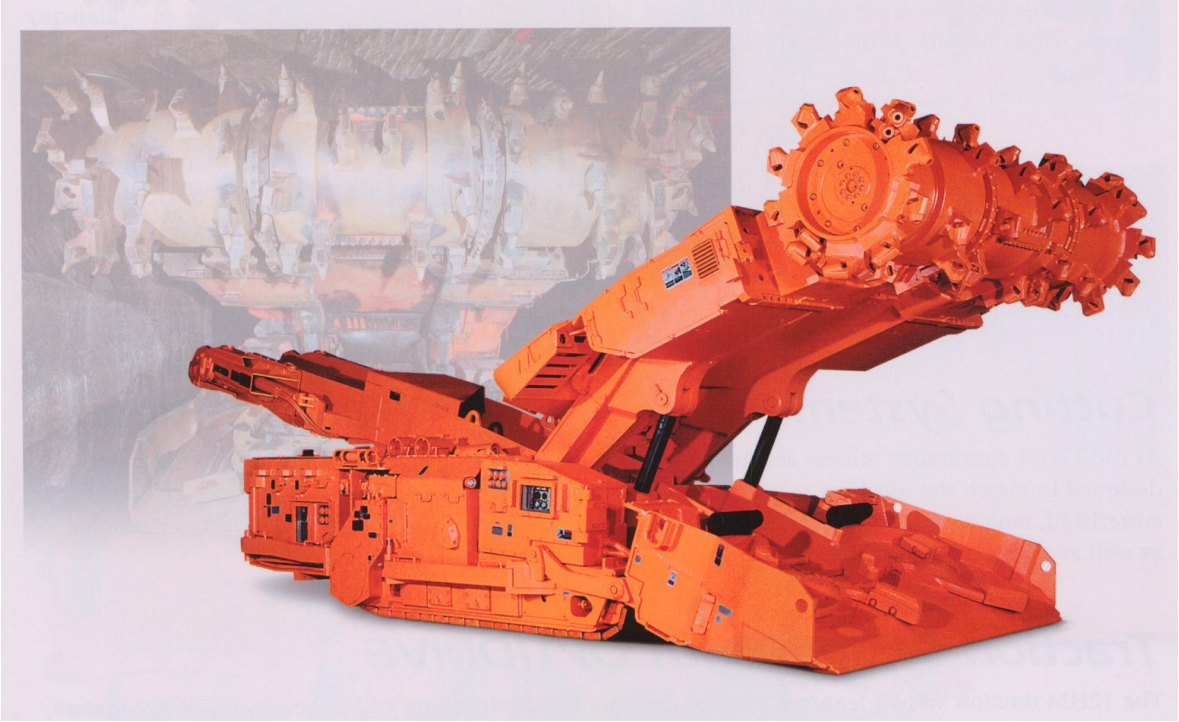
PROJECT REPORT ON

PRODUCTION AUGMENTATION BY

CONTINUOUS MINER

AT

CHURI-BENTI UG PROJECT, CCL (0.81MTY)



May 2007
Regional Institute – III
Central Mine Planning & Design Institute Ltd.
(A Subsidiary of Coal India Ltd)
Gondwana Place, Kanke Road, Ranchi – 834 008

STANDARDISED INFORMATION

FOR

EMPOWERED SUB-COMMITTEE (ESC)

OF

CIL BOARD

FOR

CHURI-BENTI UG PROJECT, CCL (0.81MTY)

May 2007
Central Coalfields Limited
(A Subsidiary of Coal India Ltd)
Darbhanga House, Ranchi – 834 001

CHAPTER – I

INTRODUCTION

1.1 BACKGROUND OF THE PROJECT REPORT

Churi UG is an existing project under the administrative control of North Karanpura Area of Central Coalfields Limited. The mine has been taken over at the time of nationalization. Prior to nationalization, it belonged to M/s United Karanpura Collieries Ltd. Before nationalization, Lower Bachra seam has been worked in distant past through Incline No. 2, 3, 4 & 5 in patches, which are presently abandoned. The existence of water, fire etc cannot be ruled out in these abandoned workings. At the time of nationalization, Churi old mine was under operation. The first Feasibility Report for the project was undertaken in 1979 to work Upper and Lower Bachra seams. After approval of the report, the mine development continued in Upper Bachra & Lower Bachra seams.

Major area under Churi UG project has been developed and is standing on pillars. Further investment is required in the mine for sustaining the existing production as well as for production augmentation.

Mass Production Technology with Continuous Miner has been introduced in few mines of the Coal India Limited. In view of encouraging results in SECL and WCL, CCL management has also proposed for introduction of similar technology in UG mines of CCL. Churi UG has been identified as a potential mine for introduction of Continuous Miner Technology.

Churi-Benti UG project (developed mining area in Churi block & part of virgin area in Benti block annexed to Churi UG mine) has been identified for introduction of mass production technology. It is proposed to augment the coal production as well as liquidate standing pillars at Churi UG. This report has been prepared to assess the technological and financial implications of the introduction of Continuous Miner Technology (based on equipment specifications as implemented in other CIL mines) and to form a guideline for the process of the technological transfer. Recently, agreement for supply of Continuous Miner package has been signed between ECL and M/s JOY MINING for Jhanjra Project. The cost and specification of Continuous Miner package considered for this report is same as that of Jhanjra Project.

1.2 PREVIOUS REVIEW OF THE PROJECT

The Project Report for Churi UG Project (Re-organization) was approved in Feb'1982 by Government of India for a rated capacity of 0.84MTY with a capital investment of 16.77 crores. The Churi project could not be completed and the production remained far below the targeted production of 0.84 MTY. Recently, the Derating-cum completion (foreclosure) report was prepared and has been approved by the CCL Board in the 333rd meeting on 9.9.2006 for a capacity of 0.16MTY. It has been forwarded to GOI for competent sanction of foreclosure. The RCE of Churi project has also been approved by CCL Board in Dec'06 and forwarded to GOI for its consideration.

Mean while, for improvement in production from the existing project, various reviews of the project have been taken up (prior to de-rating cum completion report) and the reports have been submitted. A chronology of various reports is as under:

RPR (0.60MTY)	**:**	Jan'91 (Approved by CCL Board in July'93 but not approved by CIL Board due to low IRR
RPR (0.33MTY)	:	Dec'98
Augmentation Report (0.45 MTY)	:	Dec'2005
RPR (0.84 MTY)	:	March'2006
De-rating Cum Completion Report:		July '2006 (Approved By CCL Board In 333rd meeting in sept'06 And sent to govt of India For its approval
And RCE of Churi UG project:		Approved by CCL Board in Dec'2006 and sent to GOI for approval

1.2 EXPLORATION STATUS

The area within the proposed mine boundary is about 7.69 sq. km. The present mining area of the project falls under Churi & Benti (part) blocks, about 5.89 sq. km in Churi block & 1.8sq. km in Benti block. Detailed exploration has been carried out in both the blocks. Total number of boreholes within the proposed boundary is about 79BHs. The boreholes density works out to 10.26BHs/sq. km. However, additional boreholes have been proposed for purpose of detailed analysis of seams/bands and confirmation of seam/band thickness, wherever gap in geological input exists.

CHURI BLOCK

A total of 56 boreholes have been drilled within mine boundary, including 3 non-coring boreholes. The borehole density works out to 9.50boreholes per square km. The detailed exploration of Churi blocks revealed two major workable seams, i.e. Upper Bachra seam (UBS) & Lower Bachra seam (LBS). Upper Bachra seam (UBS) is not well developed in the north-western part of the block along Damodar river. In the block, Lower Bachra seam has been interpreted as single geological seam/horizon. However, the seam structure indicates multiple dirt bands, especially in LBS. The average grade as per geological report is grade' C' but the grade realization for the project is grade 'B' (LF).

BENTI BLOCK

The total area within mine boundary in Benti block is about 1.80 sq. km. A total of 23 boreholes exist within the area. The borehole density works out to 12.7boreholes per square km. In Benti Block only Lower Bachra seam is workable. The lower Bachra seam has splitted in two parts namely BLB (Bottom Lower Bachra) and Top Lower Bachra. The parting between BLB & TLB varies from 0.30-5.10m in the block area within mine boundary. Top lower Bachra is again splitted into two parts namely Upper Section of Top Lower Bachra and Lower section of Top lower Bachra. Out of these three section, only two section BLB (Bottom Lower Bachra) & Upper Section of Top Lower Bachra (UTLB) is workable.

TLB has been interpreted as combined Top Lower Bachra (CTLB) in part of the mining area while in some part has been interpreted as split seam-section, i.e Upper section of Top Lower Bachra (UTLB) and Lower section of Top Lower Bachra (LTLB). The parting between UTLB & LTLB varies from 0.30- 2.07m. However, major part of the mining area is having parting of around 1.0m or less. CTLB occurs as thick seam with grade of coal D-E. In split seam-section, UTLB has workable seam thickness, with thinning of seam to unworkable thickness on eastern and northern side and grade of coal D-F. The LTLB shows workability in patches with grade of coal B-D. In major part of the mining area, the parting between BLB and UTLB/CTLB is generally around 1.0m or less. The BLB generally has workable thickness with grade of coal varying from A-E.

In Benti block, UBS has been developed partly along Damodar river (common boundary between Churi & Benti blocks). However, the seam is generally unworkable.

1.3 CHRONOLOGY OF MINING ACTIVITIES

The first Feasibility Report for the project was undertaken in 1979 to work Upper and Lower Bachra seams in Churi Re-organization (CRO). Subsequently, Inclines 6 & 7 were driven up to Lower Bachra seam. Since then, B&P development continued in UBS & LBS. Later, LHDs were introduced in the Churi UG project for B&P development. After exhaustion of development reserves in LBS, additional area in adjoining Benti block (sector-A) was annexed to the Churi UG project to continue with B&P development. Presently, one B&P district with LHDs (5Nos.) is in operation in Bottom Lower Bachra (BLB) seam/section in mining area under Benti block and one manual B&P district in Upper Bachra seam in CRO. In Benti block, only initial trunk roadway development has been done. The coal production during 2005-06 from Churi UG project has been 0.16Mt. Out of this, 0.10 Mt from LHDs panel and 0.06 Mt from manual B&P panel.

1.4 NECESSITY OF RECASTING PROJECT REPORT

Most of the property in Churi Block is developed and standing on pillars. DGMS is also imposing restrictions on giving permission for further development. Depillaring of these developed pillars is essential. Recent experiences in SECL and WCL have shown that depillaring with Continuous Miner (CM) is suitable to achieve higher production.

CCL management has desired for introduction of Mass Production Technology (MPT) to achieve higher rate of production from a mine / project. Churi UG mine has been identified for deployment of Continuous Miner. The area, which is free from overlying developed seams or unworkable overlying seams in Churi block, i.e western section of CRO (Churi Re-organization), few panels of eastern section of CRO (E12 & E13) and virgin area in Benti block, having thickness >3.0m has been considered for deployment of Continuous Miner (similar to introduced in Chirimiri & Tandsi UG mines of SECL & WCL respectively). There is change in technology proposed for the mine and significant investment is required for production augmentation as well as sustaining the production. Hence, it is required to recast the report.

Scope of the report*:* The purpose of the report is to augment the existing production by deploying Continuous Miner which may enhance the production, economics and profitability of the project. The scope of this report is limited mainly to depillaring of western section of CRO, few panels of eastern section of CRO (E12 & E13) and development & depillaring in Benti block by Continuous Miner.

1.5 JUSTIFICATION OF PRESENT REPORT

The present status of the mine suggests the following:

- The entire property in Churi block is almost developed and standing on pillars while mining area in Benti block is almost virgin.
- The development reserve for CM in mining area under Benti block has limited mine life.
- The development and depillaring reserves for CM in the proposed area is for about 9 years.
- The liquidation of standing pillars is essential. Depillaring cannot be undertaken, as surface land is not acquired.
- Additional investment on acquisition of land is required for sustaining production.
- In the present scenario, the mine is incurring losses @ of about Rs. 266/T, which is likely to increase further with increase in various cost elements.
- Further investment is required for enhancement of production and/or introduction of new technology.
- It is desired for production augmentation by adopting new technology on risk-gain sharing basis.
- Investment is required for man-riding system due to long and arduous traveling distance.
- Improved ventilation is required for ventilating distant panels.
- Additional capital is required for mine development and P & M.
- Better productivity and performance of Continuous Miner suggests feasibility of enhanced production by way of introduction of mechanization at working places.
- Integrated planning for coal & material transport, ventilation and pumping.

1.6 RISK / DIFFICULTIES & CONSTRAINTS IN MINING

The difficulties / constraints and risk associated are :

- The seams lie at relatively low depth of cover thereby likely poses difficulty in caving and strata control.
- Presence of Damodar and Saphi rivers on surface – a potential source of danger
- Surface subsidence likely to significantly damage surface land.
- Coal to be left in UG to protect state highway on surface.
- Relatively low parting between seams
- Developed galleries are roof bolted.
- Crossing of Damodar River.
- Shifting of surface features like road, power trestles, Villages, company/ private quarters etc.
- Other constraints as mentioned in the Chapter-IX

1.7 PROJECT OBJECTIVES & TARGET BENEFICIARIES

The objective of the present report is to augment the coal production from the mine keeping in view overall demand of better quality coal and better / improved performance of the mine and higher capacity utilization of the existing resources.

The coal produced from the mine would be included in the basket linkages.

1.8 SALIENT FEATURE OF PRESENT REPORT

The objective of the present report/project is two-fold:

- Production augmentation
- Introduction of modern technology in CCL mines on risk-gain sharing basis.

The present report envisages introduction of Continuous Miner in CCL mines. Churi - Benti UG project has been identified for introduction of Mass Production Technology. The basic criteria / requirement as identified are as follows:

(a) Technology:

Transfer of technical know-how for mechanization of face workings with introduction of Continuous Miner in underground mining systems to ensure an average daily production of 1700 -2000TPD from one district / panel.

(b) Production Guarantee on risk-gain sharing basis

Production will be guaranteed for a period of 5 years. The guaranteed production level will be decided mutually. The mutually agreed production will be on risk-gain sharing basis, i.e. linked to the production level and cost of equipment. The contract agreement should include transportation of face coal up to surface bunker or as agreed mutually.

(c) Supply of Equipment & Maintenance

As a step for introduction of the technology, the supplier would provide comprehensive maintenance of the equipment and operational guarantee for five years at mutually agreed rate of production.

(d) Transfer of Technical know-how

After completion of term of five years the supplier would hand over the detailed drawings of the equipment and ensure easy availability of the spares. Maintain office in India to ensure supply of spares.

(e) Site Investigation & Scientific Studies

For deployment of continuous miner
Method of development
Method of extraction
Feasibility of mining with CM in contiguous part and other area in Churi UG

(f) Mine / District Layout

Development & Extraction layout for the mine over a period of 9-10 years and the proposed panel to match new technology.

(g) Equipment / Machinery

Detailed requirement of equipment for introduction of the technology.

(h) Infrastructure Requirement

Modifications needed in the existing infrastructure like, transport, ventilation, electrical layout, workshop, stores, coal handling, etc.

(i) Manpower

Daily requirement of manpower in the district with their job description.

(j) **Implementation Schedule**

Implementation schedule with schedule of transfer of technological know-how, training of personnel, etc.

CHAPTER –II

MARKETABILITY & LINKAGE

2.1 Demand & Availability

The demand and availability of Central Coalfields Limited during X^{th} & XI^{th} plan period are as under:

Sl No.	End User	Demand (MT)						
		2005-06	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**
1	Existing TPS	31.43	31.43	31.43	31.43	31.43	31.43	31.43
2	X Plan TPs	2.19	7.11	13.07	14.53	14.53	14.53	14.53
3	XI Plan TPS	0.00	0.00	1.45	4.47	12.81	19.48	22.49
	Total Power Utility	33.62	38.54	45.95	50.43	58.77	65.44	66.45
4	Captive Power	2.77	2.77	2.77	1.35	1.35	1.35	1.35
5	Steel	5.50	6.00	6.1	6.20	6.30	6.40	6.50
6	Cement	0.18	0.18	0.18	0.18	0.18	0.18	0.18
7	Sponge Iron	0.92	0.92	0.92	0.92	0.92	0.92	0.92
8	Other sectors	6.84	6.78	6.73	6.68	5.63	6.58	6.53
	Total Demand	**49.83**	**55.19**	**62.65**	**55.76**	**74.15**	**80.87**	**83.93**
	Production	40.40	42.00	47.50	52.50	57.80	61.70	367.00
	Gap	**-9.43**	**-13.19**	**-15.15**	**-13.26**	**-16.35**	**-19.17**	**-16.93**

Source: Consolidated coal availability report of CCL, March 2006

The above table reflects that even after achievement of projected additional production from Churi UG project, there would be enormous gap in coal availability in CCL. The Augmentation report will help to reduce this gap with consistent supply of superior grade of coal.

2.2 Linkage

At present coal from Churi U/G project is mainly being sent to various sponge iron plants. The additional production will be included in basket linkages.

CHAPTER – III
PROJECT SITE INFORMATION

3.1 LOCATION

Churi-Benti U/G project is located in the South-central part of North Karanpura coalfield between the latitudes $23^{o}41'05"$ and $23^{o}42'04"$ and the longitudes $85^{o}03'$ and $85^{o}04'20"$ covering an area of about 7.68 sq.kms. in Chatra district of Jharkhand state. It is covered by topo sheet Nos. 73E/2 and 73A/14 (Scale 1"=1 mile) of Survey of India. Saphi River forms the south-eastern boundary and arbitrary line beyond Fault F11A and along the fault plane of F11A of Benti Block forms the western boundary of the project. Ray Bachra colliery and Ashok OCP of Piparwar area is situated to the North / North-east and Manki colliery (now exhausted) to the south/south- west of Churi project as shown in the Location Plan (Plate-I). It has two units.

3.2 COMMUNICATION

Churi-Benti UG project is situated at a distance of 8 km on fair weather road connecting Khalari and Ray railway stations on the Gomoh-Dehri-on-Sone loop line of the East Central Railway. An all weathered 25 km long road links Khalari with Bijupara village on the state highway connecting Ranchi and Daltonganj.The P.W.D. road connecting Khalari and Barkagaon in Hazaribagh district also passes through the Churi block. CCL Hq. at Ranchi is situated at a distance of about 73km from Churi UG project.

3.3 TOPOGRAPHY, DRAINAGE AND HYDROLOGY

The topography of the area except in the western part is gently undulating and sloping towards Saphi and Damodar rivers. The area as per borehole records and colliery records lies between RL 404.50m and RL 476.80m above Mean Sea Level. In the western part of the block, adjoining Manki mine, the terrain is hilly, as few spurs of the Belangi Hill (RL 529.74m) traverse the block.

The average annual rainfall of the area is around 1500mm, most of the precipitation of which is during the monsoon season with some winter rains. Damodar and Saphi rivers control the drainage of the area. Water has been found in some drilled boreholes but there has been no evidence of any water under positive piezometric head in any of the boreholes drilled in the block. However, seepage of water has been recorded in the workings of the Lower Bachra seam through the floor of the seam in Incline No. 2A. A highly porous and permeable coarse-grained sandstone and conglomerate layer forming the floor of the Lower Bachra seam appears to be under water pressure and is being recharged in the outcrop region by the Saphi River.

The High Flood Level of Saphi River as recorded close to the incline mouth by the colliery authorities in 1976 and supplied to the Exploration Division is 420.95m above the M.S.L. Part of developed working of Churi UG in W7 , W8,and W9 panels falls below HFL. One seasonal nala is also passing over

the panels of W8 , W9,and W10. While working below it safety care should be taken.

Incline No.1 in the Lower Bachra seam was driven from the area falling under high flood level of Saphi River. It has since been sealed and six numbers of check dams between 2nd and 3rd levels have been constructed as protective measures. Records of the H.F.L. on Damodar river (413.12-416.16m) have been taken from the adjoining Hesalong block.

CHAPTER – IV

GEOLOGY AND DEPOSIT APPRAISAL

4.1 Background

The summarized geological assessment has been prepared from the following geological reports:

a) Geological Report on Churi Block, 1977

b) Supplementary Note on Geology of North-Western part of Churi Colliery, May 1985.

c) Geological Report for Benti Block, March 1992.

The approved Feasibility Report of 0.84 MTY was prepared on the basis of Geological Report on Churi Block, 1977.

4.2 Exploration Status

a) **Churi Block**: The exploration in Churi Block was initiated in 1975 and concluded in Jan, 1976. A total of 15 Boreholes (NNKC 1,2,3,6,11,15, 24-32) were drilled along with 5 boreholes (CBH 1,3,4,5 and CHPR) by colliery authorities. In 1983-85, additional 13 boreholes (NNKC 33-36, 40-48) were undertaken in virgin North-Western part. The data of these 13 boreholes were utilized for updating the stratum contours of Lower Bachra seam for the virgin north-western patch of Churi Block. 3 more non-coring boreholes (NNKC 37,38,39) were also drilled for dewatering and sinking electrical cables.

In June 1990, 6 (six) boreholes were drilled for proving of structure and determining the physico-mechanical properties. Subsequently, CCL drilled 4 (four) boreholes in the eastern part to confirm continuity of Lower Bachra seam. In 2001-02, 10 (ten) no of bore holes were drilled by CMPDI for updating of seam plans.

Table 4.1: Details of Boreholes

Agency	Period/ Year	Series	No. of Boreholes	Meterage (m)
	Before Nationalisation	CBH/CHPR	5	-
CMPDI	75-76	NNKC	15	1332
CMPDI	8385	NNKC	13	1236.60
CMPDI	83-85	NNKC	3(Non-coring)	280.75
CMPDI	1990	NNKC	6	579.20
CCL	-	CCPS	4	365.15
CMPDI	2001-02	CMCPS	10	918.00
			56	4711.70

The total area of the block is about 5.89 Km^2 and the borehole density is 9.5 boreholes/km^2.

b) **Benti Block**: A total of 101 boreholes were drilled over on area of 8.55 km^2 in Benti Block. Out of the total boreholes, 93 boreholes were coring and remaining 8 boreholes were partly coring/non-coring. The borehole density works out to 11.81 bore hole per square kilometer. The borehole density for the area proposed to be mined in Benti block (Sector-A) through Churi is 12.7 boreholes/km^2.

4.3 Geology and Structure of Project Area

4.3.1 The general geological sequence of the North Karanpura Coalfield is as follows:

Table 4.2: **Sequence of Geological Formation**

Upper Gondwana	**Mahadeva Formation** **Panchet Formation**	**Triassic**
Lower Gondwana	Raniganj Formation Barren Measure Formation	Permian
Damuda Sub-group	Barakar formation Karharbari formation Talcher formation	 Permo Carboniferous
---------- Unconformity----------		
Gneisses and schists		Pre-cambrian

Of the above, only Karharbari and Barakar formations contain economical coal seams.

4.3.2 Geological Succession of Churi Block

On the basis of available surface and sub-surface data, following succession has been established for Churi Block**.**

Table 4.3: **Geological succession in Churi Block**

Formation	Broad Lithology	Thickness (m)
Recent	Soil and sub-soil	0.23 (CBH-3) to 12.20 (NNKC-3)
Barakar	Conglomerate, sandstone, alternate bands of sand stone & shale, grey shale, fire clay etc.	30.03 (NNKC-27) to 84.61 (NNKC-31)
Karharbari	Sandstone, fire clay, grey shale, conglomerate	20.22 (NNKC-15) to 47.42 (NNKC-27)
	Upper Bachra seam	0.13 (NNKC-35)

		to 4.84 CCPS-10)
	Parting of conglomerate, sandstone, alternating bands of sandstone & shale, sandy shale, grey shale & carbonaceous shale	0.49 (CCPS-10) to 20.27 (CCPS-4)
	Lower Bachra seam	1.71 (NNKC-32) to 11.24 (NNKC-48)
	Sandstone & shale	Not drilled
Talcher	Khakhi green sandstone, shale & boulder bed	

The Karharbari formation contains two major coal horizons i.e. Upper Bachra seam and Lower Bachra seam.

