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RECAST PROJECT REPORT

(INCLUDING MINING PLAN)

FOR

DHANKASA U/G MINE (1.00 Mty)

(PENCH AREA)

WESTERN COALFIELDS LIMITED

(JOB No. - 4011871)

VOLUME – I

(EXECUTIVE SUMMARY)

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CMPDI

REGIONAL INSTITUTE-IV, KASTURBA NAGAR,
JARIPATKA, NAGPUR, PIN – 440 014

AN ISO 9001:2000 COMPANY

CERT NO: CI / 8656

Area Planning Officer
WCL, Pench Area

EXECUTIVE SUMMARY

Area Planning Officer
WCL, Pench Area

RECAST PROJECT REPORT FOR DHANKASA U/G MINE

EXECUTIVE SUMMARY

1.0 INTRODUCTION

1.1 GENERAL

The proposed Dhankasa UG Mine has been planned in the Geological blocks of Dhankasa and Naheriya (partly). These Geological Blocks are located in the north-eastern part of Pench-Kanhan Valley Coalfield, District Chhindwara, Madhya Pradesh. The area is covered in the Survey of India Topo-sheet No. 55 N/3 (RF 1:50,000) and is defined by Latitudes N 22°17'39" and N 22 °19'33" and Longitudes E 78°59'04" and E 79°01'13". The nearby operating mines are Naheriya UG & Urdhan OC. Naheriya U/G Mine is about 6 kms from proposed Dhankasa U/G Mine. Thesgora and Mathani mines are about 22 kms on the western side of Dhankasa Block. Dhankasa UG will be under the administrative control of Western Coalfields Limited.

1.2 HISTORY OF MINING

Dhankasa geological block is a virgin block. Dhankasa U/G project is aimed at bridging the deficit in supply of coal partially from Pench Kanhan Coalfield as well as WCL. The report has proposed the deployment of mass production technology in order to generate higher production and productivity levels.

Dhankasa block lies between Sonpur and Naheriya Blocks and Jamunia Block forms the south western boundary. North-south flowing Junapani nalla and east-west flowing Dhankasa nalla pass along the western and southern boundaries of the block. This Report has proposed to exploit proved reserves of 9 sectors in the Geological Block-i.e. Sectors 2,3,4,5,6,7,13,14 &15.

1.3 EXPLORATION STATUS

The Recast PR for Dhankasa UG Mine, Pench Area, WCL was prepared based on the following Geological Reports-

(1) Geological Report on Exploration for Coal, Dhankasa Block', Pench-Kanhan Valley Coalfield, Chhindwara District, Madhya Pradesh, prepared by MECL, Nagpur, in November 1997.

(2) Geological Report on Exploration for Coal, Naheriya Block', Pench-Kanhan Valley Coalfield, Chhindwara District, Madhya Pradesh, prepared by MECL, Nagpur, in October 1994.

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The detailed exploration in Dhankasa Block has been carried out by MECL in 2 phases:

i)	PU-Series	22 boreholes	-	July '89 to May '93
ii)	PD-Series	69 boreholes	-	May '94 to March '97

The present geological assessment of the proposed mine area is based on the data of 91 boreholes involving a total meterage of 17864.80m in an area of 7.40 km^2. This includes major part of Dhankasa geological block and a part of Naheriya block. The density of boreholes works out to 12 B.H/ km^2.

The proposed Dhankasa U/G mine has been projected in major portion (5.20 km^2) of Dhankasa Block and a small part of Naheriya Block (0.30 km^2) which is in structural continuity with Dhankasa Block. The total area of the proposed mine is 5.50 km^2. 73 exploratory boreholes fall within this area involving a total meterage of 10682.55m. The density of boreholes works out to 13 boreholes/km^2.

1.4 PREPARATION OF PROJECT REPORT FOR DHANKASA U/G MINE

All milestone events/decisions involved in the preparation of Recast P.R for Dhankasa UG mine has already been detailed in earlier chapter "PRE-PLANNING INTERACTIVE PROCESSING ". However, the most important Mile-Stone events will be discussed in this chapter.

The 3rd Recast Project Report for Dhankasa U/G Mine was prepared in February-2008 for a production target of 1.0 Mty with 2 nos of Continuous Miner districts & 1 LHD district (with 2 LHDs). The major changes made in this PR with respect to the earlier Project Report were as follows:

a) The target capacity of the mine 1.0 Mty, which will be generated from 2 C.M districts (0.91 Mty) and 1 LHD district (0.09 Mty). Each Continuous Miner District to produce 1517 tpd (0.455Mty). The LHD district would contribute 300tpd (0.09 Mty).

b) Workability of Seam-III+Parting+Seam-II was checked along the lines of Seam-II (Packet).

c) Inclusion of Cavability Study to ascertain the cavable nature of strata due to the presence of Deccan Trap. (Study report enclosed as Annexure-I).

By incorporating all the points mentioned above, the Recast P.R of Dhankasa UG Mine was finalized in February-2008 & submitted to WCL. Subsequently, this Report is presented at WCL-HQ. The WCL Board in its 212 st meeting held on 17.06.2008 has given administrative approval to **Recast Project Report for Dhankasa UG Mine** for a capacity of 1.00 Mty with a total capital cost of Rs 152.86 Crores in " **Partial Hiring** " option subject to " **Cost Plus Agreement** " with prospective customer. (Annexure-I enclosed).

(WCL Board in its 201st meeting held on 16.01.2007 had already accorded administrative approval for Introduction of Continuous Miner Technology, through out-sourcing by global tendering, in Dhankasa U/G Mine). The project did not take up as no FSA was signed with any prospective consumers.

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Chief General Manager (P&P), WCL vide letter no. WCL/C-1(E)/(P&P)/SPP/ 921 dated 23.09.2013 requested CMPDI, RI-IV to update the Project Report of Dhankasa U/G Mine as the project is proposed to be offered under MDO concept and RFQ document for the global bid is under finalization at CIL. The Project Report for Dhankasa U/G Mine was updated on Partial Hiring Option in October 2013 (Approved Option) and was submitted to WCL.

Further, Director (Tech) (P&P), WCL vide letter WCL/D(T)P&P/Secy./249 dated 30-11-2013, asked CMPDI, RI-IV to customize the Draft RFQ Document for inviting bids for finalizing MDO for Dhankasa U/G Mine. As desired by WCL, the Customized Draft RFQ Document was prepared and submitted to WCL in 2nd week of December-2013. Customized Model RFQ document for Dhankasa UG Mine with Indicated Project Cost (P.H option) & Updated Project Report (Oct-2013) were submitted to TSC of WCL on 16th January 2014. During the deliberations, the Committee directed CMPDIL, RI-IV to recast the P.R. after consultation with CMPDIL (HQ), Ranchi so that the provisions in the P.R. are commensurate with stipulation in the MDO document prepared by CMPDIL (HQ).

It was finally decided to update the Project Report for Dhankasa U/G Mine on Departmental Option for the purpose of getting the Indicated Project Cost in Model RFQ Document. The updated P.R & the customized Model RFQ Document (MDO) were presented by RI-IV, CMPDIL in the Technical Sub Committee Meeting of WCL held on 05.02.2014. After detailed deliberations, the Technical Sub Committee recommended both the PR & MDO document of Dhankasa UG U/G Mine to be placed before WCL Board for approval.

WCL Board held on 22.02.2014, while according Board Approval, advised CMPDI, RI-IV to explore the possibility of increasing the capacity of Dhankasa U/G Mine based on the technical consideration so as to improve the economics of the mine before inviting RFQ.(Annexure-II enclosed). The Board after detailed deliberations, in order to facilitate early opening of Dhankasa U/G Project, accorded approval for the following:

a) Project Report of Dhankasa U/G Mine at an estimated capital of Rs. 426.27 Crores on Departmental Option only for the purpose of arriving at the indicated capital requirement for inviting RFQ/RFP.

b) Inviting RFQ for development and operation of Dhankasa U/G Mine under MDO route through Global Tender by CMC Department.

c) Acquisition of land and extending R&R benefits etc., as an advance action at updated estimated cost of Rs. 68.9714 Crores (max.) for Dhankasa U/G Mine.

Taking WCL Board directions into consideration, a Conceptual Note on exploring the possibility of increasing production was prepared in March 2014 with 3 nos of Continuous Miner districts.

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1.5 RISKS / CONSTRAINTS

Following risks/ constraints are anticipated while implementing this Project:

a) About 60% extractable reserves are lying in Sector-3 and 4 of Dhankasa Geological Block, which are less geologically disturbed sectors. Balance 40% extractable reserves are available in comparatively more geologically disturbed areas.

b) The thick cover of Basalt overlying the Barakar formation could cause difficulty in caving of roof in those areas where the thickness of formations between the basalt and the roof of first workable seam is less than 10 times the total thickness of extraction. Induced caving methods may have to be adopted in such areas for safety consideration.

c) Major part of the surface area overlying Dhankasa U/G mine is covered by forest of various categories. The approach road to the mine from Naheriya U/G mine is passing mostly through forest. Forestry Clearance under Forest Conservation Act will be required from MoEF besides approval of EMP. Subsidence Prediction studies are required to be carried out to ascertain the extent of tensile strain developed below the forest due to extraction below ground. If the tensile strain is found to exceed 10mm/m the NPV of entire forest may have to be paid.

d) The productivity of Continuous Miner district is based on the likely support density and the capability of the roof bolting machine which is an integral part of the continuous miner package. The support density as well as support system design has been worked out based on the available data of geo-engineering properties of the strata overlying the coal seams and orientation of faults, etc. Any change in support density requirement may affect CM production.

e) Availability of clean water for operating the Continuous Miner packages during the initial development years could pose a problem since the mines of Pench Area are known to be dry. Separate arrangements have to be made to overcome this problem.

f) The quality of Seam-II Pack (Seam-IC+ parting+ Seam-II) is comparatively low due to the presence of the parting/band (aranaceous shale) with a thickness of 0.4 to 0.6 m between Seam-IC and II.

g) Induced caving has to be practiced at the many goaf areas where roof strata does not fall by its own. Induced Caving by blasting preferably from underground or from surface has to be conducted. The Coal production from the mine will definitely depends on the success of strata control.

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2.0 MARKETABILITY & JUSTIFICATION

The following table shows the demand for coal including middling's, from the various Existing, Completed, On-going, and Future Projects of WCL:

Sl. No.	Particulars	Coal Demand Projections (Mt)			
		2016-17	2017-18	2018-19	2019-20
1	Demand of Coal from the WCL Mines	69.28	70.08	70.58	70.58

The coal production from WCL is 40 to 45 Mt per annum since last many years and WCL is gearing up to increase the production up to 60 Mt by 2019-20. To achieve the projected 60 Mt per annum production, it is essential to open new projects like Dhankasa U/G Mine. The following table shows the coal production from the mines of WCL up to 2019-20 from the various Existing, Completed, On-going, and Future Projects:

Sl. No.	Particulars	Coal Production Projections (Mt)			
		2016-17	2017-18	2018-19	2019-20
1	Existing Mines	0.25	0.25	0.20	0.20
2	Completed Projects	15.38	12.39	10.20	10.15
3	On-going Projects	22.27	21.10	25.67	28.05
4	Future Projects	10.10	16.26	18.93	21.60
5	Total	48.00	50.00	55.00	60.00

Thus, the deficit in availability of coal from the various existing, completed, on-going and future projects of WCL is as follows:

Sl. No.	Particulars	Surplus / Deficit Projections (Mt)			
		2016-17	2017-18	2018-19	2019-20
1	Demand of Coal	69.28	70.08	70.58	70.58
2	Availability of Coal	48.00	50.00	55.00	60.00
3	Surplus (+) / Deficit (-)	(-) 21.28	(-) 20.08	(-) 15.58	(-) 10.58

From the above tables, it is clear that the deficit in availability of coal including middling's from the various existing, completed, on-going and future projects of WCL will be 21.28 Mt in 2016-17. This gap between demand and supply of coal will be narrowed to about 10.58 Mt in 2019-20 provided all the future projects are opened as per schedule.

The Production from Dhankasa U/G Mine will not only bridge the gap to the extent of planned production but will also establish a new mass production technology for underground mines and thus there will be an augmentation in underground production. Therefore in view of deficit of coal, there is no problem in marketing of coal and hence opening of Dhankasa U/G Mine is justified.

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WCL, Pench Area

3.0 PROJECT SITE INFORMATION

3.1 LOCATION

Dhankasa Block is located in the north-eastern part of Pench-Kanhan Valley Coalfield, District Chhindwara, Madhya Pradesh. The area is covered in the Survey of India Topo-sheet No. 55 N/3 (RF 1:50,000) and is defined by Latitudes N 22°17'39" and N 22°19'33" and Longitudes E 78°59'04" and E 79°01'13".

Dhankasa geological block covers an area of 7.40 km^2. The proposed Dhankasa UG mine is planned in the block which also includes Sector-4 (about 0.30 sq.km.) of Neighboring Naheriya geological block which is in structural continuity with Sector-3 of Dhankasa block. Sector-4 of Naheriya geological block was not included in Naheriya U/G mine due to 20-30m down throw fault $F_{8(N)}$-$F_{8(N)}$ and Gunor River flowing over this sector.

3.2 GEOLOGICAL BLOCK BOUNDARIES:

The boundaries of Dhankasa Geological Block is as mentioned below-

North	: Arbitrary line 200m away from existing boreholes in the block. & Northern side of .Junapani Nalla.
North-East	: Sonpur Block.
South	: Baheriya Village.
South-West	: Jamunia & Naheriya Blocks.
West	: Jamunia Block (part)

3.3 ACCESSIBILITY AND COMMUNICATION

The approach to Dhankasa block is through a 6 km long kutcha hill/forest road from Naheriya U/G Project. Naheriya U/G Project can be approached from Khirsadoh / Parasia by an all-weather road, nearly 30km via Shivpuri and Thesgora mines. Naheriya U/G Project can also be accessed from Singhori village located 20 km from Chhindwara on Chhindwara-Narsingpur road. From Singhori village, there is a metalled road, nearly 8 km up to Naheriya Project via Bokai Township. Chhindwara town is located 27 km south-east of Parasia on State Highway No.19. Chhindwara is connected to Amla (120 km) through a broad gauge line of Central Railway. Parasia and Chhindwara are the nearest rail heads for Dhankasa Block.

3.4 TOPOGRAPHY & DRAINAGE

The entire area of Dhankasa geological block is covered by Deccan Trap basalt, which on differential erosion has given rise to rugged terrain comprising hills and valleys. The northern part around borehole PD-62 is occupied by hills with maximum altitude of 890m in the block, from which the ground slopes down to the level of 722m in the south, which is the minimum altitude in the block.

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The major drainage in the area is provided by southerly flowing perennial Gunor River. The southerly flowing Junapani nalla and Dhankasa nalla flowing westerly are the prominent tributaries to the Gunor River. The major part of the area is covered with forest. Gunor River & Dhankasa nalla in the block has not been recorded anywhere. Hence the HFL value of 720m from the neighboring Naheriya Block, is considered in this Report. The northern bank of Dhankasa nalla and Gunor River are marked by steep scraps and hence zones of flood levels are likely to be restricted to the banks on either side.

3.5 CLIMATE AND RAINFALL

This area has a pleasant climate on account of its elevation. Summer is moderate but winter is cold.

The average annual rainfall is around 1150 mm. The precipitation is concentrated during the period from 15th June to 15th September. Highest precipitation is generally recorded in the period from July to August. In this area the average relative humidity varies from 22.5% to 76%.

3.6 PRESENT LAND USE PATTERN

The total land requirement for Dhankasa UG project is 582.651 Ha out of which Forest Land covers an area of 385.841 Ha, Tenancy Land 181.465 Ha & Govt. land 15.345 Ha. Out of the total 581.651 Ha, 549.131 Ha land is involved for mining purpose and the remaining 33.52 Ha land for approach road, colony, infrastructures and rationalization of plots etc. The total land base to be acquired under All Rights, Surface Rights & Mining Rights are 294.293 Ha, 33.52 Ha and 254.838 Ha respectively.

The land use pattern of this area is directly controlled by the topography. The plateau and valley portion are used as cultivated land round the year. The slopes are covered by forests of moderate to thick density. The plateau and valley portion are used as cultivated land round the year. The slopes are covered by forest of moderate to thick density. The topsoil is typical black cotton soil occurring mostly in the valleys.

The top soil is typical black cotton soil occurring mostly in the valleys. Thickness of soil varies from 0.50m to about 3.00m. Sub-soil is dull brown to grey in colour with dominance of boulders of basalt.

Major crops in this area are Maize, Jawar, Ground nut and Wheat. Major flora in this area are Teak, Sal, Mahua, and Tendu together with thorny bushes. The Monkey, Peacock, Fox, etc. represent the major fauna of the area.

The details of land type & its acquisition right is mentioned in para 21.1 "LAND REQUIREMENT".

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4.0 GEOLOGY AND DEPOSIT APPRAISAL

4.1 INTRODUCTION

Recast Project Report for Dhankasa U/G Mine is based on

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The detailed exploration in Dhankasa Block has been done by MECL in 2 phases:

i) PU-Series 22 boreholes - July '89 to May '93

ii) PD-Series 69 boreholes - May '94 to March '97

The present geological assessment of the proposed mine area is based on the data of 91 boreholes involving a total meterage of 17864.80m in an area of 7.40 km^2. This includes major part of Dhankasa geological block and a part of Naheriya block. The density of boreholes works out to 12 boreholes/ km^2.

The proposed Dhankasa U/G mine has been projected in major portion (5.20 km^2) of Dhankasa Block and a small part of Naheriya Block (0.30 km^2) which is in structural continuity with Dhankasa Block. The total area of the proposed mine is 5.50 km^2. 73 exploratory boreholes fall within this area involving a total meterage of 10682.55m. The density of boreholes works out to 13 boreholes/km^2.

4.2 GEOLOGICAL SUCCESSION IN DHANKASA BLOCK

Age	Formation	Lithology	Thickness Range (m)	
			Minimum	Maximum
Sub-Recent to Recent	Soil (Residual & transported)	Sandy and Clayey soil	0.20	7.00
Upper Creta-ceous. To Eocene	Deccan trap with intertrappeans Dolerite dyke	Flows of Basalt with beds of clay/clayey stone of variegated colours	41.33	228.26
----------UNCONFORMITY----------				
Jurassic	Jabalpur	Gritty sandstone & clays with red jasper pebbles	1.34	32.38
----------UNCONFORMITY----------				
Permian	Motur	Clay/clay stone of brick red, purple & grey colour with sandstone lenses/bands at places.	7.67	75.92

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Geological Succession....contd

Age	Formation	Lithology	Thickness Range (m)	
			Minimum	Maximum
Permian	Barakar	Sandstone with kaolinised feldspars interbanded with shale and coal-seams	4.50	83.65
Permian	Talchir	Fine grained argillaceous sand stones & green shale.	0.35	+ 7.99
----------UNCONFORMITY----------				
Pre-Cambrian	Metamorphic	Not encountered in any boreholes.		

4.2.1 Different formations are described below in brief:

a) Talchir Formation: Talchir is the oldest formation. It consists of fine grained sandstones and shales of greyish green colour with undecomposed feldspars. Occasionally pebbles of quartzite are found embedded in shale/sandstone.

b) Barakar Formation : Coal bearing Barakar formation overlies the Talchir sediments conformably and is generally represented by grey feldspathic sandstones, shales, carbonaceous shales and coal seams. It is overlained by Moturs and Jabalpurs overlie this formation. The Barakar formation can be sub divided into 3 horizons viz.Upper Barakars, Middle Barakars and Lower Barakars on the basis of the coal bearing column. Coal formation is found in Middle Barakars.

c) Motur Formation: The Motur formation conformably overlies the Barkar Formation. It is characterized by brick red, brown and grey clays with occasional thin sandstone bands, at places, the clay is arenaceous and gives the appearance of clay stone. The transition zone between Barakars and Moturs is generally marked by grey clay and siltstone.

d) Jabalpur Formation: Sediments of Jabalpur overlie Motur and Barakar formation unconformbly. The sediments are characterized by medium to coarse grained sandstones which are compact and contain calcareous and arenaceous cementing material. White and brown calcareous clay with pebbles of Jasper and quartz are found in some of the boreholes.

e) Deccan Trap: The Gondwana sediments in the block are covered by the flows of Basalt which are the result of the wide spread volcanic activity of upper cretaceous to Eocene periods. The thickness of Deccan Trap /Basalt formation in Dhankasa Block is ranging from 99m to 201m.

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f) Weathered Zone: Upper portion of Deccan Trap has undergone differential weathering due to which loose unconsolidated mural has been produced.

g) Soil: Mostly the block is covered with soil. The soil is mostly of residual type & it is derived from basalt and contain pebbles and boulders of Trap. Its colour is black and is popularly called as black cotton soil.

h) Basic Intrusive: A dyke/sill has been encountered in borehole No. PU-85 at the depth of 151.18m to 161.29m where localized effect of igneous activity is noticed in Seam-II and Seam-III. The degree of devolatisation has been expressed in terms of VMu% and accordingly 10%, 18% and 30% VMu% lines have been drawn to demarcate the burnt coal (up to 10% VMu), heat affected coal (10% to 30% VMu) and heat unaffected coal (> 30% VMu).

4.3 GEOLOGICAL STRUCTURE OF THE BLOCK

The geological structure of Dhankasa block has been deciphered entirely on the basis of sub-surface data obtained from the boreholes drilled in the block.

The present geological assessment of the proposed mine area is based on the data of 91 boreholes involving a total meterage of 17864.80m in an area of 7.40 km^2. This includes major part of Dhankasa geological block and a part of Naheriya block. The density of boreholes works out to 12 B.H/ km^2.

The proposed Dhankasa U/G mine has been projected in major portion (5.20 km^2) of Dhankasa Block and a small part of Naheriya Block (0.30 km^2) which is in structural continuity with Dhankasa Block. The total area of the proposed mine is 5.50 km^2. A total of 73 exploratory boreholes fall within this area involving a total meterage of 10682.55m. The density of boreholes works out to 13 boreholes/km^2.

