सीएमपीडीआई
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A Mini Ratna Company

SURVEY SECTION
AMP. OCP.

CENTRAL COALFIELDS LIMITED (CCL)

PROJECT REPORT
OF
AMRAPALI EXPANSION OCP
CAPACITY-25.0 MTY
PEAK CAPACITY - 35.0 MTY

NORTH KARANPURA COALFIELD
DIST –CHATRA (JHARKHAND)

[TEXT & APPENDICES]
(JOB NO. 341576)

OCTOBER' 2015

REGIONAL INSTITUTE-III
CENTRAL MINE PLANNING & DESIGN INSTITUTE LIMITED
(A Subsidiary of Coal India Limited)
GONDWANA PLACE, KANKE ROAD, RANCHI – 834 031,
JHARKHAND, INDIA

cmpdi
A Mini Ratna Company

सेन्ट्रल माइन प्लानिंग एण्ड डिजाईन इन्स्टीट्यूट लिमिटेड
(कोल इण्डिया लिमिटेड की सहायक कम्पनी/ भारत सरकार का उपक्रम)
Central Mine Planning & Design Institute Limited
(A Subsidiary of Coal India Limited/ Govt. of India Public Sector Undertaking)
Regional Institute-3
Corporate Identity Number – U14292JH1975GOI001223

पत्रांक: सीएमपीडीआई/क्षे.सं.3/खान योजना/2016/01

दिनांक: 05.01.2016

सेवा में,
महाप्रबंधक (परियोजना एवं परिकल्पना),
सी सी एल
राची ।

विषय : **Submission of Final Report of Expansion Project Report for Amrapali OCP (Job No.341576).**

महोदय,

This is in reference to Annual Programme of CCL 2015-2016. The job was taken up by the Opencast Department of RI-III, CMPDI, Ranchi. The Draft report was submitted to you vide our letter no. CMPDI/RI-III/MP/2015/51 dated 09.09.2015.

The Final Expansion Project Report (EPR) has been finalized based on the comments from CMPDI (HQ) and CCL.

Two copies of the final Project Report titled "**Expansion Project Report for Amrapali OCP 25.0MTY**" (Job No. 341576) are enclosed for your kind perusal and necessary action.

भवदीय,

5/1/16
क्षेत्रीय निदेशक

संलग्नक : As above.

- GM (M-A) Area. – 1 Copy with Plan
- Shri Arvind Kr. Sr Manager (M) / PEP } – do –
- CM (M) / PEP.

for needful action please.

8/1/16

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SUMMARISED DATA

A. General :

1.	Name of the Project	:	Amrapali Expansion OCP (25.0 MTY)
2.	Coalfield	:	North Karanpura Coalfield
3.	Location	:	Chatra District, Jharkhand
4.	Company	:	Central Coalfields Limited
5.	Address of the Company	:	Darbhanga House, Ranchi PIN- 834001
6.	Nearest Railway Station	:	The nearest railway station is Ray which is around 34 Km on Barkakana-Dehri-On-Sone-Gomoh of the Eastern Railway. Tori Railway station is another railhead, located south-west of the block, at a distance of about 50 km.
7.	Roads	:	Amrapali OCP is linked with various important places such as Hazaribagh via Barkagaon by about 50 km long metalled road ,Balumath town through a fair weather road (about 30 km) and Khalari via Piparwar (about 30 km) .

B. Geological Information:

1. General Information:

1.	Name of blocks	**Amrapali and kishanpur**
2.	Area(Sq.Km)	• Amrapali – 10.11 • Kishanpur – 5.89
3.	Borehole Density (nos./sq km)	10
4.	Geological Reserves (MTes.)	• Amrapali – 486.50 • Kishanpur – 203.31
5.	Opencastable Geological Reserves (MTes.)	689.81
6	Underground Geological Reserves (MTes.)	-

2. Sequence of Coal Seams and Parting

Seam	Amrapali Block			Kishanpur Block		
	Thickness Range(m)	Borehole Intersection	Geological Reserves	Thickness Range (m)	Borehole Intersection	Geological Reserves
IV	3.99-7.15	44	58.83	3.54-7.77	27	**25.89**
Parting	1.65-9.47	-		5.55-18.68	-	
III Top	2.83-4.55	3	1.80	2.09-2.58	2	**1.43**
Parting	0.00-2.22	-		0.00-2.27	-	
III Bot	3.62-4.55	3	1.98	3.23-5.23	3	**2.65**
III Comb	4.68-10.24	42	78.84	5.78-12.31	29	**42.54**
Parting	5.24-16.72	-		1.17-18.1	-	
II Top	1.09-3.42	50	23.04	0.21-4.50	30	**4.13**
Parting	1.80-18.90	-		1.28-17.39	-	
II Bot	0.44-5.67	50	30.64	0.20-4.16	42	**4.22**
Parting	4.35-32.97	-		0.51-17.91	-	
I Top	1.53-9.44	20	29.75	1.85-9.33	41	**31.40**
Parting	0.00-22.64	-		0.00-18.47	-	
I Top + I Mid	8.28-17.13	24	60.25	11.16-13.58	4	**6.66**
I Mid	0.90-8.53	14	25.97	0.26-7.61	46	**14.81**
Parting	0.00-6.02	-		1.47-33.62	-	
I Bot	3.87-11.98	43	72.48	4.85-12.61	52	**69.49**
I Mid +I Bot	13.51-19.59	10	19.45		-	
ITop+ I Mid+ I Bot	19.36-27.14	20	83.47		-	
Total			486.50			**203.31**

C. Technical Information:

Sl. No.	Particular	Unit	East Section	West Section	Total
1	Area of the proposed mine block	sq. km	6.62	5.37	11.99
2	Borehole density within mine area	BHs/sq.km	9	10	9.5
3	Mine parameters				
	Av. Strike length of the quarry	km	2.5	2.5	5.0
	Extent along dip (Avg.)	km	2.6	2.6	2.6

4. Description of coal seams proposed to be worked along with the parting details

East Section						
Seam/ Parting	Thickness Range (m)	Av Grade		Gradient (deg)	Mineable Reserves (Mt)	Volume of OB (Mcum)
Top OB	10.00 - 140.00 (75.00)	GCV	Grade	3 – 6		329.57
IV	4.20 – 7.15(6.00)	4598.45	G10		35.41	
Parting	2.47 – 8.11 (5.50)					24.92
III Combined	5.00 – 10.24 (8.40)	4291.62	G11		53.16	
Parting	5.24 – 12.22 (8.30)					40.09
II Top	1.30 – 3.42 (2.10)	4242.36	G11		12.74	
Parting	2.81– 13.69 (7.80)					31.36
II Bottom	0.70– 5.00 (1.90)	3906.79	G12		16.39	
Parting	4.35 – 32.97(24.00)					91.11
I Top	1.53– 9.44 (5.50)	3819.89	G12		14.04	
Parting	1.04 – 22.62 (12.00)					4.81
I Middle	2.82 – 8.53 (7.50)	3865.41	G12		36.13	
I Middle + Top	8.28– 17.13(13.75)					
Parting	1.09 – 6.02 (3.00)					4.32
I Bottom	5.44 – 9.82 (8.00)	3854.12	G12		133.80	
I Bottom + Middle	5.74 – 19.59(15.21)					
I Bottom + I middle + I Top	15.55 – 27.14 (23.07)					
Total		4040.83	G11		301.67	526.19

West Section						
Seam/ Parting	Thickness Range (m)	Av Grade		Gradient (deg)	Mineable Reserves (Mt)	Volume of OB (Mcum)
Top OB	10.00 - 150.0 (80.00)	GCV	Grade			206.29
IV	4.54 – 7.45 (5.80)	4382.18	G10		20.01	
Parting	5.55 – 16.36 (10.50)					28.88
III Combined	4.12 – 9.25 (7.80)	4043.24	G11		38.72	
Parting	5.89 – 18.78 (12.00)					33.03
II Top	0.21 – 2.77 (0.90)	4191.44	G11		3.27	
Parting	4.31 – 17.39 (12.00)					41.60
II Bottom	0.20 – 2.53 (0.80)	3897.87	G12		1.98	
Parting	1.82 – 17.91 (7.80)					31.51
I Top	3.20 – 9.33 (5.50)	3805.41	G12	6-8	27.96	
Parting	1.27 – 18.47 (10.00)					26.94
I Middle	0.51 – 5.66 (1.50)	3816.22	G12		20.59	
I Middle + Top	11.16 – 14.86(13.13)					
Parting	2.80 – 30.71(16.00)					52.51
I Bottom	4.85 – 11.10 (7.90)	4014.09	G11		53.17	
I Bottom + Middle	-					
I Bottom + I middle + I Top	-					
Rehandling						3.00
Total		4007.66	G11		165.71	423.77

4. Description of coal seams proposed to be worked along with the parting details

Total(East Section+West Section)				
Seam/ Parting	Av Grade		Mineable Reserves (Mt)	Volume of OB (Mcum)
Top OB				535.86
IV	4520.48	G10	55.43	
Parting				53.80
III Combined	4186.88	G11	91.88	
Parting				73.12
II Top	4231.72	G11	16.00	
Parting				72.96
II Bottom	3905.78	G12	18.37	
Parting				122.62
I Top	3810.23	G12	42.00	
Parting				31.76
I Middle	3847.16	G12	56.72	
I Middle + Top				
Parting				56.83
I Bottom	3900.02	G12	186.97	
I Bottom + Middle				
I Bottom + I middle + I Top				
Rehandling				3.00
Total	4031.00	G11	467.37	949.96

			East Section	West Section	Total
5	Av. Stripping Ratio	m^3/t	1.74	2.56	2.03
6	Method of Mining	-	Shovel - Dumper/ Surface Miner- FE Loader - Dumper		
7	Target Output	Mt			
	Nominal production capacity	Mt	15.00	10.00	25.00
	Peak production capacity	Mt	21.00	14.00	35.00
	Production capacity (at 85%)	Mt	12.75	8.50	21.25
8	Year of achieving Target Production	6th Year			
	(from zero date)				
9	Year of start of Internal Dumping	5th Year			

10 Production Phasing (from zero date upto target year) Mt

Year of Quarry operation	Coal output (MTe)	Volume of OBR (MCUM)	Stripping Ratio (Cum/te)
1	4.00	3.65	0.91
2	8.00	3.08	0.39
3	12.00	8.79	0.73
4	15.00	15.80	1.05
5	20.00	18.34	0.92
6	25.00	30.39	1.22

Variant I – Both Quarry I & II departmental
Variant II – Both Quarry I and Quarry II outsourced

Reclamation and common equipment in both the variants mentioned above is proposed to be departmental as per requirement.

11	Total Mine Life (at Nom. production capacity)	Years	22 yrs	
	Pre-construction period		-	
	Construction period		-	
	Production build-up period		5 yrs	
	Production period		15 yrs	
	Tapering / mine closure period		2 yrs	
12	Major HEMM Deployed for Coal (Target Year)	Capacity	Variant I	Variant II
	Surface Miner	3800-4200 mm	7	Outsourced
	Shovel	10.0-12.0 cum Hydraulic	2	
	FE Loader	11 - 13 Cum.	7	
	Dumper	100 T	37	
	Drill	160 mm	2	
	Dozer	410 HP	9	
	Wheel Dozer	460 HP	2	
13	Major HEMM Deployed for OB			
	Hyd. Shovel	20 -22 cum	3	Outsourced
	Hyd. Shovel	10-12 cum	4	
	Dumper	190T	28	
	Dumper	100T	36	
	Drill	250mm	7	
	Wheel Dozer	460 HP	2	
	Dozer	410 HP	7	
	Dozer	750-850 HP	5	
14	Total Manpower(Maximum)	Nos	2232	539
	Existing Manpower		275	
	Additional		1955	264
15	Overall Output per manshift (OMS)		42	-
16	Seam-wise weighted average grade of coal (non-coking/coking)		G11 (Av GCV 4000-4300 kcal/kg)	
17	Presence of Major Surface Constraints (nallas, road, power line, etc.)		State Highway 7	
18	Coal Transport within the mine (In-pit belt conveying system or by Truck)		In-pit belt conveying system /Truck	
19	Surface Coal Transport to Siding/Despatch Point and Mode of Despatch		Conveyor/Truck	
20	Any Railway Siding and distance		Proposed Amrapali Siding	
21	Name of any Specific Customer/Industry		NTPC (10 MTY)/Basket Linkage	

D.	ENVIRONMENTAL & OTHERS		Variant I	Variant II
1	Civil Construction houses Residential	Nos.	1228	296
	Housing satisfaction	%	55	55
2	Water Demand			
	Colony	kl	1123.57	276.61
	Industrial		4448.16	3986.71
3	Total Land to be acquired	Ha	2478.89	
	Government land	Ha	465.27	
	Tenancy land	Ha	697.90	
	Forest land (type of forest)	Ha	1315.72	
4	Land to be acquired within minetake area (excavation area)	Ha	1198.69	
	Government land	Ha	205.89	
	Tenancy land	Ha	308.84	
	Forest land (type of forest)	Ha	683.96	
5	Land to be acquired outside minetake area (Beyond Excavation Area, such as Approach Road, Infrastructure, Colony, etc.)	Ha	1191.04	
	Government land	Ha	240.19	
	Tenancy land	Ha	360.29	
	Forest land (type of forest)	Ha	590.56	
6	Land to be acquired for external dumping	Ha	89.16	
	Government land	Ha	19.18	
	Tenancy land	Ha	28.78	
	Forest land (type of forest)	Ha	41.20	
7	Net Present Value of Forest Land			
	Total Area	Ha	784.08	
	Total Value	Rs.Lakhs	8332.71	
8	Habitation & Rehabilitation			
	No. of villages within mine boundary	Nos.	11	
	No. of PAFs to be rehabilitated		2000	
9	Cost of Tenancy Land & Rehabilitation			
	Total Cost	Rs. crores	196.99	
	R&R only		110.80	
10	Average annual rainfall	Mm	1377	
11	Make of Water (Maximum)	Cu.m/day	214923(East) 189291(west)	
12	Total installed pumping capacity	Lps	1200	
13	Drainage of the Area (Name of river/nala)		Barki River, Bahutchua nala & Chundru Nala	
14	Any proposed diversion of nala or power line		Nala flowing in the up dip side of the Quarry	

			Variant-I	Variant II
E.	**Finance**			
1	Total Capital Investment	Rs. Crores	4234.60	2450.31
	a) Upto Target		1975.76	106.39
	b) Beyond Target		6210.35	2556.70
	c) Total			
2	Specific Investment	Rs. / tonne	1693.84	980.12
	a) Upto Target		790.30	42.55
	b) Beyond Target			
3	Total Capital Investment on P&M	Rs. Crores	2330.43	745.52
	a) Upto Target		1928.95	77.37
	b) Beyond Target			
4	Specific Investment on P&M	Rs. / tonne	932.17	298.21
	a) Upto Target		771.58	30.95
	b) Beyond Target			
5	a) Additional Capital (over Existing 106.77 Crs.)	Rs. Crores	4128.01*	2343.72*
	b) Sanctioned Capital (12 MTY PR) –Feb'2012		858.11	858.11
6	Output per manshift (OMS) (Departmental Manpower)	Tonne	42.43	175.69
7	Earnings per manshift (EMS) - (Departmental Manpower)	Rs.	2094.02	2207.10
8	Estimated Cost of Production	Rs. / tonne	1032.53	913.45
	a) At 100% production level		1133.77	970.18
	b) At 85% production level			
9	Estimated average selling price	Rs. / tonne	1318.89	1318.89
10	Estimated Profit	Rs. / tonne	286.36	405.44
	a) At 100% production level		185.12	348.71
	b) At 85% production level			
11	**Financial Internal rate of return (FIRR)**	%		
	a) At 100% production level		45.08%	75.99%
	b) At 85% production level		31.95%	60.04%
	Financial Internal rate of return (FIRR)**			
	a) At 100% production level		**33.12%**	**64.53%**
	b) At 85% production level		21.09%	**49.61%**
12	Break-even point			
	Production	Mty	16.68	11.04
	Production level	%	66.70%	44.17%
13	Cost of Outsourcing (average)			
	a) OB	Rs/tonne	0.57	148.23
	b) Coal	Rs/tonne	1.40	52.60
14	Final Mine Closure Cost / te.	Rs/tonne	7.70	7.70
15	Year of Achieving target Production		6th	6th

* Existing capital considered as 106.59 crores instead of 106.77 crores after considering written down value (WDV) in Prosepecting and Boring head.

** FIRR calculation based on selling price of washed coal as notified price of equivalent grade (G-9).

Text

CHAPTER - I

INTRODUCTION

1.1 BACKGROUND OF THE PROJECT

Three power projects are being set up by NTPC under the Mega Power Policy of Govt. of India. The three power projects are (i) North Karanpura Jharkhand STPS (3000 MW) (ii) Barh STPS (3000 MW) and (iii) Kahalgaon TPS (500MW). The Hon'ble Prime Minister of India laid the foundation stone of these mega power projects on 5th March'98.

Two Opencast Projects in N.K. Coalfield Magadh and Amrapali OCPs have been identified for supplying coal to above two STPS. The requirement of power grade coal will be around 12 M.te per annum for each STPS and with these objective in view, the above two OCP's were proposed for a rated capacity of 12 MTPA each. It is envisaged that these two OCPs will be worked at an operating efficiency of not less than 85%.

Amrapali Opencast Project area is remote and no basic infrastructure like Road, Power, Railway, Water Supply arrangement are available in this project. To develop the area these facilities are to be made available, which normally take a long period.

Project Report for Amrapali OCP (12Mty), CCL with both coal and OB outsourcing variant was approved by CIL Board vide letter no CIL:X(D):04112:2012:3674 dated 23rd February2012.

EMP for Amrapali OCP (12 Mty) was approved by MOEF vide ref no. J-11015/109/2003-IA.II(M) on 03.01.2006

1.2 SALIENT FEATURE OF APPROVED AMRAPALI OCP (12 MTY)

1.2.1 Project Summary

The PR involved extraction of coal from two geological blocks Amrapali and Kishanpur. The blocks are fully explored and geological information were available to plan a large scale Opencast Mine of 12 MTY capacity.

For Amrapali OCP electric power is proposed to be drawn from existing Pipanwar sub station.

The summarized data of the project report (12 MTY) is given in Table-1.1

Table-1.1

Sl. No.	Particulars	Amrapali OCP (12.0 MTY) UCE' January'12
1.	Mineable Reserves (M.tes)	291.10
2.	Volume of OBR (Mm3)	459.68
3.	Av. Stripping Ratio (M3/te)	1.58
4.	Rated Capacity / annum	12.0 MTY
5.	Projected Life (Years)	30 (incl. 2 yrs. construction period)
6.	Overall Grade	F
7.	Initial Capital Requirement (Rs. Crores)	858.11
8.	Estimated cost of production (Rs./te):	
9.	(a) at 100%	471.38
	(b) at 85%	515.86
	Selling Price (Rs./te)	727.00
10.	Profit (Rs./te)	
	(a) at 100%	255.62
	(b) at 85%	211.14
11.	IRR (%)	
	(a) at 100%	31.03
	(b) at 85%	24.34
	Estimated Manpower Requirement (Nos.)	343
12.	O.M.S. (Old)	132.52

1.2.2 Advance Action Proposal

The advance Action proposal was sanctioned by GOI at an estimated capital of Rs. 889.72 Lakhs vide letter no. 43011/24/2001-CPAM dt. 25/09/2001 to carry out following activities:

a) Land Acquisition

b) Village Rehabilitation

c) Transmission line for power supply arrangement

d) Approach road

1.3 PRESENT STATUS OF THE PROJECT

1.3.1 Approval of the Project Report

1.3.1.1 Approval of the Project by CCL Board

The DPR was prepared in April, 2005 and subsequently updated in July'2006. The UCE (July'2006) was sent along with the Draft CCEA note in November'2006 for approval. As per the relevant directives on the subject, there had been changes in the price of inputs (P&M, Civil, Salaries & Wages etc.). These changes necessitated updating of cost estimates in March'09. The Project Report for Amrapali OCP (12.0MTY) was discussed in the 360th (Item No.4 (16) meeting of CCL Board on 30.07.2009 and the Board approved the proposal envisaging outsourcing of both coal production and OB removal, to CIL board for approval of the PR. The PR was updated in Oct,2009 for consideration in ESC of CIL Board.

1.3.1.2 Approval of the Project by CIL Board

Project Report for Amrapali OCP (12Mty), CCL with both coal and OB outsourcing variant was approved by CIL Board vide letter no.CIL:XI(D):04112:2012:3874 dated 23rd February2012 for an initial capital investment of Rs. 858.11 crores.

1.3.2 Status of land acquisition

Non Forest Land

Total land required: 633 Ha (including 76.10 ha for railway siding)

Land required for initial 10 years: 113.28 Ha. (12 MTY)

- Authentication yet to be completed.
- Physical verification for authentication of GMK land in Honhe, Ursu and Kumrang Khurd village has been completed.
- In Kumrang Kala, 80% GMK land has been verified,
- In Binglat village, verification is under process.
- MoC has sanctioned Rs. 21 lac for 2.275 acres in Kumarang Khurd and Kumarang Kalan village. Rs 21 lac disbursed to villages of Kumarang Khurd and Kumarang Kalan. In addition, Rs 15.17 Lakhs for 1.68 acres of Honhe village in respect of land compensation will be released shortly.

Forest Land

Total forest land required : 793.08 Ha (including 102.90 ha for railway siding)

Land required for initial 10 years : 531.64 Ha (12 MTY)

Stage-II FC obtained in Oct-10. 307.40 Ha handed over to CCL out of total requirement for initial 10 years. Balance land will be handed over in phases.

1.3.3 Rehabilitation

Total Project affected families required to be resettled & rehabilitated (12 MTY PR) - 451

1.3.4 Construction of Railway Siding

- Survey work for finalization of alignment for Construction of Railway Siding by M/s RITES - CMPDI has been requested for plotting of final route alignment drawing on Mouza map for preparation of land schedule by Area.
- Revised DPR submitted.

1.3.5 Status of EMP

EMP for Amrapali OCP (12 Mty) was approved by MOEF vide ref no. J-11015/109/2003-IA.II(M) on 03.01.2006

1.3.6 Present Mine Operation

Two separate coal winning and OB removal contracts for 15.0 Mtes and 23.93 Mcum respectively is under implementation. Yearwise coal production and OB removal is summarized below:

Year	Coal (Mtes)	OBR(Mcum)
2013-14	-	2.54
2014-15	2.55	17.74
Total	2.55	20.28

1.3.7 Existing Manpower

Executive	:	20
Monthly Rated	:	71
Daily Rated	:	184
Total	:	275

1.4 PRESENT PROPOSAL

As per XIIIth plan document CIL is required to produce 795 Mtes of coal in the terminal year of XIII plan i.e. 2021-22 which is likely to be revised upward. To meet the ever increasing demand of coal annual capacity of big opencast projects of CCL like Magadh, Amrapali and Ashok are required to be reassessed.

Project Report of Amrapali Expansion OCP (12.0 MTY) has been recast with an annual nominal capacity of 25.0 MTY and a peak annual capacity of 35.0 MTY. The expansion of the report from 12.0 MTY to 25.0 MTY is proposed to be achieved with following considerations:

- Increased advance rate of about 125 - 150m per annum as achieved by nearby mines like Ashok and Piparwar.
- Ample reserves available in the dip side, beyond the extent of 12 MTY project, within the considered Amrapali and Kishanpur blocks and beyond dip side limits of these blocks. The area beyond the block limit of Amrapali and Kishanpur block is partly explored in the name of Magadh North East Block (block area 3.35 sq km, geological reserves 166.72 Mtes & total metrage drilled 8350.45m) and partly unexplored. The area is provisionally identified as CIL block.

The mine is proposed to work through two sections (East section and West section) without any inter quarry barrier.

PHASES OF MINING PROPOSED

Mining operation is proposed to be carried out in two phases. In the first phase (Phase I) reserves of fully explored Amrapali and Kishanpur Blocks only are proposed to be exploited upto Chudru nala (block boundary). Reserves of the area beyond block boundary of Amrapali and Kishanpur blocks is proposed to be mined in Phase II after detailed exploration and geological proving.

The present proposal is the detailed mining proposal for Phase I only. Mining proposal for Phase II will be prepared after detailed exploration of the area identified for Phase II.

1.5 MINING VARIANTS PROPOSED

This proposal of Amrapali Expansion OCP (25.0 MTY) envisages two variants options of mine operation & capital investment for consideration and to take investment decision.

Variant - I

The option envisages total coal production & OB removal by departmental means. Departmental Coal production is proposed to be carried out using shovel-dumper/surface

Miner-pay loader-dumper combination. OB removal is proposed to be carried out using shovel-dumper combination.

Variant - II

The option envisages outsourcing of total coal production & OB removal for both Quarry I &II. *Reclamation and common equipment in both the variants mentioned above is proposed to be departmental as per requirement.*

1.6 TARGET CAPACITY OF THE PROJECT

Considering the geo-mining parameters of the block the target capacity of the proposed quarry has been fixed at 25.0 MTY with a peak capacity of 35.0 MTY

1.7 PRODUCTIVITY ENHANCEMENT

The mine has been designed to produce at the rate of 25 MTY. The design of the mine is mainly based on lay & deposition of coal seams and intervening partings of the block as estimated in the Geological report and the HEMM productivity norms adopted in CIL mines.

Keeping into account the current state of development in technology and attainment of improved skills of operators and maintenance crew, it will be possible for coal producing company to achieve higher coal production from the targeted by achieving higher availability and utilization of HEMM.

It is therefore, Amrapali Expansion OCP may produce coal higher to 35.0 MTY in any one or all the year of the life of the mine against nominal mine capacity of 25 MTY.

1.8 TECHNOLOGY UPGRADE

Upgrading technology is a prerequisite for more effective use of resources and thus improving environmental performance, which becomes all the more important in view of a rapidly growing demand of coal in our country. In most cases, newer technologies and processes are both more efficient and less polluting than the technology they replace, allowing increased production using less material and causing less pollution.

Considering, what has been stated in the above paragraph, the proposed Project Report suggests flexibility in the implementation stage within the scope of the report to respond to improvements in technology and equipment which would result in improved profitability, productivity and mitigate environmental hazards due to mining.

CHAPTER-II

MARKETABILITY & JUSTIFICATION

2.1 DEMAND AND SUPPLY SCENARIO

The availability and demand from CCL is given below (pl. refer Table 2.0)

2.2 UTILITY OR MARKET FOR THE COAL FROM PROJECT

Liberalisation of power & other sector by Govt. of India has generated wide spread interests for Private and Public sector investments in these sectors. As such, there is an appreciable increase in the number of upcoming industries in both Private and Public Sectors. This has resulted in a sharp increase in the demand of non-coking coal in CCL. Project Report of the Amrapali Expansion OCP (25MTY) is therefore, proposed with a view to partially fulfil the above indicated growth in demand

2.3 AVAILABLE LINKAGE OR FIRM FUEL SUPPLY AGREEMENT (FSA)

The coal from the Amrapali Expansion OCP is proposed for nearby Barh STPP of NTPC, basket linkage and E-Booking to consumers in Power and other sectors.

2.4 JUSTIFICATION OF OPENING THE PROJECT BASED ON MARKETABILITY (TO FULFILL THE GAP IN DEMAND) AND/OR FIRM LINKAGE (FSA)

The availability figures till end of XIIth plan period (2016-17), as shown in the following Table, have been obtained from CCL. It appears from the figures that till 2013-14 there is a gap of Power as well as Washery grade coal. After considering the production from the upcoming project this gap reduces. The gap in demand and availability of coal over the year justifies implementation of this project.

