EXECUTIVE SUMMARY OF PROJECT REPORT
ADASA UG to OC

1.0 INTRODUCTION

Adasa Geological Block is situated in the Nagpur district of Maharashtra state and lies in the south east of Saoner Project of Nagpur Area, WCL. A Project report on Adasa U/G mine was prepared by CMPDI, Nagpur in August, 1990 for a target capacity of 0.24 Mty. This PR was based on geological report on "Adasa Geological Block", Kamptee Coalfield, District Nagpur, Maharashtra prepared in October,1989. Subsequently, additional exploration was carried out in this block and a Geological Note on revised structure of Adasa block was prepared by CMPDI, Nagpur in September,1996. Based on revised structure, a PR was prepared in April,1997 for a capacity of 0.21 Mty which was approved By WCL in July,1997 subject to finalization of viable commercial agreement with the customer.

Coal supply agreement was signed between MSEB & WCL on 19.10.2000 to supply coal on cost plus basis. The PR was approved by WCL Board on 27.12.2000 with capital investment of Rs 39.8738 Crores. Presently production is being done from this Underground Mine with Bord & Pillar method of working. Production was started from the year 2005-06 from Seam IV B & Seam IV M. Depillaring operation is not started till date. The existing manpower of Adasa Underground mine as on 31.12.2014 is 603.

Chronology of Previous Approved Reports

Year of Preparation	Year of Approval	Technology adopted	Production Capacity (Mty)	Approved Capital (Rs.Lakh)
1	2	3	4	5
April,1997	December, 2000	Bord & Pillar method (Underground working)	0.21	3987.38

The year wise production & financial performance from existing Adasa UG mine is shown in table below.

Sl. No.	Year	Coal Production (Mt)	Profit (Rs/t)
1	2005-06	0.030	N.A.
2	2006-07	0.134	769.45
3	2007-08	0.216	467.22
4	2008-09	0.260	21.81
5	2009-10	0.286	248.52
6	2010-11	0.287	81.31
7	2011-12	0.291	(-)228.35
8	2012-13	0.318	(-)54.07
9	2013-14	0.324	258.09
Total		**2.146**	

As per Annual Plan for the year 2014-15, WCL has desired to prepare a Project Report for conversion of Adasa UG mine into Opencast Mine so that full extraction of Coal can be done and target can be increased to reduce the demand supply gap. Accordingly, the PR of Adasa UG to OC mine has been formulated. The production from proposed Adasa UG to OC has been envisaged from the year 2018-19 as three years period has been envisaged for land acquisition. As per the projections, the proposed yearly production from Adasa UG mine has been envisaged as 0.30 Mty till 2017-18.

Draft Project Report for Adasa UG to OC was prepared in December, 2014. The Draft Project Report was discussed at CMPD (HQ) on 23.02.2015 and in Planning Committee of WCL on 16.03.2015. The final Project Report for Adasa UG to OC has been prepared in March, 2015 for three options i.e. Departmental Option, Partial Hiring Option & Total Hiring Option considering suggestions made by CMPDI (HQ) and Planning Committee Meeting of WCL.

The final Project Report for Adasa UG to OC (March, 2015) was presented in Technical Sub Committee of WCL Board on 07.07.2015. The TSC recommended total hiring option as this option is yielding 13.76 % IRR at 85% capacity with total capital investment of Rs 300.8908 crores (including WDV of Rs 11.9882 crores for existing assets). The desired selling price of coal to yield 12% IRR at 85% capacity works out to Rs 1438.05/t while average notified selling price of coal for G-8 grade for power sector is Rs 1513.50/t. TSC also suggested to specify the proposed deployment of Surplus manpower of Adasa Underground mine after its conversion into OC mine.

The Executive Summary of Project Report for Adasa UG to OC (March, 2015) has been prepared for Total Hiring option incorporating the proposed deployment of surplus manpower of Adasa UG mine after its conversion into opencast mine as suggested by TSC of WCL Board. Other than this proposed deployment of surplus manpower, there is no change in the PR submitted to TSC of WCL Board.

Subsequently the PR has been duly approved by WCL Board in 267th meeting held on 11th August, 2015 as communicated by Company Secretary vide letter No. WCL/BD/SECTT/BM-267/2015/2250 dated 21.08.2015.

1.2 EXPLORATION STATUS

Total 44 boreholes involving 5157.94 m. were drilled in Adasa block and Geological Report was published in October,1989. Subsequent to the submission of this report 16 additional boreholes were drilled involving 1544.40 meters for proper delineation of sub crop of seams and faults, there by attempting to revise the structure of the block. A Geological Note was published in September, 1996. Further 10 boreholes involving 451.80m. were drilled for precise delineation of the block and a note was published in July 2002.

The present geological assessment of Adasa geological block area is based on the data of 70 boreholes involving a total meterage of 7154.14 m. in an area of 2.5 km^2. The density of boreholes works out to 24 boreholes per km^2 considering 60 boreholes (excluding 10 boreholes drilled for production support).

1.3 MINING ACTIVITIES

Presently coal production is being done from Adasa UG mine by Bord & pillar method of working. The coal extraction is being done from Seam-IV(M) and Seam - IV (B). The annual coal production is about 0.30 Mt. The mining activities from Adasa UG mine is proposed to cease from the year 2018-19, when excavation work in proposed Adasa UG to OC is envisaged to start.

1.4 JUSTIFICATION OF PREPARATION OF PR

Adasa Underground mine was planned in the year 1997 in Adasa Block as the Opencast method of working was not economically viable at that time for 6.50m^3/t stripping ratio in Departmental Option. However, in recent times, the mine upto 6 to 7 m^3/t stripping ratio can be planned by Opencast method economically viable for Partial hiring and/or Total hiring option. In Underground mining, all the coal seams are not workable due to less seam thickness (less than 1.50m) and / or insufficient parting with underlying/overlying workable seams. In Adasa UG mine also, only two seams namely seam IV (M) and Seam IV (B) were proposed to be worked, leaving other seams as unworkable. Thus, a lot of coal reserves are lost in UG mining. However, in opencast method, there are no such limitations and therefore, the mineable reserves increase manifold. Thus, from conservation point of view, opencast method is preferred over underground method. In proposed Adasa UG to OC mine, five coal seams viz. Seam-V, Seam-IV (T), Seam – IV (T)A, Seam – IV (M) and Seam-IV (B) can be worked by opencast mining. Moreover, the target capacity in opencast mining is much more than the underground mining. It is proposed in this PR to plan opencast mine of 1.50 Mty which is 5 times more than the existing capacity of Adasa UG mine.

There is huge gap between demand and supply of coal linkage to WCL And it is very essential to bridge this gap by opening new projects or by enhancing the target production of existing mines of WCL. Hence, the conversion of Adasa UG to OC mine is justified.

1.5 SALIENT FEATURES OF PRESENT PR (CAPACITY, CAPITAL, ETC.)

In Total hiring option with target capacity of 1.50 Mty , the proposed additional capital provisions works out to Rs. 288.9026 Crores . The proposed PR is recommended for EMP clearance at peak capacity of 1.85 Mty. Presently, there

is existing fuel supply agreement on cost plus basis with MAHAGENCO for coal production from Adasa underground mine.

The salient features of the proposed Project Report for Adasa UG to OC mine March, 2015) are tabulated below:-

Salient Features of Project Report for Adasa UG to OC Mine

Sl. No.	Particulars	Project Report for Adasa UG to OC Mine (March,2015)
		Total Hiring Option
01	Mine Capacity (Mty)	1.50
02	GCV (kCal/kg) / Grade of Coal	5020 (G-8)
03	Manpower Requirement (Nos.)	128
04	Overall OMS (t)	44.39
05	Additional Capital Required (Rs. Crores)	288.9026
06	Cost of Production (Rs /t)	
(a)	@ 100% of target capacity (Rs/t)	1068.46
(b)	@ 85% of target capacity (Rs /t)	1132.00
07	Av. Selling Price (Notified) (Rs/t) For Power sectors	1513.50
08	Profit/Loss (Rs /t) For Power sectors	
(a)	@ 100% of target capacity (Rs /t)	445.04
(b)	@ 85% of target capacity (Rs /t)	381.50
09	Financial IRR (%)	
(a)	At 100% capacity	17.22
(b)	At 85% capacity	**13.76**

1.6 CONSTRAINTS / RISK IN MINING

The proposed quarry is fraught with following surface constraints :-

i) Rehabilitation of Kotodi Village :

The Kotodi village is situated in the coal bearing area. The total number of families in this village is 152 with a total population of 592. The total number of houses is 238. The rehabilitation of this village has been proposed in the PR. The quarry surface of quarry-I has been kept at 100m distance from boundary of Kotodi village so that smooth operation can be started in quarry-I.

ii) Rehabilitation of Yerangaon Village:

The Yerangaon village is located in dip side of property (SW side) towards Silori block . A part of this village lies on property of proposed Adasa UG to OC mine and a part lies on property of proposed Silori OC. In this village, there are 153 houses and 127 families with a total population of 465. For rehabilitation of this village, provision is made in the proposed PR for Adasa UG to OC. Project Report for Silori OC (March,2015) in dipside block of Adasa block has also been prepared and capital provision for rehabilitation of Yerangaon village has also been made in PR for Silori OC. It is suggested that the proposed capital provision for rehabilitation of Yerangaon village shall be considered in only one PR whose implementation is done earlier.

iii) Diversion of Nalla

In the dip side (south side) of Adasa block property, a seasonal nalla is passing through coal bearing area, which is required to be diverted to release coal. One another seasonal nalla is passing through property of adjacent Silori block which is merging with seasonal nalla passing through property of Adasa block. Provision for diversion of seasonal nalla passing through adjacent Silori OC has been made in PR of Silori OC along its dipside quarry boundary.

Provision for diversion of seasonal nalla passing through Adasa block has been partly made along dipside quarry boundary of proposed Adasa UG to OC and partly along quarry boundary of proposed Silori OC. If in future, proposed PR for Silori OC is not implemented/ delayed, then provision for diversion of seasonal nalla passing through proposed Adasa UG to OC has to be changed accordingly. The HFL of seasonal nalla is not known, hence, an embankment 6m above HFL with top width of 20m along proposed route of diversion of nalla has been proposed.

iv) Diversion of 132 kV Power Line

132 kV power line is passing through property of Adasa block which is proposed to be diverted along eastern side quarry boundary. Capital provision for 3.5 km diverted length of 132 kV power line has been envisaged in proposed Project Report for Adasa UG to OC. The surveyed alignment of 132kV power line is not known. If, after survey, alignment of 132 kV power line is found away from proposed quarry boundary of Adasa UG to OC, then proposed capital provision for diversion of 132 kV power line shall be deleted.

v) Diversion of Patansaongi- Adasa village road

A village road (Patansaongi - Adasa road) is passing through quarry-I of proposed Adasa UG to OC mine which is required to be diverted. Capital provision for 1.50 km diverted length of village road has been provided in this report.

2.0 MARKETABILITY & JUSTIFICATION

The mines of WCL are under constant pressure to meet the increasing demand of non-coking coal for power plants and other bulk consumers from Western as well as Southern part of country. The justification of this mine has been studied in the light of estimated demand for coal from WCL and production forecast from existing, completed, ongoing and future projects of WCL.

Following table shows the deficit in availability of coal, including middlings from the various Existing, Completed, On-going, and Future Projects of WCL:

Sl. No.	Sector	Projections of Surplus / Deficit of Coal (Mt)				
		2015-16	2016-17	2017-18	2018-19	2019-20
1	Demand for coal	69.08	69.28	70.08	70.58	70.58
2	Availability of coal	45.000	48.00	50.00	55.00	60.00
3	Surplus / Deficit (+/-)	**(-) 24.08**	**(-) 21.28**	**(-) 20.08**	**(-) 15.18**	**(-) 10.58**

The availability of coal shown above includes the coal production from Adasa UG to OC mine. From the above table, it is clear that the deficit in supply of coal from WCL as a whole will be (-) 24.08 Mt in 2015-16 which will be

narrowed down to (-) 10.58 Mt in 2019-20 provided WCL achieved the target production of 60.00 Mt in 2019-20. New mines/ projects have to be opened or expansion of existing operating mines has to be done by WCL in order to meet the ever increasing demand of coal. There is a deficit in supply of coal from the mines of WCL and therefore a ready market exists for the coal produced from proposed Adasa UG to OC mine.