The structure of Dhankasa block appears to be moderately disturbed in the southern half whereas the northern half is structurally complicated due to the presence of a number of faults. The east-west trending fault F_4-F_4 passing through central part of the block divides it into two halves. The south central part of the southern half which covers about 1/4th area of the block has comparatively flat topography and appears to be undisturbed. On the contrary the complicated structure evolved in the north & north–eastern part of the block is reflected on the surface in the form of rugged topography. In all, a total of 12 faults have been deciphered within the block.

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4.3.1 STRIKE AND DIP

The strike of the coal seam is in general NE-SW swerving to NNE-SSW. However, local undulations and drag effects can be seen near the faults. The dip of the coal seam, in general, is towards north-west and varies from 3° to 6°. The gradient is varying from 1 in 10 to 1 in 20.

4.3.2 GEOLOGICAL SECTORS

The Geological Block of Dhankasa is divided into 17 sectors and having 12 nos of faults with throw varying up to 40m. The details of Sectors are tabulated below-

Sector No.	North	East	South	West
1	Fault $F_{8(N)}$-$F_{8(N)}$	Sub-crop of seam	Fault $F_{6(N)}$- $F_{6(N)}$	Block boundary
2	Fault $F_{9(N)}$- $F_{9(N)}$	Sub-crop of seam	Sub-crop of seam.	Fault F11- F11
3	Fault $F_{9(N)}$- $F_{9(N)}$	Sub-crop of seam	Fault $F_{8(N)}$-$F_{8(N)}$	Gunor river
4	Faults F_4-F_4 , F_2-F_2	Fault F_4-F_4	Fault $F_{9(N)}$-$F_{9(N)}$	Block boundary
5	Fault F_4-F_4	Sub-crop of seam	Fault $F_{9(N)}$-$F_{9(N)}$	Fault F11- F11
6	Fault F_3- F_3	Junction of faults F_3-F_3 & F_2-F_2	Fault F_2-F_2	Block boundary
7	Fault F_4-F_4	Junction of faults F_4-F_4 & F_2-F_2	Faults F_2-F_2 & F_3-F_3	Block boundary
8	Block boundary	Sub-crop of seam	Fault F_4-F_4	Fault F_{12}-F_{12}
9	Block boundary	Fault F_{12}- F_{12}	Fault F_4-F_4	Fault F_9-F_9, F_{11}-F_{11}
10	Junction of Faults F_9-F_9 & F_{11}-F_{11}	Fault F_{11}-F_{11}	Fault F_4-F_4	Fault F_{10}-F_{10} & F_9-F_9
11	Junction of Faults F_9-F_9 & F_{10}-F_{10}	Fault F_{10}-F_{10}	Fault F_4-F_4	Fault F_9-F_9
12	Block boundary	Fault F_9-F_9	Fault F_4-F_4	Fault F_8-F_8
13	Fault F_5-F_5	Fault F_8-F_8	Fault F_4-F_4	Block boundary
14	Fault F_6-F_6	Arbitrary line join faults F_6-F_6 & F_5-F_5	Fault F_5-F_5	Block boundary
15	Block boundary & Fault F_7-F_7	Faults F_8-F_8,F_5-F_5 & arbitrary line joining Fault F_6-F_6 & F_5-F_5.	Fault F_6-F_6	Block boundary
16	Block boundary	Junction of block and Fault F_7-F_7	Fault F_7-F_7	Block boundary
17	Fault F_4-F_4	Sub-crop of seam	Junction of Fault F_{12}-F_{12} & sub-crop	Fault F_{12}-F_{12}

Sector-4 of Naheriya block is in continuity with Sector-3 of Dhankasa block hence its boundary and reserves have been included in Sector-3.

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4.3.3 FAULTS

There are series of faults in the Dhankasa Block, which have rendered the mine property into small sectors. There are 12 nos. faults with throw varying from 5m to 40m in the mining area. The description of the faults which is as given in the following table:-

DESCRIPTION OF FAULTS IN DHANKASA U/G MINE AREA

Sl. No.	Fault No.	Location and Linear Extension	Strike	Amount & Dir. of throw
01.	$F_{8(N)}$-$F_{8(N)}$	It is located in the southern part of the block, around BHs PD-25 & PD-26. 840 m. Extends further on either side.	E-W	30m south 10° east
02.	$F_{9(N)}$-$F_{9(N)}$	South central part of the block, around BHs PU-203&PU-120 in the SW to PD-12 in the NE 3 Km. Extends further & abuts against fault F4 in the east.	N70°E-S70°W	10m south 25° east.
03.	F_1-F_1	Located near south- western boundary, around BHs PD-65 & PD-22. 1.2 km.	N80°E-S80°W	5m to 10m, dying out near PU-120, due north 6° west.
04.	F_2-F_2	Located in the Central part of the block around BHs PD-49 and PD-17. 2.4 km. Abuts against fault F4 in the NE.	N80°E-S80°W	40m in west, reducing to 15m in the east due north 12° west.
05.	F_3-F_3	Located in the Central part of the block, around BHs PD-38 and PD-60. 2.0 km, Abuts against fault F2 in the east.	N80°E-S80°W	10m south 5° to 10° east.
06.	F_4-F_4	Located in the Centre of the block, PU-87 in the west to PD-48 in the east. Extends over 3.2 km within the block and continues further.	E-W to ENE-WSW.	30m, in the west to 60m in the east. north 5° to 8° west in the major part and swerves to N16°E around BH PU-90 &123.
07.	F_5-F_5	Located in northern part of the block around BHs PU-129 & PD-11. 2.6 km, abuts against fault F8 in the north.	ENE-WSW to NE-SW.	15m south 10° to 45° east
08.	F_6-F_6	Located in northern part of the block around BHs PU-69 & PD-59, 1.6 km dying out in the NE.	Curveli-near N5° E to S75°W.	20m in the west, progressively dying out in the North-eastern part south 10° to 35° east.

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Description of faults…contd

Sl. No.	Fault No.	Location and Linear Extension	Strike	Amount & Direction of throw
09	F_7-F_7	Located in northern part of the block, around BHs PD-50 & PD-10, 1.5 km.	Curvelinear NE-SW.	10m south 22° to 50° east.
10.	F_8-F_8	Located in north-eastern part of the block, around BHs PU-128, 125 & PD-37, 1.6 km.	NE-SW	15-20m south 60° east.
11.	F_{11}-F_{11}	Located in the eastern part of the block, across N-S width of the block, around BHs, PD-5, 34, 3 & PD-126, 2.5 km and extending further in the north and south.	Curvilinear NNE-SSW	10m in the north increasing to 25m in the south. It is cutting across faults F4 & F9(N) due south 70° to 85° east.
12.	ms-ms	Located in the northern part of the block, 0.24 km.	NE-SW	2m due southerly.

4.3.4 DYKES

A dyke/sill has been encountered in borehole No. PU-85 at the depth of 151.18m to 161.29m where localized effect of igneous activity is noticed in Seam-II and Seam-III. The degree of devolatisation has been expressed in terms of VMu% and accordingly 10%, 18% and 30% VMu% lines have been drawn to demarcate the burnt coal (up to 10% VMu), heat affected coal (10% to 30% VMu) and heat unaffected coal (> 30% VMu).

4.3.5 HYDRO-GEOLOGICAL STUDIES

Ground water occurs below the water table in the inter-granular pore spaces of Deccan trap basalt and their secondary porous structures and it exists under both confined and unconfined conditions. On perusal of water level data of dug wells around Dhankasa Block, depth to water table in unconfined aquifer varies from 0.60m to 7.50m bgl in post monsoon months. As per the information collected, the water table fluctuation ranges between 2.0m and 5.0m. It has been inferred that the ground-water flow direction is towards Dhankasa and Junapani nallas, i.e. south and south-west. The effluent nature of Gunor River, which flows north to south corroborates the inference drawn. It was reported that the potentiality of both confined and unconfined aquifers in Deccan Traps is low to moderate. The water is alkaline in nature with pH values of water ranges from 7.0 to 8.0. The water may be suitable for domestic and agricultural use.

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4.4 DESCRIPTION OF COAL SEAMS

Exploration in Dhankasa Block has confirmed the presence of all the five major coal seams (and their sections) of Pench-Kanhan Valley Coalfield, namely: I, II, III, IV and V in descending order. The youngest Seam-I is represented by three sections namely, IA, IB and IC. Seam-III and IV occur as coalesced as well as split sections designated as Top and Bottom. Seam- II and V occur as independent seams. Details of coal seams have been given in the following table:-

Sl. No.	Seam No/ Parting (m)	Floor depth (m)		Thickness (m)		Dominant Thickness (m)	Remarks
		Min.	Max.	Min.	Max.		
01.	IA	113.70	244.42	0.04	3.03	0.49	
	Parting			7.46	11.36	9.41	
02.	IB	146.98	238.84	0.07	1.66	0.43	
	Parting			0.31	4.44	2.00	
03.	**IC**	122.80	241.49	0.11	2.67	2.00	**Seam-II (Pack)** Considered workable
	Parting			0.40	7.12	0.60	
04.	**II**	110.10	243.95	0.22	3.10	1.90	
	Parting with III Comb.			0.51	12.90	4.31	
05.	III(T)	124.18	272.25	0.36	1.49	0.74	
	Parting			0.39	2.51	0.96	
06.	III(B)	126.02	263.36	0.12	0.94	0.48	
07.	III Comb.	96.00	259.88	0.20	2.55	1.37	
	Parting			0.43	15.55	2.54	
08.	IV(T)	115.75	255.09	0.71	2.20	1.10	
	Parting			0.40	0.96	0.58	
09.	IV(B)	122.15	256.86	0.58	5.74	2.21	
10.	**IV(B)/ Comb.**	104.74	251.44	1.30	7.48	4.50	**IV B/Comb.** Considered workable
	Parting			0.26	5.93	2.95	
11.	V	109.78	282.61	0.07	2.57	0.90	

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4.5 GEOLOGICAL RESRVES

The following table shows the net in-situ proved geological reserves seam-wise and sector-wise for thickness +1.5m:

(Figs in Mt)

Sector	Seam								Total
	IC	II	IIIT	III Comb	IVT	IVB	IV Comb.	V	
1*	-	-	-	-	-	-	0.059	0.407	0.466
2	-	-	-	-	0.025	0.170	0.631	-	0.826
3	-	0.309	-	0.688	0.010	0.039	2.624	0.366	4.036
4 (Naheriya)	1.356	1.340	-	1.061	-	-	2.201	1.549	7.507
4	3.096	3.181	-	3.455	0.152	0.416	12.130	1.228	23.342
5	-	-	-	-	-	-	0.631	-	0.631
6	0.902	0.613	-	0.160	-	-	1.692	0.013	3.380
7	0.741	0.525	-	0.152	-	-	1.862	-	3.280
8*	0.316	-	-	0.299	0.004	-	0.613	0.080	1.312
9*	0.200	-	-	-	0.087	-	0.707	0.056	1.050
10*	0.032	-	-	-	0.030	-	0.187	-	0.249
11*	0.132	0.109	-	-	0.021	-	0.462	-	0.724
12*	0.236	0.124	-	-	-	-	0.624	-	0.984
13	1.164	0.850	-	0.031	-	-	2.804	-	4.849
14	0.484	0.650	-	-	-	-	1.299	-	2.433
15	0.648	0.571	-	-	-	-	2.212	-	3.431
16*	0.305	0.120	-	-	-	-	0.652	-	1.077
17*	-	-	-	-	-	-	-	-	-
TOTAL (Geo.Block)	9.612	8.392	-	5.846	0.329	0.625	31.390	3.699	59.893
TOTAL (Mine Area)	8.391	8.039	-	5.547	0.187	0.625	28.086	3.156	54.031

The geological reserves for thickness range +1.5m for the seams considered for exploitation in the proposed Dhankasa U/G mine are tabulated below: (Figs. in Mt)

Seam	Geological Reserves (thickness >1.5m)
Seam II (Pack)	19.430
Seam IV(B)/Combine	28.711
Total	**48.141**

The Sectors marked with * are not considered in the proposed boundary of Dhankasa U/G mine therefore the proved geological reserves of 1.5m and above thickness in various seams and sectors will be 54.031 Mt for Dhankasa U/G Mine.

Reserves in **Seam-II (Pack)** consist of reserves of Seam-IC & Seam-II including the aranaceous shale parting (0.4 to 0.6m thick) between these two seams from mining point of view.

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5.0 MINE BOUNDARY, RESERVES, PRODUCTION TARGET & MINE LIFE

5.1 PROPOSED MINE BOUNDARY

Following features form the boundaries of the proposed Dhankasa U/G mine.

a) Northern boundary – Fault F_7-F_7, arbitrary line which corresponds to common block boundary between Dhankasa and Sonpur Geological Blocks, Faults F_8-F_8 and Fault F_4-F_4.
b) Eastern boundary - Subcrop of Seam-IV (B)/(Combine)
c) Southern boundary - Gunor river and Fault $F_{8(N)}$-$F_{8(N)}$
d) Western boundary - An arbitrary line 200m west of boreholes PJP-1, PD-59,PU-87, PD-38, 64, 65 to be extended to grid line.

5.2 REASONS FOR SELECTING/OMITTING SEAMS/SECTIONS

The minimum seam thickness required for smooth operation of continuous miner package is 2.4m and the maximum cutting height of the continuous miner is 4.6m. For continuous miner deployment only Seam IVB/Comb is suitable. But it is not prudent to exploit only one seam and surrender the rest, from conservation point of view. An exercise was carried out to determine the resultant grade of coal if Seam II is worked along with Seam IC and the intervening parting. The thickness of Seam II + Parting + IC, hereafter referred to as Seam II Pack, has an average thickness of 4.0 m in the mining area which is suitable for continuous miner deployment.

5.2.1 Reason for sacrificing Seam-III

The parting between Seam-II and Seam-III is varying from 2m to 4m and both have similar thickness and grade. An exercise was carried out to determine the workability of Seam-III (Packet), i.e. Seam-III + Parting + Seam-II. The grade of product mix of Seam-III (Packet) varies from Grade 'D' to grade 'F' where the parting is less than 1.0m. This situation is available only in Sector-4. This is a very small patch and the parting between Seam-III and Seam-IV (Combine) in this patch is less than 3.0m. If Seam-II (Packet) is worked in Sector-4, Seam-IV (Combine) will have to be surrendered due to parting being less than 3.0m. In the remaining area of Sector-4 and other sectors Seam-III and Seam-II cannot be clubbed together along with parting since the combined thickness will exceed 4.6 m and coal will have to be surrendered in favour of shale which will bring the quality to level of E/F grade. Further the parting between Seam-III and Seam-IV(B)/(Combine) is less than 3 m. In case Seam-III (Packet) is worked then Seam-IV(B)/(Combine) will have to be sacrificed. Seam-II has developed a thickness of +1.5m in more area than Seam-III. Hence Seam-II (Packet) is being considered for exploitation over Seam-III (Packet). It is necessary to sacrifice Seam-III in order to mine the thicker and better quality Seam-IV(Combine).

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5.2.2 Reason for sacrificing Seam-V

Seam-V has developed workable thickness of +1.5m in a very small patch in Sector-4 only. The parting with Seam-IV(Combine) is around 1.5m to 2.5m. Due to these factors Seam-V has not been considered for mining in the present assessment. The extractable reserves in Seam-V have been estimated at 0.80 Mt only. In order to mine these limited reserves, low height equipment would be required and it would not prove to be cost effective. Seam-V may be worked below the settled goaf of Seam-IV (Combine) after a time gap of at least 5 years i.e. at the end of mine life and hence its reserves have not been considered at this stage.

5.3 COAL SEAMS CONSIDERED FOR EXPLOITATION IN THIS REPORT

Only Seam-II Pack & Seam-IVB/Comb have been considered for exploitation in this report. Seam-II Pack and Seam-IVB/Comb are contiguous seams. Ideally these two coal horizons should be developed and extracted simultaneously with perfect vertical superimposition even during slicing stage. An attempt was made to create a liquidation plan on these lines but it was not found to be practically feasible since the rate of advance in these 2 seams are not very similar due to change in extent and extractable reserves in each seams. Hence the workings in upper seam- Ie Seam-II Pack will be kept either vertically coincident (during initial stages) or will be kept in advance by some pillars with respect to lower seam-i.e. Seam IV B/Comb (during the later stages of mine operations).

5.4 DENSITY OF BOREHOLES

The detailed exploration in Dhankasa Block has been done by MECL in 2 phases:

i)	PU-Series	22 boreholes	-	July '89 to May '93
ii)	PD-Series	69 boreholes	-	May '94 to March '97

The present geological assessment of the proposed mine area is based on the data of 91 boreholes involving a total meterage of 17864.80m in an area of 7.40 km^2. This includes major part of Dhankasa geological block and a part of Naheriya block. The density of boreholes works out to 12 boreholes/ km^2.

The proposed Dhankasa U/G mine has been projected in major portion (5.20 km^2) of Dhankasa Block and a small part of Naheriya Block (0.30 km^2) which is in structural continuity with Dhankasa Block. The total area of the proposed mine is 5.50 km^2. 73 exploratory boreholes fall within this area involving a total meterage of 10682.55m. The density of boreholes works out to 13 boreholes/km^2.

An additional 11 nos of exploratory boreholes are proposed for the west part of the mining block (where borehole density is low) for improving the borehole density to the range of 15 boreholes/ km^2 for operating Continuous Miner districts.

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5.5 NET-GEOLOGICAL, MINEABLE & EXTRACTABLE RESERVES

The Mining losses in Seam-II Pack & seam-IVB are tabulated below (in Mt)-

Particulars of coal lost	Seam-II Pack	Seam-IV B	Total
Panel barriers	1.68	2.82	4.50
Angle of draw / surface features	4.341	4.64	8.981
Sub-panelisation	0.63	1.06	1.69
Ribs in pillas	2.399	4.461	6.86
Thickness <2.16m & >4.6m	0.28	2.77	3.05
Poor grade	0.34	-	0.34
Total	9.67	15.751	25.421

The seam-wise net geological, mineable and extractable reserves (greater than 1.5 m thickness) in the proposed Dhankasa U/G mine: (Figs. in Mt)

Seam	Net Geo. Res.	Mineable Res.	Min. Loss	Extra. Res.
Seam II Pack	19.430	17.810	9.670	8.140
Seam IV(B)	28.711	26.611	15.751	10.860
Total	**48.141**	**44.421**	**25.421**	**19.000**

5.6 PRODUCTION TARGET AND LIFE OF THE MINE

5.6.1 Production Target

It is proposed to exploit both Seam-II Pack & Seam-IV Comb (average thickness of 4.0 to 4.25 m) in Recast PR of Dhankasa UG Mine with 2 nos of Continuous Miner districts. Based on the time study of operations (cutting & loading of coal by CM, marching to 2nd face, roof bolting etc.) in Continuous Miner district, each CM will be able to produce about of 1650-700 tpd. Hence, the annual production from 2 CM districts would be 3350 tpd (1.00 Mty).

5.6.2 Life of Mine

The extractable reserves in the proposed mine have been estimated as 19.00 Mt. The total life of Dhankasa UG Mine works out to 23 years with a target capacity of 1.0 Mty. Out of 23 years of mine life, a period of 2 years will be the pre-construction & construction period and the coal production starts from 3rd year.

5.6.3 In-situ Coal quality

The quality of Seam-II Pack is low compared to the quality of Seam-IV B/Comb. The overall grade of coal in Seam-II Pack is G-10 Grade only (GCV-4563 K.Cal/Kg) due to the inclusion of the aranaceous shale parting (0.4m-0.6 m thick) between Seam-IC & II. The grade of coal in Seam-IV Comb is G-6 Grade (GCV-5605 K.Cal/Kg). The weighted average grade of coal during the entire life of mine would be **G-7** (GCV **5208 K.Cal/Kg)**.

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6.0 MINE ENTRIES

6.1 DIMENTIONS & PURPOSE OF MINE ENTRIES

Two inclines and an airshaft have been proposed as entries for Dhankasa U/G mine. The inclines and the airshaft will be driven from surface up to Seam-IV(Combine). The dimensions and purpose of mine entries is tabulated below:-

Entry	Dimension (m)	Length (m)	Gradient	Purpose
Incline No. 1	5.0 x 3.0	468.65	1 in 4.5	Belt conveyor, traveling route & main intake.
Incline No. 2	5.0 x 3.0	468.65	1 in 4.5	Haulage, intake airway & man-riding system
Airshaft	5.0 dia	129.50	Vertical	Return air way

It is proposed to drive a pair of inclines to touch Seam-IVB/Comb in Sector-3 nearly 90 m on the rise side of the BH PD-58. The inclines will start near BH PD-27. The ground topography near the proposed incline mouth is nearly flat (SRL about 738m) and sufficient tenancy land is available for mine infrastructure. The inclines are located between the bends of the seasonal Dhankasa nalla whose bed is nearly 2m below the surface. The surface RL of the banks of Dhankasa nalla is 734m and 736m. Possibility of rain water rising over the banks of the nalla is very less as the ground topography is sloping towards the nalla in all directions. Therefore, the possibility of rain water inundating the mine through the inclines can be ruled out. However, the mouth of Inclines may be further protected by embankments. The inclines will be driven below Dhankasa nalla. The minimum cover between the roof of the inclines and floor of the nalla is nearly 22 m of Deccan Trap Basalt rocks. Therefore nalla diversion is not proposed in the report. The bed and sides of Dhankasa nalla over a length of 100 m will be cement grouted as an additional precaution to make it impervious to surface water run-off. The air shaft will be located over Sector-4 near fault $F_{9(N)}$-$F_{9(N)}$ in forest land.

6.2 ENTRY TO SEAM-II PACK

The proposed inclines will touch Seam-IVB/Comb without crossing Seam-II Pack. In order to rationalize transport system to Seam-II Pack, two number of drifts would be driven from the incline bottom at a gradient of about 1 in 17 and will touch floor of Seam-II Pack in Sector-3 near its sub-crop. The length of these drifts would be 95m each. The dimension of these drifts would be 4.8m x 3.0m. Both the drifts will serve as intake airways and will also ensure machine, material and men transport to Seam-II from surface.