Table 2.0 - Demand and Supply of Coal

Summary of Coal Balance as on 01.03.2012(based on MOC letter dt. 17.02.2012) (in Million Tonnes)		for Business As Usual Production In XII Plan CCL					for Optimistic Production In Plan & beyond CCL				
	Particulars	2012-13	2013-14	2014-15	2015-16	2016-17	2012-13	2013-14	2014-15	2015-16	2016-17
	I: PSA/LOA Commitment at 100% level without any regulation										
A1	FSA for TPPs as on 31.3.2009	32.81	32.81	32.81	32.81	32.81	32.81	32.81	32.81	32.81	32.81
A2	Qty (MOC letter dt. 17.02.2012) for TPPs 01.04.09 to 31.03.12)	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
A3	Qty (MOC letter dt. 17.02.2012)for TPPs (XII Plan) (on the Commissioning Year)	3.93	1.25	9.40	3.33	0.00	3.93	1.25	9.40	3.33	0.00
A4	Qty (MOC letter dt. 17.02.2012) for TPPs (XII Plan) (Already Commissioned)	0.00	3.93	5.18	14.58	17.91	0.00	3.93	5.18	14.58	17.91
A	Total for Power Utility Sectors (A1+A2+A3+A4)	59.75	61	70.39	73.73	73.73	59.75	61	70.39	73.73	73.73
B1	Ongoing FSA for Other then Power Utility Sectors	8.57	8.57	8.57	8.57	8.57	8.57	8.57	8.57	8.57	8.57
B2	Coking Coal Quantity for Steel Sector (Annual Plan:2011-12)	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95
B3	FSA/LOA for Other then Power Utility Sectors*	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83
B	Total for Other then Power Utility Sectors (B1+B2+B3)	16.35	16.35	16.35	16.35	16.35	16.35	16.35	16.35	16.35	16.35
C	dilution Quantity(@10% of Production)	5.5	6.2	7	7.6	8.3	5.5	6.3	7.5	8.5	9.2
D	Total Demand (@100% level without any regulation) (A+B+C)	81.6	83.55	93.75	97.68	98.38	81.6	83.65	94.25	98.58	99.28
E	Production	55	62	70	76	83	55	63	75	85	92
F	Not Coal Balance (E-D)	-26.6	-21.55	-23.75	-21.68	-15.38	-26.6	-20.66	-19.25	-13.58	-7.28
	II: If Dispatches are regulated as under										
G1	FSA Regulated at trigger level (90%) for Power Utilities as on 31.03.2009	29.53	29.53	29.53	29.53	29.53	29.53	29.53	29.53	29.53	29.53
G2	Qty (MOC letter dt. 17.02.2012) Regulated at new trigger level (80%) for TPPs (01.04.09 to 31.03.12)	18.40	18.40	18.40	18.40	18.40	18.40	18.40	18.40	18.40	18.40
G3	Qty (MOC letter dt. 17.02.2012) Regulated on best effort basis (@50% on the year of commissioning for TPPs(XII Plan))	1.97	0.63	4.7	1.67.	0	1.97	0.63	4.7	1.67	0

Summary of Coal Balance as on 01.03.2012(based on MOC letter dt. 17.02.2012)		for Business As Usual Production In XII Plan					for Optimistic Production In Plan & beyond				
	(in Million Tonnes)	CCL					CCL				
	Particulars	2012-13	2013-14	2014-15	2015-16	2016-17	2012-13	2013-14	2014-15	2015-16	2016-17
G4	Qty (MOC letter dt. 17.02.2012) Regulated at new trigger level (80%) for TPPs (XII Plan) (from 2nd year onwards)	0.00	3.15	4.15	11.66	14.33	0.0	3.15	4.15	11.66	14.33
G	FSA regulated at trigger level Power Utilities sector (G1+G2+G3+G4)	49.9	51.71	56.76	61.26	62.26	49.9	51.71	56.78	61.26	62.26
H1	Ongoing FSA regulated at trigger level (50%) for other than power utility sectors	5.14	5.14	5.14	5.14	5.14	5.14	5.14	5.14	5.14	5.14
H2	Coking Coal Quantity for Steel Sector (Annual Plan:2011-12	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95
H3	FSA / LOA regulated at trigger level (50%) for other than power utility section	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
H	FSA/LOA regulated at trigger level for Other then Power Utility Sectors (H1+H2+H3)	11.01	11.01	11.01	11.01	11.01	11.01	11.01	11.01	11.01	11.01
I	dilution (reduced to 7% of Production)	3.85	4.34	4.90	5.32	5.81	3.85	4.41	5.25	5.95	6.44
J	Total Demand (@ regulation at trigger level) (G+H+I)	64.76	67.05	72.69	77.59	79.08	64.76	67.12	73.04	78.22	79.71
K	Net Coal Balance (E-J)	-9.76	-3.05	-2.69	-1.59	3.92	-9.76	-4.12	1.96	6.78	12.29

* : of which FSA has been conducted for 2.557 MT and FSA remains to be conducted for 1.272 MT

Summary of Coal Balance as on 01.03.2012(based on MOC letter dt. 17.02.2012)		for Business As Usual Production In XII Plan					for Optimistic Production In Plan & beyond				
	(in Million Tonnes)	CCL					CCL				
	Particulars	2012-13	2013-14	2014-15	2015-16	2016-17	2012-13	2013-14	2014-15	2015-16	2016-17
G4	Qty (MOC letter dt. 17.02.2012) Regulated at new trigger level (80%) for TPPs (XII Plan) (from 2nd year onwards)	0.00	3.15	4.15	11.66	14.33	0.0	3.15	4.15	11.66	14.33
G	FSA regulated at trigger level Power Utilities sector (G1+G2+G3+G4)	49.9	51.71	56.76	61.26	62.26	49.9	51.71	56.78	61.26	62.26
H1	Ongoing FSA regulated at trigger level (50%) for other than power utility sectors	5.14	5.14	5.14	5.14	5.14	5.14	5.14	5.14	5.14	5.14
H2	Coking Coal Quantity for Steel Sector (Annual Plan:2011-12	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95
H3	FSA / LOA regulated at trigger level (50%) for other than power utility section	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
H	FSA/LOA regulated at trigger level for Other then Power Utility Sectors (H1+H2+H3)	11.01	11.01	11.01	11.01	11.01	11.01	11.01	11.01	11.01	11.01
I	dilution (reduced to 7% of Production)	3.85	4.34	4.90	5.32	5.81	3.85	4.41	5.25	5.95	6.44
J	Total Demand (@ regulation at trigger level) (G+H+I)	64.76	67.05	72.69	77.59	79.08	64.76	67.12	73.04	78.22	79.71
K	Net Coal Balance (E-J)	-9.76	-3.05	-2.69	-1.59	3.92	-9.76	-4.12	1.96	6.78	12.29

* : of which FSA has been conducted for 2.557 MT and FSA remains to be conducted for 1.272 MT

Summary of Coal Balance as on 01.03.2012(based on MOC letter dt. 17.02.2012)		for Business As Usual Production In XII Plan					for Optimistic Production In Plan & beyond				
	(in Million Tonnes)	CCL					CCL				
	Particulars	2012-13	2013-14	2014-15	2015-16	2016-17	2012-13	2013-14	2014-15	2015-16	2016-17
G4	Qty (MOC letter dt. 17.02.2012) Regulated at new trigger level (80%) for TPPs (XII Plan) (from 2nd year onwards)	0.00	3.15	4.15	11.66	14.33	0.0	3.15	4.15	11.66	14.33
G	FSA regulated at trigger level Power Utilities sector (G1+G2+G3+G4)	49.9	51.71	56.76	61.26	62.26	49.9	51.71	56.78	61.26	62.26
H1	Ongoing FSA regulated at trigger level (50%) for other than power utility sectors	5.14	5.14	5.14	5.14	5.14	5.14	5.14	5.14	5.14	5.14
H2	Coking Coal Quantity for Steel Sector (Annual Plan:2011-12	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95
H3	FSA / LOA regulated at trigger level (50%) for other than power utility section	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
H	FSA/LOA regulated at trigger level for Other then Power Utility Sectors (H1+H2+H3)	11.01	11.01	11.01	11.01	11.01	11.01	11.01	11.01	11.01	11.01
I	dilution (reduced to 7% of Production)	3.85	4.34	4.90	5.32	5.81	3.85	4.41	5.25	5.95	6.44
J	Total Demand (@ regulation at trigger level) (G+H+I)	64.76	67.05	72.69	77.59	79.08	64.76	67.12	73.04	78.22	79.71
K	Net Coal Balance (E-J)	-9.76	-3.05	-2.69	-1.59	3.92	-9.76	-4.12	1.96	6.78	12.29

* : of which FSA has been conducted for 2.557 MT and FSA remains to be conducted for 1.272 MT

CHAPTER – III

PROJECT SITE INFORMATION

3.1 LOCATION

The proposed Amrapali OCP is located in the northern part of the N.K. coalfield and lies in the Chatra District of Jharkhand. 2 geological blocks namely Amrapali and Kishanpur have been considered in the proposed mine. The Amrapali OCP is enclosed by Pachra Block in the east and koyad Block in the west.

Location of Blocks Considered

- Survey of India Topographic Map — 73 A/13 and special sheet no. 12&13
- **Co-ordinates :**

  Amrapali Block
  - Latitudes — 23^0 51' 31" & 23^0 53' 38" N
  - Longitude — 85^0 00' 05" & 85^0 02' 07" E

  Kishanpur Block
  - Latitudes — 23^0 51' 58" & 23^0 53' 30" N
  - Longitude — 84^0 58' 55" and 85^0 00' 05" E

3.2 COMMUNICATION

The metalled road connecting Tandwa with Hazaribagh (80 Km.) via Semaria passes through the block. Another metalled road connects Tandwa with Hazaribagh (50 Km.) via Barkagaon. Tandwa is also connected to Ranchi (92 Km.) via Khalari (28 Km.) and Bijupara by metalled road.

Nearest rail head is Ray Station at a distance of about 34 Km. from the block on Barkakana Dehri-on-sone loop line of the eastern railway. Tori is another nearby Railway Station located south of the block at a crow fly distance of about 52 km.

3.3 TOPOGRAPHY

The Amrapali block is characterised by more or less flat terrain with gentle undulation. In general ground slopes towards south. The maximum and minimum elevation is 497 and 440m respectively.

Chundru and Barki rivers flowing west to east and north to south respectively control the drainage of the block. The Chundru river marks the Southern boundary of the block whereas Barki river is the eastern limit of the property. Besides, there are some small seasonal nalas, which discharge their load into main nalas of the block. All the nalas of the block are seasonal except Chundru and Barki River, which are perennial..

3.4 CLIMATE

The climate is tropical with severe summer. The temperature during summer (March to June) goes as high as 450 C. The summer is very hot and dusty. But nights are generally pleasant. The winter (November to February) is cold and minimum temperature is 10C. The rainy season is generally from June to October. The total rainfall in a year on an average is about 1011 mm of which 69% precipitation is during rainy season.

CHAPTER - IV
GEOLOGY AND DEPOSIT APPRAISAL

4.1 INTRODUCTION

Amprapali OCP block consists of an area of 16.0 sq. km. with two blocks Kishanpur with an area of 5.89 sq. km and Amprapali with an area of 10.11 sq. km. respectively. Amprapali block is contiguous to Kishanpur block in the west, Pachra block in the east and Kasiadih UG block in the north.

4.1.1 Geological Reports Prepared

- Geological Report on Kishanpur Block, North Karanpura Coalfield, CMPDI, March 1991
- Geological Report on Amrapali Block, North Karanpura Coalfield, CMPDI ,October 1991

4.1.2 Block Boundaries

The block boundaries of Amrapali OCP are as follow:

North : Kasiadih U/G

South : Chundru Nadi

East : Barki Nadi

West : Bahutchua Nala

The limitation of the block boundaries are given as below:

Block	Longitude	Latitude
Amrapali Opencast Project	84°58'55" to 85°02'07"E	23051'31 to 23053'38"N
Amrapali	85°00'05" to 85°02'07"E	23°51'31" to 23°53'38"N
Kishanpur	84°58'55" to 85°00'05"E	23°51'58" to 23°53'30"N

4.1.3 Any other relevant details

Amrapali OCP consisting of Amrapali and Kishanpur are virgin and are best suitable for mega opencast mining project.

4.2 EXPLORATION STATUS

4.2.1 No. of boreholes & meterage drilled

The total of 158 nos. of boreholes has been drilled in Amrapali and Kishanpur geological blocks. The boreholes drilled in Amrapali and Kishanpur are 99 and 59 respectively. The earliest phase

of drilling was conducted in 1968- 69 and 1980-81 by GSI and further carried out by CMPDI in 1983-1988.The details of no. of boreholes and meterage drilled are given as below:

Table 4.1 - Details of drilling in Amrapali OCP

S.N.	Block	Agency	Coring	Non - coring	Total	Meterage	Year of Drilling
1	Amrapali	CMPDIL	97	02	99	12633.95	1968-81 (GSI) 1984-91(CMPDI)
2	Kishanpur	CMPDIL	59	00	59	8756.85	1980-81 (GSI) 1983-88(CMPDI)
3	Amrapali OCP	CMPDIL	156	02	158	21390.80	1968-81 (GSI) 1983-91(CMPDI)

4.2.2 Density of boreholes

In Amrapali OCP the density of boreholes drilled is 10 boreholes per sq.km. The details of density of boreholes in Amrapali OCP and block wise is given as below:

Table 4.2 - Borehole densities in Amrapali OCP

S.No.	Block	Borehole Nos.	Area (Sq. km.)	Borehole density (BH/Sq. km)
1	Amrapali	99	10.11	10
2	Kishanpur	59	5.89	10
3	Amrapali OCP	158	8.31	18

4.2.5 Density of seams

The densities of seams in different blocks are given as follow:

Table 4.3 - Density of coal seams in Amrapali OCP

S.No.	Seam	Amrapali Block			Kishanpur Block		
		No. of B.H.	Area Sq. km.	Borehole density	No. of B.H.	Area Sq. km.	Borehole density
1	V Top	--			2		
2	V Bot	--			3		
3	IV	44			27		
4	III Top	3			2		
5	III Bot	3			3		
6	III Comb	42			29		

7	II Top	50			30		
8	II Bot	50			42		
9	I Top	20			41		
10	I Top + I Mid	24			4		
11	I Mid.	14			46		
12	I Bot	43			52		
13	I Mid + I Bot	10			--		
14	I Top + I Mid + I Bot	20			--		
	Total	99	10.11	10	59	5.89	10

4.2.6 Number of Boreholes Analysed

In Amrapali OCP consisting of two blocks i.e. Amrapali and Kishanpur blocks. Fourteen nos. of seams have been encountered. All the boreholes in which the coal seams have been encountered, band by band analysis have been carried out. After getting the analytical result overall analysis has been carried out. In addition certain special tests have also been done for the seams in the blocks. The details of the no. of samples on which analysis carried out in the blocks are given below.

Table 4.4 - Details of analysis at different blocks in Amrapali OCP

S N.	Seam	Amrapali Block				Kishanpur Block			
		Bandby Band	Overall	Ultimate	Special Tests	Band by Band	Overall	Ultimate	Special Tests
1	V Top	-	-	-	-	-	-	-	-
2	V Bot	-	-	-	-	2	1	-	-
3	IV	36	36	12	23	23	23	4	9
4	III Top	3	3	2	3	2	2	1	1
5	III Bot	3	3	2	3	3	3	1	2
6	III Comb	34	34	7	18	26	25	4	8
7	II Top	38	36	10	19	21	19	3	6
8	II Bot	45	43	12	26	35	33	4	10
9	I Top	16	15	3	8	38	35	8	18
10	I Top+ IMid	21	21	4	8	4	4	-	-
11	I Mid	12	10	3	6	36	34	4	7

12	SO	34	28	6	13	44	37	15
13	Mc+ SO	9	9					2
14	Sc+Mc+ SO	15	14	6	13			-

4.2.7 Reliability of data

No statistical calculation and analysis have been done for any analytical parameter of the coal seam in Amrapali OCP blocks.

4.3 GEOLOGY AND STRUCTURE OF BLOCK

4.3.1 Geological settings

The Amrapali OCP blocks are located in the northern part of North Karanpura Coalfields. In this area Barakars are lying directly over the Metamorphics. Barren Measures are exposed further dip side of the blocks. Metamorphics exposed on the ground lies towards north of the block boundary. The general sequence of the blocks are described as below

Table 4.4 - Stratigraphic Sequence of Amrapali OCP Block, North Karanpura Coalfield

Period	Formation	Thickness (m)	Lithology
Recent			Alluvium
Lr. Cretaceous	Intrusive	-	Lamprophyre and dolerite dykes and sills
Lr. Triassic	Panchet	50-225	Micaceous fine grained sandstone and red shales
Upper Permian	Raniganj	155-432	Medium to coarse grained sandstone, grey shale carb shale and thin coal seams
Middle Permian	Barren Measure	180-457	Dark shale, sandy micaceous shale
Lr. Permian	Barakar	145-457	Coarse to medium grained sandstone, grey shale, carbonaceous shale, fire clay and thick coal seams
Lr. Permian	Karharbari	3-75	Conglomerate, sandstone, grey shale carbonaceous shale & coal seams
Up. Carboniferous to Lr. Permian	Talchir	2-130	Green shale, Sandstone Rhythmites
Pre-Cambrian			Granite, Gneiss, Mica Schist and Amphibolites

4.3.2 Coal bearing formation

Barakar Formation is the main coal bearing formation of this area. The formation consist of mainly coarse to medium grained sandstone, carbonaceous shale, shale, fire clay, sandy shale and thick coal seams. Barakar lies directly over the metamorphics. Amprapali block contains only four seams i.e. seam I to seam IV and Kishanpur geological block contain five major distinct coal seams, which are designated as Seam I to V in ascending order. Seam V occurs in two splits, V top & V Bottom in Kishanpur block only. This seam is less than 1 m and lies with substantial parting of 120 to 130m with seam IV. Hence seam V does not have opencast potentiality. Seam I to IV within Barakar formation are potential quarriable seams in both the blocks. Seam I is the thickest and most important seam in this area and is split into sections of Top, Middle and Bottom. Seam I Bottom is the thickest seam while Seam I Middle is highly interbanded. Seam II occurs in to splits II Top and II Bottom. Seam III is occurs as unsplitted composite seam in the entire Amprapali OCP. Seam IV is the topmost seam and does not show any splitting like underlying seams.

4.3.3 Sequence of coal seams

The details of coal seams with its partings are given as below.

Table 4.5 - Seam wise Thickness Range, Borehole Intersection, Amrapali Block,

Seam	Amrapali Block			Kishanpur Block		
	Thickness Range (m)	Borehole Intersection	Borehole Density	Thickness Range (m)	Borehole Intersection	Borehole Density
V Top	-	-		0.28-0.45	2	
Parting	-	-		5.69	-	
V Bot	-	-		0.80-0.87	3	
Parting	-	-		121.69-131.84	-	
IV	3.99-7.15	44		3.54-7.77	27	
Parting*	1.65-9.47	-		5.55-18.68	-	
III Top	2.83-4.55	3		2.09-2.58	2	
Parting	0.00-2.22	-		0.00-2.27	-	
III Bot	3.62-4.55	3		3.23-5.23	3	
III Comb	4.68-10.24	42		5.78-12.31	29	
Parting	5.24-16.72	-		1.17-18.1	-	
II Top	1.09-3.42	50		0.21-4.50	30	
Parting	1.80-18.90	-		1.28-17.39	-	
II Bot	0.44-5.67	50		0.20-4.16	42	

Parting**	4.35-32.97	-		0.51-17.91	-	
I Top	1.53-9.44	20		1.85-9.33	41	
Parting***	0.00-22.64	-		0.00-18.47	-	
I Top + I Mid	8.28-17.13	24		11.16-13.58	4	
I Mid	0.90-8.53	14		0.26-7.61	46	
Parting	0.00-6.02	-		1.47-33.62	-	
I Bot	3.87-11.98	43		4.85-12.61	52	
I Mid +I Bot	13.51-19.59	10			-	
ITop+ I Mid+ I Bot	19.36-27.14	20			-	

* Also includes parting between IV and III (Comb.)

** Also includes parting between II Bottom and I Top & Mid Comb. / I Top, Mid and Bot. combined.

*** Also includes parting between I Top and I Middle and Bottom combined.

4.3.4 Structural Settings

Amrapali OCP consisting of two blocks lies in the northern most part of North Karanpura coalfield. Metatamorphic formation occurs in the northern boundary of the block. The area is characterized by a simple geological structure with less numbers of faults. In the north eastern boundary of the block, Fault F6 is the major fault of about 130 m. throw towards north. This has brought the Barren Measures in juxtaposition of Barakars in the down dipside of Amrapali Block. Other faults, F4 and F5 have throw of 30 to 40 m. Amprapali OCP is amost free from faults. However the faults F1, F2 & F3 of Amprapali block are located in the eastern part of the area.

4.3.5 Dip and Strike

The dip of the project and the different blocks are as follow:

Amrapali OCP varies from 5° - 10° towards south.

Amrapali Block varies from 5° - 10° towards south.

Kishanpur Block varies from 5° - 10° towards south.

The strike of the formations of the project and the different blocks are as follow:

Amrapali OCP trending roughly E– W swings in major part with local swings to WNW – ESE.

The block wise strike of the formation is as follow:

Amrapali Block trending roughly E – W.

Kishanpur Block trending roughly E – W.

4.3.5 Fault Characterstics

The block is traversed by 7 numbers of faults from F1-F1 to F7 – F7 with variation of throw from 5m. to 130 m. Among these fault F1-F1 and F6 – F6 are major faults, are trending NW – SE in the Amrapali OCP block. The faults are oblique and curvilinear in nature. The details of the faults are described as follow:

Table 4.6 - Details of Faults

SN	Fault	Amount of throw (m)	Trend	Direction of throw
1.	F1-F1	0-20	NNE-SSW	North-westerly
2.	F2-F2	0-8	NE-SW	North-westerly
3.	F3-F3	15-20	NE-SW	North-Westerly
4.	F4-F4	30- 40	NE-SW	North-Westerly
5.	F5-F5	30- 40	NE-SW.	South easterly
6.	F6-F6	50 -130	NE-SW	Northerly
7.	F7-F7	5-25	N-S	Westerly

4.3.7 Igneous Intrusives

One dolerite dyke occurring in adjoining Koyad block disappears on reaching Kishanpur block. However, a small segment of the incrop of seam-I Bottom is found to have been affected by the dyke in the northwestern part of Kishanpur block.

4.4 DESCRIPTION OF COAL SEAMS

4.4.1 Important Coal Seams

Barakar formation in the Amrapali contains only 4 seams (I to IV) and Kishanpur blocks contain five coal seams, which are designated as seam-I to seam-V in the ascending order. Seam-V occurs in two spits, V Top & V Bottom in Kishanpur block only. This seam is less than 1 m. and lies with substantial parting of 120 to 130 m. with seam IV hence seam V does not have opencast potentiality. Seam I to seam IV within Barakar formation are potential quarriable seams in Amprapali and Kishanpur geological blocks. Seam I is the thickest seam in the area and splits in Top, Middle and Bottom. Seam I Bottom is the thickest in Amprapali OCP. Being non coking coal the quality parameters like proximate analysis, calorific value, ultimate analysis, HGI, Ash Fusion range and Ash Analysis have been carried

out of all the seams split wise and combined. However other special tests like coking properties, petrographic studies and washability tests have not been done in the blocks of Amrapali OCP.

4.4.2 Description of Individual Seams

4.4.2.1 Seam – I Top +I Middle +I Bottom

The seam- I Top +I Middle +I Bottom exist in Amprapali block (East –Quarry). Seam I Top + I Middle + I Bottom has occurred in Amrapali block with thickness 19.36-27.14m.

4.4.2.1.1 Details of Splitting:

The seam splits in three parts seam I Bottom , I Middle and I Top and occur as a composite seam.

4.4.2.1.2 Roof and Floor:

The immediate floor and roof are generally represented by carbonaceous shale and grey shale.

4.4.2.1.3 Burning of Coal Seams

There is no surface burning for this seam.

4.4.2.1.4 Dirt bands:

The detail of the dirt bands in the seam are as follow:

Table 4.7 - Details of dirt bands encountered in Seam I Top + I Mid + I Bot

Block	Combustible Dirt Bands < 1 m			Non combustible Dirt Bands			Avg Band%
	No.	Thick.	Percent	No.	Thick.	Percent	
Amrapali	13-27	4.0-7.14	17.9-26.31	1-8	0.47-1.57	1.88-6.47	27.66

4.4.2.1.5 Quality Parameters:

a. Proximate Analysis:

The proximate analysis on 60%R.H. and 40°C of the seam has been carried out which is being described as follow:

Table 4.8 - Results of Proximate Analysis of Seam IT +IM +I B

Block	Moisture%	Ash%	V.M%	Gross CV (K. Cal/Kg)	UHV (K. Cal/Kg)	Grade
In-band						
Amrapali	3.6-5.1	38.6-47.6	21.4-23.0		1835-2925	F-G
BCS						
Amrapali	4.3-5.7	32.5-39.5	23.1-24.9	4210	2855-3740	E-F

The overall grade is generally F.

b. Ultimate Analysis:

The ultimate analysis of the seam is given as follow:

Table 4.9 - Results of Ultimate Analysis of Seam IT +IM +I B

Block	C%	H%	N%	S%	O%	CO_2	P%
Amrapali	82.3-85.1	4.9-5.5	1.7-2.1	0.5-0.7	9.9-10.5	0.1-1.62	0.035-0.06

c. H.G.I and Ash Fusion Range

The special tests of the seam is given as follow:

Table 4.10 - Results of HGI and Ash Fusion Range of Seam IT +IM +I B

Block	I.D.T.°C	H.T. °C	F.T. °C	H.G.I.
Amrapali	1170-1380	1340->1400	>1400	58-60

d. Ash Analysis

The ash analysis of the seam is given as follow:

Table 4.11 - Results of Ash Analysis of Seam IT +IM +I B

Block	SiO_2	AL_2O_3	Fe_2O_3	TiO_2	P_2O_5	SO_3	CaO	MgO	Na_2O	K_2O
Amrapali	59.40-63.72	26.47-30.40	3.17-5.20	1.58-1.90	0.31-0.47	0.00-0.39	1.00-2.01	0.65-0.90	0.42-0.88	0.75-1.32

e. Other Special Tests

Coking Properties, Petrographic Tests and Washability Tests have not been carried out

4.4.2.2 Seam-I Bottom:

Seam I Bottom is the bottom most coal seam of the block. Seam I Bottom has occurred in Amrapali and Kishanpur Block with thickness ranges from 3.87 m to 12.61 m.

4.4.2.2.1 Details of Splitting:

The Seam-I Bottom is the bottommost split of Seam I.

4.4.2.2.2 Roof and Floor:

The immediate floor and roof are generally represented by carbonaceous shale, sandy shale, fine to medium grained sandstone and grey shale.

4.4.2.2.3 Burning of Coal Seams:

There is no burning effect in the coal seam in the area.

4.4.2.2.4 Dirt bands:

The detail of the dirt bands in the seam are as follow:

Table 4.12 - Details of dirt bands encountered in Seam I Bottom

Block	Combustible Dirt Bands < 1 m			Non combustible Dirt Bands			Avg Band%
	No.	Thick.	Percent	No.	Thick.	Percent	
Amrapali	1-19	0.25-3.92	4.19-32.72	1-8	0.45-2.26	4.17-22.71	21.49
Kishanpur	1-13	0.06-2.46	1.11-31.82	1-3	0.06-0.95	0.41-5.67	23.45
Amrapali OCP	1-19	0.06-3.92	1.11-32.72	1-8	0.06-2.26	0.41-22.71	21.49-23.45

4.4.2.2.5 Quality Parameters:

a. Proximate Analysis:

The proximate analysis on 60%R.H. and 40°C of the seam has been carried out which is being described as follow:

Table 4.13 - Results of Proximate Analysis of Seam I Bottom

Block	Moisture%	Ash%	V.M%	Gross CV (K. Cal/Kg)	UHV (K. Cal/Kg)	Grade
In-band						
Amrapali	3.0-6.8	34.6-50.7	19.8-23.9	-	1390-3185	F-G
Kishanpur	3.4-5.9	31.4-49.2	20.6-24.8	3285-4775	1505-3850	E-G
Amrapali OCP	3.0-6.8	31.4-50.7	19.8-24.8	3285-4775	1390-3850	E-G
BCS						
Amrapali	3.4-7.1	33.9-47.3	20.8-24.0	3380-4680	1780-3575	E-G
Kishanpur	4.6-6.5	29.6-41.3	22.0-25.6	3970-4785	2540-4100	F-G
Amrapali OCP	3.4-7.1	29.6-47.3	20.8-25.6	3380-4785	1780-4100	E-G

The overall grade is generally E to G.

b. Ultimate Analysis

The ultimate analysis of the seam is given as follow:

Table 4.14 - Results of Ultimate Analysis (dmmf) of Seam I Bottom

Block	C%	H%	N%	S%	O%	CO_2	P%
Amrapali	82.1-86.5	4.5-5.6	1.6-2.0	0.6-0.8	7.6-10.7	0.04-1.74	0.033-0.09
Kishanpur	80.2-84.7	4.4-5.2	1.2-1.9	0.6-1.2	8.2-13.1	0.36-1.20	0.11-0.27
Amprapali OCP	80.2-86.5	4.4-5.6	1.2-2.0	0.6-1.2	7.6-13.1	0.04-1.74	0.033-0.27

c. H.G.I and Ash Fusion Range

The special tests of the seam is given as follow:

Table 4.15 - Results of HGI and Ash Fusion Range of Seam I Bottom

Block	I.D.T °C	H.T °C	F.T °C	HGI
Amrapali	1150-1390	1270->1400	-	58-60
Kishanpur	1150-1380	1290->1400	>1400	58-62
Amrapali OCP	1150-1390	1270->1400	>1400	58-62

d. Ash Analysis

The ash analysis of the seam is given as follow:

Table 4.16 - Results of Ash Analysis of Seam I Bottom

Block	SiO_2	AL_2O_3	Fe_2O_3	TiO_2	P_2O_5	SO_3	CaO	MgO	Na_2O	K_2O
Amrapali	58.70-64.07	25.01-29.40	2.04-6.9	1.67-1.89	0.32-1.47	0.05-0.52	1.00-1.87	0.50-0.90	0.46-0.49	0.69-0.82
Kishanpur	59.74-65.28	23.12-26.12	5.12-7.24	1.42-1.72	0.29-0.82	0.22-0.47	1.32-2.61	0.54-1.56	0.34-0.70	0.48-1.04
Amrapali OCP	58.70-65.28	23.12-29.40	2.04-7.24	1.42-1.89	0.29-1.47	0.05-0.52	1.00-2.61	0.50-1.56	0.34-0.70	0.48-1.04

e. Other Special Tests

Coking Properties, Petrographic Tests and Washability Tests have not been carried out.

4.4.2.3 Seam-I Middle

The seam-I Middle occurs above Seam-I Bottom. Seam I Middle has occurred in Amrapali and Kishanpur Block with thickness ranges from 0.26 m to 8.53 m.

4.4.2.3.1 Details of Splitting

Seam-I Middle is the centre most split of seam.

4.4.2.3.2 Roof and Floor

The immediate roof and floor is commonly carbonaceous shale. Grey shale is also noticed in few of the boreholes

4.4.2.3.3 Burning of Coal Seams

There is no burning effect in the coal seam in the area

4.4.2.3.4 Dirt bands:

The detail of the dirt bands in the seam are as follow:

Table 4.17 - Details of dirt bands encountered in Seam I Middle.

Block	Combustible Dirt Bands < 1 m			Non combustible Dirt Bands			Avg Band%
	No	Thick.	Percent	No.	Thick.	Percent	
Amrapali	1-9	0.2-1.24	2.84-16.10	Nil-1	Nil-0.26	Nil-3.38	10.59
Kishanpur	Nil-8	Nil-1.65	Nil-32.28	Nil-3	Nil-0.61	Nil-20.83	22.68
Amrapali OCP	Nil-9	Nil-1.65	Nil-32.28	Nil-3	Nil-0.61	Nil-20.83	10.59-22.68

4.4.2.3.5 Quality Parameters:

a. Proximate Analysis:

The proximate analysis on 60%R.H. and 40°C of the seam has been carried out which is being described as follow:

Table 4.18 - Results of Proximate Analysis of Seam-I Middle.

Block	Moisture%	Ash%	V.M%	Gross CV (K. Cal/Kg)	UHV (K. Cal/Kg)	Grade
In-band						
Amrapali	3.8-4.8	35.0-40.0	23.1-24.6	-	2855-3405	E-F
Kishanpur	3.7-7.4	26.0-49.8	19.9-27.4	3240-5030	1450-4290	D-G
Amrapali OCP	3.7-7.4	26.0-49.8	19.9-27.4	3240-5030	1450-4290	D-G
BCS						
Amrapali	4.4-5.6	33.3-36.3	23.4-24.6	4325-4760	3115-3670	E-F
Kishanpur	4.1-6	28.4-45.8	20.6-27.4	3580-5010	1960-4150	E-G
Amrapali OCP	4.1-6	28.4-45.8	20.6-27.4	3580-5010	1960-4150	E-G

The overall grade is generally F. The results show minor variation in basic quality over the area.

b. Ultimate Analysis

The ultimate analysis of the seam is given as follow:

Table 4.19 - Results of Ultimate Analysis (dmmf) of Seam I Middle

Block	C%	H%	N%	S%	O%	CO_2	P%
Amrapali	82.9-85.3	4.9	1.5-2	0.6-0.7	7.7-10	0.06-1.67	0.065-0.16
Kishanpur	80.0-82.6	4.5-5.1	0.96-1.8	0.5-1.1	10.6-13.2	0.43-1.4	0.16-0.27
Amprapali OCP	80.0-85.3	4.5-5.1	0.96-2	0.5-1.1	7.7-13.2	0.06-1.67	0.065-0.27

c. H.G.I and Ash Fusion Range

The special tests of the seam is given as follow:

Table 4.20 - Results of HGI and Ash Fusion Range of Seam I Middle

Block	I.D.T °C	H.T °C	F.T °C	HGI
Amrapali	1170-1380	1310->1400	-	55-62
Kishanpur	1170-1360	1290->1400	-	57-59
Amrapali OCP	1170-1380	1290->1400	-	55-62

d. Ash Analysis

The ash analysis of the seam is given as follow:

Table 4.21 - Results of Ash Analysis of Seam I Middle

Block	SiO_2	AL_2O_3	Fe_2O_3	TiO_2	P_2O_5	SO_3	CaO	MgO	Na_2O	K_2O
Amrapali	56.20-65.12	24.79-29.20	2.11-7.20	1.69-2.10	0.42-1.00	0.05-0.37	1.09-1.50	0.67-1.00	0.49-0.62	0.74-0.98
Kishanpur	57.9-64.56	24.72-29.70	4.56-7.60	1.54-2.10	0.28-0.60	0.00-0.46	1.10-2.46	0.82-1.28	0.39-0.78	0.50-1.06
Amrapali OCP	56.20-65.12	24.72-29.70	2.11-7.60	1.54-2.10	0.28-1.00	0.00-0.46	1.09-2.46	0.67-1.28	0.39-0.78	0.50-1.06

e. Other Special Tests

Coking Properties, Petrographic Tests and Washability Tests have not been carried out.

4.4.2.4 Seam-I Middle + I Bottom

Seams I Bottom and I bottom combine over major part of the block covering southern, central and northern part. Seam I Middle + I Bottom has occurred in Block with thickness ranges from 13.51 m to 19.59 m.

4.4.2.4.1 Details of Splitting:

Seam-I Middle is the centre most split of seam.

4.4.2.4.2 Roof and Floor:

The immediate roof is generally constituted by grey or sandy shale with subordinate carbonaceous shale. The immediate floor is usually represented by the carbonaceous shale or sandy shale.

4.4.2.4.3 Burning of Coal Seams:

There is no burning effect in the coal seam in the area.