Thus, there will be no problem in marketing of 1.50 Mty coal from Adasa UG to OC mine in view of large deficit in availability of coal from the mines of WCL.

Firm Fuel Supply Agreement / linkage is available with MAHAGENCO for coal production from Adasa UG mine. However, after conversion from UG to OC mine, either the existing linkage may be continued or fresh linkage with existing customer and / or other customers may be explored as the proposed target production from Adasa UG to OC mine is 1.50 Mty whereas the target capacity as per approved PR of existing Adasa UG mine is 0.21 Mty.

3.0 PROJECT SITE INFORMATION

3.1 LOCATION & COMMUNICATION

The proposed mine area is in Saoner Sub-basin of Kamptee Coalfield and is under the administrative control of Nagpur Area of WCL. Adasa Project is further eastern continuity of Saoner Phase-I and forms a part of Topo Sheet No. 55 K/15 (RF 1: 50,000) of Survey of India. The mining block covers an area of **2.50 sq. km.** The geographical coordinates of the block are:-

Latitudes	:	N 21º 19' 31", N 21º 21' 16"
Longitudes	:	E 78º 55' 47", E 78º 58' 40"

The proposed Adasa block is well connected to Saoner township by all-weathered road. Saoner town is connected with Nagpur by a State Highway & is located at a distance of 38 km from Nagpur. It is also connected by Narrow Gauge railway line with Nagpur. Saoner railway station is at a distance of 43 km from Nagpur railway station. Adasa Project lies East of Saoner mine-I on the road, which connects Saoner to Nagpur via Kalmeshwar. The mine area is also approachable from Nagpur by Katol Road via Nagpur-Kalmeshwar-Saoner road, the distance being 43 km. There is BG siding at Saoner, near Saoner Mine-I.

From the siding, coal is mainly despatched to Khaparkheda thermal power station.

3.2 TOPOGRAPHY & DRAINAGE

The mine area has gentle undulating topography formed by the hard and silicified Kamptee and Deccan Trap rocks. The maximum and minimum elevation of the area under consideration is 300.36 to 313.75m above M.S.L. The main drainage of the area is controlled by easterly flowing Kolar and Chandrabhaga rivers. The Chandrabhaga River passes south of the mine. A few seasonal nalas mainly carrying the rain water during monsoon discharge into these rivers. The ground generally slopes towards South-East. The regional drainage is controlled by Kolar River joining the Kanhan River near Kamptee Township. The Kanhan River flows at a distance of 10 km towards the north of Saoner Project.

4.0 GEOLOGY AND DEPOSIT APPRAISAL

4.1 INTRODUCTION

The Kamptee Coalfield is within the command area of WCL and is located in the northern part of Pranhita-Godavari Valley Basin. The area under consideration falls in the Saoner Sub-basin of Kamptee Coalfield.

4.1.1 Geological Reports prepared for the blocks under reference

The details of geological documents on which the present assessment is based are mentioned below:

(1) Geological Report on Adasa Block, Kamptee Coalfield, CMPDI, October 1989.

(2) Geological Note on open cast feasibility in Adasa Block, CMPDI, September 1996.

(3) Geological Note on revised structure of Adasa Block, CMPDI, September 1996.

(4) Geological Note on production support drilling in Adasa UG mine area, CMPDI, July 2002.

(5) Interim note on interpretation of High Resolution Shallow Seismic Survey data, Adasa Block, Kamptee Coalfield, Nagpur, CMPDI, October 1989.

4.1.2 Geological Block Boundaries

The boundaries of proposed Adasa Geological block are as follows:

a) Northern boundary - Projected sub crop of the seam II (B)

b) Southern boundary - Fault $F_{12} – F_{12}$

c) Eastern boundary - Projected Sub crop of the seam-II (B)

d) Western boundary - Projected sub crop of the seam- II (B)

4.2 EXPLORATION STATUS

The exploration details of the proposed Adasa block are tabulated below **:**

Sl.No.	Block Name	No. of Boreholes	Meterage	Area of Block (km^2)	Borehole Density
1.	Adasa block	60	6702.34	2.50	24

10 boreholes involving 451.80m.drilled for production support have not been considered for evaluation of borehole density.

4.3 GEOLOGICAL STRUCTURE OF THE BLOCK

4.3.1 Strike and Dip

The strike of the strata varies from E-W to WNW-ESE to NW-SE with its dip towards S, SSW and SW respectively. The gradient varies from 1 in 5 to 1 in 8 in major part of the area. It is observed to be flatter in the central part of the area. Adasa Block forms the Northern limb of the plunging synform terminating against the fault F12-F12.

4.3.2 Faults

Based on the sub-surface data obtained from the boreholes and underground mine workings, details of faults are given below in the following table:

Sl.No.	Fault Name	Strike	Direction of throw	Amount of throw (m)	Basis
1.	$F_{14} - F_{14}$	NW-SE to WNW-ESE to EW	SW to SSW to S	0-10m.	Difference in FRL values on either side of the fault and mine workings.
2.	$F_{12} - F_{12}$	WNW-ESE	SSW	190m.	Difference in FRL values on either side of the fault. All the seams are missing in BHs. CMKSN-276,278 and 279

4.4 DESCRIPTION OF COAL SEAMS

All the five coal seams/groups of coal seams as proved in the other blocks of Kamptee Coalfield have been found to occur in the Adasa Mine area also. The succession of these seams with their thickness range and intervening partings is given in the following table:

Seam	**Thickness range (m)**		**R e m a r k s**
	Minimum	**Maximum**	
V	1.60 (CMKSN-262)	5.25 (CMKSN-426)	Considered workable
	(Normal range 4.00 to 5.00m)		
Parting	18.60 (CMKSN-373)	28.35 (CMKSN-116,117A)	
IV(T)	0.15 (CMKSN-116)	2.27 (CMKSN-453)	Considered workable
Parting	1.77 (CMKSN-98)	14.65 (CMKSN-262)	

IV(T)A	0.16 (CMKSN-116)	3.06 (CMKSN-453)	Considered workable
Parting	0.73 (CMKSN-229)	5.50 (CMKSN-274)	
IV(M)	1.13 (CMKSN-323)	7.42 (CMKSN-110)	Considered workable
	(Normal thickness range 5.0 to 6.0 m)		
Parting	3.36(CMKSN-226)	7.15 (CMKSN-320)	
IV(B)	0.15 (CMKSN-107)	2.49 (CMKSN-270)	Considered workable
	(Normal thickness range 1.2 to 2.0m)		
Parting	7.05 (CMKSN-271)	13.96 (CMKSN-253)	
III(T)	0.20 (CMKSN- 264)	1.98 (CMKSN-229)	Developed in Patches, considered unworkable
Parting	9.47 (CMKSN- 452)	16.17 (CMKSN-254)	
III(B)	0.13 (CMKSN-101)	1.82 (CMKSN-453)	Developed in Patches, considered unworkable
Parting	5.55 (CMKSN-116)	19.46 (CMKSN-455)	

Seam	**Thickness range (m)**		**R e m a r k s**
	Minimum	**Maximum**	
II(T)	0.10 (CMKSN-266)	1.59 (CMKSN-116)	Developed in Patches, considered unworkable
Parting	5.10 CMKSN-101)	12.59 (CMKSN-113)	
II(B)	0.10 (CMKSN-254)	1.41 (CMKSN-274)	Developed in Patches, considered unworkable

4.4.1 QUALITY OF COAL

The seam-wise quality of coal (GCV and grade) as well as weighted average quality of all the seams is tabulated below :

Seam Name	GCV Range (kCal/kg)	Grade Range	Weighted Average GCV (kCal/kg) & Grade
Seam-V	3995 - 4415	G-12 – G-10	4233, G-11
Seam-IV(T)	3195 - 5496	G-14 – G-7	5367, G-7
Seam-IV(T)A	3499 - 4523	G-13 – G-10	3995, G-12
Seam-IV(M)	4660 - 5610	G-9 – G-6	5258, G-7
Seam-IV(B)	3228 - 5380	G-14 – G-7	5300, G-7
Seam-III(T)	3463 - 6915	G-13 – G-2	5564, G-6
Seam-III(B)	3557 - 6597	G-13 – G-3	5917, G-5
Seam-II(T)	5000 - 6656	G-8 – G-3	5757, G-6
Seam-II(B)	3691 - 6514	G13 – G3	5576, G-6
Overall (all seams)			**5098, G-8**
Overall (Workable Seams- V, IV(T), IV(T)A, IV(M) & IV(B)			**5020, G-8**

The weighted average quality considering all seams works out to 5098 kCal/kg. However, the weighted average quality considering workable seams, viz. Seam-V, IV (T), IV(T)A, IV(M) and IV(B) works out to **5020 kCal/kg**.

4.5 GEOLOGICAL RESERVES

The net in-situ geological reserves in the proposed Adasa block is tabulated below :

NET INSITU PROVED GEOLOGICAL RESERVES (>1.0m)

Seams	Net Geological Reserves (Mt)	Average GCV (kCal/kg)	GCV BAND
V	3.83	**4233**	G11
IV(T)	1.50	**5367**	G-7
IV(T)A	2.33	**3995**	G-12
IV(M)	14.01	**5258**	G-7
IV(B)	4.78	**5300**	G-7

III(T)	1.58	**5564**	G-6
III(B)	0.82	**5917**	G5
II(T)	0.31	**5757**	G6
II(B)	0.30	**5576**	G6
TOTAL	**29.46**	**5098**	**G8**

5.0 MINE BOUNDARY, MINEABLE RESERVES, TARGET & LIFE

5.1 MINE BOUNDARY DELINEATION

Total Nine seam-sections namely Seam –V, IV (T), IV T (A), IV (M), IV (B), III (T), III (B), II (T) & II (B) have developed in the proposed block. Out of these seam-sections, the upper seam-sections from top most seam -V to Seam-IV (B) have developed in most part of the mine area, hence these seam-sections – (Seam V, IV (T), IV T(A), IV (M) & IV (B)) have been considered for mining. The lower seams below IV (B) are partly developed, thin and inconsistent and therefore the reserves of these seams (Seam-IIIT, IIIB, IIT & IIB) have not been considered for mining. However, as suggested by CMPDI (HQ), during presentation of Draft PR for Adasa UG to OC mine, the possibility of mining Seam-III (T) should be ascertained during actual operation of the mine.
The incrop of Seam-IVB defines the mine boundaries in the North side (Rise side), East side and west side. In the south side (dip side) of the property, fault F12-F12 (of about 190 m down throw) exists. In the upthrow side of fault, Adasa block is situated while in the down throw side of fault, Silori block is situated. In the proposed Adasa UG to OC, it is envisaged to extract coal upto this dipside fault. In the eastern dip side area, the quarry surface of Adasa OC will extend in mine boundary of proposed Silori OC. Since, the dip side quarry batter of Adasa UG to OC mine and side batter of Silori OC mine overlap, boundaries between Adasa UG to OC and Silori OC may be adjusted in future depending upon the sequence of working of the two mines in this area.

In the western side of the proposed Adasa UG to OC, property of Saoner Mine-I exists while in the south side , Saoner IV block exists. In the eastern side of Saoner IV block , Silori OC block exists. Hence Saoner IV block is surrounded by Saoner –I, Adasa and Silori block. Saoner IV block is deep seated. However Saoner IV block can be approached from the proposed Saoner –I OC side in future. Thus, the mine boundaries of Adasa UG to OC are as follows :

North (rise side)	South (dip side)	East	West
Full incrop of seam IVB	Fault F12-F12	Full incrop of seam IVB leaving safe distance from Chandrabhaga river	Full incrop of seam IVB

5.2 MINEABLE RESERVES

For estimation of reserves, 10% geological loss and 5% mining loss has been considered. However, no geological loss has been considered for seam-IV(M) and Seam-IV(B) as these seams are already developed by Bord and pillar method of working. The seam wise mineable coal reserve after deducting already extracted reserves and proposed coal extraction from seam IV(M) and seam IV (B) by underground mining in next four years (upto 31.03.2018) is as follows :

Sl. No.	Seam Name	Gross Geological reserves (Mt)	Net Geological reserves (Mt)	Net Mineable reserves (Mt)	Already extracted reserves by Adasa UG mine till 31.3.2014	Proposed extraction by Adasa UG mine upto 31.3.2018 (Mt)	Balance mineable reserves as on 31.3.2018 (Mt)
1	**2**	**3**	**4**	**5**	**6**	**7**	**8 = (5-6-7)**
1	V	4.25	3.83	3.63	0.00	0.00	3.63
2	IV(T)	1.67	1.50	1.43	0.00	0.00	1.43
3	IV(T)A	2.59	2.33	2.21	0.00	0.00	2.21
4	IV(M)	14.01	14.01	13.31	1.38	0.60	11.33
5	IV(B)	4.78	4.78	4.54	0.46	0.60	3.48
	Total	**27.30**	**26.45**	**25.13**	**1.84**	**1.20**	**22.08**

The quarry for proposed Adasa UG to OC mine has been sub divided in two sub quarries i.e. Quarry-I & Quarry-II to maximize backfilling of OB. Initially, mine operation is proposed in Quarry-I and after exhaustion of reserves in Quarry-I, mine operation is proposed in Quarry-II.