4.3.3 Geological Structure

Churi Block: The area presently under consideration in Churi Block lies between faults F17 & F10. Fault F17 exists in the north-eastern part of the block where as fault F10 exists in the southern and south-western part of the block . The throw of fault F17 is about 50m towards north-west in the northern part which gradually decreases to around 5m near borehole No. CHPR-57 located on the left bank of Saphi river. The throw of fault F10 varies from 15-25m and the throw is towards north-east. The area between these two faults is characterized by simple geological structure. There are three more faults (F11A, F12, F13) in addition to above two faults which trend almost NW-SE with north-easterly throw of 5 to 13m. There are four minor slips also F11B, F11, F15 and F18) whose throw varies from 2 to 5m (Ref. Stratum contour plans).

Of the above faults, F11, F11A, F11B, F12 and F15 have been encountered in the mine workings while F18 was responsible for omission of Upper Bachra Seam in NNKC-24. Fault F15 encountered in the mine

workings was also responsible for omission of Upper Bachra seam in NNKC-19.

Table 4.4: **Details of Faults in Churi Block**

Sl. No.	Fault No.	Trend	Direction of throw	Amount of throw (m)	Remarks/Evidence
1	F_{10}	NW-SE	NE	7-15m throw diminishing in SE direction	Omission of Lower Bachra seam in CBM-6; also encountered in workings of south central part.
2	F_{11}	NW-SE	SW	0-10m dies out in the west	Encountered in the workings of Lower & Upper Bachra seam in the south Central part and seen in the Saphi river.
3	F11a	NW-SE	N-E	5m	Based on stratum contours.
4	F11b	E-W	South	2m	Based on stratum contours
5	F_{12}	NW-SE	NE	5m	Encountered in UG workings.
6	F_{12A}	NE-SW	SE	0 to 3m, dies out in the north	Omission of Upper Bachra seam in CCPS-3.
7	F_{13}	NW-SE	NE	8 to 10m	Based on aerial photographs & stratum contours.
8	F_{15}	East-West	South	3m	Upper Bachra seam omitted in borehole NNKC-19. Minor slips in the workings of Churi Colliery.
9	F_{17}	NW-SE	NE	5-50m Reduces eastward	Based on aerial photographs and floor contours
10	F_{18}	E-W	S	0-4m	Omission of Upper Bachra Seam in NNKC-28.

The strike within the block is roughly NE-SW in the major part of the area which gradually swings to almost north-south in the eastern part. The strike between fault F_{13} and F_{17} in the north-eastern part has further taken swing to almost NNW-SSE. The local swings in strike is mainly due to rolls. The dip of the strata generally varies between 2^0 & 3^0 (1 in 20 to 1 in 40) in the major part of the property. However, in the southern part of the area, gradient gradually increases locally as could be seen from the stratum contour plans.

The seam belong to Karharbari formation, which is known to contain seams with erratic behaviors, therefore, the confidence level of geological interpretation is comparatively low.

Benti Block: In the Benti Block, only Karharbari formation is coal bearing having Bachra seam normally in 2 to 4 splits. The Benti block is a part of the northern limb of Karkatta- Piparwar plunging anticline. The strike in the northern and south central part is roughly N-S with westerly dip, which swings to NW-SE in the northeastern corner of the block. The N-S strike of the northern part swings to almost NE-SW strike before becoming E-W in the north-western part of the block. The strike again swings to more or less NE-SW strike in the western part. In sector-'A', the strike varies from N-S to NW-SE and dip ranges from 1 degree to 3 degree (1 in 60 to 1 in 20) due SW to west. In Benti Block, 18 faults have been established.

Table 4.5: **Sequence of coal seams & partings in Benti Block**

Formation	**Seam/Parting**	**Sector 'A' of Benti Block Thickness range (m)**	
		Minimum	Maximum
Karharbari	Strata between Barakar & Upper Bachra/Top Lower Bachra	47.50	62.35
	Upper Bachra seam	0.53	0.96
	Parting	0.50	1.61
	Lower section of Top Lower Bachra	0.40	2.0
	Combined Top Lower Bachra	3.0	5.10
	Parting	0.3	3.0

	Bottom Lower Bachra	2.12	4.25

4.4 Coal Seams

In the Churi Block, two seams namely Upper Bachra and Lower Bachra have been encountered.

4.4.1 Upper Bachra Seam

It varies in thickness from 0.13 m (NNKC-35) to 4.84 m (CCPS-10) and is mostly devoid of any dirt bands. Generally, it is 2 to 3 m in thickness in major part of area. The seam thickness decreases to less than 1.2m in the south-western part (NNKC- 26,28, 33, 35, 40, 48) and in the northern part of the property (NNKC- 43, 44, 49). The immediate roof of UBS is generally grey shale, sandy shale, conglomerate, medium to coarse grained sands ton, carbonaceous shale etc. The immediate flor is predominantly carbonaceous shale and grey shale.

4.4.2 Lower Bachra Seam

It is the bottom most seam having thickness from 1.71m to 11.24m (NNKC-48) and occurs 0.68m to 20.27m (CCPS-4) below Upper Bachra seam. The Iso-parting indicates that the parting gradually increases from 3m in the middle of the property to about 18m in the south-eastern region. In the north-western part, parting varies from 1 to 3m. The thickness normally varies from 3-5m, which gradually increases to 9m in the western part near Damodar river.

It has been observed from the seam structure plans that there is generally a persistent dirt band of carbonaceous shale/grey shale occurring about 2 to 2.5m below the roof. The bottom section of the seam is generally clean and better in quality than the upper section which is commonly inter banded and often contains thick shaly coal horizons.

The immediate roof of LBS is carbonaceous shale, grey shale, fine to medium grained sandstone. Floor is generally grey shale, intercalation of shale and sandstone, carbonaceous shale, sandy shale and at times by

medium to coarse grained sandstone. The summarized range of Analytical parameters for LBS & UBS is given in Table: 4.6.

Table 4.6: **Analytical Parameters for LBS & UBS**

Seam	Particula Of Analysis	On 60% RH & 40^{0}C			UHV (Kcal/kg)	Grade
		M%	Ash%	VM%		
Upper Bachra	Ex-band	6.4-8.5	17.8-27.6	25.6-27.7	4210-5420	C-D
	In-band	5.4-8.0	17.8-30.3	23.2-27.7	3685-5420	C-E
Lower Bachra	Ex-band	7.6-9.4	10.9-25.5	24.1-26.5	4330-6225	A-D
	In-band	6.3-9.0	15.9-31.0	21.5-27.3	3640-5865	B-E
Clean bottom section	Clean coal	7.6-9.2	9.0-14.2	23.9-25.3	5755-6610	A-B

4.4.3 In the Benti Block: Upper and Lower Bachra seams occur**.**

Upper Bachra Seam:

It occurs in a small patch in sector-A along the eastern block boundary. This has completely pinched out near the boundary of Benti and Churi mine. This seam has not been considered in this Report due to low thickness (<1m). The grade of coal varies from 'D' to 'F'.

Lower Bachra Seam:

The Lower Bachra seam in Benti Block splits into two parts.

a) Top Lower Bachra seam(TLB), and

b) Bottom Lower Bachra seam(BLB)

The Top Lower Bachra seam (2 to 5m thick) has again splitted into two distinct sections designated as:

i) Upper Section of Top Lower Bachra (UTLB)

ii) Lower section of Top Lower Bachra (LTLB)

However, both the above upper and lower sections have merged together in small isolated patches in Sector 'A' and designated as combined Top Lower Bachra(CTLB).

The Bottom Lower Bachra seam has thickness range of 0.24 to 4.18m and is persistent throughout the property.

4.4.4 Upper section of Top Lower Bachra seam

It is persistent throughout the property as well as in sector-A, except near the western block boundary where it has pinched out completely.

Thickness : It varies generally from 1.5 – 3.5m.

Dirt Bands: It is normally less than 0.30m in thickness and are carbonaceous shale in nature.

Roof & floor: The immediate roof is represented by medium to coarse grained sandstone, carbonaceous shale, grey shale and conglomerates. The floor is marked by carbonaceous shale, sandy shale, grey shale, medium shale to coarse grained sandstone and alternate bands of shale and sandstone.

Quality: The UHV and grade (In Band) varies from 3105 K.cal/kg ('F') in NNKA-394 to 4955 K.cal/kg ('C') in NNKA-65. The overall grade of coal is 'D'.

4.4.5 Lower Section of Top Lower Bachra seam

This section is overlain by Upper section of Top Lower Bachra seam after a parting of 0.50m to 11.33m and pinches out completely in the western part of the block.

Thickness: It is genrally 1.2 to 2m in the proposed area.

Dirt Bands: The seam is mostly free from dirt bands. It has been found in only 3 bore holes and is generally less than 0.38m in thickness.

Roof & Floor: The immediate roof is represented by carbonaceous shale, sandy shale, medium to coarse grained sandstone and alternate bands of shale and sandstone. The floor is

normally sandy shale, alternate bands of shale and sandstone, medium grained sandstone and gray wackes.

Quality: The UHV and grade (In band) ranges from 4070 K.cal/kg ('E') in NNKA-394 and 5725 K.cal/kg ('B') in NNKA-65. The overall grade is 'D'.

4.4.6 Combined Top Lower Bachra Seam

The Upper and Lower sections of Top Lower Bachra seam have merged together in three narrow isolated patches in the sector.

Thickness: The thickness of the combined Top Lower Bachra seam varies from 1.10m (NNKA-372) to 5.10m (KP-1). The combined seam is geerally around 4.0m in thickness in the north-eastern patch in Sector-A.

Dirt Bands: The thickness of the dirt bands is less than 0.19m. The dirt bands have been found in 4 boreholes out of the 15 boreholes.

Roof & Floor: Immediate roof is generally represented by carbonaceous shale and coarse to very coarse-grained sandstone. The floor is marked by the sandy shale, carbonaceous shale and greywacke.

Quality: The UHV/grade varies from 3285 K.cal/kg ('F') in NNKA-375 to 4275 K.cal/kg ('D') in NNKA-66. The overall grade is 'D' in the Sector'A'.

4.4.7 Bottom Lower Bachra seam

It is the Lower most split of the main Bachra seam.

Thickness: The thickness of Bottom Lower Bachra seam varies from 2 to 4m.

Dirt Bands: The dirt bands are generally carbonaceous shale and grey in nature. Its thickness is less than 0.30m except in one boreholes.

Roof & Floor: The immediate roof is coarse to very coarse grianed sandstone, carbonaceous shale, grey shale and sandy shale. Floor is represented mostly by sandy shale, alternate bands of shale and sandstone and carbonaceous shale followed by shale, grey wackes and coarse to very coarse grained sandstone.

Quality: The overall grade is 'B'.

4.5 Geological Reserve

Churi Block: The estimated net-in-situ geological reserves in Upper & Lower Bachra seams is about 36.29 MT.

Benti Block (Sector-'A'):

The estimated net-in-situ geological reserves in Upper section of Top Lower Bachra seam and Bottom Lower Bachra seam are 4.171 MT and 8.697 MT respectively.

The detailed break-up of extractable reserve in Churi-Benti blocks is as under:

Seam / Section	Churi block		Benti block		Total
	Dev.	Dep.	Dev.	Dep.	
A. Continuous Miner					
Lower Bachra seam (LBS)	0.224	2.979	---	---	3.203
Bottom Lower seam (BLB)	---	---	0.464	0.547	1.011
Sub-Total	**0.224**	**2.979**	**0.464**	**0.547**	**4.214**
B. Heightening District					
Lower Bachra seam (LBS)	0.915		---	---	0.915
Sub-Total	**0.915**		**---**	**---**	**0.915**
C. Bord & Pillar					
Upper Bachra seam (UBS)	0.755	2.928	---	---	3.683
Lower Bachra seam (LBS)	0.242	5.037	---	---	5.279
Bottom Lower Bachra (BLB)	---	---	0.521	0.748	1.269
Upper section of Top Lower Bachra (UTLB)	---	---	0.418	0.430	0.848
Sub-Total	**0.997**	**7.965**	**0.939**	**1.178**	**11.079**

CHAPTER – V

PRESENT STATUS OF MINE

5.1 GENERAL

Churi U/G Project is a nationalized project in the North Karanpura Area of Central Coalfields Limited. At the time of nationalization, Churi old mine was under operation. Manual development was in progress in LBS & UBS. After nationalization, a feasibility report for Churi Underground (Re-organization) was prepared and approved in Feb'82 for a rated capacity of 0.84 MTY with capital investment of 16.77 Crores. The feasibility report was a combination of the two mines (Existing and Proposed) with certain common arrangement for transport, Ventilation and Pumping.

5.2 PRESENT DEVELOPMENT OF THE PROPERTY

The entire property of Churi Block has been developed in stages:

(a) **Churi old (Manual section**): This development is prior to nationalization of the mine. Both Upper Bachra Seam (UBS) and Lower Bachra Seam (LBS) have been approached through Incline Nos. 3A, 4A and 1A, 2A respectively and fully developed by Bord & Pillar method of mining with manual loading. Almost entire property in Churi old mine is standing on pillars and is available for depillaring. Presently return airway of CRO is through this Churi old section.

(b) **Churi Underground (Re-organization):** The remaining area of Churi Block is approached through Incline No 6 & Incline no-7as envisaged in the approved feasibility report (0.84 MTY). The proposed method of mining for Upper Bachra seam were re-treating Long wall caving with solid blasting & Manual loading onto AFC and friction prop as support for Thickness 1.2 – 2.0 m and Manual Bord and Pillar for Thickness 2.0m to 4.0m. Whereas for Lower Bachra seam, the proposed methods were Blasting gallery method with Jumbo drill and remote controlled LHD for Thickness 4.5m-6.0m & Manual Bord & Pillar for Thickness 3m-4.5m.

Presently, almost entire area of Lower Bachra is developed by conventional Bord and Pillar method with LHD and Upper Bachra seam is developed manually. The development reserve of CRO is near to exhaustion. Almost

entire property is developed and standing on pillar and is available for depillaring.

Benti Section: Part of the Benti Block (Sector-A) is annexed to the Churi Block. This annexed part has been approached by driving 3 nos. of drivages headings from W-6 panel in the western section of CRO. Presently, Bottom section of Lower Bachra seam is being developed by Bord & Pillar method with LHDs (5 nos.). The annexed part to Churi project is beyond the scope of the approved feasibility report.

Before nationalization, few patches of the Churi Block are also worked in lower Bachra seam through incline no. 2,3,4 & 5, which is presently abandoned. The existence of water, fire etc cannot be ruled out in these abandoned workings.

5.1 PRESENT INFRASTRUCTURE

Churi underground project is an ongoing project. Most of the infrastructure likes approach road, service buildings and residential buildings for the mine is already exists. The Churi-Benti Project shall utilize the existing infrastructure. Various mine development activities like incline drivages (6 & 7 Nos.); Airshaft and surface coal handling arrangement (5 x 125 Te) have already been completed.

5.1.1 Existing Underground Coal Transport

The existing UG coal evacuation system in Churi UG project is through a series of 1000 / 800 mm belt conveyors, which includes trunk conveyors (TB1 to TB4) covering entire length of trunk roadways in Incl. No.7and gate belt conveyors. Coal from the working face is loaded either manually or by LHDs on to chain conveyors and Chain conveyors fed it to gate belt conveyors. The gate belt conveyors feed coal on to trunk belt conveyors, which in turn carries coal up to surface bunkers. This existing transport system is also for workings in Benti section.

5.1.2 Existing Men & Material Transport

A direct haulage of 65 KW rating is installed on surface for transport of material from surface along the Incline no.6 to underground. Thereafter, endless rope haulages are used to haul the material trollies to the out bye of the existing panels. Within the panel, endless haulage is also used to supply material to in bye faces of the panels .

5.1.3 Surface Coal Transport

Coal evacuated from UG is stored on surface in 5 overhead steel hoppers of 125 Te capacities, which directly loads either on to consumer's truck or side dumps on to surface, in case emergency arises.

5.2 PRESENT STATUS & METHOD OF MINING

LBS: Bord and Pillar with LHD (Development almost completed)

UBS: Manual Bord and Pillar (Development is in Progress)

BLB: Bord and Pillar with LHD (Development is in Progress)

Major part of the area is standing on pillars and manual development is being carried out in upper Bachra seam in the eastern side of the Churi Re-organization (CRO) and development with LHD is in progress in Bottom Lower Bachra seam/ Section in Benti Block. .

5.3 EXISTING VENTILATION ARRANGEMENT

At present, exhaust system of ventilation is being followed for ventilating the workings of mine. Presently, Churi UG mine is an operating mine with two incline entries (Inc. 6 & 7) on the rise side working as main intake airways and an air shaft serves as main return airway with a main mechanical ventilator (PV200 make) installed in the air shaft. The present air discharge through the main fan is about 50.0m^3/s at an operating fan pressure of about 58mm of WG.

Two standby fans exist, one a Model AF-80 fan in the fan drift parallel to the existing fan drift and other a Model PV-160 fan in 1A incline. Only the main fan PV200 make is in operation.

5.4 EXISTING POWER SUPPLY ARRANGEMENT

The existing Churi Reorganization sub-station (2x1MVA, 11/3.3KV) receives power at 11 KV from old KDH 33/11 KV substation via Dakra sub-station. Out of these two 1 MVA transformers, one transformer caters the loads of surface and some underground loads. The other transformer feeds power to different underground equipment through 3.3 KV overhead lines. which is being tapped by cables passing through boreholes to underground substation & different load points.

5.5 SERVICE & RESIDENTIAL BUILDINGS

The major service buildings like Pit office, cap lamp room, sub-station, workshop, store, service magazine, Haulage room etc. already exist at Churi UG Project. However, the existing sub-station, workshop, store need further strengthening and additional construction of water reservoir, shed etc. on surface.

The break-up of existing residential buildings at Churi is as under:

Type of Quarters	Existing no of Quarters
MQ(LCH)	910
A	90
B	48
C	7
D	3
Barrack	52
Total	**1110**

5.6 WATER SUPPLY

The present water supply is from Damodar River, which is fed directly for consumption. Saphi River is another source of water for water supply to the colony after treatment. Present system of water supply and sewerage is sufficient to fulfill the potable and industrial water demand.

5.7 EXISTING MANPOWER

The existing manpower deployed at Churi UG is 905 (as on 1.1.07). The details of the existing manpower are as under:

Sl. No.	Particulars	Existing Manpower
1	Piece Rated Workers	177
2	Daily Rated Workers	576
3	Monthly Paid Staff	130
4	Executives	22
TOTAL		**905**

5.8 LAND ACQUISITION STATUS

Non-forest land (24 Ha) has been acquired for colony construction. Major part of the mining area is under forestland, which is yet to be acquired. Total land for mining is yet to be acquired.

5.9 PAST PERFORMANCE

(a) Production

Year	**86-87**	**87-88**	**88-89**	**89-90**	**90-91**	**91-92**	**92-93**	**93-94**	**94-95**	**95-96**
Prod (MT)	0.156	0.150	0.205	0.228	0.214	0.230	0.240	0.246	0.204	0.226
Year	**96-97**	**97-98**	**98-99**	**99-00**	**00-01**	**01-02**	**02-03**	**03-04**	**04-05**	**05-06**
Prod (MT)	0.236	0.229	0.244	0.233	0.210	0.172	0.175	0.185	0.168	0.161

(b) **Other Existing Parameters of the project**

- Selling price/Te : Rs. 1441.00
- Cost price/Te : Rs. 1707.00
- Profit/loss : (-) Rs.266.00
- Manpower (as on 31.3.06) : 945
- O.M.S : 0.66
- Production : 0.162 MT

CHAPTER – VI

SALIENT FEATURES OF APPROVED PR

6.1 GENERAL

The Feasibility Report of Churi UG for a rated capacity of 0.84 MTY was approved by Govt. of India in Feb 1982 for a capital investment of Rs. 16.77 Crs.

The method of work proposed and production envisaged is as follows:

(a) Upper Bachra seam

- Retreating Long wall caving with solid blasting & Manual loading onto AFC and friction prop as support for Thickness 1.2 – 2.0 m
- Manual Bord and Pillar (Thickness 2.0m to 4.0m)

(b) Lower Bachra Seam

- Blasting gallery method with Jumbo drill and LHD (Thickness 4.5m-6.0m)
- Manual Bord & Pillar (Thickness 3m-4.5m)

(c) **Production Envisaged**

* Upper Bachra	:	0.135 MTY (Long wall Panel)
		0.150 MTY (B & P Panel)
Sub-total	:	**0.285 MTY**
* Lower Bachra	:	0.42 MTY (2- Blasting gallery panels)
		0.15 MTY (B & P panel)
Sub-total	:	**0.57 MTY**
Total	**:**	**0.855 MTY (Approved for 0.84 MTY)**

6.2 SUMMARISED DATA

Sl.No.	**Technical/Financial Parameters**	**As per Approved Feasibility Report (0.84 MTY)**
1	Name of the Report	Feasibility Report for Churi Underground Project (Re-organization)
2	Target Capacity (MTY)	0.84
3	Seams considered	Upper Bachra seam (UBS)

		Lower Bachra Seam (LBS)
4	Thickness of Seam UBS: LBS:	 0.13 – 4.42 m 1.71 – 11.24 m
5	Seam gradient	1 in 20 (2 Deg. to 3 Deg.)
6	Av. grade	'C'
7	Extractable Reserve (MT)	21
8	Manpower	1858
9	O.M.S. (Te)	1.651
10	Life (Yrs.)	28
11	Target Years	1983-84
13	SPT (Rs./Te)	Rs. 63.26
14	CPT (Rs./Te) At 100% target production At 85% target production	 Rs.59.92 Rs. 68.81
15	Profit/Loss (Rs./Te) At 100% target production At 85% target production	 Rs. 3.34 (-) Rs. 5.55
16	Internal Rate of Return (%) At 100% of target production At 85% of target production	 7.2 % 1.4 %

6.3 SALIENT FEATURES OF DE-RATING-CUM-COMPLETION REPORT

The Derating- cum- completion Report of Churi UG was approved in the 333rd Board meeting of CCL on 9.9.2006 at a production level of 0.16 MT. The Board also directed that a Revised Cost Estimate (RCE) reflecting the notional approved capital cost vis-à-vis actual expenditure incurred against the approved items be informed to the Board and the Govt. The RCE for Churi UG was prepared in Jov.'06 and approved by CCL Board in Dec.'06 and sent to Govt. of India for its approval. The existing capital expenditure approved by CCL Board as on 31.3.06 for Churi UG project is Rs. 21.39 Crs.

Head-wise Capital Investment Approved by CCL Board for De-rating

Sl. No.	Particulars	As per Feasibility Report (Feb.'82)	Capital Investment (As on 31.3.06)	Variance
1	**Land**	42.00	79.09	(-) 37.09
2	**Buildings**	144.59	248.16	(-) 103.57
3	**Plant & Machinery**	1019.94	1508.63	(-) 488.69
4	**Furniture& Fittings**	4.44	14.41	(-) 9.97
5	**Railway siding**	233.66	24.09	209.57
6	**Vehicles**	11.67	19.91	(-) 8.24
7	**Prospecting& Boring**	4.10	60.60	(-) 56.50
8	**Mine Development**			
8a	Capital outlay in Mines			
8b	Road & Culverts			
8c	Water Supply			
8d	SR & FR cost			
8e	Revenue expenditure capitalized			
	Sub-Total	**216.28**	**184.41**	**31.87**
	Total	**1676.68**	**2139.30**	**(-) 462.62**

Approval of RCE for Churi Under ground project from Govt of India is still waiting.