4.4.2.4.4 Dirt bands:

The detail of the dirt bands in the seam are as follow

Table 4.22 - Details of dirt bands encountered in Seam I Middle + I Bottom

Block	Combustible Dirt Bands < 1 m			Non combustible Dirt Bands			Avg Band%
	No	Thick.	Percent	No	Thick	Percent	
Amrapali	4-17	1.35-4.97	9.22-25.88	1-3	0.06-0.95	0.41-5.67	23.45

4.4.2.4.5 Quality Parameters

a. Proximate Analysis:

The proximate analysis on 60%R.H. and 40°C of the seam has been carried out which is being described as follow.

Table 4.23 - Results of Proximate Analysis of Seam I Middle + I Bottom

Block	Moisture%	Ash%	V M%	Gross CV (K Cal/Kg)	UHV (K Cal/Kg)	Grade
In-band						
Amrapali	4.0	3.5-3.8	-	1915-2485	1915-2485	F-G
BCS						
Amrapali	4.0-4.6	33.8-40.9	-	4125-4705	2705-4705	F

b. Ultimate Analysis

The ultimate analysis of the seam is given as follow:

Table 4.24 - Results of Ultimate Analysis (dmmf) of Seam I Middle+I Bottom Combined

Block	C%	H%	N%	S%	O%	CO_2	P%
Amrapali	82.9-85.3	4.9	1.5-2	0.6-0.7	7.7-10	0.06-1.67	0.065-0.16
Kishanpur	80.0-82.6	4.5-5.1	0.96-1.8	0.5-1.1	10.6-13.2	0.43-1.4	0.16-0.27
Amprapali OCP	80.0-85.3	4.5-5.1	0.96-2	0.5-1.1	7.7-13.2	0.06-1.67	0.065-0.27

c. H.G.I and Ash Fusion Range

Has not been carried out

d. Ash Analysis

Has not been carried out.

e. Other Special Tests

Coking Properties, Petrographic Tests and Washability Tests have not been carried out

4.4.2.5 Seam-I Top + I Middle

4.4.2.5.1 Details of Splitting:

It represents combination of Seams I - Top and Seam - I Middle. Seam I Top + Middle has occurred in Block with thickness ranges from 8.28 m to 17.13 m.

4.4.2.5.2 Roof and Floor:

The immediate roof and floor strata are generally represented by carbonaceous shale.

4.4.2.5.3 Burning of Coal Seams:

There is burning effect in the coal seam in the area.

4.4.2.5.4 Dirt bands:

The detail of the dirt bands in the seam are as follow:

Table 4.25 - Details of dirt bands encountered in Seam I Top + I Middle.

Block	Combustible Dirt Bands < 1 m			Non combustible Dirt Bands			Avg Band%
	No.	Thick.	Percent	No.	Thick.	Percent	
Amrapali	2-25	0.84-4.28	5.83-30.55	Nil-4	Nil-3.23	Nil-22 89	22.28
Kishanpur	6-9	2.12-3.51	18.2-26.59	Nil-2	Nil-0.34	Nil-3.05	11.69
Amrapali OCP	2-25	0.84-4.28	5.83-30.55	Nil-4	Nil-3.23	Nil-22 89	11 69-22.28

4.4.2.5.5 Quality Parameters

a. Proximate Analysis

The proximate analysis on 60%R.H. and 40°C of the seam has been carried out which is being described as follow:

Table 4.26 - Results of Proximate Analysis of Seam I Top + I Middle

Block	Moisture%	Ash%	V.M%	Gross CV (K. Cal/Kg)	UHV (K. Cal/Kg)	Grade
In-band						
Amrapali	3.5-6.0	37.5-48.4	20.3-22.5	-	1655-2895	F-G
Kishanpur	4.1-4.7	42.5-46.6	20.2-21.2	3575-3870	1905-2385	G
Amrapali OCP	3.5-6.0	37.5-48.4	20.2-22.5	3575-3870	1655-2895	F-G
BCS						
Amrapali	3.6-6.4	33.7-38.3	21.6-25.7	4130-4715	2950-3615	E-F
Kishanpur	5.1-6.4	35.0-38.9	23.4-24.4	3965-4520	2650-3365	E-F
Amrapali OCP	3.6-6.4	33.7-38.9	21.6-25.7	39654715	2650-3615	E-F

The overall grade is generally E to F.

b. Ultimate Analysis:

The ultimate analysis of the seam is given as follow:

Table 4.27 - Results of Ultimate Analysis of Seam I Top + I Middle

Block	C%	H%	N%	S%	O%	CO_2	P%
Amrapali	82.9-85.3	4.5-5.3	1.9-2.0	0.38-0.8	9.8-9.9	1.57-1.68	0.097-0.10
Kishanpur	83.3	5.0	1.4	0.8	9.5	-	-
Amprapali OCP	82.9-85.3	4.5-5.0	1.4-2.0	0.38-0.8	9.5-9.9	1.57-1.68	0.097-0.10

c. H.G.I and Ash Fusion Range

The special tests of the seam is given as follow:

Table 4.28- Results of HGI and Ash Fusion Range of Seam I Top + I Middle

Block	I.D.T °C	H.T °C	F.T °C	HGI
Amrapali	1270-1360	1360->1400	>1400	58

d. Ash Analysis

The ash analysis of the seam is given as follow:

Table – 4.29: Results of Ash Analysis of Seam I Top + I Middle

Block	SiO_2	AL_2O_3	Fe_2O_3	TiO_2	P_2O_5	SO_3	CaO	MgO	Na_2O	K_2O
Amrapali	63.74-64.52	26.12-26.42	2.52-4.12	1.62	0.37	0.34-0.47	1.32-1.71	0.67-0.69	0.48-0.78	0.68-1.44

e. Other Special Tests

Coking Properties, Petrographic Tests and Washability Tests have not been carried out

4.4.2.6 Seam-I TOP

Seam I Top has occurred in Amrapali and Kishanpur Block with thickness ranges from 1.53 m to 9.44 m.

4.4.2.6.1 Details of Splitting:

Seam-I Top is the upper most split of seam.

4.4.2.6.2 Roof and Floor:

The immediate roof and floor are generally represented by carbonaceous shale or grey shale.

4.4.2.6.3 Burning of Coal Seams:

There is no burning effect in the coal seam in the area.

4.4.2.6.4 Dirt bands:

The detail of the dirt bands in the seam are as follow:

Table 4.30 - Details of dirt bands encountered in Seam I Top

Block	Combustible Dirt Bands < 1 m			Non combustible Dirt Bands			Avg Band%
	No.	Thick.	Percent	No.	Thick.	Percent	
Amrapali	1-5	0.09-2.07	5.88-34.08	Nil-1	Nil-0.27	Nil-4.65	22.15
Kishanpur	Nil-9	Nil-1.27	Nil-30.27	Nil-3	Nil-0.26	Nil-5.71	17.38
Amrapali OCP	Nil-9	Nil	Nil-34.08	Nil-3	Nil-0.27	Nil-5.71	17.38-22.15

4.4.2.6.5 Quality Parameters:

a. Proximate Analysis

The proximate analysis on 60%R.H. and 40°C of the seam has been carried out which is being described as follow:

Table 4.31 - Results of Proximate Analysis of Seam-I Top

Block	Moisture%	Ash%	V.M%	Gross CV (K. Cal/Kg)	UHV (K. Cal/Kg)	Grade
In-band						
Amrapali	3.5-3.9	39.5-49.6	18.4-21.6	-	1515-2940	F-G
Kishanpur	2.9-6.4	28.0-47.3	17.6-23.2	3360-4990	1890-4150	E-G
Amrapali OCP	2.9-6.4	28.0-49.6	17.6-23.2	3360-4990	1515-4150	E-G
BCS						
Amrapali	4.0-5.6	30.9-39.8	21.7-25.5	4050-4960	2715-3985	E-F
Kishanpur	3.8-6.4	28.0-43.8	22.4-24.4	3735-4990	2195-4150	E-G
Amrapali OCP	3.8-6.4	28.0-43.8	21.7-25.5	3735-4990	2195-4150	E-G

The overall grade is generally F. The results show minor variation in basic quality over the area.

b. Ultimate Analysis

The ultimate analysis of the seam is given as follow:

Table 4.32 - Results of Ultimate Analysis (dmmf) of Seam I Top

Block	C%	H%	N%	S%	O%	CO_2	P%
Amrapali	82.9-85.4	4.8	1.6-1.8	0.6-0.8	7.4-9.9	0.08-0.98	0.2-0.59
Kishanpur	79.8-84.5	4.4-5.27	0.86-1.9	0.47-0.8	8.7-13.5	0.12-1.3	0.04-0.2
Amprapali OCP	82.9-85.4	4.4-5.27	0.86-1.9	0.47-0.8	7.4-13.5	0.08-1.3	0.04-0.59

c. H.G.I and Ash Fusion Range

The special tests of the seam is given as follow:

Table 4.33 -Results of HGI and Ash Fusion Range of Seam I Top

Block	I.D.T °C	H.T °C	F.T °C	HGI
Amrapali	-	1270-1390	1360->1400	-
Kishanpur	54-62	1180-1280	1320->1400	-
Amrapali OCP	54-62	1180-1390	1320->1400	-

d. Ash Analysis

The ash analysis of the seam is given as follow:

Table 4.34 - Results of Ash Analysis of Seam I Top

Block	SiO_2	AL_2O_3	Fe_2O_3	TiO_2	P_2O_5	SO_3	CaO	MgO	Na_2O	K_2O
Amrapali	55.40-63.70	23.30-30.50	5.80-8.60	1.50-1.90	0.47-2.40	0.00-0.41	1.61-3.00	0.67-0.90	0.64	1.12
Kishanpur	61.37-64.17	23.47-27.87	3.72-6.47	1.32-1.59	0.13-0.52	0.13-0.52	0.84-2.42	0.39-1.74	0.30-0.87	0.60-1.27
Amrapali OCP	55.40-64.17	23.30-30.50	3.72-8.60	1.32-1.90	0.13-2.40	0.00-0.52	0.84-3.00	0.39-1.74	0.30-0.87	0.60-1.27

e. Other Special Tests

Coking Properties, Petrographic Tests and Washability Tests have not been carried out

4.4.2.7 Seam-II Bottom

Seam II Bottom has occurred in Amrapali and Kishanpur Block with thickness ranges from 0.20 m to 5.67 m.

4.4.2.7.1 Details of Splitting:

Seam-II Bottom is the lower most split of Seam-II.

4.4.2.7.2 Roof and Floor:

The immediate roof and floor of the seam is generally represented by shale, sandy shale, grey shale, intercalation of shale and sandstone, carbonaceous shale, and fine to medium grained sandstone

4.4.2.7.3 Burning of Coal Seams:

There is no burning effect in the coal seam in the area.

4.4.2.7.4 Dirt bands:

The detail of the dirt bands in the seam are as follow:

Table 4.35 - Details of dirt bands encountered in Seam II Bottom

Block	Combustible Dirt Bands < 1 m			Non combustible Dirt Bands			Avg Band%
	No.	Thick.	Percent	No.	Thick.	Percent	
Amrapali	1-14	0.05-1.74	2.35-32.7	Nil-2	Nil-0.34	Nil-15.34	18.13
Kishanpur	1-4	0.17-1.14	15.04-15.06	Nil-2	Nil-0.34	Nil-6.19	27.61
Amrapali OCP	1-14	0.05-1.74	2.35-32.7	Nil-2	Nil-0.34	Nil-15.34	18.13-27.61

4.4.2.7.5 Quality Parameters:

a. Proximate Analysis:

The proximate analysis on 60%R.H. and 40°C of the seam has been carried out which is being described as follow:

Table 4.36 - Results of Proximate Analysis of Seam II Bottom

Block	Moisture%	Ash%	V.M%	Gross CV (K. Cal/Kg)	UHV (K. Cal/Kg)	Grade
In-band						
Amrapali	3.2-5.5	35.6-47.7	19.8-24.5	-	1780-3350	E-G
Kishanpur	4.5-5.9	40.1-47.7	21-22.3	3395-3900	1680-2745	F-G
Amrapali OCP	3.2-	35.6-47.7	19.8-24.5	3395-3900	1680-3350	E-G
BCS						
Amrapali	3.4-6.7	32.4-47	20.2-25.5	3480-4780	1875-3740	E-G
Kishanpur	4.9-6.6	33.3-42.3	22.3-22.9	3805-4505	2330-3435	E-G
Amrapali OCP	3.4-6.7	32.4-47	20.2-25.5	3480-4780	1875-3740	E-G

The overall grade is generally F. The results show minor variation in basic quality over the area.

b. Ultimate Analysis

The ultimate analysis of the seam is given as follow:

Table 4.37 - Results of Ultimate Analysis of Seam II Bottom

Block	C%	H%	N%	S%	O%	CO_2	P%
Amrapali	82.1-85.2	4.7-5.36	1.6-2	0.5-0.8	7.8-10.7	0.06-1.59	0.062-0.11
Kishanpur	79.5-84.4	4.4-4.6	1.6-1.8	0.5-0.6	8.8-14.0	0.8-1.1	0.08-0.18
Amprapali OCP	79.5-85.2	4.4-5.36	1.6-2	0.5-0.8	7.8-14.0	0.06-1.59	0.08-0.18

c. **H.G.I and Ash Fusion Range**

The special tests of the seam is given as follow:

Table 4.38 -Results of HGI and Ash Fusion Range of Seam II Bottom

Block	I.D.T °C	H.T °C	F.T °C	HGI
Amrapali	1190-1380	1340-1400	>1400	55-61
Kishanpur	1150-1280	1310->1400	>1400	59-62
Amrapali OCP	1150-1380	1310->1400	>1400	59-62

d. Ash Analysis

The ash analysis of the seam is given as follow:

Table 4.39 - Results of Ash Analysis of Seam II Bottom

Block	SiO_2	AL_2O_3	Fe_2O_3	TiO_2	P_2O_5	SO_3	CaO	MgO	Na_2O	K_2O
Amrapali	59.80-65.72	23.98-28.40	3.42-7.00	1.42-1.81	0.10-0.47	0.00-0.47	0.40-2.10	0.41-1.10	0.31-0.59	0.59-1.60
Kishanpur	57.30-63.94	24.47-29.60	3.92-7.12	1.19-2.10	0.32-1.01	0.14-0.89	0.82-2.64	0.34-1.52	0.34-0.87	0.48-0.99
Amrapali OCP	57.30-65.72	23.98-29.60	3.42-7.12	1.19-2.10	0.10-1.01	0.00-0.89	0.40-2.64	0.34-1.52	0.31-0.87	0.48-1.60

e. Other Special Tests

Coking Properties, Petrographic Tests and Washability Tests have not been carried out

4.4.2.8 Seam-II Top

Seam II Top has occurred in Amrapali and Kishanpur Block with thickness ranges from 0.21 m to 4.50 m.

4.4.2.8.1 Details of Splitting:

Seam-II Top is the upper most split of seam II.

4.4.2.8.2 Roof and Floor:

The immediate roof and floor of the seam is generally represented by carbonaceous shale, grey shale, sandy shale, gritty sandstone, intercalations of shale and sandstone and fine to coarse grained sandstones in order of abundance.

4.4.2.8.3 Burning of Coal Seams:

There is no burning effect in the coal seam in the area.

4.4.2.8.4 Dirt bands:

The detail of the dirt bands in the seam are as follow.

Table 4.40 - Details of dirt bands encountered in Seam II Top

Block	Combustible Dirt Bands < 1 m			Non combustible Dirt Bands			Avg Band%
	No.	Thick.	Percent	No.	Thick.	Percent	
Amrapali	Nil-3	Nil-0.25	Nil-11.79	-	-	-	4.78
Kishanpur	1-3	0.06-0.33	3.73-11.91	-	-	-	8.90
Amrapali OCP	Nil-3	Nil-0.33	Nil-11.91	-	-	-	4.78-8.90

4.4.2.8.5 Quality Parameters:

a. Proximate Analysis:

The proximate analysis on 60%R.H. and 40°C of the seam has been carried out which is being described as follow:

Table 4.41 -Results of Proximate Analysis of Seam II Top

Block	Moisture%	Ash%	V.M%	Gross CV (K. Cal/Kg)	UHV (K. Cal/Kg)	Grade
In-band						
Amrapali	3.6-7.8	29.0-42.5	21.6-25.5	-	2495-3750	E-F
Kishanpur	6.4-7.5	32.2-35.3	21.8-24.0	4300-4435	3145-3420	E-G
Amrapali OCP	3.6-7.8	29.0-42.5	21.6-25.5	4300-4435	2495-3750	E-G
BCS						
Amrapali	3.6-7.8	29.0-42.5	21.9-25.5	3990-4760	2495-3710	E-F
Kishanpur	6.7	30.2-30.8	23.6-26.1	4680-4740	3725-3805	E-F
Amrapali OCP	3.6-7.8	29.0-42.5	21.9-26.1	3990-4760	2495-3805	E-F

The overall grade is generally F. The results show minor variation in basic quality over the area.

b. Ultimate Analysis

The ultimate analysis of the seam is given as follow:

Table 4.42 - Results of Ultimate Analysis of Seam II Top

Block	C%	H%	N%	S%	O%	CO_2	P%
Amrapali	81.5-86.7	4.5-5.5	1.7-2.1	0.5-0.7	7.4-11.1	0.06-1.69	0.028-0.08
Kishanpur	81.9-82.1	4.4-5.2	0.76-1.9	0.54-1.0	11.1-11.5	0.37-1.0	0.037-0.17
Amprapali OCP	81.5-86.7	4.4-5.5	0.76-2.1	0.5-1.0	7.4-11.5	0.06-1.69	0.028-0.17

c. H.G.I and Ash Fusion Range:

The special tests of the seam is given as follow

Table 4.43 - Results of HGI and Ash Fusion Range of Seam II Top

Block	I.D.T °C	H.T °C	F.T °C	HGI
Amrapali	1170-1325	1280->1400	>1400	55-59
Kishanpur	1250-1280	-	>1400	59
Amrapali OCP	1170-1325	1280->1400	>1400	55-59

d. Ash Analysis

The ash analysis of the seam is given as follow:

Table 4.44 - Results of Ash Analysis of Seam II Top

Block	SiO_2	AL_2O_3	Fe_2O_3	TiO_2	P_2O_5	SO_3	CaO	MgO	Na_2O	K_2O
Amrapali	61.01-64.72	24.74-28.42	2.72-4.92	1.49-1.90	0.20-0.67	0.00-0.57	0.30-2.84	0.69-1.52	0.62-0.79	1.05-1.42
Kishanpur	59.64-63.10	26.79-27.60	4.30-5.89	1.62-2.00	0.30-0.34	0.00—0.42	0.70-2.18	0.80-1.01	0.69	1.42
Amrapali OCP	59.64-64.72	24.74-28.42	2.72-5.89	1.49-2.00	0.20-0.67	0.00-0.57	0.30-2.84	0.69-1.52	0.62-0.79	1.05-1.42

e. Other Special Tests

Coking Properties, Petrographic Tests and Washability Tests have not been carried out

4.4.2.9 Seam-III:

Seam III has occurred in Amrapali and Kishanpur Block with thickness ranges from 4.68 m to 12.31 m

4.4.2.9.1 Details of Splitting:

Seam-III has two splits, viz. Seam III Bottom and Seam III Top.

4.4.2.9.2 Roof and Floor:

The immediate roof and floor is represented by greyshale, carbonaceous shale, sandy shale, intercalation of shale & sandstone and fine to medium grained sandstones in order of their abundance.

4.4.2.9.3 Burning of Coal Seams:

There is no burning effect in the coal seam in the area.

4.4.2.9.4 Dirt bands:

The detail of the dirt bands in the seam are as follow:

Table 4.45 - Details of dirt bands encountered in Seam III

Block	Combustible Dirt Bands < 1 m			Non combustible Dirt Bands			Avg Band%
	No.	Thick.	Percent	No.	Thick.	Percent	
Amrapali	Nil-11	Nil-1.58	Nil-20.95	-	-	-	17.67
Kishanpur	3-12	0.92-1.73	11.18-21.54	-	-	-	8.90
Amrapali OCP	Nil-12	Nil-1.73	Nil-21.54	-	-	-	8.90-17.67

4.4.2.9.5 Quality Parameters:

a. Proximate Analysis:

Table 4.46 - Results of Proximate Analysis of Seam III.

Block	Moisture%	Ash%	V.M%	Gross CV (K. Cal/Kg)	UHV (K. Cal/Kg)	Grade
In-band						
Kishanpur	4.8-7.2	35.9-44.6	20.3-23.1	3600-4170	2025-3285	F-G
BCS						
Kishanpur	5.1-7.7	31.2-39.8	21.4-23.8	3860-4515	2590-3805	E-F

The overall grade is generally E - F. The results show minor variation in basic quality over the area.

b. Ultimate Analysis

The ultimate analysis of the seam is given as follow:

Table 4.47 - Results of Ultimate Analysis of Seam III

Block	C%	H%	N%	S%	O%	CO_2	P%
Kishanpur	80.9-84.1	4.6-5.3	1.02-1.9	0.39-0.6	8.8-12.7	0.16-1	0.167-0.24

c. H.G.I and Ash Fusion Range

The special tests of the seam is given as follow:

Table 4.48 - Results of HGI and Ash Fusion Range of Seam

Block	I.D.T °C	H.T °C	F.T °C	HGI
Kishanpur	1160-1280	1310->1400	-	60-62

d. Ash Analysis

The ash analysis of the seam is given as follow:

Table 4.49 - Results of Ash Analysis of Seam III

Block	SiO_2	AL_2O_3	Fe_2O_3	TiO_2	P_2O_5	SO_3	CaO	MgO	Na_2O	K_2O
Kishanpur	55.6-62.37	23.68-29.8	5.82-6.8	1.65-2	0.89-1.2	0.5-0.87	1.89-1.9	0.9-1.49	0.48	0.86

e. Other Special Tests

Coking Properties, Petrographic Tests and Washability Tests have not been carried out

4.4.2.10 Seam-III Bottom:

Seam III Bottom has occurred in Amrapali block and Kishanpur block with thickness ranges from 3.23 m to 5.23 m.

4.4.2.10.1Details of Splitting:

Seam-III Bottom is the bottom most split of seam III.

4.4.2.10.2Roof and Floor:

The immediate roof and floor are usually represented by carbonaceous shale, grey shale, alternate bands of shale and sandstone, sandy shale and fine grained sandstone.

4.4.2.10.3Burning of Coal Seams:

There is no burning effect in the coal seam in the area.

4.4.2.10.4Dirt bands:

The detail of the dirt bands in the seam are as follow:

Table 4.50 - Details of dirt bands encountered in Seam III Bottom.

Block	Combustible Dirt Bands < 1 m			Non combustible Dirt Bands			Avg Band%
	No	Thick	Percent	No.	Thick	Percent	
Amrapali	4	0.64-1.00	17.68	-	-	-	17.67
Kishanpur	2-7	0.32-0.88	9.91-19.26	Nil-3	Nil-0.29	Nil-5.54	17.11
Amrapali OCP	2-7	0.32-1.00	9.91-19.26	Nil-3	Nil-0.29	Nil-5.54	17.11-17.67

4.4.2.10.5Quality Parameters:

a. Proximate Analysis:

The proximate analysis on 60%R.H. and 40°C of the seam has been carried out which is being described as follow:

Table 4.51 - Results of Proximate Analysis of Seam III Bottom

Block	Moisture%	Ash%	V.M%	Gross CV (K. Cal/Kg)	UHV (K. Cal/Kg)	Grade
In-band						
Amrapali	4.3	38.5	-	4305	2995	F
Kishanpur	5.1-5.7	37.1-39.7	22.9	4010-4080	2660-3020	F
Amrapali OCP	4.3-5.7	37.1-39.7	22.9	4010-4305	2660-3020	F
BCS						
Amrapali	4.3	38.5		4305	2995	F
Kishanpur	5.3-6.4	33.6-38.3	22.3-23.9	4180-4425	2885-3450	E-F
Amrapali OCP	4.3-6.4	33.6-38.5	22.3-23.9	4180-4425	2885-3450	E-F

The overall grade is generally F. The results show minor variation in basic quality over the area.

b. Ultimate Analysis

The ultimate analysis of the seam is given as follow:

Table 4.52 - Results of Ultimate Analysis of Seam III Bottom

Block	C%	H%	N%	S%	O%	CO_2	P%
Amrapali	82.87-83.2	4.6-5.0	2.0	0.8	9.4	1.71	0.07
Kishanpur	80.9	4.4	1.9	1.9	12.3	1.4	0.09
Amprapali OCP	80.9-83.2	4.4-5.0	1.9-2.0	0.8-1.9	9.4-12.3	1.4-1.71	0.07-0.09

c. H.G.I and Ash Fusion Range

The special tests of the seam is given as follow:

Table 4.53 - Results of HGI and Ash Fusion Range of Seam III Bottom

Block	I.D.T °C	H.T °C	F.T °C	HGI
Amrapali	1200	1360	-	60
Kishanpur	1140	1300	-	55
Amrapali OCP	1140-1200	1300-1360	-	55-60

d. Ash Analysis

The ash analysis of the seam is given as follow:

Table 4.54 - Results of Ash Analysis of Seam III Bottom

Block	SiO_2	AL_2O_3	Fe_2O_3	TiO_2	P_2O_5	SO_3	CaO	MgO	Na_2O	K_2O
Amrapali	64.11	25.12	3.74	1.61	0.47	0.32	1.81	1.24	0.64	0.94
Kishanpur	60.47	26.89	5.79	1.54	0.42	0.11	1.98	1.68	0.38	0.74
Amrapali OCP	60.47-60.47	25.12-26.89	3.74-5.79	1.54-1.61	0.42-0.47	0.11-0.32	1.81-1.98	1.24-1.68	0.38-0.64	0.74-0.94

e. Other Special Tests

Coking Properties, Petrographic Tests and Washability Tests have not been carried out

4.4.2.11 Seam-III Top

Seam III Top has occurred in Amrapali and Kishanpur Block with thickness ranges from 2.09 m to 4.55 m.

4.4.2.11.1Details of Splitting:

Seam-III top is the uppermost split of seam III.

4.4.2.11.2Roof and Floor:

The immediate roof and floor of the seam is represented by carbonaceous shale, grey shale, sandy shale, fine grained sandstone and alternate bands of shale and sandstone in order of their abundance.

4.4.2.11.3Burning of Coal Seams:

There is no burning effect in the coal seam in the area.

4.4.2.11.4Dirt bands:

The detail of the dirt bands in the seam are as follow:

Table 4.55 - Details of dirt bands encountered in Seam III Top

Block	Combustible Dirt Bands < 1 m			Non combustible Dirt Bands			Avg Band%
	No.	Thick.	Percent	No.	Thick.	Percent	
Amrapali	2	0.16	6.72	-	-	-	6.72
Kishanpur	1	0.09-0.16	4.31-6.21	-	-	-	5.35
Amrapali OCP	1-2	0.09-0.16	4.31-6.72	-	-	-	5.35-6.72

4.4.2.11.5Quality Parameters

a. Proximate Analysis

The proximate analysis on 60%R.H. and 40°C of the seam has been carried out which is being described as follow:

Table 4.56 - Results of Proximate Analysis of Seam III Top

Block	Moisture%	Ash%	V.M%	Gross CV (K. Cal/Kg)	UHV (K. Cal/Kg)	Grade
In-band						
Amrapali	4.8	33.2	23.7	4730	3655	E
Kishanpur	6.5	28.6-32.2	25.4	4580-4780	3560-4055	E
Amrapali OCP	4.8-6.5	28.6-32.2	23.7-25.4	4580-4780	3560-4055	E
BCS						
Amrapali	4.8	33.2		4730	3655	E
Kishanpur	6.7-8.6	26.2-30.8	26	4665-4970	3710-4360	D-E
Amrapali OCP	4.8-8.6	56.2-33.2	26	4665-4970	3655-4360	D-E

The overall grade is generally E. The results show minor variation in basic quality over the area.

b. Ultimate Analysis

The ultimate analysis of the seam is given as follow:

Table 4.57 - Results of Ultimate Analysis of Seam III Top

Block	C%	H%	N%	S%	O%	CO_2	P%
Amrapali	82.64-83.0	4.6-5.0	1.9	0.8	9.7	1.32	0.59
Kishanpur	80.9	4.5	1.8	0.6	12.2	0.17	0.17
Amprapali OCP	80.9-83.0	4.5-5.0	1.8-1.9	0.6-0.8	9.7-12.2	0.17-1.32	0.17-0.59

~~c. H.G.I, Ash Fusion Range~~

c. H.G.I and Ash Fusion Range

The special tests of the seam is given as follow:

Table 4.58 - Results of HGI and Ash Fusion Range of Seam III Bottom

Block	I.D.T °C	H.T °C	F.T °C	HGI
Amrapali	1170-1330	1320->1400	>1400	57
Kishanpur	1150	1290	>1400	58
Amrapali OCP	1150-1330	1290->1400	>1400	57-58

d. Ash Analysis

The ash analysis of the seam is given as follow:

Table 4.59 - Results of Ash Analysis of Seam III Bottom

Block	SiO_2	AL_2O_3	Fe_2O_3	TiO_2	P_2O_5	SO_3	CaO	MgO	Na_2O	K_2O
Amrapali	62.98	24.32	4.69	1.71	0.43	0.37	2.44	1.72	0.54	0.8
Kishanpur	63.72	24.32	4.79	1.62	0.37	0.17	2.54	1.47	0.39	0.61
Amrapali OCP	62.98-63.72	24.32	4.69-4.79	1.62-1.71	0.37-0.43	0.17-0.37	2.44-2.54	1.47-1.72	0.39-0.54	0.61-0.8

e. Other Special Tests

Coking Properties, Petrographic Tests and Washability Tests have not been carried out.

4.4.2.12 Seam-IV:

Seam IV has occurred in Amrapali and Kishanpur Block with thickness ranges from 3.54 m to 7.77 m.

4.4.2.12.1Details of Splitting:

Further splitting of seam IV has not been recorded.

4.4.2.12.2Roof and Floor:

The immediate roof strata is generally represented by grey shale, carbonaceous shale, intercalations of shale and sandstone, sandy shale and fine to coarse grained sandstone while the floor is composed by grey shale, sandy shale, carbonaceous shale and fined grained sandstone.

4.4.2.12.3Burning of Coal Seams:

There is no burning effect in the coal seam in the area.