The quarry wise and cut wise reserves are as follows:

Quarry	Description	Coal (Mt)	OB (Mm^3)	SR (m^3/t)
CUT-I (including access trench)	Upto 250m FRL of seam-IVB	1.70	29.07	17.10
CUT-II	250m to 220m FRL of seam-IVB	4.63	27.17	5.87
CUT-III	220m FRL to fault F12-F12 at seam-IVB	5.97	20.84	3.49
Sub total		**12.30**	**77.08**	**6.27**
CUT-IV (including access trench)	Upto 250m FRL of seam-IVB	3.75	32.91	8.78
CUT-V	250m to 220m FRL of seam-IVB	2.88	20.72	7.19
CUT-VI	220m FRL to fault F12-F12 at seam-IVB	3.15	15.65	4.97
Sub total		**9.78**	**69.28**	**7.08**
Total		**22.08**	**146.36**	**6.63**

5.3 TARGET PRODUCTION AND MINE LIFE

In the proposed Adasa UG to OC mine, target is proposed as 1.50 Mty considering strike length of mine, gradient of seams (1 in 5 to 1 in 8), thickness of seams and rate of deepening per annum. Average rate of deepening has been considered as 10m. Production from mine has been envisaged from fourth year as three years time has been envisaged for acquisition of land. Target production has been envisaged from 8^{th} year.

The total mineable reserves estimated in proposed mine is 22.08 Mt and with 1.50 Mty target production, the life of mine works out to 20 years including three years of land acquisition.

The break-up of mine life is as under:

Period	Life (Years)
Pre construction period	3Year
Construction/Production Build-up period	4 Years
Target capacity period	12 Years
Tapering capacity period	1 Year
Total life	**20 Years**

6.0 METHOD OF MINING

6.1 MINE PARAMETERS

The geo-mining parameters of the proposed quarry are tabulated below:

Sl. No.	Particulars	QUARRY-I	QUARRY-II	TOTAL
1.	Area of the Quarry			
a)	On floor (ha)	106.10	116.77	222.87
b)	On surface (ha)	161.50	152.43	313.93
2.	Depth (m)			
a)	Initial	40	35	35
b)	Final	94	114	115
3.	Average gradient of Seams	1 IN 6.5	1 IN 6.5	1 IN 6.5
4.	Average thickness of seams (m)			
a)	Seam-V	3.51		
b)	Seam-IV T	1.35		
c)	Seam-IV TA	1.47		
d)	Seam-IV M	4.42		
e)	Seam-IV B	1.54		
5.	Average Strike length (m)	1570	1700	3270

6.	Width on surface (m) [dip rise]	880	770	880
7.	Width on floor (m) [dip rise]	620	600	600
8.	GCV (kCal/kg) (Overall)	5020(G-8)		
a)	Seam-V	4233(G-11)		
b)	Seam-IV T	5367 (G-7)		
c)	Seam-IV TA	3395 (G-12)		
d)	Seam-IV M	5258 (G-7)		
e)	Seam-IV B	5300(G-7)		
9.	Mineable Reserves (Mt)	12.30	9.78	22.08
10.	Total OB (Mm^3) including access trench	77.08	69.28	146.36
11.	Average stripping ratio (m^3/t)	6.27	7.08	6.63

6.2 SELECTION OF MINING METHOD

The property has multi seams and upper group of seams (Seam V to IVB) has been considered in the proposed Project report for Adasa UG to OC. Thickness of seams are varying from 1.35 m to 4.42 m and the average gradient of seams is 1 in 6.5. Moreover, the Seam-IV (B) & Seam-IV(M) are standing on pillars. Hence, deployment of Surface miner is not suitable for developed seams. The balance mineable reserves in the proposed Adasa UG

to OC mine are 22.08 Mt only and the revenue life of mine is only 17 years. Hence, deployment of Dragline and Surface miner is not suitable in this property. Hence, Shovel-Dumper combination which is prevalent in mines of WCL, is proposed in the Project Report for Adasa UG to OC mine. With Shovel - Dumper system, two stripping methods are possible:

1. Inclined Slicing method

2. Horizontal Slicing method

In mild gradient of seams, positioning of HEMM is not difficult in inclined slicing method where benches in coal are made parallel to the seam. Hence, this method has been proposed in this project report. In horizontal slicing method, coal and OB are to be excavated in same bench and there is chance of mixing of parting OB with coal, thus, deteriorating the quality of coal. Since the gradient of seams in the proposed mine is flat to mild, the Shovel -Dumper system of mining with Inclined Slicing is recommended for the proposed mine.

6.3 EQUIPMENT SELECTION

In Total hiring option, OB removal & coal extraction has been proposed by hiring of HEMM. Some common departmental HEMM have been proposed in Total Hiring option which are tabulated below :

Sl. No.	HEMM	Total Hiring Option
A)	**For Common**	
1.	8-12 t Mobile crane	1
2.	28 kl Water Sprinkler (on 60T dumper chassis)	1
3.	Fire Fighting Truck	1
4.	4.0-6.0 m^3 Front End Loader	1
5	2.8 m^3 Diesel hyd. Backhoe	1

6.4 MINING SYSTEM & SYSTEM PARAMETERS

6.4.1 Width & height of benches

The height of benches in OB has been considered as 10m while height of benches in coal has been considered as per thickness of seam. The width of working and non working benches for top overburden removal have been considered as 30m and 20m respectively. The height of benches for parting removal has been considered as 10m or as per thickness of parting, if thickness of parting is less than 10m. The width of coal and parting bench has been considered as 20m. The height and width of uppermost two benches in OB has been considered as 5m.

6.4.2 Slope of benches & quarry

i) <u>During mining operation</u>

The slope of topmost two benches has been considered as 45^0. The slope of Individual OB and coal benches has been considered as 70^0. The rise side quarry slope has been considered as 37^0 and dipside working slope of quarry has been considered about 15^0 during mining operation.

ii) <u>At the end of quarry</u>

At the end of quarry, the slope of topmost two benches has been considered as 45^0 whereas the slope of OB benches in hard strata and coal benches has been considered as 70^0. Quarry slope has been considered as 37^0 in rise side & dipside of quarry.

It is proposed in this Project Report to carry out scientific study for slope and design of benches in quarry. Based on above scientific study, bench and quarry profile may change.

7.0 MINING & DUMPING STRATEGY

7.1 CONSTRAINTS ON MINE DEVELOPMENT

The various surface constraints involved in proposed Adasa UG to OC project are as follows : :-

i) Rehabilitation of Kotodi Village

The Kotodi village is situated in the coal bearing area. The total number of families in this village is 152 with a total population of 592. The total number of houses is 238. The rehabilitation of this village has been proposed in the PR. The quarry surface of quarry-I has been kept at 100m distance from boundary of Kotodi village so that smooth operation can be started in quarry-I.

ii) Rehabilitation of Yerangaon Village

The Yerangaon village is located in dip side of property (SW side) towards Silori block . A part of this village lies on property of proposed Adasa UG to OC mine and a part lies on property of proposed Silori OC. In this village, there are 153 houses and 127 families with a total population of 465. For rehabilitation of this village, provision is made in the proposed PR for Adasa UG to OC. Project Report for Silori OC (March,2015) in dipside block of Adasa block has also been prepared and capital provision for rehabilitation of Yerangaon village has also been made in PR for Silori OC. It is suggested that the proposed capital provision for rehabilitation of Yerangaon village shall be considered in only one PR whose implementation is done earlier.

iii) Diversion of Nalla

In the dip side (south side) of Adasa block property, a seasonal nalla is passing through coal bearing area, which is required to be diverted to release coal. One another seasonal nalla is passing through property of adjacent Silori block which is merging with seasonal nalla passing through property of Adasa block. Provision for diversion of nalla passing through adjacent Silori OC has been made in PR of Silori OC along its dipside quarry boundary.

Provision for diversion of seasonal nalla passing through Adasa block has been partly made along dipside quarry boundary of proposed Adasa UG to OC and partly along quarry boundary of proposed Silori OC. If in future, proposed PR for Silori OC is not implemented/ delayed, then provision for diversion of seasonal nalla passing through proposed Adasa UG to OC has to be changed accordingly. The HFL of seasonal nalla is not known, hence, an embankment 6m above HFL with top width of 20m along proposed route of diversion of nalla has been proposed.

iv) Diversion of 132 kV Power Line

132 kV power line is passing through property of Adasa block which is proposed to be diverted along eastern side quarry boundary. Capital provision for 3.5 km diverted length of 132 kV power line has been envisaged in proposed Project Report for Adasa UG to OC. The surveyed alignment of 132kV power line is not known. If, after survey, alignment of 132 kV power line is found away from proposed quarry boundary of Adasa UG to OC, then proposed capital provision for diversion of 132 kV power line shall be deleted.

v) Diversion of Patansaongi- Adasa village road

A village road (Patansaongi - Adasa road) is passing through quarry-I of proposed Adasa UG to OC mine which is required to be diverted. Capital provision for 1.50 km diverted length of village road has been provided in this report.

7.2 MINING STRATEGY

7.2.1 Quarry & Access Trench

The proposed Adasa UG to OC mine has been sub divided in two quarries i.e. Quarry-I & Quarry-II to maximize backfilling of OB. Initially, mine operation is proposed in Quarry-I as its stripping ratio is lesser than Quarry-II and after exhaustion of reserves in Quarry-I, mine operation is proposed in Quarry-II. It is proposed to make an access trench in Quarry-I to touch coal at FRL of about 272m at floor of Seam-IVB. A haul road has been envisaged at gradient of 1 in 16 at floor of Seam-IVB. Initially the OB of Quarry-I will be dumped in external OB dump. The sandy soil/ top soil would be dumped on coal bearing area on Quarry-II which will be reclaimed on top of OB dump at a later stage.

At the end of quarry-I, it is proposed to make another access trench in quarry-II, which is proposed to touch coal at floor of Seam-IVB at FRL of about 277m.

7.2.2 Cut-wise Coal, OB & Stripping Ratio

Three no. of cuts have been envisaged in Quarry-I namely Cut-I, Cut-II, and Cut-III. Similarly, three no. of cuts have been envisaged in Quarry-II namely Cut-IV, Cut-V and Cut-VI. The coal, OB & stripping ratio in various cuts are tabulated below:

Quarry	Description	Coal (Mt)	OB (Mm^3)	SR (m^3/t)
CUT-I (including access trench)	Upto 250m FRL of seam-IVB	1.70	29.07	17.10
CUT-II	250m to 220m FRL of seam-IVB	4.63	27.17	5.87
CUT-III	220m FRL to fault F12-F12 at seam-IVB	5.97	20.84	3.49
Sub total		**12.30**	**77.08**	**6.27**
CUT-IV (including access trench)	Upto 250m FRL of seam-IVB	3.75	32.91	8.78
CUT-V	250m to 220m FRL of seam-IVB	2.88	20.72	7.19
CUT-VI	220m FRL to fault F12-F12 at seam-IVB	3.15	15.65	4.97
Sub total		**9.78**	**69.28**	**7.08**
Total		**22.08**	**146.36**	**6.63**

7.2.3 Schedule of quantities

The schedule of quantities upto target production (at 100% target capacity) proposed in Total hiring option is as under :

Year of Implementation	I	II	III	IV	V	VI	VII	VIII
Coal Production (Mt)	LAND			0.10	0.50	0.80	1.20	**1.50**
OB Removal (Mm^3)	ACQUISITION			3.50	9.00	11.60	11.60	8.25

Target capacity is achieved in VIII year of mine life (V year of quarry operation). Initial three years period has been envisaged for land acquisition.