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6.3 ENTRY TO VARIOUS SECTORS

The following table shows the dimensions, length and year of drifting as per the proposed liquidation plan of the underground drifts for entry into various sectors catering to various requirements of the mine. The cross-sectional dimension of all stone drifts proposed in this report is 4.8m x 3.0 m.

Sl.No	Particulars of Drifts	Year
1	**Entering Seam-II Pack from Incline Bottom at Seam -IV Comb.**	
	2 Nos. of Drifts to access Seam-II Pack from Incline bottom. Each drift is about 95 m long driven upwards at a gradient of 1 in 17 .	Yr-3
2	**Crossing Fault F-9 F-9**	
	4 Nos. of Drifts to access II-MD2 from II-MD1 by crossing fault F-9. Lengths of drifts are 34.0m each @1 In 4.5 in Seam-II Pack.[II-D1]	Yr-3
	4 Nos. of Drifts to access IV-MD2 from IV-MD1 by crossing fault F-9. Lengths of drifts are42.0m each @ 1 In 4.5 gradient in Seam-IV Comb.[IV-D1]	Yr-3
3	**Crossing Fault F-2 F-2**	
	4 Nos. of Drifts to access MD4 from MD3 by crossing fault F-2 jointly for both the seams (Seam-II Pack & Seam-IV Comb.). Lengths of drifts are 280 m each @ 1 In 4.5 gradient. [II-IV-D2]	Yr-3
4	**Crossing Fault F-3 F-3**	
	4 Nos. of Drifts (II-D3) to access II-MD5 from II-MD4 by crossing fault F-3. Lengths of drifts are 50.0m each @ 1 In 4.5 in Seam-II Pack.[II-D3]	Yr-3
	4 Nos. of Drifts (IV-D3) to access IV-MD5 from IV-MD4 by crossing fault F-3. Lengths of drifts 46.0m each @ 1 In 4.5 in Seam-IV Comb.[IV-D3]	Yr-3
5	**Crossing Fault F-4 F-4**	
	4 Nos. of Drifts to access MD6 from MD5 by crossing fault F-4 jointly for both the seams (Seam-II Pack & Seam-IV Comb.). Lengths of drifts are 218 m each @ 1 In 4.5 gradient. [II-IV-D4]	Yr-3
6	**Crossing Fault F-5 F-5**	
	4 Nos. of Drifts to access MD7 from MD6 by crossing fault F-5 jointly for both the seams (Seam-II Pack & Seam-IV Comb.). Lengths of drifts are 112 m each @ 1 In 4.5 gradient. [II-IV-D5]	Yr-3
7	**Crossing Fault F-6 F-6**	
	4 Nos. of Drifts to access MD8 from MD7 by crossing fault F-6 jointly for both the seams (Seam-II Pack & Seam-IV Comb.). Lengths of drifts are 120 m each @ 1 In 4.5 gradient. [II-IV-D6]	Yr-3
8	**Drifts in Seam-IV Comb. to enter Sector-5 from Sector-4**	
	3 Nos. of Drifts to enter panel IV-23 from panel IV-14 by crossing fault F-11. Lengths of drifts are 95 m each @ 1 In 4.5 gradient. [IV-D7]	Yr-18
9	**Drifts in Seam-IV Comb. to enter Sector-2 from Sector-5**	
	3 Nos. of Drifts to enter panel IV-24 from panel IV-23 by crossing fault F-9. Lengths of drifts are 60 m each @ 1 In 4.5 gradient. [IV-D8]	Yr-18

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The guidelines for estimation of average cost per meter for construction of circular shaft and inclines were issued by CMPDI (HQ) with a provision for escalation in labour and material components. As per the above guidelines, the average cost per meter length for drivage of inclines and sinking of airshaft has been estimated after considering due escalations.

The length of inclines & stone drifts and depth of airshaft proposed in this Recast Project Report of Dhankasa UG Mine are tentative and as per the available geological data given in the geological report and could vary depending upon the surface RLs and floor RLs encountered during actual drivage. Thus, at the time of actual drivage of the inclines / drifts, a section should be drawn to firm up the starting and ending position of the inclines & drifts so as to arrive at actual length.

The average drivage rate of inclines (5.0m x 3.0m) in the proposed Recast PR for Dhankasa UG mine is considered as 60 m/month with advanced drivage machineries/equipment. The average rate of advance considered for sinking of airshaft (5.0m dia) is about 20 m/month. The rate of underground drifting (4.8m x 3.0 m) considered for this project is about 75-80 m/month.

7.0 MINING STRATEGY

7.1 SURFACE CONSTRAINTS

Dhankasa U/G mine area has a rugged terrain and majority of the area under consideration is covered by forest area (385.841 Ha out of total 582.651 Ha). The approach road to the project is envisaged from Naheriya U/G Mine. The proposed approach road will be constructed over the Forest, Government and Tenancy land for which land has to be acquired after obtaining clearance under Forest Conservation Act. A small village namely Bhumka Dhana exists near the mine boundary. No coal exists beneath the village. However, meagre coal reserves will be blocked on account of angle of draw in order to safeguard the village during extraction of pillars.

Junapani nalla flowing from east to west over the mining area is also blocking coal beneath and within safety barrier zones. Gunor River, which forms part of the southern boundary of the block, is flowing from north to south. Dhankasa nalla is located on the southern and western side of the block thereby blocking some coal reserves beneath & within safe barrier zones. The pair of inclines is to be driven beneath this nalla. The minimum thickness of traps over the roof of the inclines is 22 m. Hence it is proposed to line the entire section and bed of the nalla with cement concrete to make it impervious to surface water. It is not proposed to divert Dhankasa nalla or change the natural drainage pattern of the area.

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7.2 GEO-MINING CHARECTERISTICS

7.2.1 Seams to be Worked

Both Seam-II Pack & Seam-IVB/Comb have been considered for exploitation in this report. Seam-II Pack and Seam-IVB/Comb are contiguous seams. Ideally these two coal horizons should be developed and extracted simultaneously with perfect vertical superimposition even during slicing stage. An attempt was made to create a liquidation plan on these lines but it was not found to be practically feasible since the rate of advance in these 2 seams are not very similar due to change in extent and extractable reserves in each seams. Hence the workings in upper seam- le Seam-II Pack will be kept either vertically coincident (during initial stages) or will be kept in advance by some pillars with respect to lower seam-i.e. Seam IV B/Comb (during the later stages of mine operations).

7.2.1 Geo-Engineering Properties of Strata.

The uni-axial compressive strength in dry and wet condition, tensile strength and protodyakonov index of 10 m column and 3 m column of roof and 1.0 m column of floor of the workable coal seams based on the geo-engineering tests carried out on the cores of borehole nos. PD-41, PD-68 and PD-69 are tabulated as under:

Sl No.	Particulars	Dry UCS (MPa)	Wet UCS (MPa)	Tensile strength (MPa)	Proto Dyk. Index	Lithology of Strata
2.	3 m roof strata above Seam–II Pack	13.60 to 19.15	3.35 to 11.98	3.05 to 5.99	-	Shale, sandstone, coal bands
3.	Seam-II(Packet)	15.32 to 29.37	17.12	3.33-4.29	1.11-1.05	Coal /Shale
4.	1 m floor below Seam-II Pack	12.43 to 23.13	14.28	2.10 to 4.71	-	Intercalation Sandstone.
6.	3 m roof strata above Seam-IVB/Comb.	15.01 to 28.38	10.20 to 14.97	1.46 to 4.53	-	Sandstone, shale
7.	Seam IVB/Comb.	-	-	3.53	0.69 to 1.03	Coal
8.	1m floor below Seam-IVB/Comb.	25.00 to 32.73	17.60	3.45 to 4.61	-	Sandstone.

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From the above table it is observed that in dry condition the roof of both the workable seams is quite strong and competent. The mines of Pench-Kanhan Coalfield are generally dry and no major seepage of water from the roof has been experienced till date. Based on the strength parameters of the 3 m roof strata of Seam-II Pack and Seam-IVB/Comb, the RMR of the roof of the seam is likely to be around 43 i.e. at the lower end of 'Fair Category". The floor of both the seams is quite competent and not likely to get affected due to water and movement of tyre / crawler mounted equipment. The Protodyakanov Index of both the coal seams is nearing 1.0 and the tensile strength is varying from 3.33 to 4.29 MPa. These parameters indicate that the coal is moderately hard. Similar readings have been observed for the coal at Tandsi Project. The CM is able to cut the coal quite easily and the consumption of picks is reported to be quite reasonable.

Geo-Mining Parameters of the Mine.

A	**General-Particulars**	Value	
1	Geo. Block Area (km^2)	7.40	
2	Mining Area (km^2)	5.50	
3	No. of BHs intersections (Mining Area)	73	
4	BH Density BHs/ Sq.Km(Mining Area)	13.30	
5	Addl BHs proposed for a density of 15 BH/Sq.Km	11 nos	
B	**Details with respect to Seams**	Seam-II Pack	Seam-IVB/Comb
1	Mining Area (km^2)	3.97	5.18
2	Workable Avg. Thick. Range (m)	3.5 – 4.5	3.5 – 4.75
3	Seam Gradient (Average)	1 in 13	1 in 14
4	Average Parting with upper seam (m)	-	4.0 – 8.0
5	Net Extractable Reserves- (Mt)	8.14	10.86
6	Total Reserves (Mt)	19.00	
7	Avg. Grade & GCV of Seams – K.Cal/Kg & Grade	4562 G10	5605 G6
8	Gassiness (anticipated)	Deg. – I	Deg. – I
9	Immediate roof	Shale , coal bands & Sandstone	Intercalations of Shale & Sandstone
10	Immediate floor	Intercalations of Shale & Sandstone	Aranaceous Shale & Sandstone

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Cavability Characteristics

The strata between Seam-II Pack and the Basalt traps comprises mainly sandstone, shale, clay and clay stone. The thickness of the intervening strata varies between 10 to 108 m. The thickness of basalt traps within the mine boundary varies from 41 to 208 m.

At most places, the thickness of strata in between Seam-II Pack and the Basalt traps is less than 10 times the combined thickness of extraction of the two workable seams. If the bulking factor is low, such as 1.1 or 1.2, the intervening strata may not be sufficient to fill the void after caving resulting in unfilled gaps below the basalt. This may give rise to large span of basalt hanging over unfilled areas in goaf. To avoid dynamic load due to sudden failure of basalt involving large spans, it may be advisable to restrict panel size and height of extraction in certain areas of the property till the caving characteristics of the basalt trap are established by trial in a panel in favorable part of the mine area.

It is suggested to carry out physico-mechanical tests for the entire thickness of basalt formation in Dhankasa Block. Piece length should also be obtained from the cores to ascertain the massive nature of the trap. If the basalt traps prove to be as dense as observed in Thesgora Block, difficulty in caving could be experienced in the panels where the thickness of strata between the basalt trap and Seam-II Pack is less than 10 times the combined thickness of extraction. This would cause the Deccan Trap formation to keep hanging over a large area and may result in air blast when it caves by itself.

Report on Cavability Study of Deccan Trap basalt formation in the adjacent Naheriya U/G Mine was received in December 2007 and this report has categorized the Deccan Trap basalt formation as difficult to cave. Therefore, caving of roof would be a difficult proposition over those panels where the thickness of strata between the basalt formation and first workable coal seam is less than 10 times the total thickness of extraction. Although the report on Cavability Study has restricted its conclusion to Naheriya U/G mine area only, it still serves as an indication for Dhankasa U/G Mine also.

In the proposed Recast PR for Dhankasa UG Mine, provision for Induced Caving has been given by which the roof strata in the goaf will be deliberately bring down with blast holes drilled mostly from underground .A financial provision of Rs19.50/t has been kept in the cost of production for induced caving by blasting of roof strata.

Incubation Period

The nearest underground mine where depillaring has been carried out by cable bolting method is Mathani U/G mine. In this mine, the incubation period of Seam-V has been established as six months. While estimating the extractable reserves in Dhankasa U/G mine, incubation period of six months has been considered.

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Wateriness of Seams

Ground water occurs below the water table in the inter-granular pore spaces of basalt traps and their secondary porous structures. Ground water exists under both confined and unconfined conditions. The potentiality of both confined and unconfined aquifers in the basalt traps is low to moderate. It can thus be inferred that the mine will not face any serious problems due to seepage of strata water. In the adjacent Naheriya U/G mine, same configuration of seams is being worked. There, Seam-II is pitch dry while very little seepage of water has been observed through the massive sandstone roof of Seam-IV.

The make of water in Dhankasa U/G mine is likely to be just sufficient to cater to the clean water requirement of continuous miner packages, water spraying in LHD district and for the pneumatic roof bolters.

7.3 UNDERGROUND CONSTRAINTS ON MINE DEVELOPMENT

While estimating the extractable reserves in Dhankasa U/G mine, incubation period of six months has been considered as per the experience gained in Mathani U/G mine. Percentage extraction in continuous miner panels has been worked out based on the depillaring permission given to Tandsi Project. Three water bodies namely Gunor River, Dhankasa nala and Junapani nala flow over the mine area. Only development of coal seams will be done below and within safe distance, considering 35^0 angle of draw, of the three water bodies and Bhumka Dhana village.

In case the Deccan Traps are difficult to cave, Induced Caving by blasting of roof strata will have to be carried out either from underground or surface. This is to be conducted at regular intervals where ever the roof strata in goaves is not falling by its own. Subsidence cracks are likely to reach the surface where the thickness of hard strata is less than 15 times the thickness of extraction. At such places, it is proposed to acquire the land. Over most panels induced caving by blasting from the surface will have to be carried out in order to cave the Deccan Trap basalt formation and pack the goaf. It is proposed to acquire the land over these panels. Provision for induced caving has been given in the proposed Recast PR of Dhankasa UG mine.

Both the workable coal horizons are contiguous in nature. The panel layout in both the seams has been superimposed. It is proposed to develop and extract both Seam-II Pack & Seam-IVB/Comb. Simultaneously by keeping the pillars and galleries of both the seams vertically coincident at all places where ever possible. During later stages of mine working, the advance rate in Seam_II Pack (upper seam) will be kept a few pillars in advance of the Seam-IVB/Comb (lower seam).

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7.4 SELECTION OF MINING METHOD

7.4.1 OPENCAST POTENTIALITY

In Dhankasa Geological Block, the seam floor depth ranges from about 100 m to 280m. Due to high depth, the average stripping ratio for opencast mining works out to 17.13 cum/t. Other major constraints/ risks in opening / development of the seams in Dhankasa Geological block by opencast methods of mining are-

a) Majority of the land in mining area is forest (385.841 Ha out of total 582.651 Ha)
b) Rehabilitation of Bhumka Dhana village
c) Presence of Deccan Trap formation (thickness from 41m to 216m).

Hence, in present scenario, the opencast mining in Dhankasa Block is ruled out.

7.4.2 UNDERGROUND MINING METHODS

In the underground mining methods, the options available are continuous cutting methods and by blasting-off the solids with intermediate technology.

a) Blasting-off-the-solids with Intermediate Technology

Bord and Pillar method of mining with caving involves coal preparation by blasting-off-the-solids and loading by SDLs/LHDs onto coal tubs/chain or belt conveyor. This method involves discontinuous operation of equipment, is manpower intensive and utilization of equipment is low. Due to the serial nature of operations, the output from the district is governed by the number of blasts in every available face, which normally does not exceed 1.5 per shift. This restricts the output capacity of the district. For a mine to produce around 1.00 Mty with intermediate technology, a large number of production districts have to be operated simultaneously which require a large work force. Traditional approach of opening small mines with more number of production districts can no longer cater to the shortfall in availability of coal. Large mines deploying mass production technology with less manpower involvement can only meet the ever increasing demand for coal.

b) Continuous Cutting Methods

Continuous cutting methods require that extraction of coal be carried out by caving method since sand stowing will not be able to keep pace with the cutting machine and large number of unstowed voids will result. Also the availability of sand or material for stowing is scarce and also capital intensified. In the proposed Dhankasa U/G mine, extraction by caving is possible .

Continuous cutting method can be deployed in two forms:

(i) LongWall mining using power supports
(ii) Continuous miner technology on Bord & Pillar or Rib-Pillar method.

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The other advantages of adopting CM technology are as follows:

a). Higher production capacity from one district (1500-1800 tpd as per the geological conditions) as against 500 tpd from an intermediate technology district preparing coal by blasting-off-the-solids. Better utilization of men and machines.

b). Centralized and concentrated working places enabling better supervision and safety.

c). Easier and better management of ventilation.

d). Requires lesser manpower comparing to SDL/LHD methods of mining.

e). With increasing depth of workings, roof management becomes difficult and gets further aggravated due to blasting. Continuous cutting of coal not only eliminates blasting but also permits much larger outputs from the production district.

Continuous miner Technology also has certain disadvantages in relation to an intermediate technology district preparing coal by blasting-off-the-solids. These are listed below:

1) Capital intensive equipment package compared to SDL/LHD methods of mining.

2) Efficient workmanship / maintenance back up is required. Skilled maintenance personnel and inventory of spares and consumables is required for smooth and continuous operation.

3) Highly skilled operators and maintenance personnel are required.

4) Flexibility of operation in respect of conventional SDL/LHD mining is less.

Therefore this report proposes working of 2 numbers of Continuous Miner districts for simultaneous development & depillaring of panels in both Seam-II Pack and Seam-IV B/Comb by Bord and Pillar system of method of mining. The workings in upper seam- i.e. Seam –II Pack will be vertically coincident with the pillars & galleries of lower seam-i.e. Seam-IV B/Comb. Where ever such verticality of seam workings are not practically possible, the workings in upper seam will be kept in advance of some pillars.

By considering all the above mentioned parameters for selection of method of mining for Dhankasa UG mine, Continuous Miner technology has been suggested to harness the Bord & Pillar method of mining.

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7.5 MINE DEVELOPMENT STRATEGY

For the development of the proposed Dhankasa U/G Mine, the following strategy is envisaged:

a) Acquisition of land for mine infrastructure and mine entries which includes Forest land is proposed in the first year of mine operation. The land required for incline drivage & surface infrastructures will be acquired during 1st year itself.

b) Arrangement for temporary and permanent power supply and water supply arrangement at the mine entries site and start of drivage / sinking.

c) Drivage of 2 nos of inclines from surface up to the floor of Seam-IVB/Comb at a gradient of 1 in 4.5 (x-sec 5.0m x3.0m & 469.0 m long) will be done during 2nd year. The inclines will touch the floor of Seam-IV B/comb near BH No-PD 58 in sector-3. These inclines will not cut the upper seam-i.e. Seam-II Pack. Hence to access the upper seam-i.e. Seam-II Pack, 2 nos of drifts are driven from inclines bottom at a gradient of about 1 in 17 and the lengths of each drifts would be about 95.0 m.

d) Drivage of the air-shaft from surface up to the floor of Seam-IVB/Comb will also be driven during 2nd year. This air-shaft will cut the upper seam-i.e. Seam-II Pack. The depth of Airshaft would be about 139.0 m with a diameter of 5.0m.

e) Main-fan will be installed in the fan drift of Air-Shaft .

f) Installation of belt & haulage along the Inclines –I & II respectively. Chair lift system of man riding arrangements will to be installed during 2nd & 3rd year of mine operation.

g) During the end of 2nd year, the Inclines will touch Seam-IV B/Comb. Seam-II Pack also will be accessed through a couple of drifts during the same year. Once both seams are accessed, 1 Continuous Miner sets will be put in operation in each seams. CM package no-1 will be deployed in Seam-II Pack while package no-2 will be deployed in Seam-IVB/Comb for development of main-dip panels. 5 Heading Main-dip panels will be established in each seams almost along the centre of property from rise side to dip side. The alignment of main-dips will be from southern part of the block (central part) to northern end of the block (central part).

h) During development of Main-dips panel, The following sets of drifts (D1,D2,D3, D4,D5&D6) are to be made to cross Faults F9-9,F2-2,F3-3,F4-4,F5-5&F6-6. Out of 5 headings main-dips panel, 4 nos of drifts are proposed. The details of drifts are given in earlier paragraphs-ENTRY TO VARIOUS SECTORS.

i) During initial stages, workings in Seam-II Pack (by CM-1) & Seam-IVB/Comb (by CM-2) will advance in the same rate. Once the north most part of main-dips panel (MD-8) is developed, then Panel-2 and Panel-1 will be developed and depillared by respective CM packages. Thus, the development cum depillaring operation commences from the dip most part of the block (north end) and proceed towards the rise side part of the block (south end). In general, the panels except those in main-dips will be first developed and then depillared in one go. The detailed mine liquidation plan is given in the forth coming paragraph- at 9.3 "MINE LIQUIDATION PLAN".

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8.0 METHOD OF MINING / MINING SYSTEM & EQUIPMENT

8.1 METHOD OF MINE DEVELOPMENT

In Dhankasa U/G mine development is proposed by Bord & Pillar method. The main dips and the panels will generally consist of 5 headings. The pillars and galleries in Seam-II Pack and Seam-IVB/Comb will be vertically superimposed. The pillar sizes in the panels will be 25.5m, 34.5m & 45.0m centre to centre as per depth in each sector for a gallery width of 4.8m. The pillars in main dips will be rectangular with the strike dimension being 45.0 m and dip dimension varies from 25.5m to 34.5m as per depth. The height of development galleries will be restricted to 3.0m for trunk roads while that of other working panels would be 4.6m or the seam thickness whichever is lesser.

The concept of CM application demands that the galleries be supported only one time using good quality roof bolts so that no further heightening is involved and scope for secondary support is ruled out. Hence, the development height in panels will be the height of seam or 4.6m whichever is less. Once the CM has been taken out of a particular heading after cutting, the roof bolting machine is trammed in to support the area mined by the cutting machine. The machines therefore operate alternately & independently and have flexibility for both cutting and roof bolting operations. The width of the cutting drum of the CM is about 3.3m. This cycle is repeated 3 to 4 times, the roof and floor trimmed and the operation repeated for the remaining 1.5 m gallery width. The depth of each web is 0.8 m.