CHAPTER-VII

MINE BOUNDARY, RESERVES & MINE LIFE

7.1 SELECTION OF MINING AREA

Existing mine boundaries : The existing mine boundaries of Churi UG mine covers area lying in Churi mine block and part of Benti block The present boundary of the Churi UG is as under :

North/North-East	:	Adjusted boundary between Ashok OCP (Piparwar Area) & Churi UG in Benti block and Common boundary with Ray Bachra UG along fault F17-F17
West	:	Arbitrary line beyond Fault F11A along the fault F11A plane and Damodar river
South -East	:	Saphi river
South/South-West	:	Common Boundary Between Churi and Manki Colliery

Subsequently, alteration / addition has been done in the approved boundary (on the northern side) within Churi block as boundary fault (F-13) was not encountered. However, Ray Bachra UG had encountered a fault (F-17). Hence, natural extension of the mine boundary of Churi UG was made by adjustment of common boundary between Churi & Ray Bachra UG mines. Later, after exhaustion of development reserves in Lower Bachra seam & non-availability of surface land for depillaring, part of the virgin property lying in Benti block across Damodar river up to fault F-11A (Sector-A) was also annexed into Churi UG.

While evaluating and finalizing the boundaries of proposed Churi-Benti UG project, the mining area of existing Churi UG lying within Churi & Benti geological blocks have been considered

The total area within mine boundary of Churi–Benti UG project is 7.68 Sq.kms Out of the above Churi block has 5.89 sq. km. of area. Only 2.03 sq km has been considered for this reporting in Churi Block.. Out of the 1.79 Sq.Kms of the area in Benti Block ,0.41 sq.kms is considered for CM deployment in Benti block.. The total area for the Churi –Benti Block for CM deployment is 2.44 sq.kms.

Criteria for selection of mining area for CM: It is now proposed for deployment of Continuous Miner in the mine on similar specifications, as done in some other UG mines of CIL. Accordingly, mining area having seam thickness more than 3.0m has been identified for application of Continuous Miner. Similarly, extractable reserve has been estimated for workable seam/section thickness up to 4.6m.

The present report has been prepared for augmentation of production by deploying Continuous Miner (CM) in the Churi – Benti UG project. The area selected for deployment of CM is the western section of CRO, where Upper Bachra Seam (UBS) is not workable , few panels in Eastern section of CRO (E12 & E13) and part of sector-A of the Benti Block having thickness greater than 3.0m. So the extent of

working for this report limits only to panels (W1 to W15) in western section of CRO and few panels in Eastern section of CRO (E12 & E13) of Churi Block and part of Benti Block only for CM.

The area having thickness less than 3.0 m in Benti Block have been proposed to work with Low Height LHD in Churi-Benti project. Area having thickness greater than 3.0m have been proposed to work with Continuous Miner.

Feasibility of extension of project boundary:

The possibility of extension of existing boundary was examined for adding more reserves for deployment of Continuous Miner. It is not possible to extend the existing boundary. The possibility of extension of existing boundary in Benti Block up to Fault F-13 was also examined. Due to presence of link road for Ashok project and existing Benti nala, the extension of the boundary up to fault F13 is not possible. The colliery authority has also communicated this.

The existing mine boundary in Benti Block has been taken as project boundary for the Churi-Benti project.

7.2 MINE BOUNDARIES

The proposed boundary for Churi-Benti UG project is same as existing boundaries of Churi UG mine.

7.3 EXTRACTABLE RESERVES

The area under the Churi-Benti project falls under the Churi & Benti (partly) blocks. While calculating the reserves for continuous miner, the following considerations have been made:

- The area having thickness greater than 3.0m has been considered for CM deployment. The remaining areas has been considered for conventional Bord & Pillar development/ Depillaring.

- The virgin patches falling within the proposed CM panels shall be developed and depillared by continuous miner itself. Its reserves are shown in the table below.

- The thickness of extraction in development and depillaring for CM has been considered as 4.6m
- The percentage of extraction has been taken as 65% of coal in standing pillars

- The development height for B &P working has been considered as 2.4m or less (actual thickness of the seam after leaving 0.3m-0.5m of coal in roof).

- The extractable thickness for the conventional B & P depillaring has been taken as 4.0m or less (actual seam thickness).

- Roof coal beyond 2.40m in the developed galleries shall be taken while depillaring.

- Out of total 11.079 M.Te of extractable reserves only 0.939 M.Te of extractable reserves in Benti Block is considered for B &P development.

Table 7.1: Summary of Estimated Extractable Reserves

Seam / Section	Churi block		Benti block		Total
	Dev.	Dep.	Dev.	Dep.	
A. Continuous Miner					
Lower Bachra seam (LBS)	0.224	2.979	---	---	3.203
Bottom Lower seam (BLB)	---	---	0.464	0.547	1.011
Sub-Total	**0.224**	**2.979**	**0.464**	**0.547**	**4.214**
B. Heightening District					
Lower Bachra seam (LBS)	0.915		---	---	0.915
Sub-Total	**0.915**		**---**	**---**	**0.915**
C. Bord & Pillar					
Upper Bachra seam (UBS)	0.755	2.928	---	---	3.683
Lower Bachra seam (LBS)	0.242	5.037	---	---	5.279
Bottom Lower Bachra (BLB)	---	---	0.521	0.748	1.269
Upper section of Top Lower Bachra (UTLB)	---	---	0.418	0.430	0.848
Sub-Total	**0.997**	**7.965**	**0.939**	**1.178**	**11.079**

7.4 PRODUCTION TARGET & LIFE OF THE MINE

Considering an average productivity of the loading equipment over the life of the mine, proposed production target from the mine is as under:

Existing production - 0.16 MTY

Additional Production

Heightening District - 0.15 MTY
(2 Remote Controlled LHDs – 2.7Cu.m.)

Continuous Miner Panel - 0.50 MTY

TOTAL - 0.81 MTY

Considering the extractable reserves in western section of Churi block, few panels in Eastern section of CRO (E12 & E13) & part of Benti block and the production schedule, the life of the mine is expected to be about 11years (including production built-up & tapering periods).

CHAPTER-VIII

MINE ENTRIES

8.1 SELECTION OF MINE ENTRIES

Churi underground(Re-organization) is an on going project. It has been approached through a pair of inclines (Inc.No-6 & Inc. No-7). Presently the mine is operating in Bottom Lower Bachra seam in Benti block and Upper Bachra seam in Churi block with above-mentioned entries. It is proposed to continue with same set of mine entries for Churi-Benti project. The brief detail of the existing entries along with their proposed utility is shown in Table 8.1.

For deployment of continuous miner in Benti block (including one of the existing panel) to enhance production, it is proposed for additional drivages in coal below Damodar River. It is necessary to make additional drivages at appropriate location for optimal ventilation system, traveling/ man-riding route, provide approach for transport of CM package equipment requiring tramming height of around 2.7m, provide alternative escape route and to make optimal use of existing resources.

It is proposed for drivages in coal to connect panel W-11 (in Lower Bachra seam, Churi block) along true dip and trunk roadway in Bottom Lower Bachra seam/section (Benti block) at right angle up to fault F-11A. This will facilitate formation of self-draining panels on either of the trunk roadway and optimal transport & ventilation layout of the panels.

Justification for additional Drivages :

The proposed drivages will be second drivages below Damodar River. While granting permission for the first drivages below Damodar River through W-6 panel, DGMS has made observation for alternate means of access & egress on other side of Damodar River. The approach to surface site in Benti block is long and difficult. It will be difficult to maintain such isolated mine entry. Such isolated place is likely to give way to illegal activities. Moreover, problem of extremists already exists in this area. In view of the difficulty of maintaining isolated mine entry, it is better to provide alternate means of access & egress from underground itself.

Besides, the drivages from the surface would take 3-4 years. Considering limited reserves and life of mine in Benti block, the drivages may not be economic.

8.2 DIMENSION & PURPOSE OF MINE ENTRIES

The detail of the mine entries & other drivages area are shown in Table 8.1 along with dimension and purpose.

8.3 DETAILS OF STRATA BUNKERS

The brief description of mine entries, underground drivages and other drivages/strata bunkers is given in Table 8.1.

Table - 8.1: Brief Description of Mine Entries & Drivages

The details of existing entries and other mine drivages to be used for the project are as follows:

Sl. No.	Mine entry (Incline/shaft - No./Name)	X-Section (Dia/WxH) (m/m x m)	Length/ Depth (m)	Gradient	Approach (From / To)	Purpose & mode of transport fitted, if any
Existing Entries & Underground Drivages						
A.	**CHURI OLD MINE AREA (MANUAL SECTION)**					
1	Incline No.1	4.8mx2.8m	200	-	Surface toUBS	Sealed off
2	Incline No.1A	4.8mx2.8m	205	-	Surface to UBS/LBS	Return of LBS
3	Incline No.2A	4.2mx1.8m	40	-	Surface toUBS/LBS	Haulage (Presently sealed off)
4	Incline No.3A	4.8mx2.8m	172	-	Surface toUBS	Traveling and intake (Presently sealed off)
5	Incline No.4A	4.8mx2.8m	167	-	Surface toUBS	Haulage (Coal/material) (Presently sealed off)
6	Air Shaft 1 (Near Incline No.4A	4.26m dia	51.82	Vertical	Surface toLBS	Return airway (main fan) for UBS.
B.	**CHURI RE-ORGN. AREA (MECHANISED SECTION)**					
1	Incline No.6	4,8m x 2.8m	400	1 in 4	Surface to LBS	Haulage (Material supply) & Intake.
2	Incline No.7	4.8m x 2.8m	450	1 in 4.5	Surface to LBS	Coal transport (Belt conveyor), Travelling & Intake.
3	Drivages below river Damodar, 3-headings	3.0m x 2.0m	-	-	Churi to Benti Block (Existing)	Haulage and belt roadway, intake/return airways
C.	**CHURI OLD MINE AREA (DEVELOPED & SEALED OFF)**					
1	Incline No.2, 3, 4 & 5					
Proposed Additional Other Drivages						
1	Drivages below river Damodar, 3-headings	4.8m x 3.0m	-	-	Churi to Benti Block	Additional escape route & Ventilation
2	Strata Bunker (SB1)/Staple Pit	600t	-	Vertical	-	Strata Bunker
3	Strata Bunker (SB2)/Staple Pit	400t	-	Vertical	-	Strata Bunker

CHAPTER – IX

MINING STRATEGY

9.1 CONSTRAINTS IN MINING

The present constraints within the project boundary are summarized as under:

A. Surface Constraints

(i) Acquisition of land (Forest/ Jungle Jhari/Tenancy)
(ii) Power trestles passing over the proposed mining area of Churi block.
(iii) Rehabilitation of villages/ families.
(iv) Roads, Damodar & Saphi rivers, nala and HFL over the mining area,
(v) Existing mine boundary, diverted Benti nala & approach road to Ashok OC project in Benti block
(vi) Piparwar rehabilitation site over Benti block
(vii) Other surface features, like Piparwar GM office, BOC quarters, DVC sub-station, water filter plant, etc. over Churi block

B. Underground Constraints

The proposed mining area of the project consists of area under Churi block and part of area under Benti block (up to existing boundary in sector A). The details of the underground constraints for the blocks are stated as under :

1. Churi block

(i) The development reserve in Lower Bachra seam (LBS) and Upper Bachra seam (UBS) has almost exhausted.
(ii) The thickness of Lower Bachra seam to the west has gradually increased. The average thickness being 5.5 m. In one isolated borehole NNKC-48 (in the south-west), the thickness has increased to as much as 11.24m.
(iii) LBS & UBS are contiguous in major part of the property except in a small part to the east in Churi old, where the parting is more than 9m. The parting reduces to as low as 0.47m.
(iv) Analysis of seam structure of LBS shows presence of bands mostly in the upper section. Extraction of full seam thickness of LBS may affect the overall grade.
(viii) Existing galleries of the developed panels of UBS & LBS has low development height up to 2.4m.
(ix) The system of support in the existing developed galleries of the panels in UBS & LBS is roof bolting.
(x) Low parting thickness between the seams in major part of mining area
(xi) Narrow x-section (3.0m x 2.0m) of the approach to Benti block through 3-headings in W-6 panel of Lower Bachra seam (LBS) in Churi block to Bottom Lower Bachra (BLB) in Benti block below Damodar river.

2. Benti block

(i) The upper Bachra seam has not developed over the entire proposed mining area, except a small part near to Damodar River.

(ii) Lower Bachra seam splits in two parts. Top (TLB) & Bottom (BLB) sections. Top section further splits in two parts, i.e Upper (UTLB) & Lower (LTLB) sections. The splits of Top section combines (CTLB) in some part of the property.

Splitting / merging of the seam/section over the proposed mining area is observed in Benti block. The property shows presence of irregular banding of seam/sections. Therefore, it is essential to ensure exact working over the entire property in the proposed mining area

(iii) The parting between the seam/section mainly comprises of shale/ carb. Shale/ sandy shale, which may not be self-supporting and may require leaving of 0.3-0.5m of coal in roof.

(iv) Grade of the coal for bottom split (BLB) varies from B – E and top section (UTLB) varies from D-F.

(v) The parting between BLB & LTLB/CTLB varies from 0.30-5.0m. In major part of the area, it is generally less than 1.0m. The parting between LTLB and UTLB in major part of the area is also less than 1.0m. Hence, entire middle section may be lost either in maintaining statutory parting of 3.0m between two workable sections or due to its unworkable thickness.

9.2 GEO-MINING CHARACTERISTICS

The geo-mining parameters of the workable seams/sections in Churi & Benti block have been summarized in the tables below :

Table 9.1 : Geo-mining Characteristics of mining area under Churi block

Sl. No.	Parameters	Upper Bachra Seam (UBS)	Lower Bachra seam (LBS)
1	Area within mine boundary	5.89 sq. km	
2	Mining area considered for CM deployment	2.03 sq. km	
3	No. of borehole intersections within mine boundary	56	
4	Boreholes density (BHs/sq.km)	9.5	
5	General Thickness range (m)	0.13-4.84	1.71-11.24
6	Depth range (m)	26.21 - 91.00	21.59 - 93.65
7	Parting (m)	0.47-20.27	
8	Grade of Coal (inband)	C – E	B – E
9	Present declared grade	Grade ‘B’ Long Flame	
10	Immediate roof	Grey shale, sandy shale, conglomerate, medium to coarse grained sand stone	Carb. Shale / grey shale / fine to medium grained sandstone
11	Immediate floor	Carbonaceous shale, grey shale	Grey shale, intercalations of shale & sandstone, carbonaceous shale, sandy shale
12	Present Status of mining	Manual B&P development being carried out	Development almost completed. Standing on pillars

Table 9.2: Geo-mining Characteristics of mining area under Benti block

Sl. No.	Parameters	Upper section of Top Lower Bachra (UTLB) / Combined Top Lower Bachra (CTLB)	Bottom Lower Bachra (BLB)
1	Area within proposed mine boundary **Existing area** Additional area beyond existing boundary (not considered for this report)	2.1sq. km **1.79sq. km** 0.31sq. km	
2	Mining area considered for CM deployment	0.41 sq. km	
3	No. of borehole intersections within proposed mine boundary	23	
4	Boreholes density (BHs /sq. km)	12.7	
5	General Thickness range (m)	0.45 – 4.15 (UTLB) 1.10 – 5.10 (CTLB)	0.24 - 4.25
6	Depth range (m)	73.10 – 109.19 (UTLB) 74.06 – 106.75 (CTLB)	76.27 – 121.68
7	Parting (m)	0.30 – 5.17 (parting between BLB & CTLB/LTLB)	
8	Grade of Coal (inband)	C – F (UTLB) D – F (CTLB)	A – E
9	Present declared grade	Grade 'B' Long Flame (BLB)	
10	Immediate roof	Medium to coarse grained sandstone, carbonaceous shale grey shale & conglomerate	Coarse to very coarse grained sandstone carbonaceous shale, grey shale & sandy shale
11	Immediate floor	Carbonaceous shale, sandy shale, grey shale, grey wacks, medium to coarse grained sandstone & alternate band of shale & sandstone	Sandy shale, alternate bands of shale & sandstone, carbonaceous shale, grey wacks, coarse to very coarse grained sanstone
12	Present Status of mining	Virgin	Initial B&P development by LHD being done

9.3 SELECTION OF MINING METHOD

Existing Mining Method

The entire property in Churi UG project is almost developed along the floor in both Upper Bachra & Lower Bachra seams except few virgin patches in UBS. The parting thickness over the entire property of Churi UG mine varies from 0.47m to 20.27m.

The property lying between the parting ranges of 0.47m to 9.0m falls under the contiguous condition. Therefore, the entire property of the mine has been classified into two categories i.e. contiguous property & Non-contiguous property.

In the discussions held at CMPDI HQ, it was decided to deploy Continuous Miner in the areas free from workable thickness of UBS and having parting (between UBS and LBS) greater than 9 m. This area lies west to the main dip in the CRO and few panels of eastern section of CRO.

Subsequently, in the review meeting, chaired by CMD, CCL on 16.09.2006 at N.K area office, it was decided to deploy CM in the western section of CRO only. The remaining area i.e. eastern section of CRO & Churi old section shall be worked later on by any other suitable method. It was also advised that CM should first be utilized for development in any virgin patch of the mine to gain experience. Accordingly, the working strategy has been formulated.

PRESENT PROPOSAL

The property lying in the western section of CRO, panel E12 & E13 and part of Benti Block has been considered for deployment of CM. The extractable reserve for CM in the above mentioned area has been estimated 4.214 MT.

FUTURE POTENTIAL FOR CM DEPLOYMENT:

Eastern section of Churi Re-organization and Churi Old section.

Both the seams are almost developed and standing on pillars in the eastern section of CRO and Churi old mine. The extractable reserves of about 8.9 MT may be available for depillaring. The details of the reserve are given in Chapter-IV. But this requires scientific investigation for parting stability to work both the seams independently. The major portion of the above-mentioned part is contiguous in nature.

9.4 SELECTION OF MINING METHOD

9.4.1 Introduction of Mass Production Technology

The various methods of Mass Production Technology are as follows:

(i) <u>Blasting Gallery Method</u>

It is suitable for depillaring of thick coal seams. The optimum thickness of seam for this method is at least 8.0m. The area having seam thickness more than 8.0m in Churi UG is in a very small patch. Rest part of the area is having thickness less than 8m and also has overlying Upper Bachra seam having workable thickness with low parting. To work Upper Bachra seam, a minimum parting of at least 3.0m has to be maintained. To maintain a parting of 3.0m or more, the effective thickness of extraction in Lower Bachra seam will further get reduced. If full thickness is extracted in Lower Bachra Seam, the Upper Bachra Seam will not be extractable. Contiguity of seams exists in a considerable part of the property. The average seam thickness of LBS is around 5.5 m. Even if it is considered for extraction of reduced seam thickness in LBS (<8m), it will not be suitable for the exploitation of both the seams. Analysis of seam structure shows that seam/ section comprises of multiple bands and generally band exists beyond 4.0 m. Therefore, if the extraction will be done by Blasting gallery methods, the grade of the seam will fall down at least by one grade due to presence of multiple bands in upper section of the seam. The project may not be economically viable on reduction

of grade from the declared grade'B'. Hence, this method has not been considered.

(ii) **Longwall Method**

As both the seams are almost developed on Bord & Pillar method and balance virgin reserve is not sufficient for longwall mining. So, this method has not been considered.

(iii) **Working in Double Sections**

Churi -Benti project is planned for the area where upper seam is not workable. Only lower seam (LBS) is workable having average thickness of 5.5m. Double section workings may be considered for the eastern section of CRO. Double section workings may be considered later on.

(iv) **Depillaring with Continuous Miner**

This method has been successfully used in Indian mining conditions. Experience in zero seam of Anjan Hill Mine of SECL and Tandsi Underground mine of WCL is encouraging. The geological conditions of both the mines are almost similar to that of Churi UG. The only difference is that Churi Underground project is developed along the floor of the seam having development height of 2.4m.and bolted galleries. The proposed area for CM deployment consists of Western section of CRO and part of the Benti block. The proposed area for CM deployment shows overlying seam/ section unworkable and is suitable for deployment of CM. The area proposed in Benti is virgin. Development and depillaring of property in Benti will further help in gaining confidence for CM operation. Hence, this method may be adopted for depillaring of developed pillars of western section of Churi Reorganization and for development and depillaring in Benti block.

9.4.2 Reasons for Selecting Continuous Miner

Continuous Miner has been selected for development of virgin property in Benti block and depillaring of developed pillars in Churi UG project. The reasons for selection of this method are as follows:

a) Churi UG has been developed on Bord & Pillar method. It has a flat gradient (2-3 degree) and the av. thickness of seam is 5.5m.
b) Benti block is almost virgin. Seam thickness, gradient and declared grade are favorable for CM deployment.
c) Benti Block has been already approached through W-6 panel.
d) The working panel can be isolated quickly from goaf area as the rate of extraction is faster.
e) The proposed method is flexible and does not require large geologically undisturbed patches as in the case of longwall mining. In Churi UG, the developed workings are almost free from any geological disturbances.

f) This method requires relatively low capital cost for high production and productivity in comparison to longwall method.

g) The rate of extraction of this method is high and the method has been proved successful in Anjan Hill/ NCPH mines and Tandsi mines of SECL and WCL respectively.

9.5 MINE DEVELOPMENT/DEPILLARING STRATEGY

9.5.2 PROPOSED MINE DEVELOPMENT STRATEGY

The broad mining strategy proposed for implementation is briefly described as under :

a. Delineation of Mining Area (for CM)

(i) The mining area having seam thickness >3.0m and unworkable overlying seam/sections and/or free from workable seam/sections shall be worked with Continuous Miner.

Accordingly, virgin area in Bottom Lower Bachra seam/section of Benti block, developed panels of western section of CRO (panels W1 –W15) and E12 & E13 panels of eastern section of CRO have been considered for deployment of Continuous Miner.

(ii) Virgin patches falling within the developed panels in LBS in Churi-Benti underground project are proposed to be developed and depillared by Continuous Miner.

(iii) No working has been proposed in the areas having thickness less than 2.0m. If any doubt arises regarding the thickness of the seam in the proposed area by different suggested method, the same may be verified by putting some extra exploration boreholes. Provision for exploratory boreholes have been made in this report.

IV. The assessment of reserves for continuous miner panels has been done on the basis of CM deployed in some of the mines CIL with operating height limited to 4.6m, thereby leaving some coal in roof in western section of CRO. Efforts should be made while finalizing the technology for implementation to maximize the recovery/extraction.

b. Heightening and Widening of Galleries

Existing galleries of developed panels in western section of CRO except W-16 panel is proposed for heightening. No heightening is proposed in Benti section.

The existing Churi underground mine is developed along the floor in both the seams having height of working 2.4m and width of gallery is 4.2m. The

approved and available Continuous Miner, presently operating in CIL mines, is available for 4.6m heights. So the existing developed workings, wherever feasible, are to be heightened up to 4.6m and it shall be re-supported with roof bolting. The blasted coal will be loaded by Remote controlled LHDs. Provision for the same has been made in this report.

The workings of heightening shall be kept sufficiently ahead of Continuous Miner panels so that working of CM is not affected.

Adjustment of mine boundary.
As colliery authorities communicated us that further extension of boundary up to fault F-13 is not possible and existing boundary in Benti should be considered as the final boundary. So, property beyond the existing boundary in Sector–A of Benti block has not been considered for this report

c. Additional Approach to Benti block by crossing below Damodar River:

It is proposed to first deploy the CM in Benti block for development and depillaring of BLB seam/section. This requires crossing of Damodar River by driving 3 headings from panel W-11, to facilitate the transport of CM package equipment and effective ventilation system of the project. The existing headings for approach to Benti block through W-6 panel has effective x-section of 3.0x2.0m, which may not be adequate for CM transportation

The heightening of existing headings below Damodar River from panel W-6 may not be practically feasible. Hence, it is proposed to re-cross Damodar river from panel W-11 with limited number of headings of adequate x-cross section after taking permission from DGMS.

d. Strategy for remaining area

(i) It is proposed to develop and depillar simultaneously the remaining area of Benti block in two sections having thickness less than 3.0m by Bord & Pillar method with low-height LHDs.