7.3 DUMPING STRATEGY

In the proposed PR of Adasa UG to OC, 146.36 Mm^3 of OB has to be excavated to extract 22.08 Mt coal. The quarry has been divided in two quarries i.e.

Quarry-I & Quarry-II. Out of 146.36 Mm^3 of OB, 77.08 Mm^3 of OB is in quarry-I while 69.28 Mm^3 of OB is in quarry-II.

The top 0-15 m thickness of OB in quarry area is mostly sandy. Out of 77.08 Mm^3 OB in quarry-I, 24.71 Mm^3 is sandy soil and rest 50.37 Mm^3 is hard OB. It is proposed to dump 20.50 Mm^3 sandy soil of quarry-I on coal bearing area of quarry-II which will be reclaimed in later stage. 33.87 Mm^3 hard OB will be dumped in external OB dump and balance 4.21 Mm^3 sandy soil will be dumped in external OB dump in 60-90 m layer. 0.91 Mm^3 hard OB of quarry-I will be used for construction of embankment against Chandrabhaga river and proposed diverted route of seasonal nala. Rest 17.59 Mm3 OB (77.08-20.50-33.87-4.21-0.91) of quarry-I will be dumped in internal dump in quarry-I.

The entire OB of quarry-II will be dumped in de-coaled void of quarry-I & II. Moreover, 20.50 Mm^3 sandy soil dumped on coal bearing area of quarry-II will be rehandled on external dump (3.04 Mm^3) and internal dump (17.46 Mm^3). Thus total OB in internal dump works out to 104.33 (17.59+69.28+17.46) Mm^3 which is 71.28 % of total OB of proposed Adasa UG to OC mine.

Kolar river is flowing in northern side of property at a distance of about 1.5-2.0 km. The HFL of Kolar river is not known. However, if HFL of Kolar river is higher than the general surface RL of Adasa block, then, an embankment (6m above HFL) will be required to be constructed for safety of the mine.
In the rise side (northern side) of the proposed Adasa OC block , non coal bearing area exists , hence external dumping of OB for Adasa UG to OC mine is proposed in rise side (northern side) of proposed Adasa UG to OC.

The capacity of different External and Internal Dumps are as follows :

Sl. No.	OB Dump	Height of Dump	Type of Dump	Dump Capacity (Mm^3)	Location
1.	External Dump	0-60m	Hard OB	33.87	External Dump in north-east side of Quarry on non-coal bearing area
		60m-90m	Top / Sandy Soil	7.25	

	Sub-Total (External dump)			**41.12**	
2	Embankment	6m above HFL	Hard OB	0.91	Along Chandrabhaga river and diverted nala
3	Internal Dump	Below Ground & Heightened to merge with external dump.	Loose Top/ sandy Soil & Hard OB	104.33	In the void of Quarry-I & II
Total (External Dump incl Embankment)				**42.03**	**(28.72%)**
Total (Internal Dump)				**104.33**	**(71.28%)**
TOTAL (EXTERNAL + INTERNAL)				**146.36**	

7.3.1 DUMPING ARRANGEMENTS

Two dumps (one 30m high temporary dump for dumping of sandy / top soil having capacity of 20.50Mm^3 on coal bearing area of quarry-II & another permanent external dump 90m high for dumping of OB having capacity of 41.12 Mm^3) have been proposed in the PR for Adasa UG to OC mine. The maximum height of external dump above ground level is proposed to be kept as 90m and maximum height of sandy soil OB dump above ground level is proposed to be kept as 30m.

In the void of quarry, 104.33 Mm^3 of OB is proposed to be backfilled. However, scientific study for slope stability of external dump and internal dump is proposed for optimum design of dump considering safety of mine. Each layer of 30m OB dump is proposed with two tiers of 15m height for slope angle of 37^0 and berm width of 6 m). Between two layers of OB dump of 30m height a berm width of 30m has been proposed.

About 135 ha void area is proposed to be left at the end of mine life.

8.0 MINING SCHEDULE & EQUIPMENT PHASING

8.1 DESIGN CRITERIA

Project Report for Adasa UG to OC mine envisages 330 days of working in a year based on 7 days schedule of mine working. As per the prevalent practice in WCL, there will be 3 working shifts in a day each of 8 hours duration. The excavation category of OB material has been assumed as 50% Category III + 50% Category IV. Whereas, for Coal it is assumed as Category IV. The insitu volume weight of OB material has been assumed as 2.1 t/m^3 whereas for coal it is assumed as 1.60 t/m^3.

8.2 ANNUAL PRODUCTIVITY OF HEMM WITH DIFFERENT LEAD

The entire coal and OB will be extracted through outsourcing agency and therefore, the productivity of HEMM will depend on the HEMM to be deployed by outsourcing agency. However, the lead for coal and OB has been estimated based on quarry and dump profile and distance of dump from quarry.

Based on the quarry profile, dump location & distance between different cuts of quarry & dumps, the following haul distances have been assessed for OB and coal.

Sl. No.	COAL / OB	LEAD
i)	For Coal (Maximum)	2.50 km
ii)	For OB (Average)	2.75 km

8.3 CALENDAR PROGRAMME OF EXCAVATION

The calender programme of excavation has been envisaged considering cutwise quantities. Initially excavation has been proposed in Quarry-I and after exhaustion of reserves in Quarry-I, excavation has been proposed in Quarry-II. The target capacity of mine has been kept as 1.50 Mty considering geo mining parameters and annual rate of deepening. The initial three years period has been kept for land acquisition. Coal production is envisaged from fourth year and target capacity is envisaged in 8^{th} year.

CALENDAR PROGRAMME OF EXCAVATION (TOTAL HIRING OPTION)

YEAR	Coal (Mt)		Natural OB (Mm^3)		Programmed OB (Mm^3)		SR (m^3/t)	Rehan-dling of OB
	Yearly	Cum.	Yearly	Cum.	Yearly	Cum.		
1 - 3	Land Acquisition							
4	0.10	0.10	2.93	2.93	3.50	3.50	35.00	0.00
5	0.50	0.60	8.12	11.05	9.00	12.5	18.00	0.00
6	0.80	1.4	12.99	24.04	11.60	24.1	14.50	0.00
7	1.20	2.6	10.26	34.29	11.60	35.7	9.67	0.00
8	1.50	4.1	8.80	43.10	8.25	43.95	5.50	0.00
9	1.50	5.6	8.80	51.90	8.25	52.2	5.50	0.00
10	1.50	7.1	7.00	58.89	8.25	60.45	5.50	0.00
11	1.50	8.6	5.24	64.13	6.75	67.2	4.50	0.00
12	1.50	10.1	5.24	69.37	6.75	73.95	4.50	1.50
13	1.50	11.6	5.24	74.61	6.75	80.7	4.50	1.54
14	1.50	13.1	9.41	84.02	6.75	87.45	4.50	5.38
15	1.50	14.6	13.16	97.18	11.60	99.05	7.73	5.38
16	1.50	16.1	13.10	110.28	11.60	110.65	7.73	2.23
17	1.50	17.6	10.79	121.07	11.60	122.25	7.73	2.23
18	1.5	19.1	10.44	131.51	11.60	133.85	7.73	2.24
19	1.5	20.6	7.48	138.99	7.50	141.35	5.00	0.00
20	1.48	**22.08**	7.38	**146.36**	5.01	**146.36**	3.39	0.00
TOTAL	**22.08**		**146.36**				**6.63**	**20.50**

8.4 DUMPING SCHEDULE

Yearwise schedule of OB dumping as per calendar programme of excavation proposed in Total hiring option is as shown in Table below:

Schedule of OB Dumping

Year	Quarry	Programmed OB (Mm^3)	Emban-kment (Mm^3)	Sandy soil Dump (Mm^3)	External Dump (Mm^3)	Backfilling (Mm^3)	
						By insitu OB	By Rehandling of Sandy Soil
1	Land Acquisition						
2	Land Acquisition						
3	Land Acquisition						

4	Q - I	3.50	0.91	0.99	1.60	0.00	0.00
5	Q - I	9.00	0.00	5.81	3.19	0.00	0.00
6	Q - I	11.60	0.00	2.74	8.86	0.00	0.00
7	Q - I	11.60	0.00	2.74	8.86	0.00	0.00
8	Q - I	8.25	0.00	2.74	5.51	0.00	0.00
9	Q - I	8.25	0.00	2.74	3.01	2.50	0.00
10	Q - I	8.25	0.00	2.74	2.84	2.67	0.00
11	Q - I	6.75	0.00	0.00	1.50	5.25	0.00
12	Q - I	6.75	0.00	(-) 1.50	1.50	5.25	1.50
13	Q - I	3.13	0.00	(-) 1.54	1.21	5.54	1.54
	Q - II	3.62					
14	Q - II	6.75	0.00	(-) 5.38	3.04*	6.75	2.34
15	Q - II	11.60	0.00	(-) 5.38	0.00	11.60	5.38
16	Q - II	11.60	0.00	(-) 2.23	0.00	11.60	2.23
17	Q - II	11.60	0.00	(-) 2.23	0.00	11.60	2.23
18	Q - II	11.60	0.00	(-) 2.24	0.00	11.60	2.24
19	Q - II	7.50	0.00	0.00	0.00	7.50	0.00
20	Q - II	5.01	0.00	0.00	0.00	5.01	0.00
Total		**146.36**	**0.91**	**0.00**	**41.12**	**86.87**	**17.46**

* By Re-handling of OB

The total quantity of backfilling OB works out to 104.33 Mm^3 out of total OB of 146.36 Mm^3 which works out to 71.28%. The hiring charges for rehandling of OB has been considered as Rs 54.03/m^3 for planning purpose.

8.5 HIRING OF HEMM / SCHEDULE OF HEMM AND EXPENDITURE ON HIRING

8.5.1 Scope of Work Proposed to be Outsourced

The scope of work by hiring/outsourcing of HEMM shall include blast hole drilling, earth work excavation, loading, transportation, dumping, dozing, maintenance of haul road, leveling at dumping sites, water spraying and land reclamation etc. as per guidelines of the project authorities highlighted in this project report or otherwise to suit the local conditions. All statutory rules,

regulations and applicable laws are to be followed including those related to government licenses, workmen compensation, service tax, insurances etc.

Excavated materials shall have to be dumped at sites, which will be shown by project authorities from time to time in accordance with dump plan of this report. Similarly coal has to be transported upto coal stock yard/CHP.

Haul road has to be maintained with the requisite gradient as per regulation and in accordance with the conditions imposed by DGMS in its permission under regulation 98(1) and (3) and other relevant provisions of Coal Mines Regulations, 1957.

8.5.2 Scope of Work Proposed to be done Departmentally

Blasting operation, surface illumination and pumping facilities would be provided departmentally.

8.5.3 Population of Departmental HEMM

Population of major common departmental HEMM provided in Total Hiring option are as follows :

Population of Major HEMM

Sl. No.	HEMM	Nos.
I.	**For Common**	
1.	8-12 t Mobile Crane	1
2.	Fire fighting Truck	1
3.	2.8 m^3 Diesel Hyd. Backhoe	1
4.	4.0-6.0 m^3 Front End Loader	1
5.	Water Sprinkler 28 kl	1

8.5.4 Annual Work Load for Hiring / Outsourcing Agency

The annual workload for external agency would be as per calendar programme of excavation for total hiring as tabulated below :

Year	Coal (Mt)		Natural OB (Mm^3)		Programmed (Mm^3)		RH of OB (Mm^3)
	Yearly	Cumml.	Yearly	Cumml.	Yearly	Cumml.	
IV	0.10	0.10	2.93	2.93	3.50	3.50	0.00
V	0.50	0.60	8.12	11.05	9.00	12.5	0.00
VI	0.80	1.4	12.99	24.04	11.60	24.1	0.00
VII	1.20	2.6	10.26	34.29	11.60	35.7	0.00
VIII	1.50	4.1	8.80	43.10	8.25	43.95	0.00
IX	1.50	5.6	8.80	51.90	8.25	52.2	0.00
X	1.50	7.1	7.00	58.89	8.25	60.45	0.00
XI	1.50	8.6	5.24	64.13	6.75	67.2	0.00
XII	1.50	10.1	5.24	69.37	6.75	73.95	1.50
XIII	1.50	11.6	5.24	74.61	6.75	80.7	1.54
XIV	1.50	13.1	9.41	84.02	6.75	87.45	5.38
XV	1.50	14.6	13.16	97.18	11.60	99.05	5.38
XVI	1.50	16.1	13.10	110.28	11.60	110.65	2.23
XVII	1.50	17.6	10.79	121.07	11.60	122.25	2.23
XVIII	1.5	19.1	10.44	131.51	11.60	133.85	2.24
XIX	1.5	20.6	7.48	138.99	7.50	141.35	0.00
XX	1.48	**22.08**	7.38	**146.36**	5.01	**146.36**	0.00
TOTAL	**22.08**		**146.36**				**20.50**

8.5.5 Outsourcing Rates

The cost of OB removal and coal extraction by hiring/outsourcing of equipment depends on type of strata and lead. In the proposed mine, the strata under consideration is medium hard strata.