4.4.2.12.4Dirt bands:

The detail of the dirt bands in the seam are as follow:

Table 4.60 - Details of dirt bands encountered in Seam-IV

Block	Combustible Dirt Bands < 1 m			Non combustible Dirt Bands			Avg Band%
	No.	Thick.	Percent	No.	Thick.	Percent	
Amrapali	1-8	0.15-0.87	3.41-13.50	Nil-2	Nil-0.68	Nil-13.41	12.2
Kishanpur	2-7	0.37-1.39	4.97-26.63	Nil-3	Nil-0.37	Nil-7.96	19.37
Amrapali OCP	1-8	0.15-1.39	3.41-13.50	Nil-3	Nil-0.68	Nil-13.41	12.2-19.37

4.4.2.12.5Quality Parameters

a. Proximate Analysis

The proximate analysis on 60%R.H. and 40°C of the seam has been carried out which is being described as follow:

Table 4.61 - Results of Proximate Analysis of Seam IV

Block	Moisture%	Ash%	V.M%	Gross CV (K. Cal/Kg)	UHV (K. Cal/Kg)	Grade
In-band						
Amrapali	4.3-6.9	28.1-39.9	23-24.8	4175-5185	2800-4330	D-F
Kishanpur	4.6-8.9	29.7-40.4	22.3-23.9	3790-4465	2415-3575	E-F
Amrapali OCP	4.3-8.9	28.1-40.4	22.3-24.8	3790-5185	2415-4330	D-F
BCS						
Amrapali	4.7-7.5	25.4-35.1	22.5-25.2	4535-5365	3405-4635	D-E
Kishanpur	5.1-9.1	27.8-39.1	22.5-24.8	3970-4810	2870-3945	E-F
Amrapali OCP	4.7-9.1	25.4-39.1	22.5-25.2	3970-5365	2870-4635	D-F

b. Ultimate Analysis:

The ultimate analysis of the seam is given as follow:

Table 4.62 - Results of Ultimate Analysis of Seam IV

Block	C%	H%	N%	S%	O%	CO_2	P%
Amrapali	81.8-84.1	4.5-5.2	1.7-2.0	0.5-0.7	8.7-10.4	0.05-1.59	0.066-0.79
Kishanpur	80.1-83.9	4.4-5.3	1-1.8	0.4-0.5	-	0.35-1.2	0.19
Amprapali OCP	80.1-84.1	4.4-5.3	1.1-2.0	0.4-0.7	8.7-10.4	0.05-1.59	0.066-0.79

c. H.G.I and Ash Fusion Range

The special tests of the seam is given as follow:

Table 4.63 - Results of HGI and Ash Fusion Range of Seam IV

Block	I.D.T °C	H.T °C	F.T °C	HGI
Amrapali	1160-1290	1300->1400	>1400	54-59
Kishanpur	1160-1260	1220->1400	>1400	59-64
Amrapali OCP	1160-1290	1220->1400	>1400	54-64

d. Ash Analysis:

The ash analysis of the seam is given as follow:

Table 4.64 - Results of Ash Analysis of Seam IV

Block	SiO_2	AL_2O_3	Fe_2O_3	TiO_2	P_2O_5	SO_3	CaO	MgO	Na_2O	K_2O
Amrapali	54.70-65.92	22.42-26.02	2.57-7.30	1.52-1.82	0.41-2.80	0.00-0.37	0.82-4.80	0.37-1.40	0.42-0.65	0.83-1.00
Kishanpur	63.56-64.41	23.98-24.11	3.89-5.12	1.55-1.59	0.47-0.74	0.27-0.28	0.00-0.07	1.37-1.57	0.33-0.57	0.75-0.91
Amrapali OCP	54.70-65.92	22.42-26.02	2.57-7.30	1.52-1.82	0.41-2.80	0.00-0.37	0.00-4.80	0.37-1.57	0.33-	0.75-1.00

e. Other Special Tests

Coking Properties, Petrographic Tests and Washability Tests have not been carried out.

4.4.2.13 Seam-V Bottom:

Seam V Botttom has occurred in Kishanpur Block with thickness ranges from 0.80m to 0.87m.

4.4.2.13.1Details of Splitting:

Seam-V Bottom is the bottom most split of seam-V.

4.4.2.13.2Roof and Floor:

The immediate roof strata is represented by fine grained sandstone, carbonaceous shale and sandy shale. The immediate floor is invariably composed of carbonaceous shale or sandy shale.

4.4.2.13.3Burning of Coal Seams:

There is no burning effect in the coal seam in the area.

4.4.2.13.4Quality Parameters:

a. Proximate Analysis

The proximate analysis on 60%R.H. and 40°C of the seam has not been carried out.

b. Ultimate Analysis. Ash Fusion Range. HGI and Ash Analysis

Ultimate Analysis, Ash Fusion Range, HGI and Ash Analysis have not been carried out.

4.4.2.14 Seam-V Top:

Seam V Top has occurred in Kishanpur Block with thickness ranges from 5.00 m to 7.00 m.

4.4.2.14.1Details of Splitting:

Seam-V Top is the top most split of seam-V.

4.4.2.14.2Roof and Floor:

The immediate roof strata is generally represented by shale, carbonaceous shale, fine to medium grained sandstone, grey shale, and floor strata by carbonaceous shale, grey shale, sandy shale, fine to coarse grained sandstone and shale.

4.4.2.14.3Burning of Coal Seams:

There is burning effect in the coal seam in the area.

4.4.2.14.4Quality Parameters:

a. Proximate Analysis:

The proximate analysis on 60%R.H. and 40°C of the seam has not been carried out.

b. Ultimate Analysis. Ash Fusion Range. HGI and Ash Analysis

Ultimate Analysis, Ash Fusion Range, HGI and Ash Analysis have not been carried out

4.5 GEOTECHNICAL AND HYDROGEOLOGICAL INFORMATION

4.5.1 Physico-mechanical Properties

'Borehole cores of CNKA-59 were tested for various physico-mechanical properties. These boreholes falls in the south eastern part in the block. The test results of various physic-

mechanical properties viz. uniaxial compressive strength, shear strength, tensile strength, bulk density have been summarized in the table below.

Table 4.65 - Details of the parameters of the physico-mechanical properties

Particulars	Compressive Strength Kg /Cm^2		Tensile Strength Kg /Cm^2		Shear Strength Kg /Cm^2		Bulk Density t /m^3	
	Range	Avg	Range	Avg	Range	Avg	Range	Avg
Conglomerates	28.60-65.52	41.82	7.02-11.47	9.10	24.49-54.88	39.68	1.90-2.09	2.00
Cgd. Sandstone	83.58-122.91	99.83	4.81-13.00	8.94	53.58-71.11	62.34	2.11-2.26	2.16
Mgd. Sandstone	154.85-212.20	183.52	15.93-19.86	17.89	60.13-84.88	72.50	2.12-2.16	2.14
Fgd. Sandstone	63.73-162.85	113.29	7.29-28.43	15.07	115.91-162.61	139.40	1.87-2.17	2.04
Intercal. shale & sst.	134.10-245.00	193.07	13.23-26.52	19.57	139.75-172.2	158.22	1.37-2.28	2.00
Sandy shale	148.02-203.37	168.78	21.27-28.41	25.02	123.17-167.53	145.02	1.69-2.35	2.15
Grey shale	99.63-268.02	188.27	12.96-38.10	23.90	52.14-180.18	124.44	1.43-2.30	2.11
Carb. Shale	112.68-209.36	156.09	11.84-28.66	17.34	81.45-170.94	116.71	1.27-2.10	1.76
Shaly Coal	83.81-243.13	156.10	8.02-26.48	14.44	55.92-183.11	103.67	1.24-2.15	1.53
Coal	92.34-198.16	141.56	5.01-24.51	11.67	22.51-146.49	72.07	1.04-1.64	1.30

4.5.2 Hydrgeological Details

Hydrogeological potentiality has been carried out in the area. The results are as follow:

Range of water table (m-bgl)

Pre-monsoon (April/May)

Core zone : 8.25

Buffer zone : 8.57

Post-monsoon (November)

Core zone : 3.49

Buffer zone : 5.15

Total annual replenishable recharge (million m^3/year) : 45.08 M.Cum

Net annual ground water availability (million m^3/year) : 42.83 M.Cum

Stage of ground water development in% : 15.55%

4.6 GEOLOGICAL RESERVE

4.6.1 Brief Methodology

The reserve for each seam has been calculated separately by isochore method. The area between two isochores values was determined with the help of planimeter which was multiplied with the average thickness of the two isochores to calculate the volume of coal including all dirt bands. The volume of reserve for individual areas between the ishochore lines were multiplied with the specific gravity of the coal seams to calculate the 'gross' geological reserve. The specific gravity as considered by a formula 1.28 + 1% average ash of the coal seams including all dirt bands. A standard deduction of 10% was made for to get the 'net' geological reserve. The estimation was done by considering the side of the excavation as vertical.

The reserve estimated for individual area between two successive isochors were added to arrive at the total figure for different depth lines within the block. Further total reserve of each sector and the entire block was determined by addition of each reserve. Similar procedure was used to get the reserve within each grade and within different grade.

4.6.2 Net Geological Reserve

The net geological reserve of the Amrapali OCP is given as below:

Table 4.66 - Seamwise net geological reserve

Amrapali Block				Kishanpur Block				
Seam	Proved	Indicated	Total	Seam	Proved	Indicated	Total	Grand Total
IV	58.83	-	58.83	IV	25.89	-	25.89	84.72
III	78.84	-	78.84	III	42.54	-	42.54	121.38
III Top	1.80	-	1.80	III Top	1.43	-	1.43	3.23
III Bot.	1.98	-	1.98	III Bot.	2.65	-	2.65	4.63
II Top	23.04	-	23.04	II Top	4.13	-	4.13	27.17
II Bot.	30.64	-	30.64	II Bot.	4.22	-	4.22	34.86
I Top	29.75	-	29.75	I Top	31.40	-	31.40	61.15
I Mid.	25.97	-	25.97	I Mid.	14.81	-	14.81	40.78
IT+ I M	60.25	-	60.25	IT+ I M	6.66	-	6.66	66.91
I Bot.	72.48	-	72.48	I Bot.	69.49	-	69.49	141.97
IM +IB	19.45	-	19.45	IM +IB	-	-	-	19.45
IT + IM + IB	83.47	-	83.47	IT + IM + IB	-	-	-	83.47
Total	486.50	-	486.50	Total	203.31	-	203.31	689.81

4.6.3 Reserve within hard cover

Being an opencast mine the reserve within hard cover is not required in Amrapali OCP.

4.6.4 Reserve under Fire

There is no coal fire zone in this area.

4.7 RECOMMENDATION

4.7.1 Future Exploration

Although Amrapali block has quarriable potentiality within 1:5 cut-off ratio and huge coal deposit but the coal is inferior in quality all in E to F grade. In the southern and north-western part of the block boreholes could not be drilled due to forest. For precise delination of incrop of seams and position of faults about 1500m drilling by 9 to 10 boreholes is required.

4.7.2 Utility of Coal

All the coal seams in Amrapali OCP are non coking in nature and can be utilized power generation only. About 10m.ton will be utilized for NTPC Power Plant in Barh STPP and the rest will be utilized in Washery plant.

4.7.3 Deposit Modelling

No computerized geological modeling has been done for this block.

CHAPTER – V

MINE BOUNDARY, RESERVES & MINE LIFE

5.1 INTRODUCTION

5.1.1 Present Status of Mine

Implementation of Amrapali OCP (12 MTY) is in process.

Present Mine Operation

Two separate coal winning and OB removal contracts for 15.0 Mtes and 23.93 Mcum respectively is under implementation. Yearwise coal production and OB removal is summarized below:

Year	Coal (Mtes)	OBR(Mcum)
2013-14	-	2.54
2014-15	2.55	17.74
Total	2.55	20.28

5.2 PIT FORMULATION STRATEGY

5.2.1 General

- Amrapali Expansion OCP (25 MTY) has been planned using coal resources of 2 blocks namely Amrapali and Kishanpur Blocks.
- Ample reserves available in the dip side, beyond the extent of 12 MTY project, within the considered Amrapali and Kishanpur blocks and beyond dip side limits of these blocks. The area beyond the block limit of Amrapali and Kishanpur block is partly explored in the name of Magadh North East Block (block area 3.35 sq km, geological reserves 166.72 Mtes) and partly unexplored.
- The area south of Amrapali and Kishanpuir block is provisionally identified as CIL blocks.
- Block delineation and proving of area beyond dip side limit of Amrapali and Kishanpur geological blocks to be taken up in future. Exploration is proposed to be carried out

in the area beyond dip side limit of Amrapali and Kishanpur geological block south of east-west flowing Chundru nala.

- Considering the geological set up and lay and disposition of coal seams Amrapali Expansion OCP has been divided into two sections viz East section and West section without any inter quarry barrier. East section has been planned to largely extract coal reserves of Amrapali Block while West section is proposed to extract reserves of Kishanpur blocks. The limits of East Section and West section have been shown on Drg.No. RI-3/OCM/001273.
- Both the sections will be worked simultaneously with east Section working ahead of west section.

Pit Formulation strategy

The pit formulation strategy adopted is typically suitable for maximising extraction of the coal reserve keeping in view of economics, important surface infrastructures and safety of the mine workings. The safety of the mine working will become important as the final depth of the quarry reaches 225 m at the end of the mine life. The working of the quarry will continue with base seam, I Bottom/I Middle and Bottom / I Middle, Bottom and Top combined Seam and gradually advance as shown in the Final stage quarry plan.

5.2.2 Sequence of Operation

Both East and West Sections are proposed to be worked simultaneously with east Section working ahead of west section.

5.2.3 Base Seam

Lower most seam I Bottom/I Middle and Bottom / I Middle, Bottom and Top combined Seam has been considered as the base seam in the present proposal.

5.3 BOUNDARIES OF Mining BLOCK

The Plan showing the quarry boundary is given vides Drg.No. RI-3/OCM/001273. The mine boundary has been fixed as follows: -

- **Northern Boundary**

  The northern floor boundary is fixed along incrop of base seam I Bottom/I Middle and Bottom / I Middle, Bottom and Top combined.

- **Southern Boundary**

  Southern floor boundary has been fixed leaving surface barrier of 100 metre from Chundru nala.

- **Eastern Boundary**

  The eastern boundary has been fixed leaving surface barrier of 100 metre from Barki River.

- **Western Boundary**

  Western surface boundary has been fixed leaving surface barrier of 100 metre from Bahutchuha nala.

5.4 MINEABLE RESERVES-VOLUME OF OBR-STRIPPING RATIO

The total balance mineable reserves are estimated as **467.37** Mte. and total volume of overburden is estimated as **949.96** M.cum, with an average stripping ratio of **2.03** Cum per tonne. The breakup of seamwise coal reserves and volume of OB between different seams is given in table no.5.b. Seams having thickness less than 1 metre have not been considered for estimation of total reserves. To work these seams by horizontal slicing method, running stripping ratio becomes very high.

Table- 5.2 – Seamwise Coal Reserves and Volume of OBR

Sl. No.	Particulars	East Section	West Section	Total
A.	COAL RESERVES (Mte.)			
1	IV	35.41	20.01	55.43
2	III Comb.	53.16	38.72	91.88
3	II Top	12.74	3.27	16.00
4	II Bottom	16.39	1.98	18.37
5	I Top	14.04	27.96	42.00
6	I Mid./I Mid.+I Top	36.13	20.59	56.72
7	I Bot./I Bot.+I Mid.	133.80	53.17	186.97
8	**Total**	**301.67**	**165.71**	**467.37**

B	O.B (Mcum.)			
1	TOP OB	329.57	206.29	535.86
2	IV – III Comb	24.92	28.88	53.80
3	III Comb – II Top	40.09	33.03	73.12
4	II Top-II Bottom	31.36	41.60	72.96
5	II Bottom-ITop	91.11	31.51	122.62
6	I Top –I Middle	4.81	26.94	31.76
7	I Middle – I Bottom	4.32	52.51	56.83
8	Total	526.19	420.77	946.96
9	Rehandling		3.00	3.00
10	**Grand Total**	**526.19**	**423.74**	**949.96**
11	**Strpping Ratio (cum/te)**	**1.74**	**2.56**	**2.03**

The mineable reserves have been estimated from Borehole Data with the help of Minex Software. Due to the Geo-structural complexities and faults, a loss of 10% has been considered as geological loss. The loss of thickness along the floor and the roof has been taken as 0.15 m.

5.5 LIFE OF THE MINE

For the rated output of 25 MTY of ROM coal and with the mineable reserves of 467.37 M.tes the life of the opencast mine is estimated as 22 years. The anticipated production programme during initial years is given in Table no.5.3

Table No.5.3 - Anticiapated Coal & OB Production Programme upto target Year

Year of Quarry operation	Coal output (MTe)	Volume of OBR (MCUM)	Stripping Ratio (Cum/te)
1	4.00	3.65	0.91
2	8.00	3.08	0.39
3	12.00	8.79	0.73
4	15.00	15.80	1.05
5	20.00	18.34	0.92
6	25.00	30.39	1.22

*** 6th year is the target year.**

CHAPTER – VI

METHOD OF MINING

6.1 OPENING OF THE OPENCAST

Since the mine is already operational the mine is required to be extended towards both east and west direction from present working to develop the proposed floor haul road, installation of belt conveyor and optimization of overburden dumping. It is proposed that the proposed quarry is fully developed along strike length to gainfully deploy the higher size HEMM as envisaged in order to achieve the desired rated output and optimization of OB disposal.

6.2 GEOLOGICAL & MINING CHARACTERISTICS

The geological & mining characteristics of the proposed Amrapali Expansion Opencast (25 MTY) is given in Table 6.0. Total 10 numbers of coal seams/horizons including splits and mergers of seams occur within the above quarriable area.

Table No.6.0 - Gological and Mining Characteristics

Sl. No.	Particulars	Unit	East section	West section
A	Seam /Parting Thickness			
1	Top OB	m	10.00 - 140.00 (75.00)	10.00 - 150.0 (80.00)
2	IV	m	4.20 – 7.15 (6.00)	4.54 – 7.45 (5.80)
3	Parting	m	2.47 – 8.11 (5.50)	5.55 – 16.36 (10.50)
4	III Combined	m	5.00 – 10.24 (8.40)	4.12 – 9.25 (7.80)
6	Parting	m	5.24 – 12.22 (8.30)	5.89 – 18.78 (12.00)
7	II Top	m	1.30 – 3.42 (2.10)	0.21 – 2.77 (0.90)
8	Parting	m	2.81– 13.69 (7.80)	4.31 – 17.39 (12.00)
9	II Bottom	m	0.70– 5.00 (1.90)	0.20 – 2.53 (0.80)
10	Parting	m	4.35 – 32.97 (24.00)	1.82 – 17.91 (7.80)
11	I Top	m	1.53– 9.44 (5.50)	3.20 – 9.33 (5.50)
12	Parting	m	1.04 – 22.62 (12.00)	1.27 – 18.47 (10.00)
13	I Middle	m	2.82 – 8.53 (7.50)	0.51 – 5.66 (1.50)
	I Middle + Top		8.28– 17.13 (13.75)	11.16 – 14.86 (13.13)
14	Parting	m	1.09 – 6.02 (3.00)	2.80 – 30.71 (16.00)
15	I Bottom	m	5.44 – 9.82 (8.00)	4.85 – 11.10 (7.90)
16	I Bottom + Middle	m	5.74 – 19.59 (15.21)	-
17	I Bottom + I middle + I Top	m	15.55 – 27.14 (23.07)	-

Sl. No.	Particulars	Unit	East Section	West Section
B	Seam Gradient	Degrees	3-6	6-8
C.	Specific Gravity of Seams			
7	IV	t/cum	1.61	1.62
8	III Combined	t/cum	1.65	1.66
11	II Top	t/cum	1.66	1.65
13	II Bottom	t/cum	1.71	1.70
17	I Top	t/cum	1.72	1.69
18	I Middle	t/cum	1.69	1.70
19	I Middle+ I Top	t/cum	1.71	1.72
20	I Bottom	t/cum	1.71	1.68
21	I Bottom+ I Middle	t/cum	1.72	-
	I Bottom+ Middle+Top	t/cum	1.72	-
D	Excavation Category (assumed)		50%III, 50% IV	50%III,50% IV

E	QUARRY PARAMETERS			
1	Maximum strike length along Quarry floor	Km	2.30	2.30
2	Maximum strike length along Quarry surface	Km	2.60	2.60
3	Maximum length of the quarry along dip along Quarry floor	Km	2.50	2.50
4	Maximum length of the quarry along dip along Quarry surface.	Km	2.80	2.80
5	Maximum depth of Quarry	M	220	225
6	Quarry area at surface	Sq.Km	6.62	5.37

6.3 MINING SYSTEM

The mining and geological conditions of the mine are as follows: -

(a) Multiple seams to be worked

(b) Gentle gradient of 3-7 deg (avg.) of the coal seams.

(c) Variable thickness of OB/Partings.

Considering the above mining and geological conditions the method of mining adopted to extract coal and OB is inclined slicing method. Shovel-dumper mining system has been envisaged for OB removal in both the quarries. Coal winning is proposed to be carried out using Surface Miner – FE Loader-Dumper/ shovel-dumper combination. It is also proposed to respond to improvements in technology and equipments, which would result in, improved profitability and productivity parameters taking into account of safety and environmental parameters.

6.4 Design Criteria

The following design criteria have been adopted for the mining operations:

- No. of annual working days - 330
- No. of daily shifts - 3
- Duration of each shift - 8 hours

The opencast mine would be worked on the above 3 shifts/day and 7days/week schedule and the number of working days/year are adopted as 330.

CHAPTER – VII - A

MINING STRATEGY

7.A.1 PRESENT PROPOSAL

Project Report of Amrapali Expansion OCP (12.0 MTY) has been recast with an annual nominal capacity of 25.0 MTY and a peak annual capacity of 35.0 MTY. The expansion of the report from 12.0 MTY to 25.0 MTY is proposed to be achieved with following considerations:

- Simultaneous operation in entire strike length of about 4.5 - 5 km.
- Increased advance rate of about 125-150 m per annum as achieved by nearby mines like Ashok and Piparwar.
- Ample reserves available in the dip side, beyond the extent of 12 MTY project, within the considered Amrapali and Kishanpur blocks and beyond dip side limits of these blocks, provisionally identified as CIL blocks. Part of the area beyond the block boundary of Amrapali and Kishanpur blocks (3.35 sq km) is explored under Magadh NE Block.

The mine is proposed to work through single quarry (East section and West Section) without any inter quarry barrier. At present eastern section is operational. Western section is proposed to be started from 4th year onwards.

7.A.2 MINING STRATEGY / MINING SEQUENCE

7.A.2.1 Box Cut

Since the mine is already operational the mine is required to be extended towards both east and west direction from present working to develop the proposed floor haul road, installation of belt conveyor and optimization of overburden dumping. It is proposed that the proposed quarry is fully developed along strike length to gainfully deploy the higher size HEMM as envisaged in order to achieve the desired rated output and optimization of OB disposal.

7.A.2.2 Pit Layout

Pit layout of in the present proposal has been done with following considerations:

- Seams are gently dipping with a gradient of 3^0 to 7^0 in major part of the area.

- Due to similarity in geological structure of blocks considered and large strike length the mine is proposed to work through single quarry in two sections (East section and West section) without any inter quarry barrier.
- The proposed quarry with a total strike length of about 4.5-5 km will be worked into 2 sections i.e. East and West section with more or less equal strike lengths.
- Both the sections of the proposed quarry will be worked simultaneously with presently operational East section working ahead of west section to optimize backfilling and better sump management during monsoon.

7.A.2.3 Sequence of Operation

Both east section and west section to be operated simultaneously.

7.A.2.4 Coal Evacuation

Since seams in both the sections (east and west) are gently dipping (3°- 7°) in most of the part deployment of surface miners is proposed for coal winning. Bulk of coal (about 80%) produced is proposed to be transported through belt conveyor installed on the floor and on the surface along eastern and western flank of the quarry. Separate stream of conveying arrangement is proposed for eastern and western section.

7.A.2.5 Nala Diversion

Nala flowing west to east in the up dip side of the proposed quarry will be required to be diverted at the earliest to facilitate overburden dumping and development of strike length. This nala is proposed to be diverted along the toe of the proposed external dump. The course of west to east flowing Chundru nala near down dip side of the proposed quarry is proposed to be straightened in two parts as shown in the land use plan no. RI-3/OCM/001280.

7.A.2.6 Construction of Protective embankment

Provision has been made in this PR to construct protective embankment against Barki river and Bahutchuha nala flowing north to south along eastern and western flanks of the proposed quarry respectively. HFL of the Barki River has been recorded as +455m while HFL of Bahutchuha nala has not been recorded. As the mine working is proposed to extend upto western limit of the quarry only after 5-6 years of quarry operation protective embankment against Bahutchuha nala may be constructed after 5 years of mine operation. It is proposed to generate the required data for construction of protective embankment during initial 5 years of mine operation.

7.A.3 DESIGN CRITERIA

The following design criteria have been adopted for the mining operations:

No. of annual working days	-	330
No. of daily shifts	-	3
Duration of each shift	-	8 hours

The opencast mine would be worked on the above 3 shifts/day and 7days/week schedule and the number of working days/year are adopted as 330.

7.A.4 MINING SYSTEM

The mining and geological conditions of the mine are as follows: -

(a) Multiple seams to be worked

(b) Gentle gradient of 3^0 - 7^0 (avg.) of the coal seams in the proposed quarry.

(c) Variable thickness of OB/Partings.

Considering the above mining and geological conditions the method of mining adopted to extract coal and OB is inclined slicing method. Shovel-dumper mining system has been envisaged for OB removal in both the quarries. Coal winning is proposed to be carried out using Surface Miner – FE Loader-Dumper/ shovel – dumper combination. Application of Surface Miner is proposed in both section of the proposed quarry. It is also proposed to respond to improvements in technology and equipments, which would result in, improved profitability and productivity parameters taking into account of safety and environmental parameters.

7.A.5 MINING PARAMETERS

Some major system parameters for both coal winning & OB removal are given below :-

1. Mining Benches

a) Maximum Bench Height for 10 - 12 Cum Hyd.shovel Bench	-12-15m
b) Minimum working Bench Width for 10 - 12 Cum Hyd.shovel	- 50m
Non-working Bench width for 10 - 12 Cum Hyd.shovel	- 30m
c) Maximum Bench Height for 20 - 22 Cum Hyd.shovel Bench	-15-18m
d) Minimum working Bench Width for 20 - 22 Cum Hyd.shovel	- 60m
Non-working Bench width for 20 - 22 Cum Hyd.shovel	- 40m

2. Width of the permanent haul road - 30 m.

3.	Width of the temporary transport ramp	- 25 m
4.	Usual height of the spoil dump bench	- 30 m
5.	The width of the active dump bench	- 60 m
6.	Bench Slope (working)	
	O.B. bench	- 70^0
	Coal bench	- 70^0
	Dump bench	- 37^0
7.	Overall pit slope	- 37^0.

7.A.6 APPLICATION OF SURFACE MINER

Application of surface miner is proposed in both east and west section.

7.A.7 DRILLING AND BLASTING OPERATIONS

RBH drill of 250 mm and 160mm diameter are envisaged for drilling in OB and coal respectively where coal winning is proposed to be carried out using shovel – dumper combination. Elements of drilling and blasting of OB and coal would be decided during actual course of mining. Specific consumption of explosives in OB and coal is envisaged as 0.30 kg/cum and 0.20 kg/cum respectively.

CHAPTER – VII - B

DUMPING STRATEGY

7.B.1 WASTE DISPOSAL

7.B.1.1 Identification of external dump site

One external dump site (site A) and two internal dump sites (Site B&C) are proposed in this PR as shown in Final Stage Dump Plan (Drg.No. RI-3/OCM/001279). External dump site A is proposed partly on non-forest land and partly on forest land. The total volume of OBR is estimated as 949.96 Mcum including 526.19 Mcum from East section and 423.77 Mcum from West section. West section includes 3.0 Mcum of rehandling.

Out of total volume of OBR of 949.96 Mcum 35.86 Mcum would be placed on External dump site A over and above 17.28 OBR already dumped on site A and balance 962.48 Mcum including 48.38 Mcum of OBR of Chandragupta OCP will be placed in internal dump site B &C.

7.B.1.2 Capacity of Dumps

The details of OB dumps A, B, C &D is given below:

Table 7.4 – Accomodation of OBR (in Mcum) at different stages of mine working:

Dump	Type	8th Year			15th Year			Final Stage		
		Volume (MCum)	Top RL (m)	Area (Ha)	Volume (MCum)	Top RL (m)	Area (Ha)	Volume (MCum)	Top RL (m)	Area (Ha)
A	External	35.86	+560	89.16	35.86	+560	89.16	35.86	+560	89.16
B	Internal	128.24	+560	193.61	357.52	+560	336.54	562.98	+560	532.63
C	Internal	36.52	+560	99.23	206.34	+560	253.77	399.50	+560	412.42
Total		200.62			599.72			998.34		

7.B.1.3 Yearwise Waste Disposal

Year	East Section			West Section				Total (East Section +West Section)			
	OBR	Dump A	Dump B	OBR	Dump A	Dump B	Dump C	OBR	Dump A	Dump B	Dump C
Y1	3.65	3.65						3.65	3.65		
Y2	3.08	3.08						3.08	3.08		
Y3	8.79	8.79						8.79	8.79		
Y4	13.80	13.80		2.00	2.00			15.80	15.80		
Y5	13.29	4.54	8.75	5.05		5.05		18.34	4.54	13.80	
Y6	13.29		13.29	17.09		14.26	2.83	30.39		27.56	2.83
Y7	17.28		17.28	18.30		2.96	15.34	35.58		20.24	15.34
Y8	18.26		18.26	18.35			18.35	36.62		18.26	18.35
Y9	26.65		26.65	19.48			19.48	46.13		26.65	19.48
Y10	29.17		29.17	19.48			19.48	48.65		29.17	19.48
Y11	33.83		33.83	21.98			21.98	55.81		33.83	21.98
Y12	35.44		35.44	22.80			22.80	58.23		35.44	22.80
Y13	34.89		34.89	26.26			26.26	61.15		34.89	26.26
Y14	34.69		34.69	29.55			29.55	64.24		34.69	29.55
Y15	34.62		34.62	30.28			30.28	64.89		34.62	30.28
Y16	34.46		34.46	36.52			36.52	70.98		34.46	36.52
Y17	34.46		34.46	36.52			36.52	70.98		34.46	36.52
Y18	34.46		34.46	33.21			33.21	67.67		34.46	33.21
Y19	29.65		29.65	28.30			28.30	57.95		29.65	28.30
Y20	28.85		28.85	28.30			28.30	57.14		28.85	28.30
Y21	23.08		23.08	22.64			22.64	45.72		23.08	22.64
Y22	20.51		20.51	7.66			7.66	28.16		20.51	7.66
Total	526.19	33.86	492.33	423.77	2.00	22.27	399.50	949.96	35.86	514.60	399.50

CHAPTER – VIII

MINING SCHEDULE & EQUIPMENT PHASING

8.1 RATED CAPACITY

Considering the geo-mining parameters of the blocks considered the target capacity of the proposed quarry has been fixed at 25.0 MTY including 15.0 MTY and 10.0 MTY from east section, and west section respectively.

8.2 VARIANTS PROPOSED

This proposal of Magadh Expansion OCP (25 MTY) envisages two variants of mine operation & capital investment for consideration and to take investment decision.

8.2.1 Variant – I

The option envisages total coal production & OB removal by departmental means. Departmental Coal production is proposed to be carried out partly using shovel-dumper combination and partly using surface Miner-pay loader-dumper combination. OB removal is proposed to be carried out using shovel-dumper combination.

8.2.2 Variant- II

The option envisages total coal production and OB removal to be outsourced.

Reclamation and common equipment in both the variants mentioned above is proposed to be departmental as per requirement.

8.3 CALENDAR PROGRAMME OF EXCAVATION

The Calendar Programme of Excavation is given in Table No.8.1 considering adopted sequence of opencast mine field development at optimum conditions of mining operations for the entire life of Amrapali Expansion project. The total mineable reserves have been estimated as **467.37** M.tes corresponding to a volume of OBR of **949.96** MM3 at an average stripping ratio of **2.03**m3/te. The rated output of 25 MTY would be achieved in 6th year. The detail calendar programme is shown in Table 8.1.