(ii) It is also proposed to develop and depillar simultaneously the remaining property in eastern section of CRO and Churi old in two sections by B & P with LHD or any other suitable method.

e. Sequence of operation for B & P working

- The existing LHD panel will continue in Benti Section for Bord and Pillar development of trunk heading (T-2) up to dip most point.
- After development of trunk heading (T-2) , the development of BLB and UTLB shall be done in those panels where CM cannot be deployed.
- The existing manual development in UBS will continue for development of the remaining virgin reserves in UBS in CRO.
- The manual workings shall be phased out before arrival of CM package.

- ❖ After exhaustion of development and depillaring reserves in Benti block and heightening reserves in western section of CRO, the equipment deployed there may be utilized for depillaring of the developed pillars in remaining panels of eastern section of CRO and Churi old.

f. Sequence of operation for Continuous Miner

- ❖ It is proposed to first deploy the CM in Benti block for development and depillaring of BLB seam/section.
- ❖ After development and depillaring of proposed area by CM in Benti block, the CM is proposed to be deployed in western section of CRO for depillaring of standing pillars in W1-W15, except W6. Depillaring of W6 panel is not proposed till complete exhaustion of reserves in Benti block.
- ❖ Deployment of Continuous Miner may be done in the dip most panels in western section of CRO (leaving W-6 & W-16 panels) and panel E-12 & E-13 in eastern section of CRO. The sequence of deployment of CM may be changed as per the operational requirement at that time of the project to facilitate the safe operation.
- ❖ After exhaustion of reserves in Benti block and western & eastern (panels E-12 & E-13) sections of CRO, the remaining property under Churi block may be depillared simultaneously with LHD in both the seams.

<u>Depillaring of panel W6 is possible only after complete exhaustion of reserves in Benti block.</u>

g. Phasing out of manual system of mining

The B&P development reserves for UBS are nearing exhaustion. Hence, it is proposed to phase out the manual Bord & Pillar district for CM panel.

i. Strategy for coal evacuation

- ➢ The existing belt lay out will be strengthened by replacing the existing drive heads etc.
- ➢ For coal evacuation from Benti, the proposed evacuation route will be through W-6 Panel. The trunk belt layout will be in Inc. no.7, W-6 panel, T1, T2, T3 panel of Benti block. Gate belt layout shall be in panels where CM and LHDs are proposed to be deployed.
- ➢ After exhaustion of reserves for the continuous miner in Benti block, the trunk belt of T1, T2 & T3 panel may be re-utilized for laying beyond W-6 panel to cater need of continuous miner in Churi CRO.
- ➢ The existing belt will cater the need of heightening districts in western section of CRO till the life of CM in Benti block.

i. Re-organization of Ventilation System

It is for re-organization of ventilation system considering the high resistance of the existing mine. It is for opening of trunk roadways of old Churi section for establishing return airway path. Further, the existing approach to Benti block through W-6 panel is proposed to be used as intake airway while the additional approach proposed through W-11 panel is to be used as return airway.

i. Land acquisition for the project

The land acquisition for the project is proposed for one complete life cycle of continuous miner as decided during presentation of Production Augmentation report before the FDs of CCL on 5.12.06.The provision for the same has been made in the report.

9.5.2 Utilization of Existing Resources

(i) Presently, there are 5 nos. of LHDs. For heightening & widening of developed galleries in the western section of CRO, 2 remote controlled LHDs has been proposed. The existing LHDs may be gainfully utilized for development in Benti Block. Low Height LHD will replace the existing LHDs.

(ii) Existing transport layout and mine infrastructure shall be utilized after modification as per Supplier's requirement to suit Continuous Miner technology.

(iii) W-6 panel of LBS in western section of CRO shall be left intact and maintained to facilitate the approach to Benti UG, which is presently being developed after crossing the Damodar River from this panel.

(iv) In addition to above, other existing resources may also be utilized as and when required.

9.5.3 Prior Permission from DGMS

Prior permissions from DGMS is required for the following:

(i) Heightening and widening of existing developed galleries in LBS for deployment of Continuous Miner in CRO.

(ii) Permission for development and depillaring of B&P panel with Continuous Miner.

(iii) Working below any surface features such as nalla, road, water reservoir, fire etc. These surface features include all the features, which may endanger the safety of mine.

(iv) Permission for Continuous Miner deployment shall be sought in consultation with the Supplier.

In addition to above, routine mining operations, which require prior permission from DGMS and other permission for safe working has also to be obtained.

9.5.4 Scientific Study

The technology suggested for depillaring of Lower Bachra seams by continuous miner in CRO is a new concept in CCL. It has been successfully

deployed and worked in SECL and WCL. It requires some scientific study in consultation with the bidder for safe working of the mine.

This scientific study may be conducted to:

(i) Ascertain the hydro-geological regime, since the property proposed for working is bounded between two rivers namely, Saphi and Damodar.

(ii) Ascertain the connectivity of Churi UG working with any potential source of danger, which may endanger the safety of the mine.

(iii) Ascertain the connectivity of fault etc. to rivers or any other water bodies.

(iv) Ascertain the support requirement for depillaring with CM.

In addition to above, any activity, which requires verification and may endanger the safety of the mine, shall further be confirmed by the scientific study as and when it is required.

9.6 MINE DEVELOPMENT ACTIVITIES

9.6.1 Proposed Mine Development Activities:

The following other developmental activities have to be completed:

- Acquisition of surface land (forest/tenancy).
- Rehabilitation of villages & shifting of power line.
- Heightening of existing haulage roadway (Incline no:6) for underground transportation of Continuous Miner package.
- Heightening/widening of existing developed galleries of the working panels in western section of CRO.
- Strengthening of existing coal evacuation system by belt conveyors.
- Drifting required for construction of Underground Strata Bunkers of adequate capacity.
- Arrangement for storage & supply of clean water for Continuous Miner operation.
- Construction of main sump of adequate capacity with arrangement for cleaning.
- Strengthening of existing electrical supply system at surface & underground power supply arrangement for CM package.
- The existing 37 KW endless haulage for material transport is to be replaced by 90 KW.

CHAPTER – X

METHOD OF WORK

10.1 METHOD OF DEVELOPMENT

The whole property of Churi Underground mine has been developed in stages and their present status are as follows:

CHURI BLOCK:

* **Churi Old (Manual Section)** : Developed fully by Conventional B&P with drilling, blasting and manual loading into tubs with rope haulage transport in both the seams. Presently workings are isolated except few headings for return airway.

* **Churi Old (Sealed Off)**: In this part of the property only Lower Bachra seam is worked which is developed and depillared in distant past by Conventional Bord & Pillar method and presently sealed off. It falls beyond the proposed mining area for Churi-Benti UG Project (greater than 150m from proposed boundary). The presence of water / fire cannot be ruled out.

- **Churi Re-Organization(CRO) Section** : Mechanized development of Lower Bachra seam by LHD with LDCC/MDCC and Gate Belt Conveyor transport system whereas Upper Bachra seam is developed manually. Development of LBS in CRO section is almost complete except in patches, which requires conformity of thickness by putting extra exploration boreholes. Upper Bachra Seam is partly developed and partly virgin which has to be developed by the Conventional Bord & Pillar method of mining. Depillaring of seams in CRO and Churi Old has not been done in any of the seams due to non-availability of land.

BENTI BLOCK:

Benti Section: Presently development with LHD is in progress in the Bottom lower Bachra seam/section after crossing the Damodar River through W-6 panel in CRO.

10.1.1 PRESENT MINING METHOD & MINE DEVELOPMENT

The status of the seams being worked is as under:

(i) Upper Bachra (UBS) -B & P Development in progress.
(ii) Lower Bachra (LBS) -Almost fully developed by B&P.
(iii) Bottom Lower Bachra (BLB) -B & P Dev. is in progress in Benti block

In Churi Block, both the seams namely lower Bachra & Upper Bachra are almost fully developed by Bord & Pillar method of mining. Lower Bachra seam

has been fully developed with LHD in CRO & manually in Churi old Section of Churi block. Upper Bachra seam is being developed manually in CRO. The UBS has also been developed manually by B & P method in Churi old mine. Part of the property of Upper Bachra seam in CRO, is still to be developed, which is in progress.

The Churi UG project is developed along the floor of the seam in both the seams. The size of pillar is 25x25m centre-to-centre and size of gallery 4.2x2.4m (in LBS) & 4.2x1.5-2.0m. Depth of working for UBS and LBS varies from 18-91m & 37-93m respectively. The dip of the coal bearing strata generally varies from 1 in 20 to 1 in 40 (2^0-3^0), generally towards northwest.

In Benti Block, major part of the property is virgin. Development of Bottom Lower Bachra seam/section is in progress by LHD along the floor of the seam. The size of pillar is 25x25m centre-to-centre and size of gallery 4.2x2.4m (in BLB).

10.1.2 Trunk Road Development

At present Churi Old and CRO have separate set of trunk roadways in each section along the mine entries. The trunk roadways (in each section) comprises of 4-6 headings. Trunk roadways have been driven up to the adjusted boundary between CRO and Ray-Bachra underground mine in Lower Bachra Seam.

Trunk headings development in Churi old mine has been done up to 47^{th} level. The present length along the trunk roadway up to extreme point in CRO is more than 2.5km whereas in Churi Old mine is about one km. The method of trunk roadway development in CRO is mechanized Bord & Pillar with LHD whereas in Churi old mine it is manual Bord and Pillar. At present drivage of trunk roadway is complete in both the seams and sections of workings (CRO & Churi old). Benti block has been approached through W-6 panel in CRO with 3 headings. Trunk heading development is in progress with LHD in Bottom Lower Bachra seam/section.

10.1.3 Panel Development and Extraction

The panel layout in CRO and Churi Old consists of 5-6 headings, except few, in both the seams/sections. The panels have gallery size of 4.2x2.4m & size of pillar is 25x25m center-to-center. In few cases, the size of pillar may be of lesser dimension. The seam thickness of Upper Bachra Seam varies from 1.2m to 4.0m whereas the seam thickness of Lower Bachra seam varies up to 11.24m (visual thickness) as in NNKC-48. The panels in Churi block are generally developed up to the boundary of the mine but in some cases it has not been developed up to the boundary due to thickness problem or practical operational difficulties at that time. The panels are developed generally with 2.0-2.4m height of extraction leaving 0.5-0.6m solid coal in roof against immediate shaly roof.

10.1.4 Existing Transport

Presently the mode of transport of coal from face to surface is as follows :

(a) SDL/LHD feeds coal to face conveyor/medium duty chain conveyor and then to Gate Belt Conveyor and brought to surface by trunk belt conveyor and then fed to CHP at Ray Siding.

(b) Material transport from surface to underground is through incline No.6 by direct rope haulage and endless haulages.

(c) Coal from manual district is directly loaded manually onto face conveyors which feeds to the gate belt conveyor and finally to trunk belt conveyor for transport up to surface.

10.1.5 Existing Ventilation

The mine is categorized as Degree-I in gassiness. The ventilation system comprises of Incline 6 & 7 as intake and air -shaft and Incline 1A as the return for the Upper Bachra, Lower Bachra and Bottom Lower Bachra seam/section. One PV-200 type Fan is presently installed to serve the ventilation requirement of the mine.

10.1.6 Existing Support System

The existing practices of roof support in the workings of Churi & Benti blocks are roof bolts with W-strap as per approved SSR from DGMS. It is also supplemented with conventional support as and when required.

10.1.7 Existing Production:

The present production from Churi UG is from Upper Bachra in CRO and from Bottom Lower Bachra in Benti Section. The mine is presently producing around 0.165MTY with mechanized as well as manual districts.

10.2 PROPOSED METHOD OF WORK

The suggested method of extraction for the Churi-Benti project comprises of:

- ❖ Bord & Pillar development & depillaring with Continuous Miner
- ❖ Bord & Pillar development & depillaring with low height LHD
- ❖ Heightening of existing galleries with remote controlled LHD.

10.2.1 BORD & PILLAR DEVELOPMENT & DEPILLARING WITH CONTINUOUS MINER

The Continuous Miner will be deployed for development and depillaring of virgin reserves in Benti block (Panel B-5 to B-9 & T-3). Subsequently, it will be shifted in Churi Block for depillaring of panels W-1 to W-15 in the western section of CRO and panel E12 & E13 of eastern section of CRO. The virgin patches within the panel are also proposed to be developed and depillared by Continuous Miner.

A. Geo-mining Parameters: The geo-mining parameters of the area proposed for deployment of Continuous Miner is briefly stated below:

Table 10.1 : Geo-mining Characteristics of mining area under Churi block

Sl. No.	Parameters	Upper Bachra Seam (UBS)	Lower Bachra seam (LBS)
1	Area within mine boundary	5.89 sq. km	
2	Mining area considered for CM deployment	2.03 sq. km	
3	No. of borehole intersections within mine boundary	56	
4	Boreholes density (BHs/sq.km)	9.5	
5	General Thickness range (m)	0.13-4.84	1.71-11.24
6	Depth range (m)	26.21 - 91.00	21.59 - 93.65
7	Parting (m)	0.47-20.27	
8	Grade of Coal (inband)	C – E	B – E
9	Present declared grade	Grade 'B' Long Flame	
10	Immediate roof	Grey shale, sandy shale, conglomerate, medium to coarse grained sand stone	Carb. Shale / grey shale / fine to medium grained sandstone
11	Immediate floor	Carbonaceous shale, grey shale	Grey shale, intercalations of shale & sandstone, carbonaceous shale, sandy shale
12	R.M.R	47.3	41.72-61.0

10.2: Geo-mining Characteristics of mining area under Benti block

Sl. No.	**Parameters**	**Upper section of Top Lower Bachra (UTLB) / Combined Top Lower Bachra (CTLB)**	Bottom Lower Bachra seam (BLB)
1	Area within proposed mine boundary Existing area Additional area	2.1sq. km 1.79sq. km 0.31sq. km	
2	Mining area considered for CM deployment	**0.41 sq. km**	
3	No. of borehole intersections within proposed mine boundary	23	
4	Boreholes density (BHs /sq. km)	12.7	
5	General Thickness range (m)	0.45 – 4.15 (UTLB) 1.10 – 5.10 (CTLB)	0.24 - 4.25
6	Depth range (m)	73.10 – 109.19 (UTLB) 74.06 – 106.75 (CTLB)	76.27 – 121.68
7	Parting (m)	0.30 – 5.17 (parting between BLB & CTLB/LTLB)	
8	Grade of Coal (inband)	C – F (UTLB) D – F (CTLB)	A – E
9	Present declared grade	Grade 'B' Long Flame (BLB)	
10	Immediate roof	Medium to coarse grained sandstone, carbonaceous shale grey shale & conglomerate	Coarse to very coarse grained sandstone carbonaceous shale, grey shale & sandy shale
11	Immediate floor	Carbonaceous shale, sandy shale, grey shale, grey wacks, medium to coarse grained sandstone & alternate band of shale & sandstone	Sandy shale, alternate bands of shale & sandstone, carbonaceous shale, grey wacks, coarse to very coarse grained sanstone
12	Present Status of mining	Virgin	Initial B&P development by LHD being done

B. Mining Parameters for CM Panel

No. of Headings	-	4-8
Gallery width	-	4.2m
Development height	-	2.4m(Already developed)
	-	4.6m(where heightening proposed)
Pillar Extraction height	-	2.7m – 4.6m
Av. Pillar size	-	25 x 25m center to center in UBS & LBS. (Size varies within the panels)
Panel width	-	79.2m – 179.2m (In Churi Block)
		125m – 150m (In Benti Block)
Panel length	-	Up to 1000m in both blocks
Cut out distance for CM	-	15m in split
(assumed)	-	10m in Slices
Cutting width	-	3.3m

C. <u>Panel Development</u>

CHURI BLOCK

Most of the panels in Churi block are almost developed. Panel formation has been done by considering existing panel barriers, which shows panels of 4 to 8 headings. The av. pillar size is 25m x 25m centre to centre with a gallery width of 4.2m. The virgin patches falling within the panels are proposed to be developed and depillared by CM itself.

BENTI BLOCK

Major part of the Benti block is virgin. Five headings panel has been proposed for development and depillaring. The proposed pillar size is 25m x 25m centre to centre with a gallery width of 4.2m or 4.8 m. The proposed development height for Low Height LHD panels is 2.4 m or actual seam thickness after leaving 0.3m to 0.50m coal in roof and 4.6m for CM development district. Proposed width of galleries for CM development panels are 4.8m.

Development height and Horizon - The existing average height of development in Upper Bachra, Lower Bachra, Bottom Lower Bachra and Upper Section of Top Lower Bachra seam/section proposed to 2.4m or seam thickness leaving 0.3 to 0.5m coal in the roof to provide additional support to the immediate shaly roof. The seam has been proposed to develop along the floor of the seam.

LOW HEIGHT LHD PANEL

Pillar Size	: 25m x 25m (center to center)
Gallery Size	: 4.2m
Development Ht	: 2.4m or actual seam thickness after leaving 0.3m to 0.5m coal in roof
Depillaring Ht	: Actual seam thickness

CONTINUOUS MINER PANEL b

Pillar Size	: 25m x 25m (center to center)
Gallery Size	: 4.8m
Development Ht	: 4.6 m or actual seam thickness after leaving 0.3m to 0.5m coal in roof
Depillaring Ht	: 4.6m or Actual seam thickness

D. <u>Method of Pillar Extraction</u>

Method of extraction would be depillaring with caving. There are many methods of pillar extraction by continuous miner like:

- ❖ NAVID METHOD
- ❖ CHRISMAS TREE METHOD
- ❖ POCKET AND FENDER METHOD and
- ❖ Other methods

The sketches of the above methods are enclosed in this chapter. However the method of work will be finalized after scientific study for the project .Out of the above-mentioned methods POCKET AND FENDER METHOD has been successfully tried in some other mines of CIL .The brief description of the above method is as under.

The method of extraction of pillars comprises of the following:

- Splitting and Slicing of the pillar.
- Line of extraction.
- Extraction height and horizon.
- Manner of extraction.
- Sequence of operation in Pillar extraction.

Splitting and Slicing: The existing developed pillar shall be splitted into two parts by driving a roadway of 6.6m width parallel to pre developed rises and perpendicular to the face line at the centre of pillar. The height of the splitted gallery may be 4.6m.

The existing size of pillar is 25m x 25m in which two slices in each fender may be possible. The width of one slice may be 6.6m and the width of other slice may be 3.3m. The height of extraction in slices may be 4.6m.

As the method suggested for depillaring is totally new for CCL, so the width and height of split and slices may change depending upon the method of extraction. The above width & height of splits and slices are proposed as per the method being practiced in SECL.

Line of Extraction: The pillars in a depillaring panel will be extracted while retreating from boundary, maintaining a straight line of extraction. The straight-line method with fully mechanized equipment has several advantages over the diagonal line of extraction as it reduces both the tramming distance and cable length.

Extraction Height and Horizon: The extraction height in pillar shall be up to 4.6m and it shall be worked along the floor of the seam.

Manner of Extraction: It is proposed to introduce one fully mechanized Bord & Pillar district using Continuous Miner and Ancillary equipments in Churi - Benti Project for development and depillaring of Lower Bachra and Bottom Lower Bachra seam/section. The Continuous Miner will develop virgin property in Benti block (Thickness >3m) with pillar size 25mx25m and gallery size 4.8mx4.6m. The developed pillars of the Churi-Benti Project will be depillared by the CM up to 4.6m height or actual seam thickness.

The manner of extraction would be splitting and slicing, which is common in the mines of CIL. The mine management and the work force are familiar with the method and the subsequent strata behaviour. The pillars in a depillaring panel will be extracted while retreating from boundary, maintaining a straight line of extraction. There may be several methods/layout for depillaring in a panel. A tentative layout for depillaring by C.M. is indicated in sketches 1 to 4. Keeping in view the extraction system/layout being followed in other mines of CIL with CM, one of the suggested method may be “Pocket and Fender Method”. In this method, the sequence of extraction may be as under:

A split roadway of suitable width is to be developed parallel to pre-developed rises and perpendicular to the face line at the center of the pillar. It will form two fenders and the fenders so formed shall be extracted by making inclined pockets into that fender at an angle of 60^0 to the horizontal. These inclined pockets are made at a particular distance from the side of the pillar to form a snook that will provide temporary stability to the workings and later on it will get crushed and helps in regular caving of the roof. While making fenders, the roadway shall be supported with bolts in a manner specified in the approved systematic support plan.

The coal cut by the Continuous Miner shall be collected by the gathering arm of the machine and discharged into Shuttle Cars. The shuttle car feeds the coal by a Chain Conveyor installed in its body, to a self-propelled Feeder Breaker. Coal is then discharged to the surface through a series of gate & trunk belt conveyors.

It is proposed to shift the surface features like villages, roads, power trestles, private/company quarters, sub-station etc.

Before going for development/depillaring of panels with CM in Churi-Benti Project, prior permission under Reg. 100 of CMR, 1957 have to be obtained. Similarly, various public works like road, high tension line etc. passes over the lease hold property of Churi Block. So before going for depillaring, the permission under regulation 105 of CMR, 1957 would also have to be obtained and should be complied effectively.

Sequence of Operation : The sequence of operation of Continuous Miner for "Pocket and Fender Method" has been shown in Sketch-2. The details of sequence of operation of the seams shall be as below :

- Cut 1 is driven in a split up to a maximum distance of 15m or as permitted by DGMS.
- The Continuous Miner is trammed to Cut-2 in second split of a pillar and commences cutting while the Roof Bolter Machine supports Cut-1.
- Once the CM completes Cut-2 and Roof bolting is completed in Cut-1, CM commences Cut-3 (in first split) operation.
- When Cut-3 in 1st split shall be in progress, the roof bolter shall support the Cut-2.
- As the Cut-3 is completed and roof bolter supports Cut-2, CM will again be trammed to 2nd split for Cut.4.
- When Cut-4 in 2nd split shall be in progress, the roof bolter shall support the Cut-3.
- When Cut-4 is complete and Cut-3 is supported by the roof bolter, then CM shall be trammed to first split to take the slice-5 in the fender and Cut-4 shall be supported by the roof bolter.
- This process shall be repeated as shown in sketch.

In addition to above, other method of extraction like Navid method, Christmas tree method are also available. Final method of extraction may be finalized after detailed scientific study for deployment of CM.

E. Support System

Support system shall be of roof bolting supplemented by conventional support as and when required.

Support System during panel development : At the time of panel development, the roadways are proposed to be supported with roof bolts. The roof bolting may be quick setting resin roof bolt or fixed column-grouted bolt using cement, sand mortar. Development galleries will be supported by 2-3 rows of roof bolts 1.8m in length. The distance between two adjacent rows of bolt and between two adjacent bolts in a row should be around 1.2m. The above specification may change depending upon the results of the scientific study. In addition to above, the provisions of Reg. 108 of CMR, 1957 together with related circulars are to be complied. The support system for the development galleries shall be as per the approved Systemic Support Rules.

Support System in Split and Slice : The tentative support system in split galleries may be with quick setting type resin bolts at an interval of 1.2m between the rows and between bolts.

Slices may not be required to be supported as it is to be extracted with remote operated Continuous Miner.

Support of Goaf Edges :

(i) All the goaf edges shall be supported by rows of quick setting type resin bolts at 0.80m interval in between the two bolts and between two rows and 0.5m from either sides of the pillar. The length of such bolts shall not be less than 1.8m or 2.4m. Such goaf edge support shall be provided in the split/original gallery, as the case may be, at the start of the slice cut by the Continuous Miner.

(ii) Each such goaf edge support shall have three parallel rows of bolts across the original/split gallery.

(iii) At least two wooden props shall be installed near the goaf edge on the rib side as indicator type.