The rates for OB & Coal by hiring/outsourcing of equipment for the proposed

mine have been estimated on the basis of FD approved rates of WCL with escalation in diesel rate (Rs 56.75/litre). Accordingly, rates for excavation for hiring/ outsourcing of HEMM is being adopted in this report for planning purpose and economic evaluation of the project. These rates may vary at the time of actual implementation. The rates include excavation, transport, drilling, dozing at face & dumps, haul road maintenance, water spraying etc. It is also suggested here that before awarding the work to hiring agency, geological structure should be further confirmed by drilling additional boreholes.

Lead for OB, has been calculated for each cut on weighted average basis keeping into account the OB dumping programme. However, if location or schedule of dumping changes due to any reason, then yearwise lead may changes. . The average hiring rate for excavation of Coal & OB excluding service tax has been shown at Table below :

Outsourcing Rates

Year	Coal (Mt)	Lead (km)	Rate (Rs /t)	OB removal (Mm^3)	Average Lead (km)	OB removal rate (Rs /m^3)	RH of OB (Mm^3)	Hiring rate for RH (Rs/m^3)
IV	0.10	1.25	30.32	3.50	2.00	58.08	0.00	0.00
V	0.50	1.25	30.32	9.00	2.00	58.08	0.00	0.00
VI	0.80	1.50	31.85	11.60	2.25	59.83	0.00	0.00
VII	1.20	1.50	31.85	11.60	2.50	61.58	0.00	0.00
VIII	1.50	1.75	32.65	8.25	2.75	63.33	0.00	0.00
IX	1.50	1.75	32.65	8.25	3.00	65.08	0.00	0.00

Year	Coal (Mt)	Lead (km)	Rate (Rs /t)	OB removal (Mm^3)	Average Lead (km)	OB removal rate (Rs /m^3)	RH of OB (Mm^3)	Hiring rate for RH (Rs/m^3)
X	1.50	2.00	33.45	8.25	3.25	66.84	0.00	0.00
XI	1.50	2.25	35.01	6.75	3.00	65.08	0.00	0.00
XII	1.50	2.50	36.57	6.75	3.00	65.08	1.50	54.03
XIII	1.50	2.50	36.57	6.75	2.75	63.33	1.54	54.03
XIV	1.50	2.00	33.45	6.75	2.50	61.58	5.38	54.03

XV	1.50	1.50	31.85	11.60	2.50	61.58	5.38	54.03
XVI	1.50	1.75	32.65	11.60	2.50	61.58	2.23	54.03
XVII	1.50	2.00	33.45	11.60	2.50	61.58	2.23	54.03
XVIII	1.50	2.25	35.01	11.60	2.50	61.58	2.24	54.03
XIX	1.50	2.50	36.57	7.50	2.50	61.58	0.00	0.00
XX	1.48	2.50	36.57	5.01	2.50	61.58	0.00	0.00

Above Rates (excluding service tax)for hiring of HEMM are being adopted for purpose of economic evaluation of the project during planning stage and these rates may vary during actual implementation stage.

8.6 DRILLING & BLASTING

For drilling in overburden, with a bench height of 10 m, the burden has been assumed as 4 m and spacing of 5m. For coal extraction, depending upon the thickness of seam, bench height from 1.5 m to 4.5 m is being proposed. Powder factor of 3.04 m^3/kg for OB and 7.80 t/kg for Coal has been considered for blasting for planning purpose based on actual field data from Inder UG to OC mine.. However at the time of operation of mine, drilling parameters have to be optimized on the basis of size of HEMM, actual field trial depending upon joint pattern, bedding plane and local geology of the blast site and accordingly powder factor for OB & coal may be deviated after final trial of blasting.

9.0 COAL QUALITY

9.1 SEAM WISE QUALITY

The actual quality data of different seams based on actual determination are not available. However, in view of variation in quality of different workable seams, the weighted average GCV has been estimated on the basis of calculated basis considering workable thickness and their respective geological reserves.

The seam wise quality of coal (GCV) of the workable seams in the proposed Adasa UG to OC mine are tabulated below:

OVERALL QUALITY OF SEAMS

Seam Name	Range of GCV (kCal/kg) & Grade		
	Minimum	Maximum	Average
Seam-V	3995 (G-12)	4415(G-10)	4233(G-11)
Seam-IV(T)	3195 (G-14)	5496(G-7)	5367(G-7)
Seam-IV(T)A	3499(G-13)	4523(G-10)	3995(G-12)
Seam-IV(M)	4660(G-9)	5610(G-6)	5258(G-7)
Seam-IV(B)	3228(G-14)	5380(G-7)	5300(G-7)

The weighted average GCV of coal has been assessed for the proposed mine which works out to **5020 kCal/kg (Grade G-8).**

10.0 PUMPING AND DRAINAGE

The Pumping capacity required at the time of five years after reaching the target has been calculated as under:-

Sl. No.	PARTICULARS	CALCULATED DATA
1	Max. Exposed Area (m^2)	
2	Exposed Area of Mine after backfilling (target plus 5 years), (m^2)	1000000
3	Area beyond excavation (5% of item No.2) (m^2)	50000
4	Backfilled Area (target plus five years), (m^2)	600000

Sl. No.	PARTICULARS	CALCULATED DATA
5	Run-off co-efficient for:-	
	(a) Open excavation	0.7
	(b) Beyond excavation	0.1
	(c) Infiltration Co-efficient for Backfilled area	0.2
6	Probable Max. rainfall in a day (mm)	170
7	Water collected into the quarry by direct rainfall (m^3)	140250
8	Required pumping capacity to handle the whole rain water in 100 hrs. (lps)	390
9	Required pumping capacity to handle the	59

	seepage water (lps)	
10	Total pumping capacity required to handle the whole water of the mine (lps)	449

Pumping system has been designed for the volume of water accumulated in the mine at the target plus five year production considering maximum rainfall in a day as 1**70**mm.

The water accumulated in quarry based on maximum rainfall in a day & strata seepage is 161288 m^3. Hence, the Peak pumping capacity worked out as **161288** m^3.
Above volume of water will be dewatered in **5** days at the rate of **20** hrs pumping per day.
Pumping capacity per day thus worked out as **32258 m^3 per day.**

10.1 SELECTION OF PUMPS DELIVERY RANGES

(i) Nine pumps of 80 lps x 120m head have been proposed. Out of Nine pumps, three pumps are standby.

(ii) Five face pumps with anticorrosion impellor of 11 lps x 30 m head have been envisaged in this report and out of five pumps, one is standby.

(iii) One diesel engine operated pump set of 80 lps X 60m head has been proposed.

(iv) Three delivery ranges of 219 mm dia. Have been proposed for main pumps of 80lps x 120m head and maximum two pumps will be connected in each delivery.

(v) Two delivery ranges of 168.3 mm dia. Have been proposed for auxiliary pumps 80 lps x 120m head separately.

(vi) 80 mm dia. G.I. pipe will be used for face pumps. No piping provision has been made for standby pumps.

11.0 COAL HANDLING & DESPATCH ARRANGEMENTS

11.1 INTRODUCTION

A small coal handling plant has been proposed to handle the entire production of coal from mine. Location of the CHP has been proposed near access trench of quarry-II as shown in Quarry & Surface layout Plan. However, exact location of CHP will depend upon site conditions. In the Planning Committee meeting held at WCL (HQ) on 16.03.2015, it was proposed for hiring of CHP, however details of CHP will be as follows:

Salient Features of CHP are summarized below:

a) Two Nos. Integrated Feeder breaker with secondary sizer of 600 tph for crushing of coal to (-) 100 mm size

b) Conveying of coal by 1400 mm wide belt conveyor

c) Storage of coal in a 4 x 100 t capacity overhead hoppers

d) Despatch of coal on road by trucks

e) Dust suppression and fire extinguisher system

f) Power supply, illumination and control systems

g) Civil and structural cost

h) Weighment of coal with the help of road weighbridge

11.2 Railway Siding

Crushed coal of mine will be transported by trucks to B G Siding, Saoner.

12.0 WORKSHOP & STORES

12.1 WORKSHOP

All the HEMM deployed in this mine will be hired and their maintenance will be contractor's responsibilities. Hence, there is no provision of unit excavation workshop has been made in this report.

E & M Workshop

E & M workshop, facilities have been provided to carry out the maintenance and repair of the equipment, pumps, electrical etc. of the mine. This E & M workshop will be supported by Regional/Central workshop for major repairs and parts manufacture. Facilities provided in E&M workshop are machine shop, mechanical repair shop, electrical repair shop, welding and structural section, etc. Necessary provision for plant and machinery, tools, testing equipment etc. has been provided in respective shops for efficient repair and maintenance of the mine equipments.

12.2 Stores

Unit store will cater the routine needs of consumables, spares, POLs etc.

13.0 POWER SUPPLY

The projected maximum demand for the proposed Adasa UG to OC project (including residential) is 1444 kVA. Industrial demand excluding residential demand is approx.1340 kVA. Residential demand will be met by a separate metering point at Saoner WCL substation.

Presently, Adasa UG project is receiving power from Saoner WCL 2 x 5.0 MVA, 33 / 11 kV substation. Saoner sub area is having a contract demand of 4700 kVA and the actual demand is also in the same range. Adasa UG has a maximum demand of nearly 700 kVA. Thus, to feed power from this existing substation, the contract demand will have to be raised. At present, MSEDCL supply power more than 1500 kVA and upto 5.0 MVA at 33 kV. The projected demand will be greater than 5.0 MVA with addition of new project. MSEDCL has suggested that contract demand for existing 33 kV metering point may be increased beyond 5.0 MVA. Thus power supply for the project is envisaged at 11 kV. The existing 11 kV feeder for the Adasa UG may be rerouted and extended to feed power to main substation of the proposed project, to be constructed at a suitable location near access trench. A 11 / 3.3 kV substation has been provided to cater the load requirement of all the equipment.

13.1 SALIENT FEATURES OF THE ELECTRICAL PARAMETERS :

Sl. No.	ITEM HEAD	TOTAL HIRING OPTION
1	PROJECTED MAXIMUM DEMAND	
A)	ONLY MINE	1340 kVA
B)	ONLY TOWNSHIP	104 kVA
C)	TOTAL	1444 kVA
2	SPECIFIC ENERGY CONSUMPTION	
A)	WITH RESPECT TO OB PRODUCTION	Nil
B)	WITH RESPECT TO COAL PRODUCTION	1.19 kWh/t
C)	WITH RESPECT TO COMMON LOAD	2.06 kWh/t
D)	WITH RESPECT TO TOTAL LOAD	3.25 kWh/t
3	SPECIFIC POWER COST	29.64 Rs./t
4	FIXED PERCENTAGE OF POWER COST	61.08 %
5	VARIABLE PERCENTAGE OF POWER COST	38.92 %
6	AVERAGE COST OF PURCHASED POWER	9.12 Rs./kWh

14.0 CIVIL CONSTRUCTION

The Building Cost Index for Maharashtra Region has been worked out to 560 in 2015 (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.

14.1 SERVICE BUILDINGS

Keeping in view the uses of existing service buildings and additional requirements of this mine, provision for service buildings such as E & M Workshop, Sub-station, statutory buildings, community buildings, other service buildings have been provided.

14.2 RESIDENTIAL BUILDING

Total manpower proposed for this project is 128. Considering the necessity of the project and number of existing quarters, no additional quarters is required.