8.1.1 Main Dip & Strike Development

The main dip development in all sectors will be done by deploying CM packages in both the seams. During the end of 2nd year, the Inclines will touch Seam-IV B/Comb. Seam-II Pack also will be accessed through a couple of drifts during the same year. Once both seams are accessed, 1 Continuous Miner sets will be put in operation in each seams. CM package no-1 will be deployed in Seam-II Pack while package no-2 will be deployed in Seam-IVB/Comb for development of main-dip panels. 5 Heading Main-dip panels will be established in each seams almost along the centre of property from rise side to dip side. The alignment of main-dips will be from southern part of the block (central part) to northern end of the block (central part).

For development of main-dips panel, 6 sets of drifts namely D1,D2,D3,D4,D5&D6 to be made for crossing faults F9N-9N,F2-2,F3-3,F4-4,F5-5 & F6-6 respectively. Trunk belt conveyor of 1200 mm width will be installed along trunk road in the lower seam-i.e. Seam-IVB/Comb. Coal from Seam-IVB/Comb will be transported through this trunk belt. Coal from upper seam-i.e. Seam-II Pack will be transported through 7 nos of strata bunkers made along the main-dip panel cutting through the parting between these 2 seams. The strategy involved in mine development is already detailed in earlier paragraph- at 7.5 "MINE DEVELOPMENT STRATEGY".

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8.2 METHOD OF EXTRACTION

Extraction of developed pillars is proposed by caving at all places, which are outside the angle of draw of surface features. Splitting of pillars shall be restricted to a distance of one pillar from the pillar under extraction. The area of exposure shall be restricted to 80-85 m^2 at any place at a time. Extraction of pillars shall commence from the dip / in-bye side and proceed systematically to rise / out-bye side maintaining a diagonal line of faces.

It is anticipated that permission to extract the pillars formed during development will be granted by DGMS prior to completion of development. Pillar extraction would then commence immediately upon reaching the panel boundary. In the Continuous Miner panel full mining height will have been maintained during development and pillar extraction will commence without any advance support being required. Pillar extraction will be by splitting and slicing of pillars. The pillars will be split into two / three parts dependent upon the pillar size, by driving level splits and the slices will be driven from the splits/original galleries at 60° as against 90° to the split direction. Splitting of pillar will be restricted to a distance of one pillar from the pillar under extraction. Due to the limitations of the working parameters of the Continuous Miner model, the height of extraction will be will be restricted to 4.6m or the seam thickness whichever is lesser.

Intake ventilation air reaches the face along the rise/dip three drives of the panel coursed by brick stoppings suitably plastered to minimize leakages. At least 25 m^3/sec of air is required in the LVC of each CM panel as per the international practice. Ventilation of each blind end is achieved by forced auxiliary ventilation system. Two auxiliary fans with duty of 12 m^3/sec forcing the air into the working faces are to be installed. Clean water at neutral pH and minimum suspended solids is required at the rate of 250 litres per minute at 200 kPa pressure for cooling motors, drilling and dust suppression.

The proposed mining cycle for pillar extraction & the sequence of operations is as under:

- Cut 1 is driven to a maximum of length of "cut-out distance". For the purposes of this report, it has been assumed to be 6-7 m.
- The continuous cutting machine is trammed to cut 2 and commences cutting while cut 1 is supported by the twin boom roof bolter.
- Once the continuous cutting machine completes cut 2 and roof bolting is completed in cut 1, the continuous cutting machine commences cut 3.
- The roof bolter supports cut 2 while the CM completes cut 3.
- This process is repeated for cut 4.
- The pillar will be split right through and closely spaced roof bolts installed at all the proposed goaf edges. These bolts serve the purpose of breaker line so the need of skin-to-skin chocks at goaf edges with corner props may not be needed.

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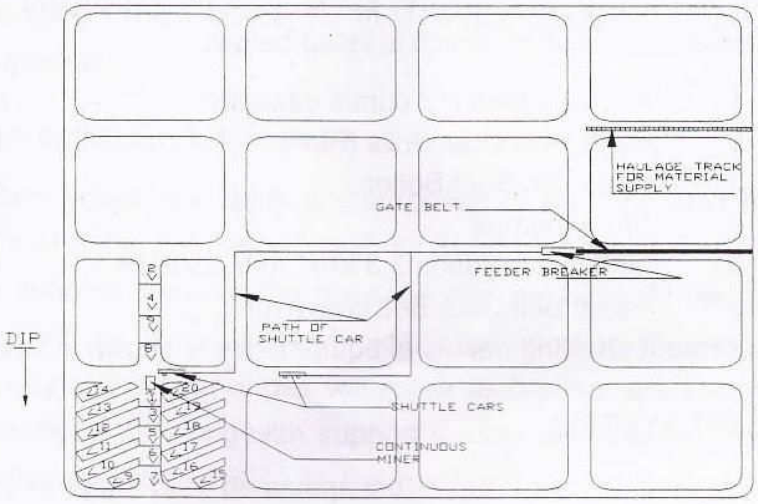
- In poor roof conditions, the split is not driven right through the pillar and a 2 m thick coal rib is left against the goaf edge as an additional protection.
- Flanking cuts 5, 6 and 7 are then taken from the cover of the supported pillar split (cuts 1 and 3). Further support is generally not necessary since the continuous cutting machine operates within 15 m of the face and the continuous cutting machine operator and shuttle car operator are always under the last row of support.
- Additional coal may be extracted from the 'stooks' (remnant portions of the coal pillars) as the continuous cutting machine is retreated judiciously dependent upon the face conditions at the time of extraction.
- The remaining flanking cuts are taken in a similar manner from the cover of the original fully supported development drive.

The schematic diagram showing the above explained cuts for pillar extraction and sequence of operations is given below:



All provisions of CMR, 1957 and DGMS circulars regarding depillaring shall be strictly adhered to. All other provisions of CMR 1957 and DGMS circulars regarding fencing of surface area, formation of sub-panels, standards of construction of isolation stopping, isolation of every panel immediately after it has been goaved out, inspection of depillaring district and around goaved out areas and maintenance of records thereof and maintenance of subsidence records, plan / sections, information regarding local falls etc. and submission for copies thereof to the DGMS, shall also be strictly adhered to.

Once main-dips development is reached the dip most part of the block (MD-8), panels in strike direction (Panel-2, Panel-1) at the north eastern part of the block will be developed. In Panel-1, depillaring will be commenced immediately after its development. Depillaring in Panel-2 will be followed after depillaring of Panel-1. The further sequencing of panels will be-Panel-3(development & depillaring), Panel-4 (development & depillaring), MD-7 (depillaring), Panel-5(development & depillaring), Panel-6(development & depillaring) etc. The sequence will be almost similar in both the seams.

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8.3 FACE EQUIPMENT

It is proposed to exploit both Seam-II Pack and Seam-IVB/Comb of Dhankasa block by Continuous Cutting Technology (2 nos. Continuous Miner Packages) with caving.

The list of major equipment's in each CM panel will be-

a) Continuous Miner (operating range: 2.16-4.6m),cutting width 3.3m, cutting power-2x170kW & total power-621 kW. The operating volt-@1100V
b) Shuttle cars- 2 each (capacity-10.19 cum.),power-202.6 kW @1100V.
c) Feeder breaker (capacity-500tph), power-112kW @1100V.
d) Twin Boom Roof Bolter (operating height: 2.4-5.0m) , Electro Hydraulic & Tyre mounted.
e) Multi Utility vehicle/LHD- std height,1.5cum capacity with 37 kW power.

Besides the above equipment's, some ancillary equipment is also required in the continuous miner district, which is listed below:

1.	Auxiliary fans (12 cum/s capacity)	-	5 Nos.
2.	Hand held Coal Drills (FLP)	-	4 Nos.
3.	Hydraulic Roof Bolter	-	2 No.
4.	Slurry pumps	-	2 Nos.
5.	Mobile substation 3.3 kV/1.1kV,330kVA	-	1 No.
6.	Panel Belt/Gate Belt conveyor		

The statement showing details of equipment's is shown in Appendix-A.3.

8.4 SUPPORT SYSTEM

It is proposed to install resin encapsulated roof bolts in the continuous cutting machine district. Since the unsupported cut-out distance is likely to be about 6-7m for Dhankasa U/G Mine, the time lag in supporting the freshly exposed roof has to be minimized by installing a bolting system, which sets faster and has high bond strength. The specifications of the proposed bolting consumables are as under:

Bolt: Diameter 22mm & length 2.4 m .The bolt should be made of TMT steel with required strength properties like ultimate tensile strength (<500 N/mm^2).

Thread: The thread should be at least 150 mm long and should allow free running of the nut. Nut should be fitted to end of the bolt with a shear pin arrangement that has a break-out facility works within a torque range of 125-150 Nm.

Resin Capsule: The resin should be in 24 mm diameter capsules of sufficiently low viscosity to enable the bolter to spin the 2.4m long bolt through resin and mix it in less than the gel setting time of the resin (20 sec.). UCS of resin should be greater than 80 MPa.

Drill Bit: The bit used for drilling roof bolting holes should be not be more than 27 mm in diameter. The bits should be twin wing negative rake & the annular space between the bolt and the hole should be 6 to 8 mm.

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8.4.1 Support System during Development Stage.

The height of extraction of development panels in trunk roads will be 3.0m only. For all other working panels, the development height will be the thickness of seam or 4.6m whichever is lesser. The support system during development stage will be designed based on the RMR of immediate 2.0 m roof strata & the guidelines for design of support system laid down by DGMS in its circulars. The support system will be finalized after the approval of DGMS. Following support system is however envisaged for the development faces in Seam-II Pack & Seam-IVB/Comb to serve as guideline only:

4 nos. resin encapsulated bolts of 2.4 m length are proposed in a row at 1.2 m spacing for a gallery width of 4.8 m in the freshly exposed area. The spacing between the adjacent rows will be 1.2 m. The geologically disturbed zones will be additionally supported.

8.4.2 Support system during Extraction stage.

During extraction stage, the splits are proposed to be supported by 4 nos. resin encapsulated roof bolts, 2.4m length with W-Strap of length 4.4m, in a row at 1.2m spacing. The spacing between the rows will also be 1.2m. At the goaf edges, the bolting density will be increased with additional number of rows of bolts. The increased density at the goaf edges will serve as breaker-line support. The above mentioned specifications along with support system are only indicative and will be governed by the approved SSR. At the goaf edges, the bolting density will be increased with additional number of rows of bolts. The increased density at the goaf edges will serve as breaker-line support.

The slices will be supported by 3 nos. roof bolts, 2.4 m long, in a row at 1.4 m spacing. The spacing between the rows will also be 1.4 m. The ledge formed at the entry of the slice will be supported by 3 nos. roof bolts with W-strap. On the rib side, the slices will be supported by chocks at 2.4 m spacing while on the solid side a row of props will be installed at 1.2 m spacing. At the goaf edges, the bolting density will be increased with additional number of rows of bolts. The increased density at the goaf edges will serve as breaker-line support.

To test the efficacy of installed support system and necessity of installing additional supports, etc. mine management will carry out routine monitoring through dual height Tell Tales. To ensure specified quality and consistency of roof bolting consumables and installation procedures, "short encapsulation pull test" shall be carried out by the mine management. The roof bolt-resin-strata system should have an average bond strength of 140 KN/300 mm of full encapsulation.

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8.5 SUBSIDENCE

Subsidence prediction study for Dhankasa U/G mine was carried out by CMPDI (HQ) in July 2006 based on the mining parameters and panel layout defined in the first Recast Project Report for Dhankasa U/G Mine (0.54 Mty) prepared in November 2005. As per this subsidence study, the angle of draw has been estimated as 35° positive near the three water bodies namely Gunor River, Dhankasa nalla and Junapani nalla.

The maximum subsidence at the fag end of mine life is expected to be around 2.935 m. In the present assessment, the mining parameters and liquidation plan have been changed. So a fresh subsidence study is warranted. In this report the angle of draw of 35° has been taken into account while estimating the extractable reserves. Angle of draw of 35° has been taken into account while estimating the extractable reserves. Further capital provision for acquisition of surface land affected due to subsidence and payment of crop compensation and compensatory afforestation has been made in this Recast Project Report.

8.6 PRODUCTION PARAMETERS

Based on the analysis of the time study of Continuous Miner districts in some of CM operating mines of Coal India Ltd (e.g.: Anjan Hill Mine of SECL) and the envisaged support system, the production parameters for the CM panels in Dhankasa U/G mine has also been arrived for production calculation-

The work elements in a cycle of continuous cutting technology with CM package will include cutting & loading of coal in face-1, marching to 2nd face, cutting & loading of coal in face-2 and marching back to face-1. The time required by CM package to complete 1 cycle of operation at Dhankasa UG mine is estimated to about 213 minutes. With an average working hours of CM as 16 hrs/ day, the no. of cutting & loading cycles by CM would be about 4.5 cycles/day. [16x60/213].

The supporting cycle time with 2 nos of Twin Boom Roof bolter for 2 faces works out to about 188 minutes. The number of roof supporting cycles would be about 5.0 per day [16x60/188] with the same 16hrs/day working hours considered for roof bolting machines.

Hence, to be on a safer side, the number of cycles for cutting/loading/supporting etc. has been considered as 4.5 cycles/day only for Dhankasa UG Mine.

Coal produced in one round = 4.8 x 4.0 x 6.5 x 2 x 1.55 = 386 t say 380 t.
(Gallery size -4.8mx4.0m,cut out distance-6.5m ,2 cuts/cycle, sp:gr:-1.55t/cum)
No. of production cycles/day = 4.5 Nos
Production per CM = 380 x 4.5 = 1710 tpd. (0.51 Mty)

To be on a safer side ,the average production considered from each CM district is 0.50 Mty . The total production from Dhankasa UG mine with 2 nos of CM districts works out to 1.0 Mty (about 3350 tpd).

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8.7 SELECTION OF EQUIPMENT

8.7.1 Trend of Mechanization

The proposed Dhankasa U/G mine is located in Pench Area of WCL. The old mines of Pench Area are manual mines. In adjacent Naheriya U/G mine, coal is prepared by blasting-off-the-solids and loaded by LHDs onto gate belt conveyors. The mining conditions in Dhankasa U/G mine are expected to be nearly the same as in Naheriya U/G since the same sequence of seams with similar geo-mining and geo-engineering characteristics are present in Dhankasa U/G mine also. At present, in many underground coal mines in India, the continuous cutting technology has been successfully adopted for mass production.

8.7.2 Optimization of Equipment

As experience to operate Continuous Cutting Technology is now gained in many Indian coal mines, it is proposed to work both the workable seams of Dhankasa UG mine with this technology- i.e. Continuous Miner districts.

It is proposed to exploit both Seam-II Pack and Seam-IVB/Comb of Dhankasa block by Continuous Cutting Technology (2 nos. Continuous Miner Packages) with caving.

The major equipment's in each CM panel are Continuous Miner ,Shuttle cars- 2, Feeder breaker ,Twin Boom Roof Bolter ,Multi Utility vehicle/LHD etc. The detailed specification has been given in the earlier paragraph.

8.8 EXPLOSIVES & MAGAZINE

Since Continuous Cutting technology is proposed in this project, provision for Magazine is not made as this is blasting free method of coal exploitation. However, provision for a mini explosive carrier has been given in this Recast PR for the purpose of drift drivages etc.

8.9 STOWING ARRANGEMENT

It is proposed to exploit both Seam-II Pack & Seam-IV/B Comb of Dhankasa UG mine by continuous cutting technology with caving method. Hence no stowing arrangement is required for this project.

8.10 SPECIFIC STUDIES TO BE CONDUCTED

Cavability study for immediate roof strata above Seam-II Pack has to be carried out in addition to Subsidence studies. Financial provision for these studies are included in this Recast PR for Dhankasa UG Mine. Other scientific studies for Geo-technical investigations, RMR, Load bearing capacity of roof & floor, Gas survey, Ventilation survey etc. also to be carried out.

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9.0 MINING SCHEDULE

9.1 EXTRACTABLE RESERVES IN WORKABLE SEAMS

The following tables shows the seam-wise, panel-wise, grade-wise extractable reserves in Seam-II Pack & Seam-IV B/Comb of Dhankasa UG Mine.

Seam-II Pack (Seam-IC+parting+Seam-II)					
Panel	Extractable Reserves - Mt			GCV	Grade
	Dev.	Dep.	Total		
II-1	0.19	0.32	0.51	4209	G11
II-2	0.22	0.12	0.34	4209	G11
II-3	0.06	0.00	0.06	4496	G10
II-4	0.09	0.20	0.29	4496	G10
II-5	0.10	0.03	0.13	4873	G9
II-6	0.23	0.57	0.80	4873	G9
II-7	0.12	0.13	0.25	4571	G10
II-8	0.14	0.23	0.37	4571	G10
II-9	0.20	0.26	0.46	4857	G9
II-10	0.04	0.06	0.10	4857	G9
II-11	0.24	0.22	0.46	4477	G10
II-12	0.20	0.34	0.54	4477	G10
II-13	0.43	0.40	0.83	4477	G10
II-14	0.06	0.10	0.16	4477	G10
II-15	0.18	0.28	0.46	4477	G10
II-16	0.07	0.11	0.18	4477	G10
II-17	0.16	0.26	0.42	4477	G10
II-18	0.03	0.05	0.08	4477	G10
II-19	0.16	0.11	0.27	4477	G10
II-20	0.20	0.12	0.32	4817	G9
II-21	0.18	0.13	0.31	4817	G9
II-22	0.05	0.00	0.05	4817	G9
II-MD1	0.00	0.00	0.00	-	-
II-MD2	0.07	0.16	0.23	4477	G10
II-MD3	0.07	0.16	0.23	4477	G10
II-MD4	0.02	0.05	0.07	4857	G9
II-MD5	0.01	0.03	0.04	4571	G10
II-MD6	0.02	0.05	0.07	4873	G9
II-MD7	0.03	0.06	0.09	4496	G10
II-MD8	0.02	0.00	0.02	4209	G11
	3.59	**4.55**	**8.14**	**4563**	**G10**

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Extractable Reserves .....contd

Seam-IVB/Comb					
Panel	Extractable Reserves - Mt			GCV	Grade
	Dev.	Dep.	Total.		
IV-1	0.28	0.47	0.75	6024	G5
IV-2	0.18	0.09	0.27	6024	G5
IV-3	0.05	0.02	0.07	5947	G5
IV-4	0.06	0.11	0.17	5947	G5
IV-5	0.11	0.02	0.13	5895	G5
IV-6	0.24	0.62	0.86	5895	G5
IV-7	0.15	0.15	0.30	5925	G5
IV-8	0.14	0.23	0.37	5925	G5
IV-9	0.18	0.23	0.41	5467	G7
IV-10	0.06	0.11	0.17	5467	G7
IV-11	0.27	0.26	0.53	5471	G7
IV-12	0.34	0.58	0.92	5471	G7
IV-13	0.41	0.35	0.76	5471	G7
IV-14	0.26	0.44	0.70	5471	G7
IV-15	0.17	0.24	0.41	5471	G7
IV-16	0.18	0.31	0.49	5471	G7
IV-17	0.16	0.27	0.43	5471	G7
IV-18	0.06	0.11	0.17	5471	G7
IV-19	0.25	0.20	0.45	5471	G7
IV-20	0.21	0.13	0.34	5535	G6
IV-21	0.18	0.15	0.33	5535	G6
IV-22	0.22	0.06	0.28	5535	G6
IV-23	0.09	0.15	0.24	5255	G7
IV-24	0.12	0.19	0.31	5255	G7
IV-MD1	0.07	0.10	0.17	5535	G6
IV-MD2	0.07	0.18	0.25	5471	G7
IV-MD3	0.08	0.19	0.27	5471	G7
IV-MD4	0.02	0.06	0.08	5467	G7
IV-MD5	0.02	0.06	0.08	5925	G5
IV-MD6	0.03	0.07	0.10	5895	G5
IV-MD7	0.02	0.02	0.04	5947	G5
IV-MD8	0.01	0.00	0.01	6024	G5
	4.69	**6.17**	**10.86**	**5605**	**G6**

The total extractable reserves of Dhankasa UG mine for both the seams works out to 19.00 Mt (Seam-II Pack -8.14& Seam-IVB/Comb-10.86). The average grade of Seam-II Pack is G10 while that of Seam-IV B/Comb is G6. The weighted average grade of the entire extractable reserves of Dhankasa UG mine for the whole life of mine works out to G7 with a GCV value of 5208 K.Cal/Kg.

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9.2 PRODUCTION SCHEDULE

The target production of 1.0 Mty from Dhankasa UG mine will be generated by operating 2 nos. of CM districts. It is proposed to work both the seams simultaneously as these seams are contiguous in nature. As per the schedule, the land acquisition for inclines & surface infrastructures will be completed in 1 year. Drivage of inclines / air-shafts with installation of main-fan,haulage track, belt conveyors etc. will be completed by end of 2nd year.

2 CM districts (one in each seam) will be established for main-dips development from 3rd year and production commences from this year itself. The main-dips panels MD1,MD2,MD3,MD4,MD5&MD6 will be developed along the trunk roads. For development of main-dips panel, 6 sets of drifts namely D1,D2,D3,D4,D5&D6 are to be made for crossing faults F9N-9N,F2-2,F3-3,F4-4,F5-5 & F6-6 respectively. Once main-dips development is reached the dip most part of the block (MD-8), panels in strike direction (Panel-2, Panel-1) at the north eastern part of the block will be developed. The workings in both the seams will be almost similar . During 3rd year, the production from each CM districts would be 0.33 Mty each – i.e. a total production of 0.66 Mty from 2 CM panels with an average coal grade of G8.

During 4th year, development of Panel-2 & Panel-1 will be completed. In Panel-1, depillaring will be commenced immediately after its development. Depillaring in Panel-2 will be followed after depillaring of Panel-1. During this year, the production from each CM districts would be 0.50 Mty – i.e. the target production of 1.0 Mty will be achieved during this year from 2 CM districts (average coal grade-G7).

During 5th year, Panels-2,3,4 etc. are worked in both the seams. The target production of 1.0 Mty will be maintained from 4th year to 19th year.