Table 8.1 – Calendar Programme of Excavation

YEAR	East Section			West Section			Total		
	Coal (Mtes)	OB (Mcum)	Stripping Ratio (Cum/te)	Coal (Mtes)	OB (Mcum)	Stripping Ratio (Cum/te)	Coal (Mtes)	OB (Mcum)	Stripping Ratio (Cum/te)
Y1	4.00	3.65	0.91				4.00	3.65	0.91
Y2	8.00	3.08	0.39				8.00	3.08	0.39
Y3	12.00	8.79	0.73				12.00	8.79	0.73
Y4	15.00	13.80	0.92		2.00		15.00	15.80	1.05
Y5	15.00	13.29	0.89	5.00	5.05	1.01	20.00	18.34	0.92
Y6	15.00	13.29	0.89	10.00	17.09	1.71	25.00	30.39	1.22
Y7	15.00	17.28	1.15	10.00	18.30	1.83	25.00	35.58	1.42
Y8	15.00	18.26	1.22	10.00	18.35	1.84	25.00	36.62	1.46
Y9	15.00	26.65	1.78	10.00	19.48	1.95	25.00	46.13	1.85
Y10	15.00	29.17	1.94	10.00	19.48	1.95	25.00	48.65	1.95
Y11	15.00	33.83	2.26	10.00	21.98	2.20	25.00	55.81	2.23
Y12	15.00	35.44	2.36	10.00	22.80	2.28	25.00	58.23	2.33
Y13	15.00	34.89	2.33	10.00	26.26	2.63	25.00	61.15	2.45
Y14	15.00	34.69	2.31	10.00	29.55	2.96	25.00	64.24	2.57
Y15	15.00	34.62	2.31	10.00	30.28	3.03	25.00	64.89	2.60
Y16	15.00	34.46	2.30	10.00	36.52	3.65	25.00	70.98	2.84
Y17	15.00	34.46	2.30	10.00	36.52	3.65	25.00	70.98	2.84
Y18	15.00	34.46	2.30	10.00	33.21	3.32	25.00	67.67	2.71
Y19	15.00	29.65	1.98	10.00	28.30	2.83	25.00	57.95	2.32
Y20	15.00	28.85	1.92	10.00	28.30	2.83	25.00	57.14	2.29
Y21	12.00	23.08	1.92	8.00	22.64	2.83	20.00	45.72	2.29
Y22	10.66	20.51	1.92	2.71	7.66	2.83	13.37	28.16	2.11
Total	301.67	526.19	1.74	165.71	423.77	2.56	467.37	949.96	2.03

8.4 TYPE AND SIZE OF MAIN MINING EQUIPMENT

Loading and transportation of coal and OB, blast hole drilling and face preparation have been proposed to be carried out by deploying heavy earth moving machine (shovel – dumper/Surface Miner-FE Loader - Dumper combination). The peak OB workload is 70.98 Mm3. Elec. Hyd shovels 20-22 Cum have been provided for top OB and other big/ consistent partings. Due to multiple seam /parting scenario and inconsistent load, electric hydraulic shovels of smaller sizes (10-12 Cum) have been provided for other partings to ensure flexibility of operation. Coal winning is proposed to be carried out largely using Surface Miner – FE Loader-Dumper combination and partly using shovel – dumper combination.

8.5 ANNUAL PRODUCTIVITY OF MAIN HEMM

The annual productivity of HEMMs have been calculated on the basis of the following:

Excavation Category:

Coal : Cat. III

OB : Cat. III&IV

The materials having compressive strength between 125 to 250 Kg/cm2 is classified as Cat.III and between 250 to 1250 Kg/cm2 as Cat.IV

Standard Utilization of Shift Hours

- Elect. Rope Shovel: 58%
- Elect. Hyd. Shovel: 61%
- Dumpers 50%

The main mining and transport equipment would be operating on 3 shifts/day and 7 days/week operating schedule. The no. of operating days/year has been adopted as 330. Based on the above operating conditions, the estimated annual productivity of the proposed shovels as per the prevalent norms is given below:

The annual productivity (MCum) of dumpers for a lead of 1.0 to 4.0 Kms is given in following table: -

Table 8.3 – Productivity of Shovels and Dumpers

Equipment	Loader Productivity (Mcum)	Dumper Productivity (Mcum) Lead (km)							
		0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
20-22 cum Hyd. Shovel + 190T Dumpers - OB	5.731	1.1688	0.9376	0.7854	0.6933	0.6316	0.5710	0.5244	0.4877
10-12 cum Hyd. Shovel + 100T Dumpers - OB	3.090	0.6407	0.5012	0.4217	0.3741	0.3425	0.3103	0.2856	0.2662
10-12 cum Hyd. Shovel + 100T Dumpers - Coal	3.267	0.6692	0.5229	0.4398	0.3900	0.3570	0.3233	0.2975	0.2772
11-13 cum FE Loader + 100T Dumpers - Coal	2.904	0.6313	0.4961	0.4184	0.3719	0.3408	0.3090	0.2847	0.2655

The productivity of Surface Miner (3800-4200 mm) has been considered as 3.0 M tes per annum.

8.6 EQUIPMENT CONFIGURATION

The equipment configurations have been proposed for this Project Report considering following working mode of East Quarry and West quarry for different variants.

Table 8.4 – Proposed Variants

Variant	East Section	West Section
I	Departmental	Departmental
II	Outsourced*	Outsourced*

* Reclamation and common equipment in both the variants mentioned above is proposed to be departmental as per requirement.

Table 8.5 - Yearwise Population of HEMM (East Section)

Particulars	Capacity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Coal																							
Elec Hyd Shovel	10-12 cum		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Surface Miner*	3800-4200 mm			2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	2
RBH Drill	160 mm		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Rear Dumpers	100T		5	13	22	22	22	23	23	23	23	23	23	23	23	23	23	23	23	23	23	18	16
FE Loader	11-13 Cum			2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	2
Wheel Dozer	460 HP		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dozer	410 HP		1	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	3
OB																							
Elec Hyd Shovel	20-22 cum			1	1	1	1	2	2	4	4	5	5	5	5	5	5	5	5	4	4	3	3
Elec Hyd Shovel	10-12 cum		1	1	2	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2
Rear Dumpers	190T			9	9	9	9	17	17	34	34	44	44	46	46	46	46	46	46	37	37	28	26
Rear Dumpers	100T		10	10	26	26	26	26	26	26	26	26	26	19	19	19	19	19	19	26	19	19	17
RBH Drill	250 mm		1	2	3	4	4	5	5	7	7	8	8	7	7	7	7	7	7	6	6	5	5
Wheel Dozer	460HP		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dozer	410 HP		1	2	3	4	4	5	5	7	7	8	8	7	7	7	7	7	7	6	6	5	5
Dozer	750-850HP		2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

*For productivity and cost purposes 3800mm Surface Miner has been considered. However larger size Surface Miner may be procured with higher productivity considering other techno economic parameters.

Table 8.5 - Yearwise Population of HEMM (East Section)

Particulars	Capacity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Common																							
DieselHyd. Shovel(with backhoe)	3-3.8 cum		2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Grader	850HP		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
RT crane	70T		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RT crane	40T		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RT crane	20T		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Mobile Crane	8T		2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
FE Loader	5-7 Cum.		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Water Sprinkler	70 KL		1	1	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Water Sprinkler Mist Spray	28KL		1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Wheel Dozer	460 HP		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dump Trucks	12-15 T		6	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Vibratory Compactor	30T		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Diesel Browser	16KL		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Hyd. Rock Breaker			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cable Handler			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tyre Handler			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Reclamation																							
FE Loader	5-7 cum		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dozer	410 HP		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wheel Dozer	460 HP		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Grader	280 HP		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Water Sprinkler	70KL		1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Water Sprinkler Mist Spray	28KL		1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Dumper	60T		2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Table 8.6 - Yearwise Population of HEMM (West Section)

Particulars	Capacity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Coal																							
Elec Hyd Shovel	10-12 cum					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Surface Miner	3800-4200* mm					1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	
RBH Drill	160 mm					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Rear Dumpers	100T					8	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	12	4
FE Loader	11-13 Cum					1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	
Wheel Dozer	460 HP					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dozer	410 HP					2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	1
OB																							
Elec Hyd Shovel	20-22 cum					1	2	3	3	3	3	3	3	4	4	4	4	4	4	4	4	3	1
Elec Hyd Shovel	10-12 cum				1	1	1	1	1	1	1	2	2	2	3	3	4	4	4	2	2	2	1
Rear Dumpers	190T					8	19	26	26	28	28	28	28	35	35	36	37	37	37	37	37	28	9
Rear Dumpers	100T				7	8	10	9	9	10	10	18	18	18	26	27	34	34	34	19	19	19	9
RBH Drill	250 mm				1	2	3	4	4	4	4	5	5	6	7	7	8	8	8	6	6	5	2
Wheel Dozer	460HP				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dozer	410 HP				1	2	3	4	4	4	4	5	5	6	7	7	8	8	8	6	6	5	2
Dozer	750-850HP					1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

*For productivity and cost purposes 3800mm Surface Miner has been considered. However larger size Surface Miner may be procured with higher productivity considering other techno economic parameters.

Table 8.6 - Yearwise Population of HEMM (West Section)

Particulars	Capacity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Common																							
DieselHyd. Shovel (with backhoe)	3-3.8 cum					2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Grader	850 HP					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RT crane	70T					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RT crane	40T					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RT crane	20T					2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Mobile Crane	8T					2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
FE Loader	5-7 Cum.					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Water Sprinkler	28 KL					1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Water Sprinkler Mist Spray	28KL					1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Wheel Dozer	460 HP					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dump Trucks	12-15 T					6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Vibratory Compactor	30T					1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Diesel Browser	16KL					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Hyd. Rock Breaker						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cable Handler						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tyre Handler						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Reclamation																							
FE Loader	5-7 cum						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dozer	410 HP						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wheel Dozer	460 HP						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Grader	280 HP						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Water Sprinkler	70KL						2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Water Sprinkler Mist Spray	28KL						2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Dumper	60T						2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Table 8.7 - Yearwise Population of HEMM (Variant I)

Particulars	Capacity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Coal																							
Elec Hyd Shovel	10-12 cum		1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Surface Miner*	3800-4200 mm			2	4	5	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	5	2
RBH Drill	160 mm		1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Rear Dumpers	100T		5	13	22	30	37	38	38	38	38	38	38	38	38	38	38	38	38	38	38	30	20
FE Loader	11-13 Cum			2	4	5	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	5	2
Wheel Dozer	460 HP		1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Dozer	410 HP		1	3	5	7	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	7	4
OB																							
Elec Hyd Shovel	20-22 cum			1	1	2	3	5	5	7	7	8	8	9	9	9	9	9	9	8	8	6	4
Elec Hyd Shovel	10-12 cum		1	1	3	4	4	4	4	4	4	5	5	4	5	5	6	6	6	4	4	4	3
Rear Dumpers	190T			9	9	17	28	43	43	62	62	72	72	81	81	82	83	83	83	74	74	56	34
Rear Dumpers	100T		10	10	33	34	36	35	35	36	36	44	44	37	45	46	53	53	53	45	38	38	26
RBH Drill	250 mm		1	2	4	6	7	9	9	11	11	13	13	13	14	14	15	15	15	12	12	10	7
Wheel Dozer	460HP		1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Dozer	410 HP		1	2	4	6	7	9	9	11	11	13	13	13	14	14	15	15	15	12	12	10	7
Dozer	750-850HP		2	3	3	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

*For productivity and cost purposes 3800mm Surface Miner has been considered. However larger size Surface Miner may be procured with higher productivity considering other techno economic parameters.

Table 8.7 - Yearwise Population of HEMM (Variant I)

Particulars	Capacity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Common																							
DieselHyd. Shovel(with backhoe)	3-3.8 cum		2	3	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Grader	850HP		2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
RT crane	70T		1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
RT crane	40T		1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Mobile Crane	20T		2	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
FE Loader	8T		2	2	2	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Water Sprinkler	5-7 Cum.		1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Water Sprinkler Mist Spray	70 KL		1	1	2	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Wheel Dozer	28KL		1	1	2	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Dump Trucks	460 HP		1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Vibratory Compactor	12-15 T		6	9	9	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Diesel Browser	30T		2	2	2	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Hyd. Rock Breaker	16KL		1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Cable Handler			1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Tyre Handler			1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Reclamation			1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
FE Loader	5-7 cum		1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Dozer	410 HP		1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Wheel Dozer	460 HP		1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Grader	280 HP		1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Water Sprinkler	70KL		1	1	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Water Sprinkler Mist Spray	28KL		1	1	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Dumper	60T		2	3	3	3	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

Table 8.8 - Yearwise Population of HEMM (Variant II)

Particulars	Capacity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Common																							
DieselHyd. Shovel(with backhoe)	3-3.8 cum		1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Grader	850HP		1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
RT crane	20T		1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Mobile Crane	8T		1	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Water Sprinkler	70 KL		1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Water Sprinkler Mist Spray	28KL		1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Dump Trucks	12-15 T		3	3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Vibratory Compactor	30T		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tyre Handler			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Reclamation																							
FE Loader	5-7 cum		1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Dozer	410 HP		1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Wheel Dozer	460 HP		1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Grader	280 HP		1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Water Sprinkler	70KL		1	1	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Water Sprinkler Mist Spray	28KL		1	1	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Dumper	60T		2	3	3	3	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

Table 8.9 - Calendar Programme of Excavation – East Section

East Section	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Total
Coal (Mtes)	4.00	8.00	12.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	12.00	10.66	301 67
IV	0.77	0.96	0.66	0.67	0.88	0.88	1.72	1.92	2.07	2.11	2.16	2.17	2.19	2.20	2.17	2.10	2.10	2.10	1.65	1 57	1.26	1.12	35 41
III Combined	0.36	1.07	2.08	1.98	1.64	1.64	2.60	2.84	2.92	2.94	3.12	3.18	3.14	3.13	3.06	2.92	2.92	2.92	2.53	2.46	1.97	1.75	53 16
II Top	0.03	0.24	0.60	0.65	0.54	0.54	0.65	0.67	0.65	0.65	0.69	0.70	0.71	0.71	0.71	0.69	0.69	0.69	0.56	0.54	0.43	0.38	12.74
II Bottom	0.07	0.29	0.63	1.07	1.09	1.09	0.93	0.89	0.75	0.70	0.58	0.54	0.67	0.71	0.77	0.89	0.89	0.89	0.84	0.83	0.66	0.59	16 39
I Top	0.05	0.10	0.14	0.72	0.89	0.89	0.70	0.66	0.25	0.12	0.40	0.50	0.60	0 63	0.63	0.61	0.61	0.61	1.32	1.44	1.15	1.02	14 04
I Middle /IMiddle+Top	0.47	0.91	1.33	2.03	2.15	2.15	1.00	0.72	0.79	0.82	0.78	0.77	0.76	0.75	1.15	2.03	2.03	2.03	3.64	3.91	3.13	2.78	36.13
I Bottom/ I Bottom +Middle /I Bottom +Middle+Top	2.26	4.44	6.56	7.87	7.81	7.81	7.40	7.30	7.58	7.66	7.27	7.13	6.93	6.86	6.51	5.76	5.76	5 76	4.47	4.25	3.40	3.02	133 80
TOTAL	4.00	8.00	12.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15 00	15.00	15.00	15.00	12.00	10 66	301 67
OB (Mcum)	3.65	3.08	8.79	13.80	13.29	13.29	17.28	18.26	26.65	29.17	33.83	35.44	34.89	34.69	34.62	34.46	34.46	34 46	29 65	28.85	23.08	20 51	526 19
Top OB	3.65	0.00	0.00	5.29	6.89	6.89	8.91	9.41	16.83	19.06	23.14	24.54	23.91	23.67	23.69	23.73	23.73	23.73	18 44	17.55	14.04	12.47	329 57
Part IV - III Comb	0.00	0.35	0.99	0.90	0.65	0.65	1.18	1.32	1.55	1.62	1.59	1.57	1.41	1 35	1.26	1.05	1.05	1.05	1 48	1.55	1.24	1 10	24 92
Part III Comb - II Top	0.00	0.45	1.29	1.42	1.16	1.16	1.63	1.75	2.08	2.18	2.24	2.27	2.28	2.29	2.32	2.41	2.41	2 41	2 38	2.38	1.90	1.69	40 09
Part II Top - II Bottom	0.00	0.50	1.42	1.50	1.20	1.20	1.15	1.13	1.27	1.32	1.45	1.49	1.66	1.72	1.78	1.93	1.93	1.93	1.94	1.94	1.55	1.38	31 36
Part II Bottom - I Top	0.00	1.75	4.98	4.22	2.84	2.84	4.27	4.62	4.85	4.92	5.28	5.41	5.39	5.39	5.17	4.70	4.70	4.70	4.34	4.28	3.42	3.04	91 11
Part I Top - I Middle	0.00	0.01	0.03	0.17	0.21	0.21	0.07	0.03	0.01	0.01	0.08	0.10	0.20	0.24	0.28	0.37	0.37	0.37	0.56	0.60	0.48	0.42	4 81
Part I Middle - I Bottom	0.00	0.03	0.09	0.30	0.34	0.34	0.07	0.01	0.05	0.06	0.05	0.05	0.04	0.04	0.11	0.26	0.26	0.26	0.52	0.56	0 45	0 40	4 32
TOTAL	3.65	3.08	8.79	13.80	13.29	13.29	17.28	18.26	26.65	29.17	33.83	35.44	34.89	34.69	34.62	34.46	34.46	34.46	29.65	28 85	23.08	20 51	526 19

Table 8.10 - Calendar Programme of Excavation – West Section

West Section	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Total
Coal (Mtes)	0.00	5.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	8.00	2.71	**165.71**
IV	0.00	0.16	0.32	0.52	0.52	1.23	1.23	1.38	1.43	1.53	1.63	1.63	1.64	1.64	1.46	1.20	1.20	0.96	0.33	**20.01**
III Combined	0.00	0.44	0.88	1.60	1.61	2.79	2.79	2.70	2.68	2.71	2.73	2.73	2.70	2.70	2.54	2.32	2.32	1.85	0.63	**38.72**
II Top	0.00	0.10	0.21	0.16	0.16	0.23	0.23	0.21	0.20	0.18	0.16	0.16	0.16	0 16	0.20	0.25	0.25	0.20	0.07	**3.27**
II Bottom	0.00	0.05	0.10	0.12	0.12	0.14	0.14	0.16	0.17	0.13	0.10	0.10	0.11	0.11	0 11	0.10	0.10	0.08	0.03	**1.98**
I Top	0.00	0.84	1.68	1.26	1.26	1.22	1.22	1.65	1.78	1.83	1.87	1.89	2.03	2.03	1.93	1.78	1.78	1.42	0.48	**27.96**
I Middle/IMiddle+Top	0.00	1.45	2.90	2.44	2.43	1.78	1.78	1.21	1.02	0.86	0.71	0.68	0.49	0.49	0.53	0.59	0.59	0.47	0.16	**20.59**
I Bottom/ I Bottom +Middle /I Bottom +Middle+Top	0.00	1.96	3.91	3.90	3.90	2.61	2.61	2.69	2.72	2.76	2.80	2.80	2.86	2.86	3.23	3.77	3.77	3.02	1.02	**53.17**
TOTAL	0.00	5.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	8.00	2.71	**165.71**
OB (Mcum)	2.00	5.05	14.09	18.30	18.35	19.48	19.48	21.98	22.80	26.26	29.55	30.28	36.52	36.52	33.21	28.30	28.30	22.64	7.66	**420.77**
Top OB	2.00	1.88	7.76	6.71	6.70	6.16	6.16	8.77	9.61	12.69	15.61	16.30	22.26	22.26	18.87	13.85	13.85	11.08	3.75	**206.29**
Part IV - III Comb	0.00	0.15	0.30	0.57	0.57	1.73	1.73	2.11	2.24	2.32	2.41	2.40	2.31	2.31	2.12	1.83	1.83	1.46	0.50	**28.88**
Part III Comb - II Top	0.00	0.34	0.68	1.80	1.81	2.76	2.76	2.50	2.41	2.29	2.17	2.14	1.86	1.86	1.87	1.88	1.88	1 51	0 51	**33.03**
Part II Top - II Bottom	0.00	1.23	2.46	3.25	3.26	3.15	3.15	2.72	2.58	2.55	2.51	2.48	2.26	2.26	2.09	1.84	1.84	1.47	0.50	**41.60**
Part II Bottom - I Top	0.00	0.62	1.23	1.60	1.60	1.84	1.84	1.98	2.03	2.07	2.11	2.11	2.04	2.04	2.05	2.07	2.07	1.65	0.56	**31.51**
Part I Top - I Middle	0.00	0.30	0.60	1.72	1.74	1.63	1.63	1.54	1.51	1.59	1.67	1.67	1.71	1.71	1.82	1.99	1.99	1.59	0.54	**26.94**
Part I Middle - I Bottom	0.00	0.53	1.05	2.66	2.68	2.20	2.20	2.36	2.41	2.75	3.07	3.18	4.09	4.09	4.39	4.83	4.83	3.87	1.31	**52.51**
TOTAL	2.00	5.05	14.09	18.30	18.35	19.48	19.48	21.98	22.80	26.26	29.55	30.28	36.52	36.52	33.21	28.30	28.30	22.64	7.66	**420.77**
Rehandling			3.00																	**3.00**
G Total	2.00	5.05	17.09	18.30	18.35	19.48	19.48	21.98	22.80	26.26	29.55	30.28	36.52	36.52	33.21	28.30	28.30	22.64	7.66	423.77

Table 8.12 - Calendar Programme of Excavation – East Section + West Section

East + West Section	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Total
Coal (Mtes)	4.00	8.00	12.00	15.00	20.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	20.00	13.37	467.37
V	0.77	0.96	0.66	0.67	1.04	1.20	2.23	2.44	3.30	3.34	3.54	3.61	3.73	3.83	3.80	3.74	3.74	3.56	2.85	2.77	2.22	1.44	55.43
II Combined	0.36	1.07	2.08	1.98	2.08	2.52	4.20	4.45	5.71	5.73	5.82	5.86	5.85	5.86	5.79	5.62	5.62	5.47	4.84	4.78	3.82	2.38	91.88
I Top	0.03	0.24	0.60	0.65	0.64	0.75	0.80	0.83	0.88	0.88	0.90	0.90	0.89	0.87	0.87	0.86	0.86	0.89	0.81	0.79	0.63	0.45	16.00
I Bottom	0.07	0.29	0.63	1.07	1.14	1.19	1.05	1.02	0.88	0.84	0.74	0.71	0.80	0.81	0.87	1.00	1.00	1.00	0.94	0.93	0.75	0.62	18.37
Top	0.05	0.10	0.14	0.72	1.73	2.57	1.97	1.91	1.47	1.35	2.05	2.29	2.43	2.51	2.52	2.64	2.64	2.54	3.10	3.22	2.57	1.50	42.00
Middle /IMiddle+Top	0.47	0.91	1.33	2.03	3.60	5.05	3.45	3.16	2.58	2.60	1.99	1.79	1.61	1.46	1.84	2.52	2.52	2.56	4.22	4.49	3.59	2.94	56.72
Bottom/ I Bottom Middle /I Bottom Middle+Top	2.26	4.44	6.56	7.87	9.77	11.73	11.30	11.19	10.18	10.27	9.96	9.85	9.69	9.66	9.31	8.62	8.62	8.98	8.24	8.02	6.42	4.04	186.97
OTAL	4.00	8.00	12.00	15.00	20.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	20.00	13.37	467.37
B (Mcum)	3.65	3.08	8.79	15.80	18.34	27.39	35.58	36.62	46.13	48.65	55.81	58.23	61.15	64.24	64.89	70.98	70.98	67.67	57.95	57.14	45.72	28.16	946.96
op OB	3.65	0.00	0.00	7.29	8.77	14.65	15.62	16.10	22.99	25.23	31.90	34.16	36.60	39.29	40.00	45.99	45.99	42.61	32.29	31.40	25.12	16.22	535.86
art IV - III Comb	0.00	0.35	0.99	0.90	0.80	0.96	1.75	1.89	3.28	3.35	3.70	3.81	3.73	3.76	3.65	3.36	3.36	3.17	3.31	3.38	2.70	1.60	53.80
art III Comb - II Top	0.00	0.45	1.29	1.42	1.50	1.84	3.43	3.56	4.85	4.95	4.74	4.68	4.57	4.46	4.46	4.26	4.26	4.27	4.26	4.26	3.41	2.20	73.12
art II Top - II Bottom	0.00	0.50	1.42	1.50	2.43	3.66	4.39	4.39	4.43	4.47	4.17	4.07	4.20	4.22	4.27	4.19	4.19	4.02	3.78	3.78	3.02	1.88	72.96
art II Bottom - I Top	0.00	1.75	4.98	4.22	3.46	4.07	5.86	6.22	6.69	6.76	7.26	7.43	7.46	7.50	7.28	6.74	6.74	6.75	6.41	6.34	5.08	3.60	122.62
art I Top - I Middle	0.00	0.01	0.03	0.17	0.51	0.81	1.79	1.77	1.84	1.84	1.62	1.61	1.79	1.90	1.95	2.08	2.08	2.19	2.55	2.59	2.07	0.96	31.78
art I Middle - I Bottom	0.00	0.03	0.09	0.30	0.87	1.39	2.73	2.69	2.25	2.26	2.41	2.46	2.80	3.11	3.29	4.36	4.36	4.66	5.35	5.40	4.32	1.71	56.83
OTAL	3.65	3.08	8.79	15.80	18.34	27.39	35.58	36.62	46.13	48.65	55.81	58.23	61.15	64.24	64.89	70.98	70.98	67.67	57.95	57.14	45.72	28.16	946.96
ehandling	0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00
Total	3.65	3.08	8.79	15.80	18.34	30.39	35.58	36.62	46.13	48.65	55.81	58.23	61.15	64.24	64.89	70.98	70.98	67.67	57.95	57.14	45.72	28.16	949.96
ripping ratio (cum/te)	0.91	0.39	0.73	1.05	0.92	1.22	1.42	1.46	1.85	1.95	2.23	2.33	2.45	2.57	2.60	2.84	2.84	2.71	2.32	2.29	2.29	2.11	2.03

CHAPTER – IX

COAL QUALITY

The average in band quality of different seams has been summarised below:

Table 9.1 – In Band Seam Quality – East Section

Seam/ Parting	Average Quality Parameters				
Seam	Ash%	Moisture%	CV(Kcal/kg)	VM%	Grade
IV	33.87	5.24	4598.45	23.42	G10
III Comb	37.35	5.12	4291.62	22.43	G11
II Top	38.98	6.12	4242.36	22.86	G11
II Bottom	42.96	4.09	3906.79	21.72	G12
I Top	44.62	3.64	3819.89	21.14	G12
I Middle/I Middle+ Top	43.60	4.00	3865.41	21.85	G12
I Bottom / I Bottom+ Middle/ I Bottom+Middle+Top	43.70	3.99	3854.12	22.12	G12
Total	41.18	4.43	4040.83	22.27	G11

Table 9.2 – In Band Seam Quality – West Section

Seam/ Parting	Average Quality Parameters				
Seam	Ash%	Moisture%	CV(Kcal/kg)	VM%	Grade
IV	34.44	6.31	4382.18	23.17	G10
III Comb	38.45	5.97	4043.24	21.91	G11
II Top	37.82	5.56	4191.44	23.16	G11
II Bottom	41.43	4.89	3897.87	22.72	G12
I Top	43.00	4.51	3805.41	21.21	G12
I Middle/I Middle+ Top	43.57	4.35	3816.22	21.51	G12
I Bottom / I Bottom+ Middle/ I Bottom+Middle+Top	41.00	4.57	4014.09	22.63	G11
Total	40.21	5.09	4007.66	22.16	G11

Table 9.3 – In Band Seam Quality – (East+West Section)

Seam/ Parting	Average Quality Parameters				
Seam	Ash%	Moisture%	CV(Kcal/kg)	VM%	Grade
IV	34.08	5.63	4520.48	23.33	G10
III Comb	37.82	5.48	4186.88	22.21	G11
II Top	38.73	6	4231.72	22.92	G11
II Bottom	42.78	4.18	3905.78	21.84	G12
I Top	43.54	4.22	3810.23	21.19	G12
I Middle/I Middle+ Top	43.59	4.13	3847.16	21.72	G12
I Bottom / I Bottom+ Middle/ I Bottom+Middle+Top	42.92	4.16	3900.02	22.27	G12
Total	40.85	4.65	4031.00	22.25	G11

Table 9.4 – yearwise quality

Year	Ash%	Moisture%	VM%	CV(Kcal/kg)
Y1	40.45	4.72	22.33	4045
Y2	40.72	4.68	22.29	4024
Y3	40.97	4.64	22.26	4005
Y4	41.14	4.56	22.23	4013
Y5	41.23	4.54	22.19	4008
Y6	41.25	4.54	22.17	4005
Y7	40.68	4.69	22.16	4040
Y8	40.52	4.72	22.18	4051
Y9	40.48	4.81	22.09	4042
Y10	40.47	4.81	22.10	4043
Y11	41.19	4.66	21.88	3986
Y12	41.15	4.67	21.89	3988
Y13	40.83	4.63	22.15	4037
Y14	40.79	4.64	22.15	4039
Y15	40.58	4.60	22.48	4068
Y16	40.69	4.58	22.45	4062
Y17	40.69	4.58	22.45	4062
Y18	40.77	4.57	22.45	4057
Y19	40.87	4.64	22.49	4037
Y20	40.95	4.62	22.47	4032
Y21	41.11	4.71	22.37	3998
Y22	41.24	4.69	22.37	3989
Total	40.85	4.65	22.25	4031

Although coal seam, overburden / interburden will be worked separately having separate benches, yet, there is a chance of deterioration in quality of coal due to admixtures from roof and floor of the seam and by the inclusion of bands (<1m) within the seam. It is envisaged that the roof of the seam is properly cleaned before blasting. A proper organization and strict quality control measures are necessary to maintain the quality of coal at faces with all precautions for quality control to reduce contamination at each contact point of coal & OB or parting.

As evident from above table the average product Mix quality of seams for both eastern and western section shall be G11 with average GCV range of 4000 - 4300 Kcal /kg.

CHAPTER - X
PUMPING AND DRAINAGE

10.1 INTRODUCTION

The pumping system of Amrapali Expansion OCP of CCL has been designed to dewater the inflow of water due to precipitation within the active pit limit during the monsoon and non-monsoon season and the ground water discharged from aquifers to enable the mining activity to continue round the year. The planning of dewatering the mine has been done in such a way that the working faces and haul roads will remain dry as far as possible. The layout of the quarry provides suitable gradient along the quarry floors and the benches to facilitate self-drainage of water to the sump at the lowest level of the quarry.

10.2 SOURCE OF WATER

The intake of rainwater to the opencast mine is non-uniform during the year. The maximum rainwater intake will be during the period of about four months (middle of June to middle of October) in a year. During dry season, seepage from strata is expected to be moderate and the same can be dealt by running required number of pumps provided for pumping during monsoon. During this period, repair & overhauling of the pumps will be done by rotation.

It is proposed to make garland drains around the quarries and divert the surface water including rainwater from catchments area to nearby natural course of water / nallah.

The capacity of main pumps is selected to pump out the expected make of water accumulated in the mine due to maximum rainfall in a day.

During the heavy monsoon period, the work in lower most benches may have to be stopped as it has been proposed to use a part of the lower most benches as sump.

Water accumulated in the sump will be pumped out to the surface and discharged into the nallah flowing outside the quarry. It is proposed to create a sedimentation lagoon by constructing a series of check dams across the nallah. The lagoon will help to separate the suspended solids from the mine water.

Water overflowing the check dams would join near-by Barki River and Bahutchua Nala.

10.3 SURFACE DRAINAGE AND FLOOD PROTECTION

All the smaller natural channels of water and nallah, finally join the Barki river form the group representing the surface water resources in the region. A suitable garland drain is proposed to arrest the rainwater entering into the mine.

10.4 THE SURFACE DRAINAGE AND FLOOD PROTECTION SYSTEM FOR THE MINE WILL INCLUDE

- Diversion of water courses to other water courses away from the mining area.
- Diversion dams/ bunding arrangement as part of water course diversions to prevent water entering the mining area.
- Cross drainage structures where the haul road and other access roads cross diversions.
- Various inlet, outlet and erosion protection structures.

10.5 IN-PIT DRAINAGE WORK

During the rainy season, water will be allowed to accumulate in the sump on the floor of lower most Seam of the quarry. Sumps are provided for the dewatering pumps which will transfer in-pit water for controlled discharge off the site. The planning of dewatering the mine shall be done in such a way that the working faces and haul roads in the quarry shall remain dry as far as possible. The layout of the quarry provides suitable gradient along the quarry floors and the benches to facilitate self drainage of water to the sump at the lowest level of the quarry.
Water accumulated in the mine sump will be pumped out to the surface and finally discharged into the near- by Barki River and Bahutchua Nala.

