analysis has been calculated considering the following parameters for assessing their influence on the Financial IRR:

a) Capital investment
b) Operating cost
c) Capacity utilisation
d) Selling price of coal

The above parameters have been increased / decreased in Steps of 5% to a maximum of 25% over the base case and the IRR have been computed.

The following table summarises the results of sensitivity analysis for declared GCV grade.

Partial Outsourcing Option

Variable Parameters	0%	5%	10%	15%	20%	25%
Increase in Capital	63.23%	59.86%	56.67%	53.66%	50.83%	48.18%
Increase in Operating Cost	63.23%	56.08%	49.44%	43.34%	37.76%	32.68%
Decrease in Capacity	63.23%	54.89%	47.22%	40.24%	33.92%	28.19%
Decrease in Selling Price of Coal	63.23%	50.89%	40.11%	30.86%	22.91%	15.93%

22.0 PARTIAL OUTSOURCING OPTION

22.1 The PR approved in Partial outsourcing option envisaged only OB removal to be done contractually. As Chitra OCP is an existing mine, it is proposed that existing resources and facilities are utilized to the fullest extent. As the existing strength of HEMM will be capable of removing some OB after producing targeted quantity of coal, only the balance OB removal has been envisaged to be outsourced in RCE. Re-handling of OB, crushing and transportation of coal also have been envisaged in the RCE to be done by outsourcing agency. However, those outsourced jobs will be overseen by departmental personnel. The scope of different jobs in this RCE would be as under:

a. Except the job of OB removal (zone to be demarcated by OCP authority), OB re-handling, crushing and transportation of coal, all other mining and related activities will be under departmental responsibility. Even overall supervision of outsourcing activity will be monitored departmentally.

b. Outsourcing agency will install, maintain and operate the mobile crushers.

c. Acquisition of land and re-habilitation of villages will be under departmental responsibility.

d. Building up of infrastructures, like roads, bridges, service buildings, power-supply arrangement, water supply arrangement will be done by project authority. Lighting arrangement in and around the quarry will also be done departmentally.

e. The process of obtaining statutory permission for explosives and supplying the same to the outsourcing agency will be under departmental responsibility.

22.2 Outsourced agency will procure its own equipments; operate and maintain the same with its own manpower. Necessary infrastructure required for operation and maintenance of the equipment owned by the agency will have to be built by itself. ECL authority should however, provide the suitable land space for the purpose.

VARIANCE ANALYSIS						(Figs in Rs. Lakh)
Particulars	Capital Provision in Sanctioned PR	RCE CAPITAL	INCREASE/ DECREASE	VARRIATION DUE TO		REMARKS
				Escalation/ De-escalation	Addition/ Deletion	
Land	2689.81	43608.05	40918.24	40501.71	416.53	The increase in RCE provision is due to increase in land rate only. In approved PR, cost of Tenancy land was Rs.3.70 lakhs per Ha which has been increased to Rs.128.56 Lakh per Ha in RCE. Cost of Govt. land and Gohcar land has increase from Rs.2.50 Lakh per Ha. to Rs.122.60 Lakh Per Ha. Addl. 3.24 Ha of Tenancy land for Grid Sub-Station.
Building						
Residential	323.98	953.25	629.27	629.27	-	Though the overall no. of quarter to be built has been reduced from 106 to 72 in the RCE, there is huge cost escalation. Civil cost Index has increased from 1519 to 5060. Two third job yet to be completed.
Non-Residential	358.79	458.15	99.36	99.36	-	Small balance amount of job remains. Escalation of cost.
Plant & Machinery						
HEMM	1725.36	1032.63	-692.73	-	-692.73	1 no. 770 HP Ripper dozer & 4 no. 35T (beyond 10th year) proposed in the approved PR have been dropped in RCE
Electricals	707.80	2395.02	1687.22	-	1687.22	Addl. Job - a grid sub-station & drawing of power line from there has been envisaged in the RCE.
Workshop & Store	146.62	23.01	-123.61	-	-123.61	As per ECL majority of the work-shop P&M provide in the PR is not be procured.
Pump, Pipes & Fittings	265.78	336.30	70.52	70.52	-	Escalation of Cost
Coal Handling Plant	1418.40	Nil	-1418.40	-	-1418.40	As Per ECL, CHP is not required. Crushing of coal to be done by Mobile Crusher with Outsourcing means.

Other P & M	110.99	2914.78	2803.79	-	2803.79	Many addl. Items like 3 no.Slope Stability radar, CCTV cameras, Biometric Attendance system, 100T weigh bridge etc have been included.
Telecommunication	-	18.00	18.00	-	18.00	
Furniture & Fittings	34.00	66.14	32.14	14.14	18.00	Escalation of Cost, Addl. Furniture for hospital
Railway Siding	30.98	610.05	579.07	-	579.07	Addl. Job of construction of drain, up-gradation of Rly. Track and installation of 100T & 120T weigh bridges included in RCE.
Vehicles	32.50	Nil	-32.50	-	-32.50	As per ECL, amount is not required.
Prospecting & Boring	45.00	32.40	-12.60	-	-12.60	As per ECL, balance amount is not required.
Mine Development						
Capital Outlay in Mines	2119.61	6143.38	4023.77	4023.77	-	Cost of Rehabilitation has increased from Rs.17.24 crore to Rs. 57.34 crores due increase in no. of PAF and cost escalation.
Roads & Culverts	890.35	954.97	45.07	45.07	-	Though length of mine haul road has been reduced in the RCE, there is overall escalation of cost.
Water Supply & Sewerage	169.55	426.45	256.90	121.78	135.12	Escalation of cost. Addl. Job of digging deep boreholes, laying of pipeline and installation of pumping station.
PR Preparation & Scientific Study	199.76	426.82	227.06	-	227.06	The increase is due to this RCE and addl. provisioning for scientific study
TOTAL CAPITAL	**11269.28**	**60379.86**	**49110.57**	**45505.62**	**3604.95**	**Major escalation involve land acquisition & rehab of villages which is about Rs. 445.25 crores. Major addl. job include electrical P&M, Railway siding and Other PM. Majore deletion involves CHP.**

Central Mine Planning & Design Institute Limited

(A Subsidiary of Coal India Ltd.)

Gondwana Place, Kanke Road, Ranchi - 834 008, India

Phone : (+91-0651) 230238, 231850, 231852, Fax : (+91-0651) 231851, 231447, Cable : MINEPLAN

E-mail : cmpdi@giasbm01.vsnl.net.in, cmpdi@hub.nic.in

Web Site : www.cmpdi.nic.in