During 20th year, 1 CM district will be with drawn from operation. Hence, during this year, the coal production will be 0.84 Mty only. Coal production tapering starts from 20th year. During the end of mine life-i.e. during 21st,22nd & 23rd years, the coal production would be 0.50 Mty,0.50 Mty & 0.36 Mty respectively. The details of mine production schedule is tabulated in next paragraph-9.3.

The production scheduling during initial years is shown in a tabular format below-

Seam/Year	Coal production (Mty)					
	Year-1-2	Year-3	Year-4	Year-5	Year-6	Year-7
Seam-II Pack [CM1]	-	0.33	0.50	0.50	0.50	0.50
Seam-IVB/Comb[CM2]	-	0.33	0.50	0.50	0.50	0.50
Total	-	0.66	1.00	1.00	1.00	1.00

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9.3 MINE LIQUDATION PLAN

The liquidation plan showing the scheduling of 2 CM packages for exploiting both Seam-II Pack & Seam-IVB/Comb is detailed in the following tables-

DHANKASA UG MINE- YEARWISE SCHEDULING OF M/Cs FOR PRODN [CALENDER PROGRAMME].

YEAR	M/C	SEAM	PARTICULARS	DEV/ DEP.	PRODN .(Mt)	M/C WISE PDODN. (Mt)	TOTAL PRODN. (YRLY)-Mt
Year : 1-2	LAND ACQUSITION (LAND FOR INCLINES & OTHER SURFACE INFRASTRUCTURES WILL BE ACQUIRED IN 1ST YEAR ITSELF).						NIL
Year : 2	DRIVAGE OF INCLINES UPTO FLOOR OF SEAM-IV COMB. & 4 DRIFTS FROM INCLINE BOTTOM TO THE FLOOR OF SEAM-II PACK TO BE COMPLETED. AIRSHAFT, FAN DRIFTS ETC TO BE COMPLETED. INSTALLATION BELT CONVEYOR , HAULAGE ETC IN INCLINES TO BE DONE. INSTALLATION OF MAIN FAN IN FAN DRIFT ETC TO BE COMPLTED.						NIL
Year-3	CM-1	II PACK	INTRODUCING CM-1 IN II-MD1 FOR DEVT. (ONLY 3 PILLARS)	DEV.	0.00	0.33	0.66
			4 Nos OF DRIFTS (II-D1) TO CROSS FAULT F9-F9 TO ENTER II-MD2. IN LATER STAGE, DRIFTS WILL BE MADE TO CROSS FAULTS F2-F2(II-D2 TO ENTER II-MD4),F3-F3(II-D3 TO ENTER II-MD5),F4-F4(II-D4 TO ENTER II-MD6),F5-F5(II-D5 TO ENTER II-MD7) & F6-F6(II-D6 TO ENTER II-MD8) WILL BE COMPLETED BEFORE ENTERING THE RESPECTIVE PANELS.				
			II- MD2 & II-MD3 FOR DEVT.	DEV.	0.14		
			II-MD4 , II-MD5	DEV.	0.03		
			II-7 (ENGAGING CM-1 TILL THE DRIFTS D4 TO CROSS FAULT F4-F4 IS COMPLETED.)	DEV.	0.05		
			II-MD6,II-MD7 FOR DEVT.	DEV.	0.05		
			II-4 (ENGAGING CM-1 TILL THE DRIFTS D6 TO CROSS FAULT F6-F6 IS COMPLETED.)	DEV.	0.05		
			II-MD8 FOR DEVT.	DEV.	0.02		
			II- 2 FOR DEVT.	DEV.	0.06		
Year-3	CM-2	IV COMB.	INTRO. OF CM-2 IN IV-MD1 .	DEV.	0.07	0.33	
			4 Nos OF DRIFTS (IV-D1) TO CROSS FAULT F9-F9 TO ENTER IV-MD2. IN LATER STAGE, DRIFTS WILL BE MADE TO CROSS FAULTS F2-F2(IV-D2 TO ENTER IV-MD4),F3-F3(IV-D3 TO ENTER IV-MD5),F4-F4(IV-D4 TO ENTER IV-MD6),F5-F5(IV-D5 TO ENTER IV-MD7) & F6-F6(IV-D6 TO ENTER IV-MD8) WILL BE COMPLETED BEFORE ENTERING THE RESPECTIVE PANELS.				
			IV- MD2 & IV-MD3 FOR DEVT.	DEV.	0.10		
Year-3	CM-2	IV COMB.	IV-MD4 , IV-MD5 FOR DEVT.	DEV.	0.04		
			IV-7 (ENGAGING CM-2 TILL THE DRIFTS D4 TO CROSS FAULT F4-F4 IS COMPLETED.)	DEV.	0.05		
			IV-MD6,IV-MD7FOR DEVT.	DEV.	0.05		
			IV-4 (ENGAGING CM-2 TILL THE DRIFTS D6 TO CROSS FAULT F6-F6 IS COMPLETED.)	DEV.	0.05		
			IV-MD8 FOR DEVT.	DEV.	0.01		
			IV- 2 FOR DEVT.	DEV.	0.03		

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Liquidation plan contd..

YEAR	M/C	SEAM	PARTICULARS	DEV/ DEP.	PRODN.(Mt)	M/C WISE PDODN. (Mt)	TOTAL PRODN. (YRLY)-Mt
Year-4	CM-1	II PACK	II- 2 FOR DEVT. BAL.	DEV.	0.11	0.50	1.00
			II- 1 FOR DEVT.&DEP.	DEV&DEP	0.39		
	CM-2	IV COMB.	IV- 2 FOR DEVT. BAL.	DEV.	0.150	0.50	
			IV- 1 FOR DEVT.&DEP.	DEV&DEP	0.35		
Year-5	CM-1	II PACK	II- 1 FOR DEVT.&DEP. BAL	DEV&DEP	0.120	0.50	1.00
			II- 2 FOR DEP.	DEP.	0.120		
			II- 3 FOR DEV.	DEV.	0.06		
			II- 4 FOR DEV. (BAL.)& DEP.	DEV&DEP	0.20		
	CM-2	IV COMB.	IV- 1 FOR DEVT.&DEP. BAL	DEV&DEP	0.40	0.50	
			IV- 2 FOR DEP.	DEP.	0.09		
			IV- 3 FOR DEV.	DEV.	0.01		
Year-6	CM-1	II PACK	II- 4 FOR DEV.& DEP. BAL	DEV&DEP	0.09	0.500	1.00
			II-MD7 FOR DEP.	DEP.	0.060		
			II- 5 FOR DEV.& DEP.	DEV&DEP	0.13		
			II- 6 FOR DEV.& DEP.	DEV&DEP	0.22		
	CM-2	IV COMB.	IV- 3 FOR DEV. BAL.	DEV.	0.060	0.50	
			IV- 4 FOR DEV.(BAL.)& DEP.	DEV&DEP	0.170		
			IV-MD7 FOR DEP.	DEP.	0.020		
			IV- 5 FOR DEV.& DEP.	DEV&DEP	0.130		
			IV- 6 FOR DEV.& DEP.	DEV&DEP	0.12		
Year-7	CM-1	II PACK	II- 6 FOR DEV.& DEP. BAL.	DEV&DEP	0.50	0.50	1.00
	CM-2	IV COMB.	IV- 6 FOR DEV.& DEP. BAL	DEV&DEP	0.50	0.50	
Year-8	CM-1	II PACK	II- 6 FOR DEV.& DEP. BAL.	DEV&DEP	0.080	0.50	1.00
			II-MD6 FOR DEP.	DEP.	0.050		
			II- 7 FOR DEV.(BAL) & DEP.	DEV&DEP	0.250		
			II- 8 FOR DEV.& DEP.	DEV&DEP	0.12		
	CM-2	IV COMB.	IV- 6 FOR DEV.& DEP. BAL	DEV&DEP	0.240	0.50	
			IV-MD6 FOR DEP.	DEP.	0.070		
			IV- 7 FOR DEV.(BAL)& DEP.	DEV&DEP	0.19		

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Liquidation plan .....contd..

YEAR	M/C	SEAM	PARTICULARS	DEV/ DEP.	PRODN.(Mt)	M/C WISE PDODN. (Mt)	TOTAL PRODN. (YRLY)- Mt
Year-9	CM-1	II PACK	II- 8 FOR DEV.& DEP. BAL	DEV&DEP	0.25	0.50	1.00
			II-MD5 FOR DEP.	DEP.	0.03		
			II- 9 FOR DEV.& DEP.	DEV&DEP	0.22		
	CM-2	IV COMB.	IV- 7 FOR DEV.& DEP. BAL	DEV&DEP	0.11	0.50	
			IV- 8 FOR DEV.& DEP.	DEV&DEP	0.37		
			IV-MD5 FOR DEP.	DEP.	0.02		
Year-10	CM-1	II PACK	II- 9 FOR DEV.& DEP. BAL	DEV&DEP	0.24	0.50	1.00
			II- 10 FOR DEV.& DEP.	DEV&DEP	0.10		
			II-MD4 FOR DEP.	DEP.	0.050		
			II- 11 FOR DEV.& DEP.	DEV&DEP	0.11		
	CM-2	IV COMB.	IV-MD5 FOR DEP. BAL	DEP.	0.04	0.50	
			IV- 9 FOR DEV.& DEP.	DEV&DEP	0.4100		
			IV- 10 FOR DEV.& DEP.	DEV&DEP	0.05		
Year-11	CM-1	II PACK	II- 11 FOR DEV.& DEP. BAL.	DEV&DEP	0.35	0.50	1.00
			II- 13 FOR DEV.& DEP.	DEV&DEP	0.15		
	CM-2	IV COMB.	IV- 10 FOR DEV.& DEP. BAL.	DEV&DEP	0.120	0.50	
			IV-MD4 FOR DEP.	DEP.	0.060		
			IV- 11 FOR DEV.& DEP.	DEV&DEP	0.32		
Year-12	CM-1	II PACK	II- 13 FOR DEV.& DEP. BAL.	DEV&DEP	0.50	0.50	1.00
	CM-2	IV COMB.	IV- 11 FOR DEV.& DEP. BAL.	DEV&DEP	0.21	0.50	
			IV- 13 FOR DEV.& DEP.	DEV&DEP	0.29		
Year-13	CM-1	II PACK	II- 13 FOR DEV.& DEP. BAL	DEV&DEP	0.18	0.50	1.00
			II- 15 FOR DEV.& DEP.	DEV&DEP	0.32		
	CM-2	IV COMB.	IV- 13 FOR DEV.& DEP. BAL.	DEV&DEP	0.470	0.50	
			IV- 15 FOR DEV.& DEP.	DEV&DEP	0.03		

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Liquidation plan..... contd..

YEAR	M/C	SEAM	PARTICULARS	DEV/ DEP.	PRODN.(Mt)	M/C WISE PDODN. (Mt)	TOTAL PRODN. (YRLY)-Mt
Year-14	CM-1	II PACK	II- 15 FOR DEV.& DEP. BAL.	DEV&DEP	0.14	0.50	1.00
			II- 17 FOR DEV.& DEP.	DEV&DEP	0.36		
	CM-2	IV COMB.	IV- 15 FOR DEV.& DEP. BAL	DEV&DEP	0.380	0.50	
			IV- 17 FOR DEV.& DEP.	DEV&DEP	0.12		
Year-15	CM-1	II PACK	II- 17 FOR DEV.& DEP. BAL	DEV&DEP	0.06	0.50	1.00
			II- 19 FOR DEV.& DEP.	DEV&DEP	0.27		
			II- 20 FOR DEV.& DEP.	DEV&DEP	0.17		
	CM-2	IV COMB.	IV- 17 FOR DEV.& DEP. BAL	DEV&DEP	0.31	0.50	
			IV- 19 FOR DEV.& DEP.	DEV&DEP	0.19		
Year-16	CM-1	II PACK	II- 20 FOR DEV.& DEP. BAL	DEV&DEP	0.15	0.50	1.00
			II- 21 FOR DEV.& DEP.	DEV&DEP	0.31		
			II- 22 FOR DEV.& DEP.	DEV&DEP	0.04		
	CM-2	IV COMB.	IV- 19 FOR DEV.& DEP. BAL	DEV&DEP	0.26	0.50	
			IV- 20 FOR DEV.& DEP.	DEV&DEP	0.24		
Year-17	CM-1	II PACK	II- 22 FOR DEV.& DEP. BAL	DEV&DEP	0.01	0.50	1.00
			II- 12 FOR DEV.& DEP.	DEV&DEP	0.49		
	CM-2	IV COMB.	IV- 20 FOR DEV.& DEP. BAL	DEV&DEP	0.10	0.50	
			IV- 21 FOR DEV.& DEP.	DEV&DEP	0.33		
			IV- 22 FOR DEV.& DEP.	DEV&DEP	0.07		
Year-18	CM-1	II PACK	II- 12 FOR DEV.& DEP. BAL	DEV&DEP	0.05	0.50	1.00
			II- 14 FOR DEV.& DEP.	DEV&DEP	0.16		
			II-MD3 FOR DEP.	DEP.	0.16		
			II- 16 FOR DEV.& DEP.	DEV&DEP	0.13		
	CM-2	IV COMB.	IV- 22 FOR DEV.& DEP. BAL	DEV&DEP	0.21	0.50	
			IV- 14 FOR DEV.	DEV.	0.26		
			3-DRIFTS TO BE MADE FOR CROSSING FAULT F11-F11 TO ENTER SEC-5 FROM SEC-4. ONCE SEC-5 IS ENTERED,AGAIN 3 DRIFTS TO BE MADE TO CROSS F9-F9 TO ENTER SEC-2 FROM SEC-5.				
			IV- 12 FOR DEV.& DEP.	DEV&DEP	0.03		

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Liquidation plan.... contd..

YEAR	M/C	SEAM	PARTICULARS	DEV/ DEP.	PRODN.(Mt)	M/C WISE PDODN. (Mt)	TOTAL PRODN. (YRLY)-Mt
Year-19	CM-1	II PACK	II- 16 FOR DEV.& DEP. BAL	DEV&DEP	0.05	0.50	1.00
			II- 18 FOR DEV.& DEP.	DEV&DEP	0.08		
			II-MD2 FOR DEP.	DEP.	0.160		
		IV COMB.	IV- 24 FOR DEV.& DEP.	DEV&DEP	0.21		
	CM-2	IV COMB.	IV- 12 FOR DEV.& DEP. BAL	DEV&DEP	0.50	0.50	
Year-20	CM-1	IV COMB.	IV- 24 FOR DEV.& DEP. BAL	DEV&DEP	0.10	0.34	0.84
			IV- 23 FOR DEV.& DEP.	DEV&DEP	0.24		
	CM-2	IV COMB.	IV- 12 FOR DEV.& DEP. BAL	DEV&DEP	0.39	0.50	
			IV- 14 FOR DEP.	DEP.	0.11		
Year-21	CM-2	IV COMB.	IV- 14 FOR DEP. BAL	DEP.	0.330	0.50	0.50
			IV-MD3 FOR DEP.	DEP.	0.17		
Year-22	CM-2	IV COMB.	IV-MD3 FOR DEP. BAL.	DEP.	0.02	0.50	0.50
			IV- 16 FOR DEV.& DEP.	DEV&DEP	0.48		
Year-23	CM-2	IV COMB.	IV- 16 FOR DEV.& DEP. BAL.	DEV&DEP	0.01	0.50	0.50
			IV- 18 FOR DEV.& DEP.	DEV&DEP	0.17		
			IV-MD2 FOR DEP.	DEP.	0.18		
			IV-MD1 FOR DEP.	DEP.	0.10		
Total Extractable Reserves (Mt)							**19.00**

The Liquidation plan for Recast PR for Dhankasa UG mine shows Year-wise, Machine wise, Seam-wise development and depillaring reserves for the entire life span of the mine. Both the CM districts will be established during 3rd year and production during 3rd year would be 0.66 Mt. During 4th year, the target production of 1.0 Mty will be achieved. This production trend of 1.0 Mty continues till 19th year. One CM package (CM-1) will be withdrawn during 20th year & the production tapering starts . During the end of mine life-i.e. during 20th,21st,22nd & 23rd years, the coal production would be 0.84 Mty, 0.50 Mty,0.50 Mty & 0.50 Mty respectively.

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9.3 ROM QUALITY

The grade of coal dispatch will vary depending upon the location of the production districts either in Seam-II Pack or in Seam-IVB/Comb. The weighted average grade of coal produced (year wise) from Seam-II Pack & Seam-IVB/Comb are calculated and tabulated below:-

YEARWISE SCHEDULING OF M/Cs WITH PRODUCTION & QUALITY-DHANKASA UG MINE-

Year	PRODUCTION (Mt)			AVG. GCV	GRADE
	CM-1	CM-2	TOTAL	K.Cal/Kg	
Year-1	-	-	-	-	-
Year-2	-	-	-	-	-
Year-3	0.33	0.33	0.66	5106	G8
Year-4	0.50	0.50	1.00	5260	G7
Year-5	0.50	0.50	1.00	5225	G7
Year-6	0.50	0.50	1.00	5340	G7
Year-7	0.50	0.50	1.00	5384	G7
Year-8	0.50	0.50	1.00	5278	G7
Year-9	0.50	0.50	1.00	5311	G7
Year-10	0.50	0.50	1.00	5203	G7
Year-11	0.50	0.50	1.00	4973	G8
Year-12	0.50	0.50	1.00	4974	G8
Year-13	0.50	0.50	1.00	4974	G8
Year-14	0.50	0.50	1.00	4974	G8
Year-15	0.50	0.50	1.00	5032	G8
Year-16	0.50	0.50	1.00	5206	G7
Year-17	0.50	0.50	1.00	5009	G8
Year-18	0.50	0.50	1.00	4987	G8
Year-19	0.50	0.50	1.00	5221	G7
Year-20	0.34	0.50	0.84	5384	G7
Year-21	-	0.50	0.50	5471	G7
Year-22	-	0.50	0.50	5471	G7
Year-23	-	0.50	0.50	5485	G7
	Total		**19.00**	**5208**	**G7**

As per the assessment, weighted average grade of total extractable reserves works out to G7 with a GCV value of 5208 K.Cal/Kg.

9.4 ZERO DATE

The zero date for this Project is April-2016 & 1st year of mine operation as 2016-17. PR approval & remaining land acquisition procedures will be completed by March-2017. Incline & Air-shaft drivages start from April-2017. Mine production commences from April-2018 (3rd year of mine operation).

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10.0 HORIZONTAL & VERTICAL TRANSPORT

10.1 INTRODUCTION

It is proposed in this Recast Project Report to produce 1.0 Mty of coal (target) from Dhankasa UG mine from 2 Continuous Miner districts. Each CM panel will produce about 1700 tpd of coal (0.50 Mty). There are 2 two workable seams viz. Seam-II (upper seam) & Seam- IVB/ Comb (lower seam) and The average parting between the two seams is around 6 to 8m.

Two inclines (Incline-1&2) are proposed in this Recast P.R for Dhankasa U/G Mine for transport of men, material & mineral (coal). Belt conveyors have been provided for gate and trunk transport of coal. Rope haulages have been provided for material transport while chair lift system has been provided for transport of men.

10.2 FACE & GATE TRANSPORT

The coal cut by the Continuous Miner will be loaded onto the shuttle car bucket by the gathering arms and in-built chain conveyor. Coal from the shuttle car bucket will be discharged into the receiving hopper of the feeder breaker. The bigger lumps of coal will be crushed to - 200 mm size in feeder breaker.. The feeder breaker (mobile type) will transfer coal onto the gate belt conveyor of 1000mm wide with 250 tph capacity and then to the out-bye conveyor system-i.e. trunk/ incline belt .

10 numbers of 1000 mm wide gate belt conveyors with total length of 4000m have been envisaged. All the gate belt conveyors have been designed to carry 250 5tph at 2.0m/sec speed and have been provided with 90 kW drive.

10.3 TRUNK TRANSPORT

Trunk belt conveyor of 1200 mm width will be installed along trunk road in the lower seam-i.e. Seam-IVB/Comb. Coal from Seam-IVB/Comb will be transported through this trunk belt conveyor. Coal from upper seam-i.e. Seam-II Pack will be transported through 7 nos of strata bunkers (in-parting) are proposed to be constructed along the main-dip panel between the workable seams. About 400m of trunk belting provision has been given for linking of gate belts with these strata bunkers. These staple pits are provided with reciprocating feeder at their discharge ends for uniform loading on succeeding conveyors and will act as a surge bunker for limiting the running time of belt conveyors.

A series of (6 numbers) 1200 mm wide belt conveyors working in tandem have been provided to cover the entire trunk roadways. These trunk belts are designed to carry 600tph and are powered with 2 x 90 kW drive. The total trunk length works out to 2450m. This includes the portion of the trunk belt 1200 mm wide in surface from incline opening to crusher. This trunk belt is designed to carry 600tph and are powered with 2 x 150 kW drive. Coal will be transported to surface CHP by a series of trunk belt conveyors working in tandem. PVC belting has been envisaged for trunk and gate transport.

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10.4 TRANSPORT OF MEN

Considering the long traveling distance from surface to working locations, chair lift system of man riding have been provided in this Report for transportation of men . This man riding system will be installed along haulage route of Incline-2 (about 680m long) & the main-dip/ trunk routes of both Seam-II Pack & Seam-IVB/Comb (each about 1.7km long). Generally, either of the system (i.e. chair lift system or the direct haulage in the incline) will be operative at a time. However this restrictions and operation schedule will be finalized as per the guidance of DGMS etc.

10.5 TRANSPORT OF MATERIAL

A haulage route is established along Incline-2 by installing a Direct Rope Haulage with a capacity of 100 kW for transport of materials between surface and incline bottom. Two numbers of 37 kW endless haulages have been provided in trunk routes of . In addition to these, 4 numbers of direct/tugger haulages have been provided for the trunk transport to cater the transport need in both the seams.

Four numbers of endless haulages have been provided for the two districts. Two numbers of Tugger haulage has also been provided as standby. The endless haulages will have single track only as the use of the haulages are only for transport of material.

11.0 VENTILATION

Exhaust ventilation system has been proposed for Dhankasa UG mine. The main mechanical ventilator will be installed at the fan drift of return air-shaft with properly constructed airlock arrangement at the top of the shaft.