10.6 GENERAL CONSIDERATIONS

10.6.1 The pumping requirement has been calculated on the basis of the following general considerations:-

- The geographical location of the Project.
- Meteorological data from the area / nearest rain-gauge station concerning rainfalls.
- Life of the mine and percentage probability of maximum rainfall in one day during the life of the mine.
- General climatic conditions, Surface features of the terrain beyond the boundary of the mine / opencast working.

- Catchments area: Mined out areas and areas beyond excavation, and dumped / spoil dump area.
- Run-off characteristics of the area.
- Depth of the quarries at different stages.
- Inflow to the quarry of UG water & seepage from nearby nallah/ river.
- Desired location at the surface where the quarry water can be discharged, considering the Surface drainage system.
- Maximum number of days to pump out the accumulated water in the quarry during peak rainfall in monsoon and the number of pumping operation hours per day-5 days @ 20 hours per day
- Geological characteristics of OB and coal seams.
- Desired location at surface where quarry water can be discharged considering the surface drainage system.
- Effective working hours – 20 hours/day for pumping calculation, but in monsoon period pumping may be done round the clock.

10.6.2 BASIC DATA

The following data has been taken into consideration for arriving at the volume of water accumulating in the quarry and the size of the pumps:-

Table-10.1: Basic data for Quarry Pumping

(a)	Maximum depth of the proposed mine	:	QE-220m, QW-225m
(b)	Probable maximum rainfall in a day in monsoon period from the probability curve	:	142mm,
(c)	Depth and Catch-ment area stage wise	:	Given in the stage wise calculation of water volume.
(d)	Run-off Co-efficient considered	:	i) For mined out area = 0.5
		:	ii) For internal dump area = 0.10
			iii) For area beyond excavation = 0.10
(e)	Inflow of water to the quarry due to seepage and underground precipitation	:	10% of probable water accumulation due to nearby Barki river.
(f)	The rainfall data has been adopted as recorded.	:	IMD Hazaribagh

10.7 ASSEMENT OF MAXIMUM RAINFALL IN A DAY

This has been drawn from the probability curve of rain-fall data received from IMD Hazaribagh, for last 10 years. The calculation has been done taking into consideration the entire area of the quarry of the proposed mine for its entire years of operational life. The probable maximum daily rainfall has been taken as 142 mm for calculation purpose.

10.8 CALCULATIONS AND ASSESSMENT OF VOLUME OF WATER TO BE PUMPED

The calculation has been done taking into consideration the entire area of the quarry of the proposed mine. Pumping system has been designed for the volume of water accumulated in the mine at the final stage of production considering probable maximum daily rainfall as 142mm. Pumping capacity worked out as under (considering water to be pumped out in 100 hrs @ 20 hrs pumping per day). The volume of maximum precipitation of water in the mine taking 10% for seepage and underground precipitation due to nearby Barki River and Bahutchua Nala. on the day of maximum rainfall has been as under:

Table-10.2: Calculation of Volume of water

Quarry East

At the end of year	Catchment's area in Sq. km				Depth of mine (m)	Max. m probable rainfall in a day (mm)	Volume of water ('000 Cum/day)
	Total quarry area	Mined-out area	Internal dump area	Area beyond excavation			
3rd	1.2600	1.20	0.000	0.0600	90	142	94.657
8th	3.0555	2.91	1.936	0.1455	130	142	108.582
15th	5.6595	5.39	3.365	0.2695	190	142	214.923
22nd	7.0245	6.69	5.326	0.3345	220	142	194.945

Quarry West

At the end of year	Catchment's area in Sq. km				Depth of mine (m)	Max. m probable rainfall in a day (mm)	Volume of water ('000 Cum/day)
	Total quarry area	Mined-out area	Internal dump area	Area beyond excavation			
5th	1.2600	1.20	0.000	0.0600	50	142	94.657
8th	2.0055	1.91	0.992	0.0955	95	142	88.683
15th	4.6305	4.41	2.538	0.2205	160	142	189.291
22nd	5.5545	5.29	4.124	0.2645	225	142	159.613

10.9 PUMPING CAPACITY

PUMPING CAPACITY REQUIRED :

Probable water accumulation on the day of maximum rainfall taking 10% for seepage and underground precipitation:-

QUARRY EAST

3rd Year = 94657 Cum., Pumping capacity/hr = 947 cum/hr (262 lps)

8th Year = 108582 Cum., Pumping capacity/hr = 1086 cum/hr (301 lps)

15th Year =214923 Cum. Pumping capacity/hr = 2149 cum/hr (595 lps)

22nd Year = 194945 Cum., Pumping capacity/hr = 1949 cum/hr (540 lps)

QUARRY WEST

5th Year = 94657 Cum., Pumping capacity/hr = 947 cum/hr (262 lps)

8th Year = 88683 Cum., Pumping capacity/hr = 887 cum/hr (246 lps)

15th Year = 189291 Cum. Pumping capacity/hr = 1893 cum/hr (524 lps)

22nd Year = 159613 Cum., Pumping capacity/hr = 1596 cum/hr (442 lps)

10.10 SELECTION OF PUMPS AND DELIVERY RANGES:

On the basis of the calculation and providing standby pumping capacity, the pumps have been provided for the quarry as under:-

QUARRY EAST

a) PUMPS:-

Main Pumps

Five nos. of 150 LPS x 270 m head pumps have been provided for the quarry. Out of five pumps , four will be working & one standby.

Low Head Pumps

Four nos of 150 LPS x 200 m head and four nos. of 38 LPS x 60 m head pumps have been provided during initial mining operation. Out of these pumps, one pump each has been kept as standby.

Face Pumps and Slurry Pumps

Five nos of Face Pumps of 15 LPS x 60 m head and five nos of Slurry Pumps of 22 LPS x 45 m head capacities have been provided to pump out the water & slurry respectively accumulated near the working faces of the quarry. Out of these pumps, one pump each has been kept as standby.

Diesel Pump

One number of 80 LPS x 270 m head diesel pump has been provided for emergency requirement of the quarry.

QUARRY WEST

a) PUMPS:-

Main Pumps

Five nos. of 150 LPS x 270 m head pumps have been provided for the quarry. Out of five pumps , four will be working & one standby.

Low Head Pumps

Four nos of 150 LPS x 200 m head and four nos. of 38 LPS x 60 m head pumps have been provided during initial mining operation. Out of these pumps, one pump each has been kept as standby.

Face Pumps and Slurry Pumps

Five nos of Face Pumps of 15 LPS x 60 m head and five nos of Slurry Pumps of 22 LPS x 45 m head capacities have been provided to pump out the water & slurry respectively accumulated near the working faces of the quarry. Out of these pumps, one pump each has been kept as standby.

Diesel Pump

One number of 80 LPS x 270 m head diesel pump has been provided for emergency requirement of the quarry.

b) SELECTION OF DELIVERY RANGES

The delivery ranges have been selected on the basis of the pumping capacity during probable maximum rainfall and velocity of flow within the reasonable limit. The delivery ranges for different capacity of pumps have been selected for nominal diameters as 300mm, 200mm, 150mm and 100mm for the pumps as per manufacturer's standard.

10.11 ESTIMATED CAPITAL COST

The details of cost estimate along with the phased requirement have been given in Appendix-A.3.4 of pumps, pipes and fittings.

CHAPTER-XI

COAL HANDLING & DESPATCH ARRANGEMENTS

11.1 INTRODUCTION

The Expansion project report for Amrapali OCP has been prepared for the production of 25.0 Mty of ROM coal. The total production of coal has been proposed from two quarries, namely quarry-East & West. A project report of Amrapali OCP (12.0 Mty) with facilities of CHP & Railway dispatch was made and approved earlier. In this expansion report a pit top washery has also been proposed for this project which will cater entire coal produced from this mine. Therefore it has been proposed that total crushed coal (-100 mm) produced from this mine will directly fed to proposed pit top washery through belt conveyors. A Coal handling plant has been proposed to cater entire production coal produced either by surface miner or produced through shovel dumper and accordingly facilities of receiving, crushing, storage & loading / conveying arrangement has been envisaged. Crushing facility at surface near quarry mouth has been envisaged to cater the production of ROM coal through Shovel – Dumper and receiving of surface miner coal.

11.2 DESIGN PARAMETERS

11.2.1 Basic Data

The following parameters has been considered while designing & planning of different units of coal handling plant:

Sl. No	Particulars	Considered Summarised Data
(a)	Coal production of mine	25.0 Mty
(a)	Coal Handling Plant Capacity	25.0 Mty
(b)	Number of working days/year	330
(c)	Number of working shift/day	3 (8 hrs. each)
(d)	Number of effective working hours/day	15
(e)	Type of unloading dumper at receiving pit of CHP	Rear Discharge Dumper
(f)	Feed size of ROM. coal (in mm)	(-) 100 mm from Surface miner

Sl. No	Particulars	Considered Summarised Data
		& 1200 mm from shovel dumper.
(g)	Despatch size (in mm) from CHP	(-) 100 mm
(h)	Type of loading	i) By belt conveyors to Washery. Final despatch from Washery by RLS Into railway wagons,
(i)	Loading hours	Round the clock.
(j)	Average Grade of coal	*Power grade*
(k)	H.G.I.	40-60
(l)	Consumer	Proposed Amrapali Washery/ Power station & others.
(m)	Mode of Despatch	By conveyer to Silo & loading through RLS into rail wagons.

11.2.2 CHP Working Schedule

The coal handling plant will be working in three shifts per day and seven days a week basis with its all units like receiving of ROM coal, conveying, storage in ground bunker, reclamation and load out system through belt conveyers & RLS.

11.2.3 System Capacity

The handling capacity of the CHP has been planned to match with the production capacity of the mine. As such three nos. of stream having different nominal system capacity of 2000/1200 TPH have been envisaged for receiving, crushing and conveying of coal up to bunkers at surface through belt conveyors. This system has been proposed at surface near quarry mouth. This system will start working from beginning and continue working as per requirement during the entire mine life. This also includes the crushing of part of ROM coal and conveying of the same. This coal will be stored into two nos. of bunkers at surface. This has been selected to meet any fluctuations of coal output from the mine or due to irregularities of despatch / transport system and seasonal fluctuations. After few years of mine operations, in pit receiving and conveying system for both the quarries (East & West) have been proposed for conveying of coal mined through surface miners. The nominal system capacity for in pit conveying system has been selected as 2000 tph for each stream keeping the peak production capacity

too. Provisions have also been envisaged that upper seams coal mined through surface miners (-100 mm size) and transported through flanks of quarries will also be received in receiving pits at respective flank of each quarry and these coal will be conveyed up to bunkers through series of belt conveyors proposed for the same. The nominal capacity of each flank conveyors will be 1200 tph. Finally coal from the bunkers will be reclaimed through plough feeders and fed to Silo or received by the proposed washery. The nominal capacity of each reclaim or loading conveyors from ground bunker to washery or Silo has been kept 2000 tph. For key plan of proposed coal handling system, please refer enclosed drawing no. RI 3 / E&M / M 2918.

11.2.4 Salient features

The following factors have been considered in finalising the location and system of proposed Coal handling System:

- Mine boundary, surface, flak and quarry floor
- Mine entry
- Proposed Railway Siding
- Conveying and Loading / feed arrangement
- Topography
- Availability of space
- Receiving arrangements(size of coal and type of dumpers)
- Crushing facility for part of coal produced from shovel dumpers
- Power supply and distribution network
- Miscellaneous facilities like dust control system, firefighting and ventilation system. Plant cleaning and infrastructure for preventive maintenance are also envisaged.
- Necessary Electrical, interlocking, signalling and communication facilities.

11.2.5 System Description

The CHP will have the following functional units as shown in the key plan of CHP. Please refer enclosed drawing no. RI 3 / E&M / M 2918

- Receiving Pits for ROM surface miner coal, shovel dumpers coal, Sizer & belt conveyors
- Ground storage bunkers (above the ground) & Reclamation
- Conveying to feed proposed washery through belt conveyors.
- Load-out system with Silo & RLS for part of the coal may be directly loaded into wagons.
- Load-out system with Silo & RLS for washed coal from Washery
- Dust control system

- Dust suppression system
- Noise control system
- Fire Protection system
- Plant cleaning system
- Plant preventive maintenance
- Weighment

11.2.6 Plant Description

11.2.6.1 Receiving and Crushing Arrangement

Entire ROM coal from quarry(East & West) produced through Shovel - Dumper combination will be transported by dumpers at surface and discharged in to the receiving hopper of crushing system (At Receiving pit-1) near mouth of quarry. One number of primary and subsequently a secondary sizer of suitable capacity (nominal 1200 tph capacity) has been provided for crushing of this coal. The coal will be crushed up to (-) 100 mm size in two stages by primary and secondary sizers. There will be one independent stream for crushing of coal up to (-)100 mm size. The crushed coal from primary sizer (nominal capacity 1200 TPH) will be collected by conveyors (1C1) and fed to secondary sizer (nominal capacity 1200 TPH) of the same stream. The crushed coal from secondary sizers will be collected by either of conveyors 1C2 or 1C3 and fed to any tripper conveyors (1C4 or 1C5). This coal from tripper conveyors will spread and stored into ground bunker-1 (above the ground) of 30,000 te Capacity.

The ROM coal produced through surface miner (-100mm size) from quarries (Both East & West) will received by rear discharge dumpers in receiving pit/hoppers (At Receiving Pit -1) at surface near quarry mouth during first 4-5 years of mine operation. One set of receiving arrangement having 10 nos. (2x5 nos. of hoppers) of hoppers have been provided at this receiving pit (Receiving Pit-1). Normally four hoppers will be operative out of five hoppers in a series but all five may also work during peak production. Coal from receiving hoppers will be reclaimed through Electro Mechanical vibrating feeder (Nominal capacity of each feeders is 500 tph) and collected by either of conveyors (2C1 & 2C2) installed underneath depending upon the operational series of hoppers at receiving pit. Receiving hoppers fitted with under width belt conveyors as shown in key plan of the proposed system. Out of these two series one will be in operation at a time, however in case of higher production both circuits may be put in operation simultaneously. The Run-Off-Mine coal produced through surface miners from quarries (East & West) of mine shall be transported by dumpers and received into receiving hoppers at surface pit (Receiving Pit -1) by means of rear discharge dumpers. Receiving hoppers have been

provided with sufficient capacity hoppers to accommodate payload of at least two dumpers at a time. The ROM coal (-100mm) from receiving hoppers will be reclaimed by Electro Mechanical vibrating feeder and will be collected by the respective conveyor (2C1 & 2C2) of 1600 mm wide, installed underneath of hoppers. The coal collected by conveyors 2C1 will be received by conveyors 1C2 or 1C3 and subsequently fed to respective tripper conveyors (1C4 & 1C5) of same capacity. This coal from tripper conveyors will spread and stored in ground bunker-1 (above the ground) of 30,000 te Capacity.

The coal collected by conveyors 2C2 will be collected by any of conveyors 2C3 or 2C4 and subsequently fed to respective tripper conveyors (2C5 or 2C6). This coal from tripper conveyors (2C5 or 2C6) will spread and stored in ground bunker-2 (above the ground) of 30,000 te Capacity.

The above arrangement will continue till the in-pit receiving conveyors for both quarry and surface conveyors along the east and west flanks are installed. However the crushing facility envisaged at surface will continue till entire mine life.

The upper seams coal produced through surface miners (-100mm) from west quarry beyond 4th year of mine operation will be transported along the west flank received at receiving pit – 2. One set of receiving arrangement having 5 nos. (Having, 1x5 nos. hoppers) of hoppers have been provided at this receiving pit (Receiving Pit-2 at west flank). Normally four hoppers will be operative out of five hoppers in a series but all five may also work during peak production. This coal from west flank will conveyed through series of conveyors (3C1 to 3C3-4) as per requirement. The ROM coal (-100mm) from receiving hoppers (At Pit-2) will be reclaimed by Electro Mechanical vibrating feeder and will be collected by the respective conveyor (3C2-3C4) of 1400 mm wide, installed underneath of hoppers. The coal collected by conveyors 3C2/3/4 will be received by conveyors 3C1 and subsequently fed to any of collecting conveyors 1C2 or 1C3. Conveyors 1C2 or 1C3 will fed coal to respective tripper conveyors (1C4 & 1C5). This coal from tripper conveyors will spread and stored in ground bunker-1 (above the ground) of 30,000 te Capacity.

Similarly upper seams coal mined through surface miners (-100mm size) in East quarry will be received in receiving hoppers (At pit-5, East flank, having, 1x5 nos. hoppers) and conveyed through series of conveyors (6C8-6C1). Conveyor 6C1 will discharge coal to any of tipper conveyors (2C5 or 2C6). This coal from tripper conveyors (2C5 or 2C6) will spread and stored in ground bunker-2 (above the ground) of 30,000 te Capacity.

The width and nominal capacity of each flank conveyors (3C1-3C4 & 5C1-6C8) will be 1400mm and 1200 tph respectively. Conveyors 3C4 and 6C8 may be extended further as per requirement.

Lower seams coal produced from West quarry through surface miner (-100 mm) will transported through floor and received by rear discharge dumpers in receiving pit/hopper (Receiving Pit-3 at floor, having 1x5 nos. of hoppers) at floor inside the quarry. Arrangement has been envisaged

at receiving pit-3 (inside the quarry at pit -3, having 1x5nos.hoppers) to receive the coal produced through surface minors and transported through floor level of west quarry. Coal from hoppers will reclaimed by Electro Mechanical vibrating feeder and will be collected by the conveyor (4C3) of 1600 mm wide, installed underneath of hoppers. This coal from floor pit-3 of west quarry will finally conveyed up to surface through series of conveyors(4C3-4C1) and fed to either of conveyor 1C2 or 1C3 and finally collected by tripper conveyors (1C4 &1C5) for storage into ground bunker-1 of 30,000te. Conveyors 4C3 will be joined by another conveyor 4C4/4C5 as per advancement of mine floor.

Similarly lower seams coal produced from Eest quarry through surface miner (-100 mm) will transported through floor received by rear discharge dumpers in receiving pit/hopper (Receiving Pit-4 at floor, having 1x5 nos. of hoppers) at floor inside the quarry. This coal from floor pit-4 of east quarry will finally conveyed up to surface through series of conveyors(5C2-5C1) and fed to either of tripper conveyors (2C5 &2C6) for storage into ground bunker-2 of 30,000te. The width and nominal capacity of each in-pit floor conveyors and subsequent conveyors (4C1-4C5 & 5C1-5C4) will be 1600mm and 2000 tph respectively. Conveyors 5C2 will be extended / joined by another conveyor 5C3/5C4 as per advancement of mine floor and system requirement.

Key plan and Coal flow arrangement of the proposed coal handling system has been shown in drawing no. RI 3 / E&M / M 2918 & RI 3 / E&M / M 2919 respectively

11.2.6.2 Storage Bunker and Reclamation system

The crushed coal received through surface CHP including flanks or in pit series of conveyors and crushing system at surface will be fed to respective tripper conveyors as shown in the key plan of proposed system.The coal from the tripper conveyors (1C4-1C5 & 2C5-2C6) will uniformly discharge coal to respective bunkers from one end of the bunker to other end with the help of trippers & cascading chute. The coal from the tripper conveyors 1C4-1C5 and 2C5-2C6 will be stored into buker-1 and 2 respectively. This ground bunkers (above ground) have been provided for total storage facility of 60,000 te capacity (2x30,000 te) to meet the requirement of fluctuation of coal production and despatch to upcoming pit top washery (Capacity 25.0 MTY). Provision has also been envisaged that crushed coal from bunkers may be directly loaded in to railway wagons through Silo and RLS for transportation up to power plant. The bunker shall be designed & constructed in a manner so that minimum sloping angle of 55 deg. to the horizontal may be achieved and it will have two slits type opening (in each bunker) for plough feeder at the bottom for reclamation of coal. Below the bunker slits opening reclaim conveyors are provided to collect coal reclaimed through plough feeders. The nominal capacity of the each reclaim conveyors (1C6 & 1C7) blow the bunker -1 and plough feeders shall be of 2000 tph. Similarly nominal

capacity of each reclaim conveyors (2C7 & 2C8) blow the bunker -2 and plough feeders shall also be of 2000 tph.

Pit top washery will collect coal from any of reclaim conveyors (1C6 -1C7 & 2C7- 2C8) through belt conveyors of suitable capacity as per their requirement. Three way chute arrangement in all four reclaim conveyors has been provided to discharge coal at different points in respective conveyors.

Width and nominal capacity of all above reclaim conveyors and succeeding conveyors in proposed CHP system will be 1600 mm and 2000 tph respectively.

Collecting and conveying of coal from reclaim conveyors chutes to washery will be in the scope of Washery.

11.2.6.3 Load out and despatch system

Following facilities have been envisaged for conveying, loading despatch of coal from the proposed CHP. The total nominal rated coal production of the Project will be 25.0 Mty. Total crushed coal (-100 mm) from the CHP will be received and processed by the proposed pit top washery before final despatch of clean as well as rejects coal of washery. However a bypass system for loading of crushed coal directly from CHP in to railway wagons by Silo & RLS has also been proposed. This loading system may be used as per requirement.

Sized coal (-) 100 mm stored in two bunkers of CHP will be reclaimed through 4 nos. of plough feeders (2 nos. in each bunker). The respective pair of reclaim conveyors fitted below each bunkers will receive crushed raw coal from bunkers through plough feeders. Reclaim conveyors 1C6 &1C7 are blow bunker-1 and 2C7& 2C8 are blow bunker-2

Arrangement has been provided in the CHP that washery will collect coal from any of reclaim conveyors (1C6 -1C7 & 2C7- 2C8) through belt conveyors of suitable capacity as per their requirement. Width and nominal capacity of each reclaim conveyor will be 1600 mm and 2000 tph respectively. Receiving or collecting conveyors of suitable capacity for receiving of coal from reclaim conveyors of CHP for conveying up to proposed washery will be in the scope of Washery.

An arrangement for loading of crushed coal (ROM coal of -100 mm) directly from CHP bunkers to railway wagons has also been proposed. Coal from any of reclaim conveyors of CHP bunkers may be received by loading conveyors (1C8 &1C9)) and fed to Silo (4000 te capacity). This coal in loading conveyors will be feed by any of reclaim conveyors having three way chute. This coal from Silo will loaded in to railway wagons through RLS. This silo has been provided for loading of coal directly from CHP in addition to 3 nos. of Silo's for loading of clean coal from washery. Width and nominal capacity of these loading conveyors will also be 1600 mm and 2000 tph respectively.

Each reclaim conveyors will be fitted with three way chute at their tail end so that these conveyors may discharge coal at three different points. These three discharge points have been provided to facilitate feeding of coal to any of following conveyors from any reclaim conveyors: i. Receiving conveyors of Washery, ii. Direct receiving, conveying and loading of ROM coal (-100 mm size) from CHP through Silo, This facility will be utilised as per system requirement during CHP operations.

The coal received by proposed washery will be washed before final despatch. This clean coal from washery will fed to Silo's through belt conveyors for loading into wagons. Conveying and feeding of clean coal into three nos. of Silos will be in the scope of washery. Three nos. Silo with RLS facility having capacity of 4000te each have been envisaged for loading and despatch of washed coal. Washed clean coal from Silo will be loaded into railway wagons through Rapid load out system (capacity 5500 tph) for final despatch of coal to the desired customers. Two loading chutes of RLS fitted below each silo will be placed on two different rail lines for loading of coal into rail wagons. Feeding / reclaim nation of clean coal up to Silo for loading into railway wagons will be in the scope of washery.

Rejects of washery will be fed / conveyed through belt conveyors to upcoming FBC plant where it will be consumed. Conveying of this rejects coal will be in the scope of proposed washery/ FBC plant.

11.2.6.4 Dust Control System

The Dust control system envisages both dust extraction as well as dust suppression system.

11.2.6.5 Dust Extraction system

The objective of the system is to extract coal dust from various dust generating points and clean dust laden air by trapping coal particles. Finally discharge clean air into the atmosphere so that dust concentration in the CHP premises may be reduced to minimum, even under the critical / worst operating condition.

The dust extraction system envisaged is of wet type. This will include net-work of suction hoods and ducting connected to a wet wall cyclone for separating dust from the air stream. Air outlet of cyclone collectors will be connected so as to discharge clean air to atmosphere. Collected dust from the cyclone collector shall be disposed off suitably. The wet type extractor is preferred because of its high efficiency and elimination of risks of secondary dusting problem and coal dust explosion.

11.2.6.6 Dust Suppression System

The objective of this system is to eliminate the air borne coal dust or suppress the dust at its source. The system involves confinement of the dust within the dust producing area by a curtain of moisture and wetting the coal dust by direct contact between the particles and droplet of water. Adequate number of precision anti-clog nozzles will be installed at suitable locations for suppressing dust by spraying water mixed with suppressant. Suitable control for dust suppression shall be provided and the system shall be so inter-locked that it functions only when the conveyor system is operating or the loading operation is on.

11.2.6.7 Noise Control

Noise pollution causes fatigue to operating personals. Provision will therefore be made to keep down the noise level to the extent possible. All machine mountings will have in their foundations anti-vibration pads/sheets for reducing the vibration and thereby noise. All transfer chutes and hoppers shall have wear resistant rubber or ultra high molecular weight plastic / synthetic liners of various thickness as per design requirement and their suitability.

11.2.6.8 Fire Fighting System

Necessary fire fighting system has also envisaged for the plant, which includes fire hydrant tees at strategic locations in sufficient quantity with suitable water supply pipe lines to cover the entire plant. Also portable type fire extinguishers to deal with electrical / oil /ordinary fires shall be provided at all strategic locations in the plant.

11.2.6.9 Plant cleaning system

To facilitate cleaning at strategic locations ample number of high pressure water serving points have been envisaged. These service points will be so located that entire working area in the plant or equipment working place can be reached. These service points will be provided with quick connecting hose couplings for easy fixing and dismantling of hoses.

To handle discharge from plant effluent and washing of the plant area, sump pumps of suitable design and capacities have also been envisaged where required. Plant effluent shall be discharged through open drain/ pipe.

11.2.6.10 Plant Preventive Maintenance

For effective maintenance of all the equipment, there will be sufficient working space around the equipment/machinery. All the equipment and conveyor discharge drums/transfer points, etc shall have covered and well ventilated housing complete with access stair ways, hand rails, platforms, cross-over ladders, etc as required.

Necessary mono-rails electric hoists and chain pulley blocks at suitable points of adequate capacity will also be provided on respective floors.

11.2.6.11 Weighment

For the purpose of Weighment of coal handling and dispatched in the CHP, one belt weigher of suitable capacity have been provided in each receiving and despatch circuit of the CHP conveyors. Few road weigh bridges of 100 te capacity have also been provided for weighment of coal during initial years of mine operations.

Loading of coal through RLS with pre-weigh hoppers facility have been envisaged.Five nos. in motion rail weigh bridges have also been provided for weighment of empty and loaded rakes for dispatch of coal.

11.3 ELECTRICALS

The electrical system shall comprise:

- Power reception and distribution system
- Centralized sequence control–cum–interlocking, automation, signaling and instrumentation system
- Illumination of plant and adjacent area
- Centralized welding circuit
- Earthing

11.4 CAPITAL INVESTMENT REQUIREMENT

The details of cost estimate for capital requirement of the proposed CHP has been shown in Appendix – A.3.5.0.

11.5 DRAWINGS

A tentative key plan and coal flow of the proposed coal handling system has been given in the drawing no. R3 / E&M / M 2918 and M 2919 respectively.

11.6 RAILWAY SIDING

A new railway siding with MGR bulb facilities has been provided for loading and dispatch of coal from the mine. The siding would take-off from Manatu station (Near Shivpur) of the proposed Arterial (Tori-Shivpur) line. The approximate distance of the proposed alignment taking off from Manatu station of main Arterial to railway siding of the Amrapali OCP is about 14 Km for single link line and yard portion with MGR bulb. Considering the volume of coal to be despatched through rail, provision for double link line with necessary yard facilities have been envisaged in the proposed siding system. Necessary rail lines in the yard / MGR has been envisaged to accommodate three nos. Silo for loading of coal into railway wagons through RLS. The coal of nearby proposed Chandragupt mine may also be evacuated through this railway siding. As such additional lines in link as well as in yard portion may be required.

Provision has been made in the proposed siding to inter-link in MGR systems so that loading of rakes will be made by any silos & RLS to any consumer wagons for loading and despatching of coal from this project. As such additional rail lines in yard have been proposed to facilitate loading through any Silo simultaneously.

For the proposed production coal will be loaded at Amrapali siding through Silo and RLS. Sufficient rail lines in yard and link portion at Amrapali siding has been envisaged to facilitate the loading operation. Provision has been envisaged that two loading chutes of RLS fitted below each silo will be placed on two different rail lines for loading of coal into rail wagons.

11.7 CAPITAL ESTIMATES RAILWAY SIDING

The estimated cost for additional provision for envisaged Railway siding has been is shown in Appendix- A. 5.

CHAPTER – XII

WORKSHOP & STORE

12.1 INTRODUCTION

This Expansion project report for Amrapali OC has been prepared for a targeted production of 25.0 MTY. So, a new unit workshop has been proposed.

This unit workshop will have two parts – Excavation and E&M workshop. Apart from this, Project store and other common facilities have been provided. A schematic layout plan of the workshop is shown in drawing No. R 3 E &M M 02906 for departmental option.

12.1.1 Maintenance facilities

This unit workshop is envisaged to cater the need of daily maintenance, scheduled maintenance, lubrication, routine inspection, minor/medium repair and replacement of parts/sub-assemblies of HEMM such as- Dumpers, Dozers, Shovels, and Drills etc.

Minor repair of assemblies and sub-assemblies of pumps, CHP, Electrical etc. deployed in the project will also be performed in this workshop. Planning of this unit workshop and project store has been done based on a routine maintenance and repair programme to achieve the high level equipment availability, reliability and longer life.

Maintenance and repair load of this unit workshop has been assessed on the basis of annual operating time, life of the equipment / assemblies/ sub-assemblies etc.

Space requirement for maintenance & repair activities, parking facilities of HEMM, washing of equipment, requirement of open and covered space/sheds etc. have also been worked out based on the number & size of HEMM to be deployed in this mine.

12.1.2 Scope of work

This Unit workshop will have two parts- Excavation and E&M workshop. Apart from this, Project store and other common facilities like- canteen, fuelling station, washing station, security post, firefighting etc. have been provided.

Any major overhaul of equipment and manufacturing of spares on large scale are beyond the scope of this workshop. These works will be carried out in nearby Regional workshop or Central workshop, Barkakana.

12.1.3 Excavation workshop

This part of unit workshop will have the facilities for attending to the scheduled maintenance, daily maintenance, minor/medium repair or replacement of parts/ sub-assemblies of face and transport equipment such as dumpers, shovels, drills, dozers, cranes, grader and other miscellaneous equipment used for mining operation.

All dumpers and dozers coming to workshop for their daily as well as scheduled maintenance will be first washed at the washing stations provided in the workshop and then brought to the respective maintenance shops.

In Daily maintenance shop, the equipment will be checked for lubrication, tyre inflation, oil levels etc.

The equipment for scheduled preventive maintenance as per recommended schedule of the manufacturers will be directed to Schedule maintenance shop where their complete lubrication will be taken care of along with diagnosis of their technical state. After evaluation of the condition, they will be sent to the Dumper repair shop.

Maintenance and minor repair of Face equipment e.g. shovels & drills will be carried out at the site. The components/ assemblies requiring further repair will be dismantled from the machine and the dis-assembled components will be brought to workshop for new replacement. In case of major repair, these will be sent to central workshop.

12.1.4 E& M workshop

Considering the nature of repair and maintenance of E&M equipment, which is different from that of the HEMM, a separate E&M workshop has been provided.

This part of the workshop will have the facilities for scheduled maintenance, day-to-day maintenance and minor repair by parts / unit replacement method of all E&M equipment deployed in the project such as Pumps, D.G sets & electrical equipment, CHP etc.