Support System at other places: The trunk roadways and other working places shall be adequately supported and secured by roof bolting system or other suitable means of support.

Support System for Geologically disturbed area : All dykes, visible slips and breaks in roof shall be supported by cogs at an interval of 2.4m on either sides of such disturbances and with cross-bars across them at an interval of not exceeding 1.2m.

Smaller geological disturbances, wherever feasible, shall be kept supported by roof bolts on both sides of the disturbances along with W-strap as suitable intervals. The length of such roof bolts shall be appropriate to the extent of the disturbances but in no case less than 1.8m. The spacing between the bolts shall be approximately chosen on the extent of the geological disturbance but in no case shall be more than 1.0m.

Additional supports shall be erected as and when required.

Monitoring of Roof Bolts : All the recommendations of DGMS Technical Circular No.3 of 1996 and other applicable regulations and circulars regarding roof bolting/floor bolting shall be effectively complied whenever applicable in this mine for safe working.

Support Material : The specifications of the support materials are as follows:

Roof Bolts : (Tor steel/MS IS:1786-1985/IS:226-1975/IS:1570)

Type : Steel/Mild steel
Lenth of rod - 1.8m/2.4m
Dia of rod - 20-22mm
Length of thread - 125-150mm

Bearing Plate (IS:226-1975)
Material = MS
Thickness = 6mm

Size = 150 x 150 mm^2
Nut **:** (IS: 1363, Part-3, 1984)
Shape = Hexagonal
Height = 20mm
Cement Capsule
Length = Not exceeding 400mm
Dia = 30-32mm
Type = Quick setting (the grout should provide a minimum anchorage of 3 Te after 30 min and 5 Te after two hours of setting.

While doing the bolting operation in any roadways/workings of the mine, the provisions of CMR 1957 and various DGMS Circular (Viz Cir Tech 3/1996) shall be effectively complied for safe working of the mine.

F. Coal Evacuation From CM Panel

The Continuous Miner would cut and simultaneously load the coal by its inbuilt stage conveyor into the shuttle car directly. The loaded shuttle car would discharge coal on to Feeder Breaker. Crushed (-100mm size) coal will be uniformly discharged on to gate belt conveyor, which is installed in the Central gallery of the panel. This gate belt conveyor will in turn discharge the coal on the trunk belt conveyor. The gate belt conveyor would be installed in the gallery so that loading distance and cable length on each side of the loading point is minimal. The panel width of the CM panel varies from 79.2m to 179.2m and length of the panel is up to 1000m. 2x200Te strata bunker is proposed in the Benti block in T-2 panel and 3x200Te strata bunker is proposed in the Churi block in the trunk heading near to W-6 panel.

G. Material Transport

The material transport in the panel is proposed to be carried out by endless and direct haulages.

H. Ventilation System in Panel

The CM panel in Churi block comprises of 4 to 8 Headings in a panel where as in Benti block 5 heading panels are proposed. In a 5 heading CM panel, three galleries on the dip side of the panel would preferably be used as intake airway while two galleries on the rise side is to be used as return airways. In case of other panels, the manager of the mine may accordingly decide the no. of galleries for intake and return airway for adequate ventilation of the panel. In no condition, the ventilation of the panel should be neglected.

The faces would be ventilated by auxiliary fan using ventilation ducting. Other measures, which may improve the ventilation of the mine, may also be adopted as and when required.

I. FACE EQUIPMENT OF CONTINUOUS MINER PANEL

It is proposed that CM panel may have the following list of equipments:

1.	Continuous Miner (Suitable to prevailing geo-mining condition)	-	One
2.	Shuttle Car	-	Three*
3.	Roof Bolter	-	One
4.	Portable Bolter	-	One
5.	Load Haul Dumper	-	One
6.	Feeder Breaker	-	One
7.	Set of Electrical Distribution equipment	-	One
8.	Communication equipment	-	One

* The no of shuttle cars has been taken as per suggestions made vide letter no. SECL:BSP: DT(O):26/82 dated 28.02.07 of DT(O), SECL addressed to Dir.(T), CIL.

The details of the equipment as proposed is as below :

Continuous Miner : One suitable Continuous Miner suited to prevailing condition is proposed. The machine is equipped with radio cord remote control, dust scrubber and methane monitor. It cuts and loads the coal in single operation.

Operational Parameters of Continuous Miner (As per CM working in SECL)

Cutting head width	-	3.3m
Cutting height	-	2.2m(Min.) to 4.6m (Max.)
Length of the machine	-	11.02m
Gallery width required	-	4.8m
Length of Cut in a single pose	-	15m

Actual specification of machine may change depending upon the method of extraction.

Shuttle Car : It transports the extracted coal from the Continuous Miner loading conveyor to a self propelled stammer Feeder Breaker. From the feeder breaker, coal is discharged to the gate belt and gate belt fed to the trunk belt conveyor. The rated load capacity of low to medium capacity shuttle car varies from 9-15 Te.

Roof Bolter : Since the development height of the panel is 2.4m, so the roof bolter which can successfully work in a gallery height of 2.2m-4.6m is proposed. The size and other specification of bolting material shall be of approved type.

Load Haul Dumper (LHD): LHD may either be diesel or battery operated. It has the following operations to perform in the Continuous Miner district.

(a) Cleaning the spillage coal from Shuttle Car.

(b) Cleaning and sweeping up the heading of Continuous Miner after it has completed cutting and thereby reducing time.
(c) Transport materials and consumable goods.
(d) Moving switchgear and transformer and also assisting installation of main HT feeder cables.

Feeder Breaker: It receives the coal from Shuttle Cars and after crushing it to the desired size of (-) 100mm, feeds it to the conveyor at consistent controlled rate. It is mounted on tracks. The Feeder Breaker is having hopper sufficient to hold a complete shuttle car.

J. Production Proposed

The production proposed from the Continuous Miner panel is 0.50 MTY.

All the mining operations in Continuous Miner panel should be in accordance with the various regulations of CMR 1957 and various circulars issued by DGMS for safe working of the mine.

10.2.2 HEIGHTENING OF EXISTING GALLERIES WITH REMOTE CONTROLLED LHD

The gallery width required for CM is 4.8m and it can cut coal up to a height of 4.6m but the existing workings have the width and height of galleries as 2.4m and 4.2m, so heightening and widening of gallery may be required. Widening of gallery will be done as and where required.

I. Proposal for Heightening of Galleries

There would be separate remote controlled LHD panel for heightening of existing galleries in the western section of CRO (W-1 to W-15 panels). Other than these panels, no heightening of panels is proposed in this report. The heightening of developed galleries is proposed up to 4.6m only leaving at least 0.3-0.5m in the roof.

II. Proposal for Widening of Galleries

Proposal for widening in those galleries is envisaged which shall be required for the movement of Continuous Miner. All the galleries of the C.M. panels may not be required for widening. The gallery through which Continuous Miner (i.e. haulage roadway) is to be driven down would be widened up to 4.8m for lowering of the machine (CM) into the panel. Widening of the galleries shall be applicable as per the requirement of CM package.

A. Layout of Panels

The mine is almost developed by Bord & Pillar method of mining in both the seams along the floor of the seam by LHD or manually in a panel form. So, the existing panel lay out or lay out proposed in the working plan shall be taken as the lay out of the panel for heightening of galleries.

B. Manner of Heightening

Heightening of galleries may be done by conventional roof blasting up to 4.6m height. Blasted coal will be loaded by remote controlled LHD.

E. Manner of Widening

Manner of widening of galleries may be by side blasting with permitted explosives only and loading of blasted coal by LHD onto Chain Conveyor.

F. Face Equipment

The coal obtained due to heightening/ widening of coal shall be loaded by remote controlled LHD. Two numbers of remote controlled LHDs shall be deployed in Heightening panel.

G. Coal Evacuation from Panel

The coal shall be loaded on to Chain Conveyor by remote controlled LHD. Chain Conveyor will feed coal to gate belt conveyor for coal evacuation from panels.

H. Ventilation of Panels

Heightening panels comprise of 4 to 8 headings, which is already developed. In five headings panel, three headings in the dip side of the panel shall act as the intake air and two headings on the rise side shall act as the return airway of the panels. In other cases, the manager of the mine may arrange the intake and return accordingly for safe working.

I. Face Ventilation

The Auxiliary Fan with ducting shall do face Ventilation.

H. Support System

The RMR of LBS varies between 41.7-61. It indicates that the immediate roof of LBS is of fair category.

As remote controlled LHD is envisaged for loading of coal in the panels, it is necessary that supports should be so designed that clear space is available for movement of the machineries. At present, the panel is developed up to 2.4m and is supported as per the approved SSR. Now it is to be heightened up to 4.6m. So, fresh SSR should be prepared and approved by the DGMS and should be effectively complied.

The bolt density for three types of roof classified on the basis of RMR value as recommended is as below:

Poor roof	-	1.2 to 1.5 bolts/m^2
Fair roof	-	1.0 bolt/sq.m.
Good roof	-	0.7 bolt/m^2

As per the RMR value, the roof of UBS and LBS falls in fair category of roof. So, the density of roof bolts in the Heightening panels should be 1.0 bolt/sq.m.

The bolt angle should generally be normal to the bedding plane in the roadways/galleries. This also holds good for other panels of the mine.
Support materials should be as per DGMS Cir, no. 3/1996.

Support of Heightened Gallery (Within 9m of face) :
Area within 9m of the working face should be treated as the green roof. The green roof support should be done as per Reg. 108 of CMR, 1957.

Support of Heightened Gallery:

* After heightening of galleries up to 4.6m, the roof shall be re-supported with roof bolts by roof bolter.
* Four bolts in a row shall be installed. The spacing between the bolts in a row and between the rows shall be 1.2m.
* Some additional roof bolts shall be installed to increase the density of roof bolts, as and when required.
* The spacing between the sides of the pillar and the bolts in a row shall be 0.6m on the both sides of the pillar corner.
* Bolts shall not be less than 1.8m/2.4m in length and 22mm in diameter.

Support at Junction: The bolt density should be at least 25% more than the bolt density of heightened gallery.

Support at Disturbed Places: In addition to the roof bolts, the geological disturbed area of the Heightening panel shall be supported by cross-bars, cogs W-straps and other suitable means as and when required.

Supports on Loose Floor: Props shall be set on solid floor and not on loose packing material. The support shall be kept tight against the roof. Wherever the props are to be set on sand a flat base piece not less than 5 cm thick, 25 cm wide and 75 cm long shall be used.

For legged steel cogs of 1.2m x 1.2m piece shall be set on solid floor and not on loose material. They shall be kept tight with timber sleepers against the roof to ensure maximum contact between the timber and the roof. The provisions for support on loose floor shall also hold for other working panels of the mine.

Support Material: The support material shall be as proposed in DGMS Gr Tech. 3/1996.

I. Production Proposed

The production proposed from Heightening panel is 0.15 MT i.e. 500 TPD.

Before going for heightening or widening of galleries in a panel in any of the seams or section, prior permission from DGMS should be obtained for that. All the mining operations in the Heightening panel should be in accordance with the various regulations of CMR 1957 and circulars issued by DGMS for safe working of the mine.

10.2.3 B & P DEVELOPMENT & DEPILLARING WITH LOW HEIGHT LHD

Bord & Pillar development & depillaring is proposed in Upper Section of Top Lower Bachra seam and Bottom Lower Bachra seam/section in Benti block. The proposed pillar size in both the seam/section is 25m x 25m, in both the seams/sections, width of gallery is 4.2m and height of gallery is 2.4m or the actual seam thickness leaving 0.3-0.5m of coal in the roof. The development is proposed in the virgin area of Upper section of Top Lower Bachra along the roof of the seam & Bottom Lower Bachra seams along the floor of the seam/section. It is proposed to leave at least 0.3-0.5m of coal in the roof, since the immediate roof of both the UTLB & BLB comprises of carb. shale, grey shale, grey wake, alternating bands of shale and sandstone. The reason to develop the UTLB along the roof is to maintain the parting thickness of 3.0m between the seams/sections for safe working.

A. Proposal for B & P Development / Depillaring panels with low height LHD

Bottom Lower Bachra Seam (BLB)

Panels B-1 to B-4, B-13 to B-15, T-1 to T-2 and B-18-B-19.

Upper Section of Top Lower Bachra Seam (UTLB)

Panels B-1 to B-4, and B-13 to B-16.

B. Layout of Panels

Since both the sections are contiguous, so layout of panels for UTLB & BLB is proposed in such a way that pillars in both the sections are vertically coincident. Generally, five headings panels for both the sections have been proposed for the development of virgin property in Benti block. Vertical coincident of pillars should be checked by putting boreholes at the alternate junctions of the development galleries from either of the workings.

C. Method of work

Development: Bord and Pillar method with Conventional Solid blasting. Low height LHD loading on to face conveyor.

Depillaring: Conventional Bord & Pillar method with caving in both the seams/sections.(simultaneous)

D. Manner of Extraction

Development: The virgin property of BLB seam would be developed along the floor of the seam leaving at least 0.3-0.5m of coal in the roof. Similarly,

UTLB seam would be developed along the roof leaving at least 0.3-0.5m of coal in the roof. The details regarding the development of BLB & UTLB seam s/sections are as below :

Size of Pillar = 25m x 25m (Centre to centre)
Width of gallery = 4.2m
Height of gallery = 2.4m or actual seam thickness

The parting between two sections should be maintained at least 3.0m.

Depillaring: Simultaneous Bord & Pillar depillaring with Caving in UTLB & BLB has been envisaged. The developed Pillars would be extracted by splitting and slicing. Each pillar would be splitted into two equal parts by one dip split of 4.2m wide. There after level slices of 4.2m wide would be driven leaving 1.8 m (minimum) rib against the goaf so that the area of roof exposure at any one working place should not exceed 60 m^2 at any time. On retreat, the ribs would be reduced judiciously. Driving of a slice would commence only when the extraction in the immediate in bye slice is completed and goaf edge support as per approved SSR is erected. Only one slice in a pillar would be driven at a time and extraction of a half of a pillar shall not be commenced until extraction of the adjoining in bye half of the pillar has been completed.

Diagonal line of extraction would be maintained. The order of slicing should be strictly followed to maintain the stipulated area of exposure of 60m^2 (max.). In no condition, except with the permission of DGMS, the area of exposure should be more than 60m^2.

E. Coal Evacuation from Panel

It is proposed that the blasted coal shall be loaded by the low height LHD on to chain conveyors and chain conveyor fed it to the gate belt conveyor for transportation of coal from panel. This system will be applicable for development and depillaring panels of both UTLB & BLB. Since the working is contiguous, simultaneous working is to be done in both the seams/sections.

F. Panel Ventilation

Two or three headings in the dip side of panel (depending upon the size of panel) shall be used as intake airway and two or three headings on the rise side of the panel shall be used as the return airway of the panel. The face ventilation of the panels in both the conditions while development and depillaring shall be done with the auxiliary fans as and when required. This will be applicable for both the UTLB & BLB seams/sections.

G. Face Equipment and Transport

Electric coal drill, Auxiliary fan, face pump may be the face equipment in UTLB & BLB workings. Blasted coal would be loaded by low height LHD on to chain conveyor and chain conveyor will fed to gate belt conveyor.

H. Support System

The immediate roof of Lower Bachra seam in the adjoining Churi block is of fair category. The RMR study for Benti has not been done, so RMR of LBS in Churi block has been taken for the support design for UTLB & BLB in Benti block. The support system for the low height LHD working comprises of :

(a) Support for development.
(b) Support for depillaring.

Support for Development

There should be a systematic support plan for development workings duly approved by DGMS in the mine. This shall be effectively complied for all workings of Churi –Benti Project:

(i) Support of working face within 9m

All working faces shall be supported by quick setting type full column grouted bolts. The first row of support shall be at a distance of 1.8m from the face. The spacing between the rows may be 1.2m. The means of support for the working faces shall be roof bolts supplemented with conventional support as and when required.

(ii) Support of Tramming level

Where required tramming levels shall be supported by cross bars on safari clamps or in duggis at an interval of 1.2m. In general, roof bolting supplemented with conventional support as and when required shall support it. Chocks/cogs shall be set as and when required.

(iii) Support at Junction

The density of roof bolts at the junction of galleries should be 25% more than those general galleries. Cross bars, cogs, chocks or other suitable type of conventional support may also be erected as and when required.

(iv) Support of Travelling Roadway

In addition to roof bolts, traveling roadway shall be supported by rope stitching or steel girders or cross bars or vertical props or chocks/cogs at suitable intervals.

(v) Support of Airways

In addition to roof bolts, airways may be supported by rope stitching or steel girders or cross-bars or vertical props or chocks/cogs.

(vi) Support of geologically disturbed places

Geological disturbed places shall be supported by cross-bars or vertical props or steel bolts or rope stitching or with chocks/cogs in addition to roof bolts as and when required.

Support for Depillaring

While going for depillaring, the systematic support plan should be prepared for depillaring districts/panels and get approved by the DGMS. It should be complied effectively for safe working of the mine. The envisaged support for depillaring panels is as below:

(i) <u>Support within two pillars of extraction</u>

The support within two pillars length of extraction would be done by roof bolts at 1.2m spacing in a row and the distance between two rows of such bolts would be 1.2m. It would be supplemented with the conventional support as and when required.

(ii) Split galleries shall be supported with roof bolts at an interval of 1.2m between the rows and 1.2m between the bolts. Additional roof bolts may also be provided to increase the density of roof bolts as and when required. It shall also be supplemented with conventional support as and when required for safe working of the time.

(iii) Junction support

Junction will be supported by roof bolts with w-strap chocks/cogs may also be erected as and when required.

(iv) Slice support

Goaf side slice will be supported by cogs at 1.5m interval and rib side by roof bolts with w-strap.

(v) Goaf Edge Support

Goaf edges will be supported by cogs placed skin to skin with corner props.

Support Material

The specification of support material regarding roof bolts shall be in accordance with the Cir. Tech 3/1996 of DGMS circulars.

Regarding the conventional support, the specification support material should be as per the provisions of CMR 1957 and DGMS circulars.

Production Proposed

Production from the B & P development/depillaring with low height LHD is proposed to be 0.10MTY.

10.3 PRODUCTION PARAMETERS

The production parameters as envisaged in the Churi-Benti Project Report is as under:

CM Panel	-	0.50 MTY
Low height LHD panel	-	0.16MTY

Heightening Panel	-	0.15 MTY
TOTAL	-	**0.81 MTY**

10.3 SUBSIDENCE

The Project Report for Churi-Benti Project covers area of Churi Re-organization (CRO) and Benti block. Total area under this project comes to about 7.68sq. km. For deployment of Continuous Miner, the proposed mining area is 2.44sq. km. The proposed method of depillaring with CM is by caving.. Earlier, a subsidence study was carried out for the Churi UG mine. However, the part of mining area for CM under Benti block was not considered. Hence, It is proposed to undertake fresh subsidence study for assessment of damage to surface for Churi-Benti project.

10.7 EXPLOSIVES & MAGAZINE

The explosives will be used only for B&P districts with LHDs including remote controlled LHDs panel. The powder factor presently obtained is around 2.0tonne/kg of explosive. Efforts should be made to improve powder factor to around 2.5tonne/kg. Blasting study may be undertaken for suitable blasting pattern.

An explosive magazine of 400 kg explosives and 2000 detonators already exists in the mine. The magazine would be used for the project. It should be maintained in accordance with Indian Explosive Act & rules there under. The adequate arrangement should be made for the safety of the magazine.

10.8 SCHEDULE OF EQUIPMENT PROCUREMENT

The year-wise phasing of P&M is given in appendix-A.3.

10.9 GENERAL PRECAUTION WHILE DEPILLARING

a. The extraction or reduction of pillars should be conducted in such a way as to avoid the extension of collapse or subsidence of the goaf over unextracted pillars.
b. During the extraction of pillars, no splitting or reduction of pillars or heightening of galleries should be carried out for a distance greater than the length of two pillars ahead of the pillar under extraction. While starting of pillar extraction, it may be extended up to 4 pillars only.
c. Attempts should be made to allow the roof to cave regularly so as to avoid the presence of large area uncollapsed. So that danger from air blast or weighting on pillars could be avoided. If needed, suitable means should be adopted to bring down the goaf at regular interval. Adequate number of convergence recorder / load cell should be installed to predict the roof fall.
d. Rib of not less than 1.8 m should not be left against the adjacent goaf. Some times, this may also be required in split galleries. So if needed, it must be left in split galleries also and may be judiciously reduced on

retreat after setting strong breaker line of cogs or other means of artificial support adjacent to it.

e. Adequate precautions against 'Air Blast' as per Cir. Tech.2/1988 should be taken.
f. The area of exposure at any depillaring slice should not be more than 60m^2 at any time.
g. In case of contiguous working, where the depillaring with caving is proposed, the extraction in both the seams or sections should be in such a manner that the line of extraction in both the seams/sections should be vertically coincident up to each other and in case of any trouble in one section, persons from both the sections should be immediately withdrawn.
h. In case of contiguous workings, the pillars in one seam/ section, should be vertically above and below the pillars in the other seam or section unless the strata are inclined at an angle of more than 30^0 from horizontal. The partings between two seams/sections should not be less than 3.0m at any place.
i. While working in any of the seam/sections, use of CO detector, methanometer and other safety apparatus must be ensured for safe working of the mine. The provision for safety apparatus has been made in this report. Telemonitoring system may also be used at the mine.
j. Water spraying arrangement to suppress the dust in continuous miner is an integral part of the machine, so availability of clean water to CM must be ensured throughout the shift.
k. The total no. of working panels may be three, and the production envisaged is 0.81 MTY. So, the ventilation of the mine should be as per statute and adequacy of ventilation in each panel should ensured. To check the adequacy of ventilation, ventilation survey for the panels/ mine should be conducted by a scientific body. The provision for ventilation survey has been made in this report.
l. As per the geological plan of the blocks, there are too many faults. But in actual mine operation such no. of faults has not be encountered. But some minor faults have been encountered as reported by the colliery management. So, adequate precautions should be taken while working near the fault. The presence of minor slips cannot be ruled out. So adequate precautions should be taken while working.
m. Over the leasehold property of Churi-Benti Block, too many important surface features like nala connected to Damodar River, public road power line, power trestles, Piparwar rehabilitation site, Piparwar GM office, DVC substation, etc exists over it. Before working below it, either it should be shifted/diverted from the proposed mining area or protective pillars of adequate size considering the angle of draw of 45^0 of the area to be depillared should be left against such surface features so that the line of fracture due to caving should not reach to the nala or other surface features lying over the property and may not affect the surface features which needs to be protected or may cause danger for

the person employed there in. Provision of filling of seasonal nala above the HFL, shifting of trestles has been made in this report.

n. No working should be conducted within 60m of HFL line without taking permission from DGMS.
o. At present, Churi Old mine has the disused isolated working. So adequate precautions should be taken while restoring the workings in Churi Old mine in both the seams.
p. The mine is surrounded by Damodar river, Saphi river, workings of Ray-Bachra colliery and old abandoned working of Churi which had been worked in distant past through incline No.2,3,4 & 5. So, adequate precautions should be taken while working approaches towards these old workings.
q. While working both the sections/seams simultaneously, both the seams/sections shall be under the supervision of same over-man and one experienced officer should be given for safe working of the mine. The above provisions will also be applicable for other working panels of the Churi-Benti project. Provisions for the same have been made in this report.
r. In case of any apprehension of danger felt by the supervisor or by any other official of the mine/project, in any of the panels, the manpower should be withdrawn for the safety of the workers.
s. Adequate precautions should be taken to avoid the danger of air blast and the provision of escape route should be made and kept maintained in the mine for safety of the mine. The persons should be trained to deal with any emergency situation, which may endanger the safety of the mine.
t. Incubation period of coal for Churi u/g is not known. It should be freshly determined so that the size of sub-panels can be decided as per the incubation period. The panel size has been envisaged in this report considering the incubation period of 9 months.
u. As soon as the panels are exhausted it should be sealed with the approved type of isolation stoppings. The competent person to ensure any leakage from goaved out workings should conduct periodic inspection of isolation stopping as per Coal Mines Regulation, 1957. The provision of water seal should be made in these isolation stopping to prevent the accumulation of water behind the stoppings. The type of water seal should be of such type that will not allow the leakage of gases from the goaved out workings.
v. The earlier subsidence study of Churi underground project clearly spelled out that the subsidence would reach to the surface so adequate precaution should be taken to avoid the accumulation of water over the subsided areas and any surface cracks formed due to subsidence should be effectively filled with non-combustible material.
w. Intrinsically safe and flameproof apparatus should be used below ground. The hydraulic fluid used by the various machines below ground should be of approved type.

x. Where blasting is to be done, only permitted explosives should be used and all precautions as per CMR 1957 with various DGMS Circular should be effectively complied with for the safe operation of the mine.
y. The working faces in each panel should be supported as per the approved SSR and if roof bolting is to be done, then full column grouting should be ensured.
z. Wearing of safety appliance by the workers should be ensured for the safety of the workers.
aa. The Incline No.1 falls within the HFL line. It is proposed to construct embankment above 3m HFL to prevent surface inrush of water.
bb. All the safety provisions mentioned together with statutes shall also be applicable while working in Benti Block.
cc. In addition to above all, such provisions of CMR 1957 and related DGMS circulars, which attracts attention while carrying out the mining operation, should be effectively complied for the safety of the mine as well as the safety of the persons employed therein.