11.1 DEGREE OF GASSINESS

The proposed Dhankasa U/G mine is a virgin mine. It is anticipated that the coal seams in Dhankasa U/G mine will be Degree-I gassy seams, since similar seams in Naheriya U/G have been classified as degree-I gassy seams. All equipment provided for use at the face below ground will have FLP electrical or will be intrinsically safe. Adequate numbers of auxiliary ventilators have been provided to maintain the air velocity at the working faces as per statute.

11.2 AIR QUANTITY REQUIREMENT

a) <u>On the basis of Coal production</u> :

As per CMR 1957, 2.5 m^3/min of air per tonne of daily output should reach the last ventilation connection (LVC) of the districts. There will be 2 CM panels in operation at a time for a total production target of 1.00 Mty (total 3350 tpd - about 1675 tpd from each CM district). Hence the minimum air quantity requirement at the LVC of the 3 working districts together works out to 140 m^3/sec.

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b) On the basis of manpower in the largest shaft

As per CMR 1957, a minimum of 6.0 m^3/min airflow per person of the largest shift should be available for ventilation of the working places. The total underground manpower in Dhankasa UG mine is estimated to be 379. It is considered that 40% of total U/G manpower will be the manpower in the largest shift, which is 152 persons. Hence, the air quantity required for ventilation of the mine works out to be 152 x 6 / 60 = 15.2 m^3/sec.

c) On the basis of temperature

As per CMR, 1957 the wet bulb temperature in any working place should not exceed 33.5° centigrade, and where the wet bulb temperature exceeds 30.5° C, arrangements are to be made to ventilate the same with a current of air moving at a speed of not less than 1.0m/sec. Thus for a maximum cross sectional area of 4.8m x 4.00 m = 19.2 m^2, the minimum air quantity requirement at face will be 19.2 m^3/sec., when the wet bulb temperature exceeds 30.5°C

Assessment of Air Quantity Requirement (m^3/sec.) based on major parameters

Air quantity requirement on the basis of	CM Dist-1	CM Dist-2	Total
Coal production (tpd)	1675	1675	3350
U/G Manpower in the largest shift	152		
Average x-sectional area of galleries (m^2) in all seams	19.2		
Minimum Airflow Required in the LVC (m^3/s)			
a) As per production			140
b) As per U/G manpower in the largest shift.			15.2
c) As per temperature (w.r.t x-sectional area)			19.2

From the above table, it is evident that the minimum air quantity requirement in the LVC of the districts is maximum on the basis of coal production i.e. 140 m^3/sec at the LVC for the 2 working districts together.

However, in highly mechanized mines with high production levels (Mechanized LongWall, Continuous Miner etc.), air quantity requirement based on production becomes very high and it is not practicable to arrange this much of air quantity in the mine. Hence exemption from DGMS is sought in such mass production technology mines. As per international standards, each mechanized district should be provided with air quantity of 20-25 cum/sec at LVC. DGMS permission regarding the requirement of air quantity at LVC of each panel should be obtained as 25 m^3/sec.

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In Dhankasa UG mine, it is proposed to ventilate 2 nos of CM districts with air quantities of 25 cum/sec at LVC of each district . An additional 10 cum/sec required for service areas, the total air quantity at the LVC of the 2 panels and service areas works out to 60 cum/sec.

Air-quantity Requirement at Main Mechanical Ventilator

The ventilation system of the mine is designed considering overall V.E.Q. of about 50%. Thus the air-quantity requirement at the main mechanical ventilator to deliver 60 m^3/sec airflow in the LVC of 2 districts & service areas works out to 120 m^3/sec .

11.3 VENTILATION SYSTEM DESIGN

It is proposed to ventilate Dhankasa U/G Mine by installing main mechanical ventilator at the fan drift of airshaft , which will be an exhaust type fan. The two Inclines (Incline-1&2) driven at a gradient of 1 in 4.5 from surface to Seam-IVB/Comb floor (each 468.65m long with a x-section of 5.0mx3.0m) and this will not cut upper seam-i.e. Seam-II Pack. Both these inclines will act as intake airways (down cast airways). Two drifts (both intake airways & 95 m long each) will be made from the incline bottom to access Seam-II Pack at a gradient of 1 in 17.

One airshaft will be driven from surface to floor of Seam-IVB/Comb vertically with a diameter of 5.0m & depth of 129.5m (near inclines bottom close to bore hole PD-58 in Sector-3). This will act as return airway (up cast shaft).

With 2 nos of Inclines proposed in Dhankasa UG mine (intake airways with cross sectional dimension of 5.0mx3.0m each), maximum air quantity that can be carried to the mine within permissible velocity of 4m/s for belt conveyor roads is 120 m^3/sec. Hence these 2 inclines will be sufficient to carry the required air quantity as intake airways.

In the trunk / main-dips panels, 5 development headings are proposed where 3 airways will act as intake routes & the remaining 2 will act as return airways. At places along trunk roads where faults are to be crossed , 4 nos of drifts are proposed where 2 will act as intake routes and remaining 2 as return routes.

Exhaust ventilation system is proposed for the mine. The main mechanical ventilator will be installed in the fan drift attached to the airshaft. The fan drift and evasee will be suitably designed to minimize the formation of eddy currents and to ensure smooth expansion of exhaust air. To ensure comfortable working environment at the faces, auxiliary ventilation using forcing fans is proposed. Air crossings will be constructed as per requirement to route the return air to the airshaft without mixing with the intake air.

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11.4 VENTILATION SIMULATION STUDY

A ventilation simulation study has been done for Dhankasa U/G Mine to assess the ventilation requirements of this mine. It is estimated that during 4th year of mine operation, the ventilation requirements in Dhankasa UG mine will be maximum. During this period, CM-1 district will be working in Panel II-1 (Seam-II Pack) while CM-2 district will be working in Panel IV-1 (Seam-IVB/Comb). The farthest working panel being Pane II-1 and the simulation study is done for ventilation network for this panel. The air quantity and pressure along the ventilation network is shown in a tabular format below-

Simulation Study for Ventilation Requirements					
Sl.No.	Location	LENGTH (m)	Air Qnty (cum/s)	Resistance (gaul)	Pressure (Pa)
1	INCLINE	468.65	117	0.047	163.14
2	DRIFT+SEAM II	155	56	0.023	18.23
3	MD -I	60	56	0.012	4.11
4	DRIFT-D(1)	34	54	0.007	4.96
5	MD-2+MD-3	730	53	0.146	44.71
6	DRIFT-D(2)	220	50	0.044	27.50
7	MD-4	160	50	0.032	8.71
8	DRIFT-D(3)	50	48	0.010	5.76
9	MD-5	150	47	0.030	7.21
10	DRIFT-D(4)	155	45	0.031	15.69
11	MD-6	240	42	0.048	9.41
12	DRIFT-D(5)	60	41	0.012	5.04
13	MD-7	180	39	0.036	6.08
14	DRIFT-D(6)	80	38	0.016	5.78
16	MD-8	150	38	0.030	4.69
17	SEAM-II,PANEL=2	720	35	0.144	19.04
18	SEAM-II,PANEL=1 **(LVC)**	900	25	0.180	13.01
19	SEAM-II,PANEL=2	720	35	0.144	44.10
20	MD-8	150	37	0.030	10.27
21	DRIFT-D(6)	80	38	0.016	5.78
22	MD-7	180	39	0.036	13.69
23	DRIFT-D(5)	60	41	0.012	5.04
24	MD-6	240	42	0.048	21.17
25	DRIFT-D(4)	155	45	0.031	15.69
26	MD-5	150	47	0.030	16.57
27	DRIFT-D(3)	50	48	0.010	5.76
28	MD-4	160	49	0.032	19.21
29	DRIFT-D(2)	220	50	0.044	27.50
30	MD-2+MD-3	730	52	0.146	98.70
31	DRIFT-D(1)	34	54	0.007	4.96
32	MD-1	180	56	0.036	28.22
33	Airshaft	116	115	0.006	76.71
34	Fandrift (Exh.Fan)	45	118	0.007	94.79
Total Pressure (Pa)					**851.23**

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11.5 FAN SPECIFICATION

The requirement of the ventilation system for Dhankasa UG mine to produce 1.00 Mty of coal is described below.

Air quantity requirement (Q)	-	120 m3/sec
Air Pressure (P)	-	851.23 Pa (86.77 mm of WG)
Mine Resistance (R)	-	0.059 gaul (P/Q2)
Air kW	-	102 Kw (PxQ/1000)
Fan Motor Power	-	157 kW (65 % overall efficiency) (Say 175 kW)

The main mechanical ventilator (exhaust type) should be capable of delivering 80-120 cum/s of air quantity at pressure range of 60-100 mm WG during the entire life of mine . The fan should be of variable rpm type and have adjustable blades so that the blade angle and/ or rpm can be changed at different stages of mine life to ensure that it works at over 85% efficiency level. In order to control the power cost, water gauge of the fan should be regularly monitored and any undue increase should be checked and suitably amended by rectifying the ventilation system below ground. For the purpose of costing, the main fan has been selected from the list of June-2015 edition of Standard Price List for Mining Equipment's (published by CMPDI-HQ) which matches the air quantity requirement of Dhankasa UG project. .

11.6 LIKELY BOTTLENECKS IN THE VENTILATION SYSTEM

In general, 5 headings panels have been proposed for trunk roads as well as for panels with 3 nos of intake air routes & 2 nos of return air routes. However, the number of drifts along main-dips panels where ever the faults are to be crossed, will be 4 only (with 2 intake airways & 2 return airways). Sector-3&4 of Seam-IVB/Comb is accessed by 3 drifts only (2 intake airways & 1 return airway). Some panels have limited nos of intake & return airways due to space restriction.

11.7 AIR VELOCITY IN MINE ENTRIES

As per statute the maximum permissible air velocity in the belt conveyor roadway is 4.0 m/sec. The cross-section of the proposed inclines will be 5.0 m x 3.0 m. With this cross-section, the air velocity along the inclines will be 4.0m/sec, which is within the permissible limits. The airshaft will be of 5.0 m diameter. The air velocity along the airshaft will be about 6.11 m/sec as against the permissible limit of 15 m/sec.

11.7 AUXILIARY VENTILATION

To ensure comfortable working environment at the faces, auxiliary ventilation is proposed. 2 nos. auxiliary fans of capacity 12 m^3/sec at 100 mm water gauge operated with a 22.5 kW motor with FLP enclosure are proposed for each Continuous Miner district. The flexible ducting for these fans will be of 1000 mm diameter.

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12.0 WATER MANAGEMENT, PUMPING & DRAINAGE

12.1 INTRODUCION

The proposed Dhankasa UG mine is planned to produce 1.0 Mty of coal from 2 CM districts and the block falls in Pench-Kanhan Coalfields of Pench Area (Madhya Pradesh). This is a green field project.

12.2 SOURCE OF WATER

The main sources of water in the proposed Dhankasa UG mine is expected from the following sources-

(a) Seepage from strata due to rainfall (The maximum total rainfall data in adjacent mines in Pench Area is 1500mm).
(b) Seepage due to ground water.
(c) Water accumulation by water supply to Continuous Miner system.

12.3 MAKE OF WATER

In absence of hydrogeological data, make of water assumed on the basis of given maximum annual rainfall data by the colliery authority during the development / depillaring of the proposed mine.

(i) Mineable area (excluding barriers against fault etc.) = 5.8×10^6 m^2
(ii) Maximum total rainfall in a year = 1500 mm
(iii) Rainy season spread over (assumed) = 120 days
(iv) Average daily rainfall = 1500/120 = 12.5 mm
(v) Run off coefficient into UG working = 0.07 of daily rainfall
(vi) Seepage to ug working = $0.07 \times 12.5 \times 5.8 \times 10^6 \times 10^{-3}$ m^3
= 5.075×10^3 m^3 = 5.075×10^6 litres
(vii) Seepage due to ground water (10% of rain water seepage) = $1/10 \times 5.075 \times 10^6$ litres
= 0.5075×10^6 litres
(viii) Total water accumulated in a day = $(5.075 + 0.5075) \times 10^6$ litres
= 5.582×10^6 litres

12.4 PUMPING CAPACITY

To pump out about 5.582×10^6 litres of water in a day from Dhankasa UG mine, the following pumping arrangements are required by considering average daily working hours of pumps as 18 hrs.

Pumping capacity required in a day = $\frac{(5.582 \times 10^6)}{(18 \times 3600)}$ = 86.14 ~ 86 lps

Here, total working hours have been taken as 18 hrs in a day and average 250 lpm of water shall be supplied to the Continuous Miner for total working hours in a day.
Water accumulated from supply to each C.M. district in a day = 250lpm x 18hrs.
Total pumping capacity required= (250x18)/(60x18)lps = 4.16 lps
For the operation of two Continuous Miner district = 2 x 5 = 10 lps
Total pumping capacity to pump out in 18 hrs = 86 + 10 = 96 lps

Considering standard 38 lps discharge pump, the total pumping capacity required will be 96/38 (say 3 nos. pumps of 38 lps each).

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12.5 SELECTION OF PUMPS AND PUMPING SYSTEM

The following Pumps/Pumping system is proposed for Dhankasa UG Mine.

Sl. No.	Description	Total Qty.	Location	Discharge pt.
1	38lps x 180m x 110kW FLP,(3.3kV Supply)	4 nos. (3+1 Standby)	Seam 'IV' Near Panel "IV 20'	Surface Through Incline
2	38lps x 150m x 90kW FLP,(550V Supply)	3 nos. (2+1 Standby)	Seam 'IV' Near Panel "IV 5'	Main Sumps Through Incline
3	38lps x 90m x 55kW FLP,(550V Supply)	3 nos. (2+1 Standby)	One each for two District.	Main Sumps Through Incline
4	11lps x 30m x 9.3kW FLP,(550V Supply)	5 nos. (4+1 Standby)	Two each for two CM's dist.	Auxiliary/Main Sumps of Seam II/Seam IV
5	11lps x 150m x 37Kw 550/440V,50Hz,NFLP	3 nos. (2+1 Standby)	Surface	CM 's districts

Required capital provision for pumping arrangement in Dhankasa UG mine is given.

12.6 SUMP/WATER LODGEMENT

One main sump near Panel IV-20 along the main dips in Seam-IVB/Comb will collect the total mine water for pumping out to the surface through the haulage incline by 150mm diameter delivery line.

One auxiliary sump will be provided in the dip side of two working districts separately, so that water can be pumped to main sumps. Details of location are given in para 6 below.

12.7 CLEAN WATER SUPPLY ARRANGEMENT FOR C. M. DISTRICTS

It is proposed to supply clean water from surface sump to the 2 CM districts through a 80 mm diameter pipe range installed along the conveyer roadway. For this purpose two 11lps, 150m head pump will be installed at the surface sump for each CM district to ensure the availability of desired quantity of clean water at required pressure at the working districts. One identical pump will be kept as standby.

A manifold will be installed near each feeder breaker for the supplying of clean water to Continuous Miners, Roof Bolters & Feeder Breakers through 50mm dia., 200m length fire resistant armoured hose. The pipe range shall be extended along with the extension of each gate belt conveyor.

The details of pumps, pipes, pipe fittings and estimated capital requirement including installation and foundation cost of above have been given in corresponding appendices.

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13.0 COAL HANDLING PLANT & SURFACE DESPATCH ARRANGEMENT

13.1 INTRODUCTION

The proposed Recast PR for Dhankasa UG Mine is designed to produce 1.0 Mty of coal with 2 Continuous Miner districts. A small coal handling plant has been envisaged to handle the entire production of coal from mine. The CHP will have facilities like secondary crushing & temporary storage of coal. Stone picking arrangement along the belts in CHP has been given so that the shale partings in Seam-II Pack may be removed. The coal from pit head will be dispatched by road to EDC siding (located nearly 36 kms away from mine).

13.2 COAL FLOW

Coal from the underground will be brought to surface by trunk belt conveyor TB1 and discharged in to double roll crusher for crushing of coal up to (-100 mm) size. Crushed coal transported through 1600 mm wide picking belt conveyor. One sets of 2 x 100 t (totaling 200 t) capacity overhead bunkers have been provided for coal and one 50 t bunker for the stone/shale picked/separated from the belt conveyor. The required manpower provision for CHP has been given in Appendix-B.

Trucks will be loaded below these hoppers with the help of hydraulic gate at the bottom openings of the hopper. An electronic road weigh-bridge of capacity 100t will be provided near the CHP which will be used for weighment of empty as well as loaded trucks . Such weigh-bridge arrangement will be equipped with printing facilities for keeping records and preparation of bills and statements.

In case there is no off-take and hoppers are full, coal from hoppers will be dumped by trucks at a suitable location on ground. These heaps will be liquidated at a later date, as and when required by equipment available in the project.

Adequate dust suppression and fire-fighting arrangement have been provided in the report.

13.3 POWER SUPPLY AND ILLUMINATION

All the equipment in the CHP will operate at 415V, 3 phases, 50 Hz. supply. The required power to the CHP will be provided from colliery's main substation. CHP and stockyard will be properly illuminated.

13.4 CAPITAL REQUIREMENT AND MANPOWER

Total estimated capital requirement along with the list of equipment is given in Appendix A.3.4. Total manpower requirement for smooth operation of CHP has been estimated and are given in Appendix B.

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14.0 WORKSHOP, STORES & MAGAZINE

14.1 WORKSHOP

The Unit Workshop at mine-level will provide basic engineering support in the form of repairs, maintenance, replacement of minor spare parts etc. The facilities and manpower provided in this Workshop would be sufficient enough to cater to the routine needs of various underground mining machines operating in the project. Washing, greasing, and checking of brake system, hydraulic system etc. would also be undertaken in the Unit Workshop. Washing, cleaning & repair of LMVs, assemblies, defective parts etc. is also envisaged.

The Unit Workshop would have the facilities of

a) Machine shop
b) U/G Mining Equipment Repair shop
c) Electrical Equipment Repair shop
d) Carpentry shop ,Smithy shop
e) Light Motor Vehicle shop
f) Washing Ramp & platform
g) Office and Stores.

Jobs that shall be carried out in the unit workshop shall be in the form of unit replacement of assemblies or replacement of defective parts.

Major and capital repairs, overhauls, manufacture of critical spares, reconditioning of assemblies and sub-assemblies and other works of capital nature would be carried out at Regional Workshop of the Area or Central Workshop at Tadali as per the requirement. As such, unit workshop has been provided with those plant and machineries adequate to support the daily repair and maintenance needs of the project only.

Manpower required for maintenance and supervision of the Unit Workshop is given at Appendix-B.

14.2 STORES

A small but independent unit stores has been envisaged to cater to the routine needs of consumables, spares, POL, etc. of the mine. Unit store shall have the backing of the Area Store and Central Store for its smooth functioning.

Manpower required for Unit Stores is given at Appendix-B.

14.3 MAGAZINE

Since Continuous Cutting technology is proposed in this project, provision for Magazine is not required as this is blasting free method of coal exploitation. However, provision for a mini explosive carrier/Van has been given in this Recast PR for the purpose of drift drivages etc.

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15.0 POWER SUPPLY, ILLUMINATION & COMMUNICATION

15.1 POWER SUPPLY

Dhankasa UG Mine is being planned for a target production of 1.0 Mty (about 3350 tpd) with 2 Continuous Miner districts. The nearby Naheriya U/G mine (about 5km away) receives 33 kV power at from Thesgora Substation of WCL. Thesgora Substation is receiving power from Chandangaon grid substation which is nearly 30-40 km from this substation. The voltage regulation of Thesgora – Neheriya 33 kV OHL is poor and further loading of proposed Dhankasa U/G mine will result in further poor voltage regulation.

15.1.1 Source of Power & Main Sub-Station

Hence,ilt is proposed to draw 20 km long 33 kV overhead line from Amarwada 132 kV/33 kV, 40 MVA grid substation for feeding power to Dhankasa U/G. This feeder from Amarwada to Dhankasa in the long run may be used as standby feeder for Naheria UG, Urdhan OC, Jamunia UG and other upcoming mines. This feeder from Amarwada to Dhankasa in the long run may be used as standby feeder for Naheria UG, Urdhan OC, Jamunia UG and other upcoming mines. The proposed Main substation - 33 kV/3.3 kV, 2x 5 MVA capacity will be located near Dhankasa UG incline.

Initially, temporary power supply arrangement has been made from one no. 100 kVA, 415 V, diesel generator set and two nos. of 10 kVA, 415 V D.G. sets. In addition to this, sufficient amount has been provided in Appendix A.8.1 for arranging temporary power from MPSEB rural feeder passing from nearby Bokai Village.

15.1.2 Connected Load & Maximum Demand

The details of connected load and Maximum Demand of the proposed Dhankasa UG UG mine and its township are as given below :-

S.No.	ITEM HEAD	VALUE
1.	CONNECTED LOAD	
	a) Only mine	8211 kW
	b) Only township	561 kW
	c) Total	8772 kW
2.	LOAD IN OPERATION	
	a) Only mine	7909 kW
	b) Only township	561 kW
	c) Total	8470 kW
3.	PROJECTED MAXIMUM DEMAND	
	a) Only mine	4880 kVA
	b) Only township	410 kVA
	c) Total	5290 kVA

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15.1.3 Salient Electrical Features & Cost Estimate.

Tarrif :- The present two part tariff of MPSEDCL as applicable for March, 2016, is as follows:-

Industrial / Mine load (33 kV coal mines) Tariff	Value
Maximum demand charges	570 Rs./kVA/Month
Energy charges	5.70 Rs./kWh
Cess charges	0.10 Rs./kWh
Electricity duty	40% of energy (kWh) charges
MPSEB HT meter rent (L.S.)	2000 per month
TOWNSHIP LOAD (GP TARIFF) Tariff	
Maximum demand charges	230 Rs./kVA/Month
Energy charges	5.05 Rs./kWh
Electricity duty	15% of energy (kWh) charges
Cess charge	0.10 Rs./kWh
HT Meter rent (LS)	Rs. 1500/month (Approx.)