14.3 ROADS AND CULVERTS

As there is no provision of colony in total hiring option, no colony road has been provided. For transportation of coal by 35 T dumpers, provision of Haul road of 2.0km length and for transportation/haulage of over burden by 35 T dumpers provision of Haul Road of 2.5 km length has been made in PR. For approaching OC mine 2.00 km length of sector road of stratum 'D' has been proposed as approach road to project sight. Accordingly, provision for approach roads have been made in PR. For approaching different Service Buildings 1.0 km. long Sector Road on Stratum `D' specification with culverts, drain, tree guards etc. has been proposed.

1.5 km length of Stratum 'B' with culverts, drains etc has been proposed for Diversion of village road (Adasa village to Patan Saongi).

14.4 WATER SUPPLY & SEWERAGE

Water supply arrangements have been envisaged for project/mine only. The total water requirement for project site has been worked out to 230 Kl in Total hiring option. However **water demand of Departmental option i.e. 390 Kl has been proposed.** Water demand for project site includes water to be supplied for dust suppression, fire fighting, water sprinkling on roads, etc

Sub-soil water through bore well has been proposed to be conveyed to O.H. reservoirs via ground sumps. Further, water from O.H. reservoir shall be supplied under gravity to different buildings after chlorination.

To avoid any discharge of effluent into natural watercourses, sewage disposal arrangement has been envisaged. Estimated amount for sewage disposal arrangement in colony site and project site along with required surface drains has been given in PR. However, final economical scheme may be formulated after detailed survey & engineering considering the site parameters.

14.5 NALA DIVERSION

Provision has been made for diversion of 3.00 km nala. In absence of detailed data from the project, bottom width of nala is taken as 50.00 m for which necessary cost provision made in PR.

15.0 SAFETY AND CONSERVATION

15.1 SAFETY FROM INUNDATION

In the rise side (North-East) of mine, Kolar river is flowing at about 1.5-2.0 km from the proposed surface edge of quarry. The HFL of this river is not known. It is suggested that considering HFL of Kolar river, if required, an embankmemt may have to be constructed against Kolar river. However, provision of embankment has not been made in this PR.

A Seasonal Nala is flowing over the property, which has to be diverted. Chandrabhaga river is flowing in the dip side of property, through Silori Block. The HFL of seasonal nala and Chandrabhaga river is not known, hence, considering safety of mine from the nala & river, provision of flood protection embankment has been made. Surface water would be channelized through proper garland drains.

15.2 DUST SUPPRESSION

For suppression of dust water sprinklers have been provided. Suppression of mine dust may be done by using package bond & dust bond, for methodology of application DGMS Circular No.8 of 1997 may be referred.

15.3 SAFETY FROM FIRE AND SPONTANEOUS HEATING

The project report proposes extraction of standing pillars from seam-IVM and seam IVB of Adasa UG mine by opencast method. The incubation period of this coalfield is reported to vary between 3 to 6 months. There may be spontaneous heating of coal in underground galleries near the quarry coal face due to leakage of air and fire may broke-out as soon as these galleries are exposed. It is proposed to lay water pipeline along the strike length on the dip side of quarry so that flexible hoses can be taken out from `T' points of the pipeline for immediate quenching of the fire in coal galleries/pillars. In addition to this, a fire retardant Bitumen based sealant which is in the approved list of DGMS can be used in the coal benches to minimize leakage of air and thereby reduce incidence of occurrences of fir due to spontaneous heating.

While extracting pillars by opencast method, precautions against coal dust explosion as specified in DGMS Circular No.4 of 1983 should be adhered to.

Wild or herbaceous plants shall be removed from the mine. No person shall deposit heated material or ashes on any opencast working. No person shall light a fire or permit a fire to be lighted in any OC working except by the permission in writing of the Manager and only for a special purpose specified therein. No coal shall be left exposed in coal benches more than its incubation period to avoid fire in seam due to spontaneous heating. Proper type of the extinguisher should be kept in each HEMM ready for use in case of emergency. In stock, coal shall be dispatched on the basis of first in first out.

15.4 SLOPE STABILITY

It is suggested that following action may be taken to deal with slope stability problem.

i) Vulnerable area may be identified and marked on quarry plan.

ii) Observation of actual alignment of fault planes, its throw, joints, etc. may be recorded during the process of exploitation.

iii) Water drainage system may be properly implemented to prevent accumulation of water in cracks. Also dumps should be leveled to prevent accumulation of water over it. Proper drainage in dumps should be also provided to prevent erosion of toe of dump. Regular monitoring of tension cracks, horizontal and vertical movement of strata in critical area may be done.

iv) Undercutting of slopes should not be done.

v) Proper hydro geological studies to be done if water table is at level of slope, it should be brought down by using submersible pumps to prevent hydrostatic pressure.

vi) Proper selection of site for dumping to be done. Before dumping place should be made free from loose material. Dumping should be done in layers/stages.

vii) After completion of dumping operations dumps to be stabilized by growing suitable vegetation.

15.5 HAUL ROAD MAINTENANCE

In this PR, haul road shall be constructed and maintained from time to time. It will be maintained by hiring agency in partial hiring and total hiring option. Safe distance between the haul road and the toe of the backfill shall be maintained.

15.6 PRECAUTIONS FROM BLASTING

Special precautions has to be taken while performing blasting operations to avoid from fly rock. Controlled blasting may be done wherever required. A scientific study for blasting has been proposed and the recommendation of this study will be implemented in the mine.

15.7 SAFETY ASPECTS FOR OUTSOURCING/HIRING OF HEMM

Special precaution should be taken while employing contractual labours in the mine. Before employing them to the mine proper vocational training should be imparted and recommendations of Safety Conferences should be strictly followed. Terms and conditions shall be fixed by management for deployment of contractual labours as well as machineries. Some of the major aspects are as follows :

A) For persons :

i) Records in Form-B & Form-E shall be maintained.

ii) Records of driving licence of operators shall be kept by Operators and readily available for inspection by management.

iii) Salaries shall be distributed in front of management representative

iv) No person shall be employed unless person holds VTC certificate and Management is informed.

v) Adequate supervision shall be maintained by competent person.

B) For Machineries :

i) All the machineries to be deployed in mines should be inspected & passed by the management.

ii) RTO certificate photo copies of all vehicles shall be submitted to

management.

iii) Daily welding, monitoring, inspection shall be done by contractor's mechanic as directed by management. Machine manufacturers should be asked to give risk analysis.

C) General :

i) No person/vehicle shall be deployed at any place other than authorized place.

ii) All employees of contractors should obey lawful instruction of mine management.

15.8 CONSERVATION OF COAL

Quarry limits are fixed in such a way to exploit maximum possible coal. Although for calculation of mineable coal reserves 5% mining losses has been taken into account, but in practice all efforts would be made to minimise the losses.

OB benches would be kept sufficiently advanced to avoid mixing of coal & OB. Maximum possible backfilling is proposed in mine.

15.9 SCIENTIFIC STUDIES

Provision for scientific studies regarding Slope stability & Hydro-geological study etc. have been made in this PR. It is suggested that before starting of backfilling operation, scientific studies have to be conducted for design of backfill dump and to find out safe distance between working face and toe of backfill dump.

16.0 ENVIRONMENTAL MANAGEMENT

This mine is an operating UG mine. MOEF has accorded Environmental clearance for the production capacity of 0.21 MTPA within land Area of 221 ha Vide letter No – J 11015/36/ 99 – IA – II (M) dt – 19/5/2000. Further Ministry of Environment & Forest has accorded Environmental Clearance for the Adasa underground coal mine expansion from its capacity 0.21 to 0.50 MTPA rated capacity involving the 221 ha land under section 7(ii) of the Environment Impact assessment Notification 2006 and subsequent amendment and circulars, thereof Vide letter No – J – 11015 / 341 / 2008 – IA – II (M) dt – 15/7/2009.

16.1 AIR QUALITY MANAGEMENT

Ambient Air quality of the Adasa UG is being regularly monitored as per Environmental Protection Amendment Rules 2000, and the same would be continued for the proposed OC project after starting of the project.

Ambient Air Quality will be controlled by black topping of roads, water spraying on roads, biological reclamation of OB dumps, green belt around CHP, OB dump, and along coal transportation roads on both sides etc.

16.2 WATER QUALITY MANAGEMENT

Adasa UG is an operating mine. The control measures like provision of settling tank for mine water discharge; Effluent Treatment Plant, etc. will be constructed for the proposed Adasa UG to OC mine, as is being done in the nearby existing projects of WCL. The regular Water Quality Monitoring as per Environment Protection Amendment Rules, 2000 is being done, and the same would be carried out for the proposed project after getting statutory clearances.

Mine pumped out water, after sedimentation, will be utilized within mine premises and balance will be used for supplementing any shortage of water in the nearby villages. Effluent from workshop will be treated in ETP & thereafter recycled. Similarly, water from CHP, after sedimentation will also be recycled.

16.3 NOISE MANAGEMENT

Control measures for noise management will be undertaken as is being done in the existing OC projects of WCL. The worker exposed to high noise level will be provided with earplugs & ear muffs. Proper enclosure and regular maintenance of equipment will be done. Plantation along road and around industrial & service building will be done to reduce the noise level.

The regular Ambient Noise Quality monitoring as per Environment Protection Amendment Rules, 2000 is being undertaken in near by mines and the same would be carried out for the proposed project after getting statutory clearances.

16.4 FLORA AND FAUNA MANAGEMENT

Adequate plantation has been proposed with native species to maintain the diversity and also to attract the fauna.

16.5 LAND RESOURCE MANAGEMENT

Regarding land use during mining, in addition to excavation of quarry for coal, overburden dump will be created along with development of other mine related infrastructures. Overburden dump is proposed to be technically and biologically reclaimed and sufficient greenery will be developed.

16.6 ENVIRONMENT MANAGEMENT SYSTEM

To have a close watch on the environmental condition and implementation of the various measures suggested, a multi- disciplinary approach is essential. At present WCL headquarter acts as apex body which supervises the activities relating to environment at project level through the General Manager. General Manager of the area coordinates the activities of various disciplines in the area to render all necessary assistance at the implementing level i.e. the project. Area Nodal Officer (Environment) monitors all aspects of environment on behalf of the General Manager. He also takes suitable steps for generation of environment data along with its analysis and interpretations.

As far as plantation is concerned horticulturist with suitable backup staff is provided in the area for undertaking the plantation jobs including rising of a nursery.

Sub-Area Manager is responsible for mechanical reclamation of the area. He is also responsible for biological reclamation with the assistance of GM's office.

16.7 CAPITAL PROVISION

A capital provision of Rs. 97.09 lakhs has been made against environment protection . In addition to this, Rs. 6.00/t has been considered in the report for revenue expenditure related to environmental activities in the mine.

17.0 LAND REQUIREMENT

The requirement of land to be acquired has been worked out on the basis of part of Khasra plan & land records provided by Nagpur area. Proposed lease hold boundary has been shown in quarry & surface layout plan. The total land requirement for proposed Adasa UG to OC mine is 596.27 ha including existing land of 12.66 ha.

17.1 TYPE OF LAND

The tentative break up of type of land proposed to be acquired for Adasa UG to OC mine is as follows :

Type of Land

Sl. No.	Particulars	Existing Land (ha)	Additional land (ha)	Total Land (ha)
1)	Tenancy land	3.83	532.52	536.35
2)	Government land	8.83	21.09	29.92
3)	Forest land	0.00	0.00	0.00
	SUB TOTAL	**12.66**	**553.61**	**566.27**
4)	Land for Kotodi & Yerangaon village rehabilitation	0.00	30.00	30.00
	TOTAL	**12.66**	**583.61**	**596.27**

17.2 LAND USE OF THE PROJECT

The land use required for the project is as follows:

Sl. No.	Particulars	Area (ha)
1.	Quarry Area	313.93
2.	External OB dump	91.50
3.	Infrastructure	12.00
4.	Embankment	14.00
5.	Area needed for rationalization and blasting zone	134.84
6.	Colony land	0.00
7.	Land for Kotodi & Yerangaon village rehabilitation	30.00
	Total Land	**596.27**

Rate for tenancy land has been considered @ Rs 10 lakh/acre and rate for government land has been considered @ Rs 6 lakh/acre. The detailed estimation about capital provision has been provided.

17.3 STATUS OF FORESTRY CLEARANCE

No forest land has been envisaged in the proposed PR.