CHAPTER – XI
MINING SCHEDULE

11.1 PRODUCTION SCHEDULE

A. Extractable Reserves

The following points have been considered for estimation of extractable reserves for the project:

- In the Churi block, it has been decided to deploy Continuous Miner in the western section of CRO & panel E12 & E13, which is free from workable thickness of UBS.
- In Benti block, the Continuous Miner is proposed to be deployed in Bottom Lower Bachra seam/section having seam thickness >3.0m, leaving 0.3-0.5m coal against shale roof, wherever upper seam/sections are not workable.
- The western section of CRO is mostly developed in Lower Bachra seam along the floor up to 2.4m. It is proposed that the virgin patches falling within the panels are to be developed and then depillared by Continuous Miner.
- The developed panels in the western section of CRO are proposed to be heightened up to maximum operating height of roof bolter for deployment of Continuous Miner.
- It has been considered that the surface features (like GM office, DVC sub-station, Pvt./Company quarters, trestles, road, etc.) will be shifted to maximize extraction from the panels.
- Villages are proposed to be rehabilitated.
- No depillaring is proposed below the Piparwar rehabilitation site.
- The pillar size in developed panels has been considered as 25m x 25m and gallery size 4.2m x 2.4m. The extractable reserves for CM panels have been estimated considering percentage of extraction as 65% of the in situ coal in pillars.
- For virgin panels in Benti block, the 5-headings panel with pillar size of 25m x 25m and gallery width of 4.8m has been considered. For virgin area falling within existing mine boundary & fault F13, has been not been considered.
- The existing connecting panel between Churi & Benti block, i.e panel W6 has not been proposed for depillaring till completion of extraction in Benti block.
- Provision for protective pillars below the nala flowing over the panels in the western section of CRO and Piparwar rehabilitation site has been made and reserve blocked in protective pillars has not been considered in extractable reserve.
- The reserves for Bord & Pillar in contiguous seams in Churi & Benti block has been estimated considering leaving parting of 3.0m in from the floor of upper including actual parting. It includes the reserves in virgin patches in the panels and in existing developed galleries (i.e, heightening while depillaring) up to 4.0m or the actual seam thickness, whichever is more. Depillaring reserves has been calculated assuming that the surface features over the panels shall be shifted. Pillar size has been taken as 25mx25m and gallery width of 4.2m.

The summary of extractable reserves in different seams/sections is shown in Table 11.1. The panel-wise extractable reserves is given in Annexure-A.

Table 11.1 : Summary of Extractable Reserves (MT)

Seam / Section	Churi block		Benti block		Total
	Dev.	Dep.	Dev.	Dep.	
A. Continuous Miner					
Lower Bachra seam (LBS)	0.224	2.979	---	---	3.203
Bottom Lower seam (BLB)	---	---	0.464	0.547	1.011
Sub-Total	**0.224**	**2.979**	**0.464**	**0.547**	**4.214**
B. Heightening District					
Lower Bachra seam (LBS)	0.915		---	---	0.915
Sub-Total	**0.915**		**---**	**---**	**0.915**
C. Bord & Pillar					
Upper Bachra seam (UBS)	0.755	2.928	---	---	3.683
Lower Bachra seam (LBS)	0.242	5.037	---	---	5.279
Bottom Lower Bachra (BLB)	---	---	0.521	0.748	1.269
Upper section of Top Lower Bachra (UTLB)	---	---	0.418	0.430	0.848
Sub-Total	**0.997**	**7.965**	**0.939**	**1.178**	**11.079**

From the above table, the reserves considered for the proposed Churi-Benti project is as under:

a) Continuous Miner (LBS & BLB) 4.214Mt
b) Heightening District (LBS) 0.915Mt
c) B&P development (UBS, BLB & UTLB) 1.059Mt

It was decided in the FD`s meeting while presenting augmentation report to make provision of land acquisition for deployment of Continuous Miner only. Hence, B&P depillaring has not been considered, as surface land is not acquired.

Additional Extractable Reserves:

(i) Benti block: If the working is extended up to the Fault F13, after statutory boundary adjustment between Churi-Benti and Ashok project, additional extractable reserves of 0.784 Mt will be available which may provide longer span of life for the continuous miner.

(ii) Additional Extractable Reserves in seam thickness beyond proposed extraction thickness of 4.6m

In western section of CRO, reserves are blocked in LBS beyond proposed extraction thickness of 4.6m. It is expected that about 1.0Mt of extractable reserve is blocked in thickness above 4.6m. While finalizing the specifications of Continuous Miner, care may be for maximization of extraction thickness.

Reserves in panel lying in the eastern section of CRO & Old Churi in UBS & LBS may be considered for deployment of CM after scientific studies.

B. Mining Schedule

The following points has been considered for mining schedule of Churi-Benti UG project:

- It is proposed to deploy Continuous Miner initially in virgin area of Benti block for B&P development to generate confidence and facilitate learning of the technical know-how.
- Simultaneously, heightening of existing galleries of the panels proposed for extraction with Continuous Miner will be undertaken.
- After initial development & depillaring by Continuous Miner in Benti block, the Continuous Miner would be deployed for depillaring of standing pillars in Churi block. The depillaring is proposed to commence from the extreme panel / dip most side of western section of CRO.
- At present two B&P development panels/districts are working. The B&P panel with LHDs is working in Bottom Lower Bachra seam/section in Benti block while the manual B&P district is working in Upper Bachra seam in Churi block.
- It is proposed that the B&P district with LHDs will continue with development in Benti block (Bottom Lower Bachra-BLB & Upper section of Top Lower Bachra- UTLB seam/sections). The manual B&P district is proposed to phased-out with introduction of Continuous Miner & Heightening districts.
- It is proposed for shifting of surface features (power trestles, road, etc.) and rehabilitation of villages overlying the proposed panels for Continuous Miner. The surface features should be shifted well ahead of the mining schedule for CM production to facilitate extraction. The provision for the same has been made in this report.
- Panel W-6, considering the entry to Benti section is not proposed for extraction till completion of final extraction in Benti block.
- Prior to deployment of CM in Churi block, existing panels are to be heightened as proposed. Heightening of the panels should be sufficiently advanced for timely deployment of Continuous Miner.
- The Continuous Miner is proposed for introduction in the third year from the zero date. In the first two years, before commencement of operation of Continuous Miner, initial preparatory work would be undertaken.
- It has been assumed that all the preparatory work in the including land acquisition, EMP approval, etc. and procurement & commissioning of equipment would be completed in two years.
- The existing LHDs in the mine should be replaced with low-height LHDs to continue with B&P development in low seam /section thickness horizons.
- Available working days in a year has been taken as 300days.
- After completion of heightening district, for the balance life the equipment may be deployed for depillaring of the reserves standing on pillar in the mine.

- In case, reserves considered for Continuous Miner exhausts early, alternative place of deployment may be suitably identified and arranged for shifting for its gainful utilization.
- The depillaring of B&P panels of Benti Block in Churi-Benti project has not been considered, as it would require acquisition of land. As decided in the FD's meeting provision for land acquisition is to be made only for Continuous Miner.
- While working with Continuous Miner in the proposed area of Churi-Benti project, scientific studies may be conducted for depillaring of standing pillars in remaining areas of the Churi block by Continuous Miner. If the results of scientific studies permit, CM may be deployed in the remaining areas after exhaustion of reserves in Churi-Benti project.

C. Construction Period

The first two years will be construction period. During this construction period, the following activities should be completed:

- NIT and Tendering.
- Finalization of contract for supply of CM package
- Scientific studies for selection of appropriate support and method of work for deployment of CM.
- Permission from DGMS to work with CM
- Permission for heightening of existing panels
- Acquisition of land for depillaring.
- Shifting of Power trestles, road and other surface features .
- Rehabilitation of villages.
- Heightening of existing roadways including inclines for marching of CM package to underground
- Strengthening of transport system as per requirement of CM
- Construction of UG strata bunker and drifting
- Construction of water reservoir and water filter plant
- Strengthening of workshop as per requirement of CM.
- Strengthening of ventilation system by opening of Churi old workings and establishing main return through LBS.
- Drivages of roadways below Damodar River to provide additional approach to Benti block.

The next two years will be production built-up period. Production from Continuous Miner and Heightening district will commence from 3rd year and target production of 0.81 MTY will be achieved in the 4th year.

Based on above, production schedule from the Churi-Benti project is proposed as under:

Technology / Year	Production from Working Districts/ Technology (Mt)				
	Continuous Miner	Heightening panel with remote controlled LHDs	B&P with low-height LHDs/ Normal ht LHD	Manual B&P	TOTAL
Year 0 / Existing	---	---	0.10	0.06	0.16
Year 1	---	---	0.10	0.06	0.16
Year 2	---	---	0.10	0.06	0.16
Year 3	0.40	0.10	0.16	---	0.66
Year 4	0.50	0.15	0.16	---	0.81
Year 5	0.50	0.15	0.16	---	0.81
Year 6	0.50	0.15	0.159	---	0.81
Year 7	0.50	0.15	---	---	0.65
Year 8	0.50	0.15	…	---	0.65
Year 9	0.50	0.07	…	---	0.57
Year 10	0.50	--	…	---	0.50
Year 11	0.31	--	--	---	0.31

11.2 COAL QUALITY

The grade of coal in Lower Bachra seam (LBS) in Churi block varies from 'A' to 'E'. In the panels proposed extraction with Continuous Miner (and heightening district for CM panels) with seam section of 4.6m, the grade of coal generally is from 'B' to 'C' (long flame). In Benti block, grade of coal of Bottom Lower Bachra seam (BLB) in proposed panels for Continuous Miner varies from 'A' to 'C' (long flame), generally 'B' grade (long flame).

In Benti block, the development reserves for B&P panels with LHDs in Bottom Lower Bachra (BLB) & Upper section of Top Lower Bachra (UTLB) varies 'B' to 'D' and 'D' to 'E', respectively.

The declared grade for Churi UG during past several years of its mine operation has been grade 'B' (long lame), however the geological grade is 'C'. Almost entire Churi UG mine has been developed and presently B&P development is being continued in Benti block. The present declared grade of coal is 'B' (long flame). After discussion in FD's meeting on 5.12.06 and 22.3.07 at CCL, it has been decided that declared grade of the mine should be taken for planning purpose instead of geological grade 'C'.

Considering the extractable reserves and variation of grade in the property for CM, B&P & heightening panels, the average grade of coal is expected to be of grade 'B' (L/F). Accordingly, grade of coal for financial evaluation has been considered as Grade 'B' (L/F).

11.3 ZERO DATE

Zero date of the project has been considered as the date of land acquisition, EMP approval and/or sanction of report, whichever is later.

CHAPTER – XIII

MINE VENTILATION

13.1 DEGREE OF GASINESS

Churi UG is an existing mine in North Karanpura coalfield presently working Upper Bachra seam & Bottom Lower Bachra seam. The mine has been categorized as degree-I gassy mine. No active emission of inflammable gas has been noticed during development in Upper & Lower Bachra seams and in Bottom Lower Bachra seam in Benti block. Further, it is proposed to continue work in Bottom Lower Bachre & Upper section of Top Lower Bachra in Benti block and Lower Bachra seam in Churi block. Hence, gassiness of the mine has been taken as degree-I, for the purpose of assessment of ventilation requirement & planning.

In conformity with Coal Mines Regulation, 1957 & related circulars issued by DGMS & standards of ventilation, following criteria have been used:

a) *Restrictions on the **maximum velocity** in a drivage or mine entries*

Fan drift or Ventilation shaft	-	15m/s
Man winding shaft or haulage roadways	-	8m/s
Other roadways	-	6m/s
Conveyor roadways	-	4m/s
Face	-	4m/s

b) ***Minimum air quantity** requirement in a panel at LVC*

Based on the production from a ventilation district - 2.5m^3/min./t

Based on the manpower deployed in the largest shift - 6m^3/min./person, Which ever is more.

c) *Requirements of **minimum velocity** at the working faces in the mine*

Immediate out bye of ventilation connection from face	-	30m/min.
4.5m from face on intake side of brattice/partition	-	30 m/min.
7.5m out bye of the discharge end of an air pipe	-	15 m/min.

d) *Estimation of **aerodynamic resistance** of a path/mine*

$R = k \times P \times L / A^3$ R - Aerodynamic resistance in kg sec^2 m^{-8}

Where, k - Coefficient of aerodynamic resistance

P - Perimeter of the path in metre

L - length of airway in m

A - area of x-section in m^2

e) *Estimation of **pressure requirement** for a path/fan*

$P = R \times Q^2$ Where, P - pressure drop in Pa

Q - air flow through a path in m^3/s

f) *Estimation of **motor power requirement** for the main fan*

$Q = 1.1 \times P \times Q/(n_f \times n_t)$ P - main fan pressure in Pa

Where, Q - air flow through the main fan in m^3/s

n_f & n_t - fan & transmission efficiencies

g) *Standards of **Ventilation Efficiency** in a mine*

Ventilation Efficiency Quotient (VEQ) of a mine	-	60% or more
Operating Efficiency of Main fan (n_f)	-	60%
Transmission Efficiency (n_t)	-	95%

13.2 AIR QUANTITY REQUIREMENT

The estimated air quantity requirement at the working panels' last ventilation connections (LVCs) during different stages (refer para 13.3.3) of mine operation as described above is given in Table 13.1.

Table 13.1 : Estimation of Air Quantity Requirement (in m^3) at Panel LVCs

Parameter	Air requirement (m^3/s) forProposed Operating panels' LVC		
	Continuous Miner Panel	B&P Panel with LHDs	B&P with remote controlled LHDs
Production (TPD)	1700	534	500
Manpower (largest shift)	70	120	100
On the basis of production (@@2.5m^3/min/t	22.0 Considering production, air quantity & velocity in panel would be very high. Hence, air requirement at velocity of 1.0m/s has been considered.	22.5	20.8
On the basis of manpower @6.0m^3/min/ person	7.0	12.0	10.0
On the basis of velocity @0.50m/s (assuming x-section of 4.8x2.4m/4.6m	11.0	5.8	5.8
On the basis of Temperature (assuming temprature exceeds 30.5^{o}C, taking velocity of 1.0m/s)	22.0	11.6	11.6
Max. of Air requirement	22.0	22.5	20.8
TOTAL	65.3		

On the basis of above, the total air quantity requirement at the panel last ventilation connection is expected to be about 65.3m^3/s. The air quantity would, therefore, be accordingly regulated so that all the working places / districts get the required quantity of air as per statute for safe operation of the mine and safety of the persons employed therein.

One fan (PV-200 type, sec., 79 mm wg) is operating in Churi old section and catering the existing requirement of the mine. The discharge through the existing fan is about 50m^3/s. Existing fan capacity may not be sufficient to cater the ventilation requirement of the Churi-Benti Project. However, detailed ventilation survey (keeping in view that 3 districts would be operated at a time in the Project), should be carried out to ascertain the actual ventilation requirement for the Project.

For better ventilation in the mine, choking of return, leakage through fan drifts/shafts, air locks, setting of fan, maintenance of stoppings, etc. should be examined carefully and adequate steps should be taken for any rise in temperature

and humidity. For better conditions at the working faces, it is desirable to maintain that the air velocity of air 1.0m/s.

There will be three numbers of panels working at a time. It is suggested that the colliery management should prepare a ventilation management plan clearly stating the code of practices and implemented for proper ventilation management in the mine. In addition to above, various provisions of CMR, 1957 together with different circulars issued by DGMS should be complied effectively to maintain the adequacy of ventilation in the working places.

13.3 VENTILATION SYSTEM DESIGN

13.3.1 Present Ventilation Arrangement

9.2 Present Ventilation System

At present, exhaust system of ventilation is being followed for ventilating the workings of mine. Presently, Churi UG mine is operating mine with two incline entries (Inc. 6 & 7) on the rise side working as main intake airways and an air shaft serves as main return airway with a main mechanical ventilator (PV200 make) installed in the air shaft. The present air discharge through the main fan is about 50.0m^3/s at an operating fan pressure of about 58mm of WG. The details of main intake & return airways is as under :

Intake airway	**Inc. 6**	4.8 x 2.8 m^2
	Inc. 7	4.8 x 2.8 m^2
Return airway	**Air shaft 1**	4.26 dia. (Fan – PV200 make)

Two standby fans exist, one a Model AF-80 fan in the fan drift parallel to the existing fan drift and other a Model PV-160 fan in 1A incline. Only the main fan PV200 make is in operation.

Problems in the existing ventilation arrangement / system: The present VEQ and the system efficiency of the mine is about 39%. The mine resistance is about 0.2272gaul, which is very high. Besides, there are several bottlenecks in ventilation system of the mine. A ventilation study has been conducted for the Churi UG with the existing extent of workings in October 2006. The deficiencies in the existing system have been indicated. Further, proposals have been suggested for improvement in the existing system of ventilation. The recommendations of the report on ventilation system design for the mine submitted in October 2006 should be complied.

Presently, working panels in Benti block is being ventilated by the existing approach through W6 panel. It is proposed to operate two districts in Benti block including Continuous Miner district. It has been proposed for additional approach for Benti block through W-11 panel. This would facilitate in improving the ventilation for the panels in Benti block.

13.3.2 Proposed Ventilation Arrangement

It is proposed to utilize the existing ventilation system. Certain modifications in the underground ventilating paths is suggested to reduce the mine resistance as well as improvement in ventilation efficiency as mentioned under :

- It has been proposed for additional approach for Benti block through W11 panel.
- The zig-zag return is proposed to streamlined by directing the return air through trunk roadways of Churi old section in Lower Bachra seam.

Besides, the suggestions made in the report 'Ventilation System Design', for Churi colliery should be implemented.

13.3.3 Ventilation Simulation

From the ventilation study carried out for the mine, it appears that the single existing main fan may not be adequate as the present discharge is about 50m^3/s at wg of about 58mm. Total air quantity required at panels' LVC is about 65.3m^3/s. Considering VEQ of 60%, air discharge required through the fan is about 108.83 m^3/s. The required pressure at the main fan considering present mine resistance of 0.2272gaul works out to 196mm of water gauge, which is very high. Hence, the mine resistance needs to be significantly reduced.

Ventilation study has been undertaken for the mine. Several deficiencies have been indicated in the report. By implementing the suggestions, it has been shown that the mine resistance is likely to reduce to about 0.14gaul. It is further proposed for modification in ventilating paths as suggested in Para 13.3.2. It involves opening of old Churi section and drivages of additional approach to Benti block for additional return paths. This may reduce the mine resistance further and the mine resistance is likely to be less than 0.1gaul.

Considering mine resistance of 0.10gaul and air requirement at panels' LVC and main fan, the required fan pressure will be about 86mm of wg. To meet the above required ventilation parameters, the existing main fan along with one of the standby fan or a new main fan with the suitable parameters (higher volume & increased discharged pressure) would be required. It is proposed to utilize the existing resources (main fans).

Hence, it is proposed for operating existing main fan along with another standby fan in parallel. Simply operating two fans in parallel will not meet the ventilation requirement of the Churi-Benti Project, unless resistance of the ventilating path is reduced to less than 0.10 Gaul. Hence, it is necessary to reduce the resistance by implementing the suggestions mentioned above. The proposed ventilation arrangement is expected to be adequate for the project after incorporation of suggestions made above and the ventilation study report. Hence, ventilation simulation for different stages of the mine has not been carried out.

It is expected that depending upon the layout of ventilating paths, sequence & extent of working panels and leakages, VEQ of the mine can be improved further, thereby reducing the required air discharge through the main fan.

13.3.4 Proposed Ventilation Layout

Ventilation layout of the main/trunk headings: The fresh air taken into the mine through mine entries would be taken to the working panels along the main/auxiliary trunk roadways. These trunk roadways comprises of 4-7headings. Generally, 2-3 central headings have been considered as main intake airways while the flank headings on either side have been taken as main return airways, where working panels lies on either side to trunk headings. Where the working panels lies on one side of the trunk roadways, the three headings along/adjacent to the working panels have been taken as intake airways while the remaining headings will work as return airways. In the auxiliary trunk roadways, the intake and return airways have been considered based on minimum requirement of air crossing.

While crossing the Damodar river, the existing trunk headings are limited to 3 headings only. In this situation, 2 headings works as intake and 1 heading as return airway for the existing workings in the Benti section. It is proposed to re-cross the Damodar river with limited no. of headings through Panel W-11 of western section of CRO. It will help in improving the ventilation for the workings in Benti section with CM and low height LHD.

Ventilation layout of the panels: The existing B&P panels comprises of 4-8 headings in Churi block. For the proposed B&P panels in Bottom Lower Bachra and Upper Section of Top Lower Bachra seams/sections, 5 headings layout has been envisaged, wherever possible. In all these panels, it is generally proposed for ascensional system of ventilation, as far as practicable, with 2-3 headings on the dip side to work as panel intake airways while 2 headings on the rise side to work as panel return airways.

13.4 FAN SPECIFICATIONS

The existing main fan (along with standby fans) is proposed to be utilized for the project. The specifications of the present operating main fan is as under :

Paticulars	Fan & its motor
Model	PV200
Make	VOLTAS
Fan type	Exhaust
Impeller diameter (mm)	2000
No. of V-belt grooves	4
No. of V-belts	4
Fan pulley diameter (mm)	275
Motor pulley diameter (mm)	440
Fan RPM	880
Installed motor power (kW)	90
Motor RPM	1440
Total Current drawn (Amperes)	85
Voltage (V)	550

13.5 AUXILIARY VENTILATION

In the panels, auxiliary fans are proposed to be installed for ventilating the working faces. Provisions of auxiliary fans and ventilation ducting have been made in the report for proper face ventilation.

CHAPTER – XIX

MANPOWER, PRODUCTIVITY & TRAINING

19.1 MANPOWER REQUIREMENT

The manpower for the proposed Churi-Benti UG project has been assessed keeping in view the existing deployment at surface as well as underground. At present, total of 905 (nos.) manpower is working at the mine (as on 01.01.2007). The break-up of the existing manpower is given in Table 19.1.

The manpower requirement for has been estimated for the target production of 0.81Mty, including existing production of 0.16Mty and incremental production of 0.65Mty. The total manpower has been as 863 (nos.). Out of this total manpower, underground manpower has been estimated as 651 (nos.) while the surface manpower has been estimated as 212 (nos.). For the incremental production of 0.65Mty, the incremental manpower has been taken 293 (nos.).