Based on the above tariff, the power cost estimate of the Dhankasa UG mine has been calculated and placed in the table given below:-

Sl.No.	Particulars	Value
1.	SPECIFIC ENERGY CONSUMPTION	
	a) With respect to total load of mine only	20.14 kWh/t
	b) With respect to total load of mine + township	20.87 kWh/t
2.	SPECIFIC POWER COST (Including township)	Rs.201.60 /t
3.	FIXED PERCENTAGE OF POWER COST	30.89 %
4.	VARIABLE PERCENTAGE OF POWER COST	69.11 %
5.	SPECIFIC DEMAND	5.290 MVA/Mt.
6.	CAPACITOR BANK PROVIDED	
	a) Only mine	3600 kVAR
	b) Only township	125 kVAR
	c) Total	3725 kVAR
7.	AVERAGE COST OF PURCHASED POWER	Rs. 9.66 / kWh

The details of capital of electrical P & M and estimated capital required is given at Appendix-A.3.1.

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15.2 ILLUMINATION

Illumination of the proposed Dhankasa UG mine is proposed in the following ways-

a) Underground Illumination: Face, Mine Roadways, etc.

b) Mine roadways, loading points, pump houses, etc. would be illuminated by fluorescent lamps with FLP/mining type fittings, weather-proof, suitable for accommodating single or twin 20 W fluorescent lamps at 110 V supply and provided with wire guard protection.

c) Coal faces would be illuminated by CFL. lamps with FLP/mining type fittings (well-glass), suitable for accommodating 2 X 26 W FLP lamps at 110 V supply. The fittings shall be provided with reflector, hemispherical type with strong glass lens and wire-guard protection.

d) Adequate number of FLP lighting transformers rated 5 kVA, 550 V/110V have been provided in this report for this purpose.

e) Other Miscellaneous Illumination on Surface

f) Service roads / approach road would be illuminated by 150 W HPSV lamps mounted on steel tubular poles of 10m height erected at 30m spacing (approx).

g) Illumination of service buildings, offices would be done by 1 x 26 W or 2 x 26 W T-5 fluorescent lamps or 20/26 W CFL lamps.

15.3 COMMUNICATION SYSTEM

The following communication systems have been proposed considering the various requirements of the mine with respect to telecommunications, safety electronics and industrial electronics.

a) Intrinsically safe signalling bells
b) Electronic telephone exchange
c) Intrinsically safe Auto-CDS system (30 Lines)
   (i) Emergency (manual) exchange board with a capacity of 30 lines to be located on the surface.
   (ii) 30 extension lines drawn from the proposed Electronic Telephone Exchange (EPABX).
   (iii) I.S. Auto-Dialling Telephones (30 nos.) to be located at the strategic points in the U/G mine.
d) Communication between Mine & Area Office and long distance Communication
e) DoT Communication

Adequate capital has been provided for electronics and telecommunications. The details of equipment requirement along with their estimated cost are given in Appendix-A.3.1.

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16.0 CIVIL CONSTRUICTION

16.1 GENERAL

The proposed underground mine is situated in Pench Area of Western Coalfields Ltd and is located adjacent to existing Naheriya UG mine. The estimated total life of this project is about 23 years . As such all civil works have been envisaged on permanent specifications. It should be ensured that all the service & residential buildings are constructed on non-coal bearing area.

16.2 BUIDING COST INDEX

The Building Cost Index for M.P. Region has been worked out to 471 in 2016 (1st half) taking the prevalent rates of materials and labours. This Building Cost Index is with reference to base 100 in Nagpur as on 1.1.1992.

16.3 SERVICE BUILDINGS

Keeping in view of the requirement of the mine, provision for service buildings such as Project office, Manager office, Unit E&M Workshop, Unit stores, Sub-station etc. have been proposed in this Report. Other building to be provided are camp lamp room, canteen, First-aid center, Washrooms, rest shelter, Garage, Cycle/scooter shed, security room , staff rest house, haulage engine house, fan house, CDS control room etc. Capital provision for service buildings is given in Appendix-A.2.1

16.4 RESIDENTIAL BUILDINGS

In Departmental option, total manpower proposed for this project is 490. Considering the necessity of the project, 255 Nos of typed quarters have been envisaged which satisfies 52.04% of the required manpower. This consists of 197 MQ's, 31 B-type, 14 C-type, 2 D-type, and 11 Hostel type accommodations.

In Partial Hiring option, the total manpower proposed for this project is 313. Considering the necessity of the project , 166 Nos. of typed quarters have been envisaged which satisfies the 53.04% of the required manpower. The typed quarter consists of 113 MQ's, 27 B-type, 14 C-type, 2 D-type, and 10 Hostel type accommodation.

The capital provision for residential buildings is given in Appendix-A.8.2

16.5 ROADS AND CULVERTS

For approaching Dhankasa UG Mine site, 4.0 km long road from existing Naheriya UG mine site has been proposed in this Report. To access service buildings, provision for sufficient service roads are given in this Report. Since residential colony is proposed for Dhankasa UG mine, colony roads are also proposed to be given. Required culverts also provided in this Project. The estimated amount and other details for approach road, colony road, and Service road are given in Appendix-A.8.2.

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17.0 MANPOWER, PRODUCTIVITY & TRAINING

17.1 MANPOWER

The manpower requirement for the proposed Dhankasa U/G Mine has been assessed keeping in view the location of the mine, work culture and work load norms prevalent in nearby mines of the Area. The proposed manpower, production and productivity for a target capacity of 1.0 Mty for Departmental and Partial Hiring Options of the proposed Recast Project Report for Dhankasa U/G Mine are tabulated as below:

Sl. No.	Group Name	Departmental Option				Partial Hiring Option			
		Including Welfare		Excluding Welfare		Including Welfare		Excluding Welfare	
		Strength (Nos.)	OMS (t)	Strength (Nos.)	OMS (t)	Strength (Nos.)	OMS (t)	Strength (Nos.)	OMS (t)
1	U/G	379	10.104	379	10.10	202	18.949	202	18.95
2	Surface	111	34.125	97	39.05	111	34.125	97	39.05
	Total	490	7.796	476	8.027	313	12.81	299	12.75

The total manpower proposed for Dhankasa UG mine are 490 nos in Dept. option & 313 nos in P.H option. In partial hiring option, operations in both the CM districts like continuous miner / shuttle car/ feeder breaker/ twin boom roof bolters etc. will be on hiring. Coal transport up to the gate belt, mine ventilation arrangements including installation/shifting of devices also come under the purview of hiring contractor. Category-wise, job-wise manpower for Dhankasa UG mine is given in Appendix-B.

17.2 MANPOWER PHASING

The manpower phasing in the initial years to achieve 1.0 Mty of target production in Departmental option of Dhankasa UG mine is tabulated below-

Particulars	Year-1	Year-2	Year-3	Year-4	Year-5
Manpower (nos)	5	10	420	490	490
Coal Productionn (Mt)	-	-	0.80	1.0	1.0

17.3 TRAINING:

Mechanisation with Continuous Miner has been proposed in the mine and therefore, training should be imparted to all personnel connected with operation and maintenance of different machines. For continuous miner operation, training may be imparted at Tandsi Project. For other jobs, services of Chhinda VTC will be utilized till another VTC is established at Naheriya to cater to the requirements of the new mines. Supervisory training will be imparted at Supervisory Training Institute, Chhindwara.

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18.0 SAFETY & CONSERVATION

18.1 DEGREE OF GASSINESS

The coal seams in the proposed Dhankasa UG mine are expected to be 'Degree-I' gassy seams. This assumption is based on the fact that in the adjacent Naheriya U/G mine, the coal seams have been classified as Degree-I gassy seams by DGMS. Therefore it is necessary that gassiness of the seams should be ascertained just after touching coal seams. Regular gas survey should be carried out as per statute. If the change in gassiness is recorded, the provisions have to be modified accordingly.

18.2 INUNDATION

Dhankasa and Junapani nallas, are two seasonal nallas, which drain into the Gunor river. All the three water bodies flow over the block. The HFL along the course of Gunor river and Dhankasa Nalla in the block has not been recorded anywhere. However, in the neighbouring Naheriya U/G mine, HFL value of 720m was considered. The inclines of Dhankasa mine have been positioned at RL of 738.26m (Near BH No-PD-27). The river is flowing in the valleys surrounded by hills on either banks, hence there is no danger to the mine entries from this river. Part of Dhankasa nalla is flowing close to the inclines. The HFL of this nalla is also not known. In this report, it is proposed to cement grout the bed and sides of Dhankasa nalla over a length of 100 m in the region which is directly located over the inclines. This will prevent percolation of surface water below ground through the inclines. A bridge of hume pipes will be constructed over the nalla to provide access to the airshaft. In this way, the natural drainage of the region will remain unaffected.

18.3 FIRE & SPONTANEOUS HEATING

The general thickness of Seam-II Pack is around 4.0m and entire thickness will be extracted using Continuous Miner. However, Seam-IVB/Comb is having a thickness from 3m to 6m. At most of the places, it is in the thickness range of 4.5m. The extraction has been planned up to 4.6m with Continuous Miner, as such, coal of about 1.0-1.5m thickness is likely to be left out in the goaf in some areas. Similarly, coal seams which have not been considered from mining point of view, like Seam-III will be damaged due to mining of Seam-II Pack and Seam-IVB/Comb and it will ultimately find its way in the goaf of lower seam . Hence, chances of spontaneous heating of coal cannot be ruled out.

Preparatory stoppings shall be kept ready in the development headings at the out-bye end of each panel to handle with any case of outbreak of U/G fire. Every panel must be quickly & effectively sealed off by isolation stoppings in development headings in the pillars adjacent to the main dips after completion of extraction and salvaging of material from the panel.

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18.4 ROOF CONTROL

RMR of Seam-II Pack & Seam-IVB/Comb in neighboring Naheriya U/G mine, has been estimated as 41 and 43 respectively. Resin encapsulated bolting has been proposed for the CM panels in Dhankasa UG Mine. The setting time of resin bolts being only one minute, bed separation in the freshly exposed roof will be negligible.

All the panels in both seams will be vertically super-imposed and same gallery width and pillar size will be maintained due to their contiguous nature. Extraction of developed pillars will commence immediately after reaching the mine/ natural boundary on either flank in a given sector. Both seams are proposed to be exploited simultaneously.

The support system to be adopted for development and extraction stage shall be based on scientific analysis and approved by DGMS before implementation. It is suggested that monitoring of roof movement should be carried out regularly & based on the analysis of the data, the roof bolting pattern would change.

From the perusal of lithologs it is observed that there is presence of Deccan trap/Basalt above the Barakars in thickness varying from 41m to 208m. This may pose problem of caving. It is proposed to study the cavability characteristics of Basalt rocks for which adequate capital provision has been made in this Report. In case the Basalt does not cave easily, induced caving by blasting from the below ground/surface shall be adopted. Financial provision has been made for this.

The hilly nature of the area suggests that horizontal stresses could be present in this block. If the magnitude of horizontal stresses is high, then drivage of galleries could pose a serious problem. Hence, it is suggested that scientific studies be carried out to map the direction of stresses and their magnitude before the layout is finalized.

18.5 MAJOR EXEMPTIONS / RELAXATIONS REQUIRED FROM DGMS

a) As per CMR of 1957, the quantity of air to be provided at LVC of each working panel would be 2.5 cum/min with respect to daily tonne output of coal . However, the air quantity requirement based on production becomes very high and it is not practicable also to provide this much of air quantity in the mine. As per international standards, each mechanized district should be provided with an air quantity of 25 cum/sec at LVC. Hence exemption from DGMS is sought in such mass production technology mines.

b) Use of two or more number of auxiliary ventilators in a district.

c) Permission to deploy lesser number of statutory personnel like Surveyors , Under Managers etc. with respect to the production levels as per CMR.

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18.6 SUBSIDENCE

Caving is proposed as method of extraction in this report. The depth of the mine varies from around 105m to 280m. The surface topography is hilly in nature and major portion is covered with forest. Subsidence Prediction studies were carried out by CMPDI (HQ) in July 2006 based on Recast PR for Dhankasa U/G Mine (0.54 Mty, November 2005). A fresh subsidence study is required to be conducted for the enhanced production target of 1.0 Mty at Dhankasa UG Mine.

As per this study, the maximum anticipated subsidence over the mining area at the end of the mine life is about 2.935m. The maximum possible slope and tensile strain likely to occur over the mining area are 39.39 mm/m and 20.96 mm/m respectively over panels. The perennial Gunor river and the seasonal Junapani nalla are unlikely to be affected by subsidence because sufficient barrier or solid coal pillars are proposed to be left vertically below and within 35° angle of draw from the river / nalla. The seasonal Dhankasa nalla is likely to be affected by a maximum of 0.084m subsidence and 0.80 mm/m tensile strain in panels in Seam-IVB/Comb which is well within the permissible limits. The other small seasonal streamlets over the mining area are likely to be affected by a maximum of 2.640m subsidence and 19.38 mm/m tensile strain. Thus, due care has to be taken while extraction is done below them, such as avoiding extraction during monsoon and filling up the cracks developed in the streamlets bed, when dry, to avoid inrush of water below ground in the rainy season.

It is anticipated that the forest may not be considerably affected by subsidence. Only the trees falling on the edges of subsidence zones and surface cracks may get tilted or dislodged. After 22 years of mining some stretches of forest roads running over the mining area are likely to be affected by a maximum of 1.412m subsidence and 6.90mm/m tensile strain. Bhumka Dhana village and the electric transmission line are not likely to be affected by subsidence. It is recommended that while carrying out extraction in the upper Seam-II Pack, close subsidence monitoring should be done over the panels. The impact of subsidence and effectiveness of mitigative measures should be reviewed before starting depillaring in the lower Seam-IVB/Comb.

While estimating the seam-wise extractable reserves, angle of draw of 35° has been considered. It is proposed to acquire the surface area affected due to subsidence and fence it to prevent unauthorized entry. Capital provision for compensatory afforestation and crop compensation has also been made in the PR. The subsidence cracks which reach the surface will be packed tightly with soil and mud and non-carbonaceous debris and regularly dozed so that topography does not change substantially and artificial water bodies are not created. It is recommended that while carrying out extraction, close subsidence monitoring should be done, particularly in the area nearby the nallas/river, as a precautionary measure.

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18.7 GENERAL PRECAUTIONS

The cable joints of Continuous Miner, Shuttle car, Twin Boom Roof etc. have to be vulcanized & the continuity of insulation of the cable after every vulcanization should be tested and the insulation resistance recorded. All provisions and guidelines stated in "DGMS Tech. Circular No.1 of 1996 regarding use of high pressure hydraulic hoses in underground coal mines" should be strictly followed. Quality of roof bolting consumables plays a critical role in the efficacy of roof bolting. Quality control must be exercised at the mine level by carrying out short encapsulation tests, etc.

A Safety Management Plan / Emergency Plan should be prepared by the Mine Management taking into account the risk involved in various operations and the control measures to be adopted to obviate the risk. Since caving method of mining has been proposed, cracks may appear on the surface. Therefore, efforts have to be made to seal-off the cracks, so that air & water does not enter in the goaf through these cracks.

It is also proposed to continuously monitor temperature, CH4, CO, CO/O_2 ratio etc, so that appropriate steps to control eruption of fire can be taken. Gas survey should be conducted immediately after encountering the faults and emission of CH_4 should be monitored regularly to take precautions against accumulation of inflammable gas in the working faces. Stone dust barriers have to be provided as per statute. Interlocking of auxiliary fans with face machinery should be practiced.

To undertake the Physico-Mechanical Properties of rocks for designing the support system & to know the caving characteristics of the roof strata. It will be necessary to determine 'Rock Mass Rating' for preparing the Support Plan so that Systematic Support Rules can be framed. This also helps in deciding Cut-out Distance during working. To undertake Hydro-geological Studies for quantifying ground water and to assess the impact of caving on existing ground water regime.

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18.8 CONSERVATION

Dhankasa mining block is characterised by the presence of a number of faults and these faults act as barriers between panels and minimize loss of coal in panel barriers. Since CM technology has been proposed in this project, it is expected that extraction percentage of coal higher compared to conventional methods.

The avg. thickness of Seam-IC & II are 2.0m and 1.90 m respectively which are separated by a shale parting of about 0.6m between them. To exploit both seams, the concept of Seam-II Pack (Seam-IC+parting+Seam-II) is proposed in this Report which has an average thickness of about 4.25 m.

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19.0 ENVIRONMENT MANAGEMENT

The proposed Dhankasa U/G mine is located in Pench Area of WCL. A detailed Environment Management Plan will have to be prepared for this Project Report . During day to day operations at the mine and coal dispatch along road , adequate control measures like water spraying , green belt development , regular cleaning and water sprinkling of coal transportation road , etc. will be adopted so as to minimize generation & propagation of dust .

19.1 IMPACT ON AIR QUALITY

Ambient air quality monitoring data at nearby Naheriya UG Mine is generated at 4 locations every quarters . The results recorded in quarter ending Dec 2015 are given below. From the monitoring results it is seen that maximum value of TPM is recorded as 110 to 336 ug/ m^3 & PM – 10 was 78 to 223 ug/ m^3 in the actual mining activity area whereas the same for SO_x 1 to 33 & NO_x 5 to 28 were recorded . All these values are well below the threshold limits specified by CPCB .

19.2 IMPACT ON WATER QUALITY

In absence of mine effluent quality data from the proposed mine , references have been taken from the mine discharge analysis carried out at Naheriya U/G Mine to assess the likely levels of water pollution from proposed Dhankasa U/G Mine .Which is the nearest mine. It has been observed from the analysis report that pH value is ranging from 2.88 to 4.2 , TSS 24 mg / lit to 46 mg / lit , COD from 32 to 60 mg / lit and O & G < 2 mg / lit respectively at the Naheriya U/G Mine . Thus , it can be concluded that existing mine effluent does not carry significant pollution load so as to affect the natural watercourses adversely after mixing .

It is anticipated that same scenario will hold good for proposed Dhankasa U/G Mine also. However, due to control measures will be taken to arrest further water pollution if any from the proposed mine , mine effluents will be passed through a sedimentation pond before mixing with natural watercourses. As the mine starts operation , regular monitoring of effluent quality will be carried out and if any undesirable element is detected , immediate corrective measures will be taken .

19.3 IMPACT ON GROUND WATER

Since this is an underground mine and the extraction of coal shall be done at a final depth of around 360 m , negligible impact is anticipated on the ground water due to mining activity .

19.4 IMPACT ON NOICE IMPACT

To give indication on ambient noice monitoring data for Dhankasa UG mine, the references values of neighboring Naheriya UG mine has been taken which was 69.2 to71.8 db (A) during day time & 65.2 to 71.6 db (A) during night time. For colony , it was 43.2 to 45.9 db (A). All the recorded values are well below the tolerance limit as per EPA 2000.

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19.5 IMPACT ON FLORA & FAUNA

Since this is an underground mine, the impact on Flora & Fauna are insignificant due to the mining activity .

19.6 IMPACT ON LAND USE

The total land base required for Dhankasa UG Project is 582.651 ha , which includes 385.841 Ha Forest land, 181.465 Ha Tenancy land & 15.345 Ha Govt Land. The forest area covers the lion part of land base for Dhankasa UG mine. Out of 582.651 Ha land base, it is proposed to acquire 294.293 Ha of land on All Right, 33.520 Ha of land under Surface Right & 254.838 Ha of land under Mining Rights.

This being an underground mine, minimal degradation of surface features is anticipated . The plantation is likely to be carried out along the transportation route and no change is anticipated in the post mining land use pattern.

19.7 SUBSIDENCE IN PROPOSED U/G MINE

Underground mining with caving has been proposed in Dhankasa U/G Mine. Therefore subsidence prediction studies are proposed to be carried out to assess the likelihood of subsidence on surface due to underground mining activities and its impact on surface features like villages , nallas, forest road, tenancy land, etc . The surface topography is hilly in nature and majority part is covered by forest land .

19.8 CAPITAL REQUIREMENT FOR ENVIRONMENTAL PROTECTION MEASURES

Sl. No	Particulars	Amount in Rs (Lacs)
1.	Settling Tank for Mine Discharge	30 .00
2.	Base Line Data Generation	10.00
3.	Land use Mapping by Remote Sensing	8.00
4	Effluent Treatment Plant	10.00
5	Sub-Total	58.00

In addition to this, a capital requirement of Rs 60.00 lacs is proposed for Continuous Air Quality Monitoring Stations (CAQMS) including land base. Hence, total capital required for the mitigation of environmental impacts due to the mining operations in Dhankasa UG mine works out to 118.00 Lacs.

In addition to the Capital cost , Rs 6 / t under revenue head has been kept to cater for Plantation & Green belt development, Environmental Monitoring, Social development , Miscellaneous Pollution control measures etc.

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20.0 MINE CLOSURE PLANNING

As directed through memorandum No. 55011-01-2009-CPAM of Government of India, Ministry of Coal, Shastri Bhawan, New Delhi dated 27/08/2009, Mine Closure Plan has to be enclosed with all PRs / EMPs. The mine closure activities will include subsidence survey for a period of 3 years after mine closure, filling of subsidence cracks, fencing of caved out area and post-project monitoring for a period of 3 years after mine closure.

The Mine Closure Cost for this Report works out to Rs 7.70/t. The detailed calculations are tabulated as under:

Total Area of the Mine (Ha)	582.651
WPI value as on August 2009 (Base WPI)	129.6
WPI value of current available month (March 2016)	174.6
Ratio of WPI (July 2015 : March 2016)	1.347
Amount to be considered for underground (Rs. / ha)	100000
Total Mine Closure Corpus Fund (Rs. lacs)	**795.75**
Total life of this mine (excluding land acquisition in years)	22
Annual Mine Closure Corpus Fund for 2016-17 (Rs.lacs)	36.17
Annual Mine Closure Fund for 2017-18 (Rs lacs)	37.98

The year-wise mine closure cost for Dhankasa UG mine is calculated and tabulated below.