12.2 PROPOSED FACILITIES

Broadly Excavation workshop will have the following functional shops: -

i) Machine shop

ii) Electrical repair shop

iii) Engine repair shop
iv) Assembly and sub-assembly repair shop
v) Radiator repair shop
vi) Welding & Structural shop
vii) Dumper repair shop
viii) Dumper Daily Maintenance shop
ix) Schedule Maintenance (Inspection and lubrication) shop
x) Dozer repair shop
xi) Heavy repair shop
xii) Field Service equipment
xiii) Washing Station
xiv) Stores & common facilities

And E& M workshop will have the following functional shops: -

i) Machine shop
ii) Mechanical repair shop
iii) Electrical repair shop
iv) L.M.V repair shop
v) Store

12.3 EXCAVATION WORKSHOP

i) MACHINE SHOP

This shop will have the necessary machine tools for restoration of worn-out parts and manufacture of small non-complicated spare parts, which are in short supply, and required for repair of HEMM.

ii) ELECTRICAL REPAIR SHOP

This shop will have the facilities for carrying out the minor and medium repairs of the electrical components of the mining equipment. The repair facilities have been limited to the parts replacement and repair of self-starter, Dynamo, Battery charging etc.

iii) ENGINE REPAIR SHOP

This shop will have facilities for minor and medium repair and adjustment of Diesel Engine fitted with all types of Dumpers, Dozers, and Scrapers etc. working in the mine.

iv) **ASSEMBLY AND SUB-ASSEMBLY REPAIR SHOP**

Assembly & sub-assembly shop will have the facilities for repairing the assembly and sub-assembly of motor transport equipment. Since most of the machine will be of similar make and model, they will be treated under unit replacement method. The repaired assemblies will be drawn from the shop and fitted to the equipment of same make and model.

v) **RADIATOR REPAIR SHOP**

This shop will carry out the repair and over-hauling of radiators. It is equipped with water tap for proper flushing and cleaning of radiators, testing stand and other repair tools and equipment.

vi) **WELDING & STRUCTURAL SHOP**

These shops will take-up the welding of buckets of shovels and other jobs of dumpers etc. It will also under take other non-standard welding works.

vii) **DUMPER REPAIR SHOP**

This shop will cater to the need of repair/replacement of parts/components of the dumpers needing repair after their proper inspection & diagnosis of defects in the Schedule Maintenance shop.

The dumpers, which experience incidental problem in the field and require minor & medium repair will also be attended in this shop.

All dumpers coming for repair must be first washed at the washing station before entering this shop.

viii) **DUMPER DAILY MAINTENANCE SHOP**

Checking of water and oil levels, greasing of lubrication points, checking of air pressure of tyres, brake testing etc. will be performed in this shop.

ix) **DUMPER SCHEDULE MAINTENANCE (LUBRICATION AND INSPECTION) SHOP**

The schedule maintenance (lubrication and Inspection) of the dumpers as per schedules recommended by the manufacturers will be done in this shop. For this purpose pressurized lubrication system has been provided.

x) **DOZER REPAIR SHOP**

This shop is meant for carrying out the maintenance and repairs of dozers. The repairs will be done mainly by the replacement of parts, unit and sub-assemblies.

xi) HEAVY REPAIR SHOP

This shop will deal with the medium repair/replacement of component and sub-assemblies of shovels, drills etc, which will be dismantled from the equipment working in the mine and brought to this shop.

xii) FIELD SERVICE EQUIPMENT

Mobile workshop van & Mobile service van have been provided for the maintenance and lubrication of the equipment at the site of their working.

xiii) WASHING STATION

High-pressure multi jet washing unit for dumper and high-pressure water & steam jet washing unit for dozer have been envisaged for washing.

xiv) STORES & COMMON FACILITIES

A small store is provided for storage of 10 days consumption of spares & consumables required for repair & maintenance of HEMM & other mining equipment. The different repair shops will draw day-to-day requirement of spares & other consumables from this store.

A fully equipped fuelling station is also provided for fuelling the vehicles and transport equipment.

12.4 E&M WORKSHOP

I) MACHINE SHOP

This shop will undertake machining and reconditioning of spares. It will also manufacture small spares, which are in short supply and required for the repair of E&M equipment.

II) MECHANICAL REPAIR SHOP

The equipment like pumps and pumping installation experiencing incidental problem in the field and requiring minor repair will be brought to this shop where they will be inspected and repaired. Apart from this the normal maintenance/repair of the pumps will be done in this shop.

III) ELECTRICAL REPAIR SHOP

This shop will deal with the testing and minor repairing of electrical components of CHP equipment, pumps, switchgears etc.

IV) LIGHT MOTOR VEHICLE REPAIR SHOP

This shop will cater to the need of schedule maintenance, minor & medium repair and replacement of components of light and medium duty vehicles such as Jeeps, Cars, Ambulance, Trucks, and School Buses etc. The vehicles will be thoroughly washed at the washing station (meant for light & medium duty vehicles) before going to this shop for repairs.

V) STORES & COMMON EQUIPMENT

A small store is provided for storage of 10 days consumption of spares & consumables required for repair & maintenance of E&M equipment.

12.5 WORKSHOP & STORE LAYOUT

A schematic layout plan of the workshop & project store is shown in drawing no.R3 E&M M 02906for departmental option (variant-I).

12.6 WORKSHOP AND STORE PLANT & MACHINERY

The detail list of required workshop/store P&M has been provided in Appendix-A.3.3

12.7 PROJECT STORE

A project store has been provided to meet the total requirement of proposed workshop as well as additional requirement of entire project.

This full-fledged store is provided adjacent to the workshop boundary with a view to minimize the time for collection of spares and consumables required for the repair & maintenance of HEMM in this unit workshop.

12.8 CAPITAL INVESTMENT

The detail of P&M provided for the workshop along with their estimated cost has been given in Appendix-A.3.3.

12.9 LIST OF WORKSHOP (P&M)

The list of P&M for unit workshop has been provided in Appendix-A.3.3.

12.10 DRAWINGS

A general Layout plan of both Excavation and E&M workshops along with project store has been shown in Drg. No. R3 E&M M 02906.

VARIANT- II (Coal & OB both outsourced)

In this option coal & OB both is outsourced. For variant-II, only a small workshop has been provided for day to day work. In this option some HEMM has been provided for common facilities & reclamation. Day to day maintenance of HEMM will be provided in this workshop. But medium/major maintenance of HEMM is beyond the scope of this workshop. This work will be outsourced. A schematic layout plan of the E&M workshop is shown in drawing No. R 3 E&M M 02940. The details of P&M provided for the workshop along with their estimated cost have been given in Appendix-A.3.3.

CHAPTER-XIII

POWER SUPPLY, ILLUMINATION AND COMMUNICATION

13.1 POWER SUPPLY

Location and source of power

The proposed Amrapali expansion opencast project is located in the North Karanpura Coalfield. This project comes under administrative control of M&A Area of Central Coalfields Limited.

Draft expansion project report of Amrapali OCP has been formulated for two Variants, Variant – I and Variant-II, with a targeted production capacity of 25 MTY for both the Variants. The scope of activity envisaged for Variant –I and Variant-II are tabulated below:

Scope of Activity for Different Variants

Activity	Variant-I	Variant-II
OB removal	Departmental	Outsourced
Coal Production	Departmental	Outsourced
Pumping	Departmental	Outsourced
Coal Handling Plant	Departmental	Departmental
Excavation Workshop	Departmental	As required
Quarry illumination	Departmental	Departmental
E&M Workshop	Departmental	As required
Office and surface illumination	Departmental	Departmental

Proposed scheme of power supply

Considering the population of electrical HEMMs, CHP, Pumping and other common loads proposed in this report, 2 nos 2X16 MVA 33/6.6kV substation has been envisaged for fulfilling the power requirement of the project. Both the sub-stations will receive power at 33 kV from DVC switching station being constructed for feeding power to the upcoming projects of this coalfield, through independent double circuit overhead line feeders. Both the substation will have provision for receiving power at 33kV through 2 nos. 33 kV incoming feeders and facility for distributing the same at 6.6 kV to the different load centers of the project through 18 nos. outgoing 6.6 kV feeders.

Substation I will be located near southeastern corner of CHP complex and will feed power to entire east quarry, CHP loads excluding 3C series conveyors, surface illumination etc. Substation II will be located near southeastern corner of the workshop complex and cater the power requirement of west quarry, 3C series conveyors, workshop, surface illumination, office complexes and colony

2 nos. 33 kV double circuit incoming feeders each approx. 12 km long with WOLF or equivalent AAA conductor in double rail pole structure will be constructed from said DVC switching station for receiving power. One no 15 MTY Coal washery has been proposed along with the mine. Power demand for the washery will be of the tune of 15 MVA at 33kV. Therefore an independent double circuit overhead transmission line feeder will be required for receiving power for the washery from the said DVC switching station in addition to said 2 nos 33 kV double circuit incoming feeders proposed for power receiving to the substations. Construction of 33 kV washery feeder will be identical to the substation feeders.

Single line diagram of proposed substations have been shown in enclosed drawing no. R3: E&M: 0E2920 and R3: E&M: 0E2921.

13.2 ELECTRICAL PARAMETERS

Power balance charts were prepared for both the Variants based on deployment of departmental electrical equipment & installations in the project for estimating the maximum power demand, annual energy consumption and other electrical parameters. The power balance charts showing detailed calculation for Variant-I and Variant-II are placed at Table XIII (A-I) and XIII (A-II) respectively. Salient electrical parameters of the power balance charts are tabulated below:

Sl. No.	Description	Variant I	Variant II
1	Connected Load (kW)	53115	16460
2	Load in operation (kW)	48972	14020
3	Maximum power demand (kVA)	25891	6223
4	Annual Energy Consumption (MkWh)	126.53	42.77
5	Energy consumption per tonne of coal production (kWh/te)	5.06	1.71
6	Cost of energy per tonne of coal production (Rs. /te)	25.76	8.50
7	Total energy cost per annum as per prevailing DVC tariff (in Rs. Lakhs)	6439.06	2124.10

13.3 MINE SUB-STATIONS

To meet the power requirement of the project, two nos of 2 X 16 MVA, 33/6.6 kV substation has been envisaged. The transformers capacity for the substation have been selected considering maximum demand of power connected to the substation at an overall power factor of 0.98, with 100 % stand-by transformer capacity.

For arriving into the capacity of substation in Variant-II, it has been presumed that, in the outsourced activities, similar P&M that of the departmental Variant will be deployed by the contractor and power for the same will be received from the proposed mine substation. As such, capacity of the substation for both the Variants has been considered identical.

Both the 2 X 16 MVA, 33/6.6 substation proposed for the project will be identical in construction. Each substation will have the following major outdoor and indoor installations.

(i) Outdoor Installations:

- 33 kV, Isolators with / without earthing switch & DO Fuse
- 33 kV terminal structures, bus sections for receiving power.
- 33 kV, Outdoor type Circuit Breakers with VCB.
- 33 kV CTs & PTs.
- Lightning Arresters for 33 kV system voltage
- Power Transformer, 16 MVA, 33/ 6.6 kV -2 Nos
- Neutral Grounding Resisters for power transformers.
- 33 /0.415KV, 160 kVA Station Transformer.
- 33 /0.23 KV (L to L), 100 kVA Transformers for substation lighting.
- 6.6 KV, Isolators with / without earthing switch
- 6.6 kV, Outdoor type Circuit Breakers with VCB
- Lightning Arresters for 6.6 kV system voltage
- Capacitor Banks, 6.6 KV, 4560 kVAr-2 Nos for Substation-I and 3225 kVAr-2 Nos for Substation-II
- Outdoor Illumination.
- Substation earthing.

(ii) Indoor Installations:

- Remote control panels for 33 kV outdoor type circuit breakers with VCB.
- Remote control panels for 6.6 kV outdoor type circuit breakers with VCB.
- 415V Switch Board for control of station transformer.

- 230V Lighting Switch Board
- Indoor Illumination.
- 110 V D.C. Distribution Board.
- Battery, Battery Chargers.
- Indoor control panel with APFCR for control of Capacitor banks, 6.6 kV, 4560 kVAr-2 Nos for Substation-I and 3225 kVAr-2 Nos for Substation-II
- Earthing with Grid.

(iii) 6.6 kV outdoor VCBs

The various functions of the 6.6kV VCBs installed in the outdoor switchyard and energized from the secondary side of the 16 MVA 33/6.6kV power transformers will be as follows:

Sl. No.	Function	Numbers	
		Sub Stn.-I	Sub Stn.-II
1	6.6kV Incoming Power Control	2	2
2	6.6kV Main Bus Bar Sectionaliser	1	1
3	Control for Power Supply Feeders to HEMM	4	4
4	Control for Power Supply Feeders to CHP	4	2
5	Capacitor Bank Control	2	2
6	Control for Quarry Feeders for Pump	2	2
7	Control for Quarry Lighting Feeder	2	2
8	Control for Surface Lighting Feeder	1	1
9	Control for Power Supply Feeder to HEMM Workshop	-	1
10	Control for Power Supply Feeder to Colony	-	2
11	Spare	3	2
	TOTAL :	21	21

(iv) 415 V Distribution Board.

415V indoor type distribution board will be installed in the substations for receive power from the secondary side of 160 kVA 33/0.415 kV transformer installed in the substation yard and distribute the power to various loads of the substation such as float cum charger, oil filtration machine etc. In addition to above this transformer will provide 415 V power to the automatic fire fighting arrangement of the substation. This switch board will comprise of 1 no incoming control 4 pole 250 Amp MCCB and 5 nos. of outgoing control MCCBs of suitable capacity.

(v) 230 V (L-L) Lighting distribution board

415V indoor type distribution board will be installed in the substations for receive power from the secondary side of 100 kVA 33/0.23 kV (L-L) lighting transformer installed in the substation yard and distribute the power to various lighting loads. The 230 V (L-L) lighting distribution board will comprise of 1 number 3 pole MCCB as incomer and 7 nos. 2 pole MCBs as outgoing control.

(vi) Protection of substation, Controlling & Signaling.

33 kV VCB type circuit breakers will be used for primary control of both the 33/6.6 kV 16 MVA transformers of proposed mine Substations. The circuit breakers, in conjunction with Current transformers, provide protection to the transformers against over current, short circuit, and earth fault. These circuit breakers shall also trip for internal fault of transformers actuated by oil/winding temperature relay and Buchholtz relays activated by gas / oil pressure due to incipient fault inside the transformer. Similar circuit breakers will be used for control of both the incoming feeders and also as a bus coupler.

6.6 kV VCBs will be used for secondary control of transformers, control of 6.6 kV outgoing feeders, bus-coupler and capacitor bank control. These VCBs will have provision for protection against over current, short circuit and earth fault.

For protection against lightning, lightning arrestors conforming to IS: 3070 and IS: 4004 will be provided in the substation yard. Shield wires will be provided for protection of outdoor equipment against direct lightning strokes. For protection of building from lightning strokes, spikes will be provided over the building and these spikes will be interconnected by means of GI flats to form a grid. This grid will be connected to the earth pits at the four corners of the building by means of down conductors.

Remote control operation of 33 kV circuit breakers will be performed by the control switches provided in the control panel in the substation room.

Signaling system in the substation will be provided as under:

a) Signaling to inform the personnel about automatic tripping of circuit breakers due to fault.

b) Warning signal about occurrence of abnormality in any particular device.

c) Signaling to show actuation of automatic and protective relays (flags and pointer on relays)

Similar control, protection and signaling devices will be provided in the 6.6 kV outdoor circuit breakers units and indoor control panels also.

(vii) Interlocking

The air break isolators associated with the 33 KV circuit breakers in the proposed substations shall be interlocked with the circuit breakers to avoid mal- operation.

The 33 kV and 6.6 kV sectionaliser circuit breaker installed in the 33 kV and 6.6 kV outdoor bus will have electrical interlock with the respective incoming circuit breakers to avoid parallel operation of transformers.

Primary and secondary C.B.s of respective transformers shall be interconnected so that secondary control C.B. shall trip automatically when the primary control C.B. trips.

(viii) Earthing System.

Earthing grid shall be provided around the periphery of the substations for interconnection of earth pits as well as to earth all the electrical equipment.

The transformer body and the lightning arrestors provided for the transformers shall be earthed separately as per IE rules but the earth pits shall be interconnected to minimize the earth resistance so that protections to the transformers is most effective. The LAs shall be located as close to the transformers as possible.

Substation earthing shall conform to IS: 3043(current). The resistance to earth shall not exceed 1 ohm. Separate earth pits would also be constructed around workshop sheds and CHP. All the drives and electrical equipment of substation and CHP will be connected to the respective earth bus laid around the workshop and CHP with GI strip of adequate size to provide adequate earthing.

Restricted neutral earth system shall be provided for 6.6 kV distributions. The neutral of the 33/ 6.6 kV power transformers installed in the substation shall be earthed through earting resisters to restrict the earth fault current within 50 Amp.

The 33/0.415 kV Station transformer shall be provided with solidly earthed neutral system. The station lighting transformer with voltage 230 V(L to L), shall operate in un-earthed system.

13.4 POWER TARIFF

Estimated power bill for different Variants has been calculated based on prevailing tariff of DVC as tabulated below.

Sl No	Description	Rupees
1.	Normal Demand Charges (Rs. /kVA/month)	410
2.	Energy Charges (Rs./kWh)	4.05
3.	Electricity Duty (Rs./kWh)	0.20

13.5 ENERGY CONSUMPTION

Maximum annual estimated energy consumption of the project with proposed departmental load at targeted rate of production is 126.53 M kWh and 42.77 M kWh respectively for Variant I and Variant II. Detail calculation of maximum annual energy consumption, maximum power demand maximum annual power bill and year wise phasing of energy consumption, power demand and energy bill are placed at following Table XIII (A-I),XIII(B-I) & XIII (C-I) for Variant-I and Table XIII (A-II), XIII (B-II) & XIII (C-II) for Variant –II respectively.

13.6 UTILIZATION VOLTAGE

The utilization voltage of various equipment / installations of the project are as given below.

Sl. No.	Equipment	Voltage
1	Incoming Supply to Proposed project Substations	33 kV
2	HEMM	6.6 kV
3	Pump-110 kV and above	6.6 kV
4	Pumps-below 110 kW	0.415 kV
5	Workshop Equipment	0.415 kV
6	Proposed Quarters & Utility Buildings	0.415kV
7	CHP Equipment	6.6 /0.415 kV
8	Quarry /Mine Area Lighting	230 Volt (L-L)

13.7 POWER FACTOR IMPROVEMENT.

Rating of capacitor bank required for improving the overall power factor of the project up to 0.98 has been estimated in the power balance chart. As per the estimation, around 9195 kVAr and 6368 kVAr of capacitor bank will be required for achieving the desired result at Substation-I and substation-II respectively.

Therefore, 2 sets of outdoor type capacitor banks each rated at 6.6 kV of 4597 kVAr each will be installed in the switchyard of the substation and connected one each to the both bus section of the 6.6 kV split – main bus system in Substation-I. 2 sets of 3184 kVAr capacitor bank rated at 6.6kV will be installed in similar manner at substation-II. The capacitor banks will have the facility to connect or disconnect the required number of units automatically through contactor and automatic power factor correction and relay panel combination, depending upon the loading pattern at the substation. These

capacitor banks can also be controlled manually by remote control panel installed in the substation building.

13.8 QUARRY POWER SUPPLY & DISTRIBUTION

Power supply to HEMM

Four numbers of 6.6 kV overhead line feeders originating from the each substation will be drawn up to a convenient location in the quarry for feeding power to the electrical HEMMs deployed in the mine. Feeders from Substation-I will normally provide power supply to the HEMMs installed in the east quarry and feeders from Substation-II will normally provide power supply to the HEMMs installed in the west quarry. The overhead line feeders will receive power at 6.6 kV from the outgoing structures installed in the switchyard of the substations. Depending upon the various stages of quarry operation these feeders may have to be shifted or extended. Power will be tapped from 6.6 kV overhead feeders by means of outdoor type isolators and power cables for energizing the field switches for different electrical HEMMs.

In case of Variant II, power will be made available to the outsourced agency at the terminal structure of the outdoor yard of the substations for the HEMM deployed by outsourced agency. The outsourced agency will make their own arrangement for receiving power from the same and feeding power to the electrical HEMM deployed by them.

Power supply to Pumps:

Two numbers 6.6 kV overhead line feeders originating from the each substation is proposed to be drawn up to a convenient location near main sump of the each quarry for feeding power to various pumps installed in the respective quarry. Feeders from Substation-I will normally provide power supply to the pumps installed at east quarry and feeders from Substation-II will normally provide power supply to the pumps installed in the west quarry The overhead line feeders will receive power at 6.6 kV from the outgoing structures installed in the switchyard of the substations. Depending upon the various stages of quarry operation these feeders may have to be shifted or extended.

For distributing power to the main pumps, two nos kiosk type 10 panel outdoor 6.6 kV sectionalised switchboard has been envisaged. These switch board will be installed near the main sump. Power shall be tapped from 6.6 kV overhead feeders by means of outdoor type isolators and power cables for energize the switchboards.

The function of different VCB panels of 10 panel switchboards shall be as follows:

- Incoming feeder control 2 nos.
- Sectionaliser 1 no.

- Control for Main pumps 5 nos.
- Spare 2 nos.

Individual HT pump will receive power from the switchboards through dedicated switch and cable. The location of switchboard will be suitably changed with the change in the location of main sump.

For distributing power to 415V operated pumps, two nos 400kVA, 6.6kV/415V unitised substations along with two nos suitable 415V distribution panel has been envisaged for each quarry. These unitised substations will receive power at 6.6kV from 6.6kV pump feeders of respective quarry and feed power to different 415V pumps through said 415V distribution panels.

In case of Variant–II, pumping of water from the quarry will be outsourced. Power for pumping will be made available at 6.6kV to the outsourced agency at the terminal structure of the outdoor yard of the main substation. The outsourced agency will make their own arrangement to receive power from the substation and feed the same to the different pumps installed by them in the quarry.

Power Supply to CHP

Power will be made available to CHP at 6.6 kV through four nos. 6.6 kV overhead line feeders drawn from the Substation-1 to CHP sub-station. These feeders will provide power for entire CHP operation excluding power requirement for 3C series conveyors. Power for 3C series conveyors will be received from Substation-II through 2 nos 6.6kV overhead line feeders.

Provision for construction of overhead transmission line has been made in the Appendix of electrical P&M. The provision of electrical Substations, electrical P&M, power distribution, sequence control operation, Illumination for CHP etc. has been made in the relevant Appendix for CHP.

Power Supply to Workshop

Power will be made available to workshop at 6.6 kV through 6.6 kV overhead transmission line feeder from Substation-II. Provision for construction of overhead transmission line has been made in the Appendix of electrical P&M. The provision of 6.6kV/415V electrical substation at workshop, electrical P&M, power distribution at workshop and Illumination for workshop etc. has been made in the Appendix for workshop.

In case of Variant II, power shall be made available to the outsourced agency at the terminal structure of the outdoor yard of the substations-II to fulfill power requirement in the workshop constructed by the outsourced agency for maintenance of the equipment deployed by them. The outsourced agency will make their own arrangement for receiving power and utilization the same at the workshop constructed by them.

Power Supply to Township

Colony will be located at about 5 km from the substation-II. Different type of 1219 and 268 number residential quarters has been proposed in Variant I, and Variant II respectively of this report. In addition to above, service buildings such as Staff Rest House, Officers Guest House, Dispensary, Community Hall, Officers Club, School, Post office, Bank, Training Centre etc has been proposed in the different Variants of this report. Power for colony will be received at 6.6kV from Substation-II through a double circuit overhead line feeder and the same will be stepped down to 415V through 250kV 6.6/0.415kV distribution transformers installed at different locations in the colony. Power at 415V/230V will be distributed to the quarters and service buildings with 415V overhead line, cables etc.

13.9 ILLUMINATION

Two numbers of 6.6 kV overhead line feeders originating from the each substation is proposed to be drawn up to a convenient location in the quarry for feeding power to the lighting transformers installed in the mine. Feeders from Substation-I will normally provide power supply to the lighting transformers installed in the east quarry and feeders from Substation-II will normally provide power supply to the lighting transformers installed in the west quarry.

The overhead line feeder will receive power at 6.6 kV from the outgoing structure installed in the switchyard of the respective substation. Depending upon the various stages of quarry operation these feeders may have to be shifted or extended.

Power for surface illumination shall be received from the substations through separate 6.6kV overhead line feeders.

Haul Road Illumination

For illumination of permanent haul roads, 250 W HPSV lamps and luminaires mounted on 11/13 m steel tubular poles have been envisaged. Temporary haul roads shall be illuminated, through 400W HPSV lamp fitted in flood light fixtures mounted on skid mounted / mobile lighting towers depending upon their position.

Illumination of Working Faces, Quarry General Area and Dump Area

Illumination of working face will be done through mobile lighting towers fitted with diesel generator sets. Lighting of quarry general area/dump area will be done with 400W HPSV lamp fitted in flood light fixtures mounted on skid mounted lighting towers.

Service Road Illumination

150 W / 250W HPSV lamps in street light luminaires will be used for illumination of service roads of the project. The luminaires will be mounted in 11/13 m steel tubular poles installed at a suitable interval for achieving desired level of illumination.

Sufficient no. of 25/10 kVA, 3.3 kV / 0.23 kV (L – L) lighting transformers have been provided for feeding power to the light fittings installed for illumination of Haul road, service road, quarry general area, dump area, working face etc.

Township Street Illumination

8.0 km, and 1.8 km colony road has been proposed in this report in Variant I and Variant II respectively. In addition to this there will be approach road of 5 km for the colony. 150W HPSV lamps in street light luminaires will be installed on steel tubular poles of 415V colony power distribution line / street lighting poles for colony and approach road illumination.

13.10 ELECTRICAL COST ESTIMATE

The estimated total additional capital investment required on electrical, P&M including the substation and incoming power supply arrangement has been worked out for both the variants and are furnished at Appendix A.3.2 (I) and A.3.2 (II) respectively. Cost of building, other civil work and steel structural works for the substation has been included in the related Appendix of Civil section. Total estimated additional capital required for electrical P&M, substation and incoming power supply arrangement comes to Rs. 4447.58 lakhs and Rs.3187.62 lakhs for Variant I and Variant II respectively.

13.11 TELECOMMUNICATION

COMMUNICATION

Coal production has become highly capital intensive due to large scale mechanisation for production and transportation using the modern technology. To cope up with mechanisation to maintain safety and also to improve the efficiency, there is a need to establish an efficient means of voice and data communication. The effectiveness and reliability of decision making process depends on a reliable means of information exchange among the different units of surface and underground, which totally depends upon the integrated telecommunication systems for voice and data.

13.12 PROPOSED COMMUNICATION SYSTEM

The proposed communication system should cater the need of voice communication among personnel related to mine operation, administration and equipment maintenance. The system also takes into account the data communication requirement for mine operation and planning alongwith the latest office automation facilities.

While preparing the system, due consideration has been given to the state-of-art networking architecture involving the communication of voice and data over the proposed network path to avoid duplicated investment in network and proper conservation of bandwidth.

13.12.1 EXTERNAL COMMUNICATION

30 (thirty) telephone lines have been provided for communication and access to public communication grid. These telephone sets would be located in the residences and offices of key personnel of the project, sub-station, railway siding, CHP, washery,workshop, etc.and 4 lines shall also be terminated on the exchange for trunking. Besides fixed line telephones, 30 nos. of Mobile connection with sets may also be provided to key personnel of the project.

13.12.2 VOICE AND DATA NETWORKING

There shall be an IP exchange with a capacity of 500 lines upgradable to 800 lines. The proposed exchange shall be housed at workshop and shall be connected with existing exchange at Project(HQ) for providing effective and transparent communication between any two end locations. The IP Exchange shall have all the latest features like SIP extension and trunk, High Capacity Server, Media Gateway (single/multiple gateways), Redundancy (Server, Network), Encryption and Mobility facility like Wi-fi etc. The IP Exchange shall be interfaced with fixed lines for extending external communication having STD & ISD facility.The proposed IP exchange shall be interfaced with the proposed OFC network of CCL for voice and data communication.

13.13 TECHNICAL SPECIFICATIONS

13.13.1 TECHNICAL SPECIFICATION OF IP EXCHANGE

The IP exchange should provide Management and Control of audio video & data traffic from a single source and also provides Mobile Communication solution, Net working application and Computer to Telephone integration application. It should have latest SIP Enabled IP based communication server, fully modular and fully Non blocking type having distributed Client-Server with

redundant server architecture, full feature transparency, CLI facility, ISDN PRI/BRI, together with all latest feature and configuration of a modern communication server.

- It should ready to adopt present and future technologies.
- It should support 350 analog extension and 150 digital extension. It should also have trunkports and Communication redundancy.
- Exchange shall have both voice and data switching capacity.
- System software shall have auto-diagnostic programme to detect the faults and localise them.
- The exchange should support multi-media application as per latest trend. It should be possible to connect PC's, host computers etc. without modem through Digital/ISDN line.
- Exchange shall be DoT/TRC approved with ISDN facility.

13.13.2 NETWORKING FACILITY

Exchange is required to operate in any one of the following and shall be suitable for both.

i) Service Provider Junction.

ii) Exchange should also be able to inter-face directly with other exchanges, if required.

System should be capable to network with the following types of lines:

a. Direct inward dialling trunk and outward dialling trunk.

b. ISDN line.

13.13.3 FEATURES

a. Flexible numbering scheme
b. Privacy of calls
c. DID facility junctions.
d. Conferencing
e. Automatic call back on busy extn.
f. Call transfer and Call pick up.
g. Last number radial.
h. SIP extension and trunk
i. High Capacity Server
j. Media Gateway
k. Server and Network redundancy

l. Encryption
m. Mobility like SIP and Wi-Fi
n. IP Telephony feature
o. IP enhancement facilities
p. Ful active VoIP recording

13.14 24 PORT L3 SWITCH

The managed L3 Switch shall be a workgroup switch 24/48 port 10/100 having a gigabit uplink port. The switch shall have sufficient backplane and throughput alongwith QoS features for both voice and data connectivity.This Managed L3 switch should be installed at computer centre at mine .

A. TECHNICAL SPECIFICATION

- 24/48 Nos. 10/100BaseTX + 4 Nos. GBIC (min.)
- The Modules should supports 1000 Base SX /1000 Base LX/1000 BaseZX.
  Chassis based Multi-service Switch with minimum 7 Slots
  Redundant CPU
- Redundant Power Supply.
- Backplane: 64 Gbps Switching.
- Forwarding Rate: 48 Millions packets per second of L2 & L3 & L4 Packets.
- MAC address : 12000 MAC address support
- Must have L3 (IP Routing) and Layer 4 Support
- MAC Address support for 32000
- Built In 512 MB SDRAM
- Must support the following protocols:
- IEEE 802.3X (flow control)
- IEEE 802.1p (prioritisation)
- IEEE 802.1Q (V-LAN tagging)
- IEEE 802.1D (Spanning Tree Protocol)
- RIP-V.1 & RIP-V.2
- Should support access control list
- Should support Link Aggregation
- Management- Should have built-in SNMP, RMON, Web based and Command Line Interface for Management. Switch should be supplied with Network Management Software (latest version)

13.15 L2 SWITCH(24 PORT 10/100 BASETX + 2*EXPANSION SLOTS)

a. Non-blocking, wire speed switching and routing.
b. Configuration: 24 Nos. 10/100 Autosensing Ports + Two Module expansion slots which will accommodate the 1000 SX or 1000 Base LX or 1000Base-Long haul(70Km).

c. MAC Address support: 8000 MAC Address min.
d. Backplane: 8 Gbps min.
e. Forwarding Rates: 6.5 Million PPS min. for supporting wirespeed switching.
f. The switch should support QoS classification of incoming packets for QoS flows based on Layer 2,Layer 3 and Layer 4 fields.
g. Standard Compliance- support IEEE 802.3 x (flow control), IEEE 802.1p), IEEE 802.1Q (V-LAN Trunking), IEEE 802.1d (spanning tree protocol)
h. Weighted Round Robin (WRR) queuing algorithm to ensure that low priority queues are not starved.
i. Power supply should have integrated IEEE 802.3 of compliant POE (Power over Ethernet)
j. Stackable
k. Management- Have built-in SNMP, Web based and Command Line Interface for Management. SNMP v1/v2/v3, RMON.
l. Support link aggregation for increasing Backbone bandwidth.