For surface manpower, all the existing places of deployment have been taken into consideration. The same may be continued based on requirement. Additionally, new places of deployment have been identified. For underground manpower, manpower assessment is based on the requirement of re-organized trunk transport, re-organized panels & equipment. The underground manpower requirement has been worked out keeping in view the mine layout, number of equipment and statutory requirement. Provision for manpower has been made considering authorized absence of workers.

The detail of job-wise and category/scale-wise requirement of manpower has been given in Appendix-B. The break-up of total manpower (group-wise) viz., Daily rated workers, Monthly paid staff and Executives proposed project is given in Table 19.1.

Table 19.1 : Summary of Group-wise Manpower

Sl. No.	Particulars	Existing Manpower	Proposed Manpower
1	**Piece Rated Workers**	177	---
2	**Daily Rated Workers**	576	697
3	**Monthly Paid Staff**	130	138
4	**Executives**	22	28
TOTAL		**905**	**863**

It may be noted that number and category/scale of persons employed may be changed in actual practice within overall provision of manpower requirement.

Summary of manpower requirement category/scale-wise along with wages/scales & annual benefits has been provided in Appendix B.1. Phasing of manpower during initial stages of mine is given in Table 19.2.

Table 19.2 : Year-wise Phasing of Manpower

Year	Existing (2006-07)	Y1	Y2	Y3	Y4	Y5
Manpower	905	905	905	863	863	863

The retirement profile shows reduction of manpower to the tune of about 150nos. in the next 2 years and about 235nos. in next 4 years. However, the existing manpower of 905nos. has been considered during the initial years for the purpose of present evaluation.

19.2 PRODUCTIVITY & OMS

The target production from the project is 0.75Mty including existing production of 0.10Mty and incremental production of 0.65Mty. The project is likely to achieve the target production during the year 4. Considering total manpower of 950, the overall OMS is estimated as 3.32tonnes and EMS is Rs 847.93. Considering incremental production of 0.65Mty and incremental manpower of 293 (nos.), the incremental OMS is estimated as 8.5tonnes.

19.3 TRANSPORT OF PERSONNEL

It is proposed for man-riding arrangement for transportation of workmen to the nearby working places in the mine as the distance of travel is likely to increase due to increase in the extent of the mine. The same is proposed along the alignment of trunk roadways. It is suggested for haulage based mine cars for man riding. However, arrangement / layout and type of man-riding system to be provided in the mine may be finalized considering the suitability to mine at a later stage. Lump sum provision for the same has been made in the report.

19.4 TRAINING

The success of Continuous Miner system relies as much on the training programme and motivation of the management and operators as on the machinery and methodology. Prior to deployment of CM at Churi-Benti UG project, a team consisting of executives, supervisors from the mine and Planners should visit the mines of SECL/WCL where Continuous Miner is in operation. The supplier should arrange a workshop on operation and maintenance of CM.

Skilled manpower would be required for safe operations of the machines/equipment and to make the mine a highly productive. The manpower may be suitably identified and utilized for mine operations. The workers will be

imparted safety & work related training at the V.T.C. Besides, regular refresher training may be organized for the existing manpower at the V.T.C.

The actual manpower deployment in the mine is generally on the basis specific job/work requirement. The work-load of the specific job is generally non-continuous and actual working hours is very low for certain category of jobs. This requires larger manpower deployment. It is now proposed for deployment of multi-skilled crew for general services and maintenance purposes (during general shift) and other works, which are non-continuous and can be clubbed together to increase the actual working hours and minimise the total manpower. Such multi-skilled crew is proposed to be developed by in-house training at the area level.

Supplier's expert should give adequate training on operation of Continuous Miner and its ancillary equipment to the workers. The education and training for the electrical & mechanical personnel and operators should be conducted at the mine site. The operators should be given "on the job" training by skilled, experienced operator of supplier who will work alongside them for sufficient period until the trainee is fully conversant with the safe and efficient operation of the controls and method of work. It is suggested that all persons to be involved in this new technology should be given a prior general and specific exposure to method of mining & equipment to be used through theoretical lecture and visual aids, which may be procured along with equipment.

The operators involved with Mass Production Technology, Belt conveyor, Haulages etc. and electricians and mechanics would be imparted training by trained staff for operation of the respective equipments as well as to ensure safety of equipment. The refresher training will also be imparted to supervisory staff in the Area Training Center as per the requirement and needs.

Depillaring will be introduced & practiced in the mine for the first time. Strata control, monitoring as well as management, is likely to critical. It is desirable that a strata monitoring cell may be established under a senior official at the mine with appropriate instrumentation for monitoring of the strata and caving. The executives, supervisory staff as well workers involved with the depillaring / strata control may be given appropriate training for technicalities of strata management.

Strata control, monitoring as well as management, is likely to critical to the success of the Mass Production Technology in view of proposed method. It is desirable that a strata-monitoring cell may be established under a senior official at the mine with appropriate instrumentation for monitoring of the strata and caving. The executives, supervisory staff as well as workers involved with the Mass Production Technology may be given appropriate training for technicalities of strata management.

It is proposed for operating man-riding system in the mine with a view to minimise the travel distance. It is necessary that the system works efficiently and safely. It is therefore proposed for appropriate training of the man-riding operators and maintenance personnel for man-riding system.

CHAPTER – XX

SAFETY AND CONSERVATION

20.1 Safety Measures

All precautions stipulated under CMR, 1957 and circulars issued by DGMS from time to time shall be strictly complied with, for the maintenance of safe working condition in the mine. Some major identified sources of danger and their preventive measures have been described in the paragraphs given below.

20.2 Major sources of Danger

The following are identified as the major sources of dangers:

1. Surface inrush of water from Damodar River, Saphi River, Benti Nala and other seasonal Nala passing over the leasehold property.
2 Workings of Ray-Bachra colliery and old abandoned workings of lower Bachra seam which have been worked in distant past through incline no. 2, 3, 4 & 5. along with old and abandoned workings of adjacent Manki colliery
3. Strata problem
4. Fire, spontaneous heating, dust and other inflammable gas.
5. Geological disturbances.
6. Blasting in roof of already developed galleries for Heightening of existing galleries and side blasting for widening of existing galleries to facilitate the CM operation.

20.3 Preventive Measures

The suggested preventive measures are as under:

A **Surface Inrush of Water:** The sources for water inrush into the underground workings are anticipated from the following sources: -

(a) Damodar river
(b) Saphi river
(c) Benti Nala
(d) Seasonal Nala passing over the leasehold property.
(e) Surface cracks due to caving operation.
(f) Geological disturbances.
(g) Unplugged exploration Boreholes.
(h) Potholes created due to caving of the overlying seams at surface.

To guard against the above-mentioned causes, the following measures have been envisaged.

1. A solid barrier of 60m has been left against the Damodar & Saphi Rivers.
2. No working has been proposed within 60m of HFL line, except with the permission of DGMS.
3. No depillaring is proposed below Piparwar Rehabilitation site, Seasonal Nala, Benti Nala. Provisions for protective pillars to protect the important surface features have been made in the report.

4. The filling of seasonal nala and low-lying area above H.F.L should be done before going for depillaring operation. If possible, nala may be shifted/diverted from the existing working. The existing topography compels that nala and low lying area which comes under HFL line, is to be filled up with OB or other suitable material above HFL. Since the construction of embankment against the river Damodar may cause the creation of water reservoir over the workings, therefore filling of seasonal nala and low lying area above H.F.L have been proposed. If all the above is not possible, no depillaring operation should be commenced below this area except with the permission of DGMS.
5. As subsidence progresses, surface cracks should be filled up effectively with earth and the ground should be given adequate slope towards the water bodies for natural drainage, so that surface cracks may not provide the way for surface water to percolate below ground.
6. Garland drains should be made around the caved out area to prevent water accumulation over the caved area.
7. The surface position of all the faults and geological features should be clearly marked on the working plan and adequate precautions should be taken against them.
8. The HFL line of Damodar River and Saphi River has been drawn as per survey of 1976. The HFL of these rivers may have changed. So fresh survey should be conducted to draw the correct HFL line as on date. While approaching the workings below or near HFL, adequate precautions should be taken to avoid any danger to the mine.
9. Effective protective measures should be taken against danger from accumulation of rainwater, particularly over silted subsidence cracks, shallow workings etc. as well as against the embankment if any.
10. Effective measures should be taken against any obstruction in the normal drainage of the area.
11. Exploration boreholes, which are unplugged due to any reason, should be effectively plugged.
12. Potholes should be effectively filled up.
13. Constant vigilance to be exercised during rainy season by the competent person (Manager/ safety officer with senior most mine official & surveyors) to check vulnerable points and effectiveness of safety measures. In case of any doubt, persons should be withdrawn safely.

    In addition to above, the provisions of Reg. 126 of CMR 1957 together with circulars issued by the DGMS time to time should be complied effectively for safe operation of the mine.

B **Underground Inundation:** The sources of irruption of water from underground to the workings are anticipated from the following sources:

(a) Adjoining Ray-Bachra mine and old abandoned workings of inclines 2, 3, 4 & 5.
(b) Workings approaching towards geological disturbances (faults, slips etc).
(c) Working below goaved out workings.
(d) Unknown/ hidden water bodies in the overlying strata

To guard against the above-mentioned causes, the following measures have been envisaged –

1. The provisions of Reg. 107 of CMR 1957 (Working near mine Boundaries) should be effectively complied with.
2. Sequence of panel extraction should be such as to avoid working below water bodies.
3. The worked out panels isolated with stopping should be provided with water-seals to prevent accumulation of water under high hydrostatic head behind the stoppings, without leakage of the noxious gases from the goaved out area.
4. Before commencement of extraction of pillars in a seam, the workings/ goaf of overlying seams should be dewatered and made dry.
5. Hydro-geological studies should be conducted to locate the unknown/ hidden water bodies, which might become potential source of inundation in future and for safe drivages below Damodar River.
6. While approaching towards river and/ or any accumulated water bodies advance boreholes should be made by the safety-boring machine. The provision of the safety-boring machine has been made in this report.
7. Adequate parting should be left against the fault plane or any other geological disturbances, if encountered.
8. All exploration boreholes drilled from the surface should be correlated and plotted accurately on the working plan and all other plans. The boreholes should be plugged with cement from bottom to top (full column) wherever possible, to prevent direct inrush of water through such boreholes.
9. Any UG workings approaching within 60m of the water bodies, adequate precautions should be taken as per the statute.

In addition to above, the provisions of Reg. 127 of CMR 1957 together with circulars issued by the DGMS from time to time should be complied effectively for safe operation of the mine

C Precautions Against Spontaneous Heating

(a) <u>Underground Measures</u>

i) Where development has been done without giving due consideration to formation of panels, Isolation stoppings should be constructed to create artificial panel.

ii) Caving of seams should be done only in descending order. The crossing point temperature should be freshly determined (if it is not known) for deciding the size of the panels/ sub-panels.

iii) Wherever possible, extracting of the pillars should be done soon after the development of galleries, to prevent the crushing of pillars. Hence, there will be minimum time gap between formation and extraction of pillars in each panel.

iv) Regular and rapid advance of coalfaces should be maintained to ensure rapid consolidation of the goaf.

v) Method of mining should be selected in such a manner that the minimum coal is left in the goaf.

vi) After completion of depillaring operation, the panel should be sealed off by construction of approved type isolation stopping.

vii) Ventilation pressure on the stopping should be kept balanced to prevent inward leakage of air, which may cause spontaneous heating in the goaf.

viii) Approved type Hydraulic fluid and fire resistant materials should be used in the underground.

ix) The roof coal is bound to left in the panels proposed for CM deployment in CRO, since only 4.60m is to be extracted. There may be the chances of spontaneous heating of coal in the goaved out panels. So isolation of panels should be done with approved type of isolation stopping and regular monitoring should be done to avoid any dangers in the mine.

(b) Surface Measures

i) Surface cracks propagated up to the surface due to depillaring of the seams should be filled with non-combustible material to prevent the air leakage into the goaved out areas, which may cause spontaneous heating in goaf.

ii) The filling of cracks may be done with earth, clay and non-combustible material of 1.5m thick nesses. The mutti (earth clay) should be placed in thee layers of 50 cm each in succession, with proper consolidation. The mutti seal should be kept moist for a period of 5 years.

iii) It is observed that fireclay bands exist in the strata overlying the coal seams in Churi mining block. The fire clay material, being plastic in nature, may form a natural seal to the cracks caused due to mining. This will provide additional support in filling the cracks. Hence it is proposed that fire clay mining should not be permitted in that area.

iv) In no condition, any combustible material or sand should be used for filling up the cracks.

In addition to above, the provisions of Reg 117 and Reg 118A of CMR 1957 along with DGMS circulars should be strictly complied for safe operation of the mine.

D Precaution against fire

The sources of fire in the mine may be as under:

- The spontaneous heating of goaved out panels in both the seams.
- The existing fire in the same seams or section.
- The existing fire in the near by mine which is connected with the working of Churi UG by any means.
- Due to presence of any source of ignition.

Adequate precautions should be taken to prevent the spontaneous heating of coal. When the UG working approaches to any old working or adjacent workings, which is under fire, then adequate precautions should be taken as per statutes for safe working of the mine.

In addition to the above, the provisions of Reg. 118, 119, 120, 121 & 122 together with various circulars of DGMS should be effectively complied with for safe working of the mine.

E Precautions due to contiguity of the seams:

Although, this Production augmentation report doesn't envisages the workings in the contiguous part but it may have to be done in future. The following precautions may be adopted in the contiguous part :

(i) Working in both the seams should be vertically coincident.
(ii) Vertically should be checked by putting holes at the alternate junctions of the gallery.
(iii) The thickness of parting should be not be less than 3.0m in any case.
(iv) If working is to be done in both the seams independently, prior permission should be obtained from DGMS and upper seam to be depillared first.
(v) For working both the seams simultaneously, the line of extraction in both the seams should be vertically coincident.
(vi) In addition to above, the provisions of Reg. 104 of CMR, 1957 and circulars issued by DGMS should be strictly complied with.

F Precautions against Noxious gases and Inflammable gases

The Churi UG mine has its underground workings in both the seams namely Lower Bachra and Upper Bachra and is almost fully developed by Bord and Pillar method of mining with SDL/LHD loading and manual loading of coal. During development of both the seams, no incidence of abnormal make-up of gas was noticed and the mine is declared Degree-I mine. Two main mechanical ventilators of adequate capacity to cater to the ventilation requirement as well as for dilution of various gases including inflammable gases of the mine has been installed at the mine. Presently one fan PV-200 in air-shaft is operating in Churi Old mine area and is catering to the ventilation requirement of whole mine. Continuous Miner have in-built methane indicator along with the other safety instruments, so as to warn in advance before any apprehended danger. The other following precautions should also be taken:

(i) Churi underground is degree-I gassy mine. Adequate provisions have been made in the report towards building up and maintenance of standards of ventilation as per Reg 130 of CMR-1957.
(ii) Regular monitoring of atmosphere i.e the presence of noxious and inflammable gases in the goaf of UBS should be made.
(iii) The auxiliary fans should effect brisk ventilation of headings/workings.
(iv) The provisions of Reg 124, 142 and various circulars issued by the DGMS should be effectively complied with.

In addition to that other provisions of CMR 1957 related to gas and ventilation shall also be complied effectively for safe working

G Precaution against Dust

Due to operation of Continuous Miner, coal dust may be formed in appreciable quantity at the face, which may cause health hazards. In order to prevent it to be air bone, the Continuous Miner cutter head is equipped with powerful water sprays. An optional integral dust collector is also available with the machine, which controls the dust in the machine vicinity. The adequate provision for water arrangement is made in the report. The adequate precautions should also be taken for preventions of accumulations of dust particles for safe operation at face. The provision of stone dust barrier should also be implemented in the gate belt in in bye ends and out bye end. The other following precautions should also be taken:

(i) Adequate provisions have been made in this report for supply of water from surface for dust suppression in CM-panel, LHD panel. Provisions have been made in this report for adequate ventilation of the workings. Steps should be taken for effective compliance of the various provisions.

(ii) It is suggested that regular and systematic sampling of air-borne dust is to be made for control of air bore dust to safe concentration level.

(iii) In addition to above, the provisions of regulation 123, 123A and 123B together with various circulars issued by the DGMS from time to time should be effectively complied with for safe working of the mine.

H Precautions for strata control

(i) While development or depillaring of the panel, the supporting should be done as per the approved SSR.

(ii) Since the immediate roof predominantly comprises of carb shale, shaly coal shale, alternate bands of shale and sand stone, so while development in any of the seam a coal of 0.3-0.5m thickness should be left against the roof.

(iii) In case of roof bolting, it must be supplemented with the conventional support as and when required.

(iv) The scientific body should conduct the fresh cavability study of the strata for Churi UG mine.

(v) Adequate no. of convergence recorder, load cells etc. should be installed while depillaring in any panel to protect from danger of air blast.

(vi) Record of local fall and main fall should be properly maintained and analyzed in the safety committee meeting, so that the general awareness regarding local fall and main fall can be created among the workers and officials.

(vii) All other steps as needed by the situation in accordance with the provisions of regulations and circulars should be taken to avoid any mishaps due to roof fall.

(viii) In addition to above, all other provisions of CMR, 1957 which is attracted by strata problems together with various related circulars should be effectively complied for safe working of the mine.

(ix) As and when required, induced blasting may also be used to bring down the roof regularly.

The provisions of Reg 108 of CMR, 1957 and various circulars related with it should be effectively complied.

I. Working below PWD road and Power trestles

The PWD road between Bijupara & Hazaribagh together with other roads and many power trestles are passing almost through the Churi mining area and it has to be shifted to facilitate depillaring operation in the proposed area. The provisions for shifting of trestles, road, basti, filling of low lying areas and other infrastructure belonging to company have been made in this report Development under these roads and power trestles has already been done. In case of non shifting of power trestles and the roads, two nos of pillars or distance considering angle of draw of 45 deg. of the workings (which ever is more) should be left un-extracted on both sides of the roads and power trestles to protect it. This should also be applicable for all those surface features like nala, DVC Sub station, and any other important surface features which is to be protected and may cause any danger in future.

While working below surface features, the various provisions of CMR 1957 related to that together with various circulars should be effectively complied with for safe operation.

J. Signalling & Lighting

Sufficient lighting as per standards will be provided at all the required places i.e. at coal transfer points, loading points, working faces, along trunk and gate belts, feeder breaker, switch gear and maintenance area. Adequate lighting provision has to be made at underground workings, workshop and coal dispatch area to avoid accidents and to maintain safe working condition. Good communication between face, conveyor drives, key points in underground, surface control rooms, offices, workshop etc., is essential for efficient operations. Intrinsically safe signaling equipment of audio- visual type should be installed in underground for smooth and efficient communication between various points. In addition to above, the provisions of CMR, 1957 together with related circulars should be complied.

K. Precautions against subsidence due to depillaring by caving

The following control measures have been suggested.

(i) As subsidence progresses, surface cracks should be filled up effectively with earth and the ground should be given adequate slope towards the water bodies for natural drainage, so that surface cracks may not provide the way for surface water to percolate below ground.

(ii) Garland drains should be made around the caved out area to prevent water accumulation over the caved area.

(iii) It is suggested that mine management should form a team that will be responsible for the proper and regular filling of surface cracks developed due to subsidence. The team will also maintain record of the development and

filling surface cracks. Mine management at the site should arrange adequate supply of filling materials.

(iv) Surface drains should be made outside the subsidence area to prevent the surface water of adjoining area to come into active subsidence area.

(v) The topography of the mining area is uneven and the ground elevation varies from 402 to 468m, i.e. a difference of elevation of 66m. For such terrain, the maximum anticipated subsidence of 3.655m (for both seam working) is unlikely to extensively affect the drainage pattern in the area. However, subsidence may result in the formation of depressions over the center of the panels where water may accumulate during rains. So, adequate precautions against accumulation of water may be taken..

(vi) The surface features, such as rivers, surface structures and PWD road, existing over the mining area are likely to be affected by subsidence. So either it should be shifted or adequate precautions to protect surface features may be taken.

(vii) The nala flowing over the mining area are likely to be affected by subsidence. It is to be protected by leaving coal pillars un-extracted vertically below and within the subsidence influence area. Tenancy land over the mining area is likely to be affected by subsidence. Thus, if any cultivation is being done in such land, crop compensation to be paid to the tenancy land owners during the year when depillaring operation will be carried out in the panels below it and subsequent reclamation by filling and consolidation of the land.

(viii) The HT lines over the mining area are likely to be affected by a maximum amount of 1.908m subsidence. Thus, pylons of HT lines need to be protected by leaving coal pillars un-extracted vertically below it or HT lines should be shifted from the subsidence zone.

(ix) An abandoned quarry on the northern side of the mine boundary is unlikely to be affected by subsidence as it is away from the subsidence area. It is recommended that while carrying out extraction in the panels of Upper Bachra seam, close subsidence monitoring should be done and their impacts and effectiveness of the mitigative measures should be reviewed before starting depillaring in lower seam.

L Precautions against Blasting in Heightening District.

Since the entire mine is developed up to 2.4m only and it is to be heightened up to 4.60mto facilitate the CM operation for depillaring of standing pillars. This type of heightening experiences will be totally new for the project. So, before going for heightening, the permission from DGMS for Blasting, Support, Ventilation and other workings should be obtained. The entire mining operation should be in accordance with the provisions mentioned in the permission. In addition to above, other provisions as per statute should be strictly complied with.

M. Environmental Monitoring

To ensure the safe operation of the mine, the following aspects should be measured periodically and adequate precautions as per statutes should be taken.

ii) Fire damp (CH4)

iii) Carbon-Monoxide (CO)
iv) Temperature
v) Humidity
vi) Coal dust concentration

The various provisions regarding monitoring and remedial measures for each of the above as per CMR, 1957 and other related circulars should be complied with effectively.

N. Conservation

In Churi Block, two coal seams namely Lower Bachra and Upper Bachra exist with a parting ranging from about 0.47-18m. The thickness of Lower Bachra seam generally varies from 3 to 5m and gradually increases to 9m in the western part. The thickness of Upper Bachra varies from 2 to 3m in the major part of the area.

In Benti block, the Lower Bachra seam is splitted in two parts Bottom Lower Bachra & Top Lower Bachra. Top Lower Bachra further splits into two parts Upper section of Top Lower Bachra & Lower section of Top Lower Bachra. In part of the areas these two section merges and forms combined Top Lower Bachra. Two sections namely, Bottom Lower Bachra & Upper Section of Top Lower Bachra / Combined Top Lower Bachra is workable through out the property in Sector-A of Benti Block.

The mine is developed up to 2.4m in most part of the property in Churi Block. Presently development is in progress in bottom lower Bachra seam in Benti Block. The development height is 2.4m.

The maximum cutting range of the proposed Continuous Miner (which has been successfully deployed at Anjan Hill Mine, SECL) is about 4.6m. Continuous Miner having cutting height more than 4.6m. is also available. But it requires gallery width of 5.5m. But LBS has been developed with gallery width 4.2m. So, it limits the choice of the machine. The percentage of extraction achieved may be about 65% of the coal in standing pillars, considering the average thickness of coal in the area proposed for mining. In general, coal seams exhibit variable thickness. The seams having thickness greater than 3.0m has been proposed for continuous miner working. The use of continuous miner will increase the percentage of recovery as compared to conventional Bord and Pillar Method. The layout of panels and the extraction of pillars have been envisaged in such a manner to result minimal losses of coal in the goaf.

O. General

All underground workers will be provided with self-rescuers and all such resources will be examined and maintained by competent person. Where formation of coal dust is more than permissible limit, approved type of dust respirator will be provided to the workers. The various provisions of CMR, 1957 related with the safety of the mines and persons employed there in

should be strictly complied with. Adequate precaution should be taken in operation of haulage & conveyor roadways.