Sl.No.	YEAR	Amount per Year (Rs. lacs)	Production (Mt)
1	2016-17	-	-
2	2017-18	37.98	-
3	2018-19	39.88	0.66
4	2019-20	41.87	1.00
5	2020-21	43.96	1.00
6	2021-22	46.16	1.00
7	2022-23	48.47	1.00
8	2023-24	50.89	1.00
9	2024-25	53.43	1.00
10	2025-26	56.10	1.00
11	2026-27	58.91	1.00
12	2027-28	61.86	1.00
13	2028-29	64.95	1.00

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Mine closure cost..... contd.

Sl.No.	YEAR	Amount per Year (Rs. lacs)	Production (Mt)
14	2029-30	68.20	1.00
15	2030-31	71.61	1.00
16	2031-32	75.19	1.00
17	2032-33	78.95	1.00
18	2033-34	82.90	1.00
19	2034-35	87.05	1.00
20	2035-36	91.40	0.84
21	2036-37	95.97	0.50
22	2037-38	100.77	0.50
23	2038-39	105.81	0.50
	Total	**1462.31**	**19.00**

From the above table, it can be seen that the Total Amount of Mine Closure Cost Corpus Fund works out to Rs. 14.6231 Crores for Dhankasa UG mine which is to be kept in escrow account.

This mine closure cost will be utilized for different activities of Mine Closure of Dhankasa UG mine which includes

a) Dismantling of structures (Service Buildings, Residential Buildings ,Industrial Structures like CHP, Workshop, Field Substation, Cap lamp room, Haulage, Fan Installation etc).

b) Permanent sealing of mine entries (inclines mouth and air shafts)

c) Subsidence Management & Land Scaping.

d) Plantation over the cleared area obtained after dismantling and on other Barren Spaces.

e) Monitoring / Testing of parameters for three years: Air / Water Quality.

f) Entrepreneurship development (Vocational / Skill Development) Training for sustainable income of affected people etc.

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21.0 LAND REQUIREMNT, R&R PACKAGE & PROJCET IMPLEMENTATION

21.1 LAND REQUIREMENT

The total land requirement for Dhankasa UG project is 582.651 Ha out of which Forest Land covers an area of 385.841 Ha, Tenancy Land 181.465 Ha & Govt. land 15.345 Ha. Out of the total 581.651 Ha, 549.131 Ha land is involved for mining purpose and the remaining 33.52 Ha land for approach road, colony ,infrastructures and rationalization of plots etc .The total land base to be acquired under All Rights, Surface Rights & Mining Rights are 294.293 Ha, 33.52 Ha and 254.838 Ha respectively.

The breakup of total land requirement-ie 582.651 Ha is summarized below

Type of Rights	Govt. Land (Ha)	Tenancy Land (Ha)	Forest Land (Ha)	Total (Ha)
All Rights	1.463	85.903	206.927	294.293
Surface Rights	-	33.520	-	33.520
Mining Rights	13.882	62.042	178.914	254.838
Total	**15.345**	**181.465**	**385.841**	**582.651**

21.2 STATUS OF NOTIFICATION

In this Report, it is proposed to acquire 549.131 Ha (within mining area) through CBA Act of 1957. For this purpose, the relevant sections-ie Sec-4(1), Sec-7(1), Sec-9(1) & Sec-11(1) are completed for acquisition of 294.293 Ha under All Rights (Forest-206.927 Ha, Govt-1.463 Ha & Tenancy-85.903 Ha). Under Mining rights, 254.838 Ha land(Forest-178.914 Ha, Govt-13.882 Ha & Tenancy-62.042 Ha). The Land Acquisition status is being communicated by the Pench Area office vide Letter No-WCL/Pench Area/Area GM/Planning/15-16/652 dt 29.02.2016/03.03.016 from Area General Manager, Pench Area.

The remaining 33.52 Ha land base with surface rights will be acquired by direct negotiations.

21.3 TIME FRAME FOR LAND ACQUISITION & ITS CAPITAL PROVISION

It is proposed to acquire the entire land in first 3 years. The land required for approach road ,Inclines/Air-shaft & important infrastructures which are required initially ,will be acquired during the 1st year of mine life. By doing this, the drivages of Inclines and Air-shaft can be started from 2nd year itself. The approach road to Dhankasa UG mine (about 4.0 km long) is considered from the existing Naheriya UG project. Sufficient land for service roads, colony roads etc are proposed for Dhankasa UG Project.

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A capital provision of Rs. 55.0077 Cr has been made for acquisition of land for Dhankasa UG mine which includes cost of land (Tenancy & Govt.),one time monetary compensation to the tenancy land losers (for 50% of total tenancy land) and NPV for Forest Land (including compensatory afforestation charges) etc. The land rates for proposed Dhankasa UG mine are taken based on the letter received from Area General Manger, Pench Area (letter no- WCL/Pench Area/Area G.M/Planning/2015-16/571 dt. 04.01.2016).

No villages are involved within mine boundary. Hence no shifting of villages or rehabilitation is proposed in this Report . One time Monetary Compensation for the tenancy land losers in lieu of employment has been considered for 50% of total tenancy land (50% of 119.424 Ha=59.712 Ha) @ Rs 5.00 lacs /acre . For the balance land, WCL may consider to offer employment in lieu of monetary compensation if the land losers are not willing to accept monetary compensation subject to provisions of new R& R policy of CIL.

21.4 PROJECT IMPLEMENTATION SCHEDULE

Once the Recast PR for Dhankasa UG Mine is approved, the authorities should take up the following major activities-

a) EC / FC clearance is to be obtained.
b) A new EMP may have to be prepared & get approval for a target capacity of 1.00 Mty (Peak prodn-1.25Mty) with a total land requirement of 582.651 Ha.
c) Land Acquisition for Incline /air-shaft site, approach roads etc.
d) Construction of Approach Road upto Mine Entries Site.
e) Temporary and Permanent Water & Power Supply Arrangement
f) Surveying, Locating and Fixing up the Site for Mine Entries.
g) Tender and Work Award for 2 Inclines and 1 Airshaft.
h) Drivage of Inclines and Sinking of Airshaft. Installation of belt / haualage along inclines.
i) Construction of Fan Drift, Fan House and Installation of Main Fan.
j) Establishing ventilation connection between the Inclines and Airshafts and Commissioning of Main Mechanical Ventilator.
k) Once the Inclines touch the floor of LWS during the end of 2nd year , all the mine developmental activities will be followed as described in thisReport earlier- at 7.5 "MINE DEVELOPMENT STRATEGY". Mine production will commence from 3rd year.

The average advance rate for drivage of inclines is considered as 60m/month . For sinking of air-shaft , the rate of advance considered would be about 20 m/month. The cost of Incline/Air-shaft drivages (Rs/m length) has been taken from the published copy -"Guidelines for Estimation of Average cost /m for the Construction of Circular Shaft & Inclines "by CMPDI-HQ, Ranchi on 17.07.2014 after making required escalation in labour & material components.

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22.0 FINANCIAL EVALUATION

22.1 GENERAL

a) The Recast Project Report for Dhankasa U/G Mine proposes to work by Mechanized Bord & Pillar method using Continuous cutting Technology with caving method. The target capacity of the mine has been envisaged as 1.00 Mty (about 3350 tpd) from 2 Continuous Miner districts .

b) Yearly average grade of coal from Dhankasa UG project has been assessed as 'G7 & G8' in different years of mine life considering all in-seam bands. The weighted avg. grade of coal during the entire life of the mine works out to G7 (5208 K.Cal/Kg).

c) The economics has been worked out on two options namely Departmental Option and Partial Hiring Option in this report.

22.2 ACTIVITIES PROPOSED FOR HIRING IN PARTIAL HIRING OPTION

The following main activities related to production from CM package proposed to operate in a district have been envisaged for Outsourcing / Hiring in Partial Hiring Option. This also includes development and extraction of main-dips/trunk headings with Continuous Cutting technology including coal production, coal loading onto belt conveyor , roof supporting, extension of ventilation appliances etc.

(1) Procurement, supply, operation and maintenance of 2 sets of Continuous Cutting Machine package and indigenous equipment in the district including supply of spares, consumables and lubricants.

Each set of Continuous Cutting Machine package includes 1 CM, 2 Shuttle Cars, 1 Feeder Breaker, 2 Twin Boom Roof Bolters, Electrical Equipment for the same including 3.3/1.1 kV FLP Transformer, Trailing Cables, DAC Communication, Spares Parts etc.

(2) Coal preparation by continuous cutting, loading and transport of coal upto the gate belt in panels except main-trunks/main-dip.

(3) Roof support using resin encapsulated roof bolts with W-straps as per the approved support system and supply of roof bolting consumables including drill rods and bits for the bolter as per the quality and quantity requirement.

(4) Extension of ventilation ducting and cleaning of path of shuttle cars and loading and un-loading points. Coordination with the Mine Management regarding extension of gate belt, cables, etc. and operation and maintenance of equipment as per the permissions granted by DGMS or any other Competent Authority. All operations in the district shall be carried out under the control and supervision of the Mine Management.

(5) Supply of electricity from the 3.3/1.1 kV transformer and 3.3 kV/ 550 V transformer to various equipment operating in the district..

(6) Supply of clean water from near gate belt tail end to the point of use.

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(7) DGMS permission has to be obtained for the proposed equipment, proposed method of mining and any other required permissions.
(8) Construction of ventilation and isolation stoppings etc.
(9) Supply, operation and maintenance of face pumps etc.
(10) Any Scientific Investigations if required by DGMS.
(11) Coal Production as per the Proposed Target.
(12) Any other activities required to be fulfilled by the hiring agency.

22.3 CAPITAL INVESTMENT

The economics of the mine has been worked out on two options namely Departmental and Partial Hiring Options. The following table shows the Total Capital Investment (given in Appendix - A) under the major heads in Departmental and Partial Hiring Options in Recast Project Report for Dhankasa U/G Mine prepared in May-2016.

A/C Head	Particulars	Addl. Capital Investment (Rs. Lacs)	
		Dept. Option	P.H. Option
01	Land	5500.77	5500.77
02	Buildings:		
	a) Service Buildings	659.94	659.94
	b) Residential Buildings	1544.92	1071.82
03	Plant & Machinery	29954.61	9419.87
04	Furniture & Fittings	25.00	25.00
05	Railway Siding	-	-
06	Vehicles	11.68	11.68
07	Prospecting & Boring	171.24	171.24
08.1	Capital outlay in mines	5047.44	5045.03
08.2	Roads & Culverts	690.85	673.25
08.3	Water Supply & Sewerage	1278.70	1241.36
08.4	EMP & PR Preparation Cost	230.77	230.52
08.4 (A)	Env. Pollution Control Measures	118.00	118.00
08.5	Scientific Research Costs	150.00	150.00
09	Net Rev. Expenditure. Capitalized during development period	422.68	426.00
	Additional Capital Investment	**45806.60**	**24744.48**

The total Capital investment in Departmental & Partial Hiring option works out to Rs 458.0660 Cr & Rs 247.4448 Cr respectively.

22.4 FOREIGN CAPITAL

The total foreign exchange requirement including customs duty, port handling cost, inland transportation, etc. for the imported equipment of 2 sets of CM Packages in Dept. option works out to Rs. 196.6782 Cr considering exchange rate of 1 US $ = Rs. 66.84, which was the ruling rate as on 26.03.2016. No foreign capital is involved in Partial Hiring option as CM package will be procured by the contractor.

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22.5 BASIS OF PRICES OF P&M & CIVIL WORKS

The pricing of Plant and Machinery is based on the Standard Price List of June 2015 (escalated upto April-2016) circulated by the Underground Mining Division of CMPDI (HQ), Ranchi. The cost of Civil Works has been estimated on the basis of Civil Cost Index 471 for Madhya Pradesh in 1st half of 2016.

22.6 ESTIMATION OF HIRING COST IN PARTIAL HIRING OPTION

Continuous cutting machine is not being operated departmentally in any of the underground mines of Coal India Ltd. till now. Either the Continuous cutting machine package has been operated in CIL mines on Risk / Gain Sharing Basis or on Hiring Basis. Till now, norms with respect to productivity and elements of cost of production to operate Continuous Cutting Machine Package on hiring basis are not available. Hence,it was advised to consider the latest Outsourcing / Hiring Cost of Continuous Cutting Machine Package operating at Pinoura U/G Mine / Vindhya U/G Mine of Johila Area, SECL with due Escalation / Updation.

With Reference to Pinoura Contract, the specific price for Dhankasa UG mine works out to Rs 1229.58 per tonne of coal produced as on April-2016. This specific cost has been considered in estimating the economics of this project in Partial Hiring Option.

22.7 OPENING OF REVENUE ACCOUNT

The norms for bringing Coal Projects into Revenue Account, as decided in the meeting held under the chairmanship of JS & FA on 9/6/04 are as follows:

1) Revenue Expenditure to be capitalized should be net of Sales Receipts of Coal produced during the construction period.

2) The period of construction has to be defined, to determine the Commercial Readiness of the Project to yield on a sustainable basis.

3) In case of Opencast Projects, the volume of Stripping Ratio of OB and in case of UG Projects, the completion of required developmental activities during the above period of construction have to be clearly defined.

4) Based on the above, the capitalization of revenue expenses / opening of revenue account will be decided.

Accordingly, a definition of the term " Commercial Readiness " of a project has been drafted and based on this, a norm for capitalization of revenue expense / opening of revenue expenditure of a project has been suggested as under:

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COMMERCIAL READINESS:

An underground project will be treated to have reached the stage of commercial readiness to yield production on sustainable basis from the year when all the following criteria have been achieved:

i) Minimum essential mine development works like drivage of main inclines / adits / drifts / shafts etc., installation of winding arrangements & ventilation arrangement, pit top and pit bottom transport arrangements as required for attaining targeted coal production as per project report have been constructed and commissioned.

ii) In case of projects with B&P method of mining, underground workings have adequately progressed and adequate number of main mining equipment have been commissioned to enable opening of the first development panel.

iii) Construction of CHP and railway siding has been completed or adequate alternative arrangement for sizing and dispatch of coal have been commissioned for the project.

iv) The land required for the project (up to target year) has been acquired.

All the required approvals, land acquisition, drivage of inclines and sinking of airshaft for proposed Dhankasa U/G Mine will take 2 years time to bring the proposed mine into commercial readiness for production on sustainable basis. Therefore, Dhankasa U/G Mine will have cash surplus in the first year of touching coal, i.e., 3rd year of mine operation and the mine is proposed to come into Revenue from 3rd year.

22.8 COMPLETION CAPITAL

The expected completion capital for Dhankasa U/G Mine works out to Rs 502.4701 Crores in Departmental option and Rs 281.6020 Crores in Partial Hiring option.

22.9 MANPOWER & O.M.S.

In Departmental option of Dhankasa UG Mine, the manpower requirement works out to 490 , which also includes 14 nos of welfare manpower. The overall OMS for Dhankasa UG Mine in Departmental option works out to 7.796 t (with welfare manpower) & 8.027 t (withour welfare manpower).

In Partial Hiring option of Dhankasa UG Mine, the manpower requirement works out to 313 , which also includes 14 nos of welfare manpower. The overall OMS for Dhankasa UG Mine in P.H option works out to 12.184 t (with welfare manpower) & 12.758 t (withour welfare manpower).

22.10 E.M.S.

The EMS calculated as per CMPDI norms for Departmental Option & Partial Hiring Option works out to Rs. 2147.96 and Rs. 2224.05 respectively in April-2016, which are considered for determining economics in this Report.

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22.11 UNIT COST OF PRODUCTION

Appendix 'C' shows the cost of production in Departmental and Partial Hiring Options as on April-2016 in Dhankasa U/G Mine. The following table shows the Cost of Production of both the options:

Sl. No.	Particulars	Cost of Production at 100%	
		Departmental Option (Rs./t)	Partial Hiring Option (Rs./t)
1	Salaries and Wages	276.34	183.08
2	Stores	280.93	68.84
3	Power	208.15	151.71
4	Environment Pollution Control	6.00	6.00
5	Miscellaneous Exp.(incl. Induced caving)	97.49	82.71
6	Mine Closure Cost	7.70	7.70
7	Administrative Overhead	187.22	187.22
8	Hiring / Outsourcing Cost	-	1229.58
9	Depreciation	378.57	153.40
10	Interest on Working Capital @ 14.50%	43.27	84.50
11	Interest on Loan Capital @ 11.50%	60.00	32.00
	Total Cost of Production	**1545.67**	**2186.74**

The Cost of Production in Departmental Option at 100% and 85% levels of capacity utilization works out to Rs. 1545.67/t and Rs. 1762.03/t respectively. The Cost of Production in Partial Hiring Option at 100% and 85% levels of capacity utilization works out to Rs. 2186.74/t and Rs. 2311.08/t respectively.

In Stores Cost given in the above table, the Repair and Maintenance Cost consists of two parts namely (i) Face and transport equipment, i.e., direct plant & machinery and (ii) Other P&M such as Electrical equipment, Workshop, CHP, Stowing, Pumping and Miscellaneous equipment. In Partial Hiring Option, the Repair & Maintenance Cost has been worked out excluding the capital provision for Continuous Cutting Technology Packages.

The Repairs & Maintenance Cost has been treated as 60% fixed cost and 40% variable cost and is determined on the following norms:

i) 20% of annual depreciation of direct P&M, i.e., equipment required for coal preparation, loading, support, ventilation, safety and transport of coal up to the incline mouth and material up to the working face.

ii) 2% of capital cost of other equipment, i.e., equipment deployed in CHP, Workshop, Pumps & Pipe Fittings, Electrical & Communication and Miscellaneous equipment.

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During the T.S.C Meeting held for P.R of Tawa-II Expansion U/G Mine on 28-05-2010, it was directed by the committee mainly to include Maintenance Service Rate (on MARC pattern) in Dept. option as WCL has no expertise in operating C.M departmentally. But, recently a meeting was held in the chamber of Director (Tech) (P&P), WCL on 18.09.2015 (for Recast PR for Jamunia UG Report) in which it was decided to work out economics of U/G Mines on Departmental Option considering operation and maintenance of C.M. Package by WCL on its own as this technology is no longer new for WCL/CIL.

Accordingly, the store cost for Recast P.R. for Dhankasa U/G Mine (May-2016) has been worked out with Repair & Maintenance Cost of all P&M including C.M. Package as per CMPDI norms. The store cost for this project works out to Rs 280.93/t & Rs 68.84/t for Departmental & Partial Hiring options respectively.

22.12 GRADE OF COAL & WEIGHTED AVERAGE SELLING PRICE

The overall Grade of coal in Seam-II Pack is G-10 (GCV-4563 K.Cal/Kg). The coal of Seam-IV Comb has a better Grade-ie G-6 (GCV-5605 K.Cal/Kg). The yearly grade of coal varies between G7 & G8. The weighted average sale value considering 98.5% of the year-wise grade of coal and Rs. 79/t as processing charge for dispatching (–) 100 mm size coal works out to Rs. 1882.84/t and Rs. 2241.25/t for Power Sector and Non-Power Sector respectively.

22.13 CAPITAL INVESTMENT, PROFITABILITY & IRR

The Total Capital Investment, Cost of Production, Profitability, IRR and Desired Selling Price to yield 12% IRR at 100% and 85% target capacity in Departmental and Partial Hiring Options (May-2016) is tabulated below:

Sl. No.	Parameters	Dept. Option		P.H Option	
		100%	85%	100%	85%
1	Total Capital Investment incl. WDV (Rs. Cr)	458.0660		247.4448	
2	Total Cost of Production (Rs./t)	1545.67	1762.03	2186.74	2311.08
3	Avg. Sale Price(Power Sector)	1882.84			
4	Profit / Loss for Power Sectors	(+)337.17	(+)120.81	(-)303.90	(-)428.24
5	Avg. Sale Price(Non Power Sector)	2241.25			
6	Profit/Loss for Non Power Sectors (Rs./t)	(+) 695.58	(+) 479.22	(+)54.51	(-)69.83
7	I.R.R. for Power Sector (%)	(+) 21.86	**(+) 13.31**	(-) ve	**(-) ve**
8	I.R.R.for Non-Power Sector (%)	(+) 34.35	**(+) 24.30**	(+) 18.47	**(+)10.80**
9	Desired Selling Price to Yield 12% IRR (Rs./t)	1625.87	**1856.39**	2159.16	**2278.64**
10	Difference between Notified Selling Price & DSP to yield 12% IRR- Power Sectors (Rs./t)	(+) 256.97	**(+)26.45**	(-)276.32	**(-)395.80**
11	Difference between Notified Selling Price & DSP to yield 12% IRR-N-Power Sectors (Rs./t)	-	-	-	**(-) 37.39**

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22.14 CONCLUSION

In this Recast Project Report for Dhankasa U/G Mine, the Financial Evaluation has been worked out on two options namely Departmental and Partial Hiring Options as on April-2016 , which is enumerated below:

In Departmental option, with an average sale price of Rs. 1882.84/t for Power Utilities, Fertilizer & Defence Sectors etc., the mine is expected to make a profit of Rs 337.17/t at 100% & Rs 120.81/t at 85% target capacities respectively. The IRR at 100% and 85% target capacity for Power sector works out to (+) 21.86% & (+) 13.31 % respectively. With an average sale price of Rs 2241.25/t for Non Power Sector, the mine is expected to make a profit of Rs 695.58/t & Rs. 479.22/t at 100% and 85% target capacity respectively. The IRR at 100% and 85% target capacity for Non-Power sector works out to (+) 34.35% & (+) 24.30 % respectively.

In Partial Hiring option, with an average sale price of Rs. 1882.84/t for Power Utilities, Fertilizer & Defence Sectors etc. the mine is expected to make a loss of Rs 303.90/t at 100% target capacity & Rs.428.24/t at 85% target capacities. The IRR at 100% and 85% target capacity for Power sector is (-)ve. With an average sale price of Rs. 2241.25/t for Non Power Sector, the mine is expected to make a profit of Rs 54.51/t & incur a loss of Rs 69.83/t at 100% and 85% target capacity respectively. The IRR at 100% and 85% target capacity for Non-Power sector works out to (+) 18.47% & (+) 10.80 % respectively.

Since the Recast PR of Dhankasa UG project is achieving 12% IRR at 85% target capacity for both Power as well as Non-Power Sectors in Departmental option.

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