17.4 COMPENSATION & REHABILITATION

Payment of one time monetary compensation for 50 % of tenancy land has been considered in this PR. However in lieu of one time monetary compensation, employment can be proposed by WCL for balance land as per revised CIL R & R policy. It is contemplated that the entire exercise of land acquisition shall be completed in first five years of project. However coal extraction and OB removal has been proposed from 4th year. Tentative Capital provision has been provided for rehabilitation & resettlement of Kotodi & Yerangaon Villages.

18.0 MINE CLOSURE PLANNING

Mine closure planning has to be done at the starting point of the mining operations and needs periodic review and revision during its life cycle to cope with the market due to geo-technical constraints, safety and economic risks, social & environmental challenges. In the proposed Adasa UG to OC mine, necessary provision has been kept towards mine closure based on latest guidelines of MOEF. The closure cost works out to Rs. **38.56/t.**

The mine closure cost will cover the different mine closure activities for which a corpus fund will be created by opening an escrow account with the coal controller organization in nationalised bank. In case of occurrence of acid mine drainage, post closure acid mine drainage management cost shall also be included in the total closure cost. An amount @ Rs 6.00 lakhs per Ha of the project area will be deposited in this account for final mine closure. Progressive mine closure will be done with the fund provided in approved report. The life of the project is 17 years (excluding initial 3 years period of pre-construction period for land acquisition) and mine closure fund has been assessed based on this project life. As such the progressive closure will continue and final mine closure plan will be prepared 5 years before the cessation of mining activity.

The above rate has been taken from Circular No. 55011-01-2009-CPAM, Government of India, Ministry of Coal, Dated 27 August, 2009 duly updated on 7th January, 2013.

Type of Mine	:	Open Cast.
Life of Mine for Closure Plan	:	17 years
Total project area of the mine	:	566.27 ha

The financial provision for closure of Project Report for Adasa UG to OC mine works out to Rs. 8514.92 lakhs (based on February, 2015 WPI @ Rs 6 lakh/ Ha).

18.1 MINE CLOSURE BREAK-UP

The break-up of Mine Closure cost in various mine closure activities is listed in table below :

1. Mining is to be carried out in a phased manner initiating afforestation / reclamation work in the mined out area of first phase while commencing mining in the 2nd phase.

2. Upto 80% of the total deposited amount including interest accrued in the ECSROW account may be released after every 5 years. The amount released should be equal to expenditure incurred on Progressive Mine closure in past 5 years or 80% whichever is less.

3. The above cost/expenditure will be met from the corpus fund deposited in the escrow account by the mine operator. However, the additional amount beyond the escrow account will be provided by the mine operator after estimating the final mine closure cost (as per the mine closure guideline).

4. The amount indicated separately under each head is indicative only and based on actual expenditure the amount may change.

Mine Closure Activities

Sl. No.	Activity	% of Total Mine closure Cost	Amount (Rs.in Lakhs)	Remarks
A	**Dismantling of structures**			To be included in final mine closure plan.
	Service Building	0.2	17.03	
	Residential Building	2.67	227.35	
	Industrial Structures like, Workshop, Field substation, etc.	0.3	25.54	
B	**Permanent Fencing of mine void and other dangerous area**			To be included in final mine closure plan.
	Random rubble masonry of height 1.2 meter including leveling up in cement concrete 1:6:12 in mud mortar	1.5	127.72	
C	**Grading of highwall slopes**			To be included in final mine closure plan.
	Levelling and grading of highwall slopes	1.77	150.71	
D	**OB Dump Reclamation**			
	Handling/Dozing of OB Dump into mine void and preparation of Internal dump for reclamation.	88.66	7549.33	71% for progressive and 17.66% for final mine closure.
	Technical and Bio-reclamation including plantation and post care.	0.4	34.06	Equal Weightage throughout the life of the mine.
E	**Landscaping**			
	Landscaping of the open space in leasehold area for improving its aesthetic and eco value.	0.3	25.54	Equal Weightage throughout the life of the mine.
F	**Plantation**			
	Plantation over cleared area obtained after dismantling.	0.5	42.57	To be included in final mine closure plan.
	Plantation around the quarry area and in safety zone.	0.2	17.03	Equal Weightage throughout the life of the mine.
	Plantation over the external OB Dump	0.02	1.703	Equal Weightage throughout the life of the mine.
G	**Post Closure Env Monitoring/Testing of Parameters for three years.**			For three years after mine closure
	Air Quality	0.22	18.73	
	Water Quality	0.2	17.03	
H	**Entrepreneurship development (vocational/ skill development) Training for sustainable income of affected people**.	0.26	22.14	Equal Weightage throughout the life of the mine.
I	**Miscellaneous and other mitigative measures.**	2	170.30	Equal Weightage throughout the life of the mine.
J	**Post Closure Man power cost for supervision**	0.8	68.12	To be included in final mine closure plan.
TOTAL		**100%**	**8514.92**	

18.2 ESTIMATE OF PROPOSED ESCROW FUND

The total project area involved in Adasa UG to OC mine excluding land for rehabilitation of villages is 566.27 Ha. So the corpus as on August, 2009 works out to Rs 3397.62 Lakhs @ Rs 6.0 Lakh /ha of project Area. The wholesale price Index in August, 2009 is 129.6 and the WPI, for the month of February, 2015 available in the website of Office of Economic Adviser, Ministry of Commerce, Government of India is 175.8. So the current value of corpus in 2014-15 is Rs. 3397.62*175.8/129.6 Lakhs, which comes to Rs. 4608.81 lakhs. This corpus is divided by the life of mine i.e. 17 years (actual start of mining activity i.e. 4th year to end of mine life i.e. 20th year) which works out to Rs 271.11 lakhs in 2014-15. This amount is escalated @ 5% for 4 years to Rs 329.52 lakhs as on 2018-19 (1st year of mining activity or 4th year of mine life). The coal production is proposed to start from 2018-19. This amount is to be deposited in escrow account every year with 5% escalation.

Sl. No.	Financial year	Amount (Rs. 000)
1	2015-16	0
2	2016-17	0
3	2017-18	0
4	2018-19	32952
5	2019-20	34600
6	2020-21	36330
7	2021-22	38146
8	2022-23	40053
9	2023-24	42056
10	2024-25	44159
11	2025-26	46367
12	2026-27	48685
13	2027-28	51119
14	2028-29	53675
15	2029-30	56359
16	2030-31	59177
17	2031-32	62136
18	2032-33	65243
19	2033-34	68505
20	2034-35	71930
	Total	**851492**
Mine Closure cost (Rs./t)		**38.56**

19.0 MANPOWER, PRODUCTIVITY AND TRAINING

19.1 MANPOWER

The manpower requirement in the project Report of Adasa UG to OC mine has been calculated on the basis of 3 shift operation for 330 days in a year. The manpower requirement for the proposed PR for Adasa UG to OC mine has been summarized as follows :

Manpower Requirement

Sl. No.	Particulars	Total Hiring Option
1.	Executives	14
2.	Non-executives:	
i)	Monthly rated staff	49
ii)	Daily rated staff	65
3.	**Total**	**128**

It may be noted that 30 Nos. of manpower for security have been provided on hiring. For civil maintenance works, 8 nos. of manpower in Total Hiring option has been provided.

The break-up of coal, overburden and reclamation wise manpower requirement for the project has been tabulated below :

Breakup of Manpower

Sl. No.	Particulars	Total Hiring Option
1	Coal Production(Mty)	1.50
2	Peak OB removal (Mm^3/y)	11.60
3	Manpower on the basis of group operation	Nos.
i)	Coal	10
ii)	Overburden	22
iii)	Common	94
iv)	Reclamation	2
	Total	**128**

19.1.1 Manpower Phasing

The manpower phasing as per project implementation schedule and production build-up are as follows:

Sl. No.	Option	Strength (Nos.)	I Yr	II Yr	III Yr	IV Yr	V Yr	VI Yr	VII Yr	VII Yr
3.	Total Hiring	128	2	2	2	72	92	102	112	128

19.1.2 Deployment of Surplus manpower

The existing Adasa UG mine has 625 manpower as on 08.07.2015. The manpower requirement for the proposed PR for Adasa UG to OC mine is 128. The General Manager (Operation), Nagpur Area, WCL vide letter no. WCL /AGM-NGP/C1/2015/MANPOWER/191 dated 08.07.2015 communicated that 83 nos. of manpower will be superannuated during next three years. Hence surplus manpower of Adasa UG mine after three years will be 414 (625-128-83). It is further mentioned in above letter that surplus manpower shall be provided to Waghoda UG mine of Nagpur Area. The existing manpower of Waghoda UG mine is 20 against Project Report requirement of 1103.

19.2 PRODUCTIVITY

The annual capacity of this mine has been rated as 1.50 Mty of coal in Total Hiring option. However, peak OB removal in Total Hiring Option has been proposed as 11.60 Mm^3. In the proposed PR, the manpower employed would be 128 and the overall OMS works out to 44.39 t.

19.1 TRAINING

Manpower requirement for this project will be taken from existing manpower of Adasa UG and / or other mines of WCL if required. However, for unskilled/semiskilled/skilled & highly skilled manpower, persons will be taken as and when required from existing OC mines of Nagpur Area or from other areas of WCL.

For training of manpower, facilities of existing VTC of Nagpur Area will be utilised for workers as per recommendation of 10^{th} Safety Conference. Hence no extra provision has been made in this report.

20.0 PROJECT IMPLEMENTATION SCHEDULE

The proposed Adasa UG to OC is located in Nagpur area of WCL. The proposed project is conversion of existing Adasa UG mine into an opencast mine. Many infrastructure for underground mine are available at the project site. However, this project has to be provided with all infrastructural facilities for opencast mining independently in order to ensure its proper development as there is no opencast mine in nearby the proposed project.

20.1 PRE AND POST SANCTION ACTIVITIES BEFORE STARTING EXCAVATION

Pre Sanction Activities	Post Sanction activities before starting excavation
Detailed surveying of the area to locate various infrastructural facilities.	Preparation of budgetary estimates for construction of various infrastructural facilities like CHP (on hiring), Workshop, Approach Road, etc.
Coal despatch arrangements to be finalised	Posting of core management group.
Dialogue with State Government and other appropriate authorities to expedite land acquisition.	Acquisition of essential land.
Dialogue with MSEB to finalise temporary and permanent sources of power supply.	Procurement of HEMM and OPM equipment.
Dialogue with appropriate authorities to remove surface constraints such as diversion of Road, Nala, canal Electric/Telephone lines etc. and resettlement of villages.	Creating facilities for erection and commissioning of equipment.
Preparation and submission of EMP.	Starting construction of permanent approach road.
Soil investigation for construction work.	Starting construction of workshop, office, stores, etc.
	Selection, recruitment and training of manpower for the project as per manpower budget.

21.0 PROJECT ECONOMICS

The Total Hiring option in the Project Report for Adasa UG to OC has been prepared considering leasing/out sourcing of HEMM for excavation, transport, drilling, dozing, Dumping etc. for OB as well as Coal. *Planning Committee of WCL suggested to consider crushing of coal by HOE, hence CHP provision has also been made by outsourcing agency.* Pumping operation, blasting and surface illumination would be done departmentally. Based on geo-mining parameters and rate of deepening, mine target has been kept as 1.50 Mty and GCV of coal is **5020 kCal/kg (G-8)**.

21.1 EXISTING CAPITAL AND ADDITIONAL CAPITAL

The total estimated capital investment for the proposed PR for Adasa UG to OC Mine having an annual capacity of 1.50 Mt of coal and 11.60 Mm^3 of Peak OB works out to Rs 288.9026 crores excluding WDV of Rs 11.9882 crores. The specific investment for additional capital works out to Rs 1926.02/t of annual target production and Rs 265.52/m^3 of excavation considering both coal & OB. The headwise provisions are given in Table below.