CHAPTER-XXI

ENVIRONMENT MANAGEMENT

21.1 GENERAL

The present report covers part of area under Churi & Benti (partly) blocks. Upper & Lower Bachra seams are presently being worked at the mine. Presently development is in progress in Bottom lower Bachra seam of Benti block (Sector-A) and upper Bachra seam of Churi Block. It is proposed to introduce Continuous Miner technology in the mine. The method of mining proposed is Bord & Pillar with caving. The average seam thickness within proposed mining area of the workable seams is about 5.5m. The range of extraction height in the seams will be restricted to 4.6m. The maximum depth of mine workings in the mining area is likely to vary from about 21m to 121.68 m.

A study for subsidence prediction and management for Churi U/G was carried out at CMPDI (HQ) considering 4.6m of extraction and extraction for both the seams. It has been estimated that the maximum possible subsidence over the mining is 3.784m. The estimated tensile strain values in the forest area due to extraction of Upper and Lower Bachra seams individually and after extraction of both the seams are exceeding the limit prescribed by MOEF, i.e. 20mm/m. In the forest area such amount of tensile strain is likely to develop surface cracks more than 300mm wide. Part of the Benti block was beyond the scope of the study for subsidence. Churi-Benti project consists of part of Churi Block and part of Benti Block.

The method of extraction proposed for Churi-Benti Project is B & P with caving. Previously, no depillaring activities have been undertaken within the mining area. Major area under the project lies at moderate depth of cover. It is expected that caving in underground may cause subsidence at surface. Hence, it is proposed to undertake fresh subsidence study for appropriate evaluation.

The surface topography of the mining area is uneven. The ground elevation varies from 402 to 468m above MSL. The general slope of the area is towards east and west sides. Damodar and Saphi rivers flowing on the western and eastern boundary of the Churi block respectively and control the surface drainage of the existing mine area. Major portion of the surface over the proposed mining area is under forest and remaining is tenancy land. PWD road, few kutcha, Power trestles & forest roads are passing over the mining area. Accordingly, these surface features are proposed to be shifted and villages are proposed to be rehabilitated / resettled

Provision has also been made for compensatory afforestation, anti-pollution measures, base line data generation, and for earth filling over subsidence area caused by depillaring with caving

Sufficient storage capacity has also been provided in the main underground sump, so that the suspended dust particles generated due to underground mining operations settle down and comparatively cleaner water is discharged on the surface. Capital provision for settling tank has also been made in this report. Oil & grease trap would be constructed near workshop to treat effluents.

The solid waste debris due to excavation of inclines/drifting, etc. would be utilised for making the haulage embankment and surface levelling. So, any adverse effect on environment is not expected. Plantation at industrial site may be done for aesthetic look.

The noise level at the transfer points of coal in the underground workings as well as at the face and on surface, would be kept within the permissible/ recommended level of 85dBA. The general ecology comprising flora/fauna/general environmental and air, water, noise etc will be protected and improved.

21.2 COMMUNITY DEVELOPMENT

For better relation with the neighboring villages and as corporate social responsibility, it is required that community work like play ground, park, drinking water, road etc. may be provided. Churi UG mine is an existing mine and several works have been undertaken in the past for community development. However, provision of lump sum additional capital for community development has been envisaged.

21.3 EMP CAPITAL

The total additional capital under EMP head has been estimated and is shown in appendices. Further, provision has been made for EMP related activities from revenue account @Rs. 4.0/tonne, as ‘Environmental Protection Cost’.

EMP of Churi UG Project was prepared in the past considering the technology and production target of approved Feasibility Report. Since the technology and mining area has changed and boundary has also been re-adjusted, there is a need for preparation of a new EMP considering all the aspects of the Churi-Benti Project.

A comprehensive EMP report dealing with the impact of mining on environmental attributes & various mitigative measures will be prepared separately.

CHAPTER-XXII

MINE CLOSURE PLANNING

22.1 PREAMBLE

Mining is a hazardous operation as it offsets the equilibrium of natural depositional environment viz. in-situ stress field, ground water, surface drainage system as well as the socio-economic condition. Although mining activities are usually short-term phenomena, they are liable to leave long lasting impacts on landscape, ecology and on the mind set of local inhabitants. Thus, it is imperative that any mining venture should have adequate closure plan addressing issues viz. reclamation and environmental protection, rehabilitation of disturbed area. Community implementation of mine closure plan will incur some extra cost, neglecting this aspect will lead to future problems of attending compensation or expensive socio-economic problems.

Hence, efforts have been made to identify the likely impacts on geo-environmental and socio-political set-up due to closure of the proposed Churi-Benti UG project during the planning stage itself, so that it will offer an opportunity to generate resources for mitigative measures during closure of the mine.

22.2 LIFE CYCLE CONCEPTS

Mining Projects have a definite life cycle. All the mines have to eventually close their operation. The reasons for the closure may be many including economic conditions, depletion of mineable resource or any other unforeseen safety reasons.

In the present project proposal the mine life cycle planning is governed by the reserves content in the proposed mining area. Here, it is planned to exploit Lower Bachra seam in Churi block and Bottom Lower Bachra seam & UTLB in Benti section. As per mining schedule, the project life is estimated as 11 years. It is suggested that the activities for closure will be initiated at an early stage of project life in a gradual/planned manner.

22.3 MINE CLOSURE PHASE

The mine closure phase is supposed to be closed when the mine is de-commissioned, facilities at site are removed, the mine entries are sealed / fenced off, the management of waste dump/tailing is completed and the site is released in ecologically sustainable suitable for proposed land use.

The likely impacts due to closure of the mine in so far as the geo-technical/ safety/ environment and socio-political aspects are concerned and the suggested mitigative measures are elaborated as under:-

A) Technical aspects:-

i) ***Mine Entries*** : It is suggested that mine openings & workings will be properly closed & sealed so as to prevent any danger to post-mining uses of area.

ii) ***Service Buildings*** : The service buildings/structures will be removed/ demolished or may be used for some offices and the land covered under them restored for productive uses.

iii) ***Hazardous substances*** : Prior to surface demolition/restoration, a surface audit will be undertaken on all surface structures, spoil heaps, lagoons etc. to assess whether there are any hazardous materials that could cause problem i.e. explosive, asbestos, chemical oil etc.

iv) ***Disposal of assets*** : A list of surface and UG assets (P&M) will be prepared and made available to potential purchasers or transferred to other new/working mines of the company. This will ensure that the assets perform till its economic life and have better utilisation of assets.

B) Environmental aspects

i) ***Post closure Env. monitoring*** : It is suggested that the air & water quality parameters in the mined out area is monitored by some agency even after closure of the mine.

ii) ***Land reclamation and rehabilitation*** : The area on surface is mainly covered by forest, tenancy, cultivable & Govt. land. The method of mining is depillaring by caving under low to moderate depth of cover. The degradation of surface is expected due to caving. If any cracks / voids are created due to underground mining activities, it will be restored to original profile by filling up cracks / voids. The post-mining surface profile should ensure no accumulation of water and to maintain the general drainage pattern. It is suggested that the site restoration is progressive so that the restoration is more or less similar to the rate of mining.

The objective of restoration of post-mining area will be determined through consultation with local community and the govt. authority, so that the potential/ required end use of the mined out land is determined in advance. Such usage may be agriculture, forestry, amenity development or nature reserve. Necessary capital provision in the revenue account is indicated in the report.

C. Socio-political aspects

i) *Mining Community* : Due to closure of mining operation persons directly employed in the mine will be surplus. It is suggested that suitable manpower plan may be formulated by the mining company sufficiently before closure of mine for re-deployment of the work force in other units of the company.

The community in the region is highly dependent on agriculture, forest and other activities. The existence of mine is providing employment or other indirect benefits to the community. The mine closure is likely to create negative impact on the socio-economic condition of the region. It is suggested that the mine owner will interact with the local govt. to establish strategy for supporting the project affected community of the region by promoting investment in non-mining related enterprises.

ii) *Mining Township and Water supply* : It is suggested that the civic facilities developed during the mining phase will be transferred to the local govt./municipality so that, the region transforms smoothly into post mining phase.

The plan of closure shall be implemented in consultation with all stakeholders including state government.

22.4 FINANCIAL ASPECT

A corpus fund is proposed to be created by deducting @Rs.0.50/t from revenue account & will be released at the time of undertaking mine closure activity. It may include cost of all closure activities, post-mining land use, organisation for executing closure activities, post-project monitoring activities, etc.

CHAPTER XXIII

LAND & PROJECT IMPLEMENTATION SCHEDULE

23.1 LAND ACQUISITION

23.1.1 Mining Area

The distribution total area within mine boundary is as under:

Existing area within mine boundary		**-**	**7.68 sq. km**
	Churi block	-	5.89 sq. km
	Benti block	-	1.79 sq. km
A**rea where CM is proposed**		**-**	**2.44 sq. km**
	Churi block	-	2.03 sq. km
	Benti block	-	0.41 sq. km

23.1.1 Quantum & Type of Land

Land-use within mine boundary: The proposed mining area under the project covers area of existing Churi reorganization (CRO) mine and part of Benti Block. The northern limit of the mining area in Benti block is up to the existing adjusted boundary with Ashoka OCP of Piparwar Area. The limits of developed pillars in Churi block and adjoining virgin area in Benti block up to existing mine boundary constitutes the mining area for the project. Major part of the area within the proposed mine boundary is forest land. Power trestles and roads are passing over the property, which needs to be shifted. Many villages like Pahan Tongari, Sakhuwa Tola, Jobia Sarna, Manu -Tand, Barwatand, Amba-gram, etc. are situated over the proposed property. Villages & other surface features falling over the mining area needs to be shifted / rehabilitated. The quantum and type wise land use of the area within the proposed mine boundary is shown in Table 23.1. This detail of land is as per the land use plan supplied by the project.

Table 23.1: Summary of Land-use over Total Area within mine boundary

Usage of Land	Existing Land Area (Ha)		Total (Ha)
	Churi block	Benti block	
Forest	443.48	49.98	**493.46**
Non-Forest	145.38	129.14	**274.52**
Total	**588.86**	**179.12**	**767.98**

Within the existing mine boundary, the land over the mining area is to be acquired for extraction of coal (development & depillaring). The area lying on south of fault F10 has been excluded as extent of mining is not known. Only the area lying on the north of fault F10 in Churi & Benti block (within existing mine boundary) is available for extraction and is about 6.04 sq. km. The land use for the above area considered for mining is shown in Table 23.2.

Table 23.2 Details of actual mining area are as under

Usage of Land	Existing Land Area (Ha)		Total (Ha)
	Churi block	Benti block	
Forest	382.34	49.98	**432.32**
Non-Forest	58.42	113.56	**171.98**
Total	**430.76**	**171.98**	**604.30**

If the total area is to be depillared then surface land of 604.3 Ha of land is to be acquired. It comprises of 432.32.Ha forestland and 171.98 Ha non-forest land. Total amount of rupees required for the acquisition of this total land will be around 5533.22 lakhs (i.e. 55.33 Crores). As decided in the FD's of CCL, it was directed to make provision for land acquisition only for CM deployment.

Land-use for CM Deployment: Out of the total mining area as mentioned above, only part of the area is proposed for CM deployment. Area of the western section of CRO (up to W-15 panel) including panels E12 & E13 and part of the Benti block up to its existing boundary in Benti block. Major part of the area proposed for CM deployment is forest. The quantum and type wise details of land for the proposed area for CM deployment are as shown in table 23.2.

So, out of the above 604.3 Ha, only 229.10 Ha of forest land & 15.5 Ha of non-forest land will be required for CM deployment and provision for the same has been made in the report which amounts to 28.94 Crores.

Table 23.2 : Summary of Land-use for CM Deployment over Mining Area

Type of Land	Within Existing Boundary		Total Land (Ha)
	Churi	Benti	
Forest	203.5	25.6	**229.1**
Non-Forest		15.5	**15.5**
Total	**203.5**	**41.10**	**244.6**

The above delineation of land is based on the land use plan supplied by the colliery authority. Considering possibility of subsidence, it is proposed to acquire land on surface taking into account the NPV of forestland and compensation of private/govt./other type of lands.

If CCL management makes boundary adjustment up to Fault F-13 in Benti block, the additional 31 Ha of land will have to be acquired. Presently, diverted Benti nala, haul road of Ashoka project & other important road are passing over this additional property. This 31 Ha land comprises of 24.2 Ha of forestland and 6.7 Ha of non-forest land. The boundary adjustment can provide a longer development life for CM. Since Area officials have not agreed for boundary adjustment, this extended part is beyond the scope of this project report.

Land requirement for other infrastructure of the mine*:* Major infrastructure for the project / mine already exists on surface including residential colony & other welfare measures. The surface land other than the mining has not been proposed for

acquisition. The land acquisition for the project has not been done till today. It has to be acquired for the project for the exploitation of the developed and virgin reserves. As directed by FDs, it is proposed to acquire land (all rights / surface rights) only for the purpose connected with introduction (development & depillaring) of Continuous Miner only. Accordingly the provision has been made in this report.

23.1.2 Status of Notification & acquisition

The entire area within the proposed mining area is already notified under section 9 of CBA Act. The details of the land acquisition (as provided by the CCL authorities) status for Churi-Benti UG project is as below:

a) The revised forest application in new format was submitted to the DFO, Ranchi (East) on 13.7.05.
b) DFO has forwarded to CF on 27.10.05.
c) Latest development in the process of acquisition of land as communicated by CCL management is that the proposal for land acquisition is pending with RCCF.

The actual status for the land acquisition for CM deployment in Churi-Benti project has been assumed that it is not acquired till today, so the provision for its acquisition has been made in this report.

The cost of forest land has been taken as Rs 12.60 lakhs/Ha and non-forest land has been taken as Rs 0.50 Lakhs per Ha. Forest land includes GMK (jungle-jhari).

23.1.2 Time-frame for acquisition with capital provision

The phasing of the quantity of land and its capital provision is shown in Appendix-A.1.

23.2 PROJECT IMPLEMENTATION SCHEDULE

The activity for project / mine development will commence only after the acceptance of De-rating cum completion report (foreclosure) report of Churi UG project and sanction of the present report. As most of the surface infrastructure exists, initially efforts would be made to commence the trunk roadway development in Bottom Lower Bachra seam and undertaking various activities required facilitating introduction of Continuous Miner. Simultaneously, efforts would be made for timely procurement & commissioning of the Continuous Miner. Efforts would be made for consolidation of existing coal evacuation system, man-riding arrangement, pumping & ventilation re-organization, etc. The schedule for procurement of additional Plant & Machinery (P&M) & other infrastructure along with their capital phasing have been detailed in appendices

Zero Date: The zero date for the project has been considered as the date of sanction of PR and/or EMP approval, which ever is later. The project construction activities would start from Year 1. It has been assumed that the activity of PR/EMP approval and land acquisition for CM deployment would be completed in the first two (2) years, i.e. by the end of Year 2.

For timely implementation of project, it is essential that all activities related to construction of the project are properly scheduled, closely monitored and effectively supervised. All departments will have their own implementation schedule to get the project constructed within the time frame. The resources should be made available in time as soon as the project report gets sanctioned to prevent time & cost overrun.

The construction activities are required to be identified in detail for appropriate monitoring and timely implementation of the proposed project so that the project achieves its target output within time frame.

Construction Team: It is proposed to appoint a Project Officer (mining) of M-1 rank and Colliery Manager of E-5 level along with a group of Asstt. Managers of E-4/E-3 level for the mine. It is proposed that each of the units will have a dedicated team of electrical and mechanical engineers to take up the project development activities for timely execution of the work.

23.3 YEAR OF COMMENCEMENT OF PRODUCTION

The existing production from the Churi-Benti project is about 0.16Mty. It is proposed to enhance the production level of the project to 0.81Mty. The target year to achieve the rated production is Year 4. Year-wise production schedule during initial years in shown in the Table 23.3.

Table 23.3 : Production Schedule during Initial years

Technology / Year	Year 1	Year 2	Year 3	Year 4	Year 5
Manual B&P district	0.06	0.06	---	---	---
B&P with low-height LHDs	0.10	0.10	0.16	0.16	0.16
B&P heightening district with remote controlled LHDs	---	---	0.10	0.15	0.15
Continuous Miner	---	---	0.40	0.50	0.50
Total Production (Mt)	**0.16**	**0.16**	**0.66**	**0.81**	**0.81**

CHAPTER- XXIV
FINANCIAL EVALUATION

24.1 TOTAL CAPITAL INVESTMENT

Churi UG is an ongoing project in CCL. With the aim of CCL to augment coal production this PR has been envisaged with production augmentation of Churi-Benti UG to 0.75 MTY. Accordingly the economics has been worked out considering introduction of Continuous Miner Technology (for the first time in CCL). The estimated economics have been discussed in the subsequent paragraphs.

Initial capital investment has been provided in the report till the year of achieving rated coal production i.e 4th year. The capital requirement both Initial as well as beyond target year, has been proposed from the own resources of the Company. The estimated capital requirement is given below:

Sl.	Particulars	Rs.Crores
1	Initial Capital (Up to target year)	163.41
2	Additional Capital (upto target year)	145.44
3	Existing Expenditure upto 31.3.06 considered in this PR	17.97
4	Capital beyond target year.	2.39
5	Specific Investment Rs./t	2178.81

Foreign Exchange: Foreign Capital will be involved in this project. The estimated foreign exchange requirement is shown in Appendix-A.3.5.

The details of capital investment under various heads viz. Land (A.1), Buildings (A.2), Vehicles (A.6), Prospecting & Boring (A.7) and Development (A.8), are given in the appendices mentioned against each of them.

24.2 CAPITAL INVESTMENT ON P&M

Capital investment on P&M is given in Appendix-A.3. The detailed break-up for P&M, Electrical, Pump & Pipes, Workshop and Other P&M etc. are given in Appendix-A.3.1 to A.3.5. The estimated capital investment on P&M is given below:

Sl.	Particulars	Rs. Crores
1	Additional P&M (up to target year)	111.59
	P&M (beyond target year)	-
2	CMT Package (up to target year)	66.80
	CMT Package (beyond target year)	-

a. Method of Estimation of Capital Cost

The method of estimation of capital investment for P&M, Civil estimates, Development Capital, Revenue expenditure capitalised etc. is as follows.

b. Prices of Plant & Machinery

For the plant and machinery, as far as possible, the prices have been taken from the Standard Price List of Mining Equipment published by CMPDI and whenever information regarding price was not available, a broad estimate was made. Price of Continuous Miner has been based on the price of equipment in a recently concluded agreement between ECL & supplier for CMT introduction at Jhanjra mine, ECL. The 100% payment to the supplier will be on the basis of outright purchase.

c. Estimated Cost of Civil Construction

The basis for the estimation of the cost of civil construction viz. residential buildings, service buildings, roads etc. has been given in Appendices - A.2.1, A.2.2 & A.8.2.

d. Capital Investment on Vehicles

The additional capital investment on vehicles is estimated as Rs. 10.00 Lakhs. The details are given in Appendix- A.6.

e. Development

Under this head, estimated investment is given for (a) capital outlay in mines (Appendix A.8.1), (b) Roads and culverts, including haul roads (A.8.2), (c) Water Supply & Sewerage (A.8.3). The details of each item are given in the respective Appendix indicated in bracket.

f. Opening of Revenue Account

Churi UG project is an existing ongoing project.

24.3 COST OF PRODUCTION

The overall estimated average cost of production of this proposed Project comes to Rs.1261.01/t and Rs. 1404.94/t at 100% and at 85% operation levels respectively. The break-up of different cost elements is shown in Appendix-C1 & C2. Salient points regarding estimation of revenue costs are mentioned below:-

a) *Salary/Wages* : There is no additional requirement of manpower. However for the purpose of its impact on CPT, the requirement of manpower is estimated category wise/ scale wise and details of manpower are given in Appendix - B1.

Prevalent pay scales for executives and non- executives (NCWA-VII) are adopted. Mid points of the relevant pay scales of executives & non-executives have been considered in estimating the salary and wages cost. EMS works out to be Rs. 847.93. The average wages cost per tonne works out to Rs. 346.40.

b) Store :

i) Repair and Maintenance : As per standard norms formulated by CMPDI for underground mine.

ii) Explosive and Timber/Roof Bolting : Based on approximate consumption pattern of underground mines in the Area.

iii) POL & Miscellaneous store cost : As per CMPDI norms.

iv) Spares & Maintenance (for the life of project) for CM (refer to Appendix A.3.5 for details), has been considered as per the agreement for Jhanra mine, ECL. These are however subject to change upon finalisation of agreement with supplier during implementation.

The average store cost including all the above works out to Rs. 309.61/t.

c) *Power :* Detailed calculation of specific energy consumption per tonne of output is given in the chapter for power supply, illumination, etc. Power cost per unit kWh is considered as average Rs.3.20/unit. The average power cost per tonne works out to Rs. 56.84.

c) *Misc.expenses including workshop debit* : This covers the expenditure on printing & stationery, postages, telephone, repairs and maintenance of assets other than P&M, workshop debits for annual servicing and overhauling of major equipment, insurance and taxes for vehicles, normative contractual cost of major maintenance. The average misc. cost at 100% capacity level works out to be Rs. 64.08 /t.

d) *Supervision Charges for CM* : This cost is for a period of five years of initial operation of CMT package and has been considered as per the agreement for Jhanra mine, ECL. These are however subject to change upon finalisation of agreement with supplier during implementation. This works out to Rs. 138.24/t.

This would involve operational supervision by suppliers' personnel with other overheads. The incidence of income tax on salary of such personnel and service tax on services provided has been included in these charges.

e) *Depreciation:* Depreciation on assets is computed as per the prevalent norms. The straight-line method of charging depreciation has been adopted. The average depreciation cost per tonne at 100% level works out to Rs. 246.29 /t.

e) *Administration charges*: It is taken as Rs. 54.46 per tonne of annual output based on average cost per tonne of CCL .

f) Interest on Working capital @ 12.5% works out to Rs. 40.59/t.

24.4 GRADE OF COAL SELLING PRICE & PROFITABILITY

The present declared grade is 'Gr. B'. The same has been considered for the purpose of present economic evaluation. Considering the above and overall estimated average cost of production of Rs.1261.01/t and Rs. 1404.94/t at

100% and at 85% operation levels respectively, the project is likely to earn a profit of Rs. 179.99/t and Rs. 36.06/t, respectively. The profitability at different level of operation is presented in Appendix-C.1&2.

24.5 BREAK-EVEN PRODUCTION

It is estimated that the project would break-even at 36.86% of production capacity.

24.6 INTERNAL RATE OF RETURN

The overall financial Internal Rate of Return (FIRR) of the Project works out to 9.33% and 0.08 % at 100% and at 85% level of production respectively. The year-wise production and present declared grade 'B' selling price of Rs. 1441.00/t has been considered for IRR calculation. However, with a slippage of grade by one stage i.e Grade C, the IRR will not be positive.

24.7 SENSITIVITY ANALYSIS

The following parameters have been identified for assessing their impact on the profitability of the project.

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:

	Variable Parameter	**IRR at different stages of**					
			5%	**10%**	**15%**	**20%**	**25%**
1	Increase in Capital	9.33	8.34	7.40	6.51	5.66	4.85
2	Increase in Cost of Prodn.	9.33	6.24	3.10	-tive		
3	Decrease in Capacity	9.33	9.12	4.73	0.08	-tive	
4	Decrease in Selling Price	9.33	5.00	0.42	-tive		

24.8 INCREMENTAL SCENARIO

An option has been included, which shows the incremental impact of the introduction of CMT in Churi-Benti for an incremental production of 0.65 MTY. The salient features of the incremental analysis is tabled below:

Sl.	**Particulars**	
1	Incremental Capital (Up to target year) **Rs.Crores**	145.44
2	Incremental Average cost of production Rs./t	827.16
3	Incremental IRR at 100% of incremental Prod^{n}. %	21.17
4	Incremental IRR at 85% of incremental Prod^{n}. %	13.35
5	Incremental Specific Investment Rs./t	2237.55