13.16 LAN AND INTERNET

It is proposed to deploy electronic data processing facilities for production planning, control and project management etc. The system envisages to play a key role in establishment of highly effective Data Base Management System (DBMS) and Management Information System (MIS) etc.

The type of computer would be small business computer with broad facilities and also have specific facilities to carry out:

- Pay rolls
- Financial accounting
- Inventory control
- Material management
- HEMM utilization, breakdown analysis, idle time analysis etc.
- Production, dispatch schedule and variances.
- Accident records etc.
- Resource utilization & MIS.

Before initiating action for installation and implementation of the above EDP system, a detailed system study would have to be carried out with clearly defined system objectives for identifying the data processing needs and management information system needs of the project. Based on the results and findings of the study, the system configuration and specification have to be decided.

A Local Area Network with 50 PCs is proposed for this project. The PCs will be connected to the L3/L2 switches. The proposed network structure will be that of a workgroup. Suitable OS and other application software will be provided. Suitable printers, plotters CD/DVD writer shall be provided. A server with Windows XP/Windows 2003 or higher shall also be provided.

2 Nos. of L3 & 4 Nos. of L2 switches are proposed alongwith 1 no. of Point to Multimpoint Radio (Base-1no., Remote-5nos.) and 2nos. of Point to Point Radio for voice and data network.

Internet connection shall also be provided through a 2/4 Mbps leased line at project office and some residences.

13.17 MOBILE COMMUNICATION

An TETRA-based system is proposed for mobile communication in the entire operational area of the Project including all important locations. The TETRA-based system has facility to incorporate GPS based Automatic Vehicle Location System (AVLS) and is very advantageous compared to the presently used VHF walkie-talkie sets. The system based on TETRA (Terrestrial Trunk Radio) is cost-effective, reliable, extremely spectrum efficient and has higher quality reception for voice, data and multimedia.

The TETRA based network combines all the features and benefits of conventional walkie-talkie and GSM mobile network like Digital PMR, Voice and Data, Digital Cellular Phone, Alphanumeric Pager, Mobile Data Unit and encryption etc.

The TETRA System can be interfaced with the exchange at the Project Office for seamless communication between the personnel in the working quarries and those in the Project Office.

A radio survey of the mine shall have to be carried out to decide the exact location of the Tetra System.

13.17.1 OITDS (OPERATOR INDEPENDENT TRUCK DESPATCHING SYSTEM)

An operator independent Truck Despatching System using GPS for tracking and Tetra for communication is proposed for this mine for Coal and OB extraction by departmental option(I & III).

The operator independent TDS is used to monitor online, the position of mobile mining equipments in the mine and thereby optimise the use and performance of the equipment.In particular, the system shall organise the despatch of dump trucks

The proposed system provides to cater all aspects of production, performance and quality monitoring and reporting for each mine in a single unified database. The system will be able to improve the availability and utilisation of all HEMMs and allied equipments within the mine site The on line display of the system will provide a display of the entire mine alongwith stationary and moving parts. Through a graphic touch screen the operator can enter data or receive messages from the central computer. Various information like position data , equipment health data, performance data and keypad data from the onboard instrument will be captured through this system and will be communicated to

central station in data mode through wireless connectivity for automatic computing the best assignment of the equipment to optimise the production..

A system of wireless connectivity shall be established to cater voice and data connectivity between maintenance and operational personnel and the supervisor who is both mobile & stationary and also with the central station.

The main features shall be as follows:

i) Real time continuous monitoring of activities and operational status of HEMM for example:
- Where in the mine the equipment is located
- to what shovels the trucks are assigned
- to what dumping destinations the trucks are assigned
- whether they are empty,loading, dumping, hauling, parked, broken down or on a break
- what material is being loaded or hauled
- what material each shovel/loader is digging
- the grade of material at each shovel/loader
- where bottle necks are in the mine
- current shovel, loader and truck production for the shift
- production targets
- complete reporting of above

ii) Real-time monitoring of production & performance of HEMM.

iii) Display of production status (Coal & OB), equipment status (Coal & OB), shovel-dumper assignment, individual and average cycle time etc.

iv) Automatic dumper despatching, optimum shovel dumper assignment for example.
- Configure specific shovels to produce at certain tonnage rates
- Prioritize shovels
- Control the dispatch of trucks to alternate destinations
- Option to maximize production or balance shovel utilization
- Multiple dispatch groups can run alongside fixed assignments

v) Management information generation and reporting comprising production reports, stand-still report, availability report, utilisation report, Detailed operational analysis reports, etc.

vi) Bi-directional voice & data communication between different operational locations.

vii) The proposed TDS system shall be utilised with the earlier mentioned TETRA Mobile Communication as its communication network backbone. In other words, the proposed Tetra System serves both the purposes i.e. Mobile communication between operational personnel and mobile infrastructure for TDS system, in order to limit the expenditure as well as inventory.

13.18 WIRELESS RADIO SYSTEM

1 set of point to point, 1 no. of Point to Multipoint Radio (Base-1, Remote-5) are proposed for connecting the proposed LAN with important locations where cabling will not be possible. Another point to point radio is also proposed for connecting Project office with Area office.

SPECIFICATION

a.	Wireless Radio Unit	: Point to Point/Multi point links
b.	Fade Margin	: Min10db for each hop
c.	Operating Frequency	: 5.8 GHz
d.	Modulation Techniques	: OFDM
e.	Wired LAN protocol	: 802.3 10/100 Base T
f.	Operating speed	: Max. 54 Mbps Min. 6 Mbps
g.	Receiver sensitivity	: -70 dbm at 54Mbps -92 dbm at 6 Mbps
h.	Transmit power level	: + 24dbm max.
i.	Protocol	: 802.11a
j.	Configuration/Diagnostics	: Local/Remote configuration diagnostics, continuous signal quality Management.
k.	Operating Temperature	: 0oC - 55oC
l.	Humidity	: 0% to 100%
m.	Lightning protection	: Suitable surge suppressor should be included in the equipment
n.	Power supply	: 240 V AC +/- 10%
o.	Power over Ethernet	: Integrated IEEE 802.3 af compliant PoE.
p.	Management	:Web based, SNMP
q.	Security	:Radius, WEP, AES, 802.1x
r.	Safety Certifications	: UL 60950, CSA, CE Marking
s.	Electromagnetic Compatibility Certifications	: FCC part 15 Class B, CE Marking.

13.19 DUMPER COLLISION AVOIDANCE SYSTEM

Directorate General of Mines Safety (DGMS) has given a circular no. DGMS (Tech)/cir.no.009 dated 02-12-2008, to ensure the safety of dumpers and to protect loss of equipment and human life and also for ensuring safe and efficient coal mining. As per this circular dumper should be equipped with anti-collision system to avoid head to tail collision between dumpers and proximity warning along with reverse safety system to avoid collision between dumpers and blind objects.

This system consists of a Display Unit, Control Unit, GPS, Proximity Sensors and Antenna Unit. This system provides following three layers of safety:-

1. Layer 1 provides safety by detecting objects within 10 Meter range. This layer consists of proximity sensors mounted on Dumpers on three sides.
2. Layer 2 provides Distance & Directional information of other dumpers present in the vicinity of 100 Meters thus enabling operator to have better view of the situation. This layer consists of GPS, RF Link and RS232 Interface.
3. Layer 3 provides Positional information of the Dumper through GPRS to central base station by sending SMS. This layer consists of GPRS module and RS232 interface.

Antenna Assembly Unit consists of Tx Antenna, Rx Antenna, GPS Antenna with frame base. Display Unit is placed in Driver's cabin in front of Driver. Control Unit is mounted on a bracket within Driver's cabin on rear side. Power supply is taken from Engine ignition available on Dumper. Local SIM card is inserted in Control Unit. Proximity sensors are mounted on the Dumpers to provide driver with awareness of the objects within 10 m range on the sides.

The system is also equipped with the following special additional features:

i) **Proximity warning from other objects**: The dumpers are equipped with Pulsed Radar based proximity sensors at three sides to warn against impending collision with any other vehicle, human being and blind object entering in its coverage range of approx.0-10 meters.
ii) **Reverse Safety System**: The System can also be used as a reverse safety system to prevent the dumpers from toppling down from the OB dump while unloading.
iii) **Vehicle Tracking Interface:** With the help of GPRS module incorporated in the Control Unit, the location co-ordinates of a dumper can be readily known by simply sending an SMS to that particular dumper. The location co-ordinate is automatically sent back by the system. These co-ordinates can be superimposed on Google Map with a tailor-made software, to track the exact location of the dumpers within the mine.

13.20 IP SURVEILLANCE SYSTEM

To monitor the total mine working area from a centralised control room a surveillance system is proposed. All the important locations viz entry & exit points of mine., loading points, silos and working faces are to be visually monitored at a centralised location using day and night CCTV Cameras(IP enabled) and wireless network.

13.21 ELECTRONIC ATTENDANCE SYSTEM

This system shall be for attendance monitoring and evaluation. The whole attendance system consists of card reader/data collection terminals, hardware and support software with inbuilt clock and timer. The plastic card with contactless chip/magnetic stripe having the unique identification will be read by special reader unit, installed at attendance room. The card can be personalized by digital printing, thermoprinting or by embossing.

13.22 PLANT COMMUNICATION SYSTEM (PCS)

A 25-point Plant Communication System is proposed for voice communication in the Coal Handling Plant (CHP).

The PCS shall be microprocessor controlled, software programmable, central exchange based system. There shall be two-way communication facility between the central control and the remote points.

Loud speaking facility for broadcasting of messages/instructions shall be available in the PCS. The Plant Communication System shall have the facility of private communication between any two handset stations, handset to central station, in addition to the loudspeaking facility.

13.23 BUDGETARY COST ESTIMATE

The Budgetary cost estimate is enclosed in Appendix A for option-I (Departmental) & B for option-II (Outsourcing).

13.24 MANPOWER REQUIREMENT:

To maintain the IP Exchange, TETRA, OITDS, LAN, Internet, Plant Communication System etc., the manpower requirement for E&T is as follows:

Sl.No.	Manpower	Nos.
1	E-6	1
2	E-3/E-4	2
4	Foreman	2
5	Technician	4
6	Lineman/Helper	4

EXPANSION PROJECT REPORT OF AMRAPALI OC (25 MTY)

POWER BALANCE CHART

VARIANT-I

Sl. No.	LOAD DESCRIPTION	Voltage (V)	Total No. Conn.	Total No. Op.	Unit Load kW	Connected Load kW	Working Load kW	Demand Factor	Power Factor cos F	Active Load kW	Reactive Load kVAr	Apparent Load kVA	Annual working hours	Ann Energy consump. in MkWh
	SUB-STATION-1													
	OB													
1	Elect. Hyd. Shovel 20 - 22 Cum	6600	5	5	1450.00	7250.00	7250.00	0.60	0.80	4350.00	3262.50	5437.50	4851	21.102
2	Elect. Hyd. Shovel 10-12 Cum	6600	2	2	870.00	1740.00	1740.00	0.60	0.80	1044.00	783.00	1305.00	4851	5.064
3	Elect. RBH Drill 250 MM	6600	7	7	350.00	2450.00	2450.00	0.50	0.70	1225.00	1249.75	1750.00	2880	3.528
	Sub-total (OB)					**11440.00**	**11440.00**			**6619.00**	**5295.25**	**8492.50**		**29.69**
	COAL													
B-1	**HEMM**													
1	Elect. Hyd. Shovel 10-12 Cum	6600	1	1	870.00	870.00	870.00	0.60	0.80	522.00	391.50	652.50	4851	2.532
B-2	**CHP**													
1	CHP	6600/415				13455.00	11245.00	0.60	0.70	6747.00	6883.32	9638.57	4950	33.398
	Sub-total (Coal)					**14325.00**	**12115.00**			**7269.00**	**7274.82**	**10291.07**		**35.93**
	COMMON													
1	Main Pumps,700 kW	6600	5	4	700.00	3500.00	2800.00	0.70	0.80	1960.00	1470.00	2450.00	1500	2.940
2	Main Pumps, 500kW	6600	0	0	500.00	0.00	0.00	0.70	0.80	0.00	0.00	0.00	1500	0.000
3	Pumps, 55 kW	415	5	4	55.00	275.00	220.00	0.70	0.80	154.00	115.50	192.50	1500	0 231
4	Pumps, 37 kW	415	4	3	37.00	148.00	111.00	0.70	0.80	77.70	58.28	97.13	1000	0.078
5	Pumps, 22.5 kW	415	5	4	22.50	112.50	90.00	0.70	0.80	63.00	47.25	78.75	1000	0.063
6	Industrial Water Pumps, 37 kW	415	2	1	37.00	74.00	37.00	0.70	0.80	25.90	19.43	32.38	4380	0 113
7	Office & other surface Illumination	415/230				50.00	50.00	0.80	0.90	40.00	19.37	44.44	4380	0 175
8	Quarry Lighting	230 (L-L)				100.00	100.00	0.90	0.90	90.00	43.59	100.00	4380	0.394
	Sub-total (Common)					**4259.50**	**3408.00**			**2410.60**	**1773.41**	**2995.19**		**3.99**
	Total					**30024.50**	**26963.00**			**16298.60**	**14343.48**	**21778.77**		**69.62**
	Considering Diversity Factor=1.2									**13582.17**	**11952.90**	**18092.73**		
	Correcting pf upto 0.98								**0.98**	**13582.17**	**2757.98**	**13859.35**		
	Capacitor Bank Required (kVAr)										**9194.92**			

Total Connected load (Sub-Station-1)	=	**30025**	**kW**
Capacity of capacitor bank , 2 Nos.	=	**4597**	**kVAr**
Max. demand at improved p.f of 0.98	=	**13859**	**kVA**
Annual Energy Consumption	=	**69.62**	**M kWh**
Transformer selected		**2X16**	**MVA**

TABLE - XIII (A-I)

EXPANSION PROJECT REPORT OF AMRAPALI OC (25 MTY)

POWER BALANCE CHART

VARIANT-I

Sl. No.	LOAD DESCRIPTION	Voltage (V)	Total No. Conn.	Total No. Op.	Unit Load kW	Connected Load kW	Working Load kW	Demand Factor	Power Factor cos F	Active Load kW	Reactive Load kVAr	Apparent Load kVA	Annual working hours	Ann.Energy consump. in MkWh
	SUB-STATION-2													
A	**OB**													
1	Elect. Hyd. Shovel 20-22 Cum	6600	4	4	1450.00	5800.00	5800.00	0.60	0.80	3480.00	2610.00	4350.00	4851	16.881
1	Elect. Hyd. Shovel 10 - 12 Cum	6600	4	4	870.00	3480.00	3480.00	0.60	0.80	2088.00	1566.00	2610.00	4851	10.129
2	Elect. RBH Drill 250 MM	6600	8	8	350.00	2800.00	2800.00	0.50	0.70	1400.00	1428.29	2000.00	2880	4.032
	Sub-total (OB)					**12080.00**	**12080.00**			**6968.00**	**5604.29**	**8960.00**		**31.04**
B	**COAL**													
B-1	**HEMM**													
1	Elect. Hyd. Shovel 10-12 Cum	6600	1	1	870.00	870	870	0.60	0.80	522	391.5	652.50	4851	2.532
B-2	**CHP**	0												
1	CHP	6600/415				1205.00	1140.00	0.60	0.70	684.00	697.82	977.14	4950	3.386
	Sub-total (Coal)					**2075.00**	**2010.00**			**1206.00**	**1089.32**	**1629.64**		**5.92**
C	**COMMON**													
1	Main Pumps,700 kW	6600	5	4	700.00	3500.00	2800.00	0.70	0.80	1960.00	1470.00	2450.00	1500	2.940
1	Main Pumps, 500kW	6600	0	0	500.00	0.00	0.00	0.70	0.80	0.00	0.00	0.00	1500	0.000
2	Pumps, 55 kW	415	5	4	55.00	275.00	220.00	0.70	0.80	154.00	115.50	192.50	1500	0.231
3	Pumps, 37 kW	415	4	3	37.00	148.00	111.00	0.70	0.80	77.70	58.28	97.13	1000	0.078
4	Pumps, 22.5 kW	415	5	4	22.50	112.50	90.00	0.70	0.80	63.00	47.25	78.75	1000	0.063
5	Workshop	415				1200.00	1200.00	0.50	0.70	600.00	612.12	857.14	4950	2.970
6	Industrial Water Pumps, 37 kW	415	2	1	37.00	74.00	37.00	0.70	0.80	25.90	19.43	32.38	4380	0.113
7	Office & other surface Illumination	415/230				250.00	200.00	0.80	0.90	160.00	77.49	177.78	4380	0.701
8	Quarry Lighting	230 (L-L)				150.00	135.00	0.90	0.90	121.50	58.85	135.00	4380	0.532
9	Colony	6600/415				3226.00	3126.00	0.90	0.90	2813.40	1362.59	3126.00	4380	12.323
	Sub-total (Common)					**8935.50**	**7919.00**			**5975.50**	**3821.50**	**7146.67**		**19.95**
	Total					**23090.50**	**22009.00**			**14149.50**	**10515.11**	**17736.31**		**56.91**
	Considering Diversity Factor=1.2									**11791.25**	**8762.59**	**14690.70**		
	Correcting pf upto 0.98								**0.98**	**11791.25**	**2394.32**	**12031.89**		
	Capacitor Bank Required (kVAr)										**6368.27**			

Total Connected load (Sub-Station-2)	=	**23091**	**kW**
Capacity of capacitor bank - 2 Nos	=	**3184**	**kVAr**
Max. demand at improved p.f of 0.98	=	**12032**	**kVA**
Annual Energy Consumption	=	**56.91**	**M kWh**
Transformer selected		**2X16**	**MVA**

TABLE - XIII (B-I)

EXPANSION PROJECT REPORT OF AMRAPALI OC (25 MTY)

MAXIMUM YEARLY ENERGY CONSUMPTION, SPECIFIC ENERGY CONSUMPTION (kWh / t of COAL), POWER DEMAND & ENERGY BILL

ENERGY CHARGES: Rs/kWh	4.05
NORMAL DEMAND CHARGES: Rs / kWh/month	410
ELECTRICITY DUTY: Rs/kWh	0.20

VARIANT-I

Sl.No.	Power Consumption Areas	Maximum Annual Energy Consumption (Mkwh)	Target production Of Coal In (Mty)	kWh / t of Coal at Targeted Rate of Production	Maximum Power Demand (kVA)	Maximum Annual Energy Bill (Rs. Lakhs)	Energy Cost (Rs./ t of Coal Production)
1	OB	60.737		2.429			
2	Coal	41.848		1.674			
3	Common	23.945	**25.00**	0.958			
	TOTAL:	**126.530**		**5.061**	**21576.03**	**6439.062**	**25.756**

TABLE - XIII (B-I)

EXPANSION PROJECT REPORT OF AMRAPALI OC (25 MTY)

MAXIMUM YEARLY ENERGY CONSUMPTION, SPECIFIC ENERGY CONSUMPTION (kWh / t of COAL), POWER DEMAND & ENERGY BILL

ENERGY CHARGES: Rs/kWh	4.05
NORMAL DEMAND CHARGES: Rs / kWh/month	410
ELECTRICITY DUTY: Rs/kWh	0.20

VARIANT-I

Sl.No.	Power Consumption Areas	Maximum Annual Energy Consumption (Mkwh)	Target production Of Coal In (Mty)	kWh / t of Coal at Targeted Rate of Production	Maximum Power Demand (kVA)	Maximum Annual Energy Bill (Rs. Lakhs)	Energy Cost (Rs./ t of Coal Production)
1	OB	60.737		2.429			
2	Coal	41.848		1.674			
3	Common	23.945	**25.00**	0.958			
	TOTAL:	**126.530**		**5.061**	**21576.03**	**6439.062**	**25.756**

TABLE - XIII (C-I)

EXPANSION PROJECT REPORT OF AMRAPALI OC (25 MTY)

YEARWISE PHASING OF ENERGY CONSUMPTION, SPECIFIC ENERGY CONSUMPTION (kWh / t of COAL), POWER DEMAND & ENERGY BILL

ENERGY CHARGES: Rs. / kWh 4.05
NORMAL DEMAND CHARGES: Rs. / kWh/month 410
ELECTRICITY DUTY Rs/kWh 0.20

VARIANT-I

Particulars	Value (Maximum)	Yearwise Phasing																					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Maximum Total Energy Consumption In MkWh	126.53	2.64	15.63	25.34	36.21	65.08	76.53	87.54	88.24	97.38	107.37	115.42	115.84	117.57	121.85	123.25	126.53	126.53	126.39	115.20	115.17	99.72	79.18
Specific Energy Consumption (kWh / t of Coal)	5.06		5.21	2.96	2.41	3.25	3.06	3.50	3.53	3.90	4.29	4.62	4.63	4.70	4.87	4.93	5.06	5.06	5.06	4.61	4.61	4.99	5.92
Maximum Power Demand (kVA)	21576	1152	4331	5676	6962	11671	13240	14921	15244	16402	17818	19052	19052	19299	20437	21082	21576	21576	21576	19848	19848	18367	16392
Maximum Annual Energy bill In Rs.Lakhs	6439.06	168.87	877.30	1356.41	1881.38	3340.04	3904.01	4454.35	4500.20	4945.43	5439.79	5842.74	5860.54	5946.38	6184.29	6275.16	6439.06	6439.06	6433.32	5872.60	5871.19	5141.70	4171.53

TABLE - XIII (A-II)

EXPANSION PROJECT REPORT OF AMRAPALI OC (25 MTY)

POWER BALANCE CHART

VARIANT-II

Sl. No.	LOAD DESCRIPTION	Voltage (V)	Total No. Conn.	Total No. Op.	Unit Load kW	Connected Load kW	Working Load kW	Demand Factor	Power Factor cos F	Active Load kW	Reactive Load kVAr	Apparent Load kVA	Annual working hours	Ann.Energy consump. in MkWh
	SUB-STATION-1													
	OB													
1	Elect. Hyd. Shovel 20 - 22 Cum	6600	0	0	1450.00	0.00	0.00	0.60	0.80	0.00	0.00	0.00	4851	0.000
2	Elect. Hyd. Shovel 10-12 Cum	6600	0	0	870.00	0.00	0.00	0.60	0.80	0.00	0.00	0.00	4851	0.000
3	Elect. RBH Drill 250 MM	6600	0	0	350.00	0.00	0.00	0.50	0.70	0.00	0.00	0.00	2880	0.000
	Sub-total (OB)					**0.00**	**0.00**			**0.00**	**0.00**	**0.00**		**0.00**
	COAL													
B-1	HEMM													
1	Elect. Hyd. Shovel 10-12 Cum	6600	0	0	870.00	0.00	0.00	0.60	0.80	0.00	0.00	0.00	4851	0.000
B-2	CHP													
1	CHP	6600/415				13455.00	11245.00	0.60	0.70	6747.00	6883.32	9638.57	4950	33.398
	Sub-total (Coal)					**13455.00**	**11245.00**			**6747.00**	**6883.32**	**9638.57**		**33.40**
	COMMON													
1	Main Pumps,650 kW	6600	0	0	650.00	0.00	0.00	0.70	0.80	0.00	0.00	0.00	1500	0.000
2	Main Pumps, 500kW	6600	0	0	500.00	0.00	0.00	0.70	0.80	0.00	0.00	0.00	1500	0.000
3	Pumps, 55 kW	415	0	0	55.00	0.00	0.00	0.70	0.80	0.00	0.00	0.00	1500	0.000
4	Pumps, 37 kW	415	0	0	37.00	0.00	0.00	0.70	0.80	0.00	0.00	0.00	1000	0.000
5	Pumps, 22.5 kW	415	0	0	22.50	0.00	0.00	0.70	0.80	0.00	0.00	0.00	1000	0.000
6	Workshop	415	0	0		0.00	0.00	0.50	0.70	0.00	0.00	0.00	4950	0.000
7	Industrial Water Pumps, 37 kW	415	0	0	37.00	0.00	0.00	0.70	0.80	0.00	0.00	0.00	4380	0.000
8	Office & other surface Illumination	415/230				50.00	50.00	0.80	0.90	40.00	19.37	44.44	4380	0.175
9	Quarry Lighting	230 (L-L)				100.00	100.00	0.90	0.90	90.00	43.59	100.00	4380	0.394
10	Colony	6600/415				0.0	0.0	0.90	0.90	0.00	0.00	0.00	4380	0.000
	Sub-total (Common)					**150.00**	**150.00**			**130.00**	**62.96**	**144.44**		**0.57**
	Total					**13605.00**	**11395.00**			**6877.00**	**6946.28**	**9783.02**		**33.97**
	Considering Diversity Factor=1.2									**5730.83**	**5788.57**	**8145.55**		
	Correcting pf upto 0.98								**0.98**	**5730.83**	**1163.70**	**5847.79**		
	Capacitor Bank Required (kVAr)										**4624.87**			

Total Connected load (Sub-Station-1)	=	**13605**	**kW**
Max. demand at improved p.f of 0.98	=	**5848**	**kVA**
Annual Energy Consumption	=	**33.97**	**M kWh**
Transformer selected		**2X16**	**MVA**

TABLE - XIII (A-II)

EXPANSION PROJECT REPORT OF AMRAPALI OC (25 MTY)

POWER BALANCE CHART

VARIANT-II

SL No.	LOAD DESCRIPTION	Voltage (V)	Total No. Conn.	Total No. Op.	Unit Load kW	Connected Load kW	Working Load kW	Demand Factor	Power Factor cos F	Active Load kW	Reactive Load kVAr	Apparent Load kVA	Annual working hours	Ann.Energy consump. in MkWh
	SUB-STATION-2													
A	OB													
1	Elect. Hyd. Shovel 20-22 Cum	6600	0	0	1450.00	0.00	0.00	0.60	0.80	0.00	0.00	0.00	4851	0.000
1	Elect. Hyd. Shovel 10 - 12 Cum	6600	0	0	870.00	0.00	0.00	0.60	0.80	0.00	0.00	0.00	4851	0.000
2	Elect. RBH Drill 250 MM	6600	0	0	350.00	0.00	0.00	0.50	0.70	0.00	0.00	0.00	2880	0.000
	Sub-total (OB)					**0.00**	**0.00**			**0.00**	**0.00**	**0.00**		**0.00**
B	COAL													
B-1	HEMM													
1	Elect. Hyd. Shovel 10-12 Cum	6600	0	0	870.00	0	0	0.60	0.80	0	0	0.00	4851	0.000
B-2	CHP	0												
1	CHP	6600/415				1205.00	1140.00	0.60	0.70	684.00	697.82	977.14	4950	3.386
	Sub-total (Coal)					**1205.00**	**1140.00**			**684.00**	**697.82**	**977.14**		**3.39**
C	COMMON													
1	Main Pumps,650 kW	6600	0	0	650.00	0.00	0.00	0.70	0.80	0.00	0.00	0.00	1500	0.000
1	Main Pumps, 500kW	6600	0	0	500.00	0.00	0.00	0.70	0.80	0.00	0.00	0.00	1500	0.000
2	Pumps, 55 kW	415	0	0	55.00	0.00	0.00	0.70	0.80	0.00	0.00	0.00	1500	0.000
3	Pumps, 37 kW	415	0	0	37.00	0.00	0.00	0.70	0.80	0.00	0.00	0.00	1000	0.000
4	Pumps, 22.5 kW	415	0	0	22.50	0.00	0.00	0.70	0.80	0.00	0.00	0.00	1000	0.000
5	Workshop	415				300.00	250.00	0.50	0.70	125.00	127.53	178.57	4950	0.619
6	Industrial Water Pumps, 37 kW	415	0	0	37.00	0.00	0.00	0.70	0.80	0.00	0.00	0.00	4380	0.000
7	Office & other surface Illumination	415/230				200.00	150.00	0.80	0.90	120.00	58.12	133.33	4380	0.526
8	Quarry Lighting	230 (L-L)				150.00	135.00	0.90	0.90	121.50	58.85	135.00	4380	0.532
9	Colony	6600/415				1000.00	950.00	0.90	0.90	855.00	414.10	950.00	4380	3.745
	Sub-total (Common)					**1650.00**	**1485.00**			**1221.50**	**658.58**	**1396.90**		**5.42**
	Total					**2855.00**	**2625.00**			**1905.50**	**1356.40**	**2374.05**		**8.81**
	Considering Diversity Factor=1.2									**1587.92**	**1130.34**	**1949.14**		
	Correcting pf upto 0.98								**0.98**	**1587.92**	**322.44**	**1620.32**		
	Capacitor Bank Required (kVAr)										**807.90**			

Total Connected load (Sub-Station-2)	=	**2855**	**kW**
Max. demand at improved p.f of 0.98	=	**1620**	**kVA**
Annual Energy Consumption	=	**8.81**	**M kWh**
Transformer selected		**2X16**	**MVA**

TABLE - XIII (B-II)

EXPANSION PROJECT REPORT OF AMRAPALI OC (25 MTY)

MAXIMUM YEARLY ENERGY CONSUMPTION, SPECIFIC ENERGY CONSUMPTION (kWh / t of COAL), POWER DEMAND & ENERGY BILL

ENERGY CHARGES: Rs/kWh 4.05
NORMAL DEMAND CHARGES: Rs / kWh/month 410
ELECTRICITY DUTY: Rs/kWh 0.20

VARIANT-II

Sl.No.	Power Consumption Areas	Maximum Annual Energy Consumption (Mkwh)	Target production Of Coal In (Mty)	kWh / t of Coal at Targeted Rate of Production	Maximum Power Demand (kVA)	Maximum Annual Energy Bill (Rs. Lakhs)	Energy Cost (Rs./ t of Coal Production)
1	OB	0.000		0.000			
2	Coal	36.783		1.471			
3	Common	5.991	25.00	0.240			
	TOTAL:	**42.77**		1.71	6223	2124.10	8.496

TABLE - XIII (C-II)

EXPANSION PROJECT REPORT OF AMRAPALI OC (25 MTY)

YEARWISE PHASING OF ENERGY CONSUMPTION, SPECIFIC ENERGY CONSUMPTION (kWh / t of COAL), POWER DEMAND & ENERGY BILL

ENERGY CHARGES: Rs. / kWh 4.05
NORMAL DEMAND CHARGES: Rs. / kWh/month 410
ELECTRICITY DUTY Rs/kWh 0.20

VARIANT-II

Particulars	Value (Maximum)	Yearwise Phasing																					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Maximum Total Energy Consumption In MkWh	42.77	2.30	9.26	11.29	12.96	28.57	32.51	32.88	32.88	32.88	42.77	42.77	42.77	42.77	42.77	42.77	42.77	42.77	42.77	42.77	42.77	37.45	30.41
Specific Energy Consumption (kWh / t of Coal)	1.71	0.57	1.16	0.94	0.86	1.43	1.30	1.32	1.32	1.32	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.87	2.27
Maximum Power Demand (kVA)	6223	473	2275	2366	2457	4686	4747	4808	4808	4808	6223	6223	6223	6223	6223	6223	6223	6223	6223	6223	6223	6223	6223
Maximum Annual Energy bill In Rs.Lakhs	2124.10	120.98	505.37	596.26	671.51	1444.97	1615.21	1634.13	1634.13	1634.13	2124.08	2124.08	2124.08	2124.08	2124.08	2124.08	2124.08	2124.08	2124.08	2124.08	2124.08	1898.18	1556.63