Initial Capital Investment

(Amt. in `. Crores)

A/c Head	Particulars	WDV as on 01.04.2018	Additional Capital	Total Capital (WDV + Additional)
01	Land	0.0920	179.2402	179.3322
02	Civil Structure (Buildings)	10.1145	3.6054	13.7199
03	Plant & Machinery	0.4927	17.2196	17.7123
04	Furniture & Fittings	0.0000	0.5000	0.5000
05	Railway Siding	0.0000	0.0000	0.0000
06	Vehicles	0.0021	0.2106	0.2127
07	Prospecting & Boring	0.0000	1.0000	1.0000
08	Mine Development	1.2869	87.1268	88.4137
09	Revenue Expenditure Capitalised	0.0000	0.0000	0.0000
	Total	**11.9882**	**288.9026**	**300.8908**

21.2 BASIS OF PRICE OF P&M & CIVIL WORKS

The pricing of P&M is based on the standard price list of August,2014 (updated March,2015) circulated by the specialist cell of CMPDI, Ranchi. The cost of civil works has been estimated on the basis of Cost Index of 560 at Maharashtra as on first half of the year 2015 with a base of 100 in Delhi as on 1.1.1992.

21.3 OPENING OF REVENUE ACCOUNT & COMMERCIAL READINESS

The mine will come in revenue from fourth year.

Commercial Readiness

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

i) 30% of the total volume of excavation (coal and OB) envisaged in the target year

ii) The land required for the project upto target year has been acquired.

Within the above mentioned construction period, the project is in commercial readiness, as it would be able to yield production on sustainable basis and most of the infrastructure facilities like Road, CHP, Workshop, Service Building, Power Supply, Water Supply and Development activities for mine operation, would be completed and accordingly, capital provision has been made. In this Proposed Project, the mine will have cash surplus in the 4^{th} year of operation (including three years for land acquisition). .

21.4 REPLACEMENT CAPITAL

Year wise replacement capital is indicated in cash flow statement (Appd.-D1 & E1)

21.5 SOURCES OF FINANCE: INTERNAL RESOURCES OR LOAN

The source of finance will be through internal resources.

21.6 COMPLETION COST:

The completion cost for the project works out to Rs 431.6577 Crores excluding WDV.

21.7 COST OF PRODUCTION AT DIFFERENT LEVEL OF PRODUCTION:

A) SALARIES & WAGES COST

The estimated salaries & wages cost is worked out as Rs. 78.21/t at 100% capacity.

B) STORES COST

Stores cost has been estimated taking into account provision for repair & maintenance, POL, explosive, and miscellaneous stores cost. The estimated stores cost has been worked out to Rs. 102.60 /t at 100% capacity.

C) POWER COST

Estimated energy consumption is given in the relevant chapter for power supply. The average power cost per tonne of coal production works out to Rs. 32.44 at 100% level of operation.

D) MISC. EXPENDITURE

This cost has been estimated to cover expenditure on printing & stationary, postage, telephone, repair & maintenance of assets other than P&M, workshop debit, ins. & taxes for vehicles and other repairs and a further provision has been made for deterioration of coal stock. The miscellaneous cost per tonne of coal production works out to Rs. 147.27 at 100% level of operation. The miscellaneous cost also includes hiring charges for rehandling of 20.50 Mm^3 sandy soil as per calendar programme.

E) ADMINISTRATIVE CHARGES

A provision has been made in total revenue cost estimate for administrative charges based on 10% of the administrative cost per tonne of coal production communicated by WCL. Total administrative cost has been calculated at 100% level and treated as fixed cost. The administrative cost works out to Rs. 16.85 /t.

F) OUTSOURCING COST

The average outsourcing cost cost per tonne of coal production works out to Rs. 445.90 at 100% level of operation.

G) INTEREST ON WORKING CAPITAL

Interest on working capital has been calculated on the basis of 4 months operating expenditure. Interest on working capital works out to Rs. 41.95 /t at 100% capacity. Rate of interest is taken as 14.50%.

H) DEPRECIATION

Straight line method of depreciation has been provided to arrive at depreciation cost per tonne of coal production. The depreciation cost works out to Rs. 124.68/t at 100% capacity.

I) INTEREST ON LOAN CAPITAL

Interest @ 11.50% on loan capital has been computed based on given debt equity mix. Interest on loan capital works out to Rs. 34.00 /t.

J) ENVIRONMENT RELATED COST

Rs. 6.00/t of coal has been provided to absorb environmental related cost in the project.

K) MINE CLOSURE COST

Rs. 38.56/t has been provided in the project against mine closure cost.

L) COST OF PRODUCTION

Total cost of production works out to be Rs. 1068.46/t and Rs. 1132.00/t at 100% and at 85% respectively.

21.8 GRADE OF COAL & WEIGHTED AVERAGE SELLING PRICE

The **GCV of coal is 5020 kCal/kg (G-8)**. The selling price of coal has been considered as Rs. 1513.50/t for power sector and Rs. 2007.50 /t for non- power sector consumer (95% of notified price+ processing charge) .

TRANSPORTATION / LOADING / SIZING CHARGES

Rs. 79/t has been considered for sizing charges for coal upto (-) 100 mm size.

DESPATCH OF COAL & POINT OF SALE.

Coal from the face would be dispatched to coal stock yard which will be loaded in Tippers for onward transport to CHP. After crushing of coal, coal is proposed to be transported to BG siding.

21.9 PROFITABILITY (PROFIT/LOSS)

The profit with average sale value of coal as Rs. 1513.50/t works out to be Rs. 445.04/t and Rs. 381.50/t at 100% and 85% capacity respectively for power sector. The profit with average sale value of coal as Rs. 2007.50/t works out to be Rs. 939.04/t and Rs. 875.50/t at 100% and 85% capacity respectively for Non-power sector.

21.10 MANPOWER & OMS

The total requirement of manpower works out to 128 which includes provision for leave/ sickness. The existing Adasa UG mine has 625 manpower as on 08.07.2015. The manpower requirement for the proposed PR for Adasa UG to OC mine is 128. The General Manager (Operation), Nagpur Area, WCL vide letter no. WCL /AGM-NGP/C1/2015/MANPOWER/191 dated 08.07.2015 communicated that 83 nos. of manpower will be superannuated during next three years. Hence surplus manpower of Adasa UG mine after three years will be 414 (625-128-83). It is further mentioned in above letter that surplus manpower shall be provided to Waghoda UG mine of Nagpur Area. The existing manpower of Waghoda UG mine is 20 against Project Report requirement of 1103.

The annual capacity of this mine has been rated as 1.50 Mty of coal in Total Hiring option. However, peak OB removal in Total Hiring Option has been proposed as 11.60 Mm^3. In the proposed PR, the manpower employed would be 128 and the overall OMS works out to 44.39 t.

21.11 EMS

The overall EMS works out to Rs. 3203.15 as per CMPDI planning norms. The salary & wages works out to Rs. 78.21/t.

21.12 FINANCIAL IRR

The IRR of the project at 100% and 85% capacity works out to be 17.22% and 13.76% respectively for power sector.

The IRR of the project at 100% and 85% capacity works out to be 28.57% and 24.49% respectively for non- power sector.

21.13 DESIRED SELLING PRICE:

The desired selling price to yield 12% IRR at 100% and **85%** of target production works out to Rs. 1336.65/t and Rs. **1438.05/t** respectively.

21.14 SENSITIVITY ANALYSIS

The IRR % and selling price of coal (Rs./t) for 12% IRR has been given in table below for change in various parameters:

PARAMETERS		0%	5%	10%	15%	20%	25%	50%	100%
INCREASE IN POWER COST	IRR	17.22%	17.17%	17.12%	17.07%	17.02%	16.97%	16.71%	16.19%
	Sale Price for 12% IRR (Rs,.t)	1336.66	1338.46	1340.25	1342.05	1343.84	1345.63	1354.60	1372.55
INCREASE IN OPERATING COST	IRR	17.22%	15.82%	14.39%	12.91%	11.39%	9.81%	0.45%	-42.99%
	Sale Price for 12% IRR (Rs,.t)	1336.66	1385.73	1434.80	1483.86	1532.93	1582.00	1827.33	2318.00
INCREASE IN SALES REALISATION	IRR	17.22%	19.21%	21.09%	22.87%	24.57%	26.20%	33.52%	45.43%
	Sale Price for 12% IRR (Rs,.t)	1336.66	1260.99	1185.31	1109.64	1033.96	958.29	579.91	-176.84
DECREASE IN CAPACITY UTILISATION	IRR	17.22%	16.11%	14.96%	13.76%	12.51%	11.19%	3.22%	17.22%
	Sale Price for 12% IRR (Rs,.t)	1336.66	1366.89	1400.49	1438.05	1430.95	1475.53	1911.25	1336.66
DECREASE IN SALES REALISATION	IRR	17.22%	15.10%	12.82%	10.32%	7.53%	4.35%	-41.44%	17.22%
	Sale Price for 12% IRR (Rs,.t)	1336.66	1412.34	1488.01	1563.69	1639.36	1715.04	2093.41	1336.66
INCREASE IN LAND & REHABL. EXP	IRR	17.22%	16.78%	16.36%	15.95%	15.56%	15.18%	13.49%	10.82%
	Sale Price for 12% IRR (Rs,.t)	1336.66	1348.27	1359.88	1371.48	1383.09	1394.70	1452.74	1568.81
INCREASE IN MINE DEVP. EXP	IRR	17.22%	17.11%	16.99%	16.87%	16.76%	16.64%	16.07%	14.98%
	Sale Price for 12% IRR (Rs,.t)	1336.66	1340.15	1343.63	1347.11	1350.60	1354.08	1371.50	1406.33
INCREASE IN CAPITAL	IRR	17.22%	16.58%	15.96%	15.38%	14.82%	14.30%	11.98%	8.47%
	Sale Price for 12% IRR (Rs,.t)	1336.66	1354.43	1372.20	1389.96	1407.73	1425.49	1514.33	1691.99
INCREASE IN WAGES/ SALARIES	IRR	17.22%	17.10%	16.98%	16.86%	16.74%	16.61%	16.00%	14.75%
	Sale Price for 12% IRR (Rs,.t)	1336.66	1340.94	1345.22	1349.51	1353.79	1358.07	1379.47	1422.28
INCREASE IN STORE COST	IRR	17.22%	17.06%	16.89%	16.72%	16.55%	16.38%	15.53%	13.81%
	Sale Price for 12% IRR (Rs,.t)	1336.66	1342.49	1348.32	1354.15	1359.99	1365.82	1394.97	1453.28

21.15 APPROVAL STATUS:

PR has been duly approved by WCL Board in 267th meeting vide letter No. WCL/BD/SECTT/BM-267/2015/2250 dated 21.08.2015. In the Total hiring option of Project Report for Adasa UG to OC mine for annual target production of 1.50 Mty, the workload for OB removal & coal extraction would be catered by outsourcing HEMM. Total Cost of Production works out to Rs 1132.00/t at 85% of target capacity. For Power Sector, the weighted average Sale Price of coal is of Rs 1513.50/t and the **IRR** works out to **13.76%** at 85% of target capacity. For Non- Power Sector, the weighted average selling price of coal is Rs 2007.50/t and the IRR of the project at 85% capacity works out to 24.49%. The selling price to yield 12 % IRR @ 85% capacity works out to Rs 1438.05/t.

This option is considered for approval as the PR is yielding more than 12 % IRR at 85% of target capacity for power sector.

The other related mining and financial parameters are as tabulated below:-

Sl. No.	Particulars	Project Report for Adasa UG to OC Mine (March,2015)
		Total Hiring Option
A	Mining Parameters	
01	Mineable Reserves (Mt)	22.08
02	Grade/GCV of coal (kcal/kg)	5020 (G-8)
03	OB Volume (Mm3)	146.36
04	Average S/R	6.63
05	Mine Capacity (Mty)	1.50
06	Manpower Requirement (Nos.)	128
07	Overall OMS (t)	44.39
B	Financial Parameters	
01	Total Capital (Rs. Crores)	300.8908
02	Additional Capital Required (Rs. Crores)	288.9026
03	WDV of Existing Capital (as on 01.04.2018) (Rs. Crores)	11.9882
04	Cost of Production (Rs /t)	
(a)	@ 100% of target capacity (Rs/t)	1068.46
(b)	@ 85% of target capacity (Rs /t)	1132.00
05	Av. Selling Price (Notified) (Rs/t) For Power sectors	1513.50
06	Profit/Loss (Rs /t) For Power sectors	
(a)	@ 100% of target capacity (Rs /t)	445.04
(b)	@ 85% of target capacity (Rs /t)	381.50
07	Financial IRR (%) for Power Sector	
(a)	At 100% capacity	17.22
(b)	At 85% capacity	**13.76**
08	Price to yield 12 % IRR @ 85% capacity (Rs./t)	**1438.